Concepts of Athletic Training

FOURTH EDITION

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Concepts of Athletic Training

Fourth Edition

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Preface

As with the previous editions of this text, the underlying theme continues to be that coaches are the personnel who most often see a sport-related injury first. Although more NATABOC-certified athletic trainers currently are employed in high schools than at any time in history, the fact remains that the majority of high schools in the United States do not employ such personnel on a full-time basis. Therefore, coaches continue to be the primary providers of emergency care to injured athletes. As such, it is critical that coaches obtain training in the immediate care, recognition, and management of sports-related injuries. Because many sports injuries are unique in the problems they pose (e.g., dealing with the helmet, face mask, and mouth guard in tackle football), it is imperative that emergency care training be specific to sports. The fourth edition of *Concepts of Athletic Training* has undergone extensive revision in order to present future coaches as well as athletic training students with the most current information on the wide range of topics presented throughout the text.

New to the Fourth Edition

The fourth edition represents the end result of over a decade of evolution and revision of the previous editions to better serve a dynamic, changing market. Today undergraduate students in a wide array of academic programs will find this text to be an essential component in their professional preparation. Thirty years ago the vast majority of undergraduate students majoring in K–12 physical education, coaching, health education, and athletic training were typically housed in departments of health, physical education, and recreation. However, each of these fields of study has continued to evolve and expand, so that today many have their own distinct academic departments and are housed in schools, or even colleges, under a variety of names, such as health and human performance, human movement studies, and kinesiology, to name just a few. In spite of this diversity, virtually all of these fields of study require their students to receive special instruction in the care and prevention of sport- and activity-related injury. Physical educators, coaches, and, of course, student athletic trainers all need to have a foundational course in the field of athletic training. That continues to be the purpose of this text—to provide an overview to assist these future professionals in making the correct decisions when confronted with an activity-related injury or illness in their scope of practice.

As with previous editions, a number of changes have been made in this edition in order to present the student with the most current information available. These include the following:

- Updated material on the incidence of sports injuries in the pediatric age group (Chapter 1).
- New information on the etiology of overuse injuries (Chapter 1).
- Updated material describing current recommendations regarding the athletic health care team, as well as new material from the ACSM's Team Physician Consensus Statement (Chapter 2).
- An introduction to the recently passed federal regulations known as the Health Insurance Portability and Accountability Act (HIPAA) as they relate to sports injuries (Chapter 3).
- Updated information on state regulation of athletic training (Chapter 3).
- Recently completed research on the psychological impact of sports injuries on adolescents, as well as updated material on eating disorders in athletes (Chapter 5).
- A new section on supplements, since many athletes are turning to ergogenic aids in an effort to improve their performance (Chapter 6).
- Extensive added material regarding the development and implementation of the emergency plan (Chapter 7).
- Updated information on the epidemiology of head injury, along with a new "evidence-based" classification system for cerebral concussion (Chapter 9).
- New information regarding the incidence of catastrophic injuries (Chapter 9).
- Updated information on exertional heat illnesses (Chapter 18).
- NATA's position statement on exertional heat illnesses (Appendix 3).

Technology Integration

As with the third edition, information directing the reader to web sites providing additional information is given at the beginning of each chapter. The links found on **http://health.jbpub.com/athletictraining** provide additional information to the chapter content and encourage students to become more proficient in using the web as a learning resource.

The updated and improved online **Instructor's ToolKit** includes an instructor's manual, computerized test bank, and a full **PowerPoint** presentation with more than 200 slides. These slides make transitioning to the fourth edition easier, ensuring that you and your students get the most out of this text. They can be used in classrooms that have computers interfaced with LCD projectors, or can be printed directly onto overhead transparencies for use in any classroom environment.

Features

- **What If?** features are "real life" scenarios that encourage students to work on critical decision-making skills. These sections provide the sort of information typically available to coaching personnel when confronted with an injury-related problem. These scenarios can have many applications, such as simple decision-making practice sessions alone or with another student or, ideally, as the script for role-play exercises in a sports-injury class laboratory practice session.
- **Time Out** boxes provide additional information related to the text, such as NATA Athletic Helmet Removal Guidelines and OSHA Guidelines for Preventing the Transmission of HIV and HBV.
- **Athletic Trainers Speak Out** boxes feature a different athletic trainer in every chapter who discusses an element of athlete care and injury prevention.
- All relevant chapters begin with an **Anatomy Review** to introduce body parts to students unfamiliar with anatomy and provide a refresher for students who have had anatomy.

