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**A model of fundamental volleyball techniques based on
qualitative principles of biomechanical efficiency**

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Middle Tennessee State University, 1993

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A Model of Fundamental Volleyball Techniques Based on
Qualitative Principles of Biomechanical Efficiency

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A Model of Fundamental Volleyball Techniques Based on
Qualitative Principles of Biomechanical Efficiency

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ABSTRACT

A Model of Fundamental Volleyball Techniques Based on Qualitative Principles of Biomechanical Efficiency

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The sport of volleyball is played throughout the United States at various levels of recreation, competition, and education. Volleyball is an activity commonly offered in the realm of physical education. Volleyball is frequently found in instruction and in interscholastic competition.

Physical educators teaching the skills of volleyball typically lack extensive training in the sport of volleyball. Those lacking advanced training, or training available outside the institution, are dependent on the physical education teacher preparation program for acquisition of the knowledge of the fundamental skills of volleyball to be taught.

Much has been written regarding the play of volleyball. Most of that which is found in the literature is directed toward coaches and athletes involved in high-level competition. Very little is directed at instruction in educational and low-level competitive settings.

Much of the literature is based on the coaching or playing experiences of the individual authors. Findings in scientific research regarding playing techniques and skill development are inconclusive. There exists the need for a

source of understanding of volleyball skills and techniques directed at instruction in physical education.

The purpose of this educational project is the presentation of a qualitative biomechanical model of volleyball techniques. The model is based on the concept of developing the most efficient movement patterns to produce the desired outcome. Movement patterns which most efficiently accomplish the task of the skill constitute the techniques which are most effectively learned in the instructional settings of physical education and interscholastic athletics.

The model of each skill is broken down into its integrated components, such as the initial posture, movement to the ball, the striking action, and the contact surface. Each skill is presented in three parts. The description of the skill provides a detailed account of basic movements of the technique. The analysis of the skill conveys to the user an understanding of why the model is most efficient relative to other commonly observed patterns. The key teaching points section furnishes the user a brief summary of the technique's basic movements.

The format of the presentation is designed to be a source for understanding fundamental volleyball skills and as a resource to be referred to during the ongoing teaching and learning process. Its use is applicable in programs of physical education teacher preparation, activity class

Robert Earl Howard

instruction, and interscholastic athletics. The presentation of the model is designed to enhance the understanding of volleyball skills and to be used by the teacher, the learner, and the coach.

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TABLE OF CONTENTS

| Chapter | Page |
|--|------|
| 1. Introduction | 1 |
| Volleyball in Physical Education in the United States | 3 |
| Statement of the Problem | 5 |
| Purpose of the Study | 7 |
| Definition of Terms | 8 |
| 2. Review of the Literature | 15 |
| The History of Volleyball in the United States | 15 |
| The Serve | 19 |
| The Underhand Serve | 21 |
| Initial Posture | 21 |
| The Serving Action | 21 |
| Contact with the Ball | 22 |
| The Overhand Serve | 23 |
| Initial Posture | 23 |
| The Serving Action | 23 |
| Contact with the Ball | 25 |
| The Forearm Pass | 25 |
| Initial Posture | 27 |
| Movement to the Ball | 30 |
| Preparation to Pass | 32 |

| | Page |
|---|------|
| The Forearm Passing Action | 36 |
| Contact with the Ball | 39 |
| Follow-Through | 39 |
| The Overhead Set | 40 |
| Penetration to the Target Area | 41 |
| Initial Posture | 42 |
| Movement to the Ball | 43 |
| Preparation to Set | 44 |
| The Setting Action | 48 |
| Contact with the Ball | 55 |
| Follow-Through | 59 |
| The Back Set | 60 |
| The Jump Set | 62 |
| Spiking | 63 |
| The Approach | 64 |
| The Jump | 74 |
| The Arm-Swing | 79 |
| Contact with the Ball | 84 |
| Blocking | 87 |
| Initial Posture | 88 |
| Alignment of the Outside Blocker | 93 |
| Movement to Alignment, Outside Blocker | 94 |
| Alignment of the Middle Blocker | 95 |
| Movement to Alignment, Middle Blocker | 95 |

| | Page |
|--|------|
| The Blocking Action | 97 |
| Contact with the Ball | 101 |
| Follow-Through | 102 |
| Individual Defense | 102 |
| Initial Posture | 103 |
| The Digging Action | 106 |
| 3. Methods and Procedures | 109 |
| Procedures | 109 |
| Methods | 111 |
| 4. Presentation of the Model of Fundamental Volleyball Techniques | 116 |
| INTRODUCTION | 118 |
| PART 1--THE SERVE | 121 |
| Description of the Skill | 122 |
| Initial Posture | 123 |
| The Serving Action | 124 |
| Contact Surface | 125 |
| Follow-Through | 125 |
| Analysis of the Skill | 125 |
| Initial Posture | 127 |
| The Serving Action | 129 |
| Contact Surface | 133 |
| Follow-Through | 133 |
| Key Teaching Points | 134 |
| Initial Posture | 134 |
| The Serving Action | 134 |

| | Page |
|--|------|
| Contact Surface | 135 |
| Follow-Through | 135 |
| PART 2--THE FOREARM PASS | 136 |
| Description of the Skill | 137 |
| Initial Posture | 138 |
| Movement to the Ball | 140 |
| The Forearm Passing Action | 149 |
| Contact with the Ball | 151 |
| Follow-Through | 152 |
| Analysis of the Skill | 152 |
| Initial Posture | 156 |
| Movement to the Ball | 160 |
| The Forearm Passing Action | 163 |
| Contact with the Ball | 172 |
| Follow-Through | 173 |
| Key Teaching Points | 174 |
| Initial Posture | 174 |
| Movement to the Ball | 174 |
| The Forearm Passing Action | 176 |
| Contact with the Ball | 177 |
| Follow-Through | 177 |
| PART 3--THE OVERHEAD SET | 178 |
| Description of the Skill | 179 |
| Penetration to the Target Area | 180 |
| Initial Posture | 181 |

| | Page |
|--|------|
| Movement to the Ball | 182 |
| Preparation to Set | 190 |
| The Setting Action | 191 |
| Contact with the Ball | 192 |
| Follow-Through | 193 |
| Analysis of the Skill | 194 |
| Penetration to the Net | 197 |
| Initial Posture | 199 |
| Movement to the Ball | 205 |
| Preparation to Set | 209 |
| The Setting Action | 209 |
| Contact with the Ball | 220 |
| Follow-Through | 223 |
| Key Teaching Points | 223 |
| Penetration to the Target Area | 223 |
| Initial Posture | 224 |
| Movement to the Ball | 224 |
| Preparation to Set | 226 |
| The Setting Action | 226 |
| Contact with the Ball | 227 |
| Follow-Through | 228 |
| PART 4--SPIKING | 229 |
| Description of the Skill | 230 |
| The Approach | 231 |
| The Jump | 235 |

| | Page |
|--|------|
| The Arm Swing | 236 |
| Contact with the Ball | 238 |
| Follow-Through | 238 |
| Analysis of the Skill | 239 |
| The Approach | 242 |
| The Jump | 256 |
| The Arm Swing | 261 |
| Contact with the Ball | 271 |
| Follow-Through | 276 |
| Key Teaching Points | 277 |
| The Approach | 277 |
| The Jump | 279 |
| The Arm Swing | 279 |
| Contact with the Ball | 280 |
| Follow-Through | 280 |
| PART 5--BLOCKING | 281 |
| Description of the Skill | 282 |
| Initial Position | 283 |
| Initial Posture | 284 |
| Movement to Alignment, Outside Blockers | 285 |
| Alignment of Outside Blockers | 286 |
| Movement to Alignment, Middle Blockers | 287 |
| Alignment of Middle Blockers | 289 |
| The Blocking Action | 290 |

| | Page |
|--|------|
| Contact with the Ball | 293 |
| Follow-Through | 293 |
| Analysis of the Skill | 294 |
| Initial Position | 296 |
| Initial Posture | 297 |
| Movement to Alignment, Outside Blockers | 299 |
| Alignment of Outside Blockers | 300 |
| Movement to Alignment, Middle Blockers | 303 |
| Alignment of Middle Blockers | 308 |
| The Blocking Action | 310 |
| Contact with the Ball | 312 |
| Follow-Through | 313 |
| Key Teaching Points | 313 |
| Initial Position | 313 |
| Initial Posture | 313 |
| Movement to Alignment, Outside Blockers | 314 |
| Alignment of Outside Blockers | 314 |
| Movement to Alignment, Middle Blockers | 315 |
| Alignment of Middle Blockers | 316 |
| The Blocking Action | 316 |
| Contact with the Ball | 317 |
| Follow-Through | 317 |
| PART 6--INDIVIDUAL DEFENSE | 318 |

| | Page |
|--|------|
| Description of the Skill | 319 |
| Initial Posture | 319 |
| The Digging Action | 321 |
| Analysis of the Skill | 323 |
| Initial Posture | 324 |
| The Digging Action | 326 |
| Key Teaching Points | 327 |
| Initial Posture | 327 |
| The Digging Action | 328 |
| 5. Summary and Recommendations | 330 |
| Summary | 330 |
| Recommendations | 332 |
| Illustrations | 332 |
| Methodology | 333 |
| Models of Advanced Techniques | 334 |
| Quantitative Analysis | 334 |
| BIBLIOGRAPHY | 336 |

CHAPTER 1

Introduction

Volleyball is played in the United States in many different arenas. The sport is experienced by many in competition, recreational play, and educational venues. It is enjoyed by young and old, male and female, in mixtures of age and gender. Though six to a side is the standard format, organized volleyball is played with as few as two persons to a side; three persons and four persons to a side is common; and organized play with as many as nine to a side can be found. Informal volleyball play often occurs at picnics and casual gatherings, as evidenced by the courts and net poles placed in parks, beaches, and backyards.

The sport of volleyball in the United States is experienced by people in all segments of society. Within the United States Volleyball Association (USVBA) alone, national championships for males and females are offered in age groups of 12 and under, 14 and under, 16 and under, and 18 and under. Adult national championships include age groups of 30 and older, 35 and older, 40 and older, 45 and older, and 50 and older. National championships are also held for coeducational play. The national championships culminate a year of regional and local competition organized through the USVBA.

In addition to USVBA competition, many organizations promote and offer volleyball throughout the United States. The Young Men's Christian Association (YMCA) is such an organization, local and regional competition culminating with the YMCA National Championship. Many ethnic groups (e.g., Latvian-American National Championships and Japanese-American Volleyball Association) promote volleyball play within their socio-cultural community, as do groups sharing a common interest or avocation (e.g., the Christian Athletic Association and Police/Firemen National Tournament).

The sport of volleyball is offered through community departments of recreation, commercial recreation, religious organizations, industrial recreation, and many other sources. There exists, nationwide, competition on sand and grass, as well as indoor surfaces. Regardless of age, gender, or ability, the sport is available year-round for the enthusiast.

Volleyball competition is commonly included in the athletics of educational institutions at all levels from elementary school to college. Local and state interscholastic competition is held throughout the United States with many interstate competitions being held. Some states offer interscholastic competition in volleyball for males, as well as females.

Intercollegiate volleyball is engaged in conference, regional, and national competitions. Divisions exist for

men and women, for small and large schools, and for two-year and four-year schools. Many intercollegiate competitions and conferences, including a national championship, exist for those not included in university-sponsored intercollegiate athletics.

The sport of volleyball is often one of the most popular activities offered in departments of campus recreation. On campuses nationwide, volleyball play is found in organized leagues and tournaments, as well as informal play. Commonly offered through intramural sports are coeducational play, men's and women's play, and dormitory and fraternity and sorority play, in addition to open play.

Volleyball in Physical Education in the United States

Volleyball has broad appeal to programs of physical education. It is a low-maintenance game which is often self-officiated. Coeducational play may be effectively employed. Varied skill levels may be integrated into the same environment, and the numbers of players involved may also vary. Volleyball is one of the most commonly offered activities in physical education.

The game of volleyball offers the opportunity to effect many of the goals and objectives of physical education. A lifetime sport, the enthusiast can enjoy active participation throughout much of one's life. Interaction of

teammates is a necessity for effective play. A degree of physical skill and effort is reinforced by effective play. The acquisition and demonstration of skill in volleyball is psychologically rewarding, as it is in many other sports.

For those desirable ends to be realized, quality play must be effected. If the objective of the game becomes merely the return of the ball over the net, the game becomes very individualistic; minimal movement is required, and the rewards of accomplishment are diminished. The quality of play is dependent on the effective execution of techniques which result in control of the ball in all of the skills of the game.

Control of the ball is key to experiencing positive outcomes in the sport of volleyball. Lack of control of any of the game's contacts results in a breakdown in the quality of the game. The rebound contact of the initial pass, the extended contact of the set, or the ballistic contact of the spike all must be executed, effecting control over the ball for effective play to result.

Many different movement patterns may be employed to accomplish a given task, for example, to pass a served ball to the setting target. But not all movement patterns and techniques produce the same level of control, nor is proficiency gained at the same rate of time. The most efficient techniques and movement patterns relating to the skills of volleyball are those which yield the greatest

proficiency and are learned in the least amount of time. For positive outcomes to occur in the sport of volleyball, learners must acquire the most efficient techniques currently known.

Statement of the Problem

The problem for physical education in teaching the sport of volleyball is that physical education instructors, those teaching the skills and techniques, often have little current knowledge of, or advanced experience in, the sport of volleyball. Few have competed and been coached at the higher levels of the sport, either intercollegiately or through other high-level venues, such as USVBA. Though camps, clinics, and accreditation programs exist for coaches and teachers, few physical education teachers regularly attend.

Many non-elite-level coaches and physical education teachers are dependent on their college programs of physical education teacher preparation for the knowledge base of techniques taught. In too many cases, physical education teaching programs lack, or fail to utilize, persons with current expertise in the instruction of professional preparation classes directed at the skills and techniques of volleyball. Future teachers of physical education learning the skills and techniques of volleyball often have their learning experiences oriented toward teaching methods rather

than content, that is, how to teach rather than what to teach.

Outside resources available to those learning to play the game, those teaching the game, and those learning to teach the game are limited. Little in the way of quantitative research regarding the efficiency of movement skills has been published. Of the published material, movement patterns are seldom isolated from other variables; sample populations are rarely representative of the learners encountered in physical education; and the number of subjects studied generally provide less than reliable and valid data. The coach or physical educator going to the research to determine the most effective techniques finds little in the way of conclusive evidence.

As is the case with the information available at many of the instructional camps and clinics, much of the non-scientific literature available is based on the personal and extended experiences of the literature's author. Orientation is toward coaching high-level competition rather than teaching in physical education. Much of this material is directed toward systems of offense and defense and training methods.

That which is addressed concerning playing technique is often general and directed toward the specific needs of the athlete in training for high-level competition. The teacher of physical education going to the literature to acquire

knowledge of effective technique in the skills of volleyball finds much disagreement among the sources. The variety of techniques presented and used by trained athletes does not indicate which of the various techniques should be utilized by the learner in physical education and non-elite-level competition.

While the movement patterns used for the basic contacts by both the learner and the highly trained athlete are similar, the available time frame for learning and the prior experience level is far less for the learner than the trained athlete. Competitive athletes who have years of intensive training and superior physical abilities may succeed using any variety of techniques. In the educational and non-elite-level competitive settings, limited time and intensity of training necessitate that the most efficient techniques should be developed in the learner so that the rewards of the activity may be experienced by all, not merely by the physically gifted.

Purpose of the Study

The need exists in all facets of physical education instruction, teacher preparation, athletics, and recreation for a model of fundamental volleyball techniques based on qualitative principles of biomechanical efficiency. The purpose of this study is to develop efficient technique models inclusive of movement patterns resulting in, and exclusive of, movements deterring desired outcomes.

Such an understanding of efficient technique equips the physical educator and coach with effective movement sequences to present to learners. It allows the educator to convey to learners how and why given techniques result better than others in the desired outcome, facilitating the teaching and learning process. Analyzing observed movement patterns relative to the preferred model, the teacher identifies which movements are to be modified.

Such a model would benefit teaching of volleyball in physical education, supplementing general knowledge of human movement and methods of teaching by identifying appropriate content of what is to be taught. Those already teaching, as well as those involved in professional preparation, would be provided with a tool directed at the teaching environment. The goals and objectives of physical education would be furthered by enhancing the opportunity for learners to enjoy successful experiences in the sport.

Definition of Terms

Arm-swing (armswing)--the action of the hitting arm, through shoulder rotation and elbow extension, which accelerates the striking hand towards the ball while spiking or serving.

Attack--technically, any act which sends the ball over the net. Generally, an attack is a play on the ball which forcefully or strategically returns the ball across the net, such as a spike or tip.

Attack zones--areas designated along the net which define attack locations. Each zone is three feet in length and numbered zone 1 through zone 9, left to right.

Back set--a set directed to a position behind the setter.

Block--an attempt, by one or more players, to prevent the ball from crossing the net.

Brake-step--a step which stops the body momentum in a given direction.

Commit-block--a blocking mode in which the blocker (usually a middle blocker) commits to blocking a fast-tempo attack by jumping with the spiker rather than waiting until the ball is set.

Cross-court--in the direction of the opposing team's sideline opposite of the player directing the ball.

Cross-over step--a lateral movement pattern in which a short lead step is taken by the foot nearest the direction of movement, followed by the trail foot crossing in front of the lead foot, which immediately follows and is placed on the floor beyond the trail foot. There is minimal hip and shoulder rotation; shoulder and hip alignment is maintained.

Defense--the act, by a team or an individual, of controlling an opponent's attack.

Dig--the individual act of controlling an opponent's attack by means of a pass.

Down-the-line--in the direction of the opposing team's sideline nearest to, or in line with, the player directing the ball.

Federation Internationale de Volley-Ball (FIVB)--the international governing body for the sport of volleyball.

First-tempo attack--a fast-tempo attack in which the attacker is airborne prior to the delivery of the set.

Float serve--a serve in which the ball has no spin, causing the ball to move in an unpredictable path, as does a knuckleball in baseball.

Follow-through--the movement of the body after contact with the ball.

Forearm pass--a ball-handling technique in which the ball is rebounded by the forearms of the player; the primary means of receiving serve.

Goofy-footed (approach)--a spike-approach pattern in which the last two steps are taken, leaving from the foot on the hitting-hand side of the body (right foot for a right-hander, left foot for a left-hander), the last two steps ending in non-hitting hand, then hitting-hand steps (left then right for a right-hander, right then left for a left-hander).

High posture--a body posture which is nearly erect, with the legs slightly bent, 150 to 180 degrees at the knees.

Jumpset--a set executed by a player having jumped into the air.

Low posture--a posture in which the center of mass is lowered by extensive bending of the legs, 90 to 120 degrees at the knees or lower.

Medium posture--a semi-erect posture in which the legs are moderately bent, 120 to 150 degrees at the knees.

Middle blocker--a player whose initial blocking position at the net is toward the middle of the court.

Off-hand side--the side of the court from which the spiker's body is crossed before the ball reaches the hitting arm.

On-hand side--the side of the court from which the spiker's hitting arm is reached before the ball crosses the body.

Outside blocker--a player whose initial blocking position at the net is nearest a sideline.

Overhead (overhand) pass--using the overhead technique, the initial reception of a ball.

Overhead (overhand) set--using the overhead technique, the placement of the ball to a teammate to attack.

Overhead (overhand) technique--the act of playing a ball from head level or above, using finger action to control and direct the ball.

Pass--the initial reception of a ball which is then directed to a teammate.

Passing lanes, horizontal--service reception lanes running parallel to the net which define court coverage of the passers.

Passing lanes, vertical--service reception lanes running perpendicular to the net which define court coverage of the passers.

Platform (passing platform)--the placement of the arms for the purpose of rebounding the ball to a target in execution of the forearm pass.

Play set--a set which is delivered through a low trajectory, thus speeding up the tempo of the attack.

Position--the placement of the body relative to the court.

Posture--the alignment of the body segments relative to a typical carriage of the body.

Read-block--a blocking mode in which the blocker (usually the middle blocker) first identifies the direction and location of the set, then jumps to block the attack.

Regular set--a set delivered through a high arc so that the trajectory of the ball as it nears the attacker is nearly vertical.

Second-tempo attack--a fast-tempo attack in which the attacker is one step from initiating the jump as the set is delivered.

Serve--the act of sending the ball across the net to initiate play.

Set--the act of placing the ball in position, by any means, for a teammate to attack. The overhead is the preferred technique.

Setter--the player on the court designated to deliver the set.

Side-out--the exchange of service that occurs when the receiving team wins the play.

Slide step--a lateral movement sequence in which the trail foot closes to the lead foot, but does not cross. Shoulder and hip alignment is maintained.

Spike--the act of jumping and sending the ball across the net by hitting it forcefully with one hand.

Spin serve--a serve in which spin is imparted to the ball, causing it to move through an arc as does a curveball in baseball.

Target area--the intended location to which is directed a ball handling contact (e.g., serve, pass, set, etc.).

Tempo--the time differential between the set and attack contacts (e.g., first-tempo attacks, second-tempo attacks, etc.).

Tip--the act of jumping and sending the ball softly across the net, usually disguised as a spike.

Topspin--the forward spin imparted to the ball, usually during the action of serving or spiking.

Underhand serve--a serve executed by contacting the ball with the hand below the level of the shoulder, usually nearer the level of the waist.

United States Volleyball Association (USVBA)--the governing body for the sport of volleyball in the United States.

CHAPTER 2

Review of the Literature

The History of Volleyball in the United States

The sport of volleyball emerged in Holyoke, Massachusetts, in 1895, through the efforts of William G. Morgan, the physical director of the Young Men's Christian Association (YMCA). Originally titled mintonette (United States Volleyball Association, 1992), the game was designed to provide those frequenting the YMCA with "an activity that would be appropriate for large classes of businessmen--one that was not too strenuous" (Stokes & Haley, 1984, p. 2). The sport was officially renamed "volleyball" the following year, and in 1897, the rules were formally published.

The game spread nationally and became a common leisure activity for members of the armed forces at home and abroad. This led to the introduction of the sport worldwide. In 1913, volleyball was included in the Far East Games. Volleyball was further spread across Europe during and following World War I and around the globe during and following World War II.

The spread of volleyball in its various forms throughout the United States led to the need to consolidate and standardize the governing of play. "In 1928 the Volleyball Rules Committee of the YMCA was reorganized to become the United States Volleyball Association (USVBA)"

(Stokes & Haley, 1984, p. 2). Among the purposes of the newly formed USVBA were: promotion of the sport, nationwide standardization of the playing rules, and the establishment of an annual National Championship Tournament.

Growth of volleyball following World Wars I and II mirrored the experiences of volleyball growth in the United States. In 1947, the International Volleyball Federation (IVBF) (currently, the Federation Internationale de Volley-Ball [FIVB]) was formed to effect on the international level the purposes of the USVBA in the United States: promotion of the sport, worldwide standardization of the playing rules, and the establishment and coordination of international competition.

The growth of volleyball nationally and internationally can be tracked through the sport's inclusion in championship play. In 1955, volleyball was first included in the Pan American Games. In 1964, the Japanese made volleyball the showcase event in the Tokyo Olympics. With the introduction of the forearm pass and fast-tempo offensive and defensive strategies, the Japanese Olympic teams not only dominated play, but revolutionized the international game of volleyball in the process.

The Tokyo Olympics of 1964 is generally accepted as the beginning of modern volleyball. The style of play utilized by the Asian teams excited fans and brought enthusiasm for

the game. The media attention spread that enthusiasm worldwide, the United States included.

The growth of volleyball in the United States can also be seen in the sport's inclusion in national championship events. Volleyball was included in the National Association of Intercollegiate Athletics (NAIA) National Championships for the first time in 1969, followed a year later (1970) by inclusion in the National Championships of the Division of Girls' and Women's Sports (DGWS) (later to become affiliated with the Association of Intercollegiate Athletics for Women [AIAW] and currently the National Division of Girls' and Women's Sports [NAGWS]).

The community and junior colleges (National Junior College Athletic Association [NJCAA]) included volleyball in their 1974 national championships. In 1981, the National Collegiate Athletic Association (NCAA) hosted its first National Collegiate Volleyball Championships for Women. Currently, national championships are hosted by the NCAA, NAIA, and NJCAA in all divisions of women's competition, as well as NCAA National Men's Collegiate Championships.

The year 1976 is significant in the development of volleyball in the United States. Prior to that date, rules and, thus, styles of play and techniques of playing volleyball in the United States differed greatly from those of international play, putting the United States at a disadvantage to other countries in international

competition. In 1976, in an effort to become more competitive in the world arena, the USVBA committed to concurrence with FIVB rules of play. The NCAA, NAIA, and NJCAA also adopted the new USVBA rules and interpretations.

The rule change having the greatest impact on volleyball play in the United States was the rule concerning blocker touches. Prior to 1976, any ball touching the block was considered to be one of the three contacts allowed by the blocking team. Offensive strategies generally centered on setting the ball high in the air and close to the net, hitting the ball deep off of the blockers' hands. With only two contacts remaining, few counterattacks developed. Only the Asian teams with a distinct height disadvantage developed schemes designed to avoid the block.

In an effort to introduce into the game more defensive transition to offense and, thus, more exciting play, the rules were changed to allow the blocking team three contacts after the touch on the block. "Today, much has changed with the introduction of an additional block-touch. A powerful straight-line spike--the main weapon of many spikers--doesn't produce the success that it used to. Technique . . . is becoming critically important" (Chernyshev, 1980, p. 21).

Strategies, and the skills and techniques needed to execute the strategies, that evolved were designed to avoid and displace the blockers. The tempo of the offense became

faster in order to afford the blockers less time to react; lower sets farther away from the net became the norm; and initial passes made at a lower trajectory with more precision were required. Skills and techniques which prior to 1976 represented the current knowledge of volleyball in the United States became obsolete.

For the purposes of this project, 1976 represents the beginning of information availability regarding current volleyball skills and techniques. With the exception of select articles from international publications predating 1976, literature published in periodicals prior to 1976 is excluded. Because of the delay time between collecting, writing, and publishing of manuscript material, 1980 and later is deemed to be representative of current knowledge of volleyball in the United States.

The Serve

The literature presents many variations of service used in volleyball competition. They fall into two general categories: float serves and spin serves. Float serves have the advantage of moving in an unpredictable flight similar to that of a knuckleball in baseball. The flight of spin serves, due to the recognizable spin on the ball, is predictable, but the ball has the advantage of travelling at a higher rate of speed.

While the float serve may stay in the air .95 to 1.3 seconds, a hard top-spin serve may take only .7 to .9 of a second. A spiked jump serve may stay in the air for an even shorter time than a

normal top-spin serve. (Selinger & Ackerman-Blount, 1986, p. 25)

Spin serves presented in the literature include: the overhand topspin serve, the roundhouse topspin serve, the side-spin serve, the overhand reverse-spin serve, and the jump-spike serve. The execution of spin serves involves a more complex movement sequence requiring greater skill and more practice time to perfect. Thus, they are difficult to learn and more prone to error. Effective spin serves are rarely seen in instructional and recreational play due to the high risk of error. In competition, the only spin serve utilized with any frequency is the jump-spike serve, the high yield for those mastering the skill making tolerable the high risk.

Float serves are performed in a variety of ways. Attested in the literature are: the roundhouse float serve, the overhand whip serve, the sidearm serve, the underhand serve, and the overhand float serve. The underhand float serve is commonly used in instructional and recreational settings.

There are advantages to learning and utilizing the underhand serve in instructional settings. With the slower speed and softer trajectory of the underhand serve, reception is more effective, and the ball is directed more precisely. At the beginning stages of learning, two-sided play is conducted with less breaks and with greater physical

loads to the learners. In addition, "consideration should be given to the use of the underhand serve as a progression to higher levels of technique" (Gozansky, 1988, p. 28), such as the overhand float serve.

The Underhand Serve

Initial posture. The underhand serve is executed from a high body posture in balance. The feet are in a stride position spread approximately the width of the shoulders. The foot on the opposite side of the hitting arm is forward, the legs slightly bent at the knees. The distribution of weight recommended by authors varies. Many advocate the weight be predominantly on the rear foot (Ejam & Buchtel, 1983), while some recommend an even distribution of weight (Viera & Ferguson, 1989b), and others prefer the weight be held on the front foot (Gozansky, 1988).

The ball is held by the non-hitting hand at about waist level. The hitting arm is extended, hanging comfortably at the side. While "the hitting hand can be held in a variety of hitting forms: fist, paddle hand, or open hand" (Neville, 1990b, p. 10), most authors recommend an open or cupped hand.

The serving action. In most literature, the underhand serve is initiated by bringing the hitting arm backward and upward to above waist level, though some propose first tossing the ball (Gozansky, 1988). Those who advocate first tossing the ball bring the hitting arm back as the toss is

started. As the hitting arm is moving forward to strike the ball, the weight is transferred forward onto the front foot. The hitting arm in its path toward the ball is either extended or slightly bent.

The release of the ball from the supporting hand varies among the sources. For many, immediately prior to contact the supporting hand drops away from the ball and falls out of the way of the hitting hand. Some toss the ball "2 to 4 inches" (Neville, 1990b, p. 11), and others toss the ball as high as "chest level" (Gozansky, 1988, p. 29).

Contact with the ball. The hitting hand moves toward the ball in the intended trajectory of the serve. The ball is contacted slightly in front of the body at, or slightly below, waist height. Contact occurs with the heel or meaty part of the hand. Follow-through is short.

While the underhand serve is common in lower levels of volleyball play, the serve most commonly utilized is ". . . the straight overhead (floater), which serves as the basic means for all categories of volleyball players" (Zheleznyak, 1974, p. 55). The overhand float serve is more difficult to receive than its underhand counterpart because the height from which it is contacted permits a flatter trajectory. Thus, the ball is delivered with greater velocity, allowing the receivers less time to track the ball and execute their pass.

The Overhand Serve

Initial posture. The overhand float serve is executed from a high posture with the body in balance. The feet are spread approximately the width of the shoulders with the foot opposite the serving hand forward. The legs are slightly bent at the knees. Weight distribution is either toward the back foot (Gambardella, 1987) or evenly distributed between the feet (Viera & Ferguson, 1989a).

The literature varies in description of the body alignment relative to the net. Many authors recommend the "shoulders at a 45-degree angle to the court" (Stevenson, 1989b, p. 33). Others prefer the shoulders aligned parallel (Viera & Ferguson, 1989a) or perpendicular to the net (Gambardella, 1987).

The serving action. The execution of the overhand float serve consists of the ball being placed in position by the non-striking hand, a shift in weight distribution creating body momentum, and the striking hand moving to contact the ball. There is little agreement in the literature regarding the sequence of these actions.

For some authors, "the server's left hand lifts the ball, his right arm draws back and his left foot moves forward. These motions all start at once and also end at once" (Lucas, 1985a, p. 93). For others, "the elbow is drawn back and remains above the shoulder. At or near the end of this action, the ball is lifted up about two feet

high" (Dunphy & Wilde, 1991, p. 63). Some begin the service with the toss of the ball (Cox, 1980), others with a forward step and transfer of body weight (Gozansky, 1988).

"A good toss involves consistently placing the ball in position so that you can make good contact with the ball during your armswing" (Banachowski, 1984, p. 13). The ball is tossed with the non-hitting arm from about shoulder level, though some authors recommend the toss begin "from a point as high as is comfortably possible" (Stevenson, 1989b, p. 33). Some authors prefer that the ball be tossed across the midline of the body (Banachowski, 1984), to be contacted in line with the hitting shoulder. Others prefer that the ball be tossed from in front of the hitting shoulder (Scates, 1984).

As an alternative to tossing the ball, "the server lifts the ball with a smooth vertical motion. His hand stays in contact with the ball as long as possible. The ball rises from his hand less than a foot" (Lucas, 1985a, p. 93). When tossed, the ball rises as much as three feet above the head (Cox, 1980). "The toss should be high enough to allow you to swing at the ball yet not so high that it will cause timing problems" (Banachowski, 1984, p. 13).

Prior to or as the ball is tossed, the elbow of the striking hand is drawn back, placing the hand near the ear. The elbow is above (Dunphy & Wilde, 1991) or "slightly below shoulder height. The hand and wrist are held in a rigid

position with the fingers together and the palm flat" (Selinger & Ackerman-Blount, 1986, p. 27).

Simultaneous to the ball toss, weight is transferred from the back to the front foot. Some authors prefer that "no steps should be taken" (Viera & Ferguson, 1989a, p. 30). For others, "a step forward with the left foot is recommended" (Keller, 1980, p. 3). As "the weight is shifted to the forward foot, the hips and shoulders turn toward the net. The shoulder comes forward, then the elbow extends, then the wrist follows" (Dunphy & Wilde, 1991, p. 64).

Contact with the ball. The ball is contacted by the lower one-third of the hand. Many sources recommend the ball be contacted by "the serving hand at its highest possible reach" (Stevenson, 1989b, p. 33). Others prefer "that his arm is bent. A bent arm allows greater firmness at the shoulder and more control" (Lucas, 1985a, p. 99).

"Direction change is done by changing the front foot position, not by the toss or the arm swing. Always set up the ball the same and serve with the same arm swing" (Toyoda, 1989, p. 159).

The Forearm Pass

Play in volleyball is initiated with the service. The initial action by the offensive team is the reception of service. Though any ball-handling skill may be used, the forearm pass is the primary technique used in service

reception. The velocity of the serve makes legal reception using the overhand pass difficult. Also, "the forearm pass greatly increases the time that a player can follow the ball before playing it, because it is contacted later in the ball's trajectory; and greatly increases the effective range of the player" (Keller, 1980, p. 6).

The forearm pass is the most often used skill in volleyball, and some consider it to be the most important. "Passing determines the level at which a team can play" (Nelson & Compton, 1985, p. 47). Without control of the initial pass, offensive options are limited and ineffective.

"The trend in passing is to pass the ball lower" (Nelson & Compton, 1985, p. 48) at a trajectory less than 12 feet (Keller, 1977a). "It is important to emphasize the trajectory of the pass. It needs to go at a level toward the setter's forehead and not in an up and down arc" (Liskevych, 1990, p. 52). High passes create problems for setters because the upward tilt of the head while tracking the ball limits the setter's peripheral vision of the court and of the movement of players. "It is also difficult for beginners to set a high pass" (Keller, 1977b, p. 51) due to the increased velocity of, and the force exerted on the fingers by, the descending ball.

The target of the forearm pass "is not a person, but rather a specific fixed location along the net where the setter expects to receive the pass" (Selinger &

Ackerman-Blount, 1986, p. 37). Offensive schemes commonly place the passing target at the net to the right of center. "If the pass is right to target (to the setter), 70 percent of the balls should be put down by your attacker. If the pass is not to the setter . . . that percentage may drop to between 30 and 50 percent" (Liskevych, 1990, p. 50).

From the initial position, the player identifies the flight of the served ball and adjusts accordingly. "Correct and stable angles are created by proper body position relative to the court, then by proper body position relative to the ball, and lastly correct arm position and contact point" (Keller, 1977a, p. 48). "Gaining position prior to contact should be the goal of every player when learning how to pass a serve" (Wegrich, 1988, p. 19).

Initial Posture

The initial posture allows quick movement to the ball and minimal preparation upon arrival. "Balance is all important. The passer who has perfect balance when the ball is served gets a quick and controlled start" (Lucas, 1985a, p. 4).

Some authors recommend placing the feet side-by-side (Lucas, 1989a). Other authors favor the placement of either foot slightly forward:

Some books will tell you to put your right foot forward on the right side of the court, and on the left side place the left foot in front. I think it is simpler to form a basic motor program, and since most balls need to be passed on the right,

then the right foot should lead slightly.
(Kessel, 1990b, p. 35)

For others:

It is possible when passing at an angle for the foot closest to the direction of the pass to be slightly forward. For example, if the passer is on the outside edge of the court and is directing the pass forward and toward the center, the outside foot can be set back to make it easier for the passer to aim the pass back into the court.
(Dunphy & Wilde, 1991, p. 18)

The foot-forward position places "one foot forward so the big toe of the back foot is lined up with the arch of the front foot" (Neville, 1990b, p. 21).

The width of foot placement in the literature varies. Viera (cited in Viera & Ferguson, 1989a) states that "the feet should be no more than shoulder-width apart" (p. 19). Scates (1989) prefers "the feet further than shoulder width apart to provide a wide base of support for better balance" (p. 5).

For many, "the player's feet are rotated slightly inward to properly distribute the weight on the inside balls of the feet" (Wegrich, 1988, p. 18). The body is balanced, leaning "forward with the knees in front of the feet, the shoulders in front of the knees" (Viera & Ferguson, 1989b, p. 22).

In this position, "the knees are slightly flexed in a medium position level, 120 degrees flexion" (Wegrich, 1988, p. 18). Some authors prefer a lower body position. "Knees are bent with a 90-degree angle between hamstring and calf"

(Keller, 1980, p. 6). "Knees are bent at a 90-degree angle for smaller players and at a smaller angle for taller players" (Scates, 1984, p. 16).

The biggest mistake--and one that is frequently taught--is lowering the body a great deal. This is not only tiring, but slow. A low starting position requires the receiver to raise or straighten the body immediately. If the player does not rise--and moves to the ball in a lowered position--the legs cannot extend fully and movement will be slow. (Lucas, 1989a, p. 27)

The literature agrees that "the trunk or spine should be flexed forward at the hip joint and waist. This position distributes the center of gravity over the balls of the feet" (Wegrich, 1988, p. 18). The amount of flexion varies. Some favor that "the player is bent slightly forward at the waist" (Lucas, 1989a, p. 27). Others prefer that "the trunk is bent forward at 45-degrees from vertical" (Selinger & Ackerman-Blount, 1986, p. 28). For Scates (1984), "the hips are bent at approximately 90-degrees" (p. 16). Most prefer that the back be straight rather than curved.

Recommendations for placement of the arms and hands vary. Some authors advocate that "the passer keeps her hands on or near her body" (Lucas, 1985a, p. 4). Many advise that "as the player prepares to pass the serve, the arms are apart and ahead of the body" (Wegrich, 1988, p. 18). The arms are extended out from the body, "hands apart and down by the knees" (Gozansky, 1988, p. 19); "hands and arms are above knees, held away from body and parallel

to thighs" (Viera & Ferguson, 1989b, p. 22) or "held in front and apart about waist high" (Scates, 1984, p. 16). The arms are held "slightly flexed at the elbow joint" (Wegrich, 1988, p. 18). Others prefer that "the arms never bend in the entire execution of the pass" (Gozansky, 1988, p. 20).

Some authors advocate that "the feet should be perpendicular or only slightly offset to the target area" (Keller, 1980, p. 6). Many recommend that "the player should squarely face the server" (Jin, 1992, p. 68). The alignment of posture is similar to that from which the passing action is to be initiated.

Movement to the Ball

"The passer's first job, once she sees the ball coming to her, is to move her feet to the ball" (Lucas, 1985a, p. 5). The player should "concentrate on moving to the point of contact before the ball arrives instead of leading with the hands, leaving feet and balance behind" (Neville, 1990b, p. 20). "Sometimes it seems natural for the passer's arms to reach toward the ball first. The player then ends up going to the passing spot with her hands held out. This is a mistake. Arms held out slow the passer's movement to the ball" (Lucas, 1985a, p. 6). Some prefer that "the arms should be straight through the entire passing movement" (Keller, 1977a, p. 49).

Some authors state that "players must take small quick steps while maintaining a low center of gravity" (Scates, 1984, p. 16). Others counter that "if the passer's center of gravity is too low, he or she will be slow in lateral movement" (Cox, 1980, p. 31).

"If the ball is not far away, the player should use an easy skip or slide step. To accomplish this, simply push off the foot farthest from the intended direction of movement" (Neville, 1990b, p. 22). Some observe the movement as similar to a series of lateral hops, "the feet have remained side-by-side throughout the entire movement to the ball. The rhythm is 'bounce, bounce, bounce, HOP,' where the 'HOP' takes more time because it is deeper . . . lowering the body into passing position" (Lucas, 1989a, p. 27). For others, "the slide step is performed by sliding the lead foot laterally and following it with the trailing foot . . . moving to within 6 inches of the forward foot" (Scates, 1984, p. 17).

There are occasions when the distance to the ball is too great to be covered using skips or slide steps. Reception of such balls requires the use of other techniques, such as the crossover-step. Or the player may turn and run to the ball using the crossover- or brake-step to turn back (Neville, 1990b).

Preparation to Pass

At the end of movement to the ball, the body should be aligned to execute the pass. "The player wants to pass with a foot position that brings, above all, stability" (Lucas, 1985a, p. 5). Some authors state that "the feet should be no more than shoulder width apart" (Viera & Ferguson, 1989a, p. 19). Others prefer "the feet spread wider than in the ready position" (Neville, 1990b, p. 23).

Some authors prefer the passers "plant their feet and pivot toward the target with their outside foot ahead and pointed toward the setter" (Scates, 1984, p. 23). Others indicate that "the right foot should be in front of the left in all court positions. The player should align herself behind the ball in such a way that the shoulder line is perpendicular to the direction of the served ball" (Selinger & Ackerman-Blount, 1986, p. 43). For others, "you would like to have both knees and hips pointing to the target at contact" (Liskevych, 1990, p. 52).

The literature varies in the recommended alignment of the body relative to the ball. Though some authors state that the arms "must strike the ball at about waist or belly button level each time" (Liskevych, 1990, p. 52), many prefer that the ball be contacted at a lower level, "the ideal point is just above the level of the knees" (Keller, 1977a, p. 48). "The knees should be bent to whatever angle

is necessary to be able to play the ball between the waist and the knees" (Dunphy & Wilde, 1991, p. 20).

There is agreement that whenever possible "the ball should be received between the knees" (Toyoda, 1989, p. 166). To some, "an ideal set-up is to get your mid-line behind the ball" (Liskevych, 1990, p. 52). "When viewed from the front of a player, the ball should be contacted in the midline of the body with the midline vertical" (Keller, 1977a, p. 48). Others state, "the player needs to play the ball out in front and slightly to the left of the body to obtain the left to right ball movement which is used for passing to a setter" (Viera & Ferguson, 1989a, p. 19).

As the player nears the ball, the arms join to form a platform from which the ball is passed. "Early presentation of the arms to the ball enhances the passer's potential to execute the pass successfully" (Wegrich, 1988, p. 19). "The passing platform should be created toward the end of the adjustment movement to the ball" (Selinger & Ackerman-Blount, 1986, p. 38). "A good training rule . . . is to have the arms ready and presented to the ball before it penetrates the vertical plane of the net" (Wegrich, 1988, p. 18).

