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"The StairMaster 4000PT serves as an efficacious modality for cardiac rehab—particularly for those patients whose orthopedic conditions would otherwise preclude their involvement in an exercise program."
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"The StairMaster 4000PT is a safe and highly effective form of exercise conditioning for low back pain syndrome patients."
Laurence Bilfield, M.D., clinical instructor of orthopedic surgery, Case Western Reserve University School of Medicine, Cleveland, Ohio

"The StairMaster 4000PT has been an indispensable tool; supervised, proper use challenges the patient (recovering from reconstructive knee surgery) safely with adjustable programs to encourage full knee extension, gait training, and strength training."
K. Donald Shelbourne, M.D., Methodist Sports Medicine Center Indianapolis, Indiana

"Exercising on the StairMaster 4000PT is an orthopedically safe weight-bearing activity that effectively develops lower body musculoskeletal fitness, which is critical to the maintenance of functional mobility in the elderly."
M. Elaine Cress, Ph.D., University of Washington, Department of Medicine, Division of Geriatrics/Gerontology, Seattle, Washington

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Charcot-Marie-Tooth Syndrome

In 1993, I was diagnosed with a hereditary sensory motor neuropathy (Charcot-Marie-Tooth Syndrome). I was an Athletic Training Major at Towson State University and a student member of the National Athletic Trainers’ Association. Obviously, I will not be renewing my membership and I have changed my undergraduate major.

I have a dual major of Molecular Biology and Biochemistry. I hope that I will be a better or at least a more motivated researcher than those I have come across in the CMT Newsletters.

I have a going away request for the readers: If possible, please send me information and/or research on neuropathies (hereditary or otherwise) and active populations. I have not been able to uncover very much exercise physiology data or proactive training methodology, only reactive rehabilitation information.

After next year I will have to put together a major research project and I would like to have access to as much research and information as possible to help with the scientific process.

Information can be forwarded:

John H. McCannon
P.O. Box 1001
Aberdeen, MD 21001

Jaw Pad Removal

I compliment Mr. Feld on his article (Management of the Critically Injured Football Player, JAT, 1993;28: 206–212). I would like to offer an alternative to his suggestion for removal of the jaw pads in the football helmet. When the helmet is properly fitted, the jaw pads are snug against the cheeks, making it difficult to use the twisting motion he describes to unsnap the pads. A flathead screwdriver or a tongue depressor (although, this sometimes breaks easily) can help remove the jaw pads.

I would like to offer an alternative to his suggestion for removal of the jaw pads in the football helmet. When the helmet is properly fitted, the jaw pads are snug against the cheeks, making it difficult to use the twisting motion he describes to unsnap the pads. A flathead screwdriver or a tongue depressor (although, this sometimes breaks easily) can help remove the jaw pads.

Place the screwdriver between the shell of the helmet and the jaw pad and exert a small prying or twisting force against the pad and the shell simultaneously. This will cause the pad to unsnap. You can then slide it out without placing your hand into the helmet.

Using either of these tools can also decrease the risk of moving the head while maintaining cervical spine inline stabilization. This method is a viable alternative to the method suggested by Mr. Feld.

Tamra L. Fuller, MS, ATC
Elmbrook Memorial Hospital
Brookfield East High School
Brookfield, WI 53005

PAC’s, “The Facts”

In a recent letter (JAT, 1993;28:5), Einsig explained how MD and ATC educations were complementary. I also agree that many certified athletic trainers have a desire to promote their professional and educational standing within the allied health professions. Another degree or credential becoming popular among some ATCs is PAC.

PAC is an abbreviation for the credential of Physician Assistant Certified. Physician Assistants practice medicine supervised by licensed physicians. The responsibilities of a physician assistant depend on the practice setting, education, experience, and the state’s laws and regulations. They also depend on the specialty of the physician who supervises the PA. No matter the setting—in clinics, doctors’ offices, hospitals, and more—PAs perform many tasks that have, in the past, been performed by physicians. A physician assistant may: take medical histories, order laboratory tests, determine treatments, give medical advice, counsel patients, perform physical exams, diagnose common illnesses, write prescriptions, assist in surgery, and promote “wellness.”

Therefore, like Einsig’s encouragement of more students and professional athletic trainers to consider obtaining MD, ATC credentials, it is my intention to do the same for PAC, ATC credentials. Not only would this benefit the NATA in the same ways, but would also provide the personal benefit of increased professional opportunities for athletic trainers.

Like the athletic training profession, the physician assistant profession is a relatively young one. The first programs were developed in the late 1960s and early 1970s. Today, there are more than 60 programs accredited by the American Medical Association’s Committee on Allied Health Education and Accreditation. Graduates from all CAHEA programs are eligible to take the national certifying exam. Current employment opportunities are available in all fields of medicine, including primary care, orthopaedic surgery, and others associated with sports medicine. At the present time, there are between eight and ten jobs for every PA with an average salary of around $53,000 per year. The overall salary range is between $25,000 to more than $100,000. The Department of Labor projects an over 50% increase in the number of jobs available between now and the year 2000. Also, the Clinton administration’s health care reform calls for an increase in funding for PA programs and an increase in the use of PAs in health care delivery.

The PAC and ATC educations are also complementary. Like Einsig describes how being an ATC can make you a better medical student, being an ATC can make you a better PA student and give you the same benefits. The structure of the education for PA students is similar to that for medical students, although shorter in length. (The average medical school education is 152 weeks; the average PA education is 102 weeks.) Most accredited programs take 2 years to complete. Some programs offer part-time education so that students who are changing careers can attend
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Athletic Medical Insurance Practices at NCAA Division I Institutions

Scott A. Street, MS, ATC
C. Steven Yates, MEd, ATC
Ellen S. Lavery, MS, ATC
Kevin M. Lavery, MS, ATC

Abstract: As the cost of athletic medical insurance continues to rise, athletic departments are searching for ways to continue to provide quality insurance coverage while keeping costs contained. There are few published articles dealing with the specific topic of the daily operations of maintaining an athletic medical insurance program. We sent an 18-item questionnaire to the 295 active NCAA Division I head athletic trainers to ascertain the current trends in athletic medical insurance. Of these, 207 (70%) responded. Of the respondents, 85% were primarily responsible for the administration of their athletic department’s insurance coverage, although they had received no formal training in insurance management. Most athletic departments carry secondary policies and many report having a deductible. A wide range of insurance coverage and premiums were reported.

Results
Those schools competing in Division I and IAA football had larger athletic training staffs than nonfootball schools or those that competed in Division II or III (Table 2). The athletic training staff had the primary responsibility of gathering information and filing insurance claims in 85% (176/207) of the responding programs. The head athletic trainer was found to be primarily responsible for insurance in 51% (106/207) of the responding programs. The assistant athletic trainer, 17% (35/207), and/or a clerical/secretary assigned to the athletic training staff, 17% (35/207) (Table 3). Others assigned the responsibility of athletic medical insurance included the athletic business manager, the assistant athletic director, or an outside agency, such as the student health service or the university risk manager.

The percentage of the work day required to manage athletic medical insurance was reported as follows (% range): head athletic trainer (15%, 1-60), assistant athletic trainer (25%, 1-60), and secretary/clerical (50%, 10-100).

One question asked about the “formal training,” if any, the respondents had to prepare themselves for the function of handling athletic medical insurance. Although most reported “on the job” experience, the overwhelming response was that there had been no formal education on the subject of purchasing or interpreting the terms or conditions of medical insurance policies (Table 4).
Table 1.—Survey Sent to Respondents

Please complete this survey and return it in the enclosed envelope.

1. What is your NCAA affiliation?
   - Division I
   - Division IAA

2. Does your institution sponsor football?  Yes  No
   If so, at what level?

3. How many total student-athletes are in your athletic program?

4. Of those, how many are scholarship student-athletes?
   - Yes  No

5. Are your institution’s medical policies different for scholarship and nonscholarship athletes?
   - Yes  No

6. How many certified athletic trainers are on staff?
   - Full time ___  Part time ___

7. Who is primarily responsible for the insurance for athletic-related injuries?
   - Head Athletic Trainer
   - Asst. Athletic Trainer
   - Athletic Administrator
   - Business Manager
   - Secretary/Clerical
   - Other (please name)

8. How much, in a percentage, is this a part of the individual’s work time? ___ %

9. Has this person had any formal training in medical insurance policies, claims, etc? If so, please explain.

10. Does your institution have an interest in learning more about athletic injury insurance?
    - Yes  No
    If yes, through: (please mark all appropriate responses)
    - Articles
    - Lectures
    - A special symposium
    - Other

11. What type of insurance does your athletic department subscribe to?
    - Primary
    - Secondary
    - Self-insured
    - Other (please explain)

12. Does this policy have a deductible paid for by the athletic department?
    - No  Yes  Amount $

13. Does your institution’s insurance pay from “first dollar”?  Yes  No

14. Is your yearly premium:
    - $0–$10,000
    - $10,000–$20,000
    - $20,000–$30,000
    - $30,000–$40,000
    - $40,000–$50,000
    - $50,000–$60,000
    - $60,000–$70,000
    - over $70,000

15. Does someone outside the athletic department serve as an administrator?
    - Yes  No
    If so, what are their responsibilities?

16. Please name your insurance carrier.

17. Are you aware that it is allowable for institutions to pay for:
    - Drug and alcohol abuse treatment?  Yes  No
    - Eating disorder treatment?  Yes  No

18. Does your athletic insurance policy cover the following disorders:
    - Drug & alcohol treatment
    - Eating disorder treatment
    - Other
The respondents used 16 different companies for their insurance needs. A large percentage, 85% (176/207), were enrolled in a secondary insurance plan with a deductible ranging from $50 to $5000 (Table 5). They reported that in 91% (189/207) of their athletic programs, scholarship and nonscholarship athletes were treated the same with regard to medical insurance coverage; however, 9% (18/207) reported that they require the nonscholarship athlete to provide his/her own medical insurance.

A wide range of premiums was reported (Table 6). Those schools with more sports and larger teams usually paid higher premiums; however, this was not true in all cases. Some smaller programs reported paying premiums as large as those paid by schools participating in Division I football. There were many discrepancies in premiums paid and coverage received by the individual schools.

**Discussion**

There are at least three ways to finance expenses related to athletic injuries: 1) a primary insurance plan in which the school’s policy covers all athletic injury claims after a preset deductible, regardless of other insurance coverage; 2) a secondary insurance plan, which pays claims not payable by other insurance plans, such as a parent policy or other primary plans; and 3) a self-insured program in which the athletic department accepts the total financial responsibility for an injured athlete’s medical expenses, pays 100% of the costs from the athletic budget, and is not reimbursed from a third party. A secondary plan might become primary if the injured athlete has no other insurance. Also, specific riders to a policy may be purchased to include coverage of chronic injury or nonspecific illness or conditions, such as eating disorders or alcohol/drug abuse treatment.4 Riders are also available for atypical health care plans, such as Health Maintenance Organizations or Preferred Provider Organizations, which frequently have requirements such as seeing a specific physician or going to a certain facility in nonemergency situations (which may not be possible when the student-athlete is away from his/her community).3,4 Beginning with the 1991–1992 academic year, the NCAA provides a long-term catastrophic plan for all participants at no cost to the member institutions.4,8

To date, the most comprehensive research on athletic medical insurance has been completed by Lehr.5 She assessed the availability of medical insurance provided to student athletes at NCAA institutions. Her results showed that 93% of all NCAA schools provided some form of medical insurance. This figure increased to 96% at the NCAA Division I level. She also found a wide variety of types of coverage, deductibles, and benefits.

In order to find the right medical insurance policy for your institution, you must first set departmental policy. All responding institutions in our survey provide medical insurance for scholarship athletes who are injured in an athletic-related event. A nonscholarship or “walk-on” athlete may have participation stipulations.

Another consideration for athletic departments is the type of policy that fits their financial plan and yet provides their teams with maximum coverage. Athletic departments want to provide a quality health care program for their student-athletes, but at a reasonable price. For most athletic departments, the logical decision is secondary insurance. In this way, the athletic department is able to provide for the cost of the student-athletes’ medical expenses, but it does not have total financial responsibility. Primary coverage is very expensive and, in most cases, cost-prohibitive.

Purchasing a policy with a deductible is another way to reduce the overall price of an insurance premium. By paying a deductible, the athletic department is decreasing the number of claims an insurance company would have to process. This reduces administrative costs and allows the department to control its expenses more effectively.
Table 4.—Formal Training in Medical Insurance by Responsibility

<table>
<thead>
<tr>
<th>Position</th>
<th>NCAA Football Division</th>
<th>No Football</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>IAA</td>
<td>II*</td>
</tr>
<tr>
<td>Formal training</td>
<td>6 (3%)</td>
<td>4 (2%)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>No formal training</td>
<td>83 (40%)</td>
<td>48 (23%)</td>
<td>6 (3%)</td>
</tr>
</tbody>
</table>

*Institutions that are classified as Division I, but play football at a different level.

Table 5.—Type of Athletic Insurance Subscribed to

<table>
<thead>
<tr>
<th>Insurance Type</th>
<th>NCAA Football Division</th>
<th>No Football</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>IAA</td>
<td>II*</td>
</tr>
<tr>
<td>Primary</td>
<td>15 (7%)</td>
<td>4 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>Secondary</td>
<td>68 (33%)</td>
<td>44 (21%)</td>
<td>12 (6%)</td>
</tr>
<tr>
<td>Self</td>
<td>6 (3%)</td>
<td>2 (1%)</td>
<td>0</td>
</tr>
<tr>
<td>With deductible</td>
<td>72 (35%)</td>
<td>33 (16%)</td>
<td>0</td>
</tr>
<tr>
<td>No deductible</td>
<td>17 (8%)</td>
<td>19 (9%)</td>
<td>6 (3%)</td>
</tr>
<tr>
<td></td>
<td>89 (43%)</td>
<td>52 (25%)</td>
<td>13 (6%)</td>
</tr>
</tbody>
</table>

*Institutions that are classified as Division I, but play football at a different level.

Table 6.—Athletic Insurance Premiums

<table>
<thead>
<tr>
<th>Premium</th>
<th>NCAA Football Division</th>
<th>No Football</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>IAA</td>
<td>II*</td>
</tr>
<tr>
<td>0–$10,000</td>
<td>4 (2%)</td>
<td>2 (1%)</td>
<td>0</td>
</tr>
<tr>
<td>$10–$20,000</td>
<td>4 (2%)</td>
<td>10 (5%)</td>
<td>0</td>
</tr>
<tr>
<td>$20–$30,000</td>
<td>8 (4%)</td>
<td>8 (4%)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>$30–$40,000</td>
<td>17 (8%)</td>
<td>8 (4%)</td>
<td>0</td>
</tr>
<tr>
<td>$40–$50,000</td>
<td>10 (5%)</td>
<td>8 (4%)</td>
<td>0</td>
</tr>
<tr>
<td>$50–$60,000</td>
<td>6 (3%)</td>
<td>4 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>$60–$70,000</td>
<td>10 (5%)</td>
<td>4 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>over $70,000</td>
<td>25 (12%)</td>
<td>4 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>85 (41%)</td>
<td>50 (24%)</td>
<td>12 (6%)</td>
</tr>
</tbody>
</table>

*Institutions that are classified as Division I, but play football at a different level.

For financial reasons, the athletic trainer is asked to assume many duties and roles that are not directly related to the daily “hands-on” aspect of sports medicine. But are they trained for these additional duties? Most athletic trainers (those from 85% of the responding institutions) have had no prior formal education on how to manage athletic medical insurance.

In an attempt to keep premiums low, many athletic departments have set institutional policies and enrolled in insurance programs that provide secondary coverage, with or without deductibles. Many institutions change their health insurance companies frequently in order to get the best possible rate. However, this practice may create confusion for the institution considering policy renewals. Further complicating the issue is the fact that insurance premiums are set arbitrarily by insurance companies, based on actuarial data that they gather. Individual institutions are unable to determine the fairness of their assessment.

Conclusion

Although knowledge of medical insurance practices being used by similar athletic programs is helpful, gaining an adequate knowledge of the medical insurance industry is mandatory. It is important for athletic trainers and administrators to be aware of the changing
world of athletic medical insurance. For those who do not understand or are not interested in this aspect of their position, their institutions may not be getting the best quality athletic medical insurance for the price. Ultimately, higher premiums and decreased coverage may spell disaster for the student-athlete entrusted to our care in our sports medicine facilities.

Acknowledgments
We would like to thank Elizabeth Coyle for her assistance on this project and Robert Martin of Martin and Associates for his comments.

References
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Upper Extremity Proprioceptive Training

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Joseph S. Lueken, MS, ATC
Kent E. Timm, PhD, ATC, PT, FASCM
Edward J. Ryan, III, MS, ATC

Abstract: Proprioception following lower extremity injuries is commonly recommended, but there is little information on proprioception training following upper extremity injuries. No studies have evaluated whether proprioception programs for athletes in open kinetic chain activities (throwing, shot putting) should be different than programs for athletes in closed kinetic chain activities (gymnastics, swimming, kayaking, or rowing). In this paper, we provide a rationale for proprioception training for upper extremity injuries in athletes and the importance of analyzing the athlete’s sport and activity for specificity of proprioception exercises. We then discuss one popular proprioception exercise, rhythmic stabilization, and propose several additional upper extremity proprioception exercises, along with instructions for the athletic trainer on how to direct the athlete through these exercises.

Proprioception training is an essential part of any rehabilitation program to return an athlete to preinjury performance levels. Special proprioception exercises are a relatively new addition to sport rehabilitation but have been an integral part of programs for patients with brain and spinal cord injuries.

There are two essential parts of proprioception: the “body’s ability to vary contractile forces of muscles in immediate response to outside forces” and the “sense that tells the brain which position the limb is in at any moment in time.”

Exercises for range of motion, muscular strength and endurance, and cardiovascular endurance aid redevelopment of proprioception by contracting muscles and moving joints, but athletes require specific proprioception exercises to regain full musculoskeletal and athletic function.

Recurrent joint instability is either mechanical or functional, existing separately or together. With capsular or ligamentous laxity, the joint is mechanically unstable due to nonfunctional supporting structures. Muscular weakness can also cause mechanical instability since the musculature crossing the joint cannot hold the joint in position. The third cause of instability is lack of proprioceptive feedback, a functional instability, causing an uncoordinated muscular response to motion and/or stress. A functional instability does not necessarily connote a mechanical instability, and muscular weakness does not necessarily cause a functional instability.

Anatomy

Proprioceptive feedback reaches the central nervous system from receptors located in muscles and joints, vestibular apparatus in the inner ear, and the eyes. Muscle and joint receptors are stimulated by movements of the musculoskeletal system. The vestibular apparatus provides information on whole body position and is stimulated when upright body posture changes. The eyes help orient the head and body with respect to the environment. Since athletes must attend to sport-related stimuli when performing, they rely on information from muscle and joint receptors and the vestibular apparatus to balance and maintain body position. When visual stimuli are removed or are distracting, damaged muscle and joint receptors are re-educated to provide accurate positional information to the central nervous system.

Muscle receptors are comprised of muscle spindles and Golgi tendon organs. Muscle spindles are special muscle fibers in parallel with regular skeletal muscle fibers. They occur in larger numbers in “skill” muscles in the hands than in “strength” muscles in the legs and back. Muscle spindles provide information via the gamma feedback loop to the central nervous system. This loop monitors change in muscle length and velocity of contraction, providing indirect joint position information. When skeletal muscle is stimulated, muscle spindles are co-activated, maintaining tension. Decreased muscle spindle tension reduces or stops its firing. The gamma feedback loop permits rapid error correction of muscular tension in 30 to 80 ms, while correction through visual stimuli may take as long as 200 ms.

Golgi tendon organs are located in tendons near the musculotendinous junction and in series with the muscle fibers. They monitor muscle tension with firing rate escalating with increased muscle tension. Excessive firing rates from Golgi tendon organs cause a reflex decrease in muscle tension.
Joint receptors are located in joint capsules, ligaments, fat pads, and periosteum of the various joints of the body. As these structures are deformed by motion, joint receptors are stimulated, signaling joint position and movement over the entire range of motion. Joint receptors complement information from muscle spindles and Golgi tendon organs by directly registering joint motion.

No single receptor provides all the information needed by the central nervous system to evaluate posture and body position. Input from muscle and joint receptors, vestibular apparatus, and the eyes is synthesized for total body position information.

Rationale
Proprioception retraining following lower extremity injuries is commonly recommended, but there is little information on proprioception training following upper extremity injuries, especially in athletes. No studies have evaluated whether proprioception programs for athletes in open kinetic chain activities, eg, throwing or shot putting, should be different than programs for athletes in closed kinetic chain activities, eg, gymnastics, swimming, kayaking, or rowing.

Injuries requiring surgery and/or periods of immobilization tend to have larger proprioceptive deficits due to time loss and decreased use. Current injury management, therefore, encourages early, protected motion whenever possible. As mentioned earlier, musculoskeletal motion stimulates muscle and joint receptors in the injured area, maintaining a limited neurological response of these receptors.

Rehabilitation programs begin with restoration of range of motion, muscular endurance, and muscular strength. These exercises, in a non-specific fashion, stimulate joint and muscle proprioceptors in the injured extremity. Proprioceptive neuromuscular facilitation exercises (PNF), by their design, contribute to proprioception while developing range of motion, muscular endurance, and/or muscular strength.