Conclusion

This book represents an outstanding resource for students studying to become physical education teachers, coaches, and athletic trainers. Personnel charged with the responsibility of providing emergency care for athletes must be trained in the first aid procedures appropriate for sports injuries. The content of this text, the accompanying Instructor's ToolKit CD-ROM, and **http://health.jbpub.com/athletictraining** will provide instructors and students with a wealth of information on topics related to the care and prevention of sports injuries. The goal, of course, is to give coaching and teaching personnel the necessary knowledge and critical thinking skills to recognize and differentiate minor from more serious sports injuries. Once decisions are made regarding the nature of the injury, appropriate first aid care and/or medical referral can be instituted.

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CAVALIERS
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Brief Contents

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1

The Concept of Sports Injury

MAJOR CONCEPTS

After reading and studying this chapter, the reader should be familiar with the scope and breadth of the topic of sports injury. The chapter presents the most recent data available in order to provide a quantitative perspective on the number of participants injured while engaging in sport activities. It discusses the most popular definitions of sports injury currently in use, along with a variety of the most commonly used medical terms related to the type and severity of injury. These terms will be used throughout the remainder of the book and will also prove useful to the coach when communicating with members of the medical community about sports injuries. The last section of the chapter introduces the concept of epidemiology as it applies to the study of sports injury.

The web site for this book offers many useful tools and is a great source for supplementary information for both students and instructors.

Visit the site at
http://health.jbpub.com/athletictraining
to link to the following organizations and sites:

- National Collegiate Athletic Association
- Consumer Product Safety Commission

Organized competitive high school sports continue to be extremely popular among American children. Recent research indicates that approximately 6.7 million public school children are involved in these activities annually (NFSH, 2003). Along with modest growth in high school sports programs, there has been massive growth in the number of adolescent and pediatric-aged children playing sports. As a result of community-based programs, a total of approximately 30 million school-aged children are involved in sports within the United States (Adirim & Cheng, 2003).

With the implementation of the Title IX Education Assistance Act of 1972, growth in the participation of female athletes within the United States has been at 700% (Stanitski, 1989). Ironically, due to unfounded fears within both the lay and coaching communities that girls were not tough enough to play sports, many young female athletes were historically discouraged from participation. Even more disturbing is the fact that such negative stereotypes still persist within some sports organizations. Fortunately, researchers have produced data demonstrating clearly that, with few exceptions, injuries to female participants are sport specific (Figure 1.1), not gender specific (Collins, 1987). These data support the premise that, overall, females are at no greater risk for injury when involved in organized activities than are their male counterparts (Figure 1.2).

In recent years, sports-injury researchers have determined that certain types of knee injuries, specifically, those involving the anterior cruciate ligament (ACL), occur more frequently in female high school athletes in two sports—basketball and soccer—than in males in the same sports (Powell & Barber-Foss, 1999). It is interesting to note that this same trend has been found at the collegiate level. Recent research conducted by the National Collegiate Athletic Association (NCAA) via the Injury Surveillance System found the following results: Female basketball players injured their ACLs seven times more often than males during practice and five times more often than their male counterparts in games (NCAA, 1999). The majority of these ACL injuries are classified as noncontact; that is, they do not occur as a result of a collision with an opponent or inanimate object. Rather, noncontact ACL injuries are related to sports that involve rapid directional changes or deceleration when running, or repeated jumping and landing. Research is ongoing in regard to understanding the precise causative factors, as well as how to prevent such injuries from occurring (Griffin et al., 2000).

FIGURE 1.1 Data clearly indicate that injuries to female athletes are sport specific.