Rather than swinging at the ball, the arms should be used as a platform so that the ball will rebound in the proper direction and with the desired arc. It is important to "set the angle" of the platform prior to contacting the ball. (Dunphy & Wilde, 1991, p. 20)

"Ideally, the arms should be at a 45-degree angle to the floor" (Jin, 1992, p. 68) or "at a slightly steeper--more vertical--angle than 45 degrees" (Lucas, 1989a, p. 27).

Some authors advise that "the hands are placed together in a relaxed fashion with a slight elbow bend, generally not more than 20 degrees from a straight line" (Keller, 1980, p. 7). But many recommend forming a platform that "is like a board, not bending from shoulder to wrist" (Liskevych, 1990, p. 51). "To make the passing platform the arms should be straight, elbows locked, and the heels of the hands (near the wrists) touching each other" (Dunphy & Wilde, 1991, p. 19). "The player's arm position is critical to a symmetrical, smooth rebound surface. Such a surface is prepared by putting the wrists and thumbs together" (Neville, 1990b, p. 24).

The literature presents many methods of clasping the hands to form the passing platform.

The best way for the passer to join her hands is by interlocking her fingers at the first knuckle. Unlike other grips, interlocking fingers leaves the forearm muscles relaxed. This means that the passer can move her arms at their quickest.
(Lucas, 1985a, p. 14)

The finger interlace also "prevents the hands from breaking apart on contact to help ensure a favorable rebound position" (Scates, 1984, p. 19). Some prefer to "interlace the fingers at the second knuckle" (Neville, 1990b, p. 24). Others reject this technique. "Do not try to play the ball by interlocking the fingers, as this is not only

slower to form but also puts the hands in the way of the ball" (Nichols, 1986, p. 45).

Another common hand clasp is the fist-wrap. "The fist is clenched with the thumbs placed parallel and on top of the index fingers. The remaining fingers are wrapped around the closed fist" (Scates, 1984, p. 17). "The fist insert is quick and easy to form" (Neville, 1990b, p. 24). Some authors reject this technique. "Note that the fingers should not form a fist" (Dunphy & Wilde, 1991, p. 20).

With another method, "the fingers of the right hand are placed across the fingers of the left hand, the thumbs are then brought together so that they are touching along the outside edges" (Nichols, 1986, p. 45). "This position will permit the ball to contact a relatively flat plane of the soft parts of the forearms" (Ejam & Buchtel, 1983, p. 149).

The literature also presents less common techniques. "Put the thumbs together with one hand in the crotch between the thumb and index finger of the other" (Neville, 1990b, p. 24). Another, "the hands (with the arms straight) are placed in one plane edgewise to each other, and the thumbs are on the outside" (Kacharava, 1978, p. 14). Each of these methods has the disadvantage of placing one hand higher than the other, forming an unsymmetrical surface.

Common to all the hand clasps presented in the literature is that "the wrists are hyperextended down to the floor" (Wegrich, 1988, p. 19). "By rotating the wrists down

the forearms are straightened even more and the elbows are brought into a locked position. Make sure the grip is not too tight" (Selinger & Ackerman-Blount, 1986, p. 40).

The Forearm Passing Action

Arriving at the point of ball intersect with the platform formed, the player initiates the passing action. The literature offers no singular technique for effecting the skill. Rather, a variety of methods is presented for the execution of the pass.

Power is imparted to the ball by some authors through extension of the legs. "From the 90 degree angle of the legs prior to contact, the legs should be straightened as the ball is contacted" (Keller, 1980, p. 8). Others include upper body movement as well. "The actual volley begins with an extension of the knees and of the trunk" (Ejam & Buchtel, 1983, p. 149). "The power for the forearm pass comes from culminating body forces (speed of ball, leg extension, hip extension, shoulder elevation, and shoulder flexion)" (Cox, 1980, p. 31).

Some authors use leg extension to direct the ball, as well as to provide power. "Direct the ball to the target utilizing your body through leg extension while contacting the ball with little or no arm swing" (Viera & Ferguson, 1989b, p. 24). "The passing action . . . begins by pushing off the left leg. The force that is generated passes through the knees, the hips, the shoulders, and eventually,

through the arms. Very little arm movement is required to pass a fast, hard-hit ball" (Selinger & Ackerman-Blount, 1986, p. 45).

Some utilize a step to provide power and direction. "As the pass is made, shift your weight in the direction of the target. A shuffle step with the lead foot can also assist the ball in the direction of the target" (Dunphy & Wilde, 1991, p. 21). For others, the step provides only direction. "Stop, assume a balanced position and step to the target. When passing to the right, step with the right foot. When passing to the left, step with the left foot" (Gozansky, 1988, p. 19).

Other techniques utilize leg extension minimally in providing the pass force and direction. "The legs should have a major function only to transport the body in the proper position and the arms be used to execute the technique" (Keller, 1977a, p. 49). Techniques in which "the arms act as a cushion to absorb the force . . . will permit a slowing down of the ball" (Ejam & Buchtel, 1983, p. 149) and provide extended contact with the ball and require more extensive arm movement in order to propel the ball to the net area.

The "shoulders and arms . . . contribute the main force in the pass. Extend the shoulders and arms forward and slightly upward with a controlled arm swing. Guide the ball to the setter" (Gozansky, 1988, p. 20). Initiating the

passing action "with a slight elbow bend, generally not more than 20 degrees from a straight line" (Keller, 1980, p. 7), creates even longer contact between the ball and arms. "At the moment of contact, the wrists are snapped downward and the elbows extended . . . coupled with a swing of the upper arm from the shoulder" (Keller, 1980, p. 7).

Other techniques rely on the arms to rebound the ball through a low trajectory, the momentum of the ball, and a minimal arm movement providing impetus to the ball. "For many years leg straightening was thought to be the secret. The present-day passer uses a short arm swing. Her legs do not move during the pass, nor does any part of her body (except her arms)" (Lucas, 1985a, p. 2). "Players should be taught to use only those movements necessary to get the ball to the target. Unnecessary movements waste energy and can disrupt the timing necessary for effective passing" (Neville, 1990b, p. 25).

At the moment of contact, the passer makes a short, quick arm swing into the ball and immediately stops the arms. By choice, the arms would not move at all. The passer would wait like a bunter, who makes fine adjustments with the bat as the ball comes. The passer is forced to move the arms a few inches into the ball . . . in order to send the ball to the net. (Lucas, 1989a, p. 27)

"The movement arc of the platform (arms) will vary with the speed of the served ball. For slow moving serves, the arc is increased" (Wegrich, 1988, p. 19).

The arms direct, as well as propel, the ball. "The angle of deflection determines the trajectory of the pass" (Neville, 1990b, p. 25). Some advance that "a player should direct and control the ball to the target by dipping the left or right shoulder" (Burger, 1990, p. 2), directing the ball to the left or right, respectively.

Most serve received balls, in most offenses, are deflected to the right, either a large or small angle of deflection. Angle your arms, either by twisting slightly at the wrists or by dropping the right shoulder and the ball will go to the right. (Kessel, 1990b, p. 36)

Contact with the Ball

The literature varies with regard to the area of contact on the forearms. Some recommend "about 2 inches above the wrist" (Selinger & Ackerman-Blount, 1986, p. 38); others recommend "four inches above the wrist" (Jin, 1992, p. 68); others recommend as high as "about 6 inches above the wrists" (Sturm, 1992, p. 50). For some, "the ball touches the forearms one-third to one-half the distance from wrist to elbow" (Lucas, 1985a, p. 18).

Follow-Through

The amount of follow-through presented in the literature varies as well. Some prefer that the arms stop immediately upon contact (Lucas, 1989a). For others, "the arms should never swing higher than chest level" (Liskevych, 1990, p. 52). Some prefer that the "arms are straight and about shoulder height" (Gozansky, 1988, p. 20).

The Overhead Set

The offensive play begins with the reception of service or the initial pass of an attack. The pass is directed to the target area from which the offense is designed to operate. From the actual location of the pass, the setter is responsible for delivering the ball to the attackers.

The overhead setting technique is the most commonly used method of delivery. Proper technique maximizes player control of the ball. "Proper techniques are essential as solid building blocks for learning advanced setting skills" (Green, 1990, p. 46).

Accuracy is the most important characteristic of a setter. "In setting, accuracy of height and direction of the ball is essential for spiker requirements" (Toyoda, 1989, p. 153). "The attackers must have absolute confidence in the setter to deliver the ball at consistent velocities, heights and distances from the net" (Neville, 1990a, p. 20).

Definitive accuracy varies within each individual offense, tempo, trajectory, and location being a function of the particular design. Common to many systems is the basic high set which may be accurately delivered from most places on the court. "The basic overhand set is a high set, about ten feet above the net and one to two feet from the net landing near the sideline" (Gozansky, 1988, p. 43). Some authors prefer that "the balls should drop about 3-4 feet

off the net and about 4 feet inside from the antenna" (Selinger & Ackerman-Blount, 1986, p. 66). The advantage of high sets is that the trajectory and location of descent is identified by the hitter before the start of the attack; thus, greater adjustment capability exists.

Penetration to the Target Area

It is the responsibility of the setter to be at the passing target prior to the pass. "The setter should be in the ready position prepared to deliver the ball from the target before the serve is contacted by the receivers" (Neville, 1990a, p. 21). "They must first get to proper position at the net waiting for the pass, then seeing and making a movement to the ball" (Condon & Lynn, 1987, p. 21). "The setter should stand in the center of the primary target as close as possible to the net" (Selinger & Ackerman-Blount, 1986, p. 66).

"The setter must always establish the same ready position prior to the serve receiver making contact" (Neville, 1990a, p. 21). Various descriptions of the ready position exist in the literature. Some authors recommend a position "with one foot slightly in front of the other" (Gozansky, 1988, p. 21) without preference for either foot. For many authors, "the setter positions her right foot forward. This allows her to turn easily from left to right, from facing her teammates as they pass to facing down the net as she sets" (Lucas, 1985a, p. 21).

Much of the literature agrees that "his back should be at a diagonal to the net with his right foot closer to the net than his left. A line between his feet would create a 45-degree angle to the net" (Selinger & Ackerman-Blount, 1986, p. 66). "The foot position in the target ready position is along a 45 degree angle to the net. Shoulders, feet and hips should be along this line" (Neville, 1990a, p. 22). Some authors prefer having the "shoulders perpendicular to the net" (Sawula, 1989, p. 16).

Initial Posture

The literature is consistent in descriptions of the initial body posture. The feet are shoulder-width apart with the weight on the balls of the feet (Gozansky, 1988). The ankles, knees, and waist are slightly bent (Neville, 1990a). The body is in a high posture, higher than the stance used for the forearm pass (Neville, 1990b).

The position of the arms in the ready position varies. "The arms hang loose with the elbows bent at about a 100-degree angle and the hands in front of the body" (Selinger & Ackerman-Blount, 1986, p. 64). Others favor the "hands held comfortably at chest level" (Gozansky, 1988, p. 22). Some prefer that "beginners should be coached to keep the hands in front of the face" (Scates, 1984, p. 29).

In the initial position, the setter should "watch the passer in order to get an early tip on the direction and height of the pass" (Dunphy & Wilde, 1991, p. 30). "It is

especially the receiver's arms, the platform the arms make, the setter must watch" (Hippolyte, 1989, p. 54). Having recognized the direction and distance of the pass, the setter moves to a point of intersect.

Movement to the Ball

"The setter's goal is to get to the spot before the ball arrives and face the target" (Neville, 1990b, p. 34). Many favor having the "shoulders always square to the power position" (Sawula, 1989, p. 16). "The setter must maintain his body position at a diagonal to the net at almost all times, with his right foot forward and his right shoulder closer to the net" (Selinger & Ackerman-Blount, 1986, p. 71).

"The setter should move forward into the oncoming ball and never in a direction away from it" (Condon & Lynn, 1987, p. 25). Some prefer to "move quickly behind and under the ball. Pivot to face the target" (Gozansky, 1988, p. 22). For others, "the setter takes a roundabout route, a big 'C,' to face the outside hitter" (Lucas, 1989b, p. 31).

Footwork patterns used to transport the setter to the ball are similar to those used in the forearm pass (Neville, 1990b). "She can either side-step or run" (Lucas, 1985a, p. 19).

Lateral adjustments are made using three or four short sliding steps to the right or the left. For distances more than three or four steps away, the player should simply run on a curve and swing around to align himself with the ball using a

crossover step for the second-to-last step.
(Selinger & Ackerman-Blount, 1986, p. 65)

Many agree that "it is best not to set while running" (Dunphy & Wilde, 1991, p. 30). Ideally, the setter should move quickly, set the feet, square the shoulders to the target and then set the ball" (Condon & Lynn, 1987, p. 20).

You should plant and break your speed with your left foot. Then your right foot comes around and ends up in front of your left foot. The plant is left-right, not just running and then stopping with all your weight on your right foot. (Green, 1990, p. 46)

"The setter's last two steps must re-establish a 45-degree angle to the net of the shoulders, hips and toes facing the left side of the court" (Neville, 1990a, p. 24).

Preparation to Set

As the setter arrives at or near the point of ball intersect, the body is postured and aligned for the setting action. "The starting position . . . and the place of contact with the ball . . . should be the same for every set" (Condon & Lynn, 1987, p. 21). Likewise, the individual's body alignment to the ball and the court is consistent.

There is general agreement in the literature that "the midline of the body should correspond to the path of the ball and the desired direction of the pass" (Condon & Lynn, 1987, p. 25). Selinger and Ackerman-Blount (1986), however, state that:

the lateral position of the hands can vary slightly as long as one hand is in front of and

over the head. If contact is made with both hands outside of the shoulders or behind the back, it will probably be considered a mishandled ball by the official. (p. 64)

There is little agreement with regard to the alignment of the ball relative to the player's forehead, a typical reference point. Some await the ball as much as eight inches in front of the forehead (Viera & Ferguson, 1989b), and some six inches (Scates, 1984). Others recommend a distance of "4 inches or less" (Keller, 1979, p. 7).

Many recommend that "the player arrives facing the target, with the ball directed toward her forehead" (Lucas, 1985a, p. 19). Some prefer that "if the ball goes through the player's hands, it should hit his nose" (Keller, 1980, p. 23). Others state that "it is very important that the hips be underneath the ball" (Selinger & Ackerman-Blount, 1986, p. 64).

Some authors recommend the setter be flexed slightly at the waist (Neville, 1990a). Others advise that "the body should be erect" (Keller, 1980, p. 22), "her back is straight and vertical" (Lucas, 1985a, p. 25). "The side-by-side [foot position] setter tilts her body toward the target during the pass" (Lucas, 1985a, p. 24).

Many authors advise the setter to "square your shoulders to the target. When you are not in position with your feet and shoulders squared off to the antenna you find yourself setting the ball over your shoulders and become very inconsistent" (Luyties, 1990, p. 46). "When the setter

stands a meter from the net and with her back to it, it is difficult to give a long accurate set for the spike in the outside zone" (Silakhova, 1980, p. 28).

In between facing the target and having the back to the net, "the setter can face at an angle. As he is effecting the set, the body twists to the set, ending up square to the flight of the ball" (Keller, 1980, p. 24).

Many beginners face the passer rather than the attacker when setting--this is wrong. However, the feet and shoulders will open toward the passer as the ball is received and then they rotate back (square) to the target as the set is made. (Dunphy & Wilde, 1991, p. 34)

While some authors prefer that "the setter's feet should be a little more than shoulder width apart" (Yoneda, 1992, p. 53), many recommend that "the feet should be placed shoulder-width apart, with the right foot half a step in front of the other" (Selinger & Ackerman-Blount, 1986, p. 64). "The stride position is like a short walking step" (Lucas, 1985a, p. 21).

Many recommend that "the feet should be slightly staggered about shoulder-width apart, with the right foot forward" (Dunphy & Wilde, 1991, p. 32). Others prefer that "the foot closest to the net should remain forward and point toward the antenna" (Scates, 1984, p. 29). Some state merely that "one foot is in front of the other pointing toward the target" (Neville, 1990b, p. 34).

Others indicate a side-by-side foot position.

In the side-by-side position both feet are in line 90 degrees to the target. They are close to each other--only a few inches apart--and flat on the floor. The toes point toward the target. The side-by-side gives extra power. (Lucas, 1985a, p. 21)

Distribution of weight varies among the sources reviewed. "The feet are comfortably spread and body weight is equally distributed. The knees are bent and ready to make minor adjustments as the ball approaches" (Condon & Lynn, 1987, p. 21). Others favor having the "feet spread, most weight on the left foot so the player's weight can be transferred through to the target left to right. The setter must be in a flexed posture to utilize all available levers for maximum power" (Neville, 1990a, p. 24).

Prior to contact with the ball, the hands are shaped and brought into position to deliver the set. Many authors recommend that "drawing the hands to the setting position is done by bringing the hands quickly upward along the front of the body to a position directly above the upturned forehead" (Dunphy & Wilde, 1991, p. 30). There is much variety in the literature regarding the timing of hand positioning.

"To provide a target of contact, the setter's hands should be raised well in advance of his set" (Keller, 1980, p. 22). For some authors, "the player intending to set . . . raises her hands early, as soon as she knows the ball is coming to her" (Lucas, 1985a, p. 38). For many, "at the same time the person is moving under the ball, the hands are placed above the head" (Cox, 1980, p. 34).

Other authors prefer the arms not be elevated during pursuit of the ball.

The arms hang loose with the elbows bent at about a 100-degree angle and the hands in front of the body. As the ball nears the player, he should elevate his arms maintaining the same angle at the elbows. The arms are raised until the hands are about 6 inches above the head and slightly in front of it. (Selinger & Ackerman-Blount, 1986, p. 64)

"Just prior to contacting the ball, the hands should be held at chest level. Immediately before contact they should be raised to the forehead and then contact the ball" (Keller, 1977a, p. 56). Prior to contact, the hands are never above the head (Gozansky, 1988).

The placement of the elbows in preparation of setting varies with each individual hand technique. For many, the elbows are spread naturally (Neville, 1990b) and comfortably (Selinger & Ackerman-Blount, 1986). Others place "the setter's elbows very wide" (Lucas, 1985a, p. 17). Some sources prefer that "the elbows be set apart slightly wider than the shoulders" (Dunphy & Wilde, 1991, p. 32). Others favor the elbows closer to the body (Ejam & Buchtel, 1983).

The Setting Action

Some sources initiate the setting action with an extension of the lower body. "When the ball is about to be contacted, weight shifts over the front foot" (Scates, 1984, p. 29). "The player extends the knees and raises the trunk upward" (Ejam & Buchtel, 1983, p. 169).

"Leg straightening adds force to the set" (Lucas, 1985a, p. 23).

The propulsive force behind the set begins in the back leg as both knees straighten. Then it builds, passing through the hips as they rotate toward the target, through the elbows as they straighten, and finally through the wrists that push through the ball. (Selinger & Ackerman-Blount, 1986, p. 64)

This leg-arm sequence is especially useful away from the passing target area. "When setting balls a long distance toward the net, the player should bend his elbows and knees more than usual. Straighten first the legs and then the elbows" (Selinger & Ackerman-Blount, 1986, p. 64).

Other sources indicate that "your legs, arms and wrist movements should be all one fluid motion" (Luyties, 1990, p. 46). The "set begins with simultaneous extension of legs and arms forward and upward into the ball" (Gozansky, 1988, p. 22). "One of the biggest problems facing the learning setter is the lack of coordination between the legs and arms. This usually takes the form of the legs extending before the arms" (Lucas, 1989b, p. 31).

Some prefer that body extension occurs slightly after the hands contact the ball. "The ball is in your hands and you have already cushioned it with your wrists. Now, use your legs and arms together" (Green, 1990, p. 48). "As the ball springs off the hands, the body's weight is transferred from the back foot in a straight line through the hands" (Neville, 1990a, p. 37).

The movement through the ball is initiated from the left foot. The hips and shoulders turn through the ball as the weight is transferred from left foot to right. The setter is facing the intended trajectory line as the ball is released. (Neville, 1990b, p. 23)

Some authors indicate minimal leg extension:

The accomplished setter, particularly the one who disguises the sets, uses the legs very little, and often not at all, while setting. But the tension acquired from firming the legs in coordination with extending the arms is comparable to the rhythm learned. (Lucas, 1989b, p. 31)

For some authors, power for the set is gained through the action of the wrists. "Forearm muscle contraction for force is added to increase the distance of the set" (Keller, 1980, p. 23). Others prefer that "the arms, not the wrists, supply the power. Extension of the elbows [is a] prime power source for the set. The job of the wrists is to control the ball" (Dunphy & Wilde, 1991, p. 32). "The movement of the wrists forward is responsible for determining the flight pattern of the ball" (Ejam & Buchtel, 1983, p. 170).

The literature varies as well regarding the timing of hand movement toward the ball in the setting action and the actual point of contact. Some authors "encourage players to contact the ball close to the face" (Neville, 1990b, p. 35) or "near their foreheads" (Lucas, 1985a, p. 19). "The ball must be contacted as close to the head as possible. A common error is contacting the ball too far away from the head, thus reducing the amount of power that

can be used for setting" (Neville, 1990a, p. 26). "For others, however, contact with the ball should be made about 6 inches above the head and just slightly in front of it, over the center of the body" (Selinger & Ackerman-Blount, 1986, p. 64).

In executing the setting action, "you must give the ball immediate impetus" (Viera & Ferguson, 1989b, p. 57). Many prefer to "aim for a lengthy hand contact for best control and accuracy" (Gozansky, 1988, p. 22). "The best setters . . . stay in contact with the ball as it moves toward the target. They continue to touch it until the arms are straight" (Lucas, 1985a, p. 19).

Some authors start the setting action from a low hand position, below the level of the head. The "arms and hands extend up quickly to contact the ball above and in front of the forehead. A soft touch is achieved by the entire body accelerating into the ball with an equal push of the arms and legs" (Gozansky, 1988, p. 22).

For others, the player "raises her hands early. She starts moving her arms early, too, well before the ball touches her hands" (Lucas, 1985a, p. 38). "They stay in contact with the ball as it moves toward the target. They continue to touch it until the arms are straight" (Lucas, 1985a, p. 19).

Some authors begin the arm movement as the ball is contacted. "The setter must let the ball come to the hands.

Hand movement into the intended trajectory line must begin upon contact. Early movement results in jabbing at the ball and poor contact" (Neville, 1990a, p. 27).

"Wait for the ball to enter the cup and contact the finger lengths. Before the ball comes to rest the wrists rotate slightly and the arms extend fully" (Nichols, 1986, p. 20). "As the ball is contacted with the anterior or inside part of the fingertips, the wrists and fingers are flexed forward while the arms are extended at the elbow" (Cox, 1980, p. 34).

Many authors agree that "the ball is not batted, but it actually remains in contact with the hands for an instant" (Condon & Lynn, 1987, p. 21). "The player should push through with a smooth action that resembles a very quick catch and throwing motion. He should not poke at the ball abruptly" (Selinger & Ackerman-Blount, 1986, p. 64). "Receiving the ball is like a compressed spring and releasing the ball is the extension of the spring" (Gozansky, 1988, p. 22).

Some authors prefer the spring-like action be carried out primarily by the fingers: "the fingers act as a springboard, prolonging contact with the ball as long as possible" (Selinger & Ackerman-Blount, 1986, p. 64).

The ball makes initial contact on the middle finger, forefinger and thumb. The ball strikes these fingers like a diver strikes a diving board. When the fingers reach a maximum flexion, the ball begins to move in the direction away from the forehead. The smoother and quicker the finger

flexion transfer, the softer the touch appears.
(Neville, 1990b, p. 35)

Many recommend the spring-like action occur through both the fingers and wrists. "The movement [of the hands] upon contact is up and through the flight of the ball. The downward momentum of the ball causes the wrist and fingers to hyperextend. This hyperextension causes the wrists and fingers to rebound which imparts force to the ball" (Keller, 1980, p. 23).

Some authors misstate the action of the wrists and fingers as flexion rather than extension. "The setter must hold her hands gently but firmly back" (Lucas, 1985a, p. 38). The setter's wrists work as springs. They flex when the ball pushes on them. The setter does not need to think about the flex; the action is automatic.

"She does need to hold her hands gently back, without stiffness in either her hands or wrists. Wrists held rigid do not flex" (Lucas, 1985a, p. 33). "There is firmness, but it comes from opening her fingers, not from tensing them. Tensed fingers do not flex" (Lucas, 1985a, p. 36).

The amount of wrist action varies among the sources. Some sources approach the ball with "the hands relaxed and the wrists hyperextended" (Ejam & Buchtel, 1983, p. 168). "The wrists are cocked so that the angle between the forearms and hand is 135 degrees or less" (Condon & Lynn, 1987, p. 21).

Others prefer that:

your wrists should not be rotated back until the ball is in your hands. If you wait for the ball with your wrists already back then there is no cushioning action. Setting is like a quick catch and throw. The cushioning of the ball is done with the wrists--not by bending your elbows and dropping your hands down to your chin with the ball. (Green, 1990, p. 46)

Many concur that:

the angle that is prescribed by the upper arm and forearm should never decrease. This, simply stated, means that the arms are held at the chest and then to the forehead and then straightening out during the contact of the ball. At no time prior to contact should the hands and arms be extended higher than the initial touch of the ball. The angle of the elbow first decreasing then increasing is a very common error. (Keller, 1977a, p. 56)

Others allow that "just prior to contact, the angle of the elbows can decrease slightly. Once the hands contact the ball, the angle at the elbows must continuously increase. If the angle decreases, it's a held ball" (Selinger & Ackerman-Blount, 1986, p. 64). Some, however, indicate that "the hands and arms actually contact and give with the ball" (Keller, 1980, p. 24).

While many techniques initiate the setting action with the hands separated approximately the width of the ball (Kiraly, 1987b), some start with the elbows and hands much wider. "The setter's elbows are held very wide. Wide elbows put her arms in a plane, making for a direct squeeze. Wide elbows also position the passer's wrists for the greatest flex" (Lucas, 1985a, p. 27).

"The setter's arms push her hands inward as well as forward. This allows her to squeeze the ball" (Lucas, 1985a, p. 26).

Her hands and arms travel at an inward angle--about 45 degrees--until clamping the ball. Once the setter's hands are firmly touching the sides of the ball, they change direction. First they were moving toward each other; now they move toward the target, straight forward. The ball's resistance--not the player's effort--brings this change of direction. (Lucas, 1985a, p. 29)

The setter continues to squeeze the ball as her hands and the ball move forward. Her elbows . . . stay in a plane throughout the pass. Should the setter pull her arms back as the ball arrives? No. A simple inward push works better. (Lucas, 1985a, p. 30)

Contact with the Ball

Much of the literature agrees that the set is executed "with the hands in a cupped fashion approximating the size of the ball" (Keller, 1977a, p. 55) and that "the hands form a bowl into which the ball will drop" (Neville, 1990b, p. 35). "Spread your fingers, wrap them around the ball" (Viera & Ferguson, 1989a, p. 57). The "fingers spread wide apart, slightly tensed and shaped in the form of a volleyball" (Gozansky, 1988, p. 22).

Your hands should cover a good part of the ball but not to where you stretch and stiffen your hands and wrists. Your eight fingers should be rounded like the shape of the ball, with your thumbs straight. Your hands should be a mirror image of each other. (Green, 1990, p. 46)

The best description of how to position your hands for an overhead set is . . . that you should put all ten fingertips together, index to index, etc., with your fingers spread wide apart from each other. Holding your hands down by your navel,

push your elbows out away from you. Then raise your hands and arms up above your head so that your hands are in front of your face. Now just pull your hands apart so that a ball can fit nicely between them. (Kiraly, 1987b, p. 16)

The setting action balances tension and relaxation in the fingers. "The hands are cupped and relaxed. This relaxation is very essential to smooth setting" (Condon & Lynn, 1987, p. 21). "Set the ball gently but firmly, coupling hardness with softness" (Ran, 1989, p. 7).

"Seemingly contradictory, the fingers are spread so there is tension. However, the fingers are relaxed from the second knuckle to the tip of the finger. This allows for maximum absorption, yet allows for a quick release" (Neville, 1990a, p. 25). For some, "the amount of stiffness in the fingers depends on the height of the descending ball and the distance it must travel for the set" (Selinger & Ackerman-Blount, 1986, p. 64).

Some authors prefer the ball drop deep into the hands. "The ball is played on the finger lengths of both hands" (Nichols, 1986, p. 20).

The contact is not made just with the fingertips, but rather with the whole length of the fingers and the thumbs, although the little fingers may touch the ball only with the fingertips. The palm should not touch the ball. The more contact with the ball, the better the control. (Selinger & Ackerman-Blount, 1986, p. 64)

Some sources recommend that the ball drop into the hands less deep. "Contact should come on the upper two finger joints only. You should not use the terminology

'contact the ball with your fingertips' because this leads to incorrect technique" (Viera & Ferguson, 1989a, p. 45).

Others indicate that "ball contact is made . . . on the pads of the fingers" (Condon & Lynn, 1987, p. 21).

The actual point of contact will be the pads of the fingers and thumbs--about an inch back from the fingertips. All of the fingers should touch the ball, but most of the pressure will be felt on the thumbs and forefingers. The outside fingers will help control the ball. (Dunphy & Wilde, 1991, p. 31)

"The major hand contact points are with the pads of the thumb and first two fingers. Fingers 3 and 4 are placed on the side of the ball and act as guides" (Keller, 1980, p. 23). "The ball should land only on your finger pads. Your thumbs, index fingers, and middle fingers are the surfaces through which your wrists really push the ball" (Kiraly, 1987b, p. 16).

Others disagree:

Contact is actually on the pads of your fingers and on the outside part of the thumbs. If contact is in the pads of the thumbs then that means you're pressing your thumbs forward. That is wrong because when your thumbs go forward and you lead with them you lock your wrists. When your wrists are locked you will not be able to cushion the ball when you set. (Green, 1990, p. 46)

Some advise that "it is important that the thumbs contact the ball, otherwise ball control is reduced and back setting is very difficult" (Selinger & Ackerman-Blount, 1986, p. 64). Others do not emphasize the importance of ball contact on the thumbs. "The greatest amount of contact is on the first three fingers" (Condon & Lynn, 1987, p. 21).

The alignment of the hands relative to each other varies in the literature. An indicator, though not a determinant, of hand alignment is the direction and alignment of the thumbs. For example, thumbs aligned parallel to each other indicate a somewhat parallel alignment of the hand contact area. The literature generally supports Green's position that the thumbs should not be forward (Green, 1990). Otherwise, the alignment of the thumbs relative to each other varies.

Some sources advocate the "wrists tilted back, thumbs down, the thumb and index finger form a triangle" (Gozansky, 1988, p. 22). "The thumbs must be kept down and pointing back at the face so that they do not prevent the ball from entering the cup. A right angle will be formed at the forefingers when the correct position has been obtained" (Nichols, 1986, p. 20). Others oppose this position: "the thumbs are directed up and back, never forward and down. The greatest amount of contact is on the first three fingers" (Condon & Lynn, 1987, p. 21).

For some, "the thumbs should point slightly back toward the forehead" (Dunphy & Wilde, 1991, p. 30). "The thumbs are pointed at the eyes" (Neville, 1990b, p. 34). For others, "the thumbs should be back, and the hands placed on the sides of the ball rather than directly behind it" (Viera & Ferguson, 1989a, p. 45).

Some offer a more extreme position. "The specific wrist position is a slight inward rotation of the wrists. The thumbs are almost parallel with each other" (Keller, 1980, p. 24).

Other sources recommend the thumbs not at all pointed back. "The thumbs are nearly pointing at each other" (Cox, 1980, p. 34). "The fingers should be comfortably spread with the thumbs pointing toward each other, not toward the nose or away from it" (Selinger & Ackerman-Blount, 1986, p. 64).

The separation of hand contact areas, that is, the fingers and the thumbs, varies among the sources. Many prefer "that your fingers are twice as far apart as your thumbs" (Viera & Ferguson, 1989b, p. 57). Others are more specific: "the index fingers should be about 1.5 to 2 inches apart, and the thumbs should be about 1 inch apart" (Selinger & Ackerman-Blount, 1986, p. 64).

Some approach the setting action "with the thumbs of both hands nearly touching" (Ejam & Buchtel, 1983, p. 168). Others go to the opposite extreme. "Her index fingers are nearly in a line and about 8 inches apart--wider than they will be on the ball" (Lucas, 1985a, p. 36).

Follow-Through

Many authors advise the setter to "follow through by extending the body and arms in the direction of the arc you want the ball to travel" (Dunphy & Wilde, 1991, p. 32). "Do

not stop the follow-through until your elbows are straight" (Green, 1990, p. 48). "The body should follow through in the direction of the set. Passes made over a short distance require relatively minimal use of the entire body" (Condon & Lynn, 1987, p. 25).

"The hands follow the ball. In a full follow-through the bottoms of the thumbs touch each other as the hands turn over" (Neville, 1990b, p. 37). Others prefer that "on follow-through the entire body is extended in the direction of the set, palms forward, fingers extended" (Gozansky, 1988, p. 22).

Some indicate that "at the completion of the contact with the ball, the thumbs should point away from the body toward the direction of the set" (Selinger & Ackerman-Blount, 1986, p. 65). "Her hands turn outward as the ball leaves. The player's arms are straight and parallel at the end of the motion about a ball's width apart" (Lucas, 1985a, p. 39). Others counter that if "the hands pronate away from the intended trajectory line, accuracy will be compromised" (Neville, 1990b, p. 37).

The Back Set

The back set is a setting action which directs the ball to a position behind the setter. It is a basic skill, not an advanced technique or a skill primarily required for competitive play. The back set allows the setter to always

face the same direction and execute the same mechanics, regardless of the intended target of the set.

Some authors recommend that the change in direction of the back set occurs primarily through the action of the wrists:

The main difference between front setting and back setting lies in the wrist action. In back setting there is a pronounced backward flip of the wrists and a push in the backward direction. The thumbs are critical in helping support and direct the ball. (Selinger & Ackerman-Blount, 1986, p. 65)

Others change contact point, as well as wrist position:

At the point of contact the player must exaggerate the hyperextension of the wrists. The volley is executed by extending the arms upward and backwards. The ball is contacted just over the head. The movement of the thumbs . . . should be turned up and backwards in order to insure that the ball follows the intended direction. (Ejam & Buchtel, 1983, p. 172)

Some disagree, preferring to change the direction of the ball primarily through change in body posture:

All balls should be contacted in the same spot above the forehead. Snap your head back when contacting the ball and with just that one quick movement the back set can be executed. This way you can back set without arching your back. (Luyties, 1990, p. 46)

Others prefer arching the back to effect change in direction of the ball. "As the setter contacts the ball, the back is arched and the ball is directed toward the ceiling" (Viera & Ferguson, 1989b, p. 67). "Arch the back and neck while the hands follow through over the head" (Scates, 1989, p. 22).

Some prefer the back arch to be a result of forward hip motion.

The hips move forward upon contact with the ball, the back is arched, and the weight is transferred to the forward foot. The entire body follows through in the direction of the set, with the head following the flight of the ball. (Gozansky, 1988, p. 44)

"The setter . . . quickly pushes it over her head. Her shoulders move backward with her arms; her hips move backward" (Lucas, 1985a, p. 39).

Some offer a combination of these elements. "As the ball is set, the back is arched and the head is extended backwards" (Cox, 1980, p. 51). "The back set is contacted in the same place as the front set. The back will be slightly arched and your head will be back so that your arms can direct the ball to the rear" (Dunphy & Wilde, 1991, p. 36).

The Jump Set

As is the case with the back set, the jump set is a basic setting skill. It allows the setter to play balls at a higher elevation than otherwise would be possible. It increases the player's movement range through which the setting action can occur.

The skill allows the player to jump and, while airborne, execute the setting technique. "The setting action should take place at the peak of a jump. At times, the set can be executed just prior to reaching the apex of

the jump" (Selinger & Ackerman-Blount, 1986, p. 78).

"During a jump set the hips and shoulders should be perpendicular with the net at the apex of the jump and therefore at contact" (Neville, 1990a, p. 23).

Spiking

The serve or attack is received and passed to the target area. The setter executes the setting technique for the purpose of placing the ball in position to be attacked by a teammate. "The main method of attack for a volleyball team is the spike" (Alihanov, 1974, p. 73). The spike is the objective of the other ball-handling contacts.

"The spike is the skill probably most enjoyed by volleyball players. Certainly it is the most-used offensive weapon" (Hoyle & McGregor, 1989, p. 16). "The motivation for players to learn the comparatively dull intermediate contacts is the sobering fact that without ball control, there would be no spiking" (Neville, 1990b, p. 45). "Spiking is the major factor closely related to a team's success" (Hoyle & McGregor, 1989, p. 17).

Today [1980], much has changed with the introduction of an additional block-touch. A powerful straight-line spike--the main weapon of many spikers--doesn't produce the success that it used to. Technique, the ability to make maximum use of one's potential, is becoming critically important. (Chernyshev, 1980, p. 21)

The spiking action is the most complex of volleyball skills. It consists of three separate but interrelated

elements. They are the approach, the jump, and the arm-swing.

The Approach

The approach is used by the attacker to move from a position away from the net to the terminus of the set. The approach puts a spiker in a position and posture to jump, as well as initiating the jumping action. "It is important because it increases the height of your jump and increases the force you are able to impart on the ball" (Viera & Ferguson, 1989b, p. 81).

Varying among the sources is the movement speed attained during the approach. "The approach has to generate horizontal velocity that can be converted upon takeoff into vertical velocity" (Selinger & Ackerman-Blount, 1986, p. 86). Some prefer that "movement should be of medium speed, lowering the center of gravity during the movement" (Keller, 1977a, p. 68). Others indicate that "the approach is quick, smooth and vigorous" (Gozansky, 1988, p. 70).

For many, "the speed of the approach should be from slow to fast, building momentum" (Haley, 1987, p. 57). "Instead of maintaining a constant speed as you take your steps, accelerate as you go. Start slowly, pick up speed and make the last two steps explosive and powerful" (Sturm, 1992, p. 50).

Many indicate that "the horizontal speed of the attack player will vary with the player's ability to transfer this

horizontal momentum vertically" (Keller, 1980, p. 28). Some prefer that the spiker "adjusts his speed to the flight of the ball" (Scates, 1984, p. 51).

Timing the hit takes practice. The approach should be delayed long enough so that the hitter is able to generate a great deal of speed and power which will generate an explosive jump. This allows the hitter to reach the ball at the peak of the jump and contact the ball at the highest possible point. (Dunphy & Wilde, 1991, p. 48)

While Scates (1984) indicates that "the spiker starts the approach while the setter is lining up the pass" (p. 51), many authors advise that the attacker leave after the setter contacts the ball. "For most approaches the player . . . waits until the ball is set high to determine its trajectory and placement" (Gozansky, 1988, p. 70). Others "wait for the set to be half the distance to you from the setter, and then move toward the set (when the ball is at the peak of trajectory)" (Viera & Ferguson, 1989b, p. 81).

"Once the potential spiker's receiving or defensive responsibilities have been met and the ball has been passed to the setter, the spiker will get to a position about 13 to 14 feet back from the net" (Dunphy & Wilde, 1991, p. 46).

Starting that far away from the net has three advantages: it allows the spiker to generate horizontal speed that can be transferred into vertical lift on the jump, the spiker can adjust better to a set that is away from the net, and the spiker can adjust more effectively to a set that is made too far right or left of the spiker. (Dunphy & Wilde, 1991, p. 47)

Some authors advocate a shorter, more finite approach point. "Begin on the attack line" (Viera & Ferguson, 1989b, p. 81). "The approach starts about 3 meters back from the net" (Nichols, 1986, p. 29).

For some authors, the approach point varies from individual to individual. "The preliminary position for the spiker is 8 to 12 feet from the net" (Scates, 1984, p. 49). "For most approaches the player begins about 10 to 15 feet from the net" (Gozansky, 1988, p. 70). "The exact approach distance will depend on each athlete's stride length" (Haley, 1987, p. 57).

The angle of approach, that angle relative to the net through which the attacker approaches the set, varies among the sources reviewed. Some prefer that the approach angles be the same for all attack positions for both right-handed and left-handed hitters. "The player approaches the net at a perpendicular angle" (Ejam & Buchtel, 1983, p. 204) or "a near perpendicular angle" (Keller, 1980, p. 29). "Most spikers prefer to swing slightly outside the boundary line and approach the set at a slight angle" (Scates, 1984, p. 51).

Others vary the angles. "The approach patterns for right handers is at a 45-degree angle from the left and center positions and straight in on the right side" (Gozansky, 1988, p. 70).

Generally, the correct angle to the net will be between 45 and 60 degrees for a right hander on

the left side, and between 60 and 90 degrees for a right hander on the right side. For left handers, the angles are reversed. (Haley, 1987, p. 57)

Recommendations of approach footwork patterns and momentum transfer mechanisms vary among the sources. The literature allows that "he may have a one-step or several-step approach" (Kovalev, 1980, p. 43). Common to many authors is that "the spiker must move away from the net so that he or she can approach with as many steps of the designed pattern as required" (Neville, 1990b, p. 46).

"The spiker should be in a flexed position with one foot forward, leaning toward the approved direction. The body weight is balanced but ready to move over the lead foot. The arms are dangling from the shoulders" (Neville, 1990b, p. 46). Some advise that "the arms will generally be bent and carried forward" (Dunphy & Wilde, 1991, p. 46). "The posture is a medium-high, track-start position" (Gozansky, 1988, p. 70).

As the approach steps are taken:

all of the foot movements must stay within 2 to 5 inches of the floor, as opposed to a hopping action where the feet go up in the air 12 inches or more and then come down to the floor. Such a hopping action will disrupt the spiker's ability to accelerate during the approach. The spiker's transfer of weight during the approach strides needs to be as efficient as possible. The center of gravity must move forward, not up and down. Each step of the approach progresses in length and speed until the hop or step-close phase. (Haley, 1987, p. 58)

Some authors advise varying the height of the later steps to adjust the timing of the jump. "If the spiker

arrives late, the pre-jump will be low. If the spiker arrives on time, the pre-jump will be higher" (Scates, 1984, p. 51).

Recommendations for number and sequence of steps vary. "The spiker should take at least three steps, and probably no more than four" (Haley, 1987, p. 57). "A three step approach is recommended. However, two to five steps may be used" (Keller, 1980, p. 29).

Some are more definitive in their preference. "The key to a successful spike begins with your feet. Position yourself far enough away from the net so that you can take a four step approach to hit the ball" (Timmons, 1990, p. 64).