Analyse Activity
The specific activity and sport the athlete is returning to must be analyzed for specificity of proprioception exercises. If athletes normally use the upper extremity in an open kinetic chain fashion, such as throwers in various sports, volleyball players, basketball players, and weight lifters, the proprioception program should emphasize open chain exercises, such as rhythmic stabilization at multiple positions in the range of motion and the first two exercises listed below. If the athlete uses the upper extremity in a closed kinetic chain fashion, as in gymnastics where he/she is weight bearing, or in swimming, canoeing, rowing, or kayaking where the body is moved over the stationary hand (swimming) or extension of the hand (canoeing, rowing, or kayaking), proprioception exercises should be performed in that manner. Such exercises involve balancing or moving on a trampoline, wobble board, or slide board with eyes closed, analogous to lower extremity exercises.

In contrast to lower extremity proprioception training, closed kinetic chain upper extremity proprioception exercises appear later in the rehabilitation program due to the amount of strength required to support body weight on the injured extremity.

Exercises
Open kinetic chain proprioception exercises begin when range of motion and pain permit. One popular proprioception exercise for the upper extremity is rhythmic stabilization. No other open kinetic chain exercises are reported in the literature. We are proposing several additional upper extremity proprioception exercises. The exercises move from open to closed kinetic chain. If an athlete does not use his/her upper extremity in a closed kinetic chain fashion, the progression finishes with open kinetic chain exercises.

Exercise 1—Rhythmic Stabilization
The athlete positions his/her upper extremity anywhere in its available range of motion and holds an isometric contraction. The athletic trainer provides enough resistance to cause the athlete to react, but not enough to break the isometric contraction. As the athlete progresses, length of time of rhythmic stabilization increases, athletic trainer resistance increases, and amount of contact area between athletic trainer’s hands and athlete’s upper extremity decreases.

Exercise 2—Mirroring Upper Extremity
Move the uninjured upper extremity passively to various positions in the available range of motion. Ask the athlete to duplicate this position with his/her injured upper extremity, first with eyes open, then closed. If he/she misses the position, he/she opens his/her eyes and actively duplicates the desired position. Concentrate movement on the injured area, ie, focus on shoulder positions for athletes with shoulder pathology, elbow positions for elbow pathology, and so on. Perform 10 to 20 repetitions of varying positions 5 to 10 times daily. Use isokinetic testing equipment with an electrogoniometer for exact joint position measurements, if desired.

Exercise 3—Duplicating Position, Injured Upper Extremity
Have the athlete balance with both hands on the floor, a wobble board (Fig 1), and finally a trampoline (Fig 2).
2. Progress through the following body positions, first with eyes open, then closed. Start in the quadruped position and progress to kneeling push-up, full push-up, and finally feet-elevated (feet level or higher than shoulders) positions. Also, move from balancing on both hands to balancing only on the injured hand. Initially, perform each balance for 15 seconds and gradually extend to 60 seconds. Perform 5 to 10 repetitions three to five times daily.

Exercise 5—Fitter®

Have the athlete “stand” on the Fitter® (Stack Enterprises, Calgary, Alberta, Canada) on his/her hands. Move through the following body positions first with eyes open, then with eyes closed. Stabilize the Fitter with four resistance cords and position the athlete perpendicular to it. Rock the Fitter from right to left in the frontal plane (Fig 3), then move the athlete parallel to the Fitter and rock it back and forth in the sagittal plane (Fig 4). Next, move the athlete so that he/she is at a 45° angle to the Fitter and rock it on that diagonal. Repeat on the other diagonal. Progress through the four body positions as in Exercise 3. As the athlete progresses, decrease the number of resistance cords on the Fitter, making the platform more unstable. Start with one repetition of 15 seconds and extend to three to five repetitions of 60 seconds each.

Exercise 6—Ball Balancing

Have the athlete balance on his/her hands on a 48-inch Gymnastikball® (Ledragomma, Italy), first with eyes open, then closed (Fig 5). Progress from both hands on one large ball to each hand on separate balls and then to the injured arm on one ball. Also, progress through the four body positions as in Exercise 3. Use a spotter, especially when doing this exercise for the first time or changing body positions, since the athlete may fall off the Gymnastikball®. Start with one repetition of 10 seconds and progress to three to five repetitions of 60 seconds each.

These exercises help redevelop proprioception in athletes with injuries to the upper extremity. The last...
three exercises are especially useful for athletes who use the upper extremity in a closed kinetic chain fashion and become more challenging through the progression from eyes open to eyes closed and through the various body positions.

This paper was funded through grants provided by the National Athletic Trainers’ Association and Baxter Healthcare.

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Carpal Tunnel Syndrome
Gregory R. Zimmerman, MSA, ATC

Abstract: Carpal tunnel syndrome is a neuropathy resulting from compression of the median nerve as it passes through a narrow tunnel in the wrist on its way to the hand. The lack of precise objective and clinical tests, along with symptoms that are synonymous with other syndromes in the upper extremity, cause carpal tunnel syndrome to appear to be a rare entity in athletics. However, it should not be ruled out as a possible etiology of upper extremity paralysis in the athlete. More typically, carpal tunnel syndrome is the most common peripheral entrapment neuropathy encountered in industry. Treatment may include rest and/or splinting of the involved wrist, ice application, galvonic stimulation, or iontophoresis to reduce inflammation, and then transition to heat modalities and therapeutic exercises for developing flexibility, strength, and endurance. In addition, an ergonomic assessment should be conducted, resulting in modifications to accommodate the carpal tunnel syndrome patient.

Compression of the median nerve at the wrist, usually referred to as carpal tunnel syndrome, is the most common entrapment neuropathy of the upper extremity. Because of increased awareness on the part of physicians and the public, the syndrome is now recognized and managed by primary care physicians, occupational health workers, and corporate/industrial athletic trainers.

The etiology is varied and may be associated with many conditions. Those that make the median nerve more susceptible to compromise within the carpal tunnel include malaligned wrist fractures, diabetes, rheumatoid arthritis, hypothyroidism, thoracic outlet and cervical syndrome, ganglion cysts, Paget’s bone disease, and the edema of menstruation and pregnancy. More typically, however, the carpal tunnel syndrome condition develops when daily activities subject the wrists to long periods of repeated flexion or abnormal positions. Carpal tunnel syndrome often afflicts butchers, hairdressers, truck drivers, assembly line workers, and typists. However, people do not necessarily acquire the condition on the job. Patients may complain of carpal tunnel syndrome symptoms in the Spring, when they do a lot of gardening and cleaning. Activities such as clipping hedges, cutting with scissors, or pushing a vacuum cleaner can bring on symptoms associated with carpal tunnel syndrome. Often, the dominant hand is the more affected.

Unfortunately, the fact that carpal tunnel syndrome may be a complex nerve lesion, and not simply tendinitis or pressure on a nerve, is less well-appreciated, resulting too often in clinical mismanagement and ensuing disability to the patient. In this article, I will provide an overview of the current understanding of carpal tunnel syndrome and examine the approach I use to assess and manage this disorder.

History
The term carpal tunnel syndrome was first described in 1883 by Sir James Paget. In 1951 the syndrome received added attention when Phalen published the first report of a large series of decompressions. Phalen also described the well-known diagnostic wrist flexion maneuver that was named for him (Phalen’s test).

Anatomy
The carpal tunnel is a fibro-osseous tunnel in the wrist (Fig 1). The transverse carpal ligament (flexor retinaculum), a thick fibrous sheet, forms the roof of this canal, and it continues ulnarly to form the floor of Guyon’s canal through which the ulnar nerve passes. The lateral attachment of the flexor retinaculum is formed by the trapezium and the scaphoid tubercle and the medial aspect attaches to the hook of hamate and the pisiform.

The floor of the canal is composed of carpal bones. Ten structures pass through this canal: the flexor pollicis longus tendon, four superficial and four deep flexor tendons of the digits, and the median nerve (Fig 1). All tendons are surrounded by the thick synovial lining of the radial and ulnar bursae. Any condition that leads to swelling of the synovial tissue or increased volume of structures inside the carpal tunnel will cause compression of the median nerve.

Mechanisms
Changes in nerves following compression are complex. The carpal tunnel represents a fixed space with a finite volume. Any increase in its contents will correspondingly raise the pressure within the canal. Several authors have used direct measurements to document elevated carpal tunnel pressures in patients with carpal tunnel syndrome. The results of increased carpal tunnel pressure are venous and arterial obstruction, as well as anoxia, which produce edema within the nerve. Subsequent fibroblastic proliferation leads to thickening of the epineurium and perineurium, contributing a further barrier to circulation. Eventually the transmission of the axon impulses is affected.

Compression of the median nerve in the carpal tunnel can be attributed to a number of reasons, some being congenital, others related to trauma or functional disorders. It is important to iden-
Flexor Retinaculum (Transverse Carpal Ligament)
Radial Nerve (Superficial Branch)
Carpal Bones

Fig 1.—Anatomy of the carpal tunnel. (The original drawing appeared in An Ergonomics Guide to Carpal Tunnel Syndrome by Thomas J. Armstrong, published by the American Industrial Hygiene Association, 1984.)

Identify the etiology so that proper treatment may be initiated to alleviate the problem, whether it be operative or nonoperative. Any abnormality that elevates pressure in the carpal tunnel will have the effect of compromising median nerve functioning. Thickening or fibrosis of the synovium surrounding the flexor tendons is the most common cause of carpal tunnel syndrome.

Individuals may be predisposed to the development of carpal tunnel syndrome through complex nutritional, vascular, biomechanical, and anatomical factors, as well as certain disease states/conditions. Frequently reported nonoccupational causes of carpal tunnel syndrome include:
1. Systemic diseases—such as rheumatoid arthritis, acromegaly, gout, diabetes, myxoedema, ganglion formation, and certain forms of cancer.
2. Congenital defects—including bony protrusions into the carpal tunnel, anomalous muscles extending into or originating in the carpal tunnel, and the shape of the median nerve.
3. Wrist shape—recent studies of carpal tunnel syndrome patients made with the use of computerized axial tomography (CAT scanner) and standard engineering calipers suggested that there is an association between relatively square wrists and idiopathic carpal tunnel syndrome.
4. Acute trauma—Median nerve injury inside the carpal tunnel can be produced by a blow to the wrist, laceration, burn, or other acute wrist trauma.
5. Pregnancy, oral contraceptives, menopause, and gynecological surgery—Because all are uniquely female-oriented, they may, in some cases, contribute to a disproportionately high incidence rate of the syndrome in females.
6. Ergonomic factors—These include frequent deviation from the neutral wrist position, frequent use of the “pinch” grasping hand position, and repetitive wrist and hand movements. There have been several important biomechanical experiments that demonstrated pressure increases within the carpal tunnel when both the wrist and the fingers are flexed. Hand tools and air guns which generate constant levels of vibration have also been recognized as a threat. The overall incidence rate and prevalence of carpal tunnel syndrome in the work force is not yet known.

Occupations involving considerable use of the hands appear to predispose individuals to carpal tunnel syndrome. In a medical record review of 250 consecutive cases of carpal tunnel syndrome, the dominant hand was affected more often and more severely, suggesting that more frequent and more intense hand use plays a role in the development of carpal tunnel syndrome.

Signs and Symptoms

The typical patient suffering from carpal tunnel syndrome is a woman in her mid-40s, although the syndrome has been documented in an 11-year-old girl. The syndrome occurs three times more frequently in women than in men. By far, the most common symptoms are sensory in nature, with the patient reporting that the hand feels like it is “going to sleep.” Although initial symptoms may be intermittent, they can become persistent. Any posture that entails keeping the wrist flexed aggravates symptoms.

At times, the paresthesia is painful, with pain radiating up the arm as far as the shoulder. There may be subjective numbness in the median nerve distribution of the hand, especially on the volar pad of the index finger, the autonomous zone of the median nerve. Sympathetic disturbances, such as excessive sweating and mild edema in the hand, may stem from vasomotor disturbance.

As carpal tunnel syndrome worsens, nocturnal pain and tingling may awaken the patient. Typically the patient obtains relief by hanging the arm out of bed or shaking or rubbing the hand. Motor involvement may be heralded by clumsiness, due to weakness of the intrinsic thenar musculature supplied by the median nerve.
The patient becomes aware particularly of the tendency to drop things. Difficulty in tasks such as unscrewing bottle tops, turning keys, or crocheting may be encountered. The history often shows the presence of symptoms for months, although previous exacerbations and remissions may have occurred much earlier, often during a pregnancy. Rarely, a patient will recall having had intermittent symptoms for over 20 years.

Upon examination, the involved hand may appear normal. Mild sensory loss only in the median distribution is typical, often involving only the volar pad of the index finger. Weakness of the opponens pollicis muscle, and especially of the abductor pollicis brevis muscle, may be found. In severe cases, thenar muscle atrophy may be noted. Autonomic phenomena such as pallor, cyanosis, and trophic ulcerations of the fingers are rare.

Subjective feedback from hyperflexion (Phalen’s maneuver) or hyperextension of the wrist are excellent diagnostic tests, reproducing finger paresthesia in 50% of carpal tunnel cases. Inflating a tourniquet placed around the forearm, above systolic pressure to induce ischemia of the hand, may also reproduce the paresthesia within minutes.

**Differential Diagnosis**

The diagnosis of carpal tunnel syndrome is often missed because of the highly subjective nature of symptoms and the lack of objective tests and examinations. An accurate history is the key leading to the diagnosis of carpal tunnel syndrome. Differential diagnosis for carpal tunnel include cervical radiculopathy, cervical syndrome, and cervical osteoarthrosis to thoracic outlet compression, anterior intersosseous nerve entrapment, double crush, and polymyalgia rheumatica.

Cervical radiculopathy should be considered if neurologic symptoms in the hand are produced by passive neck extension and lateral flexion toward the affected side. Electromyography also may show fibrillations or F-wave abnormalities in the paravertebral muscles.

Cervical syndrome is usually preceded by minor trauma, a mechanism of injury such as falling on outstretched arms. Painful neck spasms cause temporary torticollis, with the head being tilted away from the painful side. Sharp, shooting pains spread slowly down the shoulder, upper arm, and lower arm to the wrist, with tingling and numbness in the thumb, index, and middle fingers. The neck muscles are rigid on the affected side. The biceps and triceps are diminished or absent.

Cervical osteoarthritis pain usually is present in the neck and frequently extends to the shoulder, the back of the scalp, or down the arm. Numbness and tingling of the hands are frequent symptoms, but muscle atrophy is rare. There may be crepitus when the neck is moved.

Thoracic outlet syndrome may present with pain radiating from the point of compression to the base of the neck, the axilla, the shoulder girdle region, arm, forearm, and hand. The compression involves the brachial plexus, subclavian artery, and subclavian vein, collectively referred to as the neurovascular bundle. The ulnar nerve is most frequently involved, and, as such, symptoms generally occur in the C-8 dermatome.

Compression should be excluded through appropriate testing procedures. Sensory disturbance may be present more proximally. Because of the strong association between thoracic outlet compression and distal compression, distal sites of entrapment should be examined carefully. In a 1989 survey, of 231 extremities with a primary diagnosis of thoracic outlet compression, 109 (47%) had at least one other site of nerve compression.

Anterior intersosseous nerve entrapment should be ruled out. Unlike carpal tunnel syndrome, it is not accompanied by sensory involvement of the digits and the weakness is confined to the flexor pollicis longus, flexor digitorum profundus of the index and long fingers and pronator quadratus muscles. The thenar muscles are not involved.

The term “double crush” denotes coexistence of dual compression along the course of the nerve. Double crush of the median nerve may be suspected in an older female who has more paresthesia than numbness, grip strength weakness, and significant proximal complaints accompanied by mild changes in distal sensory latency. This condition also should be ruled out when previous surgery for carpal tunnel has failed to relieve symptoms.

Systemic disorders also can manifest with carpal tunnel syndrome. Elderly carpal tunnel patients with proximal shoulder pain, morning stiffness, fatigue, low grade fever, and raised erythrocyte sedimentation rate require further evaluation to rule out polymyalgia rheumatica.

Careful physical examination and objective testing are important steps in evaluating compressive nerve lesions. Clinical examination should assess both sensory and motor involvement, as shown in the illustrations in Fig 2. The wrist flexion test, or Phalen’s test, is positive in more than 60% of patients, and is considered strong evidence for carpal tunnel. The test is accomplished by having the patient hold the wrist in a maximally flexed posture. This increases the pressure on the median nerve and reproduces the symptoms of paresthesia in the digits of the median nerve distribution.

Percussion directly over the median nerve at the wrist can produce paresthesia radiating distally into the radial three fingers (Fig 2). This test result (which is sometimes labeled incorrectly as a positive ‘Tinel’s sign’) merely signifies some neural irritability and is not diagnostic for nerve compression. Its presence in carpal tunnel syndrome is variable.

Thenar muscle function can be evaluated by measuring pinch strength. Muscle involvement to the point of visible atrophy of the abductor pollicis brevis produces the so-called shelf sign and indicates significant compromise of the nerve. Diminished pseudomotor function in the radial three digits, as evidenced by dryness or unusual texture of these fingers, signifies an interrup-
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Diagnosis Tests for Carpal Tunnel Syndrome

- **Tinel's sign** can be elicited by gently tapping the skin overlying the median nerve at the wrist with the lateral fingerprint. In the presence of carpal tunnel syndrome, this often produces paresthesias radiating to the median nerve distribution.

- **Phalen's test**. The patient acutely flexes both hands at the wrist while maintaining the dorsum of both hands and fingers in firm contact. The test is considered positive for carpal tunnel syndrome if numbness in the median nerve distribution is produced in less than 1 minute. If this fails to produce numbness, a reversed Phalen's is used with hands in acute extension at the wrist.

- **Two-point discrimination** is mapped on the fingertips. Decreased sensory discrimination may not be uniform, with some digits affected more than others.

Fig 2.—Diagnostic tests for carpal tunnel syndrome. (Reprinted with permission from Aziz W, Wolff T. Carpal tunnel syndrome. *First Hand News*. 1990;2:1-4; published by the Christine M. Kleinert Institute for Hand and Micro Surgery and Kleinert, Kutz and Associates Hand Care Center, Louisville, KY.)

Sensory testing, with a cotton wisp or pin, is essential to quantify function in any patient with a nerve lesion. In 1958, Moberg23 initially demonstrated that two-point discrimination testing clearly correlates with peripheral nerve function in the hand. However, results were rarely found to be abnormal in compressive lesions, with the exception of cases in which there was marked nerve involvement.8,25,27 Recent advances in neurophysiology have led to an explanation of this clinical finding. The static two-point discrimination test is one of innervation density, and results will remain normal until nearly all of the nerve fibers become involved.8 Among the other procedures that are occasionally required in the evaluation of carpal tunnel syndrome are: x-ray, various laboratory tests, and electrodiagnostic studies, such as electromyography.

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<td>Mild</td>
<td>Annoying discomfort; intermittent functional difficulties</td>
</tr>
<tr>
<td>Moderate</td>
<td>Pain, preventing performance of basic tasks</td>
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<tr>
<td>Severe</td>
<td>Disabling pain, unable to utilize hands for most activities.</td>
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**Table 1.—Carpal Tunnel Syndrome Stages**

**Treatment**

Carpal tunnel syndrome can be treated operatively or nonoperatively. Initially, an evaluation should be performed to determine the extent of injury and functional ability. Pain and numbness can be graded according to the degree of impairment (Table 1). Many cases respond well to nonoperative treatment, especially if the problem is identified at its earliest stages. Once the underlying cause(s) for this disorder have been eliminated and the focus has been narrowed to increased pressure within the carpal tunnel due to mechanical nature, conservative treatment may begin.

**Splinting**

Use of a splint to immobilize the wrist in a neutral position often helps to relieve symptoms by keeping pressure in the carpal tunnel at its lowest level. This day and night splinting regimen is initiated to provide rest and decrease symptoms of median nerve irritation brought about by excessive wrist movement and may possibly decrease the degree of flexor tenosynovitis. Due to possible secondary complications developing with excessive immobilization, I recommend a 3-week trial of day/night splinting. Pending a reduction in symptoms, this should be followed by another 3 weeks of night splinting only. If a reduction in symptoms has not been realized following the initial splinting, further evaluation should be conducted and splinting discontinued.

**Pyridoxine**

Pyridoxine (vitamin B6) deficiency has been demonstrated by some researchers in patients with carpal tunnel syndrome.1,4 Although treatment with vitamin B6 has been recommended, it has not proven beneficial for localized nerve lesions (though it may be helpful for systemic neuropathy).1,5,23

**Rehabilitation**

Rehabilitation should be directed at release of the nerve entrapment by decreasing edema, and reduction of scar tissue. Pain, edema, and weakness can be treated with exercise regimens and modalities such as fluidotherapy and TENS (transcutaneous electrical nerve stimulation).4 High-volt galvanic stimulation, iontophoresis, and icing are effective in reducing edema and controlling effusion. Ultrasound may be useful in reducing scar tissue formation, followed by mild passive and active stretching and strengthening (Table 2). Caution should be exercised, though, as therapeutic heat at this stage of the condition may, in some instances, exacerbate the problem by increasing the swelling within the carpal tunnel.

**Medication**

Nonsteroidal anti-inflammatory medication may lessen the synovitis, at least temporarily. Some physicians may prescribe diuretics which can provide transient relief, but the patient’s general medical condition needs to be monitored closely for electrolyte imbalances.8 Addition-
Table 2.—Rehabilitation Exercises

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<td>Ulnar deviation</td>
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<td>Grip squeeze</td>
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ally, physicians may inject corticosteroids into the carpal tunnel to decrease swelling due to flexor tenosynovitis. However, literature reports dramatic initial improvements followed by limited permanent relief.4-6,8,9,14,26

Surgery
Surgical intervention may be indicated when conservative measures have failed in patients with mild to moderate carpal tunnel syndrome or when the initial assessment has revealed the patient to have severe carpal tunnel syndrome (Table 1). The presence of thenar atrophy or significant objective sensory changes compared with the opposite hand are absolute indications for surgical treatment.8 The principle of surgery is decompression of the median nerve, which is achieved by carpal ligament release. In the presence of flexor tenosynovitis, synovectomy may be indicated.4

Stretching
Preoperatively, stretching exercises are indicated for maintenance of normal range of motion which may be compromised during splinting or unsupervised care. Following surgical release, stretching exercises are intended to be performed to a moderate, yet progressive, degree.