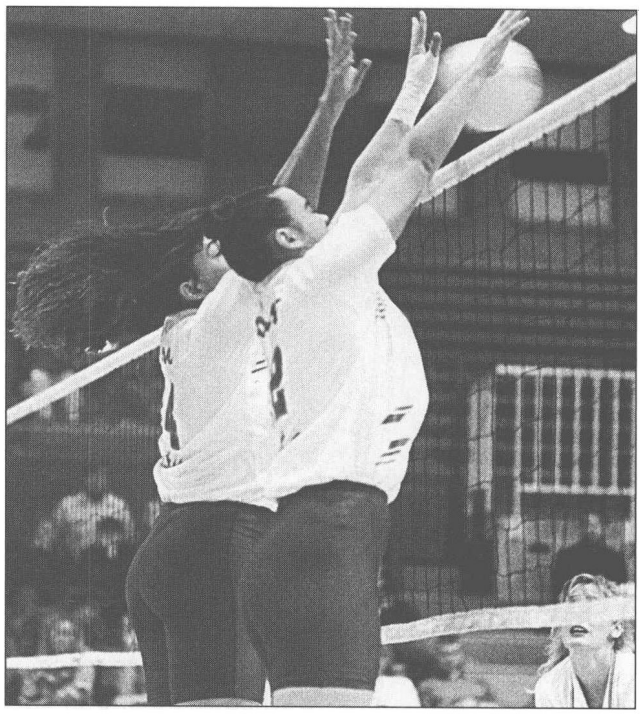

FIGURE 1.2 Females are at no greater risk for injury when involved in sports than are their male counterparts.

In spite of the best efforts of parents, coaches, and officials, **injury** continues to be an unavoidable reality for a significant number of participants. To date, two large-scale, comprehensive studies of injuries among high school–aged athletes have been completed, and their findings support the premise that injuries are a constant problem associated with sports participation (NATA, 1989; Powell & Barber-Foss, 1999).

Results from a National High School Injury Survey (1995–97) sponsored by the National Athletic Trainers'

Association (NATA) found that national injury rates have remained close to those documented by Powell for the 3-year period from 1986 to 1988. For example, the more recent data compared to the 1986–88 data indicate that in sports such as football and basketball (boys and girls) the proportion of minor, moderate, and major injuries was similar (Powell, 1987). In a similar study of high school injuries in the state of Pennsylvania, Grollman and associates (1996) found overall 3069 reportable injuries from 10 sports (boys and girls) across 40 high schools for the 1994–95 school year. The sport with the highest percentage of injuries was tackle football (46.7%), followed by boys' basketball (10%) and wrestling (9.68%). The sport producing the highest percentage of injuries for girls was basketball (7.5%).

Research looking at a broader age distribution was conducted by Damore and colleagues (2003), who studied emergency department admissions of patients ranging in age from 5 to 21 years at four hospitals for two 1-month periods (October 1999 and April 2000). They recorded a total of 1421 injuries within a group of 1275 patients within the age range of their study. Of these injuries, 41% were attributed to sports participation. The average age for such patients in their study was 12.2 years, with sprains, contusions, and fractures being the most common injuries. Males sustained more injuries (62%) to the musculoskeletal system than did their female counterparts.

Radelet and colleagues (2002) studied injuries in a population of children (1659) involved in community sports programs over the course of 2 years. Specifically, they monitored the injuries in children ranging in age from 7 to 13 years who were involved in baseball, softball, soccer, and football. An injury was defined as "requiring on-field evaluation by coaching staff, or causing a player to stop participation for any period of time, or requiring first aid during an event." They further defined an "athlete exposure" as one athlete participating in one event (game or practice). Their results, expressed as the rate of injury per 100 athlete exposures, were that soccer had the highest rate at 2.1 injuries, followed by baseball at 1.7, football at 1.5, and softball at 1.0. In all sports, there were more injuries in games than in practices, with contusions being the most common injury overall. It is also interesting to note that in soccer, there were no gender differences in injury rates.

Definition of Sports Injury

Though logic would seem to argue that determining what constitutes a sports injury would be simple, just the opposite is the case. In spite of the efforts of many within the sports medicine community, a single, universally acceptable definition of sports injury remains unavailable. Debates about precise definitions among academicians may seem petty to the injured athlete; however, from a clinical and scientific viewpoint, having a standard set of definitions would greatly improve the usefulness and impact of future injury studies.