Many de-emphasize the number of steps. "Within the four-step approach are the two and three-step variations" (Neville, 1990b, p. 46). Indicated instead is that:

the last two steps are the most important. Make a two footed takeoff by planting your right foot heel first and closing with your left foot (bringing the left foot to a position even with the right) or taking a hop onto both feet. (Viera & Ferguson, 1989b, p. 81)

The four-step approach starts "with your right foot and take a step toward the intended area of the attack (left handers should start with their left foot). You should now see the flight of the ball coming out of the setter's hands" (Timmons, 1990, p. 64). "This is a timing or reading step" (Gozansky, 1988, p. 70).

"The second step, with your left foot, puts you in position. This step is your adjustment step. It is also

your drive step. You should push hard off this step and drive forward picking up momentum for the jump" (Timmons, 1990, p. 64). "The second step is longer" (Gozansky, 1988, p. 70) than the first and followed by the step-close or hop. "The timing is step, run, step-close [or hop] with the player accelerating into the approach" (Gozansky, 1988, p. 70).

With the three-step approach, the "first step is a short running step forward with the left foot for right-handers and the right foot for left-handers. This is a timing or read step" (Gozansky, 1988, p. 70). The step-close or hop follows the first step. "The timing is step, step-close [or hop]" (Gozansky, 1988, p. 70).

The arm movements are extremely important to the approach and jumping process. The spiker wants to generate as much force as possible. When the foot reaches on the [next to last step], both arms reach as far back and as high as physically possible. (Neville, 1990b, p. 46)

Many draw the arms back earlier, "the player brings the right leg forward while simultaneously carrying the arms to the rear" (Kovalev, 1980, p. 43). Some later, "as you plant both heels . . . swing your arms back to waist height to prepare for a jump" (Viera & Ferguson, 1989b, p. 81).

Many authors prefer that the "arms are swung forcibly backward into a hyper-extended position" (Keller, 1980, p. 30). Others prefer "swing your arms back to waist height to prepare for a jump" (Viera & Ferguson, 1989b, p. 81).

"Both arms should be behind the body, no more than 45-degrees back" (Haley, 1987, p. 59).

Some prefer that the "arms come up sideways and extend backward slightly bent at the elbows" (Selinger & Ackerman-Blount, 1986, p. 88). Others disagree. "At no time should the arms have an upward and back circular motion in preparation for the lift off" (Keller, 1980, p. 30).

For many authors, the result of drawing back the arms is that "the trunk is bent forward" (Ejam & Buchtel, 1983, p. 204), "bent forward not more than a 90-degree angle with the thigh" (Keller, 1980, p. 30). Others prefer that "the upper torso should remain nearly perpendicular to the floor. If the arms are back more than 45-degrees, the upper torso bends too far forward at the waist, decreasing the efficiency of the jumping action" (Haley, 1987, p. 59).

Some authors indicate that the step-close approach, compared to the hop approach:

offers a smoother approach pattern and ability to make late adjustments and generally better body balance. Lateral position on the net, body angle to the net, and distance from the net can have minor adjustments made during the step-close. However, it is not as effective in the transfer of horizontal motion. (Keller, 1980, p. 31)

Others counter, stating that "studies have shown that it is more efficient and produces greater heights in jumping than the pure pre-jump or hop technique" (Neville, 1990b, p. 46).

The step-close portion of the step-close approach begins with the foot on the hitting hand side of the body

driving forward to be placed on the floor, followed rapidly by the placement of the other. After the running steps, the step-close for a right-hander starts "as the right leg shoots forward. Once the body is suspended in the air the left leg should quickly swing forward to catch up with the right leg. The right foot contacts the floor first, followed by the left" (Selinger & Ackerman-Blount, 1986, p. 88).

Some advocate that "you plant both heels first to change forward momentum into upward momentum" (Viera & Ferguson, 1989b, p. 81), "contacting the floor first with the heel of one foot and then with the heel of the other foot" (Scates, 1984, p. 51). "The [next-to-last] step is a breaking step landing on the heel. The [last] step is a closing step landing on the toe" (Gozansky, 1988, p. 70).

The spiker's right heel hits the floor first. His right toe quickly follows. His right heel leaves the floor, continuing its rolling action. Now his left foot joins in, touching down. Only his left toe touches the floor. His left heel never contacts the floor. (Lucas, 1985a, p. 54)

"The player's feet hitting the floor can be counted evenly, 'heel, toe, toe'" (Lucas, 1985a, p. 55).

The length of the next-to-last step varies among the sources. For some, the "[next-to-last] step is long and quick" (Lucas, 1985a, p. 51). For others, "the next-to-last step . . . is either as long or shorter than the [previous] step" (Haley, 1987, p. 58). "The [next-to-last] step will be short" (Dunphy & Wilde, 1991, p. 47).

"The [step-close] is always off the left foot (right-hander). The landing from the [step-close] starts with the right foot, which is placed on the foot with a slight heel-toe action" (Selinger & Ackerman-Blount, 1986, p. 88). It should point toward the net at about a 45-degree angle (Haley, 1987, p. 59).

"The last (left) foot planted should be somewhere between parallel and 45 degrees" (Haley, 1987, p. 59). Some authors prefer that "the left [last] foot lands forward of the right, closer to the net. Thus the left foot and left shoulder are closer to the net than the right" (Selinger & Ackerman-Blount, 1986, p. 89). For others, the last step "brings the spiker's left foot into position next to his right foot" (Lucas, 1985a, p. 50).

The spiker's "toes point about 45 degrees to the right of the target. His body, too, has turned to the right, toward his hitting hand. The spiker wants to position his hips in the air at this 45 degree angle" (Lucas, 1985a, p. 51).

"The left leg touches the floor in such a way that it can correct the direction of the jump" (Kovalev, 1980, p. 43). "Rotating the toe at slightly more than a 45-degree angle will create a blocking action that transfers the weight quicker and forces the body to leave the floor quicker. This rotation will also stop some natural drifting" (Haley, 1987, p. 59).

"The last step with the left foot stops the forward movement and prepares for the jump" (Dunphy & Wilde, 1991, p. 47).

The left foot lands only on the toes (with the heel barely elevated), perpendicular to the direction of the approach. This allows the calf muscles to absorb the shock and avoid strain on the lateral ligaments of the ankle joint. The toes of the left foot are placed against the direction of momentum. (Selinger & Ackerman-Blount, 1986, p. 89)

The hop approach begins as does the step-close with "one or two running steps prior to the hop" (Gozansky, 1988, p. 70). These steps generate momentum and precede "a hop on the last step, landing with both feet parallel. The heels are dug into the floor and the legs are flexed" (Keller, 1980, p. 30). The player should "land with the feet 1 1/2 to 2 feet apart" (Gozansky, 1988, p. 70).

The [hop] step should be shorter than the second, but not so short that momentum towards the net slows down. This slightly shorter length allows the last foot (left) to get down and plant almost simultaneously with the right, and the feet are on the floor the least amount of time. (Haley, 1987, p. 58)

Momentum is transferred by "landing on the heels and rocking to the toes into the jump" (Gozansky, 1988, p. 70).

While many authors recommend that "the hop is always off the left foot," (Selinger & Ackerman-Blount, 1986, p. 88), others merely state that "the spiker then takes a one foot . . . prejump that directly leads onto the two foot takeoff for the spike" (Scates, 1984, p. 51). Some allow

the hop (rarely the step-close) technique to be initiated with the foot on the side of the body of the hitting hand.

The easiest way to learn the approach steps is to mark two 50-centimeter circles in the attack area. The right foot lands in the first hoop as the arms start to swing back. The left foot then swings forward to land in the second hoop, followed fractionally later by the right foot. The right foot is slightly behind the left to help the rotation of the hips and trunk (Nichols, 1986).

This is known as a goofy-footed approach:

A goofy-footer is a right handed attacker whose final two steps of her spike approach finishes left foot followed by right foot. The proper finish for the normal two-footed take off for a right-handed attacker should end right foot/left foot. (Pingel, 1992, p. 72)

Some literature presents an approach pattern rarely utilized by spikers on any but the highest levels of competition in specialized situations, though often attempted by learners, the one-footed take-off. The technique is described as follows:

- 1.) Short step using the left foot with the arms moving forward.
 - 2.) Long step using the right foot with the arms moving backwards.
 - 3.) Jump onto left foot with both arms being raised simultaneously in front of the body.
- (Lipman, 1990, p. 20)

The Jump

With both the step-close and hop approach patterns, the body is preparing to jump as the feet touch the floor. Some prefer to touch down with the legs already bent. "On the

last step or hop the body is coiled like a spring, knees flexed about 120 degrees, trunk flexed forward, non-hitting shoulder toward the net" (Gozansky, 1988, p. 72).

For others, the flexion occurs on "the last step, which the volleyballer tries to execute as a loading step" (Kovalev, 1980, p. 43). "In the first phase the player is crouched, the body's center of gravity drops downward . . . the muscles execute eccentric contraction" (Fomin, 1979, p. 8). "During the last two steps the knees are flexed and the 'gathering' for the jump is completed" (Dunphy & Wilde, 1991, p. 47).

The optimum degree of bend at the knee varies among the sources. Some authors prefer that "the knees are bent at an angle of from 111 to 128 degrees" (Fomin, 1979, p. 8). Others "emphasize the 110 degree bend from which most jumps are made in volleyball" (Suwara, 1983, p. 10). Yet others place the knee angle at 102 degrees (Toyoda, 1989).

Some advocate "the angle between hamstring and calf not more than 90 degrees" (Keller, 1980, p. 30). Others allow that "smaller players may bend their knees up to 90 degrees but it is ineffective for larger players to do so" (Scates, 1984, p. 51). Others complete the theme of individualization:

The angle at which the knees and ankles are flexed varies with the player and his or her individual characteristics. However, too little flexion is preferable to too much. Being too low means a slower exchange of power, causing the loss of momentum. (Neville, 1990b, p. 48)

"Immediately on the last step or hop, momentum abruptly changes from forward to upward" (Gozansky, 1988, p. 72).

"The power for the jump comes from the quadriceps muscles, the gluteals and hamstrings, with a major thrust from the calf muscle. The arms lead the body upward" (Dunphy & Wilde, 1991, p. 48). "Movement of the trunk comes next, followed by movement of the legs in the hip, knee and ankle joints" (Kovalev, 1980, p. 45).

"As your feet come together for your jump, your arms (that were behind you after your second step) now swing forward and up towards the ball" (Timmons, 1990, p. 64). "A powerful double-arm swing on take-off helps the player gain the maximum height and the proper forward motion" (Gordon, 1988, p. 25). "By swinging both arms up together, good balance in the air will be achieved" (Nichols, 1986, p. 30).

The spiker's arms should then be whipped forward so that they arrive at or above the top of the head before the feet leave the floor. This whipping movement starts with the arms being thrust straight below the waist then up in front of the body with the elbows bent and next to the body so as to get them above the head quicker. (Haley, 1987, p. 59)

Others prefer that "his arms are nearly straight throughout their swing" (Lucas, 1985a, p. 53). "In a full sweeping motion, the arms swing through in a direct line with the approach" (Neville, 1990b, p. 46).

Some authors recommend that the player "swing forward both arms and reach high toward the set as you jump straight

into the air" (Viera & Ferguson, 1989b, p. 81). Others advocate that "the arms are brought just somewhere near the head" (Haley, 1987, p. 60). Some prefer that "the left arm (for a right handed player) is thrown upward directly over the head. The right arm is thrown upward, the elbow is bent, cocking the arm in a throwing motion" (Keller, 1980, p. 33). Others indicate that the "hitting arm is in throwing position with the non-hitting arm pointing at the ball" (Gozansky, 1988, p. 72).

The placement of the striking arm in preparation for the attack varies among the sources reviewed. Many recommend that the player "draw your hitting arm back, your elbow high and your hand close to your ear" (Viera & Ferguson, 1989b, p. 81). "The hitting hand is turned out to rotate the elbow high" (Haley, 1987, p. 60). "The elbow is at shoulder height, away from the body, with the forearm facing forward" (Keller, 1977a, p. 68). "The hitting arm should be flexed 90 degrees in the elbow joint during the backswing" (Topishev, 1976, p. 16).

Others prefer:

bend your elbow to an extreme, and move it as far to the rear and as high as you can. Your forearm and hand should then rotate up and behind your head. Keep your elbow high and begin your armswing into the ball. (Timmons, 1990, p. 64)

For some, "the hitting hand is drawn back with the elbow high towards the ceiling, arching the back only slightly" (Haley, 1987, p. 60). For others, the beginning

of the spiking arm-swing is merely a continuum of the swing of the arms during the jump. "The right hand comes up slightly above head height then rotates downward and around the shoulder, never coming to a complete stop" (Selinger & Ackerman-Blount, 1986, p. 92).

"The forward lifting motion of the arms should be coordinated with the straightening of the legs . . . and the natural straightening of the torso" (Neville, 1990b, p. 48). For some authors, the back of the attacker in the air will be straight. "The spiker wants to jump so that his body is vertical in the air" (Lucas, 1985a, p. 56).

Many prefer that the "back is arched while ascending" (Gozansky, 1988, p. 72). "As a result of the strong arm swing, the back will arch while the smasher is in the air" (Nichols, 1986, p. 30). "As the arms are going upward, the knees are bent as far as is comfortable" (Keller, 1980, p. 33). "The back is arched to allow the abdominal muscles to stretch and begin the full body snap that delivers the power to the hit" (Dunphy & Wilde, 1991, p. 48).

It is generally thought in volleyball that the spiker will "stop forward momentum and convert it into a vertical jump" (Haley, 1987, p. 58) so that "you jump straight into the air" (Viera & Ferguson, 1989b, p. 81). "It is more difficult to gain proper timing on the ball while the body is travelling forward in the air" (Keller, 1980, p. 28). Others allow that "the basic spike jump should be as

vertical as possible, [yet] players must allow for a degree of horizontal journeying" (Neville, 1990b, p. 48). "The spiker wants to jump so that his body is vertical in the air. He can, however, fly forward during his jump . . . from 1 to 3 feet" (Lucas, 1985a, p. 56).

The Arm-Swing

From a position and posture in the air following the jump, the player strikes the ball. "The armswing should yield good ball control, the highest possible reach and maximum power" (Selinger & Ackerman-Blount, 1986, p. 92). "Contact is made at the top of the jump with full arm extension" (Gordon, 1988, p. 25). "In addition to contacting the ball at the top of your jump, you need to hit the ball with a flat trajectory and let topspin bring the ball down into the court" (Waldie, 1990, p. 66).

"The timing of the contact is very important. It is desirable to hit the ball at the peak of the jump to give maximum reach and ball control" (Selinger & Ackerman-Blount, 1986, p. 96). For some, "the armswing begins as the body is moving upwards. Contact occurs at maximum height" (Haley, 1987, p. 60). Others recommend that "the ball should be hit . . . slightly after the apex of the jump" (Scates, 1984, p. 53).

"The player spikes the ball from as high as he can reach. This means that his hitting arm is nearly vertical

at contact. When his arm is straight--pointing upward--his wrist snaps" (Lucas, 1985b, p. 14).

Many authors favor that "the player should try to contact the ball as high and as far in front of the head as can be controlled" (Neville, 1990b, p. 49). For some, "the ball is contacted out in front of the shoulder (8 to 20 inches)" (Dunphy & Wilde, 1991, p. 49). For others, "contact should be made a foot or two in front of your shoulder" (Sturm, 1992, p. 51).

Many sources agree that "the motion of spiking is similar to that of throwing overhand" (Neville, 1990b, p. 48). "Throw the hitting arm up at the ball and snap" (Gozansky, 1988, p. 72) is a general description of the arm-swing presented in the literature. More than a swing of the arm, however, the arm swing is a combination of total body movements. "In no way can the arm action actually be separated. It is an integrated movement" (Keller, 1980, p. 33).

The spiker's body can be seen as a series of four movable parts. His torso (heaviest) moves first. His upper arm moves next. His forearm follows. Finally the lightest part, his hand, moves into the ball. His hand contacts the ball . . . as his hand is moving at its fastest. (Lucas, 1985b, p. 14)

Many authors recommend that, from an arched posture, an upper body piking motion be used to generate torso movement. "The back is arched to allow the abdominal muscles to stretch and begin the full body snap that delivers the power

to the hit" (Dunphy & Wilde, 1991, p. 48). "You want to be able to use the snap from your stomach for power and velocity" (Sturm, 1992, p. 51). "The body, during the action, should start from an arched position, go to a vertical position upon contact, and to a piked position on follow-through" (Keller, 1977a, p. 69).

For many, the upper body pike begins with lower body movements. "The hitting action is initiated with the feet and lower legs by snapping them forcefully downward and forward. As they become extended, they are followed by the upper leg, creating a slight pike position of the body" (Keller, 1980, p. 33).

For others:

the action begins as the trunk of the body rotates forward, supplying great initial power. As the knee opposite the hitting arm bends upward, the shoulder comes forward. The trunk, shoulder and upper arm accelerate and then, almost in unison, decelerate, transferring the momentum into the hand, which whips forward as a separate unit. (Selinger & Ackerman-Blount, 1986, p. 96)

Some sources indicate that "as the total striking action is initiated by the legs, the arm swing is initiated by the left arm" (Keller, 1980, p. 34). For others, the movements of the upper body and hitting and non-hitting arms are near simultaneous. "As you swing at the ball, your non-hitting hand drops quickly to your waist" (Viera & Ferguson, 1989b, p. 81). "The left arm and shoulder drop quickly as the right arm uncoils toward the ball. The striking shoulder elevates and the upper body torques toward the ball

as the body snaps forward from the waist" (Scates, 1984, p. 53).

Some authors indicate that "the non-hitting arm effectively counterbalances the movement to the hitting arm" (Selinger & Ackerman-Blount, 1986, p. 94). Usually, there is no need to teach a player what to do with the non-hitting arm because the movement occurs naturally. The non-hitting arm acts as a natural counterweight to keep the body in balance" (Selinger & Ackerman-Blount, 1986, p. 95).

"The shoulders are at an angle to horizontal, the left being uppermost. The angle must be reversed and is done so by forcefully swinging the left arm forward and down" (Keller, 1980, p. 34). The left arm action is downward and across the body, which limits shoulder rotation (Keller, 1980). In addition to reversing the shoulder angle, this left arm action will cause the right shoulder to be rotated upward and forward (Keller, 1980). "The left hand continuing downward and backward creates greater shoulder rotation and a turn to the left" (Keller, 1980, p. 38).

Many authors recommend that as, or slightly after, "the left arm comes down, the right arm swings up and through the ball. The right elbow precedes the arm through the hitting motion" (Keller, 1977a, p. 69).

The first movement of the right arm must be with the elbow, swinging it forward so that the upper arm is perpendicular and in front of the shoulder. From this position the right arm is extended upward to contact the ball. (Keller, 1980, p. 34)

Others prefer that "the shoulder moves toward the point of contact, followed quickly by the elbow, then by the hand" (Neville, 1990b, p. 49).

Your forearm and hand should rotate up and behind your head. Drive your right arm forward beginning at the shoulder, then follow with the upper arm, then the forearm and finally your hand. Now, snap your wrist as you contact the ball. (Timmons, 1990, p. 64)

Some authors indicate that the hand travels in a loop instead of starting in a static position:

[The hitting hand] rotates downward and around the shoulder, never coming to a complete stop, maintaining an angle of about 90 degrees between upper arm and forearm, with the forearm parallel to the floor. Toward the end of the armswing, the arm extends toward the ball. (Selinger & Ackerman-Blount, 1986, p. 94)

The action of the arm-swing is to generate speed in the hitting hand as it moves to contact the ball. "Power is mainly a function of the speed of the arm" (Selinger & Ackerman-Blount, 1986, p. 96). "Arm and wrist uncoil and snap quickly upward and forward into the ball" (Gozansky, 1988, p. 72).

"The entire movement is completed by the wrist snap" (Ejam & Buchtel, 1983, p. 205). "At contact, your wrist snaps forcibly" (Viera & Ferguson, 1989b, p. 91). "The wrist snap imparts topspin, causing the ball to drop quickly to the floor" (Neville, 1990b, p. 49).

Many authors prefer that the "wrist should be loose, and be allowed to snap freely, much like the end of a whip" (Keller, 1979, p. 39). Others advocate that "prior to

hitting the wrist is pulled back" (Nichols, 1986, p. 33).
 The "wrist is hyperextended and flexible prior to contact"
 (Gozansky, 1988, p. 72).

Contact with the Ball

The contact area on the hand varies among the sources. Many indicate that "the hand contacts . . . the ball, heel first, and spreads out over the ball" (Neville, 1990b, p. 49). "The contact of the ball is with the lower third of the open hand" (Keller, 1977a, p. 69). "The contact of the ball is primarily with the heel of the open hand, with the upper palm, base of the fingers, and finger pads following very quickly and in that order" (Keller, 1980, p. 34).

Others favor "contact on palm of open hand" (Gozansky, 1988, p. 72). "The heel and palm of the hand simultaneously contact the ball, followed by the fingers" (Scates, 1984, p. 53). Some prefer that "the hand should contact the ball slightly above center" (Haley, 1987, p. 61). "The top part of the palm of the hand, near the fingers, is the major contact point. The fingers then snap over the top of the ball" (Dunphy & Wilde, 1991, p. 49).

Though initial contact varies, "contact is made with the entire hand" (Gozansky, 1988, p. 72). "The heel of the palm supplies the power and the fingers supply the direction and top spin. The palm should be fairly loose so it can conform to the shape of the ball" (Selinger & Ackerman-Blount, 1986, p. 96).

The literature reviewed generally presented either, or both, of two common hand positions for contacting the ball during the spiking action, "open or slightly cupped" (Gozansky, 1988, p. 72). "At contact . . . the hand is in a cupped position" (Ejam & Buchtel, 1983, p. 205). The "hand position is open and fingers slightly spread for control" (Stokes & Haley, 1984, p. 43). "The hand will mould around the ball if the fingers are relaxed" (Nichols, 1986, p. 33).

"We find two acceptable options in hand position, one with the fingers and thumb together and slightly cupped, and the other with the wrist held in a relaxed position. The cupped hand will generally add a little more power" (Keller, 1980, p. 35). "For more control, attackers should open their hands more and spread their fingers slightly" (Haley, 1987, p. 61).

The literature presents that the ball is generally contacted near the "center back of the ball" (Gozansky, 1988, p. 72). Some "contact the ball slightly above center" (Haley, 1987, p. 61) or "contact the top and back of the ball" (Neville, 1990b, p. 49). For others, "the ball should be hit near the back of the ball on a deep set and higher on the ball if the set is closer to the net" (Keller, 1977a, p. 69).

Some sources indicate that "you can adjust the angle of the ball by changing the placement of your hand on the ball"

(Timmons, 1990, p. 64). Others direct the ball through the wrist action. "Use quick turn with forearm and wrist for less power but more deception" (Gozansky, 1988, p. 72). "The entire [spiking] movement is completed by the wrist snap which is used to direct the ball" (Ejam & Buchtel, 1983, p. 205). Yet others allow that the "attacker changes course of the ball by changing body position in the air to face the direction of the attack" (Gozansky, 1988, p. 72).

Many authors recommend that direction of the spike be determined by the position of the ball relative to the hitter:

The lateral direction of a power spike is determined by the location of the ball in relation to the shoulder of the hitting arm. It is very important that a spiker line up with the ball in a way that leaves as many options for hits as possible. A right handed spiker must jump behind the ball and about a foot to the left of the desired contact point on the lateral plane. (Selinger & Ackerman-Blount, 1986, p. 110)

Differing are those whose optimum alignment between ball and body is relatively constant, "contact with the ball should be made . . . in a position between the shoulder and the top of the head" (Haley, 1987, p. 61).

For those directing the ball through alignment, "a most important aspect of spike execution is the location of the ball in relation to the spiker's hitting hand and body" (Viera & Ferguson, 1989a, p. 97).

To hit the ball cross-court . . . the spiker attacks the ball before it crosses in front of his or her body. To hit the ball to down-the-line,

the spiker must allow the ball to pass in front of his or her body. (Cox, 1980, p. 57)

This is the case for right-handers and left-handers, on-hand and off-hand:

When hitting an on-hand cross-court spike, the player contacts the ball in front of the hitting shoulder. When going down-the-line, though, the spiker contacts the ball at the midline of the body. The location of the ball during the execution of the off-hand spike is just the opposite, at the midline of the body for cross-court spikes and in front of the shoulder for down the line spikes. (Viera & Ferguson, 1989a, p. 97)

Blocking

At beginning levels of play, the serve dominates play. Offense consists of merely returning service. As player reception and attack skills improve, levels of play advance, and the spike becomes the primary weapon of the team's offense. Central to a team's defense against the spike is the block.

At the lower levels of play, effective spikes are rarely accomplished. "Blocking is the least important skill at beginning levels. At higher levels of play . . . blocking becomes extremely important" (Neville, 1990b, p. 59).

The block consists of one or more players placing their hands over the net in the path of an oncoming attack. "The hoped for result is that a stable rectangle be formed by the block above the net" (Keller, 1977b, p. 88). "The blocker's responsibility--if he can't roof the ball for a quick score

or sideout--is to channel the ball to the digger or deflect it to a teammate" (Shondell, 1990, p. 21).

Efficient blocking is not only blocking with immediate success, efficient blocking is also when the block touches the ball and reduces the speed of the spiked ball or when the block limits the possibilities of attack by intimidating the opponent or by protecting or covering a great deal of its own court, giving teammates better opportunities to dig the ball and to prepare a successful counter attack. (Baacke, 1990, p. 15)

Blockers read situations and setter cues. Determining the point of attack, the blocker effects movement and alignment opposite the attacker. The blocker then jumps and extends the arms and hands to intercept the spiked ball. "The technique of blocking is generally considered to be the most difficult skill to learn" (Coleman & Neville, 1990, p. 1) and "the most difficult volleyball skill to teach" (Neville, 1990b, p. 59).

Blockers arrive at their respective blocking positions as the opposing receiver prepares to pass the ball. As the pass is executed and the ball travels to the setter, the blockers assume a ready position and prepare to defend the possible attack options. "Key on the pass. It dictates what will follow" (Dunning, 1990, p. 43).

Initial Posture

Much of the literature recommends that the blocker in the ready position "starts as close to the net as possible while allowing a vertical raise of the arms without touching the net" (Shondell, 1990, p. 21). For some authors, this

distance is "about one or two feet from the net" (Gozansky, 1988, p. 96). For others, "the starting position is at arms' length from the net" (Dunphy & Wilde, 1991, p. 74). Some "begin by standing within one foot of the net, facing the opposite court" (Viera & Ferguson, 1989b, p. 129).

Some literature allows blockers to be more than an arm's length away from the net. "The outside blocker can assume a ready position anywhere from one foot to five feet from the net. Short players should be deeper. Blockers must arrive at the take-off position early, retaining forward inertia" (Keller, 1980, p. 44).

"To be ready to block, players should stand with feet side-by-side, shoulder-width apart" (Neville, 1990a, p. 61). The "weight is on the insides of the feet" (Gozansky, 1988, p. 96). "The back is straight, tilted slightly forward toward the net. The head is up" (Neville, 1990b, p. 61).

"The legs are slightly flexed at the knees" (Neville, 1990b, p. 61). "Knees are bent sufficiently so that only one move is required to explode upward or dart laterally from the base posture. Having to bend the knees deeper before jumping or moving laterally wastes precious fractions of a second" (Herbert, 1991, p. 77). "Keep your knees flexed at all times" (Dunning, 1990, p. 43).

The blocker is advised to "keep your hands up at all times. It gets them to the blocking area more quickly and more consistently" (Dunning, 1990, p. 43). Many authors

recommend the blocker start with "hands at shoulder height, elbows flexed, forearms parallel to the net" (Gozansky, 1988, p. 96). For some, the "hands are out to the sides at shoulder level, palms facing forward with fingers spread wide" (Viera & Ferguson, 1989b, p. 129). For others, "the hands, fingers spread, are held in front of the shoulders" (Neville, 1990b, p. 61).

Some sources place "the hands above and in front of the shoulders" (Beal & Crabb, 1987, p. 67). Some authors prefer that "the blocker should start with hands about head high, elbows in and pointed forward, palms facing the net, hands at a 45-degree angle to the floor, and fingers spread. Hands are firm" (Shondell, 1990, p. 21).

Some authors allow a lower hand position. The blocker starts "with the hands at about waist height and the forearms parallel to the floor. Keeping the arms down at waist height facilitates faster lateral adjustments and a more explosive jump from a stationary position" (Selinger & Ackerman-Blount, 1986, p. 174). Others indicate, however, that "the hands drop only to shoulder level in coiling for the jump. Block position is more important than height of the block jump" (Neville, 1990b, p. 64).

In the ready position as the setter receives the pass, the blocker's focus is on the setter. "Watch the setter to see the direction and height of the set and the distance from the net" (Dunning, 1990, p. 43). Some sources advise

that the blocker also "determine speed and height of the set" (Stokes & Haley, 1984, p. 46).

"The blocker watches the [set] ball rise to its peak and makes appropriate positional adjustments. The blocker then focuses on the approaching attacker keeping the ball within his or her peripheral vision" (Neville, 1990b, p. 64). "Once the blocker has identified where the set is going, his or her focus changes from the ball to the attacker. The longer the blocker looks at the attacker, the more the blocker is able to observe" (Dunphy & Wilde, 1991, p. 76).

Much of the literature indicates that one of the things fundamental to blocking is "watching the hitter and not the ball after it has been set" (Kessel, 1990a, p. 15). "The blocker must never take his or her eyes off the assigned opponent. The flight of the ball is a secondary matter and should be watched peripherally by the blocker" (Cox, 1980, p. 82).

Some sources, however, return attention to the ball after identifying the opposing spiker approach. "They should watch the setter to determine where the ball will be set, the hitter's approach, then the ball" (Pederson, 1990, p. 20). "Watching the opposing setter, wait until the ball is set to the hitter across the net from your position on the court, then change to watch the attacker until the ball comes into view" (Viera & Ferguson, 1989b, p. 129).

Many sources emphasize that the blocker study the attacker's approach, as well as the body in the air. "The spiker's intended hitting direction can often be determined by studying the spiker's approach, jump, and armswing" (Cox, 1980, p. 88). "Spikers at any level tend to hit in the direction of their approach 80 percent of the time" (Neville, 1990b, p. 62).

"Watch the hitter's approach and set the block on that line" (Dunning, 1990, p. 43). "The blocker must first identify the spiker's angle of approach and the point where the spiker will intercept the ball, and second, get to the right spot on the continuation of the spiker's approach angle to block the shot" (Beal & Crabb, 1987, p. 67).

Others concentrate on the spiker's body in the air. "Do not watch the ball. The ball will be by you before you know it. To know where the ball will be crossing the net, you've got to watch the hitter's body, arm and hand" (Stevenson, 1989a, p. 54).

Having determined the location of the set and the approach of the attacker, the blocker aligns in relation to the spiker. In situations allowing the utilization of multiple blockers, the outside (nearest the sideline) blocker is responsible for alignment relative to the spiker, known as "setting the block." The middle blocker arrives at a position adjacent to the outside blocker.

Alignment of the Outside Blocker

"The two outside blockers are within three steps from their nearest sidelines and at least one meter from the middle blocker" (Dunphy & Wilde, 1991, p. 74). The blocker moves into the path of the attacker's approach, "setting" the block. "The blocker must have good balance and must be no more than 14 inches from the net" (Beal & Crabb, 1987, p. 67).

Some authors recommend, "in 'setting' the block, the outside blocker establishes a stable position directly opposite the approaching spiker" (Cox, 1980, p. 42). Others prefer that the blocker "attempt to line up one-half body width toward the opponent's hitting side" (Viera & Ferguson, 1989b, p. 129). Others recommend, "for a cross-court block, line up inside the arm of the hitter with the midline of the blocker. For a line block, the hitter's outside arm and shoulder should line up with the blocker's midline" (Pederson, 1990, p. 20).

Some of the sources change the positioning of the outside block relative to the attack situation. "The end blocker should keep his hand between the ball and the sideline on a close set" (Scates, 1989, p. 81).

Overblocking the line should occur when the set is delivered by opponents to an outside position along and very close to the net. In this case it is necessary to overblock the line to prevent the ball from being tipped, hit, or wiped off the outside blocker. Overblocking requires the outside blocker to position the inside hand on the ball. (McReavy, 1987, p. 110)

"The more inside the set, the farther the block moves into the court" (Pederson, 1990, p. 20). "On a deep set instruct the end blocker to move toward the center of the court" (Scates, 1989, p. 75). "Generally, the deeper the set, the less of the line that is blocked, and the block is moved toward the middle of the court" (Keller, 1980, p. 46).

Movement to Alignment, Outside Blocker

Outside blockers in typical play (other than high-level competition) are generally within a step or two of their blocking position. Movement patterns covering short blocking distances are common to much of the literature. One method presented is "for a short shift, players should execute a flat jump sideways--a take-off from one foot in the direction of the block, landing on both feet and then executing the take-off" (Ejam & Buchtel, 1983, p. 227).

A two-step [slide-step] move is designed to cover 1 to 2 meters. The blocker steps as far as needed with the foot nearest the direction of travel to front the hitter, pushing off on the opposite foot. The opposite foot closes with the lead foot. The toes are pointed toward the net during the movement. At the end of the movement the feet are closer together than in the ready position. The pelvis and shoulders remain parallel to the net during the movement. (Neville, 1990b, p. 62)

In the pre-contact position, the feet are side-by-side. It is acceptable to have the outside foot slightly closer to the net; however, it is not acceptable to have it any further away. Such a position will create a rebound angle that will carry the ball out of bounds. (Neville, 1990b, p. 63)

Alignment of the Middle Blocker

The middle blocker has blocking responsibilities all along the net, in the middle, as well as both sideline areas. Attacks in the middle often are executed at a faster tempo than outside attacks and allow the blocker less time to react and defend. The blocker must be in a position and posture to defend these sets, as well as move to the sideline and join the outside blocker.

To ensure quick movement and jumping in case of first or second tempo attacks, the block players raise their hands above their shoulders or even their head and watch with slightly bent legs and feet shoulder-wide the opponent setter and the approach of the quick spiker(s). (Baacke, 1990, p. 15)

This is critical when in the read-block mode protecting against the quick attack. It is absolutely mandatory that blockers not drop their hands in an attempt to jump [higher]. There is not enough time. The hands stay high and the thrust comes from the legs. (Herbert, 1991, p. 77)

Movement to Alignment, Middle Blocker

Having identified that the set is toward the sideline area, the blocker moves quickly to align adjacent to the outside blocker. Some sources recommend that "for short distances" (Gozansky, 1988, p. 97) or "when time permits, the middle blocker should use the slide step to move outside to block" (Shondell, 1990, p. 23). "For greater distances and for quickness use the crossover step" (Gozansky, 1988, p. 97).

The middle blocker should push off with the foot opposite the direction he wishes to move, stride

out as far as possible with the lead foot, take one or two additional steps and then square away on the final plant with both feet pointing toward the net. (Shondell, 1990, p. 23)

The three-step move is used primarily by middle blockers to cover greater distances (2 to 4 1/2 meters) with control. The blocker pushes off the foot opposite the direction of movement, with the lead toe pointing in the direction of movement. The trailing foot crosses in front of the lead foot, and the toe is planted pointing at the net. The lead foot swings around behind the trailing foot, lining up side-by-side, toe pointing at the net. The hands are carried above the head and in front of the shoulders. The shoulders and pelvis should be parallel to the net in the final position. (Neville, 1990b, p. 62)

"Break momentum and square off with the last step (or if necessary square off in the air)" (Gozansky, 1988, p. 97).

Other sources prefer that blocker movement "is executed by a quick dash forward" (Ejam & Buchtel, 1983, p. 227).

"The run should always start with a very short step followed by progressively longer steps. At the end of the run the blocker should use a short low hop, or step-close, to get to the blocking point" (Selinger & Ackerman-Blount, 1986, p. 174).

Basically, it means turn and run to the take-off point and then turn back, jump and block. Upon arrival at the take-off point . . . it is required that they "dig in" their outside foot prior to take-off, and transfer lateral momentum to height. (Keller, 1980, p. 46)

"It is important . . . that the blockers jump in unison" (Cox, 1980, p. 42). While many authors recommend the player watch the opposing hitter during alignment, some authors prefer that "after the set the moving blocker

focuses on the player setting the block" (Viera & Ferguson, 1989b, p. 132). The middle player should watch the outside player moving to that position. Then both players can jump at the same time (Viera & Ferguson, 1989b).

In order to block effectively upon arrival, the shoulders must be realigned:

As the joining blocker moves toward the set block, the shoulders are square to the sideline of the court. As the blocker closes, the outside shoulder must rotate toward the net so that the shoulders are square to the net before the blockers jump. (Viera & Ferguson, 1989a, p. 104)

The Blocking Action

Once alignment and stability are attained, the blocker prepares to jump and execute the blocking action. The literature offers a variety of depths from which the jump is taken. Many recommend initiating the jump from a leg flexion of approximately 90 degrees at the knee. "When his knees are near a right angle, he pauses, ready to jump" (Lucas, 1985a, p. 111).

"Just prior to the jump, assume a half-squat position with the back straight, explode straight up with the legs" (Gozansky, 1988, p. 96). Others place the "knee angle at 100 to 110 degrees" (Toyoda, 1989, p. 168). Some prefer "a deep squat (60 degrees plus) increases jumping height" (Keller, 1980, p. 44).

The sources vary with respect to the timing of the blocker's jump. For many, "immediately after the attacker jumps, bend your knees and jump" (Viera & Ferguson, 1989b,

p. 129). Some advise that the "blockers must time the jump so the body is beginning to descend as the ball is spiked" (Keller, 1980, p. 42). Others recommend that "a general rule of thumb is that the blockers should begin to jump when the spiker's hand crosses in front of his or her face during the ascent" (Neville, 1990b, p. 64).

This applies when the hitter is within one meter of the net. If the spike is farther than a meter from the net, the blocker should jump as the spiker's hitting arm is being swung toward the ball" (Neville, 1990b, p. 64). "The deep set requires delayed timing on the part of the blockers, the deeper the set the greater the delay" (Keller, 1980, p. 46).

As the blocker extends the legs to jump, the arms also "extend and reach from starting position" (Viera & Ferguson, 1989a, p. 104). "During the course of the jump the arms are extended up along the body and then over the net" (Ejam & Buchtel, 1983, p. 225). "The blockers must penetrate the opponent's air space as deeply as possible without touching the net" (Dunphy & Wilde, 1991, p. 79).

"The blocker jumps vertically. The hands go up after the ball on the other side of the net. The shoulders are extended upward, following the arms" (Neville, 1990b, p. 64). "Fingertips, hands, arms and shoulders are firm and forward" (Gozansky, 1988, p. 96).

The literature generally agrees that "a basic rule is that the distance between the hands and the portions of the

arms extended above the net at the moment of the spiker's contact normally should be less than the circumference of the ball" (Scates, 1984, p. 83).

The blocker's arms should be very close to the tape of the net and the arms and hands penetrating over the plane of the net. Blockers who are inexperienced . . . swing their arms backward away from the net, leaving a space between the arms and the net. The ball usually goes in this space. (Keller, 1977b, p. 89)

"The arms should rapidly and directly penetrate the net" (Shondell, 1990, p. 22). Many sources recommend that the blocker "jump and shoot the arms upward towards and over the net" (Keller, 1977b, p. 89). "The movement is not 'jump up then put your arms over the net'; the proper movement is jump up while simultaneously sliding your arms across the net" (Dunphy & Wilde, 1991, p. 79). "The jump rockets the blocker straight up, and the hands penetrate the top of the net immediately" (Beal & Crabb, 1987, p. 67).

Other sources, however, indicate that "the hand movement is a press forward and downward and inward" (Keller, 1980, p. 42).

He presses his hands forward at the height of his jump. If the blocker can reach . . . his forearms or his elbows above the net, he presses his arms forward. If he can reach his shoulders above the net, he presses forward at the waist. (Lucas, 1985a, p. 112)

Some advance this technique as being "used by experienced players" (Keller, 1977b, p. 89). "A three count block is an advanced technique. Count one is the jump with the arms vertical, count two is net penetration, count three

is landing" (Keller, 1977a, p. 76). Some advocate that the experienced blocker is "penetrating over the net, ducking the head and bringing the body into a pike position" (Keller, 1977b, p. 89), while advising that "blockers should not duck the head as the ball is being hit" (Keller, 1979, p. 57).

The outside blocker, especially, is vulnerable to blocking the ball out of bounds. "When blocking outside, the player must turn the hand that is closer to the sideline so that when the ball is deflected off the hands, it is directed back into the opponent's court" (Viera & Ferguson, 1989a, p. 104). "The angle of deflection is modified by turning the hands toward the middle of the opponent's court" (Neville, 1990b, p. 65). "I tell my outside blockers to turn the ball into the court, to turn their outside hand into the court" (Pederson, 1990, p. 20).

Others favor an inward movement of the hands to direct the ball:

For outside blockers, the hands must not reach beyond the outside shoulder. Instead, the hands must be moving in. The blocking movement is pressing towards the center of the back line, with the outside hand reaching over and out, across the net, perpendicular to the outside shoulder. Therefore, the blocker's outside arm and shoulder extend over the net slightly farther than the other half of the body. Prior to contact, the blocker extends forward from the shoulders. (Beal & Crabb, 1987, p. 67)

Some authors prefer that the blocker "just prior to contact, turn the shoulders, arms, and hands toward the center of the opponent's court" (Gozansky, 1988, p. 96), "penetrating toward the back line rather than toward the hitter" (Kessel, 1990a, p. 15).

The outside blocker should always finish the block (the ball contact) with the palms facing the middle of the opponent's court. The middle blocker moving over to assist with the block . . . needs only to have the shoulders square (parallel) to the net to block the ball into the opponent's court. (Shondell, 1990, p. 22)

Contact with the Ball

The "blocker's hands and fingers should be wide spread to cover as much area as possible" (Keller, 1977b, p. 88). Some authors prefer to "spread the fingers of your hands wide so that the thumbs are pointing at the ceiling" (Viera & Ferguson, 1989b, p. 129). Others prefer the hands spread with "thumbs pointing towards each other" (Beal & Crabb, 1987, p. 67).

Some authors recommend the blocker "learn the technique of increasing the width of the blocking area by moving the hands along the net after anticipating the path of the spiked ball" (Toyoda, 1989, p. 169).

For modern volleyball it is required to move the arms and hands actively towards the ball or towards the direction where the ball crosses the net. By such sideways blocking techniques the range of blocking can be extended considerably. (Baacke, 1990, p. 16)

"The arms should not be fully extended until the spiker makes a final move. When the spiker's final move occurs, the blocker, stretching all the way up from the abdomen, extends arms, hands and fingers" (Beal & Crabb, 1987, p. 67).