Finger Stretch. Starting from a clenched fist position, have the patient spread his/her fingers as wide as possible. Hold this position; relax. Repeat on each hand.

Wrist Circles. Keeping the fingers in a semirelaxed position, have the patient make circles with his/her wrist. Have him/her perform these with each hand, making sure to do both clockwise and counterclockwise directions.

Wrist Flexor Stretch. With the patient seated, elbows at right angles and palms together, have him/her slowly lower wrists until a stretch is felt. Be sure to keep both palms and fingers in firm contact throughout the stretch. Hold this extended position; relax (Fig 3).

Wrist Extensor Stretch. Similar to the wrist flexor stretch, except the patient flexes both wrists while maintaining the dorsum of both the hands and fingers in firm contact. Hold this stretch; relax.

Forearm Pronator Stretch. With the patient holding his/her involved hand in a handshake position, have him/her grasp it with the opposite hand and slowly turn it to a palm-down position until a stretch is felt. Hold this stretch; relax (Fig 4).

Fig 3.—Wrist flexor stretch. See text for explanation.

Fig 4.—Forearm pronator stretch, ending position. See text for explanation.

Forearm Supinator Stretch. With the patient holding his/her involved hand in a handshake position, have him/her grasp it with the opposite hand and slowly turn it to a palm-up position until a stretch is felt; relax.

This protocol should be performed two to three times daily. Hold each stretch for 10 seconds for a total of ten repetitions. They are to be done slowly and should not be stretched to the point of discomfort or pain.

Strengthening
Initially, an evaluation should be performed to determine the strength, endurance, and functional ability of the involved hand. In addition, an assessment of the job requirements will provide valuable information on the capacity for work that is recommended before return to employment. The patient may have to begin strengthening exercises using isometrics or manual resistance. However, when indicated, rubber tubing or hand-held weights may be used. Subjects should move progressively toward three sets of ten repetitions as strength increases, and/or pain subsides. Perhaps the patient may have to begin with one to two sets, working up to three sets. Exercises are to be done slowly incorporating both concentric and eccentric benefits.
Fig 5.—Forearm pronation/supination rotation. See text for explanation.

Wrist Extensors. Place the patient seated next to a treatment table, right arm extended, so that the right wrist is allowed to extend over the edge of the table, palm facing down. From this start position, extend wrist upward making sure not to lift the forearm from the table.

Wrist Flexors. Position the patient as in the previous exercise, only with palm facing upward. From this position, have the patient flex wrist upwards, making sure not to lift the forearm from the table.

Forearm Pronators and Supinators. Same position as stated above. Place nonweighted end of handle in hand with palm facing upward. Making sure not to pick the forearm off the table, roll the palm over to face downward (Fig 5).

Radial Deviation. Position patient as previously. Again, place nonweighted end of handle in hand. Wrist should be held in neutral position, with the thumb facing up. From this start position, move wrist upward, in essence, pointing the thumb toward the ceiling (Fig 6).

Ulnar Deviation. Seat patient with arm extending down at the side. Place nonweighted end of handle in hand, with palm of hand facing toward body (wrist in neutral position). From this start position, move the wrist so that the protruding handle moves upward, toward the ceiling (Fig 7).

Grip Squeeze. Patient utilizes Thera-Putty, a tennis or racquet ball, or a sponge to squeeze for a 10-second count; repeating ten times with each hand.

If after 4 to 6 weeks the symptoms still persist and the rehabilitation is not relieving the problem, the patient should be referred back to the physician for further diagnostic testing and evaluation. Exercises that exacerbate symptoms should be modified or discontinued.

Fig 6.—Radial deviation. See text for explanation.

Fig 7.—Ulnar deviation. See text for explanation.

As with many rehabilitation programs, once the patient has resolved the initial injury complaints, a total upper extremity strength, endurance, and flexibility program should be incorporated. When return to work is not feasible, assistance from a rehabilitation counselor often proves invaluable in arranging modified work or vocational planning with the same employer.

Special Considerations

Although carpal tunnel syndrome is a multifactorial condition, occupational factors are perhaps the most important aspect of prevention. The treatment and prevention of hand injuries are closely linked. Steps can be taken to prevent certain hand injuries and reduce the number and costs of carpal tunnel syndrome cases.

1. Early Diagnosis. If treated during mild impairment (Table 1), a splint will relieve many symptoms, avoiding the necessity of costly surgery.

2. Job Reassignment. If a certain flexed wrist motion is necessary in a job task, the athletic trainer may suggest temporary reassignment to job tasks that do not require repetitive wrist flexion and extension, or do not cause vibration.

3. Job Modification. Plain and simple ergonomics. The job must fit the worker, not vice versa. That may mean changing the height of the assembly line. It could entail rotating a manufactured part onto its most easily accessible side rather than working at strenuous angles, or using properly shaped tools or proper padding of the tool or the glove.

4. Job Rotation. Many carpal tunnel syndrome sufferers are employed on (dis)assembly type operations. As such, they repeat the same task(s) thousands of times daily. By rotating with fellow employees on the same operation, isolated movements are reduced, variation is incorporated.

5. Tool Redesign. In one Michigan study, workers who used standard knives in a chicken processing operation were prone to carpal tunnel syndrome. By supplying workers with knives that have 19° curved han-
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dles, the workers no longer needed to flex their wrists while cutting meat, and problems were significantly reduced.3

More recently, what may have been an engineering and technological advancement in the form of grocery store scanners, may already have proven very costly to grocery chains using these devices. Cashiers are subjected to wrist flexion and extension thousands of times daily, with a greater risk of carpal tunnel syndrome. It only makes good sense for business to establish proper work conditions, thus helping prevent carpal tunnel syndrome and the costs associated with treatment and time off from work.

Final Comments

Although carpal tunnel syndrome is not common in athletics, the athletic trainer should consider it in his/her differential diagnosis of athletes presenting hand, wrist, arm, and shoulder symptoms. Furthermore, as athletic trainers continue to be employed by industry, it will be paramount to expand our knowledge base to include those injuries sustained as a result of cumulative trauma.

References


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Tibial Plateau Fracture in a Female Soccer Player: A Case Study

Jeff A. Giulietti, ATC
Craig R. Denegar, PhD, ATC, PT
Christopher D. Harner, MD

Abstract: In general, tibial plateau fractures are rarely associated with noncontact, twisting, injuries to the knee in athletics. A 23-year-old woman sustained a noncontact valgus injury to her left knee while playing indoor soccer. Evaluation on-site and the following morning revealed no deformity and only mild pain over the anterolateral tibial plateau. All stress tests of the knee were negative. A 2+ effusion was noted the day after injury, causing us to suspect an internal derangement of the left knee. A nondisplaced tibial plateau fracture was confirmed by radiographs. The patient was treated nonoperatively with a hinged knee brace and protective weight bearing with axillary crutches. Ten weeks following the injury, radiographs revealed a healed fracture, and the patient was instructed to gradually increase her athletic activity. The mechanism of injury and symptoms suggested injury to the tibial collateral ligament and anterior cruciate ligament. The physical examination findings, however, led us to believe otherwise. It is important to recognize that valgus stresses to the knee can result in damage to structures other than the soft tissues (ie, tibial collateral ligament). This injury resulted in a nondisplaced tibial plateau fracture that healed uneventfully with appropriate nonoperative treatment.

A fracture of the tibial plateau is a relatively uncommon knee injury in sports. Those that occur in younger individuals usually result from high impact incidents, such as automobile accidents. While such fractures have been reported to result from alpine skiing accidents, fewer than 10% of all cases are related to sports. In this case, a female athlete sustained a nondisplaced tibial plateau fracture while playing indoor soccer. The mechanism of injury and resulting effusion were suggestive of soft tissue injury. However, on physical examination no evidence of damage to the ligaments was found. A routine radiographic evaluation identified the fracture. The purpose of this case study is to present an example of a knee injury that resulted in an intraarticular fracture, rather than a soft tissue injury. Cases such as this reinforce our belief that plane x-rays should be obtained as part of the evaluation of knee injuries in athletes.

The Injury
A 23-year-old white female varsity field hockey player injured her left knee while playing intramural indoor soccer. While maneuvering the ball with the medial aspect of her left foot, an opponent kicked the ball, placing a valgus force on her knee. She reported immediate pain in her left knee, which caused her to discontinue play. The athlete reported no previous injury to the left knee.

She was evaluated on the field by a certified athletic trainer (JG). During the evaluation, she described a valgus mechanism of injury. Objective examination revealed no deformity or swelling. Palpation of the anterior tibial plateau, lateral to the patellar tendon, revealed tenderness. Valgus, varus, anterior, and posterior stress tests failed to demonstrate increased laxity of the left knee. Range of motion was normal, but pain was noted with forced extension. Manual muscle testing of the biceps femoris was very painful and graded fair. Testing of the quadriceps and medial hamstrings revealed normal strength and was painless. Neurovascular screen of the left lower extremity was normal. Weight bearing was painful. Over a period of approximately 10 minutes, swelling developed over the anterior aspect of the knee, and active and passive knee flexion became increasingly painful. She was treated with ice, compression, and elevation for 20 minutes immediately following the evaluation. She was fitted for crutches, her knee was wrapped with an ace bandage and placed in a knee immobilizer, and she was instructed to elevate and apply ice to the knee. Evaluation the following morning (CD) revealed a 2+ effusion of the left knee with tenderness along the anterior margin of the tibial plateau. Active and passive range of motion were limited, secondary to pain. Stress testing failed to identify increased knee joint laxity. The athlete noted pain with passive and active eversion of the left ankle. She was instructed to continue using the knee immobilizer and crutches and was referred to an orthopaedic surgeon (CH).

She was evaluated at a local hospital emergency room that evening, secondary to her parents’ concerns.
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Radiographs (Figs 1 and 2) revealed a nondisplaced fracture of the anterolateral tibial plateau. She was provided with analgesic medications and advised to continue nonweight-bearing, crutch-assisted ambulation in the knee immobilizer until she was further evaluated by an orthopaedic surgeon.

Orthopaedic examination the following morning confirmed the diagnosis of a nondisplaced fracture of the left, anterolateral tibial plateau, without ligamentous sprain. Increased pain was noted with valgus stress testing. She was fitted with a hinge brace and instructed in touch-down weight bearing, using a heel-to-toe gait. She was instructed in active heel slides, quadriceps setting, and straight leg raises, and analgesic medications were continued as needed.

X-ray examination at 6 weeks postinjury revealed a healing fracture. She was advised to discontinue use of the knee brace, gradually increase weight bearing, and initiate a program of swimming and cycling. Crutches were discontinued at 8 weeks postinjury.

X-ray examination at 10 weeks revealed a well-healed fracture. The athlete reported some knee pain with prolonged weight-bearing activity, but this gradually resolved. The athlete was advised to gradually increase her activity level during the summer months. Approximately 5 months after her injury, she was pursuing summer recreational activities, including playing volleyball, without limitation.

Discussion
Athletic trainers evaluate many knee injuries in which a valgus mechanism of injury is described. This mechanism often results in sprain of the tibial collateral ligament and injury to other medial compartment structures, as well as the anterior cruciate ligament. Athletic trainers also encounter many knees with grade II or grade III effusion, which is often secondary to rupture of the anterior cruciate ligament. Radiographic evaluation of these injured knees is rarely remarkable.

In this case, the described mechanism was consistent with injury to the medial compartment, and the effusion that developed over the first 12 hours postinjury suggested an intraarticular injury. However, stress testing led us to suspect internal derangement of nonligamentous origin, and routine radiographs confirmed the diagnosis of bony, rather than ligamentous, injury.

We can only theorize about the mechanism of this bony injury to the knee. In part, what makes this injury unique is that there was no apparent soft tissue (ligament) involvement. In fact, isolated injury to the tibial collateral ligament is the second most common ligamentous injury to the

---

Fig 1.—Lateral view of the fracture (see arrow) of the left anterolateral tibial plateau taken on the day following the injury.

Fig 2.—Anterior view of the fracture (see arrow) of the left anterolateral tibial plateau taken on the day following the injury.
However, one must remember that whenever a joint is subjected to forces that can damage ligaments, the bone and articular cartilage can also be affected. We are seeing more evidence of this with magnetic resonance imaging following acute ligament injuries to the knee. The so-called “bone bruise,” noted by Spindler et al in 80% of patients following acute anterior cruciate ligament ruptures, makes us realize that there is bone involvement to some extent in a high percentage of knee injuries. In this case presentation, we give an example of an athlete who suffered an apparent valgus injury that resulted in more bony than soft tissue damage. The exact biomechanical mechanism that resulted in overload to the bone rather than soft tissue is not clear. Nonetheless, while the described mechanism was one more associated with injury to the soft tissues, the injury resulted in a fracture of the tibial plateau. We believe it is important for sports medicine personnel to realize that knee injuries involve a spectrum of soft tissue and bony damage.

While rare, fractures about the articular surface of the knee can occur in athletes participating in contact and collision sports. Rasmussen reviewed 260 cases of tibial condylar fractures and reported that over 90% occurred in patients more than 30 years old and 72% occurred in patients more than 55 years old. We had not previously encountered a tibial plateau fracture resulting from a valgus stress to the knee in a high school or college athlete. If the physical evaluation of the injured knee fails to identify the injury or if there is any suspicion of bony involvement, a routine radiographic examination is warranted. Although most knee injuries resulting from valgus stress involve soft tissue, this particular case is an example that resulted in a fracture. It is important to have a high degree of suspicion for injury to both the soft tissue and bone.

References
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**The scope and validity of this patent was affirmed in a U.S. District Court in January, 1992."
Casting in Sport

Mark DeCarlo, MS, PT, SCS, ATC
Kathy Malone, MA, ATC
John Darmelio, MS, ATC
Arthur Rettig, MD

Abstract: Attempts by sports medicine professionals to return high school athletes with hand and wrist injuries to competition quickly and safely have been the source of confusion and debate on many playing fields around the country. In addition to the differing views regarding the appropriateness of playing cast usage in high school football, a debate exists among sports medicine professionals as to which material is best suited for playing cast construction. Materials used in playing cast construction should be hard enough to provide sufficient stabilization to the injured area and include adequate padding to absorb blunt impact forces. The purpose of the biomechanical portion of this investigation was to attempt to determine the most appropriate materials for use in constructing playing casts for the hand and wrist by assessing different materials for: 1) hardness using a Shore durometer, and 2) ability to absorb impact using a force platform. Results revealed that RTV11 and Scotchcast were the “least hard” of the underlying casting materials and that Temper Stick foam greatly increased the ability of RTV11 to absorb impact. Assessment of the mechanical properties of playing cast materials and review of current developments in high school football rules are used to aid practitioners in choosing the most appropriate materials for playing cast construction.

Rturning athletes to competition safely and effectively is a primary concern of coaches, officials, and sports medicine practitioners alike. Using protective devices, taping, and wrapping to accomplish this return is accepted as beneficial and necessary in athletics. A protective device should:

- provide adequate protection to the injured part and prevent further injury,
- allow the injured player to participate safely and effectively,
- protect opposing players against injury from the device, and
- satisfy game officials that the above are met within the rules governing the particular sport.1

Fabricating a “splint” that allows adequate protection from reinjury, is lightweight and compact, and either does not interfere or allows minimal interference with the functional skills required of each athlete, is often the responsibility of the trainer or therapist.6

A variety of methods and materials have been used over the years to protect athletes from injury, and, more recently, to allow continued participation following injury. The use of “playing casts” for hand and wrist injuries has greatly contributed to decreasing the time lost from sport.4,8,10 Football players in particular have benefited from the use of playing casts.5

To ensure the safety of all participants in contact sports, establishing criteria for fair play is certainly necessary. This includes criteria for determining the types of protective equipment that may be worn. We believe that these criteria should be established based upon physician and trainer recommendation, agreement of game officials, and evidence produced by research studies. This research was undertaken to help answer questions raised by athletic officials and medical professionals regarding the safety of the injured player and the opposing players when a cast is worn. Biomechanical analysis was used to determine the hardness and energy absorption capabilities of materials commonly used to support and protect the hand and wrist following injury.

Materials and Methods

The following materials were tested for hardness and/or ability to absorb impact:

- RTV11 silicone (General Electric Company, Waterford, NY);
- fiberglass (Delta-Lite, Johnson and Johnson Orthopaedics Inc, New Brunswick, NJ);
- 1/8” Ezeform thermoplastic material (Smith & Nephew Rolyan, Menomonee Falls, WI);
- athletic tape, 1/2” porous (Johnson & Johnson Medical Inc, Arlington, TX);
- Temper Stick adhesive-backed foam (both 3/8” and 3/4” T-41 firm blue, Kees Goebel Medical, Hamilton, OH);
- 3/8” felt padding (Medco Supply Company, Muncie, IN);
- Scotchcast (3M Orthopedic Products Div, St. Paul, MN);
- forearm pad (“J” Pad).

Twenty hardness readings were taken from random points on each of six types of materials using a Shore durometer (Shore Instrument & MFG Co, Jamaica, NY). A durometer is an instrument with a small, blunt needle used by engineers to determine the hardness of materials (Fig 3). Readings are taken in durometer units by pressing the needle into
the material. For the purposes of this study, "hardness" is defined as the ability of the material to resist penetration or yield to pressure. Materials with an outer layer of foam could not be tested using the durometer because readings require contact with a hard, nonporous surface. The materials tested for hardness included 12" × 16" sheets of Scotchcast, Ezeform, Fiberglass, RTV11 silicone, and RTV11 with 3/8" Temper Stick foam padding and athletic tape (RTV/TS/AT). A single leather lineman’s glove (Fig 1) and a slip-on forearm pad with the straps cut off (Fig 2) were also tested, as well as the dorsal surface of a bare hand and a hand taped for athletic participation (Fig 3).

Energy absorption was measured using a Kistler force platform (Model 9281 B). A drop point test was conducted by releasing a steel ball (m = .866 kg) from the trap door of a specially constructed device onto a sample of material as it covered the surface of the platform. The ball was dropped from heights of 30, 60, and 100 cm.

The materials tested for impact absorption included all the materials tested with the durometer (except the bare hand), plus RTV11 with 3/8" Temper Stick foam padding (RTV/TS), 3/4" Temper Stick foam padding alone (3/4" TS), 3/8" Temper Stick foam padding alone (3/8" TS), and 3/8" felt padding. The RTV/TS/AT material used in both the durometer and impact absorption testing has previously been described by the authors. Each material was tested at its usual clinical application thickness (ie, two layers of RTV11 silicone, two layers of fiberglass, etc). The athletic tape was tested using six layers of tape across the force platform. Impact readings were taken for 39 trials (3 heights × 13 "conditions"). The 13 conditions included 12 test materials plus the "unprotected" force platform. The impact of the ball during the "no material" condition was measured only from a height of 30 cm. This condition was not repeated for the 60- and 100-cm heights, because the impact forces obtained would have been too great for the platform to record accurately. The force values for these heights were derived using extrapolation.

Peak vertical force at impact was recorded in Newtons by the force platform for all trials at 1000 Hz. Analysis of variance (ANOVA) was used to determine if significant differences existed among the nine surfaces (seven materials, the bare hand and taped hand) tested with the Shore durometer for hardness.
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Tukey’s multiple range test was used to determine which materials differed significantly from one another.

Analysis of covariance (ANCOVA) was used to determine if significant differences existed among the peak force (energy absorption) of 12 materials and the NM condition, with height included as a covariate, and if height-material interaction existed (to determine if height affects the various materials differently). Duncan’s multiple range test was used to determine which materials differed significantly from one another.

**Results**

There was a significant difference among the nine surfaces tested (p = .0001) for hardness. The materials fit into six groups with Ezeform being the hardest and forearm pad and bare hand being the least hard (Table 1). Significant differences also existed among the 13 conditions tested for impact absorption (F(12,13) = 6.65, p < .0009), height significantly affected peak force (F(1,13) = 543.33, p < .0001), and a height-material interaction existed (F(12,13) = 12.36, p < .0001). The no material condition demonstrated significantly higher peak force than all other materials.

Also 3/4” Temper Stick foam had significantly lower peak force than all of the other materials (Table 1).

**Discussion**

Although the use of playing casts in football is not an issue at the college or professional level where the rules allow for the use of hard material with padding, it has been a topic of debate at the high school level for the last several years. The 1994 season will mark the first time in the history of high school football that players nationwide will be permitted to participate with hard casts or splints on the hand, wrist, forearm, or elbow. The new rule stipulates that the device must be “covered on all exterior surfaces with no less than 1/2 inch thick, high density, closed-cell polyurethane, or alternate material of the same minimum thickness and similar physical properties.” The new rule further requires that the athlete present contest officials with written verification from a “licensed medical physician” attesting to the necessity of the playing cast to protect an injury.9

The decision by the National Federation of State High School Associations (NFSHSA) to change the cast rule did not come about quickly or easily. These data, which were presented at the 1993 Mid-Winter Meeting of the NFSHSA, helped form the basis for recommendations to allow playing cast usage on the high school football field. As a result of the presentation and recommendations made by the presenting medical professionals, the NFSHSA allowed six state associations (Indiana, Kentucky, Illinois, New York, Virginia, and Tennessee) to experiment with a hard playing cast rule in 1993. One state (Iowa) experimented with the use of RTV11 silicone with padding. All seven states reported favorable results and the new rule (1–5–3a) was passed in the January 1994 Mid-winter meeting of the National Federation.