Most current definitions of sports injury incorporate the length of time away from participation (time lost) as the major determinant (DeLee & Farney, 1992). Using this definition, an injury is said to have occurred when an athlete is forced to discontinue play and/or practice for a predetermined length of time—for example, 24 hours. In 1982 the NCAA established the Injury Surveillance System (ISS), which established a common set of injury and risk definitions for use in tracking collegiate sport injuries. To qualify as an injury under the ISS, that injury must meet the following criteria:

1. Occurs as a result of participation in an organized intercollegiate practice or game
2. Requires medical attention by a team athletic trainer or physician
3. Results in restriction of the student athlete's participation or performance for one or more days beyond the day of injury (Benson, 1995)

The NCAA monitors injuries at Division I, II, and III institutions across all regions of the country and produces an annual report of the findings.

The NATA has commissioned two national surveys of high school sports injuries, each spanning 3-year periods (i.e., 1986–88 and 1995–97). The injury definitions used in the NATA studies are similar to the ISS because they rely on estimates of time lost from play as the indicator of injury severity (Foster, 1996).

Even though time lost is a convenient method for identifying an injury, such a definition does not lend itself to an accurate reflection of the severity of the injury. Severity of injury determinations may be made by a variety of people, including the coach, physicians or other sports medicine personnel, parents, or perhaps even the athlete. A related problem is that no standard is currently in use by all organizations monitoring sports injuries for the amount of time—hours, days, weeks, or months—that must be lost in order to qualify as a specific level of injury severity.

From a scientific standpoint, using the amount of time lost as a definition of sports injury is subject to significant error as previously described, depending on the method of data collection and injury definitions employed. However, once an injury is identified, several qualifiers are available to enable sports medicine personnel to better describe the precise characteristics of the injury. These include the type of tissue(s) involved, injury location, and time frame of the injury, that is, either acute or chronic.

FIGURE 1.3 Acute injury to the hand in baseball.

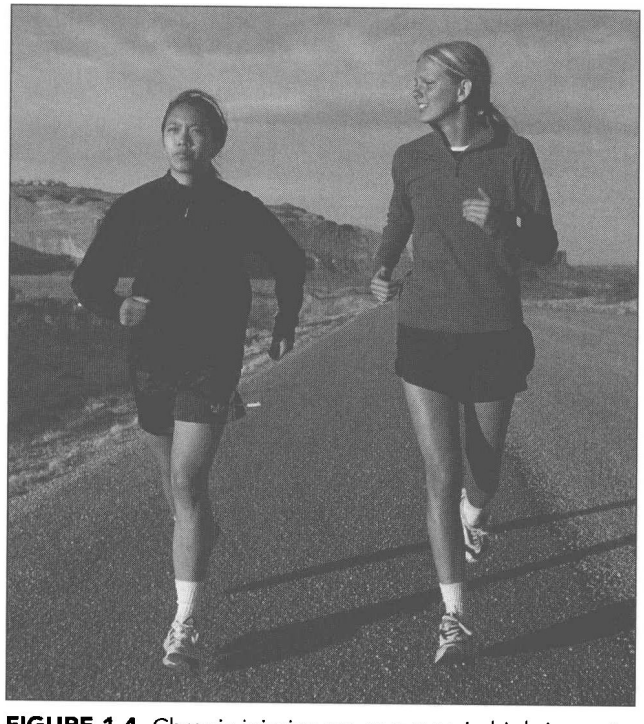

FIGURE 1.4 Chronic injuries are common in high-impact sports such as running.

A commonly used medical classification system for injuries uses two major categories: acute and chronic. **Acute injuries** have been defined as those "characterized by a rapid onset, resulting from a traumatic event" (AAOS, 1991). Acute injuries are usually associated with a significant traumatic event (Figure 1.3), followed immediately by a pattern of signs and symptoms such as pain, swelling, and loss of function. In the case of an acute injury, **critical force** has been defined as the "magnitude of a single force for which the anatomical structure of interest is damaged" (Nigg & Bobbert, 1990). The potential for critical force, and subsequent acute injury, is clearly seen in tackle football. Estimates demonstrate that the vertebral bodies in the human cervical spine have a critical force limit of 340–455 kilograms. Researchers, using devices to simulate a typical tackle, have estimated that compressive forces acting on the cervical spine can exceed these limits (Torg, 1982).