The hands and arms spread must be strong enough to prevent the ball from being driven through the block. "The hands, when raised upward, must also be sufficiently close together to ensure that the ball will not pass between [them]" (Ejam & Buchtel, 1983, p. 227). The "hands [are] in line with the arms, fingers spread, hands positioned close together" (Gozansky, 1988, p. 96).

Follow-Through

The blocker should "hang and reach to sustain the block as long as possible" (Gozansky, 1988, p. 96). "As the blocker descends, his arms and hands draw away from the net and down the sides of his body" (Scates, 1984, p. 83). The player should "land first, then turn the head to follow play" (Gozansky, 1988, p. 96). Having gained balance and located the ball, the blocker prepares for the following action.

Individual Defense

Individual defense is the act of playing attacks that evade the block or are deflected by the block, the action often termed "digging" the ball. Digging is similar to serve reception, but with significant differences. The

velocity of the oncoming ball must be absorbed so that the ball rebounding off of the arms is not sent back across the net. There is little time for positional or postural adjustment, and the player must be able to react to the ball being deflected by the blockers away from its original path.

Individual defense begins as the opponent's offensive play develops. "Each player must get ready to play the ball before it is hit by the opponents. The only way to be prepared is if every player expects to be hit with the ball every time it is attacked" (McReavy, 1987, p. 107). Some authors recommend that the player "reads opponent's play and positions self on court in the most advantageous area" (Viera & Ferguson, 1989a, p. 85).

For others:

anticipation can be made from reading the situation or by using scouting information. But anticipation can also work against defensive players. The players make a move according to the anticipated situation. If a situation occurs where the anticipated situation does not actually occur, the recovery time to correct the movement includes reaction time, stopping momentum and then making the correct move. (Welch, 1992, p. 14)

Initial Posture

You should start in the ready position. It is important to be stopped when the hitter hits the ball. If you're not, it's much harder to pick up the ball. Be sure not to get caught moving in one direction and watching the ball go the other way. Even if you're out of position, it is better to be stopped and react when the ball is hit rather than getting burned running to the "so-called" right position. (Cobbs, 1992, p. 39)

Some sources emphasize quick movement of the body into ready posture, utilizing a low quick hop (known as a pre-hop or speed-step) into ready position, stretching and loading the leg muscles much as is done for the spike jump. "The pre-hop is designed to break the player's physical and mental inertia" (Gregory, 1987, p. 2). "The speed-step [pre-hop] is a short hop forward, landing on both feet (toes) with the weight forward but the body relatively erect" (Keller, 1977b, p. 93). The timing of the speed step is that it is taken as the opponent contacts the ball for his attack.

The player gets into his court position during the opponent's pass and set. Then, just as the ball is hit--speed step. Players can . . . move in an easy controlled fashion during the opponents pass and set, do a speed step on attack and explode (if necessary) to play the ball. (Keller, 1977b, p. 94)

Not all authors share enthusiasm for the speed-step, or pre-hop as it is more commonly known. "The stationary position is recommended because the pre-hop often takes the weight from the toes and shifts it to the heels (the least desired weight distribution)" (Dunphy & Wilde, 1991, p. 86). "At the moment the hitter contacts the ball, realizing that it is impossible to predict the direction or velocity of the shot or whether it will deflect off the block, the floor defender must be stopped and in a balanced position ready to move in any direction. Any unnecessary movement at this moment predisposes the body to move in one particular

direction, and if that direction is away from the ball, the defender is going to be caught out of position" (Herbert, 1991, p. 85).

Much of the literature is in agreement that in the ready position, as the ball is attacked:

"backcourt player's posture should be as follows: knees should be bent with fingertips placed in front of knees. Body weight should be on balls of feet. Body weight should be placed forward as much as possible. Heels should not be on the floor. (Toyoda, 1989, p. 150)

"The head is up and the eyes are trained on the setter-attacker-blocker configuration" (Herbert, 1991, p. 85).

The player effects a "low center of gravity with forward body lean (lower ready position than for a pass), weight equally distributed on both feet until the exact direction of the ball is known" (Gozansky, 1988, p. 118). "To be balanced, a floor defender must stand with feet shoulder-width apart (or slightly wider), toes pointing slightly inward. The weight should be forward on the balls of the feet" (Herbert, 1991, p. 85).

The defender bends at the knees and at the waist so that the knees are in front of the toes and the shoulders are in front of the knees" (Herbert, 1991, p. 85). "The knees and hips are bent at approximately 90 degrees" (Scates, 1984, p. 103). "The closer you are to the attack the greater the knee bend" (Gozansky, 1988, p. 118).

Foot placement varies among the sources reviewed. Many authors recommend that "his feet are side-by-side and wider

than his shoulders" (Lucas, 1985a, p. 123). Some prefer to "make sure the digger's outside foot is forward so that the dig will more likely be controlled into the center of the court" (Scates, 1989, p. 106).

Others indicate:

a slightly staggered stance with the right foot forward is the preferred method because it standardizes the fundamental. If the right foot is always forward on every contact, the player doesn't have to learn the different weight shift that would be necessary if the left foot were forward. (Dunphy & Wilde, 1991, p. 86)

Directing the ball, the player should "drop the shoulder closest to the target" (Viera & Ferguson, 1989b, p. 106).

Many authors recommend that the "hands are held comfortably out from the body, elbows bent, hands over knees, hands tight" (Gozansky, 1988, p. 118). Others prefer that the "arms are held at waist with hands extended for quick reaction to spiked balls" (Toyoda, 1989, p. 150). Some indicate "the elbows hang directly under the shoulders and are bent at a 90-degree angle so that the forearms are low and parallel to the floor" (Herbert, 1991, p. 85). Yet others favor that "the arms should be held almost parallel to the floor" (Scates, 1984, p. 103).

The Digging Action

Spiked balls generally travel at greater velocity than served balls. If handled with the technique of serve reception, the ball will rebound farther. Therefore, "the

receiver must cushion the ball by 'giving' slightly at reception" (Viera & Ferguson, 1989a, p. 87).

From the ready position, quick movement of the arms to the ball is emphasized by some authors:

When defending against high velocity balls, the player's first response must be to move the hands (i.e., the platform) to the ball. Any other movement would only delay the platform move, possibly causing the hands to arrive too late to dig the ball. (Herbert, 1991, p. 87)

Many of the sources reviewed recommend "when passing a hard driven ball, the player does not swing his arms and lift his body up and through the flight of the ball. He actually cushions the ball with a body and arm movement away from the target" (Keller, 1980, p. 9). "On harder-hit balls, the player may need to take speed off the ball by cushioning it so that it doesn't rebound back over the net. This action is gained by moving the arms slightly back toward the body upon contact with the ball" (Dunphy & Wilde, 1991, p. 88).

Some advise that the "hips move forward on contact, the body leans slightly back" (Gozansky, 1988, p. 118). "The digger often cushions hard-driven spikes so that they do not rebound back over the net. This is accomplished when the digger moves his hips forward and pulls his shoulders back" (Scates, 1984, p. 103). "He draws his arms toward his body. They are nearly vertical" (Lucas, 1985a, p. 124).

Other authors prefer to keep the ball on the receiver's side by playing the ball to a more vertical trajectory:

You should flick your wrists or flex the elbows at contact to ensure height and to ensure that the ball will remain on your side. Reach towards the ball, slight extension of the body toward ball, forward and upward "poking motion." (Viera & Ferguson, 1989b, p. 106)

Control of the dig allows the defense the opportunity to convert defensive plays into offensive attacks.

CHAPTER 3

Methods and Procedures

Procedures

Quantitative biomechanical analysis involves measurement of the causes and effects of human movement. Qualitative biomechanical analysis involves comparison of an observed movement pattern to a conventional or theoretical model. In some cases the deviation of the observed from the model is measured and quantified. Often the comparison is done with the intent of conforming the observed movement pattern to that of the model.

The development and understanding of the movement model used for comparison is the primary need in using qualitative analysis in physical education instruction. In the realm of physical education instruction, there exists no universally accepted models of the skills and techniques of volleyball. A theoretical model of fundamental volleyball techniques, to be used in instruction of physical education and non-elite-level competition, was developed representing a combination of that which is indicated in the scientific research, that which is common to much of the experience-based literature, and that which lies within qualitative biomechanical principles. The movement patterns presented are those which efficiently and effectively result in positive outcomes for

learners of volleyball in the various physical education settings.

The fundamental contacts commonly taught and used in the sport of volleyball are covered. The movement patterns which execute the serve, forearm pass, overhead set, spike, block, and individual defense are described and analyzed. The user is presented with the knowledge of what movement patterns to teach and learn, as well as an understanding of why those movements are effective. Such information is useful to both the teacher and the learner, enhancing the educational process.

The format consists of three segments presenting each of the fundamental volleyball techniques to be taught. The first segment is a detailed description of the preferred movement pattern of the technique. The second furnishes an in-depth analysis of the movement pattern. The third arranges the key teaching points of the movement pattern. The presentation format is designed to simplify use by the teacher and the learner.

The first segment is an in-depth description of the movement pattern. The technique is broken down into the various phases that make up the total execution. Presented in detail are: the initial posture, movement to the ball, the preparation phase, the striking action, and the body surface contacting the ball.

A qualitative mechanical analysis of each phase of technique execution follows. By understanding how the ball is manipulated through execution of volleyball skills, the teacher and learner identify which movements exhibited by learners do and do not contribute to skill execution and, thus, which movements are to be modified and how.

A summary of key teaching points follows the technique analysis. These are listed in relation to the skill phases (e.g., initial posture, contact area). They provide the teacher and learner with a quick checklist of the skill's description and analysis.

Each segment interfaces with the others, yet serves a separate purpose. At different stages of learning, the segments may be referred to independently or in unison. The format serves to describe the whole movement sequence, to present an understanding of the various parts of the technique, and to reinforce the execution of the whole skill.

Methods

The skills and techniques of volleyball are presented and analyzed for the purpose of providing physical education instruction, teacher preparation, athletics, and recreation a resource for teaching, and preparing physical educators and coaches to teach, the sport of volleyball. Movement patterns constituting efficient volleyball technique are those which generate the most positive results in terms of

power, control, and consistency with the minimal effort in terms of body segment movements. Efficient volleyball techniques are described as they relate to balance and equilibrium, weight distribution, lines of force, generation of power, and absorption and propulsion of the ball.

As in all sports, balance in volleyball is essential for effective body movement and ball manipulation. Effective equilibrium allows the body to move quickly while maintaining desired body alignment. Lack of balance in the initial posture results in slow movement to the ball. Poor balance at the point of contact creates movement in the body which transmits both direction and force to the ball.

A player executing a forearm pass from a narrow base of support can move the passing platform laterally only slightly without rotating the torso. Such a rotation changes the angle of the platform and, thus, the direction of the pass. A spiker rotating through the horizontal plane while in the air constantly changes not only the direction of the arm-swing, but also the location of the ball relative to hitting axis. The player must adjust execution to accommodate the lack of equilibrium, thus making the skill more complex and the execution less efficient.

Balance requires only that the center of mass be over the base of support. Weight distribution refers to the location of the center of mass within the base of support. The preferred weight distribution is generally either

centered over the base of support or slightly forward toward either ball contact or the direction of the intended ball flight.

A server with the weight distribution over the back leg is in balance, but in a poor position to effect a forward weight transfer due to the poor leverage angle between the foot and the center of mass. A blocker's jump will go in the direction of the weight distribution, toward the net if forward and away from the net if rearward.

In all phases of volleyball technique, movements occur around multiple joints, creating various force vectors. Efficient movements result in force vectors which complement rather than counteract each other. Ideally, these vectors would all extend through the same line of force, through the ball toward the intended target.

A setter whose legs, arms, and hands extend in different directions during execution of the overhead set must adjust the various force vectors so that the resultant vector is of the desired force in the intended direction. A more efficient setting action would result in leg, arm, and hand extensions through the ball in the desired trajectory of the set.

Force is increased by joining and coordinating the movements of body segments through the involved joint movements. Joint movements can occur simultaneously, but

are more commonly combined sequentially, the momentum of one body part transferred to another.

The setter first extends the legs, then the arms, and finally the hands at the wrists. The serve begins with the step, shifting the center of mass and bringing the torso and shoulder forward. At the end of torso movement, shoulder rotation accelerates the elbow forward and upward. As shoulder rotation ends, momentum is transferred to the arm, which is extended at the elbow, adding velocity to the hand which strikes the ball.

Force and power in volleyball is generally a product of the accelerated mass of the body or body segment, such as the striking hand, applied to an object, such as the ball or the floor. The forceful vertical extension of the legs against the resistance of the floor accelerates the body mass upward away from the floor, the greater the acceleration through the joint angles, the more powerful the jump and the greater the height attained.

The spiker once airborne accelerates the striking hand into contact with the ball. The greater the acceleration and velocity of the hand upon contact, the greater will be the force imparted to the ball and the greater the velocity with which the ball is propelled away from the point of contact. In the same way, the acceleration of the hands throughout the extended contact propels the ball toward its intended target.

Along with the velocity and mass of the striking object, the coefficient of restitution of the ball and the striking surface determine the length of contact and the velocity with which the ball departs the point of contact. The ball bounces farther off of bones than off of the fleshy insides of the forearms, farther off of a hard fist than a relaxed, open hand. The softer surface of the insides of the forearm creates less rebound and, thus, a more extended contact with the ball which results in increased control.

Direction of the ball resulting from contact is determined by three factors. The first factor is the direction of the force vectors intersecting the ball. The second is the location of contact and application of force vectors relative to the center of mass of the ball. The third factor is the angle of the plane formed by the striking object, the angle of incidence equaling the angle of reflection.

The overhead set travels in a trajectory determined by the forces generated through extension of the legs, arms, and hands. Spiking the top of the ball causes the ball to go in a downward trajectory. Tilting the passing platform to the right causes the ball to rebound toward the right.

CHAPTER 4

Presentation of the Model of Fundamental Volleyball Techniques

This dissertation is a non-traditional type designed to fulfill requirements for the Doctor of Arts Program at Middle Tennessee State University. The study has resulted in the development of efficient volleyball technique models which are incorporated in Chapter 4. Due to the nature of its contents, Chapter 4 does not adhere to standard dissertation format.

**PRESENTATION OF THE MODEL OF FUNDAMENTAL
VOLLEYBALL TECHNIQUES**

INTRODUCTION

A biomechanical model of each of the six basic volleyball skills is presented. The technique is presented in three segments, a description of the technique, an analysis of the technique, and a recounting of the key teaching points. Each segment interfaces with the others, yet serves a separate purpose. At different stages of learning, the segments may be referred to independently or in unison. The format serves to describe the whole movement sequence, to present an understanding of the various parts of the technique, and to reinforce the execution of the whole skill.

Each skill segment is divided into the components of the skill, such as the initial posture, the action of striking the ball, and the contact area. The division parallels the sequence of actions used by the player in performing the skill in game conditions. The divisions allow the user to cross-reference between segments to enhance understanding of the skill execution.

The description of the skill provides the user a detailed portrayal of the preferred movement pattern. Each technique is presented in sufficient detail that the entire sequence of movements comprising the technique is represented. No steps are omitted and left to be filled in by the experience, or the imagination, of the user. The

description segment of each skill conveys what movement pattern constitutes the preferred technique.

The analysis segment analyzes movement patterns of the preferred technique, in addition to examining frequently observed techniques. The movements prescribed by the model are compared and contrasted to those of other common techniques. The preferred and other common techniques are analyzed relative to biomechanical principles and the laws of physics. The analysis segment of each skill conveys why the preferred movement pattern most effectively provides the desired results.

The final section is a brief review of the key movements of the preferred technique which result in successful execution of the skill. The key teaching points are a condensation of the entire movement pattern. The key teaching points represent the most important aspects of the technique. They allow effective comparison between the actual movements of the learner and the prescribed movements of the model.

Each segment serves as a reference to be used throughout instruction and learning. The description is referred to when needing more detailed information regarding what movements are to be learned than provided by the key teaching points. The analysis segment is referred to when needing a greater understanding of why specific movements render more positive results than other patterns. The

divisions within each segment afford the user easy referencing and cross-referencing.

PART 1
THE SERVE

THE SERVE

Description of the Skill

The serve functions to initiate play, but its importance far surpasses merely putting the ball in play. The serve is integral to a team's point-scoring capacity. In addition to leading directly to scoring opportunities, the serve has the potential to deter an opponent's passing and offensive capabilities. These are not accomplished by merely putting the ball into play consistently and without error.

Difficulty of reception is a key ingredient of an effective service. High velocity, sharp breaking, and unpredictable flight are factors which increase the difficulty of reception and effectiveness of a serve. A serve consistently exhibiting these qualities is integral to team success.

Another factor integral to serving success is accuracy. Accuracy includes, but is not limited to, delivering the ball consistently into play. Accuracy is the ability to direct a serve into a poorly defended location or toward a weak receiver.

A difficult-to-receive service accurately directed toward an opponent's weakness creates point-scoring opportunities not created by serves intended to merely

initiate play. How the ball is served determines the difficulty, accuracy, and consistency of the serve.

Initial Posture

The initial posture places the body in balance and preparation to initiate the serving action. The weight is distributed evenly between the feet. The body is relaxed and comfortable. The ball is held in position to begin the toss, and the striking arm and hand are positioned near the ball.

1. The foot of the non-serving hand is forward (left foot forward for a right-hander, right foot forward for a left-hander).

2. Legs are slightly bent at the knees (5 to 15 degrees).

3. The weight is evenly distributed between the feet.

4. The lead foot is pointed toward the net.

5. Hips are turned 45 degrees from perpendicular to the target of the serve.

6. The ball is held in fingers and palm of the non-serving hand at approximately shoulder height.

7. The ball is placed directly between the striking shoulder and the intended target of the serve.

8. The non-serving arm is held with the elbow slightly bent (10 to 20 degrees).

9. The serving arm is held horizontally at the height of the held ball.

10. The striking hand is flat and tensed.
11. The hand and forearm form a straight line.
12. The thumb of the striking hand is turned downward (pronation of the forearm) approximately 45 degrees.

The Serving Action

The serving action is short and compact. The striking hand is brought into position prior to the ball being tossed. The toss and weight transfer occur simultaneously. The end of the weight shift initiates the arm-swing phase of the striking action. Upon contact with the ball, all movement ceases.

1. The elbow of the serving arm is drawn back, the arm remaining horizontal.

2. The ball is lifted so that it remains directly between the striking shoulder and the intended target.

3. The ball is lifted vertically so that it rises out of the hand, peaking approximately 6 to 12 inches above the hand (no wrist action is involved).

4. Simultaneously, the lead foot steps forward (6 to 12 inches), directly toward the intended target of the serve.

5. As the step is completed and the body's weight is shifted to the lead foot, the serving arm rotates and drives the hand forward through the ball.

6. The striking hand moves in as close to a straight line as possible.

7. The wrist remains locked, with the striking hand flat and firm.

Contact Surface

Contact with the ball occurs on the lower third of the striking hand. The hand is flat and tensed, creating a hard contact surface. The hand and forearm form a straight line.

1. The fingers and thumb of the striking hand are extended and straight, not cupped.
2. The fingers and thumb are spread slightly (no more than one-half inch).
3. The palm and lower palm form a flat and firm striking surface.
4. The fingers, palm of the hand, and forearm form a straight line.
5. The ball is contacted by the flat, lower heel portion of the striking hand.
6. The ball is contacted at the center of its axis extension in line with the serving arm shoulder and the intended target.

Follow-Through

Follow-through is minimal. The striking hand stops on contact, not before, nor does it slow down prior to contact.

Analysis of the Skill

The most widely used serve in both instruction and competition is the overhand floater serve. It is a serve easily mastered and, due to the unpredictable movement of

the ball, is highly effective. The technique of the underhand serve functions as a lead-up to the overhand serve.

Accuracy of the serve is largely dependent on the consistency of the toss and the path of the arm-swing to the ball. Power is generated through the weight shift occurring during the step forward and through arm rotation at the shoulder and extension at the elbow.

The height at which the ball is contacted varies. A high-contact level allows a flatter serve trajectory and, thus, accommodates greater ball velocity. A lower contact level shortens the striking lever, the arm, and, thus, provides greater control and power to the server.

The most consistent toss is one in which the ball rises vertically and peaks at the intended point of contact. The vertical toss has no motion in the horizontal plane and, at its apex between ascent and descent, has no motion in the vertical plane. The ball at this point is motionless in a state of unsupported suspension. The arm-swing brings the striking hand into contact with the ball at the apex of the toss.

To accommodate such a toss, the body must be prepared to contact the ball with the striking hand at that point and time. In order for the ball to be struck at the apex, the weight shift and serving motion must occur as the ball is

ascending, prior to reaching the apex. Preparation for the serving motion occurs prior to the toss.

Initial Posture

The initial posture is one of balance and stability. From this posture the toss, the weight transfer, and the arm-swing are accomplished quickly and efficiently. An unbalanced posture requires additional movements to compensate, making less efficient the service action.

The foot opposite the striking arm and hand is forward (left foot forward for a right-hander, right foot forward for a left-hander). The angle of the hips is set so that no further rotation is required during the serving action. Placing the opposite foot rearward of the foot on the striking hand side (left foot back for a right-hander, right foot back for a left-hander) creates a longer stride and excessive hip rotation. Though power is gained through rotation of the hips, the rotation changes the alignment of the toss location, the striking arm shoulder which is the axis of the arm-swing, and the target of the serve. Thus, power is gained at the expense of accuracy and consistency.

The ball is held by the fingers and the palm of the non-serving hand. This allows the greatest surface area of the ball to be contacted by the tossing hand, resulting in greater control of the toss. Holding the ball in both hands covers a greater portion of the ball's surface, but results in a less efficient serving action.

The trajectory of the toss is vertical. The ball is held directly below the point at which the toss peaks. The length of the step stride determines how far in front of the body and with what degree of bend at the elbow the ball is held. Generally, the bend at the elbow will be between 10 and 20 degrees.

A ball held too close to the body requires forward horizontal displacement to bring it to the point of contact. A ball held with the arm totally extended and straight at the elbow is farther in front of the body than the distance covered by the stride step. Thus, horizontal displacement is imparted to the toss, bringing it back toward the server. In both cases the ball contains horizontal movement at its apex, rather than peaking in a motionless state which would be the ideal.

The initial posture places the arm of the striking hand at approximately the level of the held ball. The arm is horizontal with the striking hand forward of the elbow. Lowering of the thumb, turning the palm slightly outward, helps maintain the elevation of the elbow.

Other arm-swings begin with the hand held high and the arm nearly vertical. This provides a quick accurate arm-swing, but allows little shoulder rotation for power. Bringing the hand behind the head or rearward of the elbow provides an extensive range of movement to occur at the elbow, but very little shoulder rotation.

The Serving Action

Prior to initiation of the toss, the striking arm is brought into posture to begin the arm-swing. The preferred serving action starts with the striking arm at the height the ball is held. The arm is moved rearward maintaining the nearly horizontal attitude of the forearm with the striking hand forward of the elbow. This position provides the greatest degree of shoulder rotation during the arm-swing. As the striking arm moves rearward, but before it stops and reverses direction, the toss is initiated.

Accuracy and consistency in the serve are gained by placing the ball at the same location relative to the shoulder, striking it through the same arm-swing path and contacting the ball in the same spot on every serve. A ball in suspension, with no motion in any direction, would best facilitate consistency in the serving action. For a ball to be in a position of unsupported suspension, it must rise vertically with no horizontal displacement, no lateral, forward, or backward drift. At its apex, as ascent ends and before descent begins, a ball moving only in the vertical has no motion. It is at this point that the ball is to be struck during the serve.

The toss is initiated from shoulder height. The initial placement of the ball prior to the toss is in line with striking shoulder and the intended target of the serve and directly beneath the point at which the ball will be

struck. The toss is a very low toss, the ball barely leaving the tossing hand. A higher toss results in a greater error in placement of the toss, the degree of error in the toss increasing the displacement error as the ball moves farther from the tossing hand. Higher tosses also peak and then descend to the point of contact. The velocity of the descent is detrimental to consistent contact between the serving action and the ball.

The toss is made by lifting the tossing hand vertically so that the ball continues out of the hand to peak at the intended point of contact. The movement should be in only one direction, vertically upward. A long, slow motion is more accurate than a quick short movement.

Dropping or extending the tossing hand at the elbow prior to the lifting action increases the length of the arm lever tossing the ball. The longer lever moves less accurately than the shorter lever holding the ball in the preferred initial posture. The longer lever also moves in an arc, rather than vertically. Movement in the horizontal plane is imparted to the ball and prevents the ball from being motionless at the point of contact.

Tossing the ball with both hands exerts an excessive and uneven force on the ball. Thus, the two-handed toss is less accurate than the one-handed toss. With both hands being used, the striking hand moves with the ball upward through the toss trajectory and away from the beginning

point of the arm-swing. Such a toss must be high enough to allow the striking arm to recover from the toss, return to striking posture, and initiate the arm-swing. The result is an inconsistent toss trajectory and an inaccurate, circular arm-swing.

Variations in the toss can affect, in addition to the toss accuracy, the rhythm between the step and the arm-swing. Some servers toss the ball by extending the legs at the knees and raising, in addition to the ball, the whole body upward. Balance must be regained before the step and weight shift can occur. The delay in the weight shift delays the arm-swing; the ball toss is required to be higher; and thus, it is less accurate and has movement at the point of contact. The serving action is less effective.

In order for the striking hand to contact the ball at the apex of the toss, the arm-swing must begin during ball ascent. Power for the arm-swing is generated through a weight shift occurring as the foot opposite the striking arm steps toward the target of the serve. Thus, the step precedes the arm-swing, occurring during the ball toss. Generally, the step occurs as the hand lifts the ball and before the ball leaves contact with the tossing hand.

Some players start with the foot opposite the striking arm (left foot for a right-hander, right foot for a left-hander) rearward and initiate the weight transfer with a long step. Others take multiple steps, ending with a long

stride of the foot opposite the striking arm. These movements create a greater weight transfer, but also result in excessive rotation of the hips and torso. Power for the serve is generated at the expense of accuracy and consistency.

The preferred weight transfer consists of a step which is short and controlled, the foot barely above the floor. The step is in the direction of the intended target, with the toe of the foot pointing toward the target. The server's center of mass shifts forward directly toward the target.

The end of the step transfers momentum to the torso and the striking shoulder. The shoulder rotates the striking arm upward and forward. At the end of shoulder rotation, arm extension occurs at the elbow, directing the hand into contact with the ball.

The hand contacts the ball slightly in front of the serving shoulder and near, but not necessarily at, full extension. At the point of contact, the forearm and striking hand are perpendicular to the intended trajectory of the serve. Follow-through is limited.

The rhythm on the service is PULL, then LIFT-and-STEP, then SWING. The striking arm is pulled into position so that the hand remains forward of the elbow and the forearm remains nearly horizontal. The ball is lifted toward its apex and, simultaneously, the foot opposite the striking arm

takes a short step, transferring the weight forward. At the end of the weight shift and as the ball is ascending, the arm-swing begins so as to contact the ball at the peak of the toss.

Contact Surface

During the pre-swing and throughout the arm-swing, the wrist should remain locked, with the hand directly in line with the forearm. Any flexion or extension occurring at the wrist changes the angle at which the hand strikes the ball, changing the angle of rebound and causing the ball to spin.

The hand should be flat and tensed. A cupped or curved hand affects the angle of rebound similar to wrist flexion and extension. A tensed hand forms a hard contact surface which imparts to the ball greater force than would a soft contact surface.

Contact with the ball should occur at the point on the ball's surface directly in line with the intended trajectory. Contact with the ball above, below, or to the side of this point causes the ball to be directed in other than the intended direction.

Follow-Through

Because the striking hand moves in a curvilinear path, rather than a straight line, only at the point of contact is the striking surface perpendicular to the intended trajectory of the serve. Extended contact with the ball beyond the initial point of contact imparts spin to the

ball. The airflow around a ball moving without spin causes it to move, or float, in an unpredictable path. It is the unpredictable movement that causes difficulty of reception, a benefit lost if spin is imparted to the ball.

Key Teaching Points

Initial Posture

1. The left foot is forward for a right-hander; the right foot is forward for a left-hander.
2. The hips are turned 45 degrees from perpendicular to the target of the serve.
3. The ball is held in the fingers and palm of the non-serving hand, approximately shoulder height.
4. The non-serving arm is held with the elbow slightly bent (10 to 20 degrees).
5. The serving arm is held horizontally at the height of the held ball.

The Serving Action

1. The elbow of the serving arm is drawn back, the arm remaining horizontal.
2. The ball is lifted vertically so that it rises out of the hand, peaking approximately 6 to 12 inches above the hand (no wrist action is involved).
3. Simultaneously, the lead foot steps forward (6 to 12 inches), directly toward the intended target of the serve.

4. As the step is completed and the body's weight is shifted to the lead foot, the serving arm rotates and drives the hand forward through the ball.

5. The wrist remains locked, with the striking hand flat and firm.

Contact Surface

1. The palm and lower palm form a flat and firm striking surface.

2. The fingers, palm of the hand, and forearm form a straight line.

3. The ball is contacted by the flat, lower heel portion of the striking hand.

Follow-Through

Upon contact with the ball, the striking hand stops movement.

PART 2
THE FOREARM PASS

THE FOREARM PASS

Description of the Skill

The forearm pass is generally the first contact used to receive an opponent's serve or volley. It is the fundamental skill from which all volleyball strategies develop. The skills of setting and spiking, indeed even blocking and individual defense, are dependent on successful execution of the forearm pass.

The successful forearm pass allows a team to receive service or other volleys and to attack any area of the net at many different tempos. For this to occur, the passing action must direct the ball completely to the net, commonly to the right of center. The setter awaits the pass at this point.

The forearm pass is directed to the target through a specified trajectory. A high trajectory pass allows the setter more time to retrieve an errant pass. However, the downward momentum of the ball is primarily in the vertical plane and requires of the setter excessive force to counteract. Accuracy, control, and force with which the set is delivered are reduced.

The momentum of a low pass is primarily in the horizontal plane and is easily transferred through the set. A low trajectory pass also increases the setter's peripheral vision of the court and players by placing the field of

vision in the horizontal plane. The high trajectory pass causes the setter to look upward toward the apex of the pass, increasing the setter's field of vision of the roof. In addition, a low pass speeds up the tempo of the offense, allowing the defensive players less time to react to the attack options.

In addition, the low trajectory pass is effected with more efficiency and, thus, less body movement than the high trajectory pass. The momentum of the received serve or volley is transferred nearly horizontally so the ball is directed to the net with less force required of the passer. The result is more consistency in the execution and accuracy of the pass.

Initial Posture

The passer awaiting a serve or volley is in a balanced posture, ready to move quickly in any direction required by the reception formation. Neither a high posture nor a low posture is advantageous. Being excessively low requires the player to elevate the body in order to cover much distance quickly. An excessively elevated posture results in poor mechanical leverage for quick lateral movements. The ideal is that initial posture from which the individual player effects the quickest reaction and movement.

1. The feet are spread slightly more than shoulder width apart.

2. The right foot is slightly forward of the left (between heel-to-arch and heel-to-toe overlap).
3. The toes are turned slightly inward.
4. The weight is distributed evenly in the lateral plane, slightly forward toward the front foot in the sagittal plane.
5. The body is balanced and stable.
6. The legs are bent 45 to 60 degrees at the knees.
7. The trunk is bent slightly forward at the waist, 15 to 30 degrees from vertical.
8. The hips and shoulders are perpendicular to the flight of the ball.
9. The right shoulder is slightly lower (one to two inches) than the left, tilting the passing platform toward the target area.
10. The arms are held slightly to the left of center, between the midline of the body and the left knee.
11. The arms are extended from the shoulders 30 to 45 degrees from vertical.
12. The arms are extended straight, but relaxed, at the elbows.
13. The hands are separated approximately 12 to 18 inches apart.
14. The hands are held parallel and vertical.
15. The thumbs and hands are relaxed and turned downward.

16. The hands are as follows:

- (a) open, with fingers spread comfortably, curved slightly, and relaxed, or
- (b) non-dominant hand loosely forming a fist, dominant hand open and relaxed.

Movement to the Ball

The player moves to the ball to execute the forearm pass as quickly as possible. The range through which the passer can move and execute the forearm pass is determined both by the speed of movement and the time required to prepare for the execution of the pass upon interception of the ball. The initial posture of the player is already aligned to make the pass. The player moving to the ball, while maintaining body and court alignment, will be more efficient and execute the pass more quickly than the player who moves to the ball and then realigns. The preferred movement patterns are those which cover the required distance with minimal realignment at the point of ball intersect.

Distance through which the passer must move in order to reach the ball is a factor in determining the player's ability to maintain postural and positional alignment. Slide-step footwork patterns cover short distances, with little change in posture or movement of the passing platform. Crossover-step patterns cover longer distances with little change in upper body posture or movement of the

passing platform. Greater distances can be covered best by running and realigning upon arrival at the point of ball intersect.

Moving to balls not more than five feet away (within two slide steps), the player uses the following slide-step footwork pattern:

1. Pushing off with the foot farthest away from the ball (trail foot), the player takes a short step in the direction of the ball with the foot nearest the ball (lead foot).

2. The trail foot closes near (12 to 18 inches) the lead foot.

3. The lead foot strides toward the ball.

4. Repeat for a double slide step.

5. The body's momentum is controlled by the lead leg for a single slide step.

During movement to the ball, using the slide-step pattern, the following are emphasized:

1. The legs remain bent 45 to 60 degrees at the knees, varying during movement only to place the arms at the height at which the ball is to be contacted.

2. The trunk remains bent slightly forward at the waist, 15 to 30 degrees from vertical.

3. The hips and shoulders remain as perpendicular as possible to the flight of the ball.

4. The right shoulder remains slightly lower (one to two inches) than the left, tilting the passing platform toward the target area.

5. The arms remain held slightly to the left of center, between the midline of the body and the left knee.

6. The arms remain extended from the shoulders 30 to 45 degrees from vertical.

7. The arms remain extended straight, but relaxed, at the elbows.

8. The hands remain separated approximately 12 to 18 inches apart.

9. The thumbs and hands remain relaxed and turned downward.

10. The hands remain as follows:

(a) open, with fingers spread comfortably, curved slightly, and relaxed, or

(b) non-dominant hand loosely forming a fist, dominant hand open and relaxed.

As the point of intersection with the ball is neared, the player's body is postured to execute the pass:

1. The feet are spread wider than in the initial posture; the lower the ball, the wider the feet are spread.

2. The weight is distributed slightly forward toward the front foot.

3. The body is balanced and stable.

4. The legs are bent at the knees, placing the arms at the height of the ball.

5. The trunk is bent slightly forward at the waist, 15 to 30 degrees from the vertical.

6. The hips and shoulders are perpendicular to the flight of the ball.

7. The right shoulder is slightly lower (one to two inches) than the left, tilting the passing platform toward the target area.

8. The arms are held slightly to the left of center, between the midline of the body and the left knee.

9. The arms are extended from the shoulders 30 to 45 degrees from vertical.

10. The arms are extended straight, but relaxed, at the elbows.

11. The lower palm areas of the hands are side-by-side, as are the thumbs.

12. The thumbs and hands are relaxed and turned downward.

13. The hands are joined as follows:

- (a) open, with the fingers loosely interlaced and curved slightly, or
- (b) non-dominant hand loosely forming a fist, dominant hand wrapped loosely around the fist.

Moving to balls 5 to 10 feet away (more than two slide steps, but not more than two crossover steps), the player uses the following crossover-step footwork pattern:

1. Pushing off with the foot farthest away from the ball (trail foot), the player takes a short step in the direction of the ball with the foot nearest the ball (lead foot).
2. The body continues to move in the direction of the ball.
3. The trail foot crosses in front of the lead foot.
4. The lead foot follows immediately, crossing behind the trail foot.
5. Repeat for a double crossover step.
6. The lead foot plants, controlling the body momentum.

During movement to the ball, using the slide-step or crossover-step pattern, the following are emphasized:

1. The legs remain bent 45 to 60 degrees at the knees, varying during movement only to place the arms at the height at which the ball is to be contacted.
2. The trunk remains bent slightly forward at the waist, 15 to 30 degrees from vertical.
3. The hips and shoulders remain perpendicular to the flight of the ball.
4. The right shoulder remains slightly lower (one to two inches) than the left.

5. The arms remain held slightly to the left of center, between the midline of the body and the left knee.

6. The arms remain extended from the shoulders 30 to 45 degrees from vertical.

7. The arms remain extended straight, but relaxed, at the elbows.

8. The hands remain separated approximately 12 to 18 inches apart.

9. The thumbs and hands remain relaxed and turned downward.

10. The hands are as follows:

(a) open, with fingers spread comfortably, curved slightly, and relaxed, or

(b) non-dominant hand loosely forming a fist, dominant hand open and relaxed.

As the point of intersect with the ball is neared, the player's body is postured to execute the pass:

1. The feet are spread wider than in the initial posture; the lower the ball, the wider the feet are spread.

2. The weight is distributed slightly forward toward the front foot.

3. The body is balanced and stable.

4. The legs are bent at the knees, placing the arms at the height of the ball.

5. The trunk is bent slightly forward at the waist, 15 to 30 degrees from the vertical.

6. The hips and shoulders are perpendicular to the flight of the ball.

7. The right shoulder is slightly lower (one to two inches) than the left, tilting the passing platform toward the target zone.

8. The arms are held slightly to the left of center, between the midline of the body and the left knee.

9. The arms are extended from the shoulders 30 to 45 degrees from vertical.

10. The arms are extended straight, but relaxed, at the elbows.

11. The thumbs and hands are relaxed and turned downward.

12. The hands are clasped as follows:

- (a) open, with fingers loosely interlaced and curved slightly, or
- (b) non-dominant hand loosely forming a fist, dominant hand wrapped loosely around the fist.

13. The heel areas of the palms are side-by-side, as are the thumbs.

Moving to balls more than 10 to 12 feet away (more than two crossover steps), the player turns and runs toward the ball, using the following footwork pattern:

1. Pushing off with the foot farthest away from the ball (trail foot), the player takes a short step in the

direction of the ball with the foot nearest the ball (lead foot).

2. The lead leg pulls to continue the body's movement in the direction of the ball.

3. The trail foot crosses in front of the lead foot, turning the hips and shoulders in the direction of movement.

4. The lead foot follows.

5. The running movement continues until the ball is neared.

During movement to the ball, the following are emphasized:

1. The legs and trunk extend, raising the body height to facilitate greater running mobility.

2. The hips and shoulders turn toward the direction of the run.

3. The arms bend at the elbows and swing counter to the legs to facilitate running.

4. The hands remain separated approximately 12 to 18 inches apart.

5. The hands are held comfortably relaxed.

6. The hands are held as follows:

(a) open, with fingers spread comfortably, curved slightly, and relaxed, or

(b) non-dominant hand loosely forming a fist, dominant hand open and relaxed.

As the point of intersection with the ball is neared, the player's body is postured to execute the pass:

1. The next-to-last step is taken with the trail leg.
2. The lead leg follows quickly, planting and controlling the body's momentum.
3. During the next-to-last and last step, the body prepares to execute the pass.
4. The knees are bent to lower the body to the level of the ball.
5. The trunk is bent slightly forward (15 to 30 degrees).
6. During the last two steps, the body rotates so that the hips and shoulders are perpendicular to the flight of the ball.
7. The right shoulder is lowered slightly (one to two inches), tilting the passing platform toward the target area.
8. The arms are brought slightly to the left of center, between the midline of the body and the left knee.
9. The arms are extended from the shoulders 30 to 45 degrees from the vertical.
10. The arms are extended straight, but relaxed, at the elbows.
11. The thumbs and hands are turned downward.
12. The hands are brought together as follows:

- (a) open, with fingers loosely interlaced and curved slightly, or
- (b) non-dominant hand loosely forming a fist, dominant hand wrapped loosely around the fist.

13. The heel areas of the palms are side-by-side, as are the thumbs.

The Forearm Passing Action

The preferred passing action is one of rebounding the ball from the passing platform formed by the arms. The combination of the ball's velocity and the hardness of the passing surface is sufficient in most cases to propel the ball completely to the target area without much impetus provided by body or arm movements. In order for this to occur, the passing platform must be presented to the ball in position and alignment to execute the pass. Any movements made in positioning and alignment incorporated into the passing action will be transferred to the ball and affect the direction and distance of the pass.

The player arrives at the ball intersect postured to rebound the ball toward the target area:

1. The knees are bent, with the body lowered and positioned so that the forearms contact the ball without the passing platform being altered.
2. The shoulder drop tilts the passing platform toward the target.

3. The angle of the arms relative to vertical is preset to determine the trajectory of the pass.
4. The body weight is toward the front foot.
5. The hands are clasped as follows:
 - (a) open, with fingers loosely interlaced and curved slightly, or
 - (b) non-dominant hand loosely forming a fist, dominant hand wrapped loosely around the fist.
6. The heel areas of the palms are side-by-side, as are the thumbs.
7. The passing action is essentially one of the ball rebounding from the passing platform.

Where the velocity of the received ball is not sufficient for the pass to rebound completely to the target area:

1. Impetus is applied to the ball by means of a short, controlled shift of the center of mass directly toward the target.
2. The center of mass shifts horizontally, not upward, toward the target.
3. The weight shift moves the passing platform no more than necessary, generally no more than six inches.
4. The platform moves with the center of mass directly toward the target.
5. The position of the passing platform relative to the body does not change.

6. Neither the tilt nor the angle of the platform changes during the execution of the pass.

When additional force is needed and a weight shift is not possible:

1. Impetus is applied to the ball by means of a short, controlled movement of the hands directly toward the target.

2. The hands move near horizontally, not upward, toward the target.

3. The hands move the passing platform no more than necessary, generally no more than six inches.

4. The tilt and angle of the passing platform remain unchanged as much as is possible.

Contact with the Ball

The same area of the forearms contacts the ball on every pass. The area is above the rounded projection of the wrist bone and below the bulge of the forearm muscles. The arms are straight at the elbows and held comfortably close together, forming a flat and hard contact surface from which the ball rebounds.

1. Contact with the ball occurs on the insides of the forearms.

2. Contact occurs primarily with the bone (the radius) and partly with the fleshy insides of the forearms.

3. Contact occurs on the flat part of the forearm halfway between the wrist bone (radial styloid process) and

the bulge of the forearm muscles (brachioradialis) or approximately two inches above the wrist bone.

Follow-Through

The passing action is essentially a rebound of the ball; follow-through is minimal and detrimental to the passing action.