Up until now, when an athlete with a hand or wrist injury had been cleared to play by a team physician, the job of devising a means of protection that would satisfy both physicians and game officials was typically left to the trainer. Since hard protective materials were deemed illegal, even when padded, trainers and physicians began to consider different means of protection. The introduction of silicone rubber to football in the 1970s1 came about as a result of such considerations by trainers and physicians. Silicone rubber did not appear to be as hard as plaster or fiberglass and proved rigid enough to provide protection for injured ath-

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**Table 1.—Hardness (Durometer Reading, n=20) and Impact Absorption (Drop Point, n=3) of Materials Tested**

<table>
<thead>
<tr>
<th>Material</th>
<th>Hardness</th>
<th>Impact absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Tukey grouping*</td>
</tr>
<tr>
<td>No material</td>
<td>22.8 ± 5.0 (bare hand)</td>
<td>F</td>
</tr>
<tr>
<td>Scotchcast</td>
<td>39.5 ± 7.0</td>
<td>D</td>
</tr>
<tr>
<td>Ezeform</td>
<td>95.5 ± 0.9</td>
<td>A</td>
</tr>
<tr>
<td>Fiberglass</td>
<td>70.5 ± 8.7</td>
<td>B</td>
</tr>
<tr>
<td>Felt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Athletic tape (AT)</td>
<td>40.2 ± 5.8</td>
<td>D</td>
</tr>
<tr>
<td>Forearm pad</td>
<td>22.5 ± 2.3</td>
<td>F</td>
</tr>
<tr>
<td>RTV11</td>
<td>48.6 ± 1.8</td>
<td>C</td>
</tr>
<tr>
<td>3/8” Temper Stick (TS)</td>
<td>40.3 ± 2.4</td>
<td>D</td>
</tr>
<tr>
<td>Leather glove</td>
<td>32.2 ± 1.8</td>
<td>E</td>
</tr>
<tr>
<td>RTV11/TS/AT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTV11/TS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4” Temper Stick</td>
<td></td>
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</tbody>
</table>

Note, lower numbers indicate better performance.

*Means with the same grouping letter are not significantly different.

†The 60- and 100-cm force values used to calculate this mean were extrapolated using the regression equation y = 179.1x + 2199.7 (where x = height and y = Newtons). The regression formula was derived by recording the impact forces on the force platform at 10, 20, and 30 cm.
letes. Rules once regarded as clear and concise became the source of debate as coaches, trainers, and officials each attempted to define the term “hard,” as found in the rule books.

Researchers began rating casting materials for hardness using a Shore durometer. Ratings for silicone in these studies were similar to other types of protection being used for hand and wrist injuries (ie, six layers of adhesive tape and “soft splints”). Bassett et al were the first to describe a cast made from Room Temperature Vulcanizing (RTV) silicone rubber (RTV11) and medical gauze. The degree of immobility achieved by the splint was determined by the amount of silicone or supporting materials used in its construction. This particular model provided protection to the athlete without putting other players at risk and was, at the time, “universally accepted by game officials and opponents.”

The soft playing splint described by Bergfeld was used in 113 injuries and resulted in no loss of reduction in fracture or joint, no nonunions, delayed unions, or malunions, and no reported additional injuries to either the wearer or the opponent while using the splint. The device was approved by the National Collegiate Athletic Association (NCAA) and its use by high school athletes was left to the discretion of local high school athletic associations. This custom-made silicone rubber splint was made using “self-vulcanizing rubber” (RTV700) with Beta 2 red curing agent, Ensolite foam (HH Breman Mfg Co, Breman, IN) between layers of silicone, and medical gauze. It reportedly provided “the necessary rigidity to protect the injured part, while providing the shock absorption qualities of Ensolite.”

Bradley also supported the practical use of silicone rubber playing casts and stated that they were “being banned in some places because they are considered hard and potentially dangerous in contact sports.” The playing cast described included a layer of polyurethane foam padding between the second and third layers of an RTV21 silicone, which has different room temperature-vulcanizing properties than RTV11. This model was clinically applied by Bradley and used by 50 athletes in the previous 2 years without any resulting injuries or complications. A similar model constructed using RTV11, Sof-Kling gauze (Johnson & Johnson Co, Arlington, TX) and Temper Stick foam padding met the approval of the Indiana High School Athletic Association in 1991 for use in football. This model was used to successfully treat 148 football players with hand and wrist injuries over a 2-year period.

Because of its nonporous nature, silicone casts are only recommended for short-term use, such as during a 2- to 3-hour competition or practice so that maceration of the skin may be avoided. Temper Stick is considered “open-cell” polyurethane, the new rule allows for materials with “similar physical properties” to those of closed-cell polyurethane. This foam, which has been previously described for use in playing cast fabrication, has proven to provide adequate protection when combined with RTV11. The adhesive backing of the Temper Stick provides an added advantage for playing cast construction.

Conclusions

From biomechanical testing we have been able to provide information on the properties of hardness and energy absorption for different types of casting and padding materials. Although other authors have described materials used for protecting hand and wrist injuries, few have attempted to describe the properties of these materials. The criteria that a playing cast should satisfy include provisions for the safety of both the injured athlete and the opposing players, as well as the stipulation that game officials be convinced of the legality of the device. The physical properties a playing cast should possess include: 1) internal hardness to ensure immobilization of the injured part, and 2) external impact absorp-
tion to act as a cushion during contact.

It should be emphasized that no matter which types of approved materials are chosen for playing cast construction, the purpose of the device should remain clear; safe participation. Physicians and trainers must consider the specific needs of the athlete as well as the nature and severity of the injury. As is the case with other injuries, return to play is based upon the stability of the injury and the decision of the treating physician. When a playing cast is used, it is highly recommended that the device be removable and worn only on the playing field. A separate device should be provided for extended daily wear when necessary.

Acknowledgments

We would like to acknowledge Rafael Bahamonde and Dr. Gale Gehlsen of the Ball State University Biomechanics Lab in Muncie, IN for their assistance in conducting this study; and David Nelson of Methodist Hospital in Indianapolis, IN for his assistance with statistical analysis.

References

Analysis of Cerebral Concussion Frequency With the Most Commonly Used Models of Football Helmets

Eric D. Zemper, PhD

Abstract: Data on helmet models used and occurrence of cerebral concussions over five seasons were collected from a representative sample of college football teams including a total of 8,312 player-seasons and 618,596 athlete-exposures to the possibility of being injured in a game or practice. Results showed that players with a history of concussion any time during the previous 5 years were six times as likely to suffer a new concussion as those with no previous history. In light of previous studies showing cognitive deficits for up to 30 days following even minor head injuries, and the growing awareness of "second impact" fatalities, these data support a need for reconsideration of the common practice of immediate return to play following non-loss-of-consciousness head injuries. Results on concussion frequency in ten models of football helmets indicated a significantly lower than expected frequency in the Riddell M155 and a significantly higher frequency in the Bike Air Power. All other models performed within expectations. This study demonstrates the need for monitoring on-the-field performance of football helmets through continuing epidemiological studies to supplement laboratory test data, which cannot duplicate all the factors involved in actual helmet performance.

Cerebral concussion is a common injury among football players,1,5,20 being the fifth most common injury in college football.20 Reducing the number and severity of head injuries, including cerebral concussions, is the principal purpose of the football helmet. Over the past 25 years, there have been several studies reporting the incidence of concussions in football players, but few studies have looked specifically at concussion rates in players wearing different brands and models of football helmets. During the 1969 high school football season in North Carolina, Robey et al16 found essentially no difference in second and third degree concussions among brands of padded helmets or among brands of suspension helmets, but the players wearing suspension helmets had lower rates of concussion overall. Data collected by the National Athletic Injury/Illness Reporting System from a sample of high school and college teams during the 1975–1977 seasons indicated no difference in cerebral concussion rates in 13 brands of football helmets.4 More recently, in a study combining data from the NCAA’s Injury Surveillance System and from the Athletic Injury Monitoring System, it was reported that there were no differences in concussion rates among brands of football helmets in a sample of college teams during three of the four seasons studied.23 It was uncertain whether the differences in concussion rates found in the fourth year were due to real differences in protective ability among the brands of helmet or due to a statistical aberration in that year’s data.

This report on cerebral concussion in the most commonly used models of football helmets is based on data collected during a 5-year prospective study of football injuries in a national sample of college football teams conducted by the Athletic Injury Monitoring System (AIMS) operated by Exercise Research Associates of Oregon (EXRA). The results of the descriptive analyses of these data are used to address issues concerning recurrence of head injuries and monitoring on-the-field performance of football helmets.

Subjects and Methods

The data used for this study were collected during five seasons (1986–1990) by AIMS. AIMS meets the major criteria for reliable studies of sports injury rates outlined in 1987 by the American Orthopaedic Society for Sports Medicine.18 The total AIMS sample was a stratified, proportionally representative sample, based on geographic region and size of athletic program, of all NCAA and NAIA intercollegiate football teams, and was approximately a 5% sample of all these teams. The subset of data used for this report included all the teams from which complete data were available on brands and models of football helmets used, constituting an approximately 3% sample of all NCAA and NAIA football teams, and was proportionally representative by geographic region and size of program.

The study population included all intercollegiate football players at these institutions. The geographic region by program size distribution of this sample is presented in Table 1. A χ² test of goodness-of-fit comparing this distribution with the distribution expected based on NCAA and NAIA members sponsoring football during the period of this study showed no significant difference between the sample distribution and the actual distribution (calculated χ² = 15.2; critical value = 19.7, α = .05, df = 11). The results therefore are gener-
alizable to the total population of intercollegiate football teams.

Over a 5-year period, this study included a total of 93 team-seasons (an average of 19 teams per year) with a total of 8,312 player-seasons accumulating 618,596 athlete-exposures. An athlete-exposure (A-E) is one player taking part in one practice or one game, where he is exposed to the possibility of being injured. If a football team has 100 players that all take part in five practices in a given week, that team has 500 A-E for the week in practices. If 43 players actually participate in the game on Saturday, there are 43 game exposures and a total of 543 A-E for that team for the week.

Prior to the start of each football season the head athletic trainer at each participating school was sent copies of forms for reporting exposure and injury data, along with detailed instructions on how to use the forms. On a weekly basis throughout the season, from the first preseason practice until the final regular season or postseason game, the athletic trainers returned a form listing the number of practices and any games played during the week, and the number of players participating in each. They also returned separate forms detailing each football-related injury that kept a player from full participation for one day or more. The athletic trainers also were instructed to complete an injury form for any player evaluated for a suspected or diagnosed cerebral concussion, whether or not there was time-loss involved. Upon arrival at the ExRA office, each form was logged in and screened for completeness and consistency before being entered into a computer file for later analysis. In the case of missing data, or incomplete or inconsistent data on any form, the individual athletic trainer was contacted for clarification. During the 5 years of this study, 97.9% of the weekly forms were submitted.

For this study the athletic trainers also completed a form at the beginning of the season indicating the number of each brand and model of football helmet being worn by their team members. While brand data were available from all teams, for various reasons the athletic trainers from about one-fourth of the total sample of 125 team-seasons were not able to obtain complete data on the models of helmet used. This report therefore uses data only from the 93 team-seasons that provided complete helmet model data. The distribution of helmets in use by brand names was the same in the total sample and in the sample used for this report. During the last 3 years of this study the athletic trainers also indicated the number of players on the team who had a history of cerebral concussion any time during the 5 years prior to each season. This information was taken from the medical histories of the players. On the individual injury forms the athletic trainers provided information such as the type of injury, player position, the circumstances, type of playing surface being used, number of days away from participation, whether or not it required surgery and, if it was a head injury, whether or not a cerebral concussion was diagnosed, what degree based on AMA’s Standard Nomenclature of Athletic Injuries, and what brand and model of helmet was worn by the injured player. The statistical analyses for this report utilized the chi-square goodness-of-fit test with an α = .05.

Results

Concussion Rates

Data for ten models of football helmets used in a total of 93 team-seasons during the 5-year period of this study are presented in Table 2. The left-hand column of figures shows the distribution of the different models of helmets in the sample. The next column shows the total number of athlete-exposures in practices and games for each model, with the next column displaying the number of cerebral concussions observed in this sample for each model. The third column from the right lists the number of cerebral concussions expected for each model if the distribution was the same as the distribution of athlete-exposures for each model, which would be the case if every model were doing an equivalent job of protecting the head. The rate of cerebral concussions per 1,000 A-E is given in the second column from the right.

The helmet models included are those that comprised at least 2% of the helmets in use in the sample and had at least five for the expected value of the number of concussions. This eliminated four models that together accounted for only 4% of the total athlete-exposures in the sample. This step was taken to avoid violating the assumption that observed values are normally distributed around the expected value in the \( \chi^2 \) test, which is a potential problem when expected values fall below five.

The distribution of observed cerebral concussions in Table 2 does not
Table 2.—Cerebral Concussion Rates for Ten Football Helmet Models During a 5-Year Period in a Total of 93 Team-Seasons

<table>
<thead>
<tr>
<th>Helmet Model</th>
<th>No. in Use N (%)</th>
<th>No. of Athlete-Exposures</th>
<th>No. of Concussions Observed</th>
<th>No. of Concussions Expected A-E</th>
<th>Rate/1000 A-E</th>
<th>Standardized Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike Air Power*</td>
<td>3,058 (36.8)</td>
<td>217,241</td>
<td>115</td>
<td>86.04</td>
<td>0.53</td>
<td>3.12</td>
</tr>
<tr>
<td>Bike Pro Air*</td>
<td>1,822 (21.9)</td>
<td>130,988</td>
<td>81</td>
<td>51.88</td>
<td>0.62</td>
<td>4.04</td>
</tr>
<tr>
<td>Riddell M155</td>
<td>1,083 (13.0)</td>
<td>90,299</td>
<td>15</td>
<td>35.76</td>
<td>0.17</td>
<td>-3.47</td>
</tr>
<tr>
<td>Riddell WD1</td>
<td>649 (7.8)</td>
<td>48,846</td>
<td>12</td>
<td>19.35</td>
<td>0.25</td>
<td>-1.67</td>
</tr>
<tr>
<td>Riddell VSR3</td>
<td>370 (4.5)</td>
<td>29,501</td>
<td>6</td>
<td>11.68</td>
<td>0.20</td>
<td>-1.66</td>
</tr>
<tr>
<td>Riddell PAC-3</td>
<td>392 (4.7)</td>
<td>27,341</td>
<td>5</td>
<td>10.83</td>
<td>0.18</td>
<td>-1.77</td>
</tr>
<tr>
<td>Riddell VSR1</td>
<td>287 (3.5)</td>
<td>23,031</td>
<td>4</td>
<td>9.12</td>
<td>0.17</td>
<td>-1.70</td>
</tr>
<tr>
<td>Riddell AF2</td>
<td>223 (2.7)</td>
<td>18,206</td>
<td>3</td>
<td>7.21</td>
<td>0.16</td>
<td>-1.57</td>
</tr>
<tr>
<td>AHI Air Power*</td>
<td>254 (3.1)</td>
<td>17,914</td>
<td>3</td>
<td>7.09</td>
<td>0.17</td>
<td>-1.54</td>
</tr>
<tr>
<td>MaxPro Super Pro</td>
<td>174 (2.1)</td>
<td>15,229</td>
<td>1</td>
<td>6.03</td>
<td>0.07</td>
<td>-2.05</td>
</tr>
<tr>
<td>Totals</td>
<td>8,312</td>
<td>618,596</td>
<td>245</td>
<td>244.99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The Bike helmet line was purchased by American Helmet, Inc., in 1987, and AHI subsequently changed some components of the Air Power model, thus making it a “new” model. The AHI Air Power is therefore analyzed here as a separate helmet model. The Bike Pro Air was replaced after 1989 by a new model, the AHI Pro Air II, and there were not enough AHI Pro Air II helmets used in this sample to be able to include in this analysis. (There were only 4860 A-E and no concussions reported in the AHI Pro Air II.)

fall within the expected range based on number of A-E for each model of football helmet ($\chi^2 = 58.7$, compared to a critical value of 16.9, $\alpha = .05$, df = 9). A $\chi^2$ test will tell whether or not a set of results fall within an expected distribution range, but it will not indicate which categories, in this case helmet models, are contributing most significantly to the results. To identify the major contributors to this significant $\chi^2$ value, standardized residuals were calculated for each model, and are presented in the right-hand column of Table 2. Major contributors to a significant $\chi^2$ value are those categories (or helmet models) with a standardized residual having an absolute value of 2.00 or more. The Bike Air Power and Pro Air models have positive values greater than 2.00, indicating they have significantly more observed cerebral concussions than would be expected based on the number of exposures for these models, while the Riddell M155 and the MaxPro Super Pro have negative values greater than 2.00, indicating they have significantly fewer than the expected number of cerebral concussions. (Because of the relatively low number of helmets in use and exposures for the MaxPro Super Pro, and only a single observed cerebral concussion in that model, until more data become available for this model, it is probably best not to draw any immediate conclusions regarding the MaxPro Super Pro.) All other models appear to fall within expected ranges based on the number of exposures. Separate analyses indicated there were no significant effects on the distribution of concussions based on player position or on the type of play (rush, pass, kick) at the time of injury.

There is one potential concern about the data set presented in Table 2 that could have an impact on the results shown. Many teams use more than one model of helmet, and if one assumes that all the first-string players use one model and lower-string players have been given different models, which may or may not be the case on a given team, then the model being used by starters could be receiving more exposures at a greater “intensity” than other models for that team. This, in turn, could tend to skew or bias the results of analyses such as those in Table 2. To determine whether any model was affected by this potential source of bias, a subset of data was assembled utilizing only teams that used one model on at least 90% of their players. This had the practical effect of eliminating all models from the data set except the three predominant models being used by the teams in the sample: The Bike Air Power, the Bike Pro Air, and the Riddell M155. Twenty-three team-seasons re-
mained in this restricted subsample and each of the remaining models averaged a minimum of 97.5% “pure” sample. In other words, only one or two players on a given team would not be wearing the particular model of helmet used by all the other players on the team. There were representatives of all three divisions and all four geographic regions in this subset. While the four geographic regions remained proportionally representative of the national distribution, Division I teams were slightly over-represented and Division III teams were somewhat under-represented. The additional analysis for this subset of “pure” helmet model data is presented in Table 3. The $\chi^2$ test again shows a significant result. The calculated $\chi^2$ value is 14.4, compared to a critical value of 6.0, $\alpha = .05$, df = 2. Table 3 shows there apparently was a biasing effect present for the Bike Pro Air model, possibly due to the above noted potential for nonrandom distribution of the model. It now falls well within the expected range of cerebral concussions, and even shows a tendency to have fewer than the expected number of concussions. However, based on the standardized residuals, the Bike Air Power continues to show a significantly higher number of cerebral concussions than expected based on the number of exposures for this model, and the Riddell M155 shows a significantly lower than expected number of concussions. Across both sets of analyses (Tables 2 and 3) the Bike Air Power and the Riddell M155 show little change in their respective concussion rates per 1,000 A-E, and the absolute values of the standardized residuals remain well above 2.00.

Further confirmation of these results were provided when game situations were isolated, to eliminate any potential bias from the range of intensities present during practices. This third set of analyses were done using only game concussions and game exposures, where the intensity of exposure should be fairly uniform. The overall results are essentially the same as those shown in Table 3 except, as noted in previous reports for all injuries, the rates of concussions/1,000 A-E are considerably higher during games (Bike Air Power 4.64; Bike Pro Air 1.80; Riddell M155 0.38). These results continued to show the Bike Pro Air with fewer than the expected number of cerebral concussions, but within the expected range if all models were providing equal protection. Again, based on the standardized residuals, the Bike Air Power showed significantly more than the expected number of concussions, while the Riddell M155 showed significantly fewer concussions.

During the period of this study the Bike Air Power helmet was one of the oldest models on the market, having first become available in about 1975. Although manufacturers normally do not release their sales figures, it is apparent from these data that the Bike Air Power model was one of the predominant models used by college football teams during this period. (It is generally believed that the percentages of the various models in use at the high school level differ considerably from those at the college level.) Because the Bike Air Power had been available for a longer period, it is possible that, if there were a higher proportion of older Air Power helmets in this sample and if one assumes older helmets do not protect as well as newer helmets, it might affect these results. To investigate this possibility, the data were examined to see if the proportion of concussions occurring in old versus new helmets was different for the Air Power model compared with the others. The results of these analyses showed that there were no significant differences among the models in the proportion of concussions recorded in old, new, or reconditioned helmets. This also held true when history of previous concussion was factored into the analyses.

Reinjury

Data from the last 3 years of this study allowed a look at the impact of a history of cerebral concussion within the previous 5 years on the risk of sustaining another concus-
sion. During this period 2.1% of the players with no previous history of cerebral concussion suffered a new concussion, while 12.2% of the players with a previous history suffered a new concussion (Table 4). Thus, those players with a history of cerebral concussion any time during the previous 5 years were six times as likely to incur a new concussion. Further analyses showed that this result was not affected by player position or type of play at the time of injury. The proportion of concussions across all player positions was not significantly different for those with a history of previous concussions and for those with no history of concussion. Based on written communication from RM Campbell of the NCAA Staff in April 1993, there also were no significant differences in the proportion of concussions during different types of plays during games (rushing, passing, kicking) for players with and without a history of concussion, based on national data on the distribution of plays during NCAA football games.

Table 4.—Cerebral Concussion in Players With and Without Previous History of Concussion*

<table>
<thead>
<tr>
<th>Total number of players</th>
<th>6192</th>
<th>491</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of players sustaining concussion</td>
<td>127</td>
<td>60</td>
</tr>
<tr>
<td>Percent</td>
<td>2.05</td>
<td>12.22</td>
</tr>
<tr>
<td>Relative risk = 5.95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*These data cover only the 1988–1990 seasons, during which data on previous history of concussion were reported.