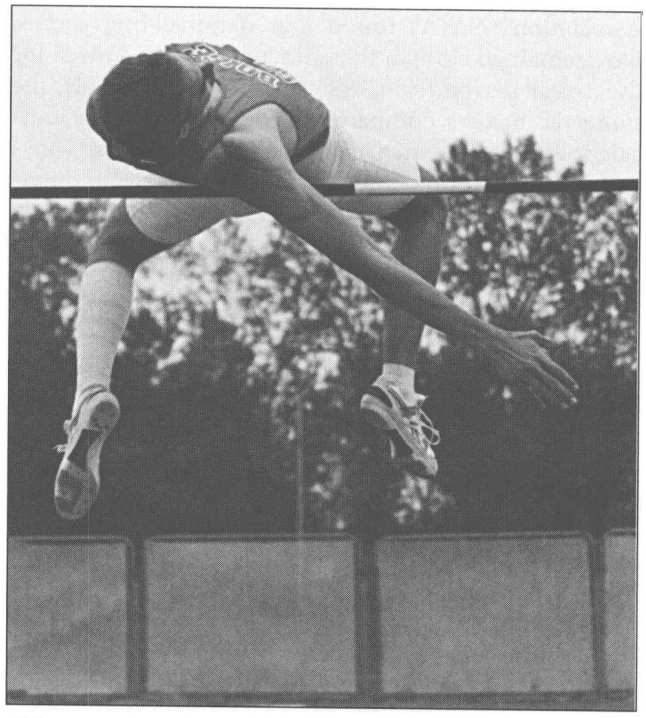

FIGURE 1.5 Injuries to the Achilles tendon are common in track and field events.

Chronic injuries have been defined as those "characterized by a slow, insidious onset, implying a gradual development of structural damage" (AAFP, 1992). Chronic sports injuries, in contrast to acute ones, are not associated with a single traumatic episode; rather, they develop progressively over time. In many cases, they occur to athletes who are involved in activities that require repeated, continuous movements, such as in running (Figure 1.4). Consequently, such injuries are sometimes called overuse injuries, implying the athlete has simply done too many repetitions of the given activity. Overuse injuries in tendons occur when the workload from exercise exceeds the ability of musculotendinous tissues to recover (Hess et al., 1989). Thus, activity serves to cause a progressive breakdown of the tissue, leading eventually to failure.

Common sites for overuse injuries are the Achilles tendon, the patellar tendon, and the rotator cuff tendon in the shoulder (Hess et al., 1989). The Achilles tendon is subjected to tremendous stress during running and jumping (Figure 1.5). Research indicates that these

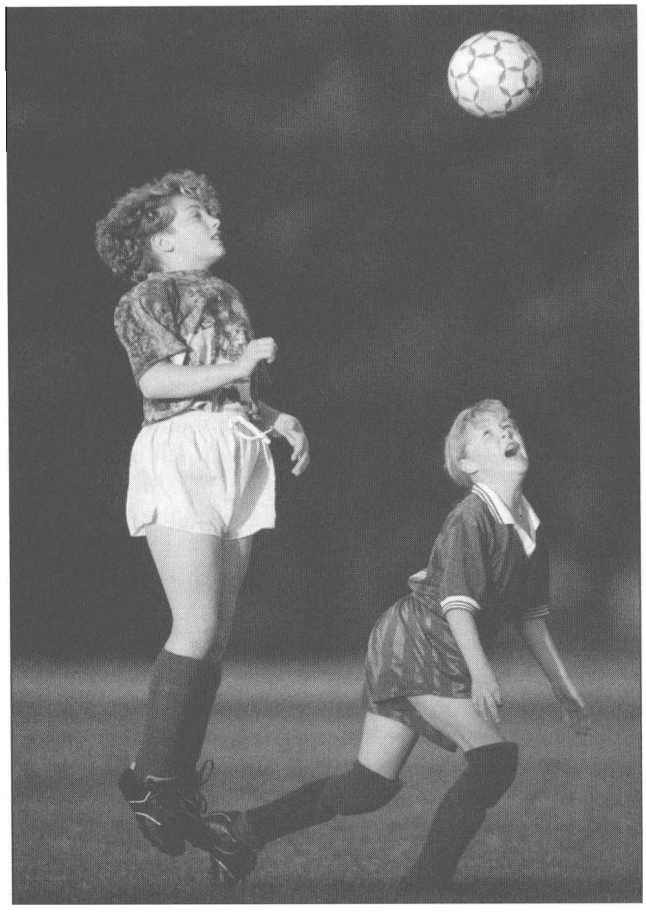

FIGURE 1.6 Jumping and landing, as well as kicking a soccer ball, subject the patellar tendon to stress.