Analysis of the Skill

The forearm pass is the most common contact used in volleyball. Variations of the forearm pass technique are utilized for setting balls in difficult situations, digging opponent's spikes, and volleying the ball over the net into the opponent's court. The primary function of the forearm pass is the reception of service and of opponent's volleys.

The forearm pass is directed to a predetermined target area along the net. Many offensive systems locate the target of the pass and the setter to the right of center. This allows hitters to attack the middle area from in front of or inside the opposing middle blocker, hindering the middle blocker's ability to defend the outside attack.

At the instructional and non-elite levels of competition, the off-center pass allows the setter to make a longer front set and a shorter back set. The setter's ability to execute a long back set is often inferior to the front set at non-elite levels. The off-center position allows both sets to be delivered with equal effectiveness.

Serve reception formations vary according to the level of play, the individual abilities of the players, and the philosophy employed by the team. Programs at the highest levels of competition, those with exceptionally gifted athletes, often employ only two or three players to receive all serves. The advantage is that the team's most accomplished passers receive all serves and, with fewer players involved, there are fewer decisions to be made in areas between players. The disadvantage, and the need for exceptional athletic ability, is that the court area covered by each player is increased as the number of receivers decreases.

Two-person and three-person receive formations divide the court vertically into passing lanes, lanes that run nearly perpendicular to the net. Each player in the formation is responsible for the reception of all balls, both short and deep, served into that player's lane. The player must possess either sufficient mobility so that the ball is aligned below waist level, or possess the ability to pass balls higher than waist level. Quality serves often require both attributes of the receiver.

The movement patterns employed by receivers in a two- or three-person receive formation to execute passes contacted at a higher elevation differ slightly from those used in the more traditional formations. The ball is played farther outside the body center line, generally to the left

of center, and the body is rotated slightly toward the ball flight. The tilt of the passing platform is greater in order to compensate for the body alignment.

More traditional formations, those often found in recreational, instructional, and non-elite-level competition, employ four or five players to receive service. Except for the setter, every player is involved in the reception. The advantage of four- and five-person formations is that there is less court area covered by each player, facilitating optimum alignment of the passer and the ball.

The disadvantage is that the opponent has the opportunity to direct the serve toward the weakest passers. The most accomplished passers handle the ball less. As more players are involved in the reception formation, there are more undefined areas between players and, therefore, more decisions to be made by the players.

Traditional four- and five-person receive formations divide the court into horizontal passing lanes, lanes that run nearly parallel to the net. Each player in the formation is responsible for the reception of balls served into that player's lane which are at or below waist level, the most advantageous level from which to execute the pass. More players in the receive formation result in smaller passing lanes covered by each individual passer. Reducing the area covered by each player increases the player's

opportunity to gain optimum ball-to-body location from which to pass the ball.

The movement patterns employed to gain optimum ball-to-body location and execute the pass use the upper body to form a passing platform from which the ball rebounds. The direction of the pass is determined by the tilt of the platform. The trajectory of the pass is determined by the angle of the platform relative to vertical.

The forearm pass is directed to the target through a specified trajectory. A high trajectory pass allows the setter more time to retrieve an errant pass. However, the downward momentum of the ball is primarily in the vertical plane and requires of the setter excessive force to counteract. Accuracy, control, and force with which the set is delivered is reduced.

A low pass allows the setter less time to retrieve an errant pass, but is generally more accurate and readily facilitates the setting action. The momentum of a low pass is primarily in the horizontal plane and is easily transferred through the set. A low pass also speeds up the tempo of the offense and increases the setter's peripheral vision of the court and players.

The arm angle from which the low trajectory pass is executed varies relative to many factors. The trajectory of the serve or volley affects the angle of rebound and, thus,

the angle of the passing platform. The player's location on the court also affects the angle of the rebound.

Generally, the angle of the platform prior to and during ball contact will be between 30 and 45 degrees from vertical. A player in an upright posture will have the arms close to the body. A player with torso bent forward at the waist will have the arms farther away from the body. But both will have the arms at approximately the same angle relative to vertical.

The lower body is used to transport the passing platform to the point of ball intersect. The most efficient movement pattern is that which most quickly transports the platform to the ball with the least distortion of the passing platform and, thus, the least time spent in preparation for the passing action at the point of intersect.

Initial Posture

The emphasis of the initial posture is placed on quick movement time and early preparation of the passing platform. The passer must react and move quickly to the point of ball intersect. Upon arrival, the platform must be postured and aligned to rebound the ball to the target. Time spent preparing the passing platform is time not available for movement to the ball.

Players often are taught to take an initial posture which is low to the floor, some so low that their hands

touch the floor. To move quickly and take the longer strides needed to cover distances greater than one step, the player must then raise the body. This slows the player's movement. It is preferred to start in a higher posture, that posture from which the individual player moves most quickly. The body is lowered to the level of the ball intersect during movement.

The initial posture is, as much as possible without restricting movement potential, aligned into the posture from which the pass will be made. The feet are spread slightly more than shoulder width apart, the right foot forward. The arms are extended, straight at the elbows, and held slightly in front of the body. The platform is tilted to the target by lowering slightly the right shoulder.

The passing platform is formed in the initial posture and maintained during transport to the ball. The hips and shoulders are perpendicular to the flight of the ball, allowing the tilt of the platform to direct the pass. The torso is nearly upright, bent approximately 15 degrees at the waist. The arms are relaxed and extended in front of the body.

Playing the ball to the left of center drops the right shoulder and tilts the platform to the right of center. The optimum point of ball contact is in front of the left thigh from the left side of the court. The point of contact moves toward the center line as the passer's position moves toward

the right side of the court. The ideal contact point is slightly to the left of the center line from the right side of the court.

Because the shoulders must be free to counterbalance the rotation of the hips during movement, the hands are not joined until arrival at the point of ball intersect. Joining the hands before or during movement restricts the counterbalancing action of the shoulders. Players then instinctively bend the arms at the elbows and raise the hands in an effort to overcome the restriction. The arms must then be straightened and brought into position upon arrival at the point of ball intersect.

This is time-consuming and reduces the effective movement range of the player. The movement of the arms, if not halted before contact, is transferred to the ball, affecting both direction and distance of the rebound. In addition, the action of straightening the arms absorbs ball momentum, reducing the rebound. With each additional variance for which the player must compensate, the simple action of rebounding the ball becomes increasingly complex and difficult to master.

In the more traditional four- or five-player receive formations from which balls are consistently played from below the waist, separating the hands more than the width of the shoulders is also inefficient. At arrival, the hands must then move a large distance before joining. The greater

the separation, the more time-consuming and the less precise is the joining of the hands. A separation of 12 to 18 inches facilitates movement and leaves the hands in a position to join quickly and accurately.

The hands join as the arms are placed in line with the flight of the serve or volley. Joining the hands earlier and moving them in line with the ball flight is less efficient. The arms move more slowly and with greater restriction joined than separated. Near the ball intersect, only the antagonistic muscles slow and stop the arm movement. Any continuing movement of the arms is transferred to the ball upon contact.

The optimum initial position places the arms near the extremes of the anticipated movement range. The arm nearest the point of ball intersect arrives and stops in position and is joined by the arm starting farther away from intersect. Because the lead arm is closer, the movement to the ball is controlled, and alignment is precise. The trailing arm's movement to the ball is faster, the momentum of the movement being stopped by the lead arm in addition to the antagonistic muscles.

In advanced receive formations, those employing only two or three receivers, the vertical passing lanes necessitate that players be able to receive balls above and below waist level. In order to effectively pass a ball between waist and shoulder level, the ball is received

outside the body center line. Since passes are generally directed to the right of center, whenever possible balls above waist level are played to the left of the body's center. This lowers the right shoulder and tilts the platform to the right.

The initial posture in two- and three-person receive formations is such that the hands are separated more than 12 to 18 inches. This allows the hand and arm nearest the ball to be outside of the body, nearer the outer extreme of anticipated movement range. Due to the left-to-right direction of most passes, the left arm is placed farther outside the body than the right. In the initial posture, the platform is tilted toward the right of center.

In more traditional formations, those employing four or five receivers, the horizontal passing lanes allow serves and volleys to be received primarily below waist level. The left arm is placed in front of the left thigh, the outer extreme contact area. The right arm is near the body's center line. Separation remains 12 to 18 inches.

Movement to the Ball

Movement patterns vary, depending on the distance to be covered while moving to the ball. Served balls within five feet of the receiver are arrived at using the slide-step pattern. The slide step allows the player to move with minimal rotation of the hips and torso. The hips and

shoulders remain perpendicular to the flight of the ball throughout the movement.

The arms and the passing platform are maintained throughout the movement. The right shoulder remains lowered, tilting the platform to the right of center. The arm angle remains 30 to 45 degrees from vertical. The point of contact on the forearms is merely brought in line with the flight of the serve. The hands are joined, and the ball is rebounded to the target.

Slide steps cover small distances. Served balls more than five feet away from the receiver require that the distance be covered by a faster method. The crossover-step pattern covers a greater distance and builds more speed on each step than the slide step. Crossover steps create a slight rotation of the hips and counterbalancing movement of the torso, but shoulder attitude remains unchanged.

The arms and the passing platform are maintained throughout the movement. The right shoulder remains lowered, tilting the platform to the right of center. The arm angle remains 30 to 45 degrees from vertical.

As with the slide-step pattern, the forearms are merely brought in line with the flight of the serve. The hands are joined, and the ball is rebounded to the target.

Most serves and volleys to be received are within the effective range of slide- and crossover-step patterns. Occasionally, however, greater distances must be covered.

The fastest way to cover long distances, such as served balls or volleys more than 10 feet away from the receiver, is to turn and run to the ball intersect and then turn back to pass.

As with most running actions, running to the ball turns the hips and shoulders in the direction of the run. The arms bend at the elbows and swing counter to the legs. The body is elevated, and the stride length increases.

Nearing the point of intersect, the stopping and gaining balance actions are combined with the action of posturing the body to execute the pass. The body rotates on the next-to-last step, the hips and shoulders returning to perpendicular to the flight of the ball. The attitude of the shoulders is adjusted to tilt the passing platform.

During the final step, the arms are straightened and angled 30 to 45 degrees relative to vertical. The passing platform is tilted toward the intended direction of the pass. The final step controls the body momentum and stops the movement of the body and platform in line to intersect with the flight of the ball. The hands are joined, and the ball is rebounded to the target. At ball contact, the body and arms are balanced and stable with no rotation toward or movement away from the target.

Because of the extended time and complexity of realigning and preparing the passing platform and the potential for error in the process, the turn-and-run pattern

is used only on balls that cannot be reached using the slide- or crossover-step patterns. Whenever time and distance permit, the slide- or crossover-step patterns are preferred.

The Forearm Passing Action

The flight of the ball is redirected toward the target area through contact with the forearms. The forearms form a single flat plane, known as a passing platform, which acts as a board rebounding the ball. Critical to the effectiveness of the platform is that the elbows remain straight prior to and during contact.

Passing the ball with the arms bent changes the trajectory of the pass. Straightening the elbows during the passing action absorbs part of the ball's inertia and reduces the rebound and distance of the pass. The length of the passing platform from the axis of rotation--the shoulders--varies, depending on the degree of bend at the elbow. Contact between the ball and a lengthening contact target make the intersect more complex and the execution of the pass less precise.

Various actions of the platform may be employed to direct the ball toward the target area. Some are more complex and less efficient than others. Moving the arms through the point of contact directly toward the target is one method of directing the ball. This requires that a straight line exist between the point at which arm movement

is initiated, the point of contact with the ball, and the target of the pass. This alignment is a difficult task on high velocity or floating serves. In the absence of optimum alignment, additional movements are needed to compensate for misalignment. The movement of the arms through the ball also imparts additional force to the rebound, force which must be counteracted in the passing action.

Moving the arms through the point of contact is commonly accomplished by one of three means. The player initiating the passing action steps toward the target, moving the arms toward the target and into contact with the ball in the process. To accomplish this action, the player must arrive at a point beyond the ball, stop and redirect movement through the ball back toward the target area. This is time-consuming and limits the range of the passer. It is also a complex process requiring precise positioning and timing.

Another method is to face the ball, then rotate the hips toward the target area as the passing action begins. The timing and speed of rotation make this technique complex and inefficient. Contacting the ball early in the rotation leaves the ball to one side of the target area; contacting the ball late leaves the ball to the other side. If the angular velocity of the rotation varies, such as in a timing adjustment, the additional force imparted to the ball varies as well. Constant adjustments of the passing action to

compensate for variances in the rotation and timing make this an inconsistent and difficult-to-master technique.

The ball may be directed by swinging the arms toward the target area prior to and during the passing action. An extended swing of the arms, such as is commonly observed, changes the angle of the arms relative to vertical. Contact occurring early in the swing produces a low and fast ball flight; contact occurring late in the swing produces a pass that is high and usually well short of the net. Adjustments made by varying the speed of the swing result in variance of trajectory and distance. Each compensatory action makes the skill more complex and inefficient.

Unlike the previously mentioned methods, the preferred method directs the ball, not by movement of the arms through the point of contact, but by tilting the passing platform toward the target area. The rebound technique requires minimal movement in preparation and execution of, and compensation for, the passing action. The hips, shoulders, and arms are aligned perpendicular to the flight of the serve or volley. The platform is tilted toward the target area by dropping the shoulder nearest the target, usually the right shoulder since passes are generally targeted to the right of center. In harmony with the principle of physics (generally stated as the angle of incidence equaling the angle of reflection), the ball rebounds in the direction

of the tilt of the passing platform, just as a ball would bounce from a board set tilted at an angle.

The angle of the platform determines the trajectory of the pass; the tilt controls the direction. The momentum and restitution (rebound) of the ball provide the impulse. Minimal movement of the platform occurs only in compensation for insufficient or excessive ball velocity of the serve or volley. The lack of movement required in preparation and execution makes the rebound pass a simple, effective, and efficient action to learn and master.

The player should arrive at the point of ball intersect in a posture to execute the forearm pass. Arriving at the point of ball intersect and then lowering the body is time-consuming and inefficient. It is preferred that during movement to the ball, the body is lowered by flexion at the knees so that the passing platform is at the level of ball intersect. Lowering the platform by bending from the waist lowers the angle of the arms toward vertical. The near vertical angle of the arms results in an extremely low pass with excessive horizontal velocity, often sending the ball back across, into, or underneath the net.

The posture at arrival and during movement maintains the hips and shoulders perpendicular to the flight of the ball. The right foot is always forward of the left. It is more efficient for the player to learn to execute the pass of every ball from the same posture and alignment than it is

to vary the posture and alignment relative to each ball and to make the adjustment during movement to the ball.

Some techniques place the outside foot forward, turning the hips and shoulders toward the intended target. This produces a pass directed straight ahead of where the player is facing. In this case, placing the weight on the forward foot moves the player's center of mass away from the target area, reducing the rebound of the pass. Placing the weight on the rear foot moves the center of mass away from the flight of the serve, also reducing the rebound of the pass. The passing action must add impetus to counteract the loss of rebound.

In addition, the ball approaches the arms from an angle and, since the angle of incidence equals the angle of reflection, leaves the arms at the same angle. The passing action, by adding force to the ball in the direction of the pass or changing the angle of the arm relative to the target, must compensate for the angle at which the ball rebounds from the arms. Each additional movement makes the passing action more complex, less efficient, and more difficult to master.

Other techniques place the right foot always forward and direct the ball by rotating the hips toward the target before the pass. This places the body weight toward the front foot which is also toward the passing target. Again, however, the ball approaches the arms from an angle other

than perpendicular, and the passing action must compensate for the angle of rebound, adding to the complexity of the passing action.

The preferred forearm passing action is essentially that of joining the hands and the ball rebounding from the contact surface of the forearms. How the hands are clasped determines to a large degree the character of the contact surface and the rebound provided. Various hand clasps exist, but four are most common.

The palm-clasp method grips one hand in the palm of the other, both palms facing up. This clasp is most often seen in recreational play where participants have experienced little formal instruction. It is also found in outdoor play where the use of a softer volleyball compensates for the technique's deficiencies.

Because one palm is placed on top of the other, an uneven passing surface exists. The result, to a greater degree with the resilient ball used indoors than the softer version employed in outdoor play, is a skewed rebound from the arms. The arms must be tilted to compensate for the unevenness of the platform, making the passing action more complex and less consistent.

A method more commonly found in instructional and competitive settings is the finger clasp. The fingers of one hand are placed on top of the fingers of the other hand, the palms side-by-side. The thumbs of both hands lay

side-by-side and clasp the fingers. The lower palm areas of the hands are adjacent.

The benefit of both of these hand clasps is that the fleshy inside of the forearm is turned slightly outward, presenting a wide and soft surface to the ball. The wide arm area provides the passer with a large surface with which to contact the ball. The soft surface area absorbs some of the ball's inertia and allows an extended period of contact between the player and the ball. The greater the contact between the player and the ball, the greater will be the player's control of the ball.

One deficiency of the finger-clasp technique is that the fingers which are held on top of the others tend to lift that hand and forearm slightly higher than the lower hand and arm, creating a slightly uneven passing surface. Another deficiency is the soft surface area presented to the ball. Because the soft surface absorbs the ball's inertia, additional impetus must be provided to the ball. The body or arm movements providing additional impetus make the passing action more complex and less efficient.

The other two common hand clasps do not lay the hands on top of each other, but rather alongside each other. The finger interlace joins the hands side-by-side, the fingers extended, separated and laced between each other. The fist wrap forms a fist with one hand and wraps the other around the first.

The finger-interlace clasp inserts the fingers of one hand between the corresponding fingers of the other hand, the thumbs placed side-by-side. The fingers are generally curled, but not gripping the opposite hand. Gripping the hands tightly tenses the platform all the way up to the shoulder, interfering with fine motor movement.

The benefit of the finger interlace is that the hands and, thus, the platform are not easily dislodged during contact with the ball. The disadvantage of the finger interlace is that the digits are exposed to injury when the player's joined hands collide with the floor. The digits are also exposed when balls bounce up from the floor and into the fingers.

The fist wrap joins the hands by forming a fist in one hand and wrapping the other, usually the dominant hand, loosely around the formed fist. The wrap is relaxed, but secure enough to prevent the hands from separating during contact with the ball. Gripping tightly tenses the platform all the way up to the shoulder, interfering with fine motor movement.

In both clasp methods, the thumbs are placed side-by-side. If the thumbs are crossed, the hand and arm of the top thumb will be lifted higher than the other, and an uneven passing platform results. The thumbs and hands are directed downward toward the floor. Extending the thumbs and hands downward tends to straighten the arms at the

elbows; lifting the thumbs tends to cause the arms to bend. The lower heel areas of the palms are adjacent.

Neither the finger interlace nor the fist wrap turns the fleshy part of the forearm toward the ball. Contact occurs primarily on the bony surface of the insides of the forearm. The surface is hard, which absorbs less of the ball's inertia. The rebound of the ball is greater than that provided by the fleshy forearm surface, requiring little or no body and arm movement to rebound the ball through a low trajectory completely to the target area at the net. Minimizing the movements simplifies the skill and increases the efficiency, effectiveness, and consistency of the execution of the technique.

In execution of the preferred method of rebound passing, both the finger interlace and the fist wrap are advantageous to the palm- and finger-clasp methods. Both accomplish the task of joining the hands and presenting a sufficiently hard rebound surface. The fist wrap is less secure, but perhaps safer, than the finger interlace.

The ball is directed toward the intended target by the tilt of the passing platform. The most efficient pattern contains minimal movement directing the ball to the target area and, thus, is readily and effectively learned. For the passing platform to rebound the ball completely to the net, the body must be stable and balanced, with the weight forward toward the front foot. Motions, such as a weight

shift onto the heels of the feet, an upward motion of the legs or arms, or an arching of the back, will direct vertical forces through the ball and reduce the horizontal distance of its flight, leaving the pass short of the net.

Exceptionally fast-moving serves, such as a jump serve, may rebound beyond the net. Such serves require that some of the impetus of the ball be absorbed in the passing action. This is accomplished by a slight movement of the arms rearward as contact with the ball occurs. An efficient means of accomplishing this task is to begin with the arms bent at the elbows 10 to 15 degrees. The arms straighten as the ball is contacted, effectively moving the forearms rearward in line with the ball flight.

Slow-moving serves and volleys require additional impetus in addition to the rebound in order that the ball reach the net. Any additional force should be directed parallel to the intended trajectory of the pass. A weight shift of the player's center of mass directly toward the target area is the preferred method. Additionally, force is gained by a slight forward, not upward, movement of the hands prior to and during contact. Care must be taken that neither of these movements changes the trajectory of the pass or the angle of the arms.

Contact with the Ball

Contact with the ball occurs primarily on the insides of the bony part of the forearms. The contact surface is

about halfway between the wrist bone (radial styloid process) and the bulge of the forearm muscles, approximately two inches above the wrist bone. This area is flat and hard, providing an accurate and direct rebound.

If the ball is contacted too low on the arm, it rebounds from the wrist area which is round in shape and harder than the forearm area. The ball rebounds farther from the harder surface. The direction of the rebound is less accurate due to the curvature of the styloid process. Contacting the ball below the wrists on the thumbs and hands, also rounded surfaces, results in an equally unpredictable pass.

Contacting the ball too high on the forearm brings the ball into contact with the bulk of the forearm muscles. This provides a softer passing surface than the preferred contact location, and much of the ball inertia is absorbed. The rebound distance is reduced, and the pass falls short of the target area. Excessive absorption may result in the official ruling of a ball-handling error.

Follow-Through

Because the passing action is essentially one of rebounding the ball to the target, follow-through is minimal. The presence of follow-through indicates movement prior to, and at, the point of contact. The movement which results in follow-through and the reasons for such movement should be eliminated from the passing action.

Key Teaching Points

Initial Posture

1. The feet are spread slightly more than shoulder width apart, right foot forward.
2. The legs are bent 45 to 60 degrees at the knees.
3. The hips and shoulders are perpendicular to the flight of the ball.
4. The arms are extended from the shoulders 30 to 45 degrees from vertical.
5. The arms are extended straight, but relaxed, at the elbows.
6. The hands are separated approximately 12 to 18 inches apart.
7. The hands are as follows:
 - (a) open, with fingers spread comfortably, curved slightly, and relaxed, or
 - (b) non-dominant hand loosely forming a fist, dominant hand open and relaxed.

Movement to the Ball

Moving to balls not more than five feet away (within two slide steps), the player uses the slide-step footwork pattern.

Moving to balls 5 to 10 feet away (more than two slide steps, but not more than two crossover steps), the player uses the crossover-step footwork pattern.

1. The hips and shoulders remain perpendicular to the flight of the ball.

2. The right shoulder remains slightly lower (one to two inches) than the left, tilting the passing platform toward the target area.

3. The arms remain extended from the shoulders 30 to 45 degrees from vertical.

4. The arms remain extended straight, but relaxed, at the elbows.

5. The hands remain separated 12 to 18 inches.

6. The hands remain as follows:

- (a) open, with fingers spread comfortably, curved slightly, and relaxed, or

- (b) non-dominant hand loosely forming a fist, dominant hand open and relaxed.

Moving to balls more than 10 to 12 feet away, the player turns and runs toward the ball.

1. The hips and shoulders turn toward the direction of the run.

2. The arms bend at the elbows and swing counter to the legs to facilitate running.

During the last two steps, the body rotates so that the hips and shoulders are perpendicular to the flight of the ball.

1. The right shoulder is lowered slightly (one to two inches), tilting the passing platform toward the target area.

2. The arms are extended from the shoulders 30 to 45 degrees from vertical, straight at the elbows.

The Forearm Passing Action

1. The knees are bent, with the body lowered and positioned so that the forearms contact the ball without the passing platform being altered.

2. The hips and shoulders remain perpendicular to the flight of the ball.

3. The shoulder drop tilts the passing platform toward the target.

4. The passing action is essentially one of the ball rebounding from the passing platform.

When the velocity of the received ball is not sufficient for the pass to rebound completely to the target area:

1. Impetus is applied to the ball by means of a short, controlled shift of the center of mass directly toward the target.

2. The center of mass shifts horizontally, not upward, toward the target.

3. The weight shift moves the passing platform no more than necessary, generally no more than six inches.

When additional force is needed and a weight shift is not possible:

1. Impetus is applied to the ball by means of a short, controlled movement of the hands directly toward the target.

2. The hands move nearly horizontally, not upward toward the target.

3. The hands move the passing platform no more than necessary, generally no more than six inches.

Contact with the Ball

1. Contact occurs primarily with the bone (the radius) and partly with the fleshy insides of the forearms.

2. Contact occurs on the flat part of the forearm, halfway between the wrist bone (radial styloid process) and the bulge of the forearm muscles (brachioradialis), or approximately two inches above the wrist bone.

Follow-Through

The passing action is essentially a rebound of the ball; follow-through is minimal.

PART 3
THE OVERHEAD SET

THE OVERHEAD SET

Description of the Skill

The initial contact by a team is the pass of the serve or volley which redirects the ball toward the net. The contact following the pass directs, or sets, the ball toward the point of attack. Though any legal contact may be used to position the ball for the attack, the preferred and most accurate method is the overhead set.

The location to which the set is directed, and the trajectory through which the ball travels, is defined individually by each team. There are, however, general target areas common to most systems. Advanced schemes use these target areas as a base and vary the point and tempo of the attack to create attack advantages.

Primary target areas are commonly the two sideline corners of the court near the net. The set is directed two to four feet from the net and zero to three feet in from the sideline. The basic set peaks 8 to 10 feet above the net so that the trajectory of the ball as it nears the attacker is nearly vertical. Another common target area is the center of the court, one to three feet from the net. Middle sets are usually lower, peaking four to six feet above the net.

The overhead set is generally carried out by one or more specialists, termed setters, especially skilled in executing the overhead set and directing the team's offense.

From the starting position, a setter must penetrate to the target area at the net and then move quickly to intercept the initial pass. At the point of ball intersect, the setter must determine the target location and trajectory of the set selection and deliver the ball. The technique used by a setter must be effective and efficient, generating power quickly and accurately without wasted motion.

Penetration to the Target Area

The starting position of the player designated to be the setter is determined by the rotation and the team's reception formation. From this position, the setter moves as the serve is contacted. Prior to the ball being received by the passer, the setter arrives at the net target area postured to move quickly to intercept the pass.

1. From the starting position, movement toward the target area of the pass occurs before the server's strike of the ball.
2. The lead foot crosses beyond the foot of the overlapping player; but does not touch the floor before the server's strike of the ball.
3. The setter runs to the target area of the pass.
4. The setter arrives at the target area prior to the passer's contact with the ball.
5. During the last two steps, the body is aligned to the setter's initial posture.

Initial Posture

The setter is near the net as the ball is passed. From this position, the setter is postured so that the set may be executed or movement to the ball may be effected quickly and efficiently. The setter's attention is directed to the platform of the passer. The setter should not initiate movement prior to contact with the actual pass.

1. The setter is near the net (within 18 inches).
2. The feet, hips, and shoulders are at a 45-degree angle away from perpendicular to the net, facing the left front attack area (zone 1, two to five feet from the net).
3. The feet are in stride position, right foot 6 to 12 inches forward of the left.
4. The feet are approximately shoulder width apart.
5. The legs are bent at the knees approximately 30 to 45 degrees.
6. The torso is in an upright posture.
7. The arms hang relaxed from the shoulders.
8. The arms are flexed at the elbows at an angle similar to the elbow angle from which the overhead set is initiated (approximately 90 degrees).
9. The wrists are bent (radial flexion) at an angle similar to the wrist angle from which the set is initiated (15 to 30 degrees).
10. The hands are separated no more than the width of the ball.

11. The planes of the palms of the hands are at approximately 45 degrees from parallel.

12. The fingers are spread comfortably and curved in the shape of the ball.

13. The thumbs are pointed slightly back toward the body (15 to 30 degrees from being in line).

14. Attention is focused on the passer's body posture and passing platform.

Movement to the Ball

As with the player executing the forearm pass, the range through which the setter can move and execute the overhead set is determined both by the speed of movement and the time required to prepare for the execution of the set upon interception of the ball. The initial posture of the player is already aligned to make the set. The player moving to the ball while maintaining body and court alignment will be more efficient and execute the pass more quickly than the player who moves to the ball and then realigns. The preferred movement patterns are those which cover the required distance with minimal realignment at the point of ball intersect.

Distance through which the setter must move in order to reach the ball is a factor in determining the player's ability to maintain postural and positional alignment during movement. Slide-step footwork patterns cover short distances with little change in posture. Crossover-step

patterns cover longer distances with little change in upper body posture. Greater distances can be covered best by running and realigning upon arrival at the point of ball intersect.

Moving to balls not more than two to five feet away (two slide steps), the setter uses the following slide-step footwork pattern:

1. Pushing off with the foot farthest away from the ball (the trail foot), the player takes a step in the direction of the ball with the foot nearest the ball (the lead foot). The trail foot closes to within 6 to 12 inches of the lead foot.

2. The lead foot strides toward the ball, returning the feet to the initial posture or slightly wider than shoulder width apart.

3. Repeat for a double slide step.

During movement to the ball using the slide-step pattern, the following are emphasized:

1. The degree to which the legs bend at the knees varies during movement in order to place the forehead in intersect with the path of the passed ball.

2. The center of mass travels in a straight line, not up and down.

3. The trunk remains in an upright posture.

4. The hips and shoulders remain facing the zone 1 attack area.

5. The arms continue to hang comfortably from the shoulders.

6. The arms remain flexed at the elbows at an angle similar to the elbow angle from which the overhead set is initiated (approximately 90 degrees).

7. The wrists remain bent (radial flexion) at an angle similar to the wrist angle from which the set is initiated (15 to 30 degrees).

8. The hands remain separated no more than the width of the ball.

9. The planes of the palms of the hands remain at approximately 45 degrees from parallel.

10. The fingers remain spread comfortably and curved in the shape of the ball.

11. The thumbs remain pointed slightly back toward the body (15 to 30 degrees from being in line).

As the point of intersect with the ball is neared, the player's body is postured to execute the set:

1. The feet are spread slightly wider than in the initial posture; the lower the ball, the wider the feet are spread.

2. The weight is distributed evenly between the feet. The body is balanced and stable.

3. The legs are bent at the knees, placing the forehead and hands at the height of the ball intersect.

4. The trunk remains in an upright posture.

5. The hips and shoulders face zone 1 attack area or rotate to face directly opposite the zone 9 attack area.

6. The arms are elevated from the shoulders so that the hands are directly in front of and above the forehead.

7. The arms remain bent approximately 90 degrees at the elbows.

8. The wrists remain bent (radial flexion) 15 to 30 degrees.

9. The hands remain separated no more than the width of the ball.

10. The planes of the palms of the hands remain at approximately 45 degrees from parallel.

11. The fingers remain spread comfortably and curved in the shape of the ball.

12. The thumbs remain pointed slightly back toward the body (15 to 30 degrees from being in line).

Moving to balls more than 5 to 10 feet away (two slide steps away, but not more than two crossover steps), the player uses the following crossover-step footwork pattern:

1. Pushing off with the foot farthest away from the ball (trail foot), the player takes a short step in the direction of the ball with the foot nearest the ball (lead foot).

2. The body continues to move in the direction of the ball.

3. The trail foot crosses in front of the lead foot.

4. The lead foot follows immediately, crossing behind the trail foot.

5. The lead foot strides toward the ball, returning the feet to the initial posture or slightly wider than shoulder width apart.

6. Repeat for a double crossover step.

During movement to the ball, using the crossover-step pattern, the following are emphasized:

1. The degree to which the legs bend at the knees varies during movement in order to place the forehead in intersect with the path of the passed ball.

2. The center of mass travels in a straight line, not up and down.

3. The trunk remains in an upright posture.

4. The hips and shoulders remain facing the zone 1 attack area.

5. The arms continue to hang comfortably from the shoulders.

6. The arms remain flexed at the elbows at an angle similar to the elbow angle from which the overhead set is initiated (approximately 90 degrees).

7. The wrists remain bent (radial flexion) at an angle similar to the wrist angle from which the set is initiated (15 to 30 degrees).

8. The hands remain separated no more than the width of the ball.

9. The planes of the palms of the hands remain at approximately 45 degrees from parallel.

10. The fingers remain spread comfortably and curved in the shape of the ball.

11. The thumbs remain pointed slightly back toward the body (15 to 30 degrees from being in line).

As the ball is neared, the player's body is postured to execute the set:

1. The feet are spread slightly wider than in the initial posture; the lower the ball, the wider the feet are spread.

2. The weight is distributed evenly between the feet. The body is balanced and stable.

3. The legs are bent at the knees, placing the forehead and hands at the height of the ball intersect.

4. The trunk remains in an upright posture.

5. The hips and shoulders face the zone 1 attack area or rotate to face directly opposite the zone 9 attack area.

6. The arms are elevated from the shoulders so that the hands are directly in front of and above the forehead.

7. The arms remain bent approximately 90 degrees at the elbows.

8. The wrists remain bent (radial flexion) 15 to 30 degrees.

9. The hands remain separated no more than the width of the ball.

10. The planes of the palms of the hands remain at approximately 45 degrees from parallel.

11. The fingers remain spread comfortably and curved in the shape of the ball.

12. The thumbs remain pointed slightly back toward the face (15 to 30 degrees from being in line).

Moving to balls more than 10 to 12 feet away (more than two crossover steps), the player turns and runs toward the ball, using the following footwork pattern:

1. Pushing off with the foot farthest away from the ball (trail foot), the player takes a short step in the direction of the ball with the foot nearest the ball (lead foot).

2. The trail foot crosses in front of the lead foot, turning the hips and shoulders in the direction of movement.

3. The lead foot follows.

4. The running movement continues until the ball is neared.

During movement to the ball, the following are emphasized:

1. The legs and trunk extend, raising the body height to facilitate greater running mobility.

2. The hips and shoulders turn toward the direction of the run.

3. The arms remain bent at the elbows (approximately 90 degrees) and swing counter to the legs to facilitate running.

4. The wrists remain bent (radial flexion) 15 to 30 degrees.

5. The hands remain separated no more than the width of the ball.

6. The planes of the palms of the hands remain at approximately 45 degrees from parallel.

7. The fingers remain spread comfortably and curved in the shape of the ball.

8. The thumbs remain pointed slightly back toward the body (15 to 30 degrees from being in line).

As the ball is neared, the player's body is postured to execute the set:

1. The next-to-last step is taken with the trail leg.

2. The lead leg follows quickly, planting and controlling the body's momentum.

3. During the next-to-last and last step, the body prepares to execute the set.

4. The arms are rotated at the shoulders, elevating the hands to a position slightly above and in front of the forehead.

5. The arms remain bent approximately 90 degrees at the elbows.

6. The wrists remain bent (radial flexion) 15 to 30 degrees.
7. The hands remain separated no more than the width of the ball.
8. The planes of the palms of the hands remain at approximately 45 degrees from parallel.
9. The fingers remain spread comfortably and curved in the shape of the ball.
10. The thumbs remain pointed slightly back toward the face (15 to 30 degrees from being in line).
11. The legs bend at the knees which lowers the forehead to the level of the ball intersect.
12. The trunk remains basically upright, tilted forward no more than 15 degrees from perpendicular with the floor.
13. During the last step, the body rotates so that the hips and shoulders are perpendicular to the zone 1 attack area or opposite the zone 9 area.

Preparation to Set

Prior to executing the setting action, the player must adjust the posture in preparation for executing the set. From lower and upper body deviations occurring during movement, the body must be returned to the initial posture and brought into balance. In addition, the arms must be elevated to bring the hands into position near the forehead,

and the fingers must be shaped in preparation of contact with the ball.

1. Preparation to set occurs during movement to the pass, not upon arrival.

2. The hands await the pass at near forehead level.

3. The arms are bent approximately 90 degrees at the elbows.

4. The wrists are bent (radial flexion) 15 to 30 degrees.

5. The hands are separated no more than the width of the ball.

6. The planes of the palms of the hands are at approximately 45 degrees from parallel.

7. The fingers are spread comfortably and curved in the shape of the ball.

8. The thumbs are pointed slightly back toward the body (15 to 30 degrees from being directly in line with each other).

The Setting Action

The setting action gathers the forces of the legs, shoulders, and arms and transfers them through the ball in the intended direction and trajectory of the set. The fingers absorb momentum and direct the ball. The preferred action is carried out through a short, quick motion, rather than one which is long and slow.

1. As the ball nears the hands (one to three inches, depending on the force to be applied to the ball), the setting action is initiated.
2. Power is generated from a short, forceful extension of the leg behind the center of mass away from the target area.
3. The other leg maintains balance.
4. Sequential to leg extension, the arms extend the hands through the ball in the intended trajectory of the set.
5. The angle of bend at the elbows never decreases during the setting action; the arms only extend.
6. Both power and direction are provided by the arm extension.
7. The hands remain separated no more than the width of the ball.
8. The planes of the palms of the hands do not rotate, but remain at approximately 45 degrees from parallel.
9. The fingers remain spread comfortably and curved in the shape of the ball.
10. Follow-through (ulnar flexion) occurs at the end of the delivery.

Contact with the Ball

Legal contact with the ball occurs only on the fingers and thumbs. Primary contact is on the sides and the rear of the ball. The fingers cover a large portion of the ball's

surface. The more surface area that is covered, the more control is afforded.

1. Primary contact occurs on the sides slightly to the rear of the ball.

2. Primary contact with the ball is made with the index and middle fingers of both hands.

3. Contact with the ball occurs to a slightly lesser degree on the thumbs and ring fingers as well and, occasionally, with the little finger.

4. The ball contacts the length of the fingers down to the second knuckle and the pad of the thumbs (to the first knuckle).

Follow-Through

Follow-through occurs after the ball has left contact with the hands and has no effect on the flight of the ball. However, the movements of the hands during contact do affect the flight of the ball and are indicated by the follow-through. Follow-through movements should continue in line with the intended trajectory of the set.

1. The hands continue to be formed in the shape of the ball throughout the setting action.

2. Follow-through occurs as the arms near full extension after the ball has left the hands.

3. Follow-through occurs primarily through arm extension at the elbows and flexion at the wrists.

4. Follow-through leaves the arms and index fingers pointed toward the apex of the set.

Analysis of the Skill

The overhead technique is a method of handling balls contacted at a level higher than the chest. This technique cradles the ball with the fingers and thumbs, employing a spring-like action of the fingers to absorb and reverse the ball's momentum. Extension of the arms and hands, along with the legs, provides the force directing the ball toward the target area of the pass or set.

The overhead technique is most often used to deliver the ball to the spiker and is generally termed the overhead set. When used to pass an opponent's volley to the setter, it is known as the overhead pass. The overhead technique is seldom used to receive service. Though it is not illegal to receive a serve with the overhead pass, it is exceptionally difficult to receive a serve legally using this skill.

The velocity of the serve often generates more momentum in the ball than can be readily absorbed by the finger action of the overhead pass. The force of the ball deforms the hand and finger arrangement to such a degree that the ball is ruled mishandled by the official. The forearm pass is more commonly used to receive a served ball and direct it toward the target area of the pass. The rebound of the ball from the forearms absorbs much of the ball's inertia, thus

reducing the momentum of the ball to be handled by the setter.

The ball, as it nears the setter, contains only a fraction of the inertia of the initial serve. The momentum of the ball does not deform the shape of the hands and fingers. The finger action of the overhead technique is then sufficient to absorb and reverse the flight of the ball.

The length of ball and finger contact, both in terms of time and distance, is longer than occurs with the forearm technique. Due to the extended contact, the overhead technique is much more accurate in trajectory, direction, and distance than is the rebound of the ball from the forearms. Should the extended contact become excessive, however, illegal ball-handling is likely to be ruled by the official.

From various starting positions on the court, the setter moves quickly to the target area of the pass as the server strikes the ball. Prior to the initiation of the pass, the setter arrives at the target area. It is from this position that the setter pursues the pass and delivers the ball to one of the attack options defined by the offensive system.

Offensive systems have many components which define the set. The attack location is the terminal point to which the

ball is directed. This may be anywhere along or away from the net.

The tempo of the set defines the time frame in which the ball and spiker arrive in the attack zone. Tempo coordinates the flight trajectory of the ball, the height at which it peaks, and the spiker's approach speed and timing. The spiker and ball arrive in the attack zone so that the hitter and the location of the ball are optimally aligned to execute the attack.

Many fast-action plays require the spiker to begin the approach before the ball is received by the setter. Defining the location and tempo of the set allows the spiker to move toward the attack point prior to seeing the delivery of the set. Communication of location and tempo may occur before the serve or during the flight of the pass. Location and tempo may be communicated from setter to spiker or spiker to setter. Such variations enhance the flexibility of offensive systems.

In order to consistently deliver the ball in tempo to the desired location, the setter must penetrate to the target area of the pass and be postured to pursue the ball immediately as the pass is made. From this position, the setter moves quickly to intersect the ball, postures the body, and delivers the set. Having arrived at the ball and postured the body, the setter delivers the ball to the attack location through the defined trajectory.

The quickness with which the setter intersects the pass and delivers the set is a factor of the quickness of initial movement, speed of movement to the ball, and the time required upon arrival to posture the body for the setting action. An efficient setting technique minimizes the execution time of each of these actions, extending the range and increasing the strength and consistency of the setter. The setter's penetration to the target area and the initial posture, once there, are essential to efficient setting technique.

Penetration to the Net

Player overlap rules define the limits of the setter's initial position within the serve receive formation. Once the ball is contacted, players, including the setter, are free to move to any area of the court. The setter's penetration to the target area begins slightly prior to the striking of the serve. While the lead foot may encroach the air space of adjacent players, care must be taken to insure that the lead foot does not contact the floor encroaching the area of an adjacent player, thus causing an overlap. Movement is speedy and directly to the target area.

The setter arrives at the target area prior to the passer's contact with the ball. The player, still moving to the target area as the ball is passed, is away from the intended location of the pass and is likely to be away from the actual point of intersect with the ball. A player,

while moving, has greater difficulty changing direction to pursue the pass than the player in a balanced, stable posture.

In addition to arriving at the target area before the initiation of the pass, the setter must arrive in an initial posture which facilitates quick movement and ready preparation to set upon intersection with the pass. The momentum of the player still moving must be halted and reversed in order to pursue the pass in any other direction. Steps which could be used to pursue the ball are lost in stopping and reversing body momentum. Regardless of the court position of the setter as the pass occurs, the body must be balanced and stable, prepared to move in any direction.

During the last two steps of penetration, the body is aligned in the setter's initial posture. The setter, during the next-to-last step, breaks the momentum of running and rotates to a position facing the left front. The last step controls the momentum and aligns the center of mass centrally over the base of support, preparing the body for movement in any direction.