Discussion

These analyses provide the basis for addressing two important issues related to sports safety that previously have not received enough attention. The first is when to allow athletes to return to activity after sustaining a concussive injury, particularly those involving no loss of consciousness. The second issue is the need for continuous monitoring of field performance data, in addition to current laboratory testing procedures, for critical pieces of sports safety equipment, such as football helmets. I hope this report will serve as the impetus for further research and discussion on these important issues.

Previous reports on AIMS college football data have indicated that cerebral concussions constitute about 5% of the total injuries and are the fifth most frequent injury in college football.20,22 At the high school level concussions have been reported as 5.4% of all football injuries,3,1 to 9% of all injuries,7 and 24% of all reported football injuries.5 It is interesting to note that in the Gerberich5 study only about 9% of the injuries were initially reported as concussions when respondents were asked if a “concussion” had occurred. However, the additional incidents were revealed when respondents were asked if there had been an incident of “not knowing the time or place, or not remembering a play or an assignment on the field” following a blow to the head. These symptoms indicated a loss of consciousness and/or awareness and therefore a concussive event. This implies that, because of a lack of complete understanding of the medical term “concussion” on the part of players and coaches, many such incidents may go unreported, particularly in retrospective studies and those that do not use trained medical personnel as data sources.

Undoubtedly, helmets do reduce the number and severity of head injuries in football players. But the question remains, are all helmets doing an equivalent job of protecting the head? Could they do a better job? These questions become even more important when you consider research showing that closed head injuries, even when they do not involve loss of consciousness, produce measurable cognitive deficits (eg, memory, information processing) for up to 30 days following injury.5 These effects are cumulative, with succeeding head injuries creating greater deficits for longer periods.7 This should raise serious concerns about even mild, non-loss-of-consciousness head injuries (eg, the “bell ringer”) to school age participants in football and other sports, and the resulting implications for classroom performance.

The problems presented by recurrent head injuries recently has become more apparent through the observations of clinicians who have reported instances of “second impact” fatalities in football players.13,17 They believe that an initial concussive event in some individuals may cause swelling and loss of compliance in brain tissue, and a subsequent head injury before complete recovery leads to further swelling and death. The implication is that an athlete should not be allowed to return to participation, even after a minor head injury, until all symptoms have completely cleared. Kelly et al23 present guidelines for man-
agement of concussion in sport that recommend that all symptoms be clear for 1 to 2 weeks before return to play is allowed.

Our results that players with any history of cerebral concussion during the previous 5 years were six times as likely to incur a concussion as those with no previous history of concussion is higher than the 4.1 times as likely rate among high school athletes reported earlier. Our data include all concussions, however, while the previous study included only loss of consciousness injuries.

Current common practices regarding return to play following even minor head injuries must be reconsidered. Athletes, coaches, and parents often pressure medical personnel to return injured athletes to play as quickly as possible. Even at the high school level, it is common for players to be returned to play within a few minutes after a “bell ringer” or a loss of awareness incident. It is difficult to implement relatively conservative guidelines, such as those suggested by Kelly et al. This is especially true during games, where the risk of head injury is much higher than during practices, as implied by the concussion rates/1,000 A-E listed in Table 2 for games and practices combined, and the rates noted earlier for games only. With this recently developed information on the occurrence of second impact fatalities and the increased risks following an initial concussion, it is time for the sports medicine community to reconsider the current practice of sending a player back in as soon as he can see straight (and the athletic trainer may have to bear the brunt of that burden).

The occasional previous attempts to analyze field performance data for football helmets generally showed that all were performing at about the same level. However, the constant changes in design and materials in the manufacture of helmets in continuing attempts to improve safety make such information obsolete within a very few years. For the first time the data presented in Table 2 clearly indicate that the distribution of the observed numbers of cerebral concussions among the different models of football helmets is significantly different from the expected distribution based on the number of exposures each model received in practices and games.

These descriptive analyses from a large national data set show very strong evidence that not all helmet models did an equivalent job of protecting against cerebral concussions. The degree of statistical significance of the chi-square tests is well beyond being close or questionable, and additional analyses of these data have shown no influence on this type of injury from such factors as player position or type of play. The question as to whether or not football helmets could do a better job of protecting the head from cerebral concussion can not be answered by this set of data until field performance data become available from any new models with which these data can be compared.

With the growing awareness of the impact of even minor head trauma, as shown by the studies of Gronwall and Wrightson, one must presume helmet manufacturers will be continuing their efforts to develop better designs and materials for their products.

All helmets used by American high school and collegiate football players must meet minimal impact attenuation standards at the time of manufacture, as established by the National Operating Committee on Standards for Athletic Equipment (NOCSAE), and undergo testing against these standards by the manufacturers and by independent NOCSAE investigators. A sampling of reconditioned helmets also are tested against the NOCSAE standard by the reconditioners to ensure that reconditioned helmets still meet the standard. The implementation of the NOCSAE football helmet standard about 20 years ago, along with subsequent rule changes against the use of the head as an initial contact point, has had a definite effect in improving the safety of the game. However, it should be evident from the results presented here that these laboratory...
testing standards do not tell the whole story. Although NOCSAE and the helmet manufacturers have a continuous program of laboratory testing of football helmets, there is a definite need for field data to monitor performance of helmets under actual conditions outside the laboratory.

In a recent review of the validity and relevance of tests used for sport surfaces, Nigg stated that the ideal procedure for assessing a sports surface with respect to its cushioning and frictional qualities (in relation to injuries) is an epidemiological study. Nigg’s comments apply equally well to the testing of football helmets. Field performance data are needed to supplement laboratory data, since no amount of laboratory testing can duplicate the complex performance data in the future environment that are the ultimate test of a football helmet in actual use. Timely field performance data can be used to spot equipment that may not be performing up to expectations, so that design changes can be made to improve performance.

Epidemiological studies of field performance data in the future should become an integral part of the process of monitoring the performance of critical sports safety equipment. This monitoring of on-the-field performance must be done on a continuing basis, since there are constant changes in design and materials that can make the results of such monitoring out-of-date in a relatively few years. The implementation of a continuing study of field performance data for football helmets and other critical pieces of sports safety equipment would be a major step in ensuring the future safety of participants at all levels in football and other sports.

Acknowledgments
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References
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Use of the Otoscope in the Evaluation of Common Injuries and Illnesses of the Ear

A. Louise Fincher, MS, ATC

Abstract: Ear injuries and/or illnesses make up only a small percentage of the total injuries seen by the athletic trainer. However, if these conditions are left undetected or untreated, permanent ear damage could result. Many ear injuries involve structures that can only be viewed through the use of an otoscope. Although more athletic trainers are using the otoscope to evaluate the ear, there is little documentation available in athletic training literature regarding its proper use. This article describes the proper use of the otoscope in evaluating the ear and discusses the common pathological conditions that might confront the athletic trainer. This article will provide a resource that can be used in conjunction with the guidance of your team physician to help you develop the knowledge and skills required for performing an otoscopic examination.

Recognition of injuries or illnesses of the ear is the first step in ensuring the proper management or treatment of these conditions. Often, the athletic trainer will be confronted with injuries or illnesses involving structures within the external or middle ear that can only be examined through the use of an otoscope. For this reason, the athletic trainer should become familiar and comfortable with using the otoscope in ear evaluation.

In 1990, Jones and Harter surveyed the directors of the National Athletic Trainers’ Association-appointed educational programs concerning their attitudes toward the use of the otoscope in injury/illness evaluation and their perceived proficiency with this instrument. The majority of those surveyed rated themselves as nonproficient. However, they indicated strong support for developing and implementing a formal instructional program for student athletic trainers regarding the proper use of the otoscope.

This article will review the anatomical structures of the ear, discuss the signs and symptoms of the common pathological conditions of the ear, and present the basic steps in performing an otoscopic examination. This article cannot teach proficiency with the otoscope, as that requires extended practice and experience. The purpose of this article is to provide a basic foundation for the development of the knowledge and skills required to perform an accurate otoscopic examination.

Anatomical Review

As with any evaluation technique, an accurate otoscopic examination relies on a good working knowledge of the involved anatomy and physiology. The anatomical structures of the ear can be divided into three parts: the external, the middle, and the inner ear (Fig 1).

External Ear

The external ear comprises the auricle, the external auditory canal, and the outermost layer of the tympanic membrane or eardrum (Fig 1). The auricle, made up of the pinna and lobule, is an irregularly shaped structure consisting of fibroelastic cartilage covered by a thin layer of tightly adherent and sensitive skin. The auricle functions to collect, amplify, and funnel sound to the external auditory canal. The important anatomical structures of the auricle are shown in Fig 2.

The external auditory canal, which runs a course from the auricle to the tympanic membrane, conveys sound to the membrane and protects the membrane and other structures of the middle ear. Although the shape and direction of the canal varies among individuals, it usually will be somewhat curved. In adolescents and adults, the canal usually will range from 2.5 to 3 cm in length, while its width will narrow near its midpoint and widen again as it approaches the tympanic membrane.

The outer portion of the external auditory canal contains the glands responsible for the production of cerumen or ear wax. Cerumen, which is slightly acidic, helps prevent infections in the external ear since bacteria do not grow well in an acidic environment.

The tympanic membrane is a delicate, paper-thin membrane, which is normally pearly gray in color and semi-transparent in appearance. This membrane is cone-shaped and tilted slightly forward and downward, such that the top portion is leaning toward the canal. The lower four fifths of the membrane is referred to as the pars tensa while its upper one fifth is known as the pars flaccida (Figs 3 and 4).

Middle Ear

The structures of the middle ear are shown in Fig 1 and consist of the following:

1. the inner layers of the tympanic membrane;
2. the ossicles or middle ear bones;
3. the middle ear space;
4. the mastoid; and
5. the Eustachian tube.

The malleus, incus, and stapes are the tiny middle ear bones referred to as the ossicles and are located in the middle ear space between the tympanic membrane and the cochlea. The middle ear system functions to...
amplify and direct sound vibrations to the cochlea located in the inner ear.2 For maximal vibration of the membrane, the air pressure behind the membrane must equal that of the atmospheric air outside the membrane. The Eustachian tube, which connects the middle ear space to the nose, maintains this equilibrium of pressure.1,2,5 Should this tube become blocked or swollen, normal hearing may be affected.

**Inner Ear**

The inner ear, which is not visible during an otoscopic examination, consists of the cochlea and the semicircular canals (Fig 1). The cochlea translates sound waves from the external world to the brain, while the semicircular canals provide the body’s sense of balance.5

**Examination**

After a thorough history is taken, physical examination begins with observation and palpation of the auricle, including gentle traction on the pinna and slight pressure applied to the tragus and lobule (Figs 5a, b, and c). If this causes discomfort, you should suspect injury or inflammation of the external ear.3,8 Next, visually inspect the outer portion of the external auditory canal for redness, swelling, drainage, foreign objects, or any sign of injury such as cuts, bruises, or bleeding.

Use the otoscope to inspect the remainder of the canal and tympanic membrane. As with other evaluation methods, examine the asymptomatic ear first. This practice not only provides a basis for comparison but also prevents transferring infectious material from the symptomatic ear to the asymptomatic ear.

Select the largest possible speculum that can be comfortably inserted into the canal.2,3,5 When inserted, the speculum should fit snugly into the outer third of the external auditory canal with slight pressure exerted on the tragus and anterior wall of the canal.3 Choosing a speculum that is too small in relation to the ear canal will produce a greater amount of movement within the canal. This increased movement will cause discomfort for the athlete and also reduce your visionary field. The following sizes of specula are most commonly used:
adults, 4 to 6 mm; children, 3 to 4 mm; infants, as small as 2 mm.\(^2\,^5\)

When performing an otoscopic examination, place your athlete in a seated position with his/her head turned slightly downward and away from the ear to be examined. To provide an optimum view of the membrane, it is often necessary to displace or straighten the canal. Do so by using your free hand to pull the pinna upward, backward, and outward. Grasp the pinna at the 10 o’clock position when examining the right ear and the 2 o’clock position when examining the left ear. Hold the otoscope in the hand closest to the front of the ear (right hand for the right ear, left hand for the left ear) with your ring and little fingers resting on the athlete’s cheek to stabilize the otoscope.\(^2\,^6\) Bracing the otoscope in this manner prevents sudden sharp movements of the speculum in the canal.

While maintaining the gentle traction on the pinna, place the otoscope at, but not in, the ear.\(^5\) Then insert the speculum into the canal as you “watch your way into the canal.”\(^8\) Avoid blindly inserting the speculum, as this can cause discomfort and possible damage to the canal and/or membrane.\(^3\,^5\) The light beam and focus of the otoscope are designed to extend well beyond the tip of the speculum; therefore, it is not necessary to push hard against the outer ear.\(^6\) The speculum tip acts primarily to keep the instrument centered in the ear canal. If there is difficulty in inserting the speculum or if the athlete experiences pain as you insert the speculum, you should readjust the position of the athlete’s head or vary the degree of pull on the pinna. If the pain persists as you introduce the speculum into the canal, even after readjusting the head, halt the examination and refer the athlete to a physician.

Cerumen present in the external canal is a common and normal finding; it may appear red or reddish brown in color under the bright light of the otoscope. Ignore the cerumen unless it obstructs your vision of the tympanic membrane. The ear is designed to move excess cerumen toward the outer portion of the external canal for easy removal. Contrary to common practice, Q-tips or cotton-tipped applicators are not recommended for removing cerumen. They usually drive the cerumen further into the canal. If the cerumen becomes excessive or hard and impacted, you can loosen the wax with a few drops of dilute hydrogen peroxide.\(^5\) There are also a
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number of commercial preparations available for this purpose. Do not put hydrogen peroxide or commercial preparations into the ear if you suspect a perforated membrane. Doing so can cause permanent hearing loss.

Once the tympanic membrane comes into view, you must tilt or rotate the speculum to view the entire membrane completely. This is similar to trying to view all corners of a room through a keyhole. Usually, the posterior inferior portion of the membrane will not be visible because of the angle of the drum and the shape of the canal.

When inspecting the tympanic membrane, there are three important landmarks to identify: the malleus, the light reflex, and the annulus. Because of its attachment to the membrane, the malleus is easily identified during an otoscopic examination. The handle of the malleus, or manubrium, is the most prominent structure seen and appears as a narrow, opaque band extending inferiorly from the short process of the malleus toward the umbo located at the center of the membrane (Figs 3 and 4). The manubrium will angle toward the 2 o'clock position in the right ear and the 11 o'clock position in the left ear. The light reflex occurs as a result of the otoscope’s light beam reflecting off the semitransparent tympanic membrane and can be seen as a wedge-shaped bright spot.

---

**Fig 7.**—Perforation of tympanic membrane (from Abbott Laboratories; see Fig 3).

**Fig 8.**—Ear Examination Record.
originating from the umbo (Fig 6). This light reflex is normally located around the 4 and 8 o’clock positions in the right and left ears, respectively. The third landmark of the membrane, the annulus, forms the outer border of the membrane and serves to attach it to the external canal.

There are several other structures located just behind the membrane that are often visible during an otoscopic evaluation. The junction between the incus and stapes (incudostapedial junction), located at a much deeper level than the malleus, can occasionally be seen through the upper back portion of the membrane (Figs 3 and 4). As shown in Figure 4, the chorda tympani nerve can often be seen passing horizontally across the middle ear just between the long process of the incus and the handle of the malleus.

When examining the membrane, inspect it for clarity, color, and position. As mentioned previously, the normal tympanic membrane should be shiny, pearl gray, and somewhat translucent. In its normal state, the tympanic membrane appears slightly avascular; however, after physical activity, prolonged examination of the ear, or in inflammatory conditions, the vessels of the membrane may become quite prominent. The position of the membrane should not bulge or retract inward. With practice, you should learn to look beyond or through the membrane to inspect for the presence of fluid or air bubbles in the middle ear space (Fig 6). Always inspect the membrane for marginal or midsubstance perforations or tears. Perforations will usually appear as round or oval holes through which a pocket or dark shadow can be seen (Fig 7). You should functionally test the ear after completing your otoscopic examination. Perform a simple hearing test using your voice as a stimulus. Begin by whispering numbers or short phrases at a distance of 1 to 2 feet, followed by a louder spoken voice if the athlete is unable to hear. During this test, ask the athlete to cover the opposite ear completely with his/her hand and be sure he/she cannot see you talk.

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Table 1.—Summary of Otoscopic Findings

<table>
<thead>
<tr>
<th>Finding</th>
<th>Possible Interpretation</th>
<th>Possible Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red, tender canal</td>
<td>Inflammation</td>
<td>Otitis externa</td>
</tr>
<tr>
<td>Bright red membrane</td>
<td>Inflammation</td>
<td>Otitis media</td>
</tr>
<tr>
<td>Yellowish membrane</td>
<td>Pus or fluid in middle ear space</td>
<td>Skull fracture</td>
</tr>
<tr>
<td>Bluish membrane</td>
<td>Blood in middle ear space</td>
<td>Chronic otitis media</td>
</tr>
<tr>
<td>Bubbles behind membrane</td>
<td>Fluid in middle ear space</td>
<td>Otitis media</td>
</tr>
<tr>
<td>Absent light reflex</td>
<td>Bulging of membrane</td>
<td>Rupture of membrane</td>
</tr>
<tr>
<td>Oval dark areas</td>
<td>Perforation</td>
<td>Obstruction of eustachian tube</td>
</tr>
<tr>
<td>Malleus very prominent</td>
<td>Retraction of membrane</td>
<td></td>
</tr>
</tbody>
</table>

can be used for documenting evaluation findings.

Postexamination

Following each otoscopic examination, thoroughly disinfect the speculum tips. First scrub them with hot water to remove all wax particles and then soak them in a covered dish of rubbing alcohol for 10 min.6 Disposable speculum tips are also available and may be more convenient than disinfecting the tips after each use.

Common Pathologic Conditions of the Ear

Illnesses

Otitis externa, or “swimmer's ear,” is an infection of the external auditory canal and is a common infection seen in athletes.1 It usually results from prolonged exposure to the water, which creates a moist environment for bacterial or fungal growth.7 Otitis externa causes the canal to become red, swollen, and tender. The canal may also become edematous and filled with a foul-smelling thick gray or white exudate.7 The athlete will experience pain when the pinna is tugged or the tragus is palpated. Once you suspect this condition, refer the athlete to a physician for antibiotic treatment. This condition may be prevented by regularly using a commercial drying agent such as Swimm Ear or a mixture of alcohol and water following prolonged exposure to water. Swimmers can also use a hair dryer to dry the ear canal after exposure to water.

Otitis media, an infection of the middle ear, often follows or accompanies an upper respiratory infection. Symptoms include pain without tenderness to touch, a fullness or roaring in the ear, a feeling of pressure, fever, hearing loss with the sensation of “being in a barrel,” and, sometimes, balance disturbance. The pain or pressure will usually subside almost instantly if the tympanic membrane ruptures.7 Otoscopic examination of otitis media reveals a red and often bulging tympanic membrane. As the membrane bulges, the light reflex becomes distorted or absent altogether. If the Eustachian tube becomes obstructed, the middle ear space will become blocked. In an attempt to equalize pressure, the middle ear space will begin absorbing air through the paper-thin membrane. This creates a vacuum, which, in turn, causes the tympanic membrane to retract. During an otoscopic examination, this retracted membrane will be quite obvious as will a yellowish fluid level or a collection of air bubbles behind the membrane.4 Table 1 summarizes the common abnormalities that might be found during an otoscopic examination.

Refer all athletes suspected of having an ear infection to a physician for proper treatment. Untreated infections can result in permanent damage to the ear.

Trauma-related Conditions

The basic construction of the auricle provides little or no room for the accumulation of fluid or blood between the skin and underlying cartilage. Deformity of the ear can result from an injury to the external ear which produces swelling of the auricle. An auricular hematoma, also known as “cauliflower ear,” may result from a contusion, repetitive friction, or twisting of the auricle.1 This condition, once common among wrestlers and boxers, is not as prevalent today, due to the improvement of protective head gear. When treating an auricular hematoma, apply ice and compression to prevent or reduce swelling in the auricle. If swelling or hemorrhaging continue, refer the athlete to a physician.

The tympanic membrane can be perforated by the introduction of a foreign object into the ear, a sharp blow to the head, a sudden pressure change, or exposure to an extremely loud noise. A perforated membrane is not a medical emergency and usually will heal spontaneously1,2 within 3 months.3 However, you should refer all athletes with a suspected membrane perforation to a physician for proper care. Water entering the middle ear space through a perforated membrane can result in permanent hearing loss. For this reason, advise the athlete to prevent water from entering the ear. You can place cotton in the ear to absorb drainage; however, be careful not to push the cotton very far into the external auditory canal. As a general rule, consult your team physician if you are unable to see the tympanic membrane during otoscopic evaluation due to swelling, wax, or drainage.

You should evaluate the ear for possible injury following any type of head injury. If you notice blood in the external auditory canal, you should always consider the possibility of a skull fracture. Bleeding in the canal, however, usually results from canal lacerations. If you see blood behind the membrane during your otoscopic examination, refer the athlete to a physician. Additionally, if you notice cerebrospinal fluid draining from the canal following a
head injury, you should immediately refer the athlete to a physician.1

Conclusion
As mentioned earlier, this article is not intended to teach proficiency in the use of the otoscope. Like any evaluation technique, otoscopic evaluation requires extended practice to develop and maintain proficiency. The details discussed in this article regarding the subtle findings of otoscopic examination are intended to be of use to you as you continue refining your skills with the otoscope. I recommend that you contact your team physician and/or local ear, nose, and throat specialist to obtain professional guidance and instruction in the proper technique of otoscopic examination. Remember, you must gain experience looking at many normal ears in order to accurately recognize abnormal findings.