forces may exceed the physiological limits of the tendon, thereby resulting in damage (Curwain & Stanish, 1984). Likewise, the patellar tendon must absorb repeated episodes of stress during sports. For instance, jumping and landing, as well as kicking a soccer ball (Figure 1.6), generate forces within this tendon that are many times greater than those produced during normal gait (Gainor et al., 1978). The rotator cuff tendon, specifically the supraspinatus, is also vulnerable to injury from overuse. Any activity requiring repeated overhead movements of the arm, such as overhead strokes in tennis (Figure 1.7), places significant stress on this tendon. This is especially true during the deceleration phase of a swing or throw, after the arm has reached peak velocity. It is during this period of movement that muscles are undergoing **eccentric contraction,** a type of contraction identified as a causative factor in tendon injury (Curwain & Stanish, 1984). Such stress can cause damage in the supraspinatus tendon, resulting in a chronic injury. A number of factors have been identified as contributing to overuse injuries (Table 1.1).

Probably the most commonly used terms for differentiating tissues involved in a given injury are *soft* and

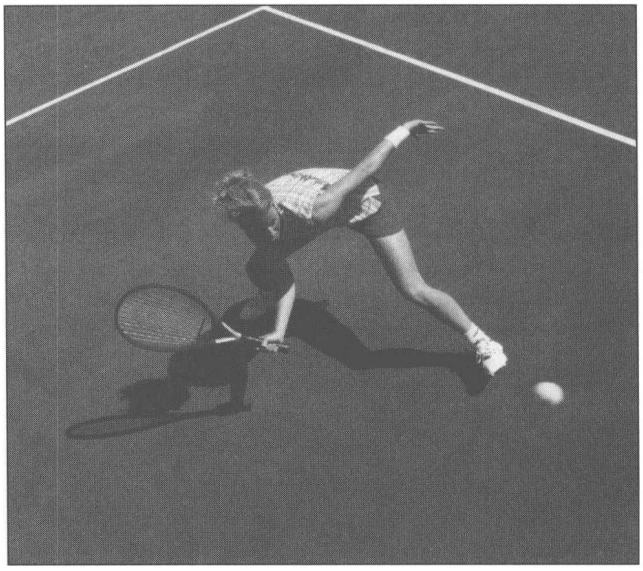

FIGURE 1.7 Tennis places significant stress on the rotator cuff.

TABLE 1.1

FACTORS CONTRIBUTING TO OVERUSE INJURY

Intrinsic Factors

Growth (susceptibility of growth cartilage to repetitive stress, inflexibility, muscle imbalance)
Prior injury
Inadequate conditioning
Anatomic malalignment
Menstrual dysfunction
Psychological factors (maturity level, self-esteem)

Extrinsic Factors

Too-rapid training progression and/or inadequate rest
Inappropriate equipment/footwear
Incorrect sport technique
Uneven or hard surfaces
Adult or peer pressure

Source: Reproduced with permission. DiFiori JP. (1999). Overuse injuries in children and adolescents. *Phys Sportsmed.* 27(1):75–89. © The McGraw-Hill Companies.

skeletal. **Soft tissue,** as a category, includes muscles, **fascia,** tendons, **joint capsules,** ligaments, blood vessels, and nerves. Most soft-tissue injuries involve contusions (bruises), sprains (ligaments/capsules), and strains (muscles/tendons). Skeletal tissue includes any bony structure within the body. Therefore, under this system, a common ankle sprain would qualify as a soft-tissue injury; a fractured wrist would be deemed a skeletal injury. These injuries, and the forces that produce them, are discussed further in Chapter 8.