The setter arrives at an initial position which is near the net. Even though the majority of errant passes are away from the net, the position near the net is the target of the passer and is optimum for the execution of most offensive

systems. The initial position should be one from which the ideal pass is most effectively handled.

Were the setter to be stationed away from the net, the pass targeted near the net would be difficult to handle effectively. The intended trajectory of the pass brings the ball to the setter's forehead level near the net. Away from the net, the setter is likely to have such a pass go over the head and out of reach. The setter must then attempt to jump and set the ball or retreat to the center line and handle the ball without touching the net. Both are more difficult and less efficient than awaiting the ball near the net.

Initial Posture

As was the case with the forearm pass, total time to execute the set includes the time spent moving to the ball and time spent posturing the body to execute the setting technique upon arrival. The initial posture is one which effects rapid initial response and speedy movement to the ball. The alignment and posture are similar to those of the setter in execution of the pass. The initial posture differs from the setting posture only in those areas where modification facilitates speed of movement to the ball.

The feet are in a stride position with the right foot, the foot nearest the net, forward. The forward foot is aligned with the heel laterally even with the toe of the rearward foot. A farther forward position creates an

elongated base of support which restricts the player's weight transfer. Elongation also narrows the base and provides poor lateral stability to the setter during the setting action.

The forward placement of the foot nearest the net, generally the right foot, is critical to the efficiency of the setter. It allows the hips to rotate toward the contact of the pass and rotate back toward the target of the set. It also facilitates weight transfer to the front foot in the direction of the target area. Following weight transfer to the forward foot, the center of mass is located farther from the net than the weight-bearing foot. The result is that gravity pulls the player away from the net following the set.

Having the outer foot forward blocks the hips from rotating farther toward the ball than the initial posture. Rotation of the hips back toward the attack zone often continues beyond the target area, sending the ball across the net. Having the outer foot forward also places the center of mass between the foot and the net. The result is that the player falls toward the net upon completion of the setting action, often causing a net foul.

The feet, hips, and shoulders are at a 45-degree angle away from perpendicular to the net. This foot position allows the setter to rotate the hips and shoulders to see the contact of the pass throughout the court area. The same

foot and hip alignment allows the hips to rotate to face the left front net area from which both the front and back sets are executed. Maintenance of this alignment, as the setter moves to the ball, facilitates execution of the setting options without the necessity of reorienting the body in preparation to set.

The arms hang loosely at the sides of the body. The arms are bent at approximately 90 degrees, the elbow angle identical to that taken when the hands are placed near the forehead to initiate the setting action. This locates the hands at approximately chest level. From this position, all that is required of the setter to position the hands is a shoulder rotation elevating the arms.

An initial posture placing the hands at forehead-height, allows the player to move to the ball in a posture to initiate the setting action. This is very efficient relative to the setting action. However, this posture restricts movement to the ball and for this reason is seldom the preferred setting posture.

An initial posture allowing the arms to hang with the hands held low, near waist level, accommodates quick movement and feels comfortable to the setter, but creates a less efficient setting action. As the hands move upward in preparation for the setting action, the angle of bend at the elbow must decrease so that the hands arrive in position to set near the forehead area. Proficient setters have little

difficulty making this adjustment, but for the learner or less accomplished setter, the added complexity of the preparation phase increases inconsistency and the time needed to posture the body for the setting action.

Players whose initial posture places the hands near waist level or who lower the hands during movement to the ball elevate the hands maintaining the arm bent at an identical elbow angle. This places the initial position of the hands excessively (six inches or more) above forehead level. To avoid contacting the ball too far above forehead level, hands held excessively high must be lowered. The angle of bend at the elbow is reduced after the arms elevate toward the ball. The hands lower to setting posture either prior to or during the setting action.

A decreasing and then increasing movement at the elbow during the setting action is an extremely complex action, requiring the action of the arms and the flight of the ball to be timed perfectly. Initiating the action of the hands too early requires the player to vary the speed of hand movement relative to the position of the ball, rather than the force of the set. Varying the hand speed relative to the position of the ball also increases the complexity of coordinating the hand action with the weight transfer. Initiating the action of the hands too late often allows contact to occur as the elbow angle decreases and causes

excessive contact, often leading to a ball-handling violation and a loss of power.

It is most efficient to shape the hands in the initial posture. As with the placement of the hands, moving to the ball and then shaping the hands for the setting action is time-consuming and less efficient. Shaping the hands during movement to the ball is readily accomplished by the proficient setter. But for the learner and less accomplished setter, shaping the hands during movement adds complexity and inconsistency to the task.

Moving with the hands separated the width of the ball allows the setter to merely elevate the arms in preparation of the setting action. Hands separated more than the width of the ball must then be brought together at the appropriate separation at contact with the ball.

Because each hand moves in an arc toward and through the ball, precise timing of this action is a must. Bringing the hands together too late provides unequal contact and force to the ball from each hand. The resultant ball flight is in the direction of the stronger hand contact, rather than in the direction of the movement of both hands. In the extreme case, uneven contact results in one hand contacting the ball before the other, and a ball-handling violation occurs.

For the hands to efficiently arrive near forehead position shaped to deliver the set, the hands should be

formed and maintained during movement to the ball. The fingers are spread and relaxed, curved in the shape of the ball. This is not a hand posture which people typically hold during movement and, therefore, is not one which is generally comfortable to learners and inexperienced players. It is not, however, anatomically restrictive to movement, and it is efficient to the setting action.

The hand position from which the setting action is initiated places the fingers perpendicular to the intended flight of the ball. Players often take an initial posture and movement pattern in which the hands are held with the fingers in line with the forearms. Such players must then re-posture the angle of wrist bend (radial flexion) as, or after, the hands arrive in position near the forehead. The preferred method of moving with the wrist angle already formed is more efficient and minimizes the complexity and time required of the preparation phases.

Setters can obtain cues of pass direction from the posture from which the pass is effected. The location of the ball relative to the player, direction of the hips and shoulders, angle of the arms, and tilt of the platform are all determinants of the flight of the pass. The setter, while maintaining balance and stability, should focus attention to the passer in order to quickly determine the path of the pass. Movement should be in response to the

actual flight of the ball, not in response to the cues. Cues merely provide early identification of ball flight.

Movement to the Ball

Movement patterns vary, depending on the distance to be covered while moving to the ball. Served balls within five feet of the receiver are arrived at using the slide-step pattern. The slide step allows the player to move with minimal rotation of the hips and torso. The hips and shoulders remain perpendicular to the intended flight of the set throughout the movement.

During the next-to-last step, the body is lowered, bringing the forehead area in line with the flight of the pass. The hands are brought to setting posture near the forehead. The final step controls the body momentum and stops the movement of the body. The lower body is postured to gain stability and effect the weight transfer in the direction of the intended set trajectory. At ball intersect, the body is balanced and stable.

The initial posture of the arms and the hands are maintained throughout the movement. The angle of bend of the elbows is that from which the setting action is initiated. The hands remain separated no greater than the width of the ball; the fingers remain curved in the shape of the ball.

Slide steps cover small distances. Passed balls more than five feet away from the setter require that the

distance be covered by a faster method. The crossover-step pattern covers a greater distance and builds more speed on each step than the slide step. Crossover steps create a slight rotation of the hips and counterbalancing movement of the torso, but shoulder orientation and hand position remain unchanged.

As with the slide-step pattern, during the next-to-last step, the body is lowered, bringing the forehead area in line with the flight of the pass. The hands are brought to setting posture near the forehead. The final step controls the body momentum and stops the movement of the body. The lower body is postured to gain stability and to effect weight transfer in the direction of the intended set trajectory. At ball intersect, the body is balanced and stable, with no rotation toward or movement away from the target.

The arms and the hands are maintained throughout the movement. The angle of bend of the elbows is that from which the setting action is initiated. The hands remain separated no greater than the width of the ball. The fingers remain formed in the shape of the ball. The forearms are merely brought in line with the flight of the serve.

Most serves and volleys are received and passed to within the effective range of slide- and crossover-step patterns. Occasionally, however, greater distances must be

covered. The fastest way to cover long distances, such as passed balls more than 10 feet away from the setter, is to turn and run to the ball intersect and then turn back to set.

As with most running actions, running to the ball turns the hips and shoulders in the direction of the run. The hands separate farther than the width of the ball and swing counter to the legs. Hand shape and wrist angle are maintained. The body is elevated, and the stride length increases.

Nearing the point of intersect, the stopping and gaining balance actions are combined with the action of posturing the body to execute the set. The hands are returned to a position of separation no greater than the width of the ball. The body rotates on the next-to-last step, the hips and shoulders returning to perpendicular to the intended flight of the set.

During the next-to-last step, the body is lowered, bringing the forehead area in line with the flight of the pass. The hands are brought to setting posture near the forehead. The final step controls the body momentum and stops the movement of the body. The lower body is postured to gain stability and effect the weight transfer in the direction of the intended set trajectory. At ball intersect, the body is balanced and stable with no rotation toward or movement away from the target.

As with the slide-step and crossover-step patterns, the initial posture of the arms and the hands is maintained throughout movement. The angle of bend of the elbows is that from which the setting action is initiated. The fingers remain formed in the shape of the ball.

Another method of the turn-and-run technique is exhibited by experienced setters and extends even farther the range of the player. During the next-to-last step, the body is lowered, bringing the forehead area in line with the flight of the pass. The hands are brought back to a separation no greater than the width of the ball and then elevated to the setting position near the forehead.

The setter's running momentum is transferred to the setting action during the last step by rotating the body toward the intended location of the set. The axis of rotation is the foot of the leg nearest the set location, the leg on which the last step is taken. The rotation of the body aligns the hips and shoulders perpendicular to the intended flight of the set. The setting action is initiated at the end of the rotation of the hips and shoulders. The rotation of the torso transfers momentum to the setting action in the direction of the attack area, generating additional power for the setter to impart to the ball.

The timing of arrival at ball intersect and initiation of the setting action are critical to success of the set. Care must be taken that rotation stops upon initiation of

the setting action. Otherwise, lateral velocity is imparted to the ball, causing it to drift in the direction of rotation, usually across the net to the opponents.

Because of the extended time and complexity of realigning and preparing for the setting action and the potential for error in the process, the turn-and-run pattern is used only on balls that cannot be reached using the slide- or crossover-step patterns. Whenever time and distance permit, the slide- or crossover-step patterns are preferred.

Preparation to Set

Ideally, the preparation-to-set phase occurs during the last two steps of movement to the ball. Moving to the ball and then posturing the body to execute the setting action takes excessive time, diminishing time available for movement. Thus, the range of the setter is diminished by not preparing the setting posture during movement. Likewise, much of the preparation is determined by the initial posture.

The Setting Action

At the point of ball intercept, actions of the lower and upper body combine to deliver the ball to the target area. The lower body effects a transfer of the center of mass toward the attack area. The arms extend through the ball to the point of intended ball apex. The fingers encircle the rearward half and sides of the ball to apply a

spring-like action to absorb and redirect the momentum of the passed ball toward the target area. Each of these forces is directed through the ball in the direction of the intended trajectory.

The distance the ball travels through the trajectory is a result of the forces of propulsion and absorption applied to the ball. The weight shift transfers energy to the ball. The acceleration of arm extension provides force through the contact with the ball. The momentum of the hands and fingers on contact imparts inertia to the ball and provides a degree of absorption and rebound.

Depending on the force to be applied to the ball, the setting action is initiated as the ball approaches one to three inches from the setter's initial hand position. Beginning the setting action from a point three inches behind the ball creates more velocity and momentum in the setting action than beginning one inch from the ball. The greater the momentum and velocity imparted to the ball, the greater the distance the ball will travel. Because the velocity of the hands upon contact is high, the duration of contact between the hands and the ball is low, limiting the player's control of the set.

Setting actions initiated three inches from the ball are used to propel sets long distances or to above-average heights. Delivering the ball completely across the court or from the deep back row are examples of such usage. Typical

sets of normal height and distance will be initiated as the ball is between one and three inches from the initial hand position. Unusually low-height or short-distance sets are initiated when the ball is nearer, approximately one inch from the hands. First- and second-tempo and middle attacks are examples where the setting action is initiated as the ball arrives to within one inch of the hands.

Many advanced and proficient setters need little power from the weight transfer to deliver typical and low-tempo sets. Less accomplished setters and learners of the skill gain needed power in the direction of the set from the transfer of the body weight. This is accomplished by moving the center of mass from a central position over the base of support to a position toward the front foot. The center of mass moves in a line parallel to the intended trajectory of the set.

Some setters effect a weight shift by initiating the setting action with a step toward the target of the set. To accomplish this task, the player must first arrive at a position behind the point of intersect, align the body to the attack zone, and then initiate the step. This is time-consuming and limits the setter's range of movement.

The forward step moves the center of mass horizontally, rather than in a direction parallel to the intended trajectory of the set. An additional flaw that is created by this method is that the end of the step transfers

momentum from the lower body to the upper torso and causes the torso to pike slightly at the waist. The piking action changes the angle of arm extension relative to horizontal and lowers the trajectory of the set.

A more practiced method of effecting a weight shift is accomplished through the extension of both legs. A common flaw among learners is to extend both legs equally. The center of mass is elevated vertically, providing upward impetus to the ball. In order to direct the center of mass forward and parallel to the intended trajectory of the ball, the setter must first lean the body to the extent that the center of mass is in line with the base of support and the apex of the intended set. This is a posture of poor stability, and the set selection is limited to the attack zone in the direction of body lean.

The preferred method of effecting a weight shift does not extend the legs vertically, nor does it require the player to take an additional step. From a central position over the base of support, the center of mass is directed upward and forward toward the apex of the set by shifting the weight from the rearward-placed foot to the forward foot. The leg extensors act in harmony, providing force and direction to the shift of the center of mass.

The extension of the rearward leg directs the center of mass forward and upward. The acceleration and length of the extension determine the power generated by the weight shift.

Force can be generated through a long, extended movement which controls the body momentum throughout weight shift. The slow, extended weight shift affords the player greater control of the shift during movement. However, it is initiated while the ball is still distant from the hand contact and is, thus, limiting to the range of the setter.

An equal force can be generated by a short, powerful movement, creating over a short distance a high acceleration of the weight transfer. The movement is initiated just prior to the arm- and hand-setting action, as the ball nears the contact zone. Because duration of the movement is short and compact, the player initiates the weight shift later in the flight of the pass and, thus, has more time to pursue errant passes. In addition to increasing the range of the setter, the short weight transfer allows the setter to execute set selection at the last possible moment, an important asset as the setter advances to advanced attack schemes.

The short, compact movement is the preferred weight transfer. The rearward leg extension thrusts the center of mass upward and forward toward the forward leg. The contraction of the forward leg extensors controls the resultant direction of the weight transfer, aligning the shift parallel to the intended trajectory of the set. The forward leg also maintains balance by keeping the center of

mass within the base of support at the end of the setting action.

The rearward (generally the left) leg provides force laterally outside of the center of mass. This force is not counteracted by the forward leg. The result, in addition to the upward and forward weight shift, is a rotation of the hip (left) and shoulder (left) forward, toward the target area of the set. The torque of rotation is transferred through the torso to the arms and hands and provides additional impetus for the set. The arm- and hand-setting action begins as the rotation of the hips and shoulder ends.

The rotation of the hips and torso terminates, with the hips and shoulders perpendicular to and facing the attack area to which the ball is directed. The rotation allows the setter to open the hips toward the pass and rotate back to face and deliver the ball to the target area. The extent of hip rotation is generally no more than 45 degrees.

The sequence is leg extension and hip rotation; then, as hip rotation ends, the arms and hands extend through the ball. Care must be taken not to initiate the rotation and arm extension of the setting action concurrently. To do so provides lateral velocity to the ball, and the set drifts toward or over the net. In addition, it is a ball-handling violation to redirect the ball while it is in contact with the hands.

As greater force is provided by the weight transfer, less force and acceleration are required of the arm extension and finger action. The duration of contact between the fingers and the ball is increased. The large muscle groups of the arms and forearms, those controlling gross motor movements, are less dominant. The small muscle groups of the forearms and hands, those controlling fine motor movement, are more able to exert control over the ball and its resulting flight.

The overhead set is controlled by absorbing and redirecting the momentum of the ball through an extended contact of the fingers and thumbs, rather than through a rebound action as occurs with the forearm pass. The action of absorption occurs in the wrists and fingers. It is a function of the momentum of the ball, the force of the hands applied to the ball, and the tension of the muscles shaping the fingers. Absorption is seldom a conscious act, but rather a result of these forces acting on contact with the ball.

Some setting techniques involve a conscious movement of the hands in the direction of the ball, then a reversal in the direction of the intended set. This action is accomplished by decreasing the angle of bend at the elbow as the ball arrives. Decreasing the elbow angle as the ball is contacted moves the hands and ball toward the body. The momentum of the ball is slowed by the movement of the arms

and reaches zero velocity as the hands reverse the direction of the ball and send it toward the attacker.

The forward setting action starts with the ball at zero velocity. The ball has no momentum; and thus, no spring-like action is required of the fingers. The fingers merely relax and conform to the shape of the ball. The strength of the hands is used in providing control, rather than power, to the set.

Due to the excessive portion of hand contact with the ball spent in the absorption phase, the length of contact during the extension phase is reduced. Weight transfer occurs during the reduced extension phase. The length of contact through which arm extension forces are applied to the ball is likewise limited. These factors limit the power with which the set is delivered. Prolonging the length of contact in the extension phase provides additional power, but causes the total length of contact to be excessive and in violation of legal ball-handling parameters.

Similar techniques absorb ball momentum by consciously increasing wrist flexion as the ball is contacted, thus rotating the finger- and thumb-contact surfaces toward the body and bringing the ball to zero velocity. The absorption phase of this movement pattern is much shorter than that which decreases the angle of bend at the elbow. This allows the extension phase to be of full duration. However, placement of the contact surfaces of the fingers and thumbs

Upper and lower body movements are made only in the direction of the intended set. The setting action is initiated by the weight transfer. At the end of the weight transfer, extension of the arms at the shoulders and elbows occurs. The hands remain formed in the shape of the ball. Wrist flexion occurs at the end of arm extension.

The hands are moving in the direction of the set trajectory as the ball is contacted. Forces of the weight transfer, arm extension, and the momentum of the ball in flight act on the contact surfaces, causing hyperextension of the fingers and thumbs and slight extension at the wrists. Extension at the wrists and hyperextension of the fingers during the extension phase of the setting action absorb the momentum of the ball. The spring-like action of the fingers absorbs and reverses the ball's inertia.

The tension with which the hands are formed provides the spring-like action of the fingers. The momentum of the ball hyperextends the fingers, causing an eccentric contraction of the respective muscles. As the momentum is absorbed and the ball slows, the eccentric contraction of the muscle automatically becomes concentric, and the fingers return to their previous posture. The eccentric to concentric contraction constitutes the spring-like action of the fingers and provides impetus to the ball.

The length of contact between the contact surfaces of the fingers and thumbs and the ball is determined by the

on the ball is altered during the wrist flexion and wrist extension phases of the setting action. Control of the ball is reduced during forceful extension due to the alteration of contact between the fingers and thumbs and the surface of the ball.

These techniques of absorption, sometimes known as deep dishing, are used extensively in outdoor two- and three-person volleyball where modification of rule interpretations allows and requires more extensive ball contact. The disadvantages of these techniques are minimized in two- and three-person volleyball since delivery of the set with quickness and power is seldom required. Since speed of release and power of delivery are necessities in the indoor six-person game, these techniques are utilized less in the six-person game than in the two- and three-person formats.

While accomplished players may execute these techniques effectively, coordination of the weight transfer with the absorption and extension phases of the setting action makes these patterns exceptionally complex. In learning environments, such as instructional and non-elite-level competitive settings, these techniques present difficult patterns for the learner to master. A more efficient and readily learned movement pattern is created by effecting absorption of the pass during the extension phase of the setting action, eliminating the conscious absorption phase of the movement.

tension of the muscles forming the hand position. Fingers which are spread and relaxed hyperextend easily and offer minimal resistance to the passed ball. Balls passed through a low trajectory present minimal momentum for the finger action to resist. The result of the setting action is a soft, controlled touch on the ball.

With high trajectory passes, the momentum of the ball may be greater than the resistance provided by totally relaxed fingers. The result is that the ball causes excessive contact with the hands or it passes altogether through the fingers. Both are ineffective and likely to be ruled ball-handling violations. To overcome the momentum of high trajectory passes, the fingers are spread and slightly tensed. The tension with which the fingers are spread is proportional to the momentum of the ball to the set.

Excessive tension provides greater resistance than the force of the ball's momentum. The ball rebounds from the fingers, rather than causing the fingers to hyperextend and absorb ball momentum. The length of contact between the finger and thumb surfaces and the ball during the rebounding action is minimal. Control provided by the rebound action of the fingers is less than that of the fingers' spring-like action.

During the setting action, the angle of the hands relative to each other and to the ball does not change. The planes of the two hand palms do not rotate, but remain at

approximately 45 degrees from parallel. The shape of the fingers and the surface area contacted should remain constant throughout the setting action. In order that the hand position in contact with the ball remains constant, the angle of bend at the wrist is coordinated to concur with the extension of the arms. Wrist extension during arm extension allows the angle of the hands relative to the forearms to change without changing the position of the hands in contact with the ball.

Flexion at the wrist is minimal during contact with the ball. Flexion at the wrist alters the contact position of the fingers and thumbs in contact with the ball. Flexion at the wrist occurs only in follow-through, at the end of arm extension, and after the ball has departed.

Contact with the Ball

Control of the ball is a function not only of the duration of contact, but also of the surface area contacted. The greater the surface area of the ball contacted by the player, the greater will be the control exerted on the ball by the player. The portion of the ball's surface through which force is applied also affects the resultant flight trajectory.

Contact between the ball and the fingers and thumbs occurs on the sides and rearward portion of the ball. The contact surface is centered longitudinally in line with the extension of the trajectory through the center of the ball.

Contact must be distributed equally along the surface area so that the sphere is directed in line with the force of the setting action.

The middle fingers are longitudinally perpendicular to the intended trajectory of the set. The spring-like action of the fingers then absorbs and reverses the momentum of the pass directly in line with the desired apex of the set. Fingers inclined more toward the vertical lower the trajectory of the set. Fingers inclined more toward the horizontal project the ball directly upward. Such finger action is not perpendicular to the intended ball flight and may cause the ball to rotate around an axis, the point of which is the contact of the fingers.

The fingers are spread comfortably to cover the greatest surface area possible. Spreading the fingers maximally tenses the fingers excessively and limits absorption of the ball. Spreading the fingers too little reduces the surface area of the ball contacted and decreases control.

In order to cover the greatest surface area of the ball, the preferred contact surface is to the rearward sides of the ball. The hands and fingers are formed in the shape of the ball. The four fingers and thumb of each hand form an arc identical to the curvature of the ball.

The palms are angled approximately 45 degrees from parallel. The thumbs are oriented slightly toward the nose

or eyebrow area of the face, approximately 30 degrees from being in line. The orientation of the thumbs may be directly in line with each other without adverse effect, but the thumbs should be oriented no farther forward than directly in line.

Pointing the thumbs slightly forward, up to 30 degrees from in line, creates a smaller contact surface and affords the player diminished control. The fingers are aligned rearward, rather than to the sides of the ball. The ring and little fingers provide minimal contact, lessening lateral control. Primary contact with the ball is on the thumbs and index fingers, with secondary contact on the middle fingers.

Many learners at both the instructional and competitive levels tend to point the thumbs severely forward, 45 degrees from in line or more prior to the setting action. Contact with the ball and thumbs in this position, in addition to being painful, is extremely detrimental to ball control. In order to avoid ball contact with the thumbs, the ball is contacted higher on the index and middle fingers. Contact occurs only on the pads of the fingers down to the first knuckle, providing a small contact surface and reduced control.

The preferred hand contour places the thumbs slightly rearward of being directly in line. The fingers are nearly vertical, angled no more than 15 to 30 degrees from

vertical. The fingers are curved in the shape of the ball. This allows contact with the ball to occur down to the second knuckle of the fingers and the first knuckle of the thumbs.

Primary contact is made with the index and middle fingers; secondary contact is made with the thumbs and ring fingers. The little fingers contact the ball minimally. The ring and little fingers, in spite of providing only secondary contact, serve a vital function in directing the set. They are aligned and make contact on the sides of the ball. If the hand contact is applied unevenly, the ring and little fingers resist the lateral resultant, and the ball is channelled in the direction of the setting action.

Follow-Through

The hands retain the shape of the ball throughout the setting action. Any rotation of the hands while the fingers are in contact with the ball causes the finger and ball surfaces to break contact. Application of the forces of the setting action are lessened and directed unevenly. Follow-through occurs only near the end of arm extension, after the ball has left contact with the fingers.

Key Teaching Points

Penetration to the Target Area

1. The setter runs to the net at the target area of the pass.

2. The setter arrives at the target area prior to the passer's contact with the ball.

3. During the last two steps, the body is aligned to the setter's initial posture.

Initial Posture

1. The setter is near the net (within 18 inches).

2. The feet, hips, and shoulders are at a 45-degree angle away from perpendicular to the net, facing the left front attack area (zone 1, two to five feet from the net).

3. The feet are in stride position, right foot 6 to 12 inches forward of the left.

4. The arms are flexed at the elbows at an angle similar to the elbow angle from which the overhead set is initiated (approximately 90 degrees).

5. The hands are separated no more than the width of the ball.

6. The fingers are spread comfortably and curved in the shape of the ball.

7. The thumbs are pointed slightly back toward the body (15 to 30 degrees from being in line).

8. Attention is focused on the passer's body posture and passing platform.

Movement to the Ball

Moving to balls not more than two to five feet away (two slide steps), the setter uses the slide-step footwork pattern.

Moving to balls 5 to 10 feet away (more than two slide steps, but not more than two crossover steps), the player uses the crossover-step footwork pattern.

During both movement patterns, the hips and shoulders remain facing the left front (zone 1) attack area.

Moving to balls more than 10 to 12 feet away (more than two crossover steps), the player turns and runs toward the ball:

1. The hips and shoulders turn toward the direction of the run.

2. During the next-to-last and last step, the body prepares to execute the set.

3. During the last step, the body rotates so that the hips and shoulders are perpendicular to the zone 1 attack area or opposite the zone 9 area.

During movement to the ball the following are emphasized:

1. The arms remain flexed at the elbows at an angle similar to the elbow angle from which the overhead set is initiated (approximately 90 degrees) and swing counter to legs.

2. The hands remain separated no more than the width of the ball.

3. The fingers remain spread comfortably and curved in the shape of the ball.

As the point of intersect with the ball is neared, the player's body is postured to execute the set:

1. The feet are spread slightly wider than in the initial posture; the lower the ball, the wider the feet are spread.

2. The legs are bent at the knees, placing the forehead and hands at the height of the ball intersect.

3. The trunk remains in an upright posture.

4. The hips and shoulders face zone 1 attack area or rotate to face directly opposite the zone 9 attack area.

5. The arms are elevated from the shoulders so that the hands are directly in front of and above the forehead.

6. The hands remain separated no more than the width of the ball.

7. The fingers remain spread comfortably and curved in the shape of the ball.

8. The thumbs remain pointed slightly back toward the face (15 to 30 degrees from being in line).

Preparation to Set

Preparation to set occurs during movement to the pass, not upon arrival.

The Setting Action

As the ball nears the hands (one to three inches, depending on the force to be applied to the ball), the setting action is initiated:

1. Power is generated from a short, forceful extension of the leg behind the center of mass away from the target area and arm extension.

2. Sequential to leg extension, the arms extend the hands through the ball in the intended trajectory of the set.

3. The angle of bend at the elbows never decreases during the setting action; the arms only extend.

4. Both power and direction are provided by the arm extension.

5. The hands remain separated no more than the width of the ball.

6. The planes of the palms of the hands do not rotate, but remain at approximately 45 degrees from parallel.

7. Follow-through (ulnar flexion) occurs at the end of the delivery.

Contact with the Ball

1. Primary contact occurs on the sides slightly to the rear of the ball.

2. Primary contact with the ball is made with the index and middle fingers.

3. Contact with the ball occurs to a slightly lesser degree on the thumbs and ring fingers, as well, and occasionally with the little fingers.

4. The ball contacts the length of the fingers down to the second knuckle and the pad of the thumbs (to the first knuckle).

Follow-Through

1. The hands continue to be formed in the shape of the ball throughout the setting action.

2. Follow-through occurs as the arms near full extension after the ball has left the hands.

PART 4
SPIKING

SPIKING

Description of the Skill

The spike is the central action in the game of volleyball. Skills, such as passing and setting (in support of the spike) and blocking and individual defense (defending against the spike), are developed in relationship to the spike. Offensive strategies of volleyball are designed to create advantages and provide the greatest opportunity of success to the spiker. Defensive strategies, including service, are designed to restrict the options available to spikers, increasing defensive capabilities.

The purpose of the spike is to attack the ball with power into a poorly defended area of the opponent's court, making control of reception difficult. The approach, jump, and arm-swing are integral to the spiking action. They increase the power of the jump and attack, while providing equilibrium to the airborne player.

Advanced schemes direct the attackers to many points along and away from the net, increasing the area defended by the blockers. Advanced schemes also increase the tempo of the attack, providing the defenders limited time to react and adjust. In these schemes the attacker is committed to a location and tempo before the ball is received by the setter and, thus, is dependent on the accuracy of the pass and set for success.

Basic volleyball schemes afford the spiker the greatest flexibility in executing the attack. The high outside set allows the spiker the option of seeing the location of the set prior to the approach. Thus, during the approach, the spiker is able to align the ball relative to the hitting shoulder for a wide range of set locations, making the spiker less dependent on the accuracy of the pass and set.

The outside location of the set affords the spiker maximum distance in both the cross-court and down-the-line directions. The distance of two to four feet away from the net allows the spiker room to swing and follow through without touching the net. It also decreases blocker coverage of the attack angles. The basic scheme creates no attack deception, but allows the spiker optimum opportunity to develop and utilize spiking ability.

The Approach

The approach is fundamental to effective spiking. It is the means through which the spiker moves from a position away from the net to the set location. In both the educational and competitive arenas, the approach consists of a predetermined sequence of steps. Depending on the location of the set, the length of the steps will vary, but seldom does the spiker deviate from the sequence. Some attack variations in advanced schemes require modifications of the basic step pattern, but these too are of a predetermined design and applicable only to that specific

variation. The approach develops speed and horizontal momentum as the spiker nears the ball. The end of the approach is a transition to the jumping action, posturing the body to jump, controlling the weight shift, and transferring momentum as the jumping action occurs. More momentum transferred into the jump results in less resistance to the jumping action and more height attained through the jump. The approach also aligns the body for the spiking action prior to the jump. Thus, none of the energy of the jump nor of the spiking action is spent realigning the body. The result is a more efficient jump and attack. The approach begins with the rear foot 12 to 17 feet from the net (depending on the length of stride and the intended height of the set).

1. The knees are slightly bent (15 to 30 degrees).
2. The weight distribution is slightly forward.
3. The arms hang loosely from the shoulders.
4. The arms are bent comfortably at the elbows.
5. The hitting hand is open and formed to spike, but relaxed, not tensed.
6. Four-step approaches generally begin with the feet in a nearly side-by-side position.
7. The first step is a rhythm step initiated with the foot of the hitting hand (right foot for a right-hander, left foot for a left-hander).

8. The first step is taken so that the lead foot has returned to the floor, leaving the feet in stride position as the setter contacts the ball.

9. The arms continue to hang loosely from the shoulders, swinging slightly to counterbalance the movement of the hips.

10. Three-step approaches generally begin from this stride position with the foot of the hitting hand forward.

11. The next step for both approaches is a speed step, building speed and power in the approach.

12. This step is taken with the foot of the non-hitting hand (left for a right-hander, right for a left-hander).

13. This step is initiated as or after the setter releases the ball (depending on the quickness of the hitter and the intended height of the set).

14. The arms continue to hang loosely from the shoulders, swinging slightly to counterbalance the movement of the hips.

15. This step leads to the final two steps in the approach (the next-to-last and last steps) which constitute the step-close maneuver, posturing the body to jump and spike.

16. The transfer from the speed step to the step-close is made with the feet close to the floor.

17. Just prior to the grounding of the next-to-last step, the arms are pulled backward and upward from the shoulders, extending at the elbows.

18. The body is lowered to a knee angle of 120 to 150 degrees.

19. The next-to-last step is taken with the foot of the hitting hand (right foot for a right-hander, left foot for a left-hander).

20. Contact with the floor is made initially by the heel of the next-to-last foot.

21. Plantar flexion and the momentum of the body rotate the foot into full contact with the floor.

22. The last step follows rapidly, with the last foot contacting the floor forward of the next-to-last foot, rotating the hip and shoulder of the non-hitting side toward the net (30 to 60 degrees from parallel).

23. Contact with the floor is made initially by the balls of the foot, the heel remaining above the floor.

24. The last foot is planted at an angle of approximately 45 degrees toward the path of the approach.

25. The rhythm for the four-step approach is as follows:

- (a) right, left, pull arms, right-left
(right-hander) and
- (b) left, right, pull arms, left-right
(left-hander).

26. The rhythm for the three-step approach is as follows:

- (a) left, pull arms, right-left (right-hander)
and
- (b) right, pull arms, left-right (left-hander).

The Jump

The jump utilizes the weight shift and transfer of momentum from the approach to initiate the jumping action. The jumping action then gathers the forces of the body to propel the spiker up toward the ball. The whole body is involved in the jumping action. Elevation of the arms, extension of the torso and legs, and plantar flexion at the ankle occur in sequence to provide the force to accelerate the body upward. Failure to utilize the whole body in the jump reduces the force generated and the height attained.

The jump also functions to posture the body in the air for the spiking action. Failure to utilize all of the body segments (for example, elevating only one arm during the jump) affects not only the jump height, but also the player's alignment and equilibrium while airborne. The attack is less powerful and efficient as body segmental forces are diminished and energy is used in realignment.

1. The step-close initiates the jumping action.
2. The body is lowered farther to a knee angle of 90 to 110 degrees immediately preceding the jumping action.

As the last foot of the step-close touches down:

1. The arms swing forward and upward from the shoulders.
2. Extension of the trunk and of the legs, along with plantar flexion at the ankles, drives the body near vertically upward (15 to 30 degrees).
3. The arms flex at the elbows (60 to 90 degrees) as they thrust upward.
4. The arms continue upward to at least shoulder height.
5. As the hitting arm rises above the level of the head, the elbow is pulled backward and slightly outward away from the body.
6. The hitting arm is bent at the elbow approximately 90 degrees.
7. The hitting hand remains forward of the elbow.
8. The hitting hand remains relaxed, open and formed in the shape of the ball.
9. The back is slightly arched.

The Arm-Swing

The arm-swing gathers body forces sequentially and accelerates the striking hand into contact with the ball. The momentum of the hand and arm is transferred to the ball and, along with hardness of the striking hand, provides resultant ball velocity away from contact. Greater hand speed results in greater ball velocity, thus, a more powerful spike.

Direction of the spike is a product of the force vectors of the arm-swing and wrist snap. The location of the ball relative to the axis of the arm-swing, the shoulder, affects the direction of these vectors at the point of contact. The surface area of the ball contacted and the shape of the striking hand determine the angle of rebound of the ball from the striking hand.

1. The non-hitting arm pulls downward in front of and along the trunk to about waist level, elevating the hitting shoulder.

2. The trunk moves from a slightly arched position to an erect or slightly piked (0 to 15 degrees) position.

3. The shoulder rotates the hitting arm upward and forward toward the ball.

4. The arm remains bent at the elbow (approximately 90 degrees) during the initial shoulder rotation.

5. The shoulder rotates the elbow forward of the hitting hand.

6. Near the end of shoulder rotation, as the elbow is at its highest forward position, arm extension at the elbow occurs.

7. The hand accelerates toward the ball.

8. Near contact with the ball, the wrist snaps (flexes) the hand over and through the ball.

9. The wrist snap generally occurs in the same direction as the arm-swing.

10. The hand remains relaxed, open and shaped in the form of the ball at contact.

11. The sequence of rotations is as follows: non-hitting arm and trunk, hitting shoulder, hitting elbow, and wrist snap.

Contact with the Ball

Contact between the striking hand and the ball transfers energy from the arm-swing to the ball. A soft striking surface, such as the upper palm or fingers, absorbs more of the energy of the arm-swing than a harder surface, such as the lower palm and heel area of the hand. A larger portion of the striking hand, such as the palm area, in contact with the surface of the ball results in more control of the direction of the spike than does a smaller portion, such as the heel of the hand or a fist.

1. The hitting elbow is straight as contact with the ball is made.

2. Initial contact with the ball is made with the lower palm area.

3. Immediately thereafter, the palm and fingers wrap over the ball in the intended direction of the spike.

Follow-Through

Follow-through is a natural result of a high-velocity arm-swing. Care must be taken on sets within 18 inches of the net that the player's hand or body does not contact the net. The force of landing should be absorbed by the whole

lower body and should leave the player balanced and capable of continuing play.

1. The wrist snap continues to full flexion.
2. The arm bends at the elbow, pulling the hand back toward the trunk.
3. Continued shoulder rotation lowers the hitting arm.
4. The momentum of the landing is absorbed by the extensors of the knee and ankle joints (eccentric contraction) during flexion of both legs.

Analysis of the Skill

Spiking the ball is the central action around which the game of volleyball exists. Although perhaps not the most important skill in the game, the spike is the end product at which the other offensive skills and strategies are directed. The objective of the pass and set is to place the ball in a position to be attacked with sufficient force to render the defense's reception ineffective. Defensive skills and strategies are developed for the purpose of impeding the effectiveness of the spike.

Height above the net and power of the spike are critical factors in the success of the attack. Contact height above the level of the net allows the attack to be driven across the net at a downward angle toward the opponent's court. The downward angle allows forceful spikes to be directed toward the court space, rather than out of bounds. The greater the height at which the ball is

contacted, the greater is the downward angle provided and the greater the attack force that is accommodated.

The components of the spiking action--the approach, the jump, and arm-swing--are developed to accommodate contact of the spike at a maximum height. The speed of the approach is transferred upward into the jumping action. The jump thrusts the spiker upward vertically. The arm-swing is effected at the highest possible reach. The approach, jump, and arm-swing are timed relative to the set so that the ball is contacted at the apex of the jump and the highest reach of the striking arm.

The basic approach, jump, and arm-swing are developed to attack the basic height set. The basic set in all volleyball is a relatively high (7 to 10 feet above the net) set to either outside attack zone. The spiker identifies the trajectory and location of the set prior to determining the approach speed and path. This affords the spiker ample opportunity for adjustment to an imprecise set. The basic approach is modified to effect attacks of faster tempo and alternate locations.

Advanced systems of volleyball set the ball through various trajectories to the attack zones. The result is variations of speed, or tempo, with which attack is executed. Varying the tempo of attack options allows spikers to work in combination to gain an advantage over the blockers and back-row defenders. High-trajectory sets

result in slow-tempo attacks; low-trajectory sets result in fast-tempo attacks.

Fast-tempo sets require the spiker to begin the approach to the intended location prior to the set. The set is defined through a fixed trajectory so that the ball and spiker arrive at the same location at the same time. The spiker has little opportunity for adjustment to an imprecise set. Blockers also have little time to adjust to the set tempo and location.

At the instructional and non-elite-level of competition, the slow-tempo set is the building block on which spiking skill is developed. Exact precision is not required of the pass or set. The spiker sees the set prior to determining approach speed and destination. The length and speed of the approach can be adjusted so that the jump and arm-swing are not altered. The timing of the approach is then adjusted to accommodate faster tempo sets.

The approach, jump, and arm-swing are coordinated toward positioning the spiker at the set location, elevating the player, powering the attack, and directing the spike. Each action exists not as a separate entity, but interrelated with the previous and succeeding actions. The efficiency of each component contributes or is detrimental to the effectiveness of the following component and the total spiking action.

The speed of the approach builds momentum which is transferred to the jump. The approach also postures the body for the jump and attack. The jumping action elevates the spiker into the air and postures the player for the attack. The arm-swing imparts force and direction to the ball during the attack. The spiking technique provides maximum energy for each component and efficient transitions linking the components. The result is not three separate actions, but rather one smooth, continuous action imparting energy to the attack.

The Approach

The approach is the means for a player to move from an initial position on the court to the location of the set. The initial position varies relative to the reception pattern, attack location, sophistication of the offensive options, and the tempo of the attack. Basic approach patterns begin with each attacker a prescribed distance from the net and at a fixed angle from the intended set location.

From the initial position, the player moves to the location of the attack through a uniform footwork pattern. Not all sets end up precisely at the intended location. The attacker adjusts the approach pattern to arrive at errant set locations by varying the length, not the sequence, of the steps. The sequence of steps for the utilized approach pattern does not vary.

Occurring at the end of the approach pattern is the transition phase of the approach, the last two steps taken prior to jumping. Often the last two steps are sequential, the next-to-last step and then the last step. Sometimes the last two steps consist of a hop, both feet contacting the floor simultaneously. The footwork of the transition phase transfers horizontal momentum of the approach into vertical force in the jumping action.

In addition to transfer of energy, the transition phase also postures the body for the jumping action. Following the step leading to the transition phase, and prior to the planting of the next-to-last step, the upper body is postured for the jumping action. Both arms are brought equally rearward and upward, and the torso is lowered comfortably. The legs are bent at the hip, knee and ankle to the angle optimum for the individual hitter's vertical jump. The center of mass is shifted to a position centered above the base of support.

In addition to posturing the player for the jumping action, the transition phase of the approach aligns the player for the spiking action. Prior to the jumping action, the transition of the next-to-last and last steps brings the body into alignment for the spiking action. The shoulder and hip of the non-hitting hand (left for a right-hander, right for a left-hander) are rotated toward the net, 30 to 45 degrees from parallel with the net. As the body

elevates, the player is postured to effect the spiking action with minimal realignment.

The basic approach is the primary pattern learned and utilized in offensive systems of instructional and non-elite-level competitive settings. Advanced offensive systems, those used in elite-level competition, modify basic patterns to meet the specific demands of location and tempo defined by each system. Players at advanced levels are required to be able to execute many different approach patterns to accomplish the variations of attack provided by the offensive system. Various basic approach patterns seen in volleyball are defined by the number and sequence of steps taken and by the method of transition into the jumping action.

Two common methods of transition are the step-hop and the step-close. The step-close moves to the transition by first planting the lead foot and then closing with the trail foot, the foot previously on the floor. The step-hop is characterized by a hop onto both feet during the transition phase.

