

## Chapter 4

### SPORTS-INJURY PREVENTION

I. Causative Factors in Injury. Causative factors of sports injuries must be identified before developing a well-planned injury prevention program.

A. Two general categories of causative factors have been proposed.

1. Extrinsic factors include equipment, environment, type of activity, and conditioning errors.

2. Intrinsic factors include athlete's age, gender, body size, injury history, fitness level, muscle strength, skill, and psychological status.

B. A list of common intrinsic risk factors for musculoskeletal injuries is shown in Table 4.1 on page 43.

II. Intervention Strategies

A. It is the responsibility of all members of the sports medicine team to identify causative factors before an injury occurs. Extrinsic factors such as faulty equipment or dangerous facilities are easily recognized. Athletes engaged in high-risk sports must be educated about hazards and prevention strategies.

B. Both the NCAA and the NFSH have developed and implemented guidelines for medical evaluations of student athletes.

1. NCAA guideline 1B requires a preparticipation physical evaluation (PPE) upon entrance into the institution's athletic program. Thereafter, only an updated medical history is required, unless an additional medical examination is warranted based on the updated history. The objectives of the PPE are shown in Table 4.2 on page 44.

2. NFSH policy states that "prior to the first year of participation in interscholastic athletics, a student shall undergo a medical examination and be approved for interscholastic athletic competition by the examining medical authority."

C. The need to develop these guidelines resulted from the dramatic increase in the number of participants and the fact that our society has become more litigious.

1. The primary purpose of a PPE should be to identify preexisting injury risk factors as well as to ascertain any injuries or diseases that represent potential problems for the student athlete.

D. Typically the PPE is administered by a licensed physician, although not all states require a physician conduct the exam.

1. Commonly identified problems include spina bifida occulta, the absence of one of a paired set of organs, as well as postural problems, obesity, high blood pressure, cardiac

defects/disorders, allergies, and skin infections.

2. The two PPE formats are office-based and station-based screening.

a. Station-based screening is useful for evaluating large numbers of athletes. Table 4.3 on page 45 indicates required and optional station-based screening PPEs, and the personnel needed to perform each phase of the screening.

b. Office-based screening works well when the physician is familiar with the athlete's medical history, but it costs more than station-based screening.

c. All information obtained during a physical exam should be handled to protect the athlete's confidentiality.

E. Although many school districts require a PPE annually, increasing health care costs may require an updated physical exam whenever the child begins a new level of competition. A complete physical evaluation should be made by a physician when a child has recovered from a serious injury.

1. The American Academy of Pediatrics (AAP) recommends athletes receive a PPE biannually with an interim "history" prior to any new sports season.

III. Injury Prevention and Preseason Conditioning. Many intrinsic risk factors can be modified with an effective conditioning program. A fit athlete is less likely to suffer an injury.

A. The two primary components of a conditioning program are general conditioning and sports-specific conditioning.

1. General conditioning focuses on aerobic fitness, muscular strength and endurance, flexibility, nutrition, and body composition.

2. Sports-specific conditioning focuses on all aspects of the particular sport that are unique to it.

B. Aerobic Fitness. *Aerobic fitness* or power is the amount of work that can be accomplished using the oxidative system of converting nutrients into energy. Continuous activities that last a minute or longer use aerobic power for muscle energy.

1. Aerobic fitness can help athlete avoid injuries that result from general fatigue.

2. Aerobic fitness can be increased by regular participation in running, bicycling, swimming, cross-country skiing, in-line skating, etc. Athletes who are not participating in an aerobic sport should include aerobic training at least 3 days per week.

C. Muscle Strength, Power, and Endurance. *Muscle strength* can be defined as the maximum amount of force that can be produced in one repetition. *Muscle power* can be defined as the "time rate of performing work". In most cases, muscle power is more important to performance than strength because performance is often time dependent. *Muscle endurance* is defined as the ability to sustain muscle activity. Weight training improves muscle strength, power, and endurance.

1. Different types of weight training involve manipulating training volume, intensity,

frequency. Moderate- to high-intensity training requires 24 to 48 hours for full recovery and to avoid overuse injury.

2. **Periodization** is the process of arranging training around specific goals and objectives with predetermined amounts of time spent training and resting. Periodization tailors the training program to meet the athlete's specific needs and maximize performance.

3. Strength training improves muscle strength, reducing the risk of injury. Connective tissues become stronger, and bone density increases; bone becomes less susceptible to trauma and fracture that can result from overuse. Additionally, strength ratios between opposing muscle groups improves and increased muscular endurance can occur.

4. **Flexibility** is defined as "the range of motion (ROM) in a given joint or combination of joints"; research indicates improved flexibility reduces the incidence of musculoskeletal injuries.

a. Tissue temperature, bone structure, tissue mass, age, and gender all help determine flexibility.

b. Two types of flexibility are static and dynamic flexibility. Static flexibility involves the ROM achieved through passive manipulation of a given joint by another person while muscles are relaxed. Dynamic flexibility is the ROM achieved by contracting muscles around the joint.

c. Stretching exercises improve extensibility of muscle tissue and can prevent muscle strains.

d. The four types of stretching exercises are ballistic, static, proprioceptive neuromuscular facilitation (PNF), and passive stretching. **Ballistic stretching** involves powerful contractions of muscles to force a joint to a greater ROM. **Static stretching** involves moving a joint to a position of stretch that is sustained from 3 seconds or longer. **Proprioceptive neuromuscular facilitation** uses the body's proprioceptive system to stimulate muscles to relax. Passive stretching involves having someone other than the athlete move the joint. Ballistic stretching is the least effective method and not recommended because it may result in injury. Static stretching is probably the most effective stretching method.

5. Nutrition and Body Composition. The body will respond better to any conditioning program when adequate amounts of nutrients are consumed. Coaches, parents, and athletes must take care to avoid an over-emphasis on leanness.

6. Periodization is the "organization of training into a cyclic structure, to attain the optimal development of an athlete's performance capacities." Periodization is achieved by manipulating the frequency, intensity, and duration of exercise and helps prevent training-induced injury. **Hypertrophy** of leg muscles is an example a specific training goal that can be achieved by periodization.

a. Most programs developed around one year training cycle, the *macrocycle*. A *microcycle*, the smallest component of the training cycle, consists of 2 to 4 weeks of specific training. The *mesocycle* consists of several successive microcycles leading

to a specific goal. The *transition phase* is a 2 to 4 week period between training seasons or between successive mesocycles. Table 4.4 describes a periodization model for football linemen.

D. Modification of Extrinsic Factors. Coaching personnel and administrators must monitor these factors to identify and eliminate any potential risks.

1. Practice/ Competition Environment. Whether an activity is outdoors or indoors, the environment must be assessed to determine if it represents a potential health risk, especially when athletes exercise in relatively high heat and humidity.

2. Facilities. All sports facilities must be designed, maintained, and frequently inspected for the safety of participants. For example, integrity of safety fences, batting cages, location of dugouts in baseball/softball, types of bases used, soccer goal construction, location of water and sanitation facilities, and EMS access routes.

a. With respect to indoor facilities, the primary safety concerns involve lighting, playing surfaces, room dimensions, and locker rooms. Medical equipment such as whirlpool baths and other therapeutic modalities should not be available for use in locker rooms.

3. Protective Equipment. Such equipment plays a vital role in prevention of injuries