Acknowledgments
I would like to thank Ken Knight, PhD, ATC, and Ken Wright, DA, ATC, for their never-ending encouragement and support of this article. I would also like to thank James Robinson, MD, and Pat Norton for their editorial assistance, and JoAnn Pou for her assistance with graphics.

References
Anabolic Steroid Use in the Adolescent Athlete

Jeffrey A. Potteiger, PhD, CSCS
Vincent G. Stilger, HSD, ATC

Abstract: Recent surveys indicate that the use of androgenic-anabolic steroids (anabolic steroids) is prevalent among adolescent athletes, particularly those in high school. The cost of clinical drug testing makes it impractical to use random testing to identify users of these ergogenic aids. The athletic trainer is often in a position to identify anabolic steroid users if he/she knows the clinical signs and symptoms. In this article, we briefly discuss the history of anabolic steroid use, how they work, their potentially dangerous side effects, evidence of increased use by adolescent athletes, and a list of clinical signs and symptoms. Finally, we suggest strategies that may help athletic trainers counsel athletes about anabolic steroid use.

Androgenic-anabolic steroid (anabolic steroids) use is prevalent among adolescent athletes, particularly those in high school. It is extremely important to identify this abuse in order to minimize the potentially dangerous side effects and to direct the athlete to alternative methods of training and conditioning. But it is impractical for high schools to use random testing to identify steroid users because of the cost of clinical drug testing. The athletic trainer may be able to help solve this dilemma. He/she is often in a position to identify athletes’ problems and to suggest treatment. Our aim with this article is to provide athletic trainers with the information necessary to identify steroid abusers and to recommend treatment.

What Are Anabolic Steroids?

Androgenic-anabolic steroids are the synthetic derivatives of the hormone testosterone. Testosterone has two primary functions: androgenic and anabolic. The androgenic functions of testosterone are responsible for the changes in the primary and secondary male sexual characteristics of humans. The anabolic functions of testosterone are responsible for accelerating the growth of muscle tissue, bone, and erythrocytes and aid in enhancing the development of neural pathways.

Anabolic steroids were first developed in the late 1930s. They were derived in a synthetic form in order to prolong the life of the compound in the circulatory system. They were first used by competitive athletes during the 1950s because of their suspected potential to enhance muscle size and strength. Since that time, their use has increased dramatically in both the athletic and nonathletic populations.

Individuals use anabolic steroids to induce a variety of physiological responses. They may use them in an attempt to increase body weight, alter body composition, increase muscle size and strength, reduce recovery time, or provide therapy for soft tissue injuries. Side effects of use are varied, ranging from minor to very serious. Table 1 illustrates some potential side effects.

Use of Anabolic Steroids Among Adolescents

Recent evidence compiled from survey questionnaires indicates that anabolic steroids are being used by adolescents. Buckley et al examined steroid use in high-school-age individuals through a survey of over 3400 12th-grade male students from 46 private and public high schools; 6.6% admitted to using anabolic steroids. Slightly over 1% of 190 high school varsity football players in the state of Texas reported using anabolic steroids at the time of the survey. In 1989, Johnson et al reported that 11.1% of over 850 11th-grade male students, but less than 0.5% of over 900 11th-grade female students were using anabolic steroids. Recently, Terney and McLain surveyed 2100 students and discovered that 4.4% admitted to using anabolic steroids.

Table 1.—Possible Side Effects From Anabolic Steroid Use

<table>
<thead>
<tr>
<th>Side Effect</th>
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<tbody>
<tr>
<td>1. Decreased reproductive hormones</td>
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<td>2. Testicular atrophy</td>
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<tr>
<td>3. Gynecomastia</td>
</tr>
<tr>
<td>4. Masculinization in females</td>
</tr>
<tr>
<td>5. Hirsutism</td>
</tr>
<tr>
<td>6. Deepening of voice</td>
</tr>
<tr>
<td>7. Clitoral hypertrophy</td>
</tr>
<tr>
<td>8. Menstrual irregularities</td>
</tr>
<tr>
<td>9. Accelerated maturation in adolescents</td>
</tr>
<tr>
<td>10. Premature epiphyseal closure</td>
</tr>
<tr>
<td>11. Increased risk of musculoskeletal injury</td>
</tr>
<tr>
<td>12. Acne</td>
</tr>
<tr>
<td>13. Temporal hair recession</td>
</tr>
<tr>
<td>14. Decreased HDL cholesterol</td>
</tr>
<tr>
<td>15. Increased LDL cholesterol</td>
</tr>
<tr>
<td>16. Hypertension</td>
</tr>
<tr>
<td>17. Elevated liver enzyme levels</td>
</tr>
<tr>
<td>18. Cholestatic jaundice</td>
</tr>
<tr>
<td>19. Aggressive behavior</td>
</tr>
<tr>
<td>20. Mood swings</td>
</tr>
<tr>
<td>21. Increased or decreased libido</td>
</tr>
<tr>
<td>22. Nervous tension</td>
</tr>
<tr>
<td>23. Edema</td>
</tr>
<tr>
<td>24. Muscle spasm</td>
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</tbody>
</table>

Jeffrey A. Potteiger is an assistant professor in the Department of Health, Physical Education and Recreation at the University of Kansas, Lawrence, KS 66045. Vincent G. Stilger is Director of the Athletic Training Program in the Department of Health, Physical Education and Sports Studies at Xavier University.
mitted to using anabolic steroids. Of those 2100 students, 1435 were athletes. Among the athletes, 5.5% indicated using steroids at some time.

Results of these investigations indicate that high school students (particularly athletes) are reportedly anabolic steroid users. One estimate places use between 500,000 to 700,000 adolescent individuals.4

Identifying Anabolic Steroid Use

The cost of laboratory testing for anabolic steroid use may prohibit testing adolescent athletes. Detection may involve the use of radioimmunoassay, gas chromatography, or mass spectrometry to identify metabolites of the anabolic steroid in the athlete's urine.11 Because of the complexities involved, each test performed in a laboratory setting costs approximately $100.00.18 Consequently, alternative methods of detection are important.

Athletic trainers are in a position to help detect use among adolescent athletes. There are many observable physical and psychological signs. The physical and psychological changes in individuals resulting from anabolic steroid use are a function of the duration of use, dosages consumed, and whether or not the individual is actively participating in a resistance-training program.13

Physical Signs

Table 2 is a list of physical signs and symptoms that help identify use. Caution must be used, however, when attempting to identify anabolic steroid abuse in the adolescent athlete. None of the physical or psychological signs provided are specific for anabolic steroid use and do not indicate steroid abuse when observed alone. However, when several of these signs are present, they may alert you to the possibility of abuse.3

When anabolic steroid use is combined with a rigorous resistance-training program, there are usually rapid gains in body weight and marked muscular hypertrophy. These changes often occur in hard-working athletes, but be aware of changes in individuals that are beyond what would be considered normal development for the adolescent athlete. As a result of the increased muscle development, there may be severe alterations in body composition, whereby large increases in lean tissue and reductions in fat tissue are observed. Additionally, there is a disproportionate increase in the development of the upper torso.3 The neck, shoulder, chest, and arm muscles can become extremely well developed in the steroid user. The large increase in upper body size can result in an increase in stretch marks on the body, particularly around the shoulders and chest areas.

Other indicators may be observable on the skin or body surface area. With anabolic steroid use, there is typically an increase in acne. This is usually very pronounced on the upper back and chest regions. If the athlete is taking injectable anabolic steroids, there may be evidence of needle marks in large muscle groups. Examination of the gluteal, quadriceps, hamstring, and deltoid musculature may reveal evidence of injectable anabolic steroid use. Long-term use may predispose the male adolescent to the onset of male pattern baldness and breast enlargement (gynecomastia).9

Users may experience an increased susceptibility to tendon strains and injuries. As a result of anabolic steroid use, muscle size and strength increase at a far greater rate than tendon and connective tissue strength. This may predispose the athlete to various tendon injuries. The tendons most commonly affected in athletes are the biceps and patellar.17 Athletic trainers working with individuals who have a history of tendon injuries and strains associated with other clinical signs of anabolic steroid use might suspect use by that person.

Oral anabolic steroids often have a toxic effect on the liver cells and inhibit their normal function.23 A vital function of the liver is the production of necessary blood-clotting factors. With anabolic steroid use, there is a decreased clotting ability of the blood, which may result in increased bruising, particularly with minor injuries.9 Another observable sign of use may be a yellow tinting (jaundice) of the skin and eyes due to decreased liver function.

Hypertension may occur as a result of the body retaining fluid (edema) through anabolic steroid use. As fluid retention increases, there is an increase in plasma volume that may elevate blood pressure if left unchecked. High blood pressure in an athlete is simple for an athletic trainer to detect. Additionally, as a result of the hypertension, there may be an increase in spontaneous nose bleeds (epistaxis) by the athlete.9

There are specific physical signs often associated with use in women. These include the abnormal development of facial and body hair (hirsutism) and breast atrophy. Additionally, there is often a deepening of the voice.12

<table>
<thead>
<tr>
<th>Table 2.—Physical Signs of Anabolic Steroid Use</th>
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<tbody>
<tr>
<td>1. Rapid weight gain</td>
</tr>
<tr>
<td>2. Alterations in body composition with marked muscular hypertrophy</td>
</tr>
<tr>
<td>3. Disproportionate development of the upper torso</td>
</tr>
<tr>
<td>4. Severe acne</td>
</tr>
<tr>
<td>5. Needle marks in large muscle groups</td>
</tr>
<tr>
<td>6. Development of male pattern baldness</td>
</tr>
<tr>
<td>7. Gynecomastia (breast enlargement)</td>
</tr>
<tr>
<td>8. Increased susceptibility to tendon strains and injuries</td>
</tr>
<tr>
<td>9. More frequent hematoma or bruising</td>
</tr>
<tr>
<td>10. Jaundice</td>
</tr>
<tr>
<td>11. Edema</td>
</tr>
<tr>
<td>12. Elevated blood pressure/epistaxis</td>
</tr>
<tr>
<td>13. Hirsutism (abnormal development of facial and body hair)</td>
</tr>
<tr>
<td>14. Atrophied breasts in females</td>
</tr>
<tr>
<td>15. Deepening of the voice in females</td>
</tr>
</tbody>
</table>
Table 3.—Psychological Signs of Anabolic Steroid Use

1. Violent mood swings including increased aggressiveness, euphoria, irritability, depression, and anxiety
2. Alterations in cognitive processes and content

Psychological Signs

Anecdotal information gathered from users suggests there are also psychological alterations associated with anabolic steroid use. A checklist of possible psychological signs of anabolic steroid use is provided in Table 3.

Increased aggression might be a side effect of anabolic steroid use. This often affects normal daily activities. Anecdotal information indicates that the smallest, most insignificant instance can trigger an aggressive outburst in the user. Users might be precipitated into violent and angry outbursts of aggression, referred to as “roid rages.” Athletes who demonstrate this type of behavior should be suspect.

Alterations in the cognitive process and content are also signs of a user. It has been suggested that an individual’s thought process is slowed when in a depressed state and becomes rapid or disorganized when in a manic state. Thought content is also altered. Increases in suicidal or homicidal thoughts have also been associated with use. Additionally, the individual might have thoughts of grandeur or disillusionment. This is manifested by the individual overtly displaying an improved self-esteem and general euphoria. Athletic trainers should observe these overt behaviors in suspected anabolic steroid users.

Other Signs

An athletic trainer should also be aware of other warning signs. According to Olinekova, these warning signs might include: obsessiveness with the gym, whereby the individual spends an extraordinary amount of time there, and extreme body consciousness behavior, particularly frequent use of a tape measure and observance of body appearance in a mirror.

Counseling the Adolescent Athlete

Often an athlete may approach an athletic trainer seeking guidance and information about anabolic steroids. When an athlete questions an athletic trainer about anabolic steroid use, the athlete is generally seeking information from someone he/she considers a credible and reliable source. Open communication and trust between the athlete and athletic trainer are extremely important and can be used to influence an adolescent athlete’s decisions.

Simply running down a list of the negative aspects of steroid use or using scare tactics is not recommended (adolescents generally feel and act immortal). You must approach the task with more substance. Following are some counseling strategies you might use when providing athletes information about anabolic steroids:

1. Educate yourself on how athletes can reach their goals through the most natural methods available. Encourage good nutritional habits and hard work as the best ways to achieve those goals.
2. Teach your athletes the skills of argument rebuttal so they can be better prepared to avoid being persuaded into health-risk behaviors.
3. Inform your athletes that self-esteem has to come from within and that external reassurance is often temporary at best.
4. Encourage your athletes to value health as a priority over appearance, money, and popularity.
5. Learn about the adverse effects of anabolic steroid use and disseminate this information to your athletes.
6. Establish a mutual trust with your athletes. Provide help to the athlete when needed.

Intervention among potential and current steroid users is challenging. You should have some prescribed protocol. It is important that the relationship and information between you and the user be strictly confidential. The emphasis should be on identification, assessment, and treatment of steroid use. Initially, you should inquire about the use of legal substances such as alcohol and tobacco and then about nutritional ergogenic aids, such as protein and vitamin supplements. Finally, you may ask if the athlete has ever used or considered using anabolic steroids. If he/she admits to use, you must assist him/her in seeking treatment.

The first step in treatment is to encourage the athlete to discuss the problem with his/her parents. Offer to assist. Some parents may already be aware of, or even encouraging, the steroid use. In this case, you must educate the parent to the harmful effects of this abuse.

Several potential treatment methods have been proposed. They include psychiatric intervention and education intervention using a problem-oriented approach, emphasizing the relationship between steroid use and side effects. We know of no published studies that have evaluated treatment protocols for withdrawal from anabolic steroids.

Conclusions

The identification of anabolic steroid use in the adolescent athlete is extremely difficult and/or costly. Because of the normal growth and development patterns of the adolescent, there will be natural changes in some of the signs that are provided. However, athletic trainers can observe extreme and sudden changes in the athlete, such as those listed in Tables 2 and 3. Athletic trainers should be concerned about their athletes and the presence of multiple indicators in a high-risk individual should signal the possibility of anabolic steroid use. If use is suspected in an adolescent athlete, that athlete should be entered immediately into an intervention program and referred to the team or family physician, who should develop a patient history, perform a complete examination, and initiate
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Athletic Training Continuing Education Needs Assessment: Pilot Study

Thomas G. Weidner, PhD, ATC

Abstract: Continuing education for certified athletic trainers is both required and essential. The purpose of this study was to determine the need, including solutions and priorities, for continuing education for athletic trainers in various employment settings. Focus group sessions were conducted during the Spring 1992 District 4 meeting of the National Athletic Trainers Association. Representatives for each of the following employment settings were selected from the preregistration list and invited to participate: high school (7 participants), college/university (8), corporate/industrial (6), professional (3), and clinical (8). Data were compiled from written lists and audio cassette recordings of group discussions. Focus group participants across all employment settings felt that their primary continuing education needs were not being addressed at district meetings. Less traditional topics (eg, ergonomics, budgeting, public relations, and functional capacity evaluations) were identified as the more essential education needs. Focus group opinions varied somewhat regarding specific topics and methods of presentation. Recommendations included a more thematic approach to topics and presentations and ample opportunities for work or discussions in small groups. Results of the focus groups could impact the professional preparation of athletic trainers.

Methods

Focus group and needs assessment research methods were reviewed and combined for this study. I conducted five different focus group sessions during the Spring 1992 District 4 meeting of the NATA, with each focus group composed of employed certified athletic trainers from one of the five primary employment settings: high school (7 participants), college/university (8), corporate/industrial (6), professional (3), and clinical (8). I randomly selected participants from the conference preregistration list, with a goal of eight representatives from each employment area accepting an invitation to participate. All corporate/industrial and professional athletic trainers who attended the conference participated in the study.

A focus group session lasted 60 minutes. Each group was divided into two smaller subgroups during each session, with the exception of the professional athletic trainers’ focus group. Sessions were scheduled so as not to conflict with important conference proceedings (eg, business meeting, keynote address, or presentation of interest to a particular group of participants). Meetings were conducted in a quiet room located adjacent to the conference presentation hall. The location of the focus group session was chosen for its convenience and comfort.

Meetings began with an orientation to the purposes, goals, and format of the sessions. The value and importance of the participants’ responses was also communicated. Subgroups were instructed to work separately on three different tasks:

1. Assess whether continuing education opportunities during NATA district conferences are addressing the needs of athletic trainers in their particular employment area.

2. Prioritize Solutions: identify relative importance of the suggestions and recommendations for improving continuing education of athletic trainers, categorized by employment setting.

3. Identify Solutions: make suggestions and recommendations for addressing specific education needs for athletic trainers in each of the various employment settings.
2. Develop a list of topics to address unmet education needs (including preferred method of presentation).
3. Prioritize needs.

These tasks provided a loose structure while allowing participants flexibility over the direction and depth of the discussion. I requested honest responses from participants and immediately attempted to establish a nonthreatening atmosphere. The moderator played a critical role in gently directing the course and pace of topical discussion, with freedom to pursue unexpected directions of discussion while encouraging thorough examination of the selected tasks. Following discussion of a particular issue for approximately 15 minutes, subgroups verbally reported their collective comments to the group at-large, and additional comments were then solicited. Each subgroup recorded their comments on a flipchart. In addition, all discussions in the sub-groups and in the group at-large were recorded on audio cassette. Prior to audio recording, I obtained informed verbal consent. Comments within and across focus group sessions relative to the three tasks mentioned above were compiled, categorized, and listed.

Results

Focus groups across all employment areas felt that their primary continuing education needs were not being addressed at their NATA district conference. Although conventional topics such as orthopedic/sports injury evaluation, surgery, or rehabilitation are considered important, they were not high priority continuing education needs and/or were not presented satisfactorily. A variety of less traditional topics were preferred by more than one focus group (Table 1). Other nonconventional topics were also identified as the more essential education needs in the corporate/industrial (eg, industrial health, health/occupational safety and health administration compliance, worksite wellness, occupational therapy), sports medicine clinic (eg, functional capacity evaluations, insurance, manual therapy), and professional (drug rehabilitation, financial planning) settings. Setting-specific topics were also important in the high school (eg, practical tips for athletic trainers on a small budget, athletic training program design) and college/university (eg, clinical instruction, career/academic guidance, research).

The method of presentation recommended by the focus groups was topic-dependent. However, several consistencies in their suggestions were apparent. To provide enough depth and breadth in a given topic area, a more thematic approach was indicated (eg, shoulder surgeries, shoulder mobilization, shoulder proprioceptive neuromuscular facilitation). More comprehensive, less fragmented learning experiences were preferred. Another common suggestion was to provide ample opportunities for work or discussions in small groups, with limited enrollment in these sessions in order to protect the quality of the experience. An example suggested in the focus groups was to begin a session with a large lecture presentation which would then lead into activities or discussions in smaller groups. Participants would then reconvene as a large group to interact with expert panelists. Pre-/post-convention “hands-on” workshops and courses were also highly recommended.

Discussion

The results of this study should be considered to be preliminary. The sample size was small, and the reliability and validity of the comments may be tenuous. Gender, years of experience, and types of previous experience may be important variables to consider in future research. However, several recommendations and implications can be considered from this study. For members of athletic training conference planning committees, I recommend the following:

1. Select less generic topics on a more regular basis. Setting-specific topics were strongly preferred by the athletic trainers in this study. However, avoid topics which are merely different and do not adequately meet the continuing education needs of athletic

Table 1.—Summary of Preferred Continuing Education Topics Among Athletic Training Employment Settings

<table>
<thead>
<tr>
<th></th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High School</td>
</tr>
<tr>
<td>Time management</td>
<td>X</td>
</tr>
<tr>
<td>Legal issues</td>
<td>X</td>
</tr>
<tr>
<td>Promotion/marketing of athletic training</td>
<td>X</td>
</tr>
<tr>
<td>Athletic training skills</td>
<td>X</td>
</tr>
<tr>
<td>Administration</td>
<td>X</td>
</tr>
<tr>
<td>Budget management</td>
<td>X</td>
</tr>
<tr>
<td>Tx &amp; rehabilitation nontraditional athlete</td>
<td>X</td>
</tr>
<tr>
<td>Injury psychology</td>
<td>X</td>
</tr>
<tr>
<td>Workmen’s comp</td>
<td>X</td>
</tr>
<tr>
<td>Documentation (invent/billing/contracts)</td>
<td>X</td>
</tr>
<tr>
<td>Presentation skills</td>
<td>X</td>
</tr>
<tr>
<td>Athletic training instruction/evaluation</td>
<td>X</td>
</tr>
</tbody>
</table>
1. Train in any given employment setting.
2. Develop a thematic approach to topics and presentations. Unrelated topics do not provide enough breadth or depth.
3. Provide ample opportunities for work or discussions in small groups. Informal dialogue and experience-sharing fostered in this format is often invaluable.
4. Continue the pre-/post-convention workshop and courses frequently scheduled as part of athletic training conferences/symposia. Very specific skills can be acquired in a relatively short period of time.
5. Develop concurrent tracks or stream of topics intended for athletic trainers in specific employment settings. Crossover topics should be strategically organized.
6. Provide sessions which point out for the NATA membership the primary responsibilities of athletic trainers in different employment settings. A broader understanding of the roles and responsibilities of our colleagues is fundamental to understanding and appreciating the future directions of athletic training.
7. Rely less on regional networks of professionals as presenters. Solicit proposals for presentations which are subject to peer review and acceptance by a selection committee. Invited speakers should reflect the input of athletic trainers employed in a particular setting.
8. Address the roles and responsibilities of athletic training educators. Provide sessions on athletic training instruction, evaluation, curriculum design, etc, perhaps using small groups to discuss teaching tips.