During the last step prior to transition, the step-hop player moves the lead foot forward. The trail foot, the foot on the floor, moves rapidly to catch up with the lead foot. Both feet plant simultaneously, with the feet separated the width of the hips. Initial contact with the floor is generally on the heels of both feet. The momentum

of the approach shifts the center of mass forward and over the feet; the foot plant rotates from the heels to the toes, initiating the jumping action.

The step-hop was a commonly taught and utilized approach pattern when the high-outside set was the basis for many offensive strategies, prior to the 1977 rule changes. It was commonly accepted that the heel-to-toe action transferred the horizontal speed of the approach into vertical energy of the jump. There is no conclusive research to support or refute this assertion. If there is greater or less transfer with the step-hop than with other approaches, the difference is slight.

The step-hop pattern has many disadvantages for the learner, both in instructional and competitive settings. The weight transfer and the heel-to-toe action limit body control during the jumping action to the forward, and to a lesser degree, the rearward direction. Effecting change in the lateral direction during the jump is restricted by the foot placement.

The hop must be high enough or short enough so that the trail foot can catch up and plant alongside the lead foot. An excessively high hop creates downward momentum that the leg extensors must overcome during the jumping action. The resistance to the jump is increased beyond mere body weight.

An excessively short hop requires the spiker to start closer to the set location, restricting both the attack

range and the range from which the player can cover the court and still arrive in position to attack. In addition, a short hop either slows the speed of the approach or, in not slowing the approach speed, allows the center of mass to shift excessively in front of the feet during the jumping action. Placement of the center of mass forward of the feet results in a forward jump toward the net. Slowing the speed of the approach negates the transfer of energy and slows the attack.

The preferred and more common approach pattern is the step-close. The step-close moves to the transition phase by planting the lead foot on the next-to-last step. The lead foot contacts the floor at the heel area, facilitating the heel-to-toe rocking action and a smooth transfer of momentum as the center of mass passes over the foot. The trail foot follows the lead foot. There is a distinctive one-two sequence in the placement of the feet.

The trail foot contacts the floor later than the lead foot and is placed closer to the net. The feet are separated slightly more than the width of the hips. The forward placement of the trail foot rotates the feet, the hips, and shoulders toward the net, 30 to 45 degrees from parallel. In addition, forward placement puts the leg extensors of the trail foot in a position to resist the forward shift of the center of mass and effect a more vertical jump.

The trail foot is not placed parallel to the lead foot but, rather, is turned inward toward the lead foot. Initial contact of the trail foot with the floor is generally on the ball of the foot area; the heel of the foot does not contact the floor. The eccentric contraction of the leg extensors, especially the calf muscles, absorbs and controls the forward shift and position of the center of mass, while loading the muscles for the jumping action.

Forces exerted on the center of mass during the jumping action determine the direction of the jump. The inward turn of the trail foot places the large leg extensor muscles in line with the center of mass in the lateral direction. The leg extensors, rather than the smaller abductors and adductors, affect lateral control and direction of the jumping action.

Fast-tempo offensive systems are increasingly employed at all levels of volleyball play. Approach patterns often begin from the location of the ball reception, rather than from the ideal position. Approach patterns are directed to system-defined locations, rather than toward visually identified locations of the set. The ability to make last instant adjustments to the actual location of the set is required of both the player and the techniques employed by the player.

At the instructional level, lack of precise ball control in passing and setting likewise requires of the

player the ability to adjust to the actual set location. The step-close transition affords the player greater flexibility than the step-hop. At the instructional and competitive levels, and for players progressing to the advanced level, the step-close is the preferred method.

The next-to-last and last steps taken in transition to the jumping action identify two common approach patterns. The most common approach pattern is the standard approach. The less common approach is termed the goofy-footed approach.

The goofy-footed approach is characterized by initiating the transition next-to-last and last steps from the foot of the hitting hand (right foot for a right-hander, left foot for a left-hander). The transition footwork is then next-to-last step with the foot of the non-hitting hand, last step with the foot of the hitting hand. The goofy-footed approach often utilizes the step-hop pattern.

The disadvantage of the goofy-footed approach is that the foot of the hitting-hand side of the body initiates the transition phase, the right foot for a right-hander. The next-to-last step is made with the non-hitting-hand foot (the left), followed by the foot of the hitting hand (the right). The step-close arrangement then turns the hitting shoulder and hip (the right side of the body) toward the net.

This is akin to stepping with the right foot while throwing with the right hand. The torso is turned away from the direction of many arm-swings. Those arm-swings are effected away from the body and away from the contraction of the powerful pectoralis major muscles of the chest through extension and inward rotation of the hitting arm. Balls directed across the body, those hit down-the-line from the on-hand side and cross-court from the off-hand side, involve flexion of the arm at the hitting shoulder and include the pectoralis major muscles. The goofy-footed approach narrows the range of directions through which the ball can be attacked with power.

In order to overcome this shortcoming, the goofy-footed hitter often adjusts the approach in order to align the hitting shoulder away from the net. One method is to rotate the body and realign the shoulders in the air. Another method of realigning the shoulders is to adjust the length of the hop so that the landing places the foot of the hitting-hand side (right), the trail foot, on the foot rearward of the lead foot (left).

To effect the jumping action and posture the body for the arm-swing is a complex task and an inefficient technique. The arms and torso, which ideally thrust upward providing lift to the jumping action, rotate horizontally to align the upper body. Force is directed away from the direction of the jump.

Jumping and then rotating in the air to alignment moves the shoulder away from the point of attack. The movement must then be reversed and directed back toward the ball. The complexity and timing of these movements make the task increasingly complex and difficult to master.

Modifying the hop to posture the body for the spiking action is equally inefficient. As the trail foot leaves the floor, the lead foot is well in front and nearer to planting. The hop must be modified to bring the trail foot forward and quickly to the floor.

Shortening the hop allows the trail foot to plant quickly, but it reduces the drive of the trail leg, decreasing the speed and momentum of the approach. Increasing the height of the hop gives the trail leg more time to plant, but places a larger load on the muscles controlling the landing, the same muscles effecting the jump. Each of these modifications helps posture the body for the arm-swing, but each makes the spiking action more complex and less efficient.

In the standard approach, the next-to-last step is taken with the foot of the hitting hand, the right foot for a right-hander. This is followed by the last step which is taken with the foot of the non-hitting hand, the left. The non-hitting hip and shoulder, the left for a right-hander, is rotated toward the net.

The approach transition aligns the body for the spiking action. No adjustments are needed during the approach or the jumping action. The player is postured to effect the spiking action as the approach ends, and elevation into the air occurs. The movements are fluid; the spiking action is efficient.

Approach patterns are primarily characterized by the transition phase, whether goofy-footed or standard, step-hop or step-close. Approach patterns may also be characterized by the number of steps taken prior to the jump. Both the step-and-plant and the hop-onto-both-feet count as two steps. The most common are the three- and four-step approaches, although two- and five-step approaches are utilized in specialized situations.

There is very little difference in the three- and four-step patterns so long as both end in the same transition to the jumping action. The two-step is a modification of the three- and four-step pattern and is used primarily on first-tempo attacks. The five-step is a modification of the three- and four-step pattern and is used by attackers whose receive position is distant from the intended location of the set.

The three-step approach takes one step prior to the next-to-last and last step transition of the step-close or step-hop. The foot making the initial step is placed rearward of the other. This posture allows the first step

to be powerful, providing speed and distance. Depending on the quickness of the hitter and the height of the set, the first step is initiated as or after the ball is released by the setter. The first step is an acceleration step, providing speed and direction to the approach.

The rhythm of the three-step is non-hitting-hand foot, pull both arms back, hitting-hand foot, and non-hitting-hand foot. For a right-hander, the rhythm is left, pull, right, and left. For a left-hander, the rhythm is right, pull, left, and right.

Because only three steps are involved, the three-step approach begins close to the net, within 9 to 13 feet. The attacker's ability to adjust to sets located distant from the net is limited. The attacker's ability to pass from the deep court and attack sets located near the net often requires modification of the approach pattern.

The three-step pattern is a very quick approach. Due to the quickness of the approach, the hitter generally has the opportunity to identify the location of the basic set prior to initiating the approach. Therefore, few adjustments are required of the approach pattern or the player.

The three-step approach is a simple and efficient pattern to learn and to execute. Understanding of the three-step pattern constitutes a basis for the learning of the more complex four- and five-step patterns. Four- and

five-step patterns extend the range of the player by providing additional steps leading to the final three steps of the approach.

The four-step approach begins farther from the net, 10 to 15 feet. The feet are placed nearly side-by-side. The player takes a short, controlled rhythm step with the foot of the hitting-hand prior to the ball being set. The rhythm step is followed by the three-step pattern. The rhythm step is taken toward the intended location of the set. The rhythm step allows the hitter to accelerate to the ball from a dynamic, rather than static, posture.

The rhythm of the four-step approach is hitting-hand foot, then non-hitting-hand foot, pull both arms back, hitting-hand foot, and non-hitting-hand foot. For a right-hander, the rhythm is right, then left, pull, right, and left. For a left-hander, the rhythm is left, then right, pull, left, and right.

Because the four-step approach begins farther from the net, the player takes longer to arrive at the ball using this pattern. Therefore, movement is initiated before the location of the ball is determined. Adjustment during the approach is often required.

Starting farther from the net, the player is more able to adjust the approach and align the hitting shoulder behind sets located away from the net. The four-step pattern covers more distance than the three-step pattern, increasing

the range of the hitter. The increased range of the approach allows the player to receive balls deep in the court and attack sets near the net without modification of the step pattern.

The four-step approach is readily learned from the three-step pattern. The first step of the four-step pattern, the rhythm step, places the feet in a posture identical to that of the three-step approach. The pattern essentially is a rhythm step, followed by the three-step approach.

The five-step approach is used primarily by attackers who, while passing, are stationed distant from the net and the outside attack zones, such as swing hitters in a two- or three-person receive formation. The first step, with the foot of the non-hitting hand, is a long step, positioning the player nearer to the attack zone. The second step, with the foot of the hitting hand, is a rhythm step taken just prior to the setter's contact of the ball. As with the four-step approach, the rhythm step places the feet in a posture identical to the three-step pattern. The three-step pattern follows the rhythm step and the release of the set.

The rhythm of the five-step approach is non-hitting-hand foot, hitting-hand foot, then non-hitting-hand foot, pull both arms back, hitting-hand foot, and non-hitting-hand foot. For a right-hander, the rhythm is left, right, then

left, pull, right, and left. For a left-hander, the rhythm is right, left, then right, pull, left, and right.

The five-step approach is also readily learned from the three-step pattern. The first step of the five-step pattern is a positional step, followed by the rhythm step, and concluding with the basic three-step approach. Learning the complex pattern of the five-step approach is facilitated by prior learning of the three- and four-step patterns.

The two-step approach is a two-and-a-half-step variation of the three-step pattern used primarily for first-tempo attacks. Unlike the typical three-step pattern, the foot of the non-hitting hand is placed adjacent or forward, rather than rearward, of the foot of the hitting hand. The first step is a slow, short, and controlled rhythm step taken as the pass is contacted.

The initial short rhythm step is taken with the adjacent or forward-placed foot of the non-hitting hand. The next-to-last and last steps of the transition, taken with the hitting-hand foot and then non-hitting-hand foot, respectively, are timed relative to the pass so that the jumping action is initiated and separation from the floor attained prior to the setter receiving the pass. The hitter is airborne and postured to effect the arm-swing as the setter delivers the ball.

The rhythm of the two-step approach is a short step with the foot of the non-hitting hand, then pull both arms

back, hitting-hand foot, and non-hitting-hand foot. For a right-hander, the rhythm is short left, then pull, right, and left. For a left-hander, the rhythm is short right, then pull, left, and right.

As with the four- and five-step patterns, the two-step approach is readily learned from the three-step pattern. The first step is a short rhythm step, followed by the next-to-last step and last step of the transition. The step sequence is identical to that of the three-step pattern.

The control and flexibility afforded the player make the step-close the preferred transition method. Combined with the step-close transition, the three-step is the preferred approach pattern to be learned first. Though it is not the most flexible pattern, the three-step is efficient and readily learned. The basic three-step approach serves as a foundation supporting the learning of more complex approach patterns and their specialized adaptations. The learning of other approach patterns should follow the learning of the three-step pattern, equipping the player to perform the many tasks required of accomplished players.

The Jump

During the transfer phase of the approach, horizontal momentum is transferred vertically to the jumping action. The jumping action elevates the player near vertically to maximum height. The jump is a result of the center of mass

accelerating upward. The whole body acts in concert to accelerate the center of mass.

The momentum of the approach is transferred to the jumping action. The smooth, fluid action of the next-to-last and last steps, timed in conjunction with the jumping action, provides continuous movement to the center of mass in transition from horizontal to near vertical movement. The momentum of the approach is dissipated when the player, and the player's center of mass, come to rest, following the approach pattern and prior to the jumping action. The acceleration of the center of mass from a static, rather than from a dynamic, position requires greater force. Lower jumping height is attained from force applied to a static, rather than dynamic, player and player's center of mass.

At the transfer phase, the body is poised for jumping action. Both arms are drawn back and upward, and the torso is lowered comfortably. The legs are flexing at the hip and knee, extending at the ankle. The leg extensor muscles are stretching while contracting eccentrically. The center of mass is moving to a position above the feet.

As the last step of the transition plants, the center of mass is positioned above the base of support and in line with the direction of the near vertical jump. The jump is initiated by the upward thrust of the torso and the forceful extension and elevation of both arms. The end of these

movements transfers upward momentum to the player's center of mass. The upward thrust of the torso and both arms is followed by a maximum concentric contraction of the leg extensors.

The force exerted by the leg extensors is directed through the center of mass. Extension through the full range of motion at the hip, knee, and ankle results in the accelerated elevation of the center of mass. The acceleration of the center of mass through extension of the legs elevates the player from contact with the floor.

Three factors determine the height attained through the jumping action: the bodyweight of the player, the strength of the muscular contraction, and the speed of the muscular contraction. The force provided by the muscle contraction is greater than the player's weight in order for the body to be lifted. The muscles exert force through a range of motion sufficient to create acceleration of the center of mass upward. The upward acceleration of the body mass lifts the player from contact with the floor.

Force, the product of acceleration and mass, contains the components of both movement of mass and the rate of movement, acceleration. One force would move a great mass. An equal force would greatly accelerate a lesser mass.

Muscular contractions produce both components of force. The strength of the muscular contraction of the leg extensors provides the force which overcomes body weight and

initiates movement of the center of mass upward. As upward momentum of the body mass reduces the actual resistance to the muscles, muscular force accelerates leg extension and the upward movement of the body. The jumping action requires both components of muscular force. The muscles must be strong enough to overcome and move upward the body's weight from the initial angle of knee bend. And the speed of contraction through the range of motion must be fast enough to accelerate the player into the air.

The strength of the leg extensors varies relative to the knee angle from which the contractions take place. At knee angles of less than 90 degrees, the angle of muscular leverage reduces the force provided by the leg extensors. At knee angles of 90 degrees or more, muscular leverage and strength are improved. Generally, the lower the body and the deeper the knee bend from which the jump is initiated, the greater is the strength required to overcome the body weight.

However, initiating the jump from a lower posture and deeper knee bend provides a greater range of motion through which the strength of the muscles is exerted. Initiating the jump from a higher posture, a knee angle of 90 degrees or more, reduces the range of motion through which the muscles act. The greater the distance through which force is exerted, the greater is the acceleration of the increase

in joint angle and, thus, to the player and the player's center of mass.

Relative to each individual player's leg strength, there is an optimum depth at which the jumping action is initiated. The optimum depth for players of exceptional leg strength may be less than 90 degrees. For players of average leg strength, the optimum knee angle may be more than 110 degrees. Generally, players attain maximum elevation, jumping from a knee angle of 90 to 110 degrees.

Once the player's inertia is overcome and the body has upward momentum, resistance to the leg extensors is greatly reduced. The speed of contraction of the muscles acting through the remaining range of motion accelerates leg extension. The greater the speed of muscle contraction, the greater the acceleration of leg extension and the greater the acceleration of the player upward. The speed of the muscle contraction and joint angle acceleration determines the height attained through the jumping action.

As the approach postures the body for the jump, the jump also postures the body for the arm-swing. Both arms are driven forward and upward. Both arms travel upward at least to the level of the shoulders. The torso is upright, with the back slightly arched.

It is critical to equilibrium and the hitting posture that both arms are elevated to at least shoulder height during the jumping action. Failure to elevate both arms

alters the initial posture from which the arm-swing is effected. In addition, elevating only one arm provides torque around the center of mass, and the body rotates as a result of the force of the arm elevation.

If the non-hitting arm remains lowered or elevates only slightly, the jumping action rotates the hitting shoulder toward the net. The forward placement of the shoulder provides a poor hitting alignment which must be corrected prior to the arm-swing, diminishing the hitting action. If the hitting arm fails to elevate, the non-hitting shoulder excessively rotates forward, toward the net, and the hitting hand is not postured for an efficient arm-swing action.

As the hitting arm rises above the level of the head, the elbow is pulled rearward and slightly outward, away from the body. Various arm-swing patterns situate the hitting hand at different positions. The preferred arm-swing places the hitting hand forward of the elbow, slightly above and outside of the shoulder. The hitting arm has a nearly horizontal attitude. The entire body in the air is relaxed and awaiting the arrival of the ball into the attack zone.

The Arm-Swing

The arm-swing is a continuation of the jumping action. During the jump, the arms are driven forward and upward, the torso is thrust upward, and the back is slightly arched. As the body is airborne, the hitting arm is brought rearward. The spiker initiates the arm-swing from this posture.

As the ball nears the point of attack, the non-hitting arm lowers, beginning the action of the arm-swing. The non-hitting arm bends at the elbow and lowers along the front of the body to a position near waist level. Care must be taken that the lowering of the non-hitting arm occurs in front of the body. Forward depression of the arm alongside the body provides torque around the vertical axis, rotating the torso and placing the hitting shoulder forward, toward the net. Excessive downward swing of the arm to a position rearward, beyond the plane of the body, further rotates the torso and the hitting shoulder.

Lowering the non-hitting arm brings the torso forward from the arched position to an upright posture. Some advocate that the torso go beyond the upright, toward a piked posture prior to contact with the ball. The greater range of motion of the piking action contributes greater impetus to the arm-swing, increasing the power of the attack. The disadvantage of piking is that the forward angle of the torso lowers the height of the hitting arm and the ball is contacted at a lower elevation. In addition, the long, forward movement of the torso makes more complex the alignment of the hitting shoulder and the timing of the arm-swing, relative to the position of the ball.

In addition to bringing the torso forward, the forward depression of the non-hitting arm elevates the shoulder of the hitting arm. The forward movement of the torso and

elevation of the hitting shoulder transfer energy to the player's arm-swing. The inertia of the torso is transferred to rotation at the shoulder; the end of shoulder rotation transfers energy to arm extension at the elbow; the energy of arm extension is transferred to the hand through flexion at the wrist. The sequential summation of the forces produces a rapid acceleration of the hand into contact with the ball.

Arm-swing patterns of varying degrees of complexity are exhibited in the game of volleyball. For the accomplished player, each offers advantages and disadvantages. Given many years of training and experience, superior athletes can experience success with many of the arm-swing patterns. For the learner in the instructional and non-elite-level competitive settings, learning and competency are enhanced through use of a less complex arm-swing pattern that efficiently provides both power and control.

One of the more complex patterns extends and elevates both arms during the jumping action. From this position, the elbow of the hitting arm swings downward below the shoulder and rearward. The hitting hand drops through a greater arc, bringing the hand near waist level. The arm-swing is initiated from this position.

Continuing the circular and rearward movement of the elbow and hand around the axis of the shoulder joint brings the hitting hand upward. The hitting elbow and hand move

circularly around the shoulder joint. The circular pattern brings the elbow upward and forward, the hand remaining rearward of the elbow. The hitting hand accelerates toward the ball through extension of the arm at the elbow and flexion at the wrist.

The advantage is the lengthy range of motion through which the muscles act. Rotation at the shoulder is in excess of 150 degrees. Arm extension at the elbow is 90 degrees or more. Such extensive rotation generates great hand speed and power in the arm-swing.

The disadvantage is that the time taken for the lengthy arm-swing is excessive. In order for the hand to contact the ball at the optimum position, the arm-swing must begin when the ball is distant from the optimum point of contact. The player is afforded less time to judge the speed, trajectory, and location of the set.

The player is often required to adjust the speed of the arm-swing to accommodate early misjudgment of the set. Adjusting the speed of the arm-swing affects the direction and power of the attack. Failure to adjust the arm-swing causes the player to adjust the point of contact, attacking the ball at less than the optimum point. Power is gained at the expense of accuracy and consistency.

Another arm-swing pattern, one of less complexity, extends and elevates both arms during the jumping action. From this posture, the hitting hand, not the elbow, is

brought rearward to a position behind the head or ear of the player. The elbow remains high, well above the level of the shoulder. The arm-swing is initiated from this position as the ball nears the attack zone.

The arm-swing is short and compact. Flexion at the shoulder brings the upper arm and elbow upward and forward. Extension of the arm at the elbow and flexion at the wrist accelerate the hand into contact with the ball.

One advantage of the compact arm-swing is that the initial position of the elbow is elevated. The elevated position of the elbow effects the arm-swing through an arc, maximizing height of ball contact. Another advantage is the compactness of the arm-swing. Rotation at the shoulder is minimal, 60 to 90 degrees. Arm extension at the elbow is greater, 120 to 150 degrees.

Such short movements are effected quickly and accurately. Unlike the long, circular arm-swing, the compact arm-swing is initiated as the ball nears the optimum point of contact. There is little need to adjust the arm-swing to the set. The speed, trajectory, and location of the set are accurately judged before the arm-swing commences.

The disadvantage is that the compact arm-swing generates little hand speed and power from the limited shoulder rotation. Because the elbow is held high and the hand is rearward of the elbow, the upper arm can be drawn

back no farther than 90 degrees, parallel to the plane of the shoulders. Forward movement of the upper arm, speed of movement, and energy transferred to arm extension from this position is limited. Accuracy and consistency are gained at the expense of power.

The preferred technique also extends and elevates both arms during the jumping action. From this posture the hitting elbow, not the hand, is drawn directly rearward. The hand remains forward at the elbow, held slightly above shoulder level. The position of the hand forward of the elbow allows the upper arm to be drawn rearward, horizontal hyperextension at the shoulder, 60 to 90 degrees beyond the plane of the shoulders. During the arm-swing, rotation of the hitting arm at the shoulder joint is effected through a range of motion of 150 to 180 degrees.

The forearm is at an attitude approximately horizontal. The angle of bend at the elbow is 90 to 120 degrees. The elbow bend is sufficient to generate high arm velocity in a short time interval, providing a quick and effective arm-swing. Greater bend at the elbow provides comparable velocity, but over a longer time frame. Lesser bend at the elbow provides a quick arm-swing, but generates less arm velocity.

The hitting hand is open and relaxed, the fingers separated approximately one-half inch. A tensed hitting hand provides a dense contact surface, but the tension of

the muscles of the hand limits the flexibility of the wrist, restricting the speed of wrist flexion, known as the wrist snap. The relaxed hand provides an unrestricted whip-like wrist snap at the end of the arm extension. In addition, the relaxed hand position allows the shape of the hand to conform to the shape of the ball upon contact.

The arm-swing is initiated as the ball nears the optimum point of ball contact. The upper arm and elbow are rotated quickly upward and forward toward the ball, with the elbow angle remaining constant. The rotation of the upper arm, combined with the constant elbow angle, moves the hitting arm through a position similar to the initial position of the compact arm-swing. The upward and forward movement of the upper arm and elbow places the hitting hand rearward, above and behind the head. The upward and forward movement of the upper arm and corresponding rearward movement of the forearm hyperextend the hand at the wrist.

The shoulder rotation of the hitting arm continues through the full 150 to 180 degrees, accelerating the elbow toward the ball. As shoulder rotation nears completion, the momentum and velocity of the upper arm are transferred to the hand through extension at the elbow. Increasing the angle of the elbow further accelerates the forearm and hand toward the ball. At the end of arm extension, inertia and velocity of the forearm are transferred to the hand which

accelerates into contact with the ball through the wrist snap.

The preferred arm-swing combines elements of both the compact and the circular arm-swing to effect power and control effectively and efficiently. The action of the muscles is effected through the full 150 to 180 degrees of shoulder rotation. The power of the circular arm-swing is generated without the lengthy loop of the pattern. As with the compact arm-swing, arm speed and power are effected quickly through a condensed range.

The direction of the attack is the result of many factors. The point of contact on the surface of the ball relative to the ball's center is one factor. The ball rebounds in the direction opposite the point of contact. For example, contacting the ball below the center directs the ball upward and generally out of bounds.

The preferred point of contact is above center. Contact above the center of the ball directs the ball downward toward the floor. The degree of downward trajectory is determined primarily by the distance above center at which the ball is contacted. Set locations near the net which are to be directed sharply downward are contacted toward the top of the ball. Sets located distant from the net are directed through a flat, near horizontal trajectory and are contacted nearer the center of the ball's surface.

One method of providing lateral direction to the ball is to apply the striking force off-center to the ball's surface. Contacting the ball to the left of center or the right of center directs the ball to the right or the left, respectively. This is done through pronation (inward rotation) or supination (outward rotation) of the hitting arm or hand just prior to contact with the ball. The last instant change of direction provides deception to the attack. Deception, however, is gained at the expense of power.

Power is derived from the summation of forces of the arm-swing levers, the torso, upper arm, forearm, and hand. Power is maximized when all vectors act through the same line of force. The force vectors of forearm and wrist snap are not in line with the arm-swing when the direction of the attack is changed through upper-arm rotation at the shoulder. The force vectors of the wrist snap are not in line with the arm-swing when the direction of the attack is changed through rotation of the hitting hand, forearm pronation, or supination, at the elbow joint. Power is reduced using these methods to change lateral direction of the attack.

The preferred method of directing the attack is the alignment of the force vectors of the arm-swing in the direction of the intended attack. This is done by aligning the hitting shoulder in line with the ball and the intended

direction of the attack. The movements of the torso, upper arm, forearm, and hand are all directed through the ball in the direction of the attack. The resultant forces of the torso, shoulder rotation, arm extension, and wrist snap all act co-linearly to the direction of the attack.

To direct the spike straight ahead, such as a down-the-line attack from either the on-hand or off-hand side, the ball is aligned above and directly in front of the hitting shoulder. To direct the spike across the body, such as a cross-court spike from the off-hand side, the ball is aligned above and in front of the player's sternum. To direct the spike away from the body, such as a cross-court spike from the on-hand side, the ball is aligned above and lateral of the hitting shoulder.

Alignment of the ball relative to the shoulder occurs during the approach and jump. To jump and then align the ball introduces movements to the jumping and spiking actions not in line with the desired resultant. The movement must then be reversed in order to effect the attack. The effect is to make less efficient and reduce the power of the action. The technique can be effectively utilized by advanced players, but the technique is complex and difficult to master for the learner in instructional and non-elite-level competition settings.

Contact with the Ball

The optimum point of contact is at the highest point of reach of the hitting arm. The hitting arm is fully extended at the point of contact. This provides the hitter maximum clearance above the net. In addition, it forces the blockers to extend upward, rather than penetrating across the net.

Contacting the ball below maximum height provides the spiker increased power and greater opportunity to hit on top of the ball and drive it downward. But the low-contact point brings the trajectory of the spike nearer net level, increasing hitter error. In addition, the low-contact height increases the effectiveness of the opposing block.

The preferred point of contact with the ball is slightly forward, approximately 6 to 12 inches, of the hitting shoulder. The forward location provides a slight downward direction to the arc of the arm-swing. Unless other factors act on the ball, such as contacting the ball below center, the resultant direction of the attack is downward toward the floor. The slightly forward point of contact lengthens the range of motion of the arm-swing, providing greater hand velocity and power to the spike.

Location of the point of contact excessively forward, more than 12 inches, provides even greater range of motion of the arm-swing and increases further hand velocity and power to the arm-swing. The arc of the arm-swing, however,

is increasingly lower as it travels forward of the hitting shoulder. The farther forward that the ball is contacted, the lower is the point of contact. Power is gained at the expense of hitting height. The effectiveness of the attack is decreased.

The player aligns the ball directly above the shoulder while spiking a set distant from the net, eight feet or more, depending on the jumping height of the hitter. Attacking the ball directly above the shoulder provides a flat trajectory sufficient to clear the net. The hitting action imparts forward rotation, known as topspin, to the ball. The air acting on the topspin causes the ball to sink as it reaches the opponent's back court.

Contacting the ball behind the shoulder seldom results in an effective spike and often results in a hitting error. The arc of the arm-swing rearward of the hitting shoulder is upward. Unless other factors act on the ball, the trajectory of the spike will be upward and often land out of bounds.

The hitting hand forms the contact surface which strikes the ball and from which the ball rebounds. Two factors affect the power transmitted to the spike and the control over the resultant ball flight. One is the hardness of the contact surface; the other is the size of the contact area.

The harder the contact surface of the hand, the more powerful is the spike and the resultant ball velocity. The hand formed in a fist provides the hardest hitting surface and the greatest velocity of the spike. The fist is also the smallest hitting surface, and the surface of the ball contacted is minimal. The fist provides the least control of the attack. Because the fingers do not wrap over the top of the ball, the spike can only be directed downward by bringing the entire fist over the top of the ball, lowering the contact height of the attack.

Shaping the hitting hand by placing the fingers and thumb tightly alongside each other forms what is commonly termed a cupped hand. Cupping the hand provides in the lower palm area a hard-hitting surface and high resultant spike velocity. The hand contact surface is small and flat, providing less than effective ball control.

The wrist snap rotates the upper hand and fingers toward the top of the ball. Straight fingers are brought into contact with the ball late in the wrist snap, 30 to 45 degrees of hand rotation after initial contact. Contact on the heel of the palm area often directs the ball away from the hand before the wrist snap can bring the fingers into contact, diminishing downward trajectory of the spike.

The preferred contact surface of the hitting hand provides a balance of both power and control. Power is derived from initially contacting the ball with the flat,

hard lower third of the palm area. Control is derived from wrapping the fingers over the top of the ball immediately after contact with the lower palm area.

The preferred contact surface is formed so that the fingers are separated approximately one-half inch from each other. The thumb is separated an equal or slightly greater distance from the index finger. The fingers are curved slightly, and the hand is relaxed.

At the end of arm extension at the elbow, the wrist snaps the hand into contact with the ball. Initial contact with the ball is on the lower third of the palm area. As the hand depresses the ball and the ball subsequently rebounds from the hand, the wrist snap wraps the fingers over the top of the ball.

Separating the fingers and thumb provides the player a large area of contact with the ball. Increasing the contact area increases the control of the attack. Increasing the contact area also dissipates the energy of the arm-swing over a larger area, absorbing a greater portion of the force of the attack. Separating the fingers as preferred has minimal effect on power, but increases control.

Separating the fingers greatly further increases the contact area, but is ineffective. The energy of the arm-swing is dissipated over a greater area. Contact with the ball is seldom evenly distributed among all of the widespread fingers. The force of the arm-swing is absorbed

as the ball hyperextends the fingers in primary contact. In addition, spreading the fingers greatly tenses and restricts the wrist-snap action of the hitting hand.

The arm-swing drives the lower hand into contact with the ball. The wrist snap rotates the upper hand and fingers toward the top of the ball. Often the ball has already departed before straightened fingers come over the top and into contact with the ball. Curving the fingers slightly brings the fingers into contact with the top of the ball immediately after initial contact. This provides downward impetus to the attack, in addition to imparting to the ball topspin which makes the ball curve downward toward the floor area.

Excessive curvature of the fingers is detrimental to the attack. Fingers curved identically to the shape of the ball are brought into ball contact simultaneously with the lower hand. The relatively soft surface of the upper hand and fingers absorbs some of the force of the hard lower palm contact area. Excessive curvature of the fingers greater than the curvature of the ball causes initial ball contact to be with the fingertips, providing neither power nor control.

A balance of relaxation and tension of the hitting hand is critical to the arm-swing. The totally relaxed hand presents a soft hitting surface which absorbs much of the energy of the arm-swing and reduces power of the attack. An

overly tensed hand does not flex at the wrist easily or quickly, and the speed of the wrist snap is restricted. The relaxed hand flexes freely and quickly as a result of the end of arm extension at the elbow. The whip-like action of the arm-swing and wrist snap is enhanced by relaxing the hand.

The relaxed hand is highly malleable. Upon contact of the lower palm area with the ball, the relaxed hitting hand conforms to the shape of the ball. The fingers are brought into contact with the top of the ball and contoured in the shape of the ball.

Generally, spreading the hand as preferred provides adequate tension to the contact surface. The conscious relaxing of the hitting hand prevents excessive tension. At the educational and non-elite competitive levels of instruction, excessive relaxation is preferable to excessive tension in the hitting hand.

Follow-Through

At contact, the elbow is totally straight, and the wrist snaps. The end of the wrist snap tends to rotate the forearm at the elbow, pronation or supination. The arm then flexes at the elbow, and the hitting hand is pulled back toward the trunk and lowered. Continued forward extension from the shoulder of the extended arm brings the hitting hand into the proximity of the net and increases the possibility of a net foul.

The player absorbs the inertia of the descending body, using the leg extensors eccentrically. The muscles of the extensors resist the downward motion so that the body slows gradually and balance is gained. As the player arrives at a state of balance, preparation for the next action is initiated.

Key Teaching Points

The Approach

1. The approach begins with the rear foot 12 to 17 feet from the net (depending on the length of stride and the intended height of the set).
2. Four-step approaches begin with the feet in a nearly side-by-side position.
3. The first step is a rhythm step initiated with the foot of the hitting hand (right foot for a right-hander, left foot for a left-hander).
4. The first step is taken so that the lead foot has returned to the floor, leaving the feet in stride position as the setter contacts the ball.
5. Three-step approaches generally begin from this stride position, with the foot of the hitting hand forward.
6. The next step for both approaches (second step for four-step, first step for three-step) is a speed step, building speed and power in the approach.
7. This step is taken with the foot of the non-hitting hand (left for a right-hander, right for a left-hander).

8. This step is initiated as or after the setter releases the ball (depending on the quickness of the hitter and the intended height of the set).

9. The next-to-last step is taken with the foot of the hitting hand (right foot for a right-hander, left foot for a left-hander).

10. Just prior to the grounding of the next-to-last step, the arms are pulled backward and upward from the shoulder, extending at the elbow.

11. The last step follows rapidly, with the last foot contacting the floor forward of the next-to-last foot, rotating the hip and shoulder of the non-hitting side toward the net (45 to 60 degrees from parallel, on-hand; 30 to 45 degrees offhand).

12. The rhythm for the four-step approach is as follows:

- (a) right, left, pull arms, right-left
(right-hander) and
- (b) left, right, pull arms, left-right
(left-hander).

13. The rhythm for the three-step approach is as follows:

- (a) left, pull arms, right-left (right-hander) and
- (b) right, pull arms, left-right (left-hander).

The Jump

1. The step-close initiates the jumping action.
2. The body is lowered farther to a knee angle of 90 to 110 degrees immediately preceding the jumping action.

As the last foot of the step-close touches down:

1. Both arms swing forward and upward from the shoulder.
2. Extension of the trunk and of the legs, along with plantar flexion at the ankles, drives the body near vertically upward (15 to 30 degrees).
3. As the hitting arm rises above the level of the head, the elbow is pulled backward and slightly outward away from the body.
4. The hitting hand remains forward of the elbow.
5. The hitting hand is relaxed, open and shaped in the form of the ball.

The Arm-Swing

1. The non-hitting arm pulls downward in front of and along the trunk.
2. The shoulder rotates the hitting arm upward and forward toward the ball.
3. The shoulder rotates the elbow forward of the hitting hand.
4. Near the end of shoulder rotation, as the elbow is at its highest forward position, arm extension at the elbow begins.

5. Near contact, the wrist snaps (flexes) the hand over and through the ball.

6. The hitting hand remains relaxed, open and shaped in the form of the ball.

7. The sequence of rotations is as follows: non-hitting arm and trunk, hitting shoulder, hitting elbow, and wrist snap.

Contact with the Ball

1. The hitting elbow is straight as contact with the ball is made.

2. Initial contact with the ball is made with the lower palm area.

3. Immediately thereafter, the palm and fingers wrap over the ball in the intended direction of the spike.

Follow-Through

1. The arm bends at the elbow, pulling the hand back toward the trunk.

2. Continued shoulder rotation lowers the hitting arm.

3. The momentum of the landing is absorbed by the extensors of the knee and ankle joints (eccentric contraction) during flexion of both legs.

PART 5
BLOCKING

BLOCKING

Description of the Skill.

The primary purpose of the block is to prevent the spiked ball from crossing the net. Typical blocking schemes space three blockers along the net, one in the center net area and toward each sideline. Following the set, the defense attempts to align two blockers across from the attacker to whom the set is directed. Some situations allow all three blockers to join in the block, while the design of some offensive variations is targeted toward preventing even a second defender from joining the block.

The block also functions to direct the attack toward court areas in which defensive players are positioned. By blocking balls directed to certain areas, the defense may position backcourt players in the attack lanes undefended by the block. Multiple blockers create a larger obstacle at the net than a single blocker and, thus, better facilitate backcourt defensive play.

Many blocking schemes exist to counteract the various offensive strategies in existence. Basic schemes require the blocker to identify the attackers, read the direction and tempo of the set, align with other blockers opposite the attacker, read the intended direction of the attack, elevate, and place the hands across the net and into the path of the attack. Advanced schemes enable blockers to

perform these basic blocking functions against the varied location and tempo of advanced attack strategies.

Initial Position

The initial position of blockers is largely a function of individual team design. Basically, the middle blocker is responsible for defending middle attacks, as well as joining either outside blocker in defense of attacks nearer the sideline area.

Outside blockers have a primary responsibility to block the outside attack. They position their block so that the combination block with the middle blocker obstructs the predetermined court area. Their secondary responsibility is to join with the middle blocker to impede middle attacks. In addition, the outside blocker moves away from the net and joins the backcourt defense when the set goes to the opposite sideline attacker.

1. Blockers move to their initial positions prior to the opponent's pass.
2. Outside blockers are positioned three to eight feet from the sideline.
3. Middle blockers are positioned near the center of the net.
4. Blockers are near the net (within one to two feet).
5. Blocker's attention is focused on the following:
 - (a) the passer;
 - (b) the opposing attacker;

- (c) the setter as the pass is received and the set delivered;
- (d) the initial flight of the set (three to five feet), determining trajectory, location, and distance from the net of the ball;
- (e) the approach of the attacker; and
- (f) NOT the ball.

Initial Posture

The responsibilities of middle blockers require different movement patterns from those of outside blockers. In order that the different patterns are executed efficiently, initial posture differs as well.

The middle blocker aligns on the middle attacker prior to the set and is in a posture to elevate and penetrate the net quickly to defend first-tempo attacks. This posture must also allow the blocker to react to the set location and move outside quickly to join adjacent blockers opposite the attacker to whom the set was directed.

Outside blockers in basic schemes rarely defend first-tempo attacks. Their posture facilitates quick movement to the location of slower tempo attacks, rather than the combination of both quick elevation and quick movement potential required of the middle blocker.

1. The feet are shoulder width apart, turned slightly inward from perpendicular to the net.
2. The weight is on the insides of the feet.

3. The legs are bent at the knees approximately 30 to 45 degrees.

4. The back is straight and slightly (0 to 15 degrees) forward.

5. The hips and shoulders are parallel to the net.

6. The arms are held to the sides of the body.

7. The hands are held at shoulder height, open and firm, outside hand turned slightly inward.

8. The hands are held near the net (within 8 to 12 inches).

Movement to Alignment, Outside Blockers

Outside blockers seldom are required to move more than six to eight feet to position the block. Movement patterns for outside blockers are those in which the player moves quickly and covers the distance with the least postural realignment needed at the point of attack. The player arrives in a posture to elevate and penetrate the net.

1. Throughout the movement to alignment, the blockers' focus is on the attacker's approach and jump, not the ball.

2. Outside blocking alignment is accomplished by use of a slide-step footwork movement pattern.

3. A step with the foot nearest the attack (lead foot) is taken, the length of which is sufficient to cover the distance (three to five feet) to the desired alignment.

4. The trailing foot closes to within shoulder width of the lead foot.

5. Repeat for a double slide step (four to eight feet).
6. Throughout the movement, feet remain pointed toward the net.
7. The hips and shoulders remain parallel to the net.
8. The hands remain at shoulder height, held within 8 to 12 inches of the net.

Alignment of Outside Blockers

The primary function of the outside blocker is to adjust to the outside set location and position the block relative to the predetermined defensive coverage. The middle blocker aligns adjacent to this location, and both blockers jump together. The secondary blocking function is in reaction to a slow inside set, in which case the outside blocker aligns next to and jumps alongside the middle blocker.

1. Prior to the setter receiving the pass, the outside blocker aligns opposite the opposing attacker first threatening the outside net area.

2. Upon alignment with the attack threat (still prior to the setter's reception of the pass), the outside blocker's attention focuses on the opposing setter.

3. As the setter delivers the ball to the defender's area, the outside blocker moves in the direction of the set to the position of the attack.

4. Once the ball is set and throughout the alignment, the blockers' focus is on the path of the attacker's approach and jump, not the ball.

5. On typical sets (two to four feet from the net), the outside blocking shoulder is across or slightly inside of the hitting shoulder of the attacker.

6. On tight sets (less than two feet from the net), the sternum of the blocker is directly across from the hitting shoulder of the attacker.

7. On deep sets (five feet from the net or more), the outside blocking shoulder is respectively more inside the hitting shoulder of the attacker; the deeper the set, the more inside is the blocker alignment.

8. On sets five to eight feet inside, the outside blocker closes to the middle blocker.

Movement to Alignment, Middle Blockers

Middle blockers cover attacks all along the net, and movement of 10 to 12 feet is often required. Over short distances, middle blockers use movement patterns similar to outside blockers. Moving longer distances quickly requires of the player footwork patterns which generate greater speed of movement and facilitate postural realignment at the point of attack. Throughout the movement to alignment, the blockers' focus is on the attacker's approach and jump, not the ball.

Alignments at or near middle net areas (movements of zero to eight feet) utilize slide-step footwork patterns.

1. A step with the foot nearest the ball is taken, the length of which is sufficient to cover the distance (three to five feet) to the desired alignment.

2. The trailing foot closes to within shoulder width of the lead foot.

3. Repeat for a double slide step (four to eight feet).

4. The feet remain pointed toward the net.

5. The hips and shoulders remain parallel to the net.

6. The hands remain at shoulder height, held within 8 to 12 inches of the net.

Alignments toward the court sidelines (movements greater than eight feet) require the use of a three-step crossover pattern.

1. A long step is taken with the foot nearest the point of attack (lead foot). The hips open to face the direction of movement.

2. The shoulders remain as near parallel to the net (within 30 to 45 degrees) as possible.

3. The lead foot points in the direction of the alignment.

4. The trailing foot crosses in front of the lead foot, planting at the point of alignment. The trailing foot

plants, pointing toward the net. The lead foot follows and is placed within shoulder width of the trailing foot.

5. The lead foot is placed slightly closer or no farther away from the net than the trailing foot.

6. The lead foot is also pointing toward the net.

7. The placement of the lead foot rotates the hips and shoulders back to a position parallel to the net.

8. The hands remain held at shoulder height, open and firm.

9. The hands, particularly the outside hand (nearest the point of attack) are held near the net (within 8 to 12 inches).

Alignment of Middle Blockers

As the pass is directed to the setter, but prior to setter contact with the ball, the middle blocker aligns opposite the fast-tempo middle attacker. From this position, the middle blocker reacts to the direction of the set and moves to align at the location of the attacker. Alignment will be adjacent to the outside blocker on sets directed near the sideline area. On sets directed between the middle and the sideline area, the middle blocker aligns inside the attacker, allowing the outside blocker to align alongside.

1. During the pass, but prior to the set, the middle blocker aligns across from the opposing attacker first threatening the middle net area.

2. Upon alignment with the attack threat (still prior to the setter's reception of the pass), the middle blocker's attention focuses on the setter.

3. As the setter delivers the ball, the middle blocker moves in the direction of the set to the position of the attack.

4. Once the ball is set and throughout the alignment, the blockers' focus is on the attacker's approach and jump, not the ball.

5. Defending a middle attack, the sternum of the blocker is aligned directly opposite of the hitting shoulder of the attacker.

6. Defending a typical outside attack (zero to four feet from the sideline), the blocker moves to a position alongside the outside blocker.

7. Defending an attack inside of the typical outside position (five to eight feet from the sideline), the blocker aligns inside the attacker's hitting shoulder, blocking the cross-court area, allowing the outside blocker to close.

The Blocking Action

An effective block places the hands above the ball and across the net into the path of the intended direction of the spiker's attack. The block should direct the ball downward back into the opponent's court. The area blocked by the spread of the hands should be as wide as possible,

the hands placed close enough together to prevent the ball from going between the spread.

1. Throughout the blocking action, the blockers' focus is on the attacker's jump and arm-swing, not the ball.

2. As the blocker nears (within the last one to two steps) the point of alignment, the body is postured for the blocking action.

3. The hips and shoulders are parallel to the net.

4. The knees are bent to 90 to 110 degrees.

5. The back is straight and slightly forward (0 to 15 degrees).

6. The shoulders are lowered, the hands remaining near shoulder height.

7. The hands are open and firm, remaining near the net (within 8 to 12 inches).

8. Depending on the depth of the set, the blocker jumps as or after the attacker leaves the floor.

9. On tight sets (one to two feet from the net), the blocker jumps as the attacker jumps.

10. On sets two to five feet from the net, the blocker jumps slightly after the attacker jumps.

11. On deep sets (five feet or more from the net), the blocker jumps respectively later than the jump of the attacker (the deeper the set, the later the jump).

12. The jump to block is initiated through a forceful extension of the legs at the knees and plantar flexion at the ankles.

13. The shoulders are elevated, and the arms are extended at the shoulders, elbows, wrists, and fingers.

14. The hands are thrust above and across the net.

15. The hand thrust is one motion, above and across, not two separate movements, up and then across.

16. As soon as the hands of the blocker clear the level of the net, they cross over the net and penetrate the opponent's court to the greatest depth their blocking jump and height allow.

17. At no time is the distance between the hands or arms and the net greater than the width of the ball (approximately 8 to 12 inches).

18. As the blockers' hands clear the level of the net, they are and remain separated a distance no greater than the width of the ball (eight inches).

19. Upon clearing the level of the net, the blocker's hand are turned inward and downward toward the center of the opponent's deep court. At no time during the blocking action do the shoulders or hands turn toward the attacker.

20. Reaching outside the body toward the attacker or sideline is discouraged.

Contact with the Ball

The hands should form a barrier, deflecting the ball back into the opponent's court area. The outside hand, especially, should be rotated toward the opponent's center court. Balls are occasionally blocked by the arms, and they, too, should be turned toward the center court.

1. The hands remain separated no more than the width of the ball (eight inches).

2. The hands remain turned inward and downward toward the center of the opponent's backcourt area.

3. Any movement occurring during the blocking action and contact is in the direction of the center of the opponent's backcourt area.

4. The fingers are separated to cover the maximum area possible, while retaining the strength to deflect the ball.

5. The thumbs are separated and pointed approximately at each other.

6. The hands are tensed and firm.

Follow-Through

Follow-through is a natural extension of directing the blocking action of the arms and hands toward the opponent's center court. Care must be taken that follow-through does not extend the action into the net. Descent follow-through should leave the player in a posture to continue play.

1. The blocker hangs in the air and sustains the blocking penetration as long as possible.

2. As the body begins descent, the arms and torso are brought directly back away from the net to a near vertical position.

3. The arms are then brought down alongside the body, the elbows bending so that the hands and arms remain close to the body.

4. After the blocker lands and gains balance, the player turns in the direction of the ball and prepares for the next play.

Analysis of the Skill

Defensive schemes are designed to defend against various offensive options by placing blockers and backcourt defenders in the path of those options available to the offense in anticipated situations. Within any given attack situation, each blocker has responsibility for alignment and coverage of specific options. Alignment occurs as the offensive situation develops, as the pass travels to the setter and as the set moves toward the attacker.

Blockers are identified by the initial blocking position taken in the defensive alignment. Generally, blocking positions are designated as middle and outside, the blockers identified as middle blockers and outside blockers, respectively. Middle blockers block all across the net, joining with outside blockers on attacks executed near the sideline. Because they are involved in blocking all attacks, middle blockers are generally the team's most

effective blockers. To be effective, middle blockers must possess height and sufficient quickness to move quickly all along the net.

The middle blocker moves adjacent to the outside blocker, and both jump to block in unison. Outside blockers have the primary responsibility of aligning the block relative to the location of the attacker and the design of the defense. On balls set to the middle or the opposite sideline areas, the non-blocking outside blocker, termed the off-side blocker, either joins the block or moves to a designated area of defensive floor coverage.

At advanced levels of competition, blocking positions are more specialized. Outside blockers are designated by which outside position they occupy. Strong-side blockers block the opponent's left outside attack area, the opponent's on-hand side for right-handed hitters. Weak-side blockers block the opponent's left-side attack area, the opponent's off-hand side for right-handed hitters.

At elite levels of competition, blocking positions are not at all specialized. Each blocker is required to function effectively at each position. On every play, the initial blocking position and responsibility of each blocker is designated relative to the offensive capabilities of the opponent's alignment and personnel.

Basic blocking movement patterns are modified at the elite level to counter specific attack capabilities of elite

players and systems. The basic mechanics of blocking are relatively similar at the instructional, non-elite, and advanced competitive levels. Learning of basic blocking techniques provides the basis of learning the more advanced blocking skills required at higher levels.

The blocking techniques of middle and outside blockers must be analyzed relative to the specific responsibilities of each. Middle blocking and outside blocking differ in the initial position, initial posture, alignment, and movement which are specific relative to the task imposed. Upon arrival opposite the point of attack, the middle and outside blockers share similar, though not identical, movement patterns in executing the jump, blocking action, contact, and follow-through.

Initial Position

As the ball is delivered across the net, whether through service, a volley, or a spike, the blockers move to their respective positions as defined by the defensive strategy. The middle blocker is toward the center of the net, and the outside blockers are toward their respective sideline. All blockers are stationed near the net, within one to two feet.

Players at low levels of play often start the block a step or more distant from the net. By starting a step or more away from the net and moving forward prior to the jump, the player gains momentum for the jumping action. The

blocking height gained by this method is slight, but the effectiveness of the blocking action is reduced greatly.

As the player moves forward and elevates, the arms remain distant from the net. Any distance between the arms and the net greater than the width of the ball allows the ball when blocked to come down on the net side of the blocker. In addition, blocking while removed from the net reduces the distance the arms can reach across the net and penetrate the opponent's court space. It is preferable to be near the net and jump lower than to jump slightly higher while distant from the net.

The initial distance from the sideline of the outside blocker position varies relative to the opponent's offensive capabilities and the defensive strategy employed. Blockers primarily defending the outside attack zone are commonly stationed within three feet of the sideline. Blockers defending attacks along a variety of net locations are often stationed nearer the center net area, five to eight feet from the sideline.

Initial Posture

The initial posture of the blockers is balanced and posed to react. Lateral movement and vertical elevation are quickly attained. The hands and arms are positioned to quickly extend and penetrate the plane of the net.

The feet are side-by-side and spread at, or slightly greater than, shoulder width. The feet are turned slightly

inward from perpendicular to the net, shifting the weight toward the balls of the feet. The legs are bent at the knees approximately 30 to 45 degrees. The hips and shoulders are parallel to the net.

The hands and shoulders are placed slightly outside of the shoulders at approximately shoulder height. The hands are held near the net, within 8 to 12 inches. The hands are tensed and firm, the outside hand turned inward toward the opponent's center backcourt area.

At advanced levels, middle blockers must protect against the opponent's first-tempo attack, generally effected from the center net area. The quickness of the first-tempo attack necessitates that the blocker immediately elevate the hands above and across the net into the path of the attack. At advanced levels, the initial posture of the middle blockers places the hands higher than shoulder level. As the opposing setter receives the ball, the hands are held above the level of the head, near the top of the net.

At elite levels of competition, first-tempo attacks are directed all along the net. Outside blockers, in addition to middle blockers, are required to defend the first-tempo attack. The hands and arms of middle and outside blockers are elevated in a similar posture to that preferred for advanced level middle blockers.

Movement to Alignment, Outside Blockers

The blocker's initial position is gained as the ball is directed toward the opponent. As the pass is contacted, the blockers' attention is on the position of the opposing attackers, the options available to the offense, and the individual requirements of the defensive strategy. The responsibility of outside blockers generally involves moving to the point of attack and aligning the block relative to the opponent in accordance to the defensive design. Following the set, the middle blocker moves to a position adjacent to the outside blocker, and both players jump to block in unison.

Outside blockers generally block attacks occurring near the sideline where they are stationed. When responsible for joining the middle blocker to defend middle area attacks, outside blockers are initially stationed midway between the sideline and the middle-court area. The initial position places outside blockers within six to eight feet of the attack which they are to defend.

Such distances are covered quickly and efficiently through the use of slide-step footwork patterns. Blockers using the slide-step pattern move to the ball, maintaining to a large degree the initial posture of the blocking action. Minimal re-configuration is required as the player nears the point of attack.

The slide-step pattern provides less movement speed, but the player arrives postured to initiate the blocking action. The use of crossover-step or turn-and-run patterns and then re-posturing to jump and block is more time-consuming, even though greater movement speed is produced by these patterns. Within the distance covered by two slide-steps, the slide-step pattern provides the fastest movement to elevation. Beyond two steps, crossover-step patterns move and elevate the blocker most quickly.

During slide-step movements, the body remains postured to initiate the blocking action. The hips and shoulders remain parallel to the net. The hands remain at shoulder height. The hands are held within 8 to 12 inches of the net.

Once the ball is set and throughout blocking alignment, the blocker's focus is in the path of the attacker's approach and jump. The location and tempo of the attack are recognized early in the flight of the set. Further information regarding the nature and direction of the attack is rarely gained watching the ball. Once the ball flight is identified, attention is shifted to the attacker.

Alignment of Outside Blockers

At advanced and elite levels of competition, alignment of outside blockers defending first-tempo attacks is similar to that of middle blockers. Alignment takes place prior to the set, occurring as the pass is in flight toward the

setter and the hitter's approach is identified. At non-elite levels, outside blockers are rarely called upon to defend first-tempo attacks. Alignment takes place during or after the set, occurring as the set is in flight toward the point of attack and the hitter's approach is identified.

The outside blocker aligns relative to the hitting shoulder of the attacker. The blocker should never be aligned outside of the attacker's hitting shoulder. Such placement only blocks the area which is outside the court boundaries. To block down-the-line spikes, the sternum of the blocker is aligned directly opposite the attacker's hitting shoulder. Outside block alignment which defends the center area of the court places the outside blocking shoulder slightly inside of the hitting shoulder.

Blocking the center-court area is a common alignment. This alignment allows a narrow lane both down-the-line and cross-court, rather than uncovering a wide lane in the area left unblocked. Backcourt defensive play is increasingly more effective as the attack lane narrows and the area to be covered is reduced. A backcourt defender is positioned in each narrow lane left unblocked. Blocking the center-court area is the preferred alignment defending typical attacks, balls set two to four feet away from the net.

Blocking opposite the down-the-line or cross-court attack uncovers a wide lane in the direction of the unblocked area. The lane is generally too wide to be

effectively covered by defenders in the backcourt. However, blocking the down-the-line or cross-court attack is effective in situations when the probability of that specific attack occurring is high.

Balls set near the net can be spiked downward sharply to the degree that backcourt defense is ineffective. Defending balls set within two feet of the net requires an alignment which protects the down-the-line area. The sternum of the blocker is aligned directly opposite the spiker's hitting shoulder. The close proximity of the attack relative to the block allows the penetration of the middle blocker to defend much of the cross-court angle created by the blocking alignment.

Deep sets, those located five feet or more from the net, are more likely to be hit in the cross-court direction. The blocking alignment is shifted in the direction of the cross-court spike. The outside blocking shoulder is aligned respectively more inside the hitting shoulder of the attacker. The farther the set is from the net, the more inside is the blocker alignment.

The outside blocker studies the attacker's body posture and movement to acquire cues as to the nature and direction of the attack. The angle of the approach, turn of the shoulders, location of the ball relative to the hitting shoulder, and style of arm-swing are all indicators of attack. Hitting cues determine last-moment adjustments.

Movement to Alignment, Middle Blockers

Middle blockers are responsible for defending attacks occurring at various tempos all along the net. They primarily, and often singularly, defend the opponent's middle-area attacks. When the ball is delivered to the outside areas, the middle blocker moves adjacent to the outside blocker at the point of attack, and the pair block in unison.

Footwork patterns utilized by middle blockers covering short distances are similar to the slide-step patterns utilized by outside blockers. The slide-step pattern maintains the blocking posture during movement. The hips and shoulders remain parallel to the net. The hands remain above the head level and near the net.

To cover longer distances, middle blockers must also be proficient using the crossover-step pattern. Crossover steps allow the middle blocker to move quickly, while maintaining the posture and alignment of the upper body. The hips and lower body rotate toward the direction of movement. Generally, the three-step crossover is the preferred movement pattern for middle blockers covering long distances.

The first step of the crossover is with the foot toward the point of attack. The first step is a long step. Though a short first step generates more speed and is more natural, the long first step is essential to covering the distance in

only three steps. Failure to attain sufficient distance with the first step necessitates the inclusion of two additional steps to the pattern in order to align the body at the end of movement. The inclusion of additional steps nullifies the speed gained by shortening the first step.

During the first step, the hips open to face the direction of movement. The foot placement is slightly more distant from the net than the initial posture, 18 to 24 inches from the net. This allows the hips to open and the opposite foot to cross over without the player coming in contact with the net. Placement of the first foot farther than 24 inches from the net effects player movement away from, rather than parallel to, the net and leads to a less effective blocking action.

It is critical to blocking effectiveness that the shoulders remain nearly parallel to the net as the hips open and throughout the movement. The shoulders should open no more than 30 degrees from parallel to the net. The outside hand should remain within 8 to 12 inches of the net throughout the movement.

The second step of the crossover-step pattern builds speed and covers the remaining distance to the location adjacent to the outside blocker. Prior to planting, the foot turns toward the net, 30 to 45 degrees from perpendicular. The foot contacts the floor with a

heel-to-toe action similar to that of the spiker-approach transition phase.

As the plant foot contacts the floor, the momentum of the run rotates the center of mass and the body around the pivot of the plant foot. The trail foot is brought alongside the plant foot. The feet are equally distant from the net and separated the width of the shoulders. The hips and shoulders are parallel to the net.

As the body rotates toward the net, and slightly prior to the landing of the trail foot, the body is lowered to optimum height for the blocking jump, the legs bend at the knees approximately 90 to 110 degrees. The leg extensor muscles are stretched through eccentric contraction and loaded for the jumping action. The trail foot plants, stops the horizontal momentum of the body, and initiates the jumping action through extension of the legs and arms.

It is critical to blocking effectiveness that upper body blocking posture be maintained during movement to the blocking position. The shoulders remain nearly parallel to the net. The shoulders should open no more than 30 degrees from parallel to the net. The outside hand remains within 8 to 12 inches of the net throughout the movement.

Movement which places the outside shoulder and hand more distant from the net necessitates the return of the arm and hand back to the net area. During the recovery, the blocker's arms and hands are facing the area outside of the

boundary. Balls blocked in this posture are generally directed out of bounds. In addition, prior to the return of the outside arm and hand near to the net, the space between the net and the arm and hand is greater than the width of the ball. Such a posture creates blocking error as balls deflected by the outside arm or hand may fall between the blocker and the net and remain on the blocker's side of the court.

Accomplished middle blockers use the crossover-movement pattern to increase jumping height, much as hitters use the spike approach. The movement is not carried out at maximum speed. Rather, the speed of movement is timed relative to the distance covered and the tempo of the attack. The blocker arrives and elevates slightly after the attacker's approach transition and jump. Horizontal inertia of the movement is transferred to the vertical action of the jump.

Some exceptionally tall middle blockers, such as those playing at elite levels, take exceptionally long strides during slide-step movements. These blockers may be able to cover the distance to the outside attack using only slide steps. Even though movement speed is reduced using slide steps, the move to peak blocking elevation is faster. For most players at instructional and non-elite competitive levels, the crossover pattern is preferred.

Another pattern observed, though rarely, in volleyball play is the turn-and-run pattern. The player turns and

takes an undetermined number of steps to reach the position of the block. The blocker postures the body for the blocking action during the jump. The speed of the movement is used to increase jumping height. The movement is timed relative to the distance to be covered and the tempo of the attack.

The blocker pivots and takes a short step toward the point of attack. The player then takes whatever number of steps is required to arrive opposite the attacker. The end of the movement is similar to the approach transfer used during the spike. The blocker arrives facing the sideline and rotates the hips, shoulders, and hands back to a position parallel to the net during the jumping action.

The advantage of the turn-and-run is the movement speed generated. The player covers the distance to the outside quickly. In addition, the high movement speed is transferred into the jumping action, gaining additional elevation for the block.

Outweighing these advantages is the postural misalignment prior to the jumping action. The body must be realigned by rotating 90 to 120 degrees during the jump. Timing of the movement, jump, rotation, and net penetration relative to the attack is critical. Arriving even momentarily late places the arms and hands distant from the net and facing the area out of bounds, increasing the probability of blocking error. Arriving early causes

excessive rotation and penetration of the net, increasing the likelihood of net-contact violations.

Alignment of Middle Blockers

As the ball is sent over the net to the opponent, the middle blocker must locate each of the attackers and identify the attack options. As the pass is in flight to the setter, the middle blocker aligns opposite the approach path of the first-tempo attacker nearest the middle area, then shifts attention to the setter. Having aligned opposite the approach destination of the first-tempo attacker, the middle blocker is in a position to defend middle attacks and also react and move to alternate set locations.

Two styles of blocking first-tempo attacks are common in volleyball competition. Read blocking is a style requiring that the blocker first identify the set location and tempo and then jump to defend. Read blocking is strong against outside and slow-tempo attacks, but vulnerable to the first-tempo attack. Commit blocking is a style requiring that the blocker jump with the first-tempo attacker prior to the delivery of the set. Commit blocking is strong defending first-tempo attacks, but vulnerable to alternate set locations.

The commit blocker aligns opposite the first-tempo attacker and jumps as the attacker jumps. The advantage is that the blocker achieves maximum elevation as the attack

occurs. The opportunity to defend the first-tempo attack is maximized.

The disadvantage is that the blocker is airborne as the set is delivered. If the set is delivered to an alternate attacker at another location, the blocker is unable to effect movement in the direction of the set until returning from the jump. Commit blocking creates for the offense one blocker situation around which backcourt defense is ineffective.

The read blocking mode, prior to the set, positions and postures the middle blocker to quickly elevate and defend against the first-tempo attack. Elevation of the already positioned blocker occurs after the set is made. The blocker moves or jumps in response to the set selection, rather than in response to the attacker's jump. Because the blocker reacts in the direction of set, movement to alternate locations of attack is not impeded.

Read blocking is the preferred method until the effectiveness of the opponent's first-tempo attack requires the blocker to commit earlier. Jumping late provides less elevation at the time of spiker contact; and thus, the blocker defense covers less of the net area, and more of the court is exposed to the attacker. When the backcourt defenders are unable to successfully defend the first-tempo attack, a commit method is required of the blockers.

Reacting to the direction and tempo of the set, the blocker moves to the location of the attack. On sets toward the middle area, the blocker aligns with the sternum directly across from the spiker's hitting shoulder. Blocking toward the outside, the blocker moves adjacent to and jumps in unison with the outside blocker.

Defending attacks inside of the typical outside location, six to eight feet inside of the sideline, requires that the middle blocker align relative to the hitter, rather than adjacent to the outside blocker. In this area, the middle blocker generally arrives at the point of attack sooner than the outside blocker. Alignment adjacent to the outside blocker prevents the outside blocker from positioning in front of the spiker's hitting shoulder. The blockers essentially move past the point of attack, allowing an excessive cross-court opening.

The middle blocker, rather than aligning adjacent to the outside blocker, aligns opposite the hitter's cross-court attack. The outside blocking arm is aligned inside of the spiker's hitting shoulder. The outside blocker moves adjacent to the middle blocker to block in unison.

The Blocking Action

Throughout the blocking action, the attention of the blocker is focused on the attacker's jump and arm-swing. The attention does not return to the ball. Cues regarding

the nature and direction of the attack are gained from the spiker's actions, not the flight of the ball.

The blocker times the jump relative to the jump of the spiker. The blocker's timing is affected by the jumping ability of the blocker. A strong jumping blocker may jump earlier than one with weak jumping ability. In addition, the timing of the blocking jump varies according to the distance the ball is set from the net.

The blocking jump is timed so that the hands are placed at maximum height and penetration as the ball approaches the net area. Blocking against typical sets, those located two to five feet from the net, the player jumps slightly after the attacker jumps. On tight sets, those within one to two feet of the net, the blocker jumps as the attacker jumps. On deep sets, those five feet or more from the net, the blocker jumps respectively later than the hitter (the deeper the set, the later the jump of the blocker).

The blocker jumps from a knee angle of 90 to 110 degrees, depending on the strength of the player. As the legs extend and the body elevates, the arms are thrust above and across the net. The thrust of the arms and hands is one movement (above and across), not two separate movements (up and then across).

Movement up and then across places the arms and hands more than one ball's width distant from the net. Such a placement allows blocked balls to be deflected down the

blocker's side of the net. At no time should the distance between the net and the arms and hands be greater than the width of the ball, approximately eight inches.

Upon clearing the level of the net, the blocker's hands are turned inward and downward toward the center of the opponent's deep court. Balls hitting the arms and angled hands are deflected back into the opponent's court area, rather than out of bounds. Extending the outside blocking arm slightly farther across the net than the inside arm also turns the hands and arms inward toward the opponent's court area. At no time should the blocker's shoulders, arms, or hands face the hitter or the sideline area.

Contact with the Ball

From the time the hands clear the net and penetrate the opponent's court space, the hands are separated no greater than the width of the ball, approximately eight inches. Greater separation often occurs as the arms and hands extend upward. Especially vulnerable are arm elevation patterns in which the arms are brought upward through a lateral arc. Until the final instant when the hands arrive in position, the circular motion creates a space through which the ball may travel to an undefended court area.

The fingers are spread and tensed. The hands should cover the greatest possible net area, while maintaining optimum strength. Spreading the fingers maximally provides the greatest coverage and the least strength. Separating

the fingers minimally provides the least coverage and the greatest strength. A separation between the fingers of approximately one inch provides a balance of strength and coverage.

Follow-Through

The blocker hangs in the air and sustains the blocking penetration as long as possible. As the body begins descent, the arms are brought to vertical. Failure to return the hands directly to vertical could result in a net contact foul.

The blocker lands and gains balance, contracting the leg extensor muscles eccentrically. Upon gaining balance, the player pivots in the direction of the ball flight and locates the ball. The player then moves to prepare for the next action.

Key Teaching Points

Initial Position

1. Blockers move to their initial positions prior to the opponent's pass.
2. Blockers are near the net (within one to two feet).

Initial Posture

1. The feet are shoulder width apart, perpendicular to the net.
2. The legs are bent at the knees approximately 30 to 45 degrees.

3. The hands are held at shoulder height, open and firm.

4. The hands are held near the net (within 8 to 12 inches).

Movement to Alignment, Outside Blockers

1. Alignment of outside blockers utilizes slide-step footwork movement patterns.

2. The hips and shoulders remain parallel to the net.

3. The hands remain at shoulder height, held within 8 to 12 inches of the net.

Alignment of Outside Blockers

1. Once the ball is set and throughout the alignment, the blockers' focus is on the path of the attacker's approach and jump, not the ball.

2. On typical sets (two to four feet from the net), the outside blocking shoulder is across or slightly inside of the hitting shoulder of the attacker.

3. On tight sets (less than two feet from the net), the sternum of the blocker is directly across from the hitting shoulder of the attacker.

4. On deep sets (five feet from the net or more), the outside blocking shoulder is respectively more inside the hitting shoulder of the attacker (the deeper the set, the more inside the blocker alignment).

Movement to Alignment, Middle Blockers

1. Throughout the movement to alignment, the blockers' focus is on the attacker's approach and jump, not the ball.

2. Alignments at or near the middle-net area (movements of zero to eight feet) utilize slide-step footwork patterns:

- (a) the hips and shoulders remain parallel to the net and
- (b) the hands remain at shoulder height, held within 8 to 12 inches of the net.

3. Alignments toward the outside of the court (movements of greater than eight feet) require the use of a three-step crossover pattern:

- (a) a long step is taken with the foot nearest the point of attack (lead foot), followed by the trail foot and then the replacement of the lead foot);
- (b) the hips open to face the direction of movement;
- (c) the shoulders remain as near parallel to the net (within 30 to 45 degrees) as possible;
- (d) the placement of the last foot near the net rotates the hips and shoulders back to a position parallel to the net; and
- (e) the hands remain at shoulder height, the outside hand (nearest the point of attack)

particularly is held near the net (within 8 to 12 inches).

Alignment of Middle Blockers

1. Prior to the setter receiving the pass, the middle blocker aligns opposite the opposing attacker first threatening the middle net area.

2. As the setter delivers the ball, the middle blocker moves in the direction of the set, aligning adjacent to the outside blocker on outside sets.

3. Defending an attack inside of the typical outside position (five to eight feet from the sideline), the blocker aligns inside the attacker's hitting shoulder, blocking the cross-court area, allowing the outside blocker to close.

The Blocking Action

1. Throughout the blocking action, the blockers' focus is on the attacker's jump and arm-swing, not the ball.

2. On tight sets (one to two feet), the blocker jumps as the attacker jumps.

3. On sets two to five feet, the blocker jumps slightly after the attacker jumps.

4. On deep sets (five feet or more), the blocker jumps respectively later than the jump of the attacker (the deeper the set, the later the jump).

5. The hands are thrust above and across the net in one motion (above and across), not two separate movements (up and then across).

6. At no time is the distance between the hands/arms and the net greater than the width of the ball (approximately 8 to 12 inches).

7. Upon clearing the level of the net, the blocker's hands are turned inward and downward toward the center of the opponent's deep court.

Contact with the Ball

1. The hands remain separated no more than the width of the ball (eight inches).

2. The fingers are separated to cover the maximum area possible, while retaining the strength to deflect the ball.

3. The hands are tensed and firm.

Follow-Through

1. The blocker hangs in the air and sustains the blocking penetration as long as possible.

2. As the body begins descent, the arms and torso are brought directly back away from the net to a near vertical position.

3. After the blocker lands and gains balance, the player turns in the direction of the ball and prepares for the next play.

PART 6
INDIVIDUAL DEFENSE

INDIVIDUAL DEFENSE

Description of the Skill

The second line of defense against opposing spikes is the backcourt defense. Backcourt defense consists of the non-blocking players positioned relative to team design and blocking alignments. Its purpose is to receive and pass spikes that elude the blockers, controlling the ball so that an offensive counterattack results. Individual defensive play, often called a dig, is the backcourt act of receiving a spiked ball.

Individual defensive play is generally executed using the forearms in a similar manner to the basic forearm pass. Because the velocity of a spike is greater than that of most serves and volleys, individual defensive play modifies the basic forearm-passing technique in order that much of the velocity of the spike is absorbed. Failure to absorb the velocity of the spike results in the ball being rebounded back across the net or out of bounds.

Initial Posture

Due to the high velocity of the spiked ball, individual defensive players have little movement time to retrieve the ball once it has been spiked. Therefore, defensive players' attention is focused on the spiker and the hitter-blocker configuration. Player positioning occurs during the attacker's approach and jump. Backcourt defensive players

align relative to the hitter-blocker configuration in accordance to the defensive scheme employed.

Some defensive players are positioned directly in line with unblocked attack lanes, that is, those outside the hitter-blocker configuration. Players positioned directly in line with spikes have little time for movement due to the high velocity of most spikes and increase their response time by playing the ball closer to the floor. Therefore, a lower initial posture is required.

Other players are positioned behind the block, that is, in line with the hitter-blocker configuration. Players positioned behind the block are generally responsible for balls deflected by the block and those hit over the blockers' hands toward the deep court. Therefore, a higher initial posture, one facilitating greater mobility, is maintained.

1. Player positioning occurs during the pass and the set.
2. Player posture during the attack should be balanced and stable.
3. Players' focus of attention is on the attacker's approach, jump, arm-swing, and positional relationship to the blockers, not the ball.
4. Players positioned behind the block are in a medium body posture, with the feet spread slightly more than shoulder width. Players directly in line with the attack

are in a low body posture, with the feet spread wider than shoulder width; the lower the body the wider are spread the feet.

5. The right foot is slightly in front of the left.
6. The weight distribution is forward on the balls of the feet.
7. The hips and shoulders are facing the attack.
8. The passing platform is tilted toward the target area.
9. The back is straight, the torso slightly forward (bent forward 0 to 15 degrees at the waist).
10. The arms are extended from the body approximately 45 degrees from vertical.
11. The elbows are bent 15 to 30 degrees.
12. The hands are as follows:
 - (a) open, with fingers spread comfortably, curved slightly, and relaxed, or
 - (b) non-dominant hand loosely forming a fist, dominant hand open and relaxed.
13. The hands are separated approximately 6 to 12 inches.

The Digging Action

The digging action is designed to absorb ball momentum while directing the ball to the target area of the court. Movement out from the body to meet the ball adds impetus to

the ball rebound. Movements back toward the body absorb and reduce ball impetus.

Alignment to the target area occurs before, not during, the reception. Movement of the body or arms toward the target area is transferred to the ball and increases, rather than absorbs, rebound impetus.

1. During the attack, movement occurs in reaction to the actual, not the anticipated, flight of the ball.

2. Initial reaction is movement of the arms toward the flight of the ball.

3. Secondary, though near simultaneous, reaction is movement of the body toward the flight of the ball.

4. The body lowers the arms to the height of the ball intercept by bending at the knees, rather than at the waist.

5. As the ball is neared, the hands are joined as follows:

(a) fingers slightly curved and loosely interlaced
or

(b) non-dominant hand loosely forming a fist, the
dominant hand wrapping the fist.

6. As the ball nears contact, the arms are straightened at the elbow, absorbing a portion of the force of the ball.

7. Contact occurs on the flat area of the forearms above the wrists and below the bulge of the forearm muscles, approximately two inches above the wrist bone.

8. The platform remains tilted toward the target area at contact.

9. The platform is approximately 30 to 45 degrees from vertical at contact, depending on the velocity of the attack and the amount of absorption required.

Analysis of the Skill

Relative to pass location and player alignment, the offense has available a number of options which the defense must counteract. Defensive schemes are designed to defend against various offensive options by placing blockers and backcourt defenders in the path of those options available to the offense in anticipated situations. Within any given situation, each backcourt defender has responsibility for alignment and coverage of specific attack options.

Defensive schemes align blockers relative to the hitter's position and attack options. Backcourt players are aligned relative to the hitter-blocker configuration, which is the hitter's position relative to the position of the blockers. Alignment occurs as the offensive situation develops, that is, as the ball travels from passer to setter or is airborne between setter and spiker.

Backcourt individual defensive technique differs from the forearm-passing techniques used to receive serves and volleys. This is due to the greater velocity of the spiked ball. High-velocity spikes allow the defensive players little time for movement in pursuit of the ball. They also

require the defender to absorb much of the momentum of the spiked ball in order to control and keep the ball in play.

Initial Posture

The high velocity of the spiked ball allows the defensive player little time to respond. The backcourt defensive player must be in or near position before the spiker attacks the ball. Watching the ball in flight provides the defender little indication of the hitter's options or intent. Reading the approach and body posture of the spiker gives the defender cues as to the intended direction of the attack. Reading the hitter-blocker configuration gives the defender cues as to the possible court location of the attack options for which the player is responsible.

The backcourt defensive player arrives in position prior to ball contact by the attacker. The posture of the defensive player is balanced and stable. Movement by the defender during the attack limits the defender's response in any other direction. It is more advantageous to be out of position and balanced than to be nearer to the correct position, yet still moving. But the most advantageous is to be in the correct position and balanced during the attack.

Backcourt players positioned behind the blocker-hitter configuration maintain a medium-high posture similar to that used in serve reception, one which facilitates mobility. Balls for which this player is responsible are hit over or

deflected off of the block. The defender behind the block, unlike the player directly in line with the spike, has more time to pursue the ball and execute the pass than the player directly in line with the spike.

The velocity of the spiked ball generally does not allow the player directly in line with the spiker, and not behind the block, time to recover and move in another direction. The backcourt defender gains time by playing the ball later in its trajectory, as it is closer to the floor. Movement time being limited, the defender has little opportunity to lower the body during the flight of the spiked ball. The player should arrive at the defensive position in a low posture, with the feet spread wider than in service reception posture.

As is common to other forearm reception techniques, the right foot is forward. It is more efficient to learn the execution of one stance than multiple stances. The hips and shoulders are square to the point of attack. The passing platform is tilted toward the target area before the attack occurs. The ball is directed by the tilt of the platform.

Some defensive postures place the arms initially near the body, a placement that enhances mobility. The arms then extend to meet the ball during the dig. The movement of the arms toward the ball provides impetus to the rebound, impetus which must be counteracted by some other body movement, such as a forward thrust of the hips and arch of

the back. Control of the dig becomes more complex as more and larger body segments are engaged.

A more efficient means of absorbing and controlling the momentum of the ball involves movement of the forearms in the direction of the spike, back toward the body. An initial posture is taken, with the arms at approximately the same angle as that of serve reception. The elbows, however, are bent 15 to 30 degrees, rather than straight.

The Digging Action

Unlike the forearm-pass reception of a serve or volley, the initial movement toward the point of ball intersect during the dig is made with the arms, rather than the body. With movement time limited due to the velocity of the spiked ball, the quickest means to the point of ball intersect is with the arms. Early presentation of the arms is also a critical factor in the player's ability to absorb, control, and direct the dig. Movement of the body follows the movement of the arms.

As the passing platform is placed in the path of the ball, body movement to the ball elevates or lowers the body and platform to the level at which the ball is to be contacted. The raising and lowering of the platform is accomplished by bending the legs at the ankles, knees, and hips, rather than lowering the torso by bending at the waist. Bending at the waist imparts positive or negative

force to the contact and changes the angle of alignment of the platform.

The platform and body should be motionless at the intersect point prior to contact. Any movement at the point of contact is transferred to the ball and affects both the impulse and direction of the contact.

As contact with the ball occurs, the arms are straightened at the elbows, moving the passing platform in line with and in the direction of the flight of the ball. Thus, momentum of the ball is absorbed by the movement of the platform, and the rebound of the ball is lessened. Further absorption, if needed, is gained by starting with the arms slightly higher and moving the arms back to the desired passing angle during the passing action. Care must be taken that the arm angle at contact remains 30 to 45 degrees and is not closer to vertical, resulting in a low pass with excessive horizontal velocity.

Key Teaching Points

Initial Posture

1. Player positioning occurs during the pass and the set.
2. Player posture during the attack should be balanced and stable.
3. Players' focus of attention is on the attacker's approach, jump, arm-swing, and positional relationship to the blockers, not the ball.

4. Players' feet are spread slightly more than shoulder width.
5. The weight distribution is forward on the balls of the feet.
6. The hips and shoulders are facing the attack.
7. The arms are extended from the body approximately 45 degrees from vertical.
8. The elbows are bent 15 to 30 degrees.
9. The hands are separated approximately 6 to 12 inches.

The Digging Action

1. During the attack, movement occurs in reaction to the actual, not the anticipated, flight of the ball.
2. Initial reaction is movement of the arms toward the flight of the ball.
3. Secondary, though near simultaneous, reaction is movement of the body toward the flight of the ball.
4. The body lowers the arms to the height of the ball intercept by bending at the knees, rather than at the waist.
5. As the ball nears contact, the hands are joined, and the arms are straightened at the elbows, absorbing a portion of the force of the ball.
6. The platform remains tilted toward the target area during contact.

7. The platform is approximately 30 to 45 degrees from vertical at contact, depending on the velocity of the attack and the amount of absorption required.

CHAPTER 5

Summary and Recommendations

Summary

Since its advent in 1895, the sport of volleyball has spread across the nation and throughout the world. It is played at all levels from informal recreation to high-level competition. Elite competition is held both nationally and internationally.

Volleyball is played by both men and women, with coeducational play being common. It is played by both the young and the old. It is a sport that addresses many of the objectives of lifetime sporting endeavors. Because of these attributes, volleyball is a common activity offered in programs of physical education.

Physical education includes the sport of volleyball in many different settings. Recreational offerings often include volleyball, both in informal and organized recreational settings. Leagues, tournaments, and drop-in play are found throughout the United States for both youth and adults.

Physical education, through interscholastic and intercollegiate sports, has a strong connection with volleyball competition. In addition to co-sponsoring athletic competitions, physical education is the training ground for many volleyball coaches. For many competitive

volleyball athletes, the initial exposure of volleyball skill development is in the realm of physical education activities and athletics.

Volleyball is a primary offering of physical education activity and instructional programs. Programs provide students of physical education the opportunity to participate in volleyball and the instruction to bring about successful participation. Physical education has the opportunity to develop in students the skills and interest to pursue continued activity in volleyball beyond the educational setting.

In order to effect many of the objectives of physical education, physical educators and coaches must be professionally knowledgeable in the movement patterns which comprise the skills and techniques of volleyball. Much information exists for instruction and for the preparation of teachers and coaches regarding the methods of how to teach. There is much less contemporary material available regarding the content of what is to be taught. Much of that which is contemporary and available is lacking in detail and directed at the training of high-level competitive volleyball teams. Amongst the existing material, there is a great deal of diversity and little consensus regarding what movement patterns comprise the most effective volleyball techniques.

There exists in physical education and athletics the need for resource materials oriented toward the content of what movements are to be taught regarding volleyball techniques. The materials should be directed toward instruction of volleyball skills and in the preparation of those teaching and coaching the sport of volleyball. The product of this project is the presentation of a biomechanical model of volleyball techniques to be used by instructors of physical education and coaches of non-elite-level competition.

The model presented is a compilation of that presented in the scientific research, that which is common to much of the experience-based literature and that which lies within qualitative biomechanical principles. The movement patterns presented are those which efficiently and effectively result in positive outcomes for learners of volleyball in the various physical education settings. The movement patterns which execute the serve, forearm pass, overhead set, spike, block, and individual defense are described and analyzed. The user is presented with the knowledge of what movement patterns to teach and learn, as well as an understanding of why those movements are effective.

Recommendations

Illustrations

The presentation of the model is a resource to the teaching and learning process. It equips the user with the

understanding of what is to be taught and learned. It offers a model against which to compare observed student movements. Observed movements deviating from the model are then corrected so that actual learner movements coincide with the model.

A need exists for the presentation of the model of volleyball techniques to be illustrated either through human drawings or photographic sequences, or a combination of both. Words are limited in representing human movement. The lack of illustration hinders the conveyance of the model to the mind of the user and the comparison of the model to the observed movement patterns exhibited by the learner.

The ideal presentation of the model is in the form of a holograph. The holograph is superimposed over actual movements of the learner. Deviations of movement from the holograph are readily observed. Through filming, the deviation could also be observed by the learner. The development and implementation of such technology would enhance the value of the model and further the teaching and learning process.

Methodology

A further step in the teaching and learning process is to advance the methodology of how skills are to be learned. The need exists for teaching progressions which isolate the variables of the movement pattern to be learned. The learning of each variable provides the basis for the

learning of the next, more complex, step in the movement pattern of the technique. Learning experiences, or drills, are needed which progress the learning environment from highly controlled to the complex conditions of actual game play. In such an environment, instruction and progress are highly individual within the context of group learning experiences.

Models of Advanced Techniques

The learning of basic techniques serves as the basis for the learning and execution of more advanced skills. Learning effective volleyball skills allows the learner to progress to higher levels of volleyball play. At higher levels, the learner will encounter strategies that require advanced variations of the basic skills. The biomechanical model of volleyball techniques needs to be expanded to include the advanced variations and highly specific techniques employed at the higher levels of competition.

Skills at advanced levels are specific to the objective of the offensive or defensive strategy employed. In addition to technique models, needed is a presentation of strategies that require variations of the fundamental techniques.

Quantitative Analysis

The technique models presented represent movement patterns of volleyball skills. The field of qualitative biomechanical analysis uses such a model in comparison of

observed movements exhibited by actual performers. Further work is needed in quantifying the deviations observed through use of such tools as cinematography and digitizing.

Much could be done in the area of quantitative biomechanical analysis. Research testing the model and measuring the results of the preferred movements would allow more specific information regarding initial joint angles, movement sequences, and resultant accelerations of body segments. Tools, such as force platforms used in conjunction with cinematography, electromyography, and digitizing, exist for quantitative analysis.

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