Implications from this study may be important. Although the professional preparation of athletic trainers for employment appears adequate, many unmet educational needs for athletic trainers remain, particularly in the sports medicine clinic and corporate/industrial settings. It appears prudent to emphasize the topics identified by athletic trainers in different employment settings and to include cognitive, affective, and clinical learning experiences. Structured rotations/practicums in a variety of athletic training employment settings could be organized. When considering current employment demographics of athletic trainers, professional preparation experiences limited to the college/university would seem restrictive. Further, role delineation studies of athletic trainers in specific employment settings may yield meaningful information useful, for more comprehensive professional preparation program design.

Acknowledgments
I would like to thank the Great Lakes Athletic Trainers’ Association (NATA, District 4) for directing and supporting this study.

References
Discrepancies in Perceptions Held by Injured Athletes and Athletic Trainers During the Initial Injury Evaluation

Leamor Kahanov, MS, ATC
Patricia C. Fairchild, PhD

Abstract: Fifty injured athletes and six athletic trainers participated in this study, the purpose of which was to determine whether perceptions held by the athlete were similar to the perceptions of the athletic trainer during the initial evaluation. We developed a questionnaire to examine six areas: the athlete's understanding of the injury and the rehabilitation program, objective elements, the athlete's frame of reference, type of communication, short-term objectives and long-term goals, and the development of a rehabilitation strategy. A Cohen's kappa was used to determine interrater agreement/disagreement. Fifty-two percent of the athletes reported that they did not understand the rehabilitation process associated with their injury. There were significant discrepancies between the perceptions held by the athlete and the athletic trainer for items in all but one of the six areas examined—the objective elements of the evaluation. It appears that a significant level of miscommunication occurred between the athlete and the athletic trainer during the initial injury evaluation. Athletic trainers need to develop better communication skills so that athletes can gain a better understanding of their injuries and requirements for rehabilitation.

The importance of effective communication between athletic trainers and athletes was underscored in a recent survey of athletic trainers, who identified the psychological strategies they felt were important in rehabilitating an injured athlete. Good interpersonal communication skills topped the list of important techniques needed by athletic trainers. Important knowledge needed by athletic trainers included information about positive communication styles, strategies for setting realistic goals, encouraging positive self-talk, and understanding the athlete's motivation for recovery.

An injured athlete's understanding of his/her injury will directly affect how the athlete responds to the injury. The perceptions formed by the athlete during the initial injury evaluation may affect that athlete's ability to effectively cope with the injury and move readily through rehabilitation to a prompt return to competition. Understanding is a key factor in the athlete's motivation for recovery and compliance with the prescribed rehabilitation program. The athletic trainer plays a pivotal role in helping the athlete understand the nature of the injury and the requirements for rehabilitation.

Several investigators have examined the interaction between physicians and their patients during the course of treatment. They identified several communication deficits, e.g., the use of medical jargon, insufficient information, and complicated explanations in physician-patient interactions, which appear to lead to misperceptions by the patient. More importantly, these misperceptions contributed to greater difficulties in patient compliance.

While several authors have examined various psychological factors, including effective communication, which affect the athlete's ability to cope with injury, none has directly explored the communication between the athletic trainer and the injured athlete. None has asked the questions: "Are good communication skills being employed by the athletic trainer?" or "Does the athlete actually understand the information he/she is being given?"

The purpose of the present study was to examine the nature of the communication between the athletic trainer and the athlete during the initial injury evaluation to determine whether or not the resulting perceptions held by the athlete and the athletic trainer were similar. Congruency of perceptions would suggest that both the athlete and the athletic trainer were actively engaged in a two-way communication that would promote the athlete's accurate understanding of his/her injury and the rehabilitation program designed for that injury. On the other hand, discrepant perceptions would suggest that miscommunication which might hinder the athlete's understanding of the injury and the rehabilitation program had occurred at some level of the interchange.

Methodology
Initially, 52 collegiate athletes from the University of Arizona and Pima College who were injured during the 1992–1993 athletic season and the six athletic trainers who completed the initial evaluation of those injured athletes comprised the sample for the study. Two of the questionnaires were completed incorrectly and had to be eliminated from
the data analysis. Therefore, the final sample consisted of 27 female athletes and 23 male athletes; all of the athletic trainers were males (28.8 ± 5.0 yr with 5.6 ± 5.5 yr experience postcertification). Initially, the athletic trainers volunteered to participate in the study. Once an athletic trainer was admitted into the sample, all athletes who were evaluated by that athletic trainer and those who met the severity of injury criterion were then asked to participate. To be considered a candidate for the study, the athlete must have incurred an acute injury that would interfere with his/her ability to continue his/her normal athletic participation, ie, at least two missed practice sessions or a missed game as a result of a sprain, strain, fracture, or an injury requiring surgery.

We developed a questionnaire to examine the nature of the communication between the athlete and the athletic trainer, based on the criteria for effective communication.13,16 Next, a panel of four certified athletic trainers evaluated each questionnaire item for clarity and appropriateness. Individuals for this panel were chosen on the basis of their personal experience with athletic injuries and the extent of their experience as athletic trainers (Mean age = 29 ± 6.0 yr; experience as ATs = 5.5 ± 7.0 yr). Two forms of the questionnaire were used: one for the athletic trainer and one for the injured athlete. The respondent answered Yes or No to a series of questions that related to: 1) the athlete’s understanding of the injury and the rehabilitation program, 2) objective elements of the interchange, 3) the athlete’s frame of reference, 4) the type of communication between the athletic trainer and the athlete, 5) short-term objectives and long-term goals, and 6) the development of a rehabilitation strategy and a written rehabilitation protocol (Table 1).

The procedures for completing the questionnaires were explained to each athletic trainer so he could distribute the questionnaire at the appropriate time. Initial evaluations were conducted directly following the occurrence of the athlete’s injury. Following the initial evaluation, an athlete who met the severity of injury criterion for inclusion in the study was asked by the athletic trainer to participate in the study. Those who agreed to do so completed the questionnaire in the training room, without the athletic trainer present. Five of the athletic trainers and their respective athletes completed the forms within 3 hours of the initial evaluation; one athletic trainer and the athletes he evaluated did so the following day, all within 24 hours of the initial evaluation.

The percentage of Yes-No responses between athletic trainers and athletes was calculated for each item. A visual inspection indicated that the

<table>
<thead>
<tr>
<th>Area/Questions</th>
<th>Agreement</th>
<th>Disagreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the injury and rehabilitation program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did the athlete understand the explanation of the injury?</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td>Did the athlete understand the extent of the injury?</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>Did the athlete understand the rehabilitation program?</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Objective elements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were there distractions?</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>Was there eye contact?</td>
<td>46</td>
<td>0</td>
</tr>
<tr>
<td>Frame of reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did the athlete feel intimidated?</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>Did the athlete feel defensive?</td>
<td>0</td>
<td>44</td>
</tr>
<tr>
<td>Did the athlete feel irritated?</td>
<td>0</td>
<td>41</td>
</tr>
<tr>
<td>Did the athlete feel comfortable?</td>
<td>38</td>
<td>2</td>
</tr>
<tr>
<td>Did the athlete feel motivated?</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Type of communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did the athlete ask questions?</td>
<td>39</td>
<td>5</td>
</tr>
<tr>
<td>Did the athlete rephrase statements?</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Did the athlete summarize the explanation of the injury?</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Short-term objectives and long-term goals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the goal of returning to activity discussed?</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Were short-term objectives discussed?</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>Were daily objectives discussed?</td>
<td>29</td>
<td>1</td>
</tr>
<tr>
<td>Were weekly objectives discussed?</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Rehabilitation strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was a rehabilitation strategy explained?</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td>Was a written rehabilitation protocol given to the athlete?</td>
<td>4</td>
<td>19</td>
</tr>
</tbody>
</table>
Yes-No response percentages were similar for all athletic trainers. Consequently, the responses for the six trainers were pooled for all subsequent analyses. Because of the requirements of the statistical technique used for the study, males and females were grouped together for data analysis to decrease the effects of small cell size. While there is evidence suggesting that males and females communicate differently, results are tentative with much still to be explained regarding gender differences.2,3,11,14

To determine the degree of agreement between athletic trainers and athletes for each question, a Cohen's kappa was calculated. The kappa index is a nonparametric statistic used for categorical data to rate agreement or similarity between two or more symmetrical units.10 A t value (p < .05) was obtained to test the hypothesis that kappa was equal to zero. A t value between -2.0 and +2.0 indicates the probability that the kappa index was no greater or worse than chance, thereby, indicating interrater disagreement. A t value outside of these parameters indicated interrater agreement.10 For those items where the assumption of adequate cell size in the agreement matrix was violated, agreement/disagreement was established by a direct examination of the agreement matrix. In the present analysis, adequate cell size for the agreement matrix was determined to be 2, as a compromise between statistical rigor (cell size = 5) and practical reality.10 This value provided control for possible inflation of Kappa due to an excessively low cell size, while permitting the maximum amount of information to be obtained from the data.

**Results**

Once the data were collected, the Yes-No answers were put into an agreement matrix based on agreement/disagreement between the athletic trainer and the athlete for each item (see Table 1). The results of the kappa analysis for those items meeting the assumption of adequate cell size are reported in Table 2, which presents the kappa index, the asymptotic standard error (ASE), the obtained t value, and whether agreement/disagreement is indicated.

There was significant disagreement between the athletic trainer and the athlete regarding the athlete's understanding of the rehabilitation program, the athlete's frame of reference related to comfort and motivation level, two items related to type of communication (ie, whether the athlete rephrased statements and summarized the explanation of the injury), whether weekly objectives and long-term goals were discussed, and whether a written rehabilitation protocol was given to the athlete. There was agreement between the athletic trainer and the athlete for one item: whether the athlete asked questions. Because of small cell size, direct examination of the agreement matrix was required for 10 items. These included items related to the athlete's...
understanding of the explanation and extent of the injury, distractions during the evaluation, eye contact, the affective components of the athlete’s frame of reference (i.e., the athlete’s irritability and feelings of intimidation or defensiveness), short-term and daily objectives, and the explanation of a rehabilitation strategy; agreement was indicated for all of these items (see Table 1).

Discussion

Communication is a dynamic process, constantly changing as the interaction between the athletic trainer and athlete evolves. While any number of factors, such as personality, past experience, and emotional state, will help to shape an athlete’s perceptions of his/her injury, a major contributor to those perceptions will be the manner in which the information is presented to the athlete. How the message is communicated will greatly influence how it is received, and, therefore, is just as important as the message itself.21

We did not attempt to evaluate the athletic trainer’s technical knowledge of injury evaluation, but rather, focused on those elements of communication that might contribute to misunderstanding or misperceptions by the athlete concerning the injury and the rehabilitation process. If the perceptions held by the athlete are incorrect, it is irrelevant whether or not the athletic trainer accurately explained the injury and rehabilitation process. It is the athlete’s perceptions that will determine his/her compliance with the rehabilitation process. Because the athletic trainer holds the advantage over the athlete in understanding the athlete’s injury and the appropriate rehabilitation strategy, it is the athletic trainer’s responsibility to ensure that the athlete understands all aspects of the injury and the rehabilitation. In so doing, the athlete is better able to assist in the development of the rehabilitation program, which in turn helps to increase the athlete’s desire to work diligently toward recovery.

Table 2.—Kappa Table: Agreement/Discrepancy in Perceptions Between Athletes and Athletic Trainers

<table>
<thead>
<tr>
<th>Questions</th>
<th>Kappa</th>
<th>ASE</th>
<th>t value</th>
<th>Agree/disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the athlete understand the rehabilitation program?</td>
<td>-0.01</td>
<td>0.10</td>
<td>-0.13</td>
<td>Discrepancy</td>
</tr>
<tr>
<td>Did the athlete feel comfortable?</td>
<td>0.17</td>
<td>0.17</td>
<td>1.23</td>
<td>Discrepancy</td>
</tr>
<tr>
<td>Did the athlete feel motivated?</td>
<td>-0.25</td>
<td>0.13</td>
<td>-1.86</td>
<td>Discrepancy</td>
</tr>
<tr>
<td>Did the athlete ask questions?</td>
<td>0.55</td>
<td>0.16</td>
<td>3.97</td>
<td>Agreement</td>
</tr>
<tr>
<td>Did the athlete rephrase statements?</td>
<td>0.15</td>
<td>0.12</td>
<td>1.18</td>
<td>Discrepancy</td>
</tr>
<tr>
<td>Did the athlete summarize the explanation of the injury?</td>
<td>0.04</td>
<td>0.12</td>
<td>0.34</td>
<td>Discrepancy</td>
</tr>
<tr>
<td>Was the goal of returning to activity discussed?</td>
<td>0.04</td>
<td>0.14</td>
<td>-0.28</td>
<td>Discrepancy</td>
</tr>
<tr>
<td>Were weekly objectives discussed?</td>
<td>0.20</td>
<td>0.12</td>
<td>1.55</td>
<td>Discrepancy</td>
</tr>
<tr>
<td>Was a written rehabilitation protocol given to the athlete?</td>
<td>-0.15</td>
<td>0.13</td>
<td>-1.12</td>
<td>Discrepancy</td>
</tr>
</tbody>
</table>

\(t\) value (p < .05) between -2.0 and +2.0 indicates disagreement. \(t\) value (p < .05) outside these parameters indicates agreement. 

Objective Elements

The athletic trainers were more aware of environmental distractions during the evaluations than were the athletes. It may be that athletic trainers have been taught the importance of creating a quiet environment and, therefore, were more aware of any distractions when they did occur. Evidently these distractions had little...
impact on the athletes and did not contribute significantly to confusion on their part. Overall, the answers to the questions related to distractions and the maintenance of eye contact indicate that the athletic trainer and the athlete were attentive to the interchange.

Maintaining eye contact during the evaluation indicates attentiveness by the trainer and promotes trust by the athlete. Distractions which are allowed to interrupt the flow of an evaluation can create a chaotic atmosphere and can lead to the athlete's feeling that he/she is unimportant and that his/her problems are of little consequence. These fairly simple communication tools can be used effectively to develop positive attitudes in the athlete. They, along with the other four communication dimensions, must be present in order to foster an effective and accurate exchange of information between the athletic trainer and the athlete.

Frame of Reference

Each athlete, with respect to his/her particular sport, has a specific set of concerns related to his/her athletic participation and career objectives. These concerns, in conjunction with the athlete's background, experience, mental perspective, and emotional state, determine the athlete's frame of reference. The athletic trainer must take these individual differences into account when working with the athlete. Focusing on that person and being attentive to that person's particular frame of reference is important for effective communication.

We attempted to identify the athlete’s frame of reference with items related to his/her mental perspective and emotional state. Agreement between the athletic trainers and athletes was found for portions of the frame of reference dimension, specifically whether the athlete was irritable, defensive, or intimidated. These rather easily discernible emotional states were not exhibited by the athletes in our study (see Table 1). The absence of these negative emotional states suggests that the athlete perceives the athletic trainer as an approachable individual. Maintaining a friendly attitude, being attentive to the athlete, and responding in a straightforward manner encourages the athlete to discuss his/her concerns with the athletic trainer. The athletic trainer needs to take advantage of this approachability, since good rapport between the athletic trainer and athlete is essential for effective communication.

The discrepancies found for the athlete's relative feeling of comfort and degree of motivation during the initial evaluation indicate that the more subtle aspects of the athlete's frame of reference are more difficult to assess. Being aware of the athlete's frame of reference is vital for identifying appropriate communication and treatment strategies that will enhance and support the athlete's efforts to recover. The athletic trainer and the athlete approach the injury from different perspectives. The main obstacle in communication is the difference in their frames of reference. It is imperative for the athletic trainer to acknowledge this difference and try to accurately assess the athlete's frame of reference.

An important skill for the athletic trainer to develop is active listening, a technique in which the athletic trainer rephrases back to the athlete not only the athlete's verbal messages, but also his/her nonverbal messages. This provides an opportunity for the athlete either to confirm the athletic trainer's perceptions or to correct any misperceptions. Such an approach will have the effect of opening the lines of communication.

Type of Communication

In turn, asking the athlete to rephrase and summarize statements made by the athletic trainer is essential for determining if the athlete understood what has been said. While the athletes did ask questions, other findings would suggest a limited exchange between the athlete and athletic trainer: 1) discrepancies indicating uncertainty as to whether the athlete rephrased or summarized explanations given to him/her, and 2) minimal summarizing of explanations by the athlete in those instances where agreement occurred. Without such rephrasing or summarizing, false assumptions about the content of the interchange can easily be made by both parties. This may be the key element in the breakdown of communication between the athlete and the athletic trainer and may be indicative of the miscommunication related to goal-setting and the significant number of athletes who did not understand the rehabilitation strategy.

Short-term Objectives and Long-term Goals

The results from the items related to short-term objectives were conflicting and difficult to interpret. The majority of participants agreed that short-term objectives were discussed. Yet, a significant discrepancy as to whether daily or weekly objectives were discussed raises questions as to what was perceived as a short-term objective. Realistic and obtainable short-term daily or weekly objectives are crucial for achieving long-term goals. We also found a discrepancy as to whether a long-term goal for the athlete's return to activity was established. Unfortunately, in many cases, "return to activity" may be assumed by the athlete and athletic trainer and not explicitly discussed in terms of concrete goals. The small, easily attained steps in the rehabilitation process lead the athlete toward full recovery by providing feedback as progress is made and bolster the athlete's motivation to keep working toward the long-term goal. The athletic trainer and athlete together need to determine the obtainable daily and weekly goals for the athlete's particular injury and then develop a rehabilitation strategy.

Rehabilitation Strategy

While most of the athletes and athletic trainers agreed that a rehabilitation strategy was explained, the fact remains that the majority of the athletes did not understand the rehabilitation program designed for their injuries. Miscommunication regarding the objectives and goals of rehabilitation may have contributed to the athlete's confusion. The athlete's understanding...
standing of the rehabilitation strategy and the rehabilitation program might have been greatly enhanced had a written rehabilitation protocol been provided to him/her.8

Conclusions

Through trust, approachability, and good rapport, athletic trainers can develop the foundation necessary for effective communication. However, as evidenced by the discrepancies in perceptions during the initial injury evaluation, a significant number of athletes did not understand rehabilitation strategies because of several deficiencies in the exchange between the athlete and athletic trainers: 1) failure to check the accuracy of the athlete’s perceptions by asking him/her to rephrase or summarize the athletic trainer’s explanations, 2) misjudgment of the athlete’s level of motivation for recovery, 3) failure to explicitly discuss short-term objectives and long-term goals, and 4) failure to give a written rehabilitation protocol to the athlete. It is important for athletic trainers to develop stronger communication skills. Undergraduate and graduate training programs need to incorporate communication skills instruction into their curricula.

References


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Ankle injuries, specifically injuries to the lateral ligaments, are some of the most common injuries seen by the athletic trainer. There are numerous examples of external supports designed to enhance the static strength of the lateral ligaments. Ankle taping has historically been the most common technique used to prevent ankle sprains or to protect a previously injured ankle when the player is returned to competition. However, researchers have been unable to reach a consensus as to the effectiveness of ankle taping and its ability to maintain its effectiveness during exercise.2,4

Factors that have prevented reproducible research studies include: the type of tape used, method of application and orientation, adherence to the skin, and selective tensioning of strips during application.3 Rigid strapping tape and Hypafix® (DonJoy Smith and Nephew, Carlsbad, Calif) are advocated for the treatment of patellofemoral tracking disorders because of their ability to maintain good adhesion over an extended period of time.5 Using the above-mentioned materials will give better adhesion to traditional ankle taping, as well as enable it to withstand athletic activity longer.

**Step 1**
Place the ankle in the neutral position with approximately 0° of plantar flexion or dorsiflexion. Prepare the ankle by shaving from a point just below the belly of the gastrocnemius/soleus complex down to the mid-metatarsal region. Spraying the area with a tape adherent would be beneficial (Fig 1). However, you should not apply tape underwrap or heel lace pads at this time.

**Step 2**
Apply two stirrups, beginning medially where the shaved region starts and ending at the same point of the lateral side, crossing under the heel of the foot (Fig 2), using Hypafix skin dressing. You do not need to apply them with any significant tension.

**Step 3**
Apply one transverse anchor strap of Hypafix overlapping the beginning and ending points of the Hypafix stirrups (Fig 3).

**Step 4**
Apply three overlapping stirrups of rigid strapping tape following the same medial-lateral path as the Hypafix stirrups. However, when applying these stirrups, apply an eversion force after crossing under the medial border of the foot. Make sure not to

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**Fig 1.—**Step 1. Place ankle at 0° dorsiflexion.

**Fig 2.—**Step 2. Apply two Hypafix stirrups covering the medial and lateral aspects of the ankle.
Fig 3.—Step 3. Secure stirrups with a transverse Hypafix anchor.

Fig 4.—Step 4. Apply three rigid strapping tape stirrups onto the Hypafix, working medial to lateral. Make sure not to compress the base of the fifth metatarsal (Fig 4).

Step 5
Complete this portion of the procedure by applying a transverse anchor of rigid strapping tape over the tape stirrups (Fig 5).

Step 6
Apply a complete ankle taping procedure using traditional white athletic tape. If you use tape underwrap reapply tape adherent to the Hypafix tape to maximize adherence (Fig 6). By using the Hypafix/rigid strapping tape materials, adherence to the soft tissue is greatly improved, and there is greater resistance to breakdown during athletic activity. As with any taping procedure, an aggressive, comprehensive ankle rehabilitation and strengthening program is essential for return to full functional sporting activity.

Because of the success we have experienced in ankle and patellofemoral taping, we are exploring a number of additional applications with Hypafix tape. Clinical trials involving elbow, wrist, and arch support taping techniques are currently underway.

Acknowledgments
Special thanks to Glade Pauley, ATC, of DonJoy Smith and Nephew for his professional involvement in this project.

References

Traditionally, lower extremity strength assessment has been performed in an open kinetic chain. Several authors, however, recommend closed kinetic chain assessment of lower extremity performance. Reliability of closed kinetic chain tests is not available. Therefore, the purpose of this study was to determine the reliability of the following single-leg hop tests: hop for distance, 6m hop for time, and 30m agility hop. Eighteen subjects (4 males and 14 females) participated in this study. An ANOVA repeated measure analysis revealed significant differences between the test trials within and between sessions for all dependent variables. However, when the mean of two test trials was analyzed, the three single-leg hop tests values were stable; that is, intraclass correlation coefficient (ICC 2,1) ranges from 0.77 to 0.99. Results demonstrate that these three single-leg hop tests were reliable as used in this study. Future research is needed to determine the sensitivity of these tests in the assessments of lower extremity performance following injury and following rehabilitation procedures.


Continuous passive motion (CPM) is a modality used in the treatment, management, and rehabilitation of a variety of orthopedic problems. Recently, CPM devices have been therapeutically employed immediately after autogenous patellar tendon reconstruction of the anterior cruciate ligament (ACL). Whereas the concept of early motion is indicated, there is a concomitant concern that the implementation of immediate passive motion may stretch or rupture the graft. Twenty subjects scheduled to undergo ACL reconstruction were randomized into two groups (10 CPM and 10 non-CPM). All subjects performed the same postoperative rehabilitation with the exception of the CPM. Objective anterior tibial translation measurements were recorded with a KT-1000 for a 30-lb (133.5 N) Lachman test at 1-year postreconstruction. The results of this study indicated that the implementation of immediate continuous passive motion did not have any deleterious effects on the stability of the ligament reconstruction.


The purpose of this study was to compare the effects of four different treatments on the control of the amount and rate of foot pronation while running. The four treatments were the reverse-8 stirrup taping technique, the low-dye taping technique, prescribed rigid orthotic devices, and no support in the running shoe. Six intercollegiate cross-country runners were filmed from the rear while running on a treadmill, and the film data were analyzed. A two-way MANOVA indicated no significant overall treatment effect for the dependent variables. A one-way ANOVA indicated that the reverse-8 stirrup taping technique significantly reduced the amount of maximum pronation when compared to shoes-no support and low-dye taping techniques. The reverse-8 stirrup had significantly fewer degrees of total rearfoot movement when compared to the low-dye taping technique. No other significant comparisons were realized. It was concluded that the reverse-8 stirrup would be as effective a treatment for excessive pronation in runners as the prescribed rigid orthotic device.


A treatment and rehabilitation protocol was implemented on a university football player sustaining a second degree lateral ankle sprain. The initial treatment plan involved the application of the RICE principle (rest, ice, compression, and elevation). This particular rehabilitation protocol was aimed at restoring range of motion and function at the earliest possible time with the use of a cryokinetic technique developed by Knight and with progressive exercise. The subject in this case study returned to full participation 6 days postinjury. The results from this report indicate that a program of cryokinetics and functional progressive exercise performed within pain-free limits can greatly enhance the return of an athlete to competition.
The implementation of interval throwing programs during rehabilitation has been suggested in the literature to allow for a quicker and safer return of the throwing athlete to competition. Many programs have clearly focused on baseball players. This program is specifically designed for the football quarterback. The program encompasses a sound flexibility and strength training regimen and provides for a supervised step-by-step progression for throwing. Although the authors have found success with early results, practitioners should apply this program with caution, as it may need to be modified for each athlete. The purpose of this paper is to establish a foundation for further work in the area of the throwing shoulder for the football quarterback.

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Twelve university females were studied to determine the reliability of four different methods of calculating concentric and eccentric peak torque (PT) and angle specific torques (ASTs) for knee extension. Each subject was tested on the Kin-Com isokinetic dynamometer on two separate occasions, performing five concentric and eccentric contractions at 60°/s−1. PT and AST at 30°, 60°, and 75° were calculated by averaging the first three contractions, averaging all five contractions, taking the single best value of the first three contractions, and taking the single best value of all five contractions. Intraclass correlation coefficients derived from these calculations showed high correlation among the four methods. Additionally, z tests performed on correlation coefficients transformed to Fisher’s Z revealed no differences between pairs of correlation coefficients. These data appear to show there is no difference among the four methods of calculating PT and AST.

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Orthotics are commonly prescribed for the treatment of lower extremity injuries secondary to hyperpronation. However, the efficacy of vacuum molded orthotics has not been established. We assessed the effects of vacuum molded orthotics on pain and level of function in athletes suffering from plantar fasciitis, medial stress syndrome, or knee pain secondary to hyperpronation. Fourteen athletes assessed their pain and level of function during athletic activity before being fitted for orthotics (Professional Rx, SuperFeet In-Shoe Systems Inc) and weekly for 7 weeks following break-in. Five athletes (36%) reported complete pain resolution and eight (57%) reported substantial improvement. Eight athletes (57%) reported full return to athletic participation and five (36%) reported substantial improvement in athletic function. One athlete failed to respond to treatment. Results indicate that vacuum molded orthotics are an effective treatment for lower extremity overuse injuries secondary to hyperpronation.

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Prophylactic ankle taping has been shown to restrict motion in and around the ankle joint. Numerous studies have examined the effect of ankle braces, including the Swede-O ankle brace, on range of motion at the ankle joint. The purpose of this study was to determine the efficacy of the Swede-O ankle brace in preventing inversion in subjects with history of injury to the ankle using the Telos stress device. The subjects for this study were six female college students with a prior history of inversion ankle trauma, or known ankle laxity. A Telos GA-II/E stress device was used to measure the talar tilt angle. Anteroposterior x-rays were taken after application of 0, 6, 9, and 15 deca-Newton (daN) of force. The Swede-O ankle support is a lace-up brace made of canvas material covered by vinyl. As unstable ankle was defined for the purposes of this study as a talar tilt of at least 10° at 15 daN. Mean talar tilt displacements were recorded at each of the five settings with the ankle bare and then with the brace applied. The major finding of the study was that the Swede-O ankle brace was not effective in limiting talar tilt. A trend toward some limitation in motion seemed to exist at the lower force. The ankle brace used in the study appears to be inadequate in preventing the talar tilt associated with inversion ankle sprain. Previous studies have shown that the Swede-O ankle brace was effective in preventing subtalar joint displacement. However, these studies all concerned subjects who had no previous history of ankle trauma, or no history of trauma within 6 months prior to the study. The findings of the present study appear to question the efficacy of the ankle brace in preventing recurrence of inversion ankle sprains. For future research, a greater number of subjects is indicated as well as randomization of the Telos stress procedure. Finally, future research should examine the role of ankle bracing on joint proprioception.

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Plantar fasciitis is one of the most common foot injuries athletes sustain. The painful heel is the result of overloading and inflammation of the plantar fascia at the insertion into the medial process of the tuberosity of the calcaneus. Many different treatment approaches have been discussed to address this overuse problem. Treatment for plantar fasciitis has included decreased weight bearing, nonsteroidal anti-inflammatory drugs (NSAIDs), orthotics, arch taping, weight loss, steroid injections, ultrasound, ice physical therapy, and surgical release. Clinically the use of night splints has been found to be very successful in the treatment of plantar fasciitis, as described in this case study.

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**Background and Purpose**—The purpose of this study was to evaluate and compare the muscle activity of the supraspinatus, infraspinatus, teres minor, and lower trapezius muscles during commonly prescribed therapeutic exercises in subjects with and without shoulder pathology. **Subjects**—Twenty healthy subjects (9 male, 11 female) and 20 subjects with recurrent unilateral shoulder pain and weakness (14 male, 6 female), aged 14 to 40 years ($\bar{x} = 28$, SD = 5.8), participated in this study. **Methods**—Subjects performed each of the following exercises using a hand held weight: prone lateral (external) rotation, sidelying lateral rotation and arm elevation in the scapular plane. Indwelling fine wire electrodes recorded electromyographic (EMG) activity during each exercise. The EMG activity in five phases of concentric contraction of each exercise was averaged and divided into three equal time intervals. Mean EMG values normalized to maximal activity for the entire phase of concentric contraction and for each of the three intervals were used in subsequent analyses. **Results**—Two-way repeated measures analyses of variance (ANOVAs) revealed between group differences only in the prone lateral rotation exercise. Compared with subjects without shoulder pathology, subjects with shoulder pain showed significantly greater EMG activity in the infraspinatus muscle and less activity in the supraspinatus muscle during this exercise. **Conclusion and Discussion**—These results suggest that the pattern of muscle activation during specific shoulder movements in patients with shoulder pain may be related to pathology. Further studies are needed to determine whether an imbalance in neuromuscular control is a factor contributing directly to shoulder dysfunction or whether such an imbalance is secondary to some pathology.

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**Background and Purpose**—This correlation study describes factors that are related to patient compliance with exercise regimens during physical therapy. We investigated whether patient compliance was related to characteristics of the patient or the patient’s illness, to the patient’s attitude, or to the physical therapist’s behavior. **Subjects and Methods**—Of a random sample of 300 physical therapists in private practice in the Netherlands, 222 therapists responded to a questionnaire survey. Eight form respondents also made audio recordings. Materials of the study were 1931 registration forms, 1837 audio recorded sessions of physical therapy sessions and 1681 patient questionnaires. **Results**—The results show that the three main factors related to non-compliance were: 1) the barriers patients perceive and encounter, 2) the lack of positive feedback, and 3) the degree of helplessness. The first factor, the barriers patients perceive and encounter, shows the strongest relation with noncompliance, and much hindrance of the complaint is positively related to compliance. There was no difference between men and women with regard to patient compliance, but less educated patients were slightly more compliant than more highly educated patients. **Conclusion and Discussion**—These correlational finds can be used to formulate hypothesis of cause and effect in future clinical research. Future research should take into account the type and efficacy of therapeutic exercise for different diseases. For physical therapy practice, it seems important that physical therapists carefully explore which problems patients encounter in their efforts to comply and that they seek solutions to those problems in mutual cooperation with their patients.

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Advances in isokinetic technology allow the physical therapist to assess concentric, eccentric, and isometric muscle performance at the shoulder in various positions. Research is limited, however, on the reliability of isokinetic measurements. The purposes of this study were: 1) to determine the test-retest reliability of concentric, ec-
centric, and isometric muscle performance measurements of shoulder external and internal rotation in the scapular plane test position, and 2) compare this reliability between the involved and uninvolved limbs of subjects with a history of unilateral shoulder pathology. Fourteen males and 10 females (17–58 years) were tested on two occasions at 1-week intervals with the Biodex isokinetic dynamometer. Peak torque, total work, and average power were recorded for concentric tests at angular velocities of 60 and 120°/s and for eccentric tests at 60°/s. Maximum average isometric torque was recorded in two positions. Means, standard deviations, and mean differences between sessions with 95% confidence intervals were calculated. Intraclass correlations coefficients (ICCs) were used to determine test-retest reliability. Isometric tests were generally most reliable (ICC = .81–.93), followed by concentric (ICC = .60–.95) and eccentric tests (ICC = .44–.92). Isokinetic and isometric reliability were usually higher for involved than uninvolved shoulders. The implication of these findings is that there appears to be a greater variability with eccentric than concentric or isometric testing of shoulder rotation. Factors that possibly contributed to variability are discussed. Clinicians should recognize potential sources of testing error when obtaining isokinetic measurements for use in clinical decision making. Further refinement of isokinetic testing protocols at the shoulder is recommended.


Subtalar joint (STJ) measurements are commonly made in the clinic to assess foot and ankle positions because of the high incidence of lower extremity dysfunctions. The purposes of this study were to investigate the intratester and intertester reliability of the open kinetic chain subtalar joints neutral (OKC STJN) and closed kinetic chain subtalar joint neutral (CKC STJN) positions and the navicular drop test (NDT). Two inexperienced testers performed repeated measurement on 15 subjects (n = 30 feet) during two testing sessions. Intratester and intertester reliability (ICC 1,1) and standard error of measurement (SEM) were determined for each dependent variable. For OKC STJN, the intratester ICC values were .06 and .27, and the intertester ICC value was .00. The intratester SEM values were 1.81 and 2.29°, and the intertester was 2.51°. The CKC STJN intratester ICC values were .14 and .18, with SEM values of 2.46 and 2.40°. The intertester CKC ICC value was .15, with an SEM of 2.43°. For the NDT, intratester ICC values were .61 and .779, and the SEM values were 1.92mm and 2.57mm. The intertester ICC value was .57 and the SEM was 2.72mm. The results reveal that both OKC and CKC STJN yield poor intratester and intertester reliability and the NDT yields poor to moderate intratester reliability and poor intertester reliability. We conclude that these foot and ankle measurements are not reliable when performed by inexperienced testers. Therefore, clinicians should practice these measurement techniques and determine their measurement error.


With multiple hand-held devices now available for measuring muscle strength, clinicians need to know if the measurements obtained with the different devices are comparable. This study was performed to determine the comparability of force measurements obtained with two different strain gauge hand held dynamometers. Specifically examined to establish comparability were differences, reliabilities, and correlations between measurements obtained with different devices. Thirty one healthy volunteers were tested with each device during a single session. The muscle groups tested isometrically were the elbow flexors, shoulder external rotators, and hip flexors. Although the magnitude of forces measured with the two dynamometers differed significantly, they demonstrated good to high reliabilities and correlations. Thus, the dynamometers should not be used interchangeably on the same patient. Either of the dynamometers, however, can be used (alone) to document muscle force production.


Chronic compartment syndrome (CCS) is a recognized cause of recurrent leg pain in the exercising patient. Decreased muscle function has been implied in this condition. This study compared the ankle dorsiflexion torque of 10 CCS patients with that of 18 control subjects during 20 repeat, maximal, isokinetic contractions at 60°/s; peak torque, relative peak torque, and endurance data were collected. Results showed significantly lower peak torque and relative peak torque endurance in the CCS group (p < .05), supporting the implication of muscle weakness in CCS. Paradoxically, endurance was significantly higher in the CCS group (p < .01), and there was a significant
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(p ≤ .01), negative correlation (r = −.05) between peak torque and endurance. The relationship between the findings and CCS is discussed. Strengthening may be useful in very mild cases or in postfasciotomy patients.

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Therapists often search for more efficient and effective ways to provide patients with information regarding their performance. The purpose of this study was to determine whether certain types of machine-based visual displays could be used as a source of error correction information to facilitate the immediate and/or delayed performance of a maximal effort isokinetic movement of the knee. The relative effectiveness of the knowledge of results (KR) provided by visual displays that differed in degree of precision and presentation schedule were compared during a practice and retention phase. Twenty four healthy male subjects (x age = 22 years) performed isokinetic extension and flexion of the knee at low (120°/s) exercise speeds. A no-KR maximal effort pretest was followed by two practice sessions during which three groups each received one form of visual KR and a fourth group practiced without KR. A no-KR maximal effort posttest was administered to all groups following a 1-day rest interval. Although visual KR did not result in any significant differences in mean peak torque output during practice, between-group comparisons of pretest to posttest changes in mean peak torque indicated that groups receiving visual KR in addition to practice demonstrated significantly greater (p < .03) improvements in mean peak
torque in three of the four conditions tested when compared with the group that practiced without KR. On the basis of these results, certain forms of visual KR appear to provide an important error correction function and promote the development of cognitive strategies that can be used to guide execution of maximal effort exercise in the absence of KR. Training patients to use machine-based visual displays in clinical settings will not only promote greater patient independence within the clinical setting but may also help the patient develop cognitive strategies that can be used to guide performance outside a supervised clinical setting.


The Cybex 6000 isokinetic dynamometer is a new isokinetic device for which no published reports of reliability have been presented in the literature. In addition, the manufacturer not only claims that the new Cybex 6000 is reliable but that torque data obtained from the Cybex 6000 are consistent with data obtained from past Cybex systems, such as the Cybex II. The purpose of this study was to investigate the intramachine reliability of the Cybex 6000 to itself and the intermachine reliability of the Cybex 6000 and the Cybex II. Data on peak torque, work, and power were collected using the Cybex 6000, and data on peak torque were obtained using the Cybex II for knee flexion and extension in 20 volunteers (10 males, 10 females). Subjects were tested three times, twice on the Cybex 6000 and one on the Cybex II, approximately 1 week apart across a 3-week period of time at angular velocities of 60, 180, and 300°/s. Data were analyzed using in-
traclass correlations. Results indicated that the majority of test-retest correlation coefficients for all parameters for intramachine reliability of the Cabbies 6000 were above .90. Comparing peak torque obtained with the Cybex 6000 to that obtained with the Cybex II (intermachine reliability), correlation coefficients ranged from .72 to .90. In conclusion, information obtained on the Cybex 6000 appears to be quite reliable in a test-retest situation using the same equipment and moderately reliable when compared to the Cybex II. Clinical implications for these results are discussed.


Several indirect clinical tests for measuring hamstring muscle length are available, but the influence of their test procedures is not well documented. This study examined four of these tests to clarify the results relative to the testing procedures. The right limbs of 30 men were tested for: 1) passive straight leg raise (SLR) with the pelvis and opposite thigh stabilized with straps (SLR-SS); 2) passive SLR with low back flat and, if needed, the opposite thigh slightly flexed and supported on pillows (SLR-LFB); 3) active knee extension with the hip at 90° (AKE); and 4) passive knee extension with the hip at 90° (PKE). A dependent t-test showed no significant differences between the angles of SLR-SS (61° ± 6.7°) and SLR-LBF (62° ± 6.2°). The SLR-SS and SLR-LBF angles for subjects needing pillows under the opposite thigh for the SLR-LBF test (n = 18) also were not significantly different. The knee flexion angles for the AKE (43° ± 10.2°) and the PKE (31° ± 7.5°) tests were significantly different (p < .001). Significant relationships (Pearson r) were found among the four tests (p < .05). The similar angles for SLR-SS and SLR-LBF and their significant relationship (r = .70, p < .001) indicated that their different testing procedures probably had a minimal influence on test results. The difference between the AKE and PKE tests suggested that the AKE test and the PKE test may represent an ‘initial length’ and a ‘maximal length’, respectively. These results should help clinicians apply the test appropriately and interpret the results accurately.


Although hip and groin pathologies are not as prevalent as other lower extremity injuries, information on the course of physical therapy to remedy these injuries is needed. This case study reviews an episode of chronic adductor tendinitis and the subsequent course of treatment. A 16-year-old female swimmer developed symptoms of an adductor strain that failed to respond to varied conservative treatments over 1 year. A unilateral tenotomy was performed, and follow-up treatment was provided. Although this patient is not symptom-free, she is swimming competitively at a major Division I college. Consideration of more than one causative factor and aggressive early diagnosis must be performed to prevent groin pain from becoming chronic.

Dynamics of Human Biological Tissues
Editors: Dean P. Currier and Roger M. Nelson
FA Davis Co, Philadelphia, PA
1992
276 pages
ISBN: 0-8036-2298-8

Dynamics of Human Biological Tissues was written to compile information regarding muscle, nerve, and connective tissue as it relates to physical therapy. This text effectively unites otherwise widely distributed information regarding tissue structure and function. Reviews of connective tissue structure and function provide an excellent review of current knowledge in this area. Skeletal muscle function and structure, and therapeutic interventions, are also presented. Unfortunately, therapeutic interventions are limited to electrical stimulation applications. Peripheral nerves, tendons, and articular cartilage are primarily addressed as they relate to therapeutic interventions, although cursory function and structure is presented.

The information provided for specific therapeutic interventions are well presented, however several important therapeutic modalities are not addressed. The most conspicuous omission is therapeutic exercise. The effects of exercise on tissue function and remodeling are important information for those interested in sports injury rehabilitation.

The topics most likely to interest athletic trainers include: effects of stress and motion on scar remodeling, effects of stress on strength of collagen in scar tissue, factors that influence force-frequency relation in skeletal muscle, high frequency fatigue versus low frequency fatigue, tendon healing, and remodeling and repair of articular cartilage. Athletic trainers who make extensive use of electrical stimulation will find well-reviewed applications for skeletal muscle and articular cartilage. Sections addressing tissue structure and function may serve as a good review.

I recommend using this text as a supplemental text for undergraduate clinical or rehabilitative biomechanics courses or undergraduate injury evaluation courses. It is also an excellent reference text for the practicing athletic trainer.

Christopher D. Ingersoll, PhD, ATC

Rehabilitation of the Knee: a Problem-solving Approach
Editor: Bruce H. Greenfield
FA Davis Company, Philadelphia, PA
1993
467 pages, illustrated
ISBN: 0-8036-4335-7
Price: $41.00

This book is written for the educational advancement of both the advanced student who is studying the knee and for the clinician who is looking for greater detail. The major focus of this text is rehabilitation for both sports- and nonsports-related knee injuries with each chapter written by recognized rehabilitation specialists/clinicians.

The organization of the book is such that the initial chapters set the basis for the rest of the text by discussing functional anatomy, the elements involved with sequential evaluation and clinical problem-solving, and principles of exercise progression. The subsequent chapters address evaluation and rehabilitation strategies for Nonprotective (ie, microtrauma injuries, patellofemoral joint dysfunction, arthritis) and Protective (ie, intra-articular and extra-articular reconstructions, posterior cruciate ligament, medial capsular, lateral compartment, meniscal) injuries to the knee. Great detail is afforded to the factors that affect treatment implementation and rehabilitation progression, and the use of multimodal training (both open and closed chain).

What differentiates this text from others is its organizational approach which emphasizes formulating a treatment plan based upon knowledge of functional anatomy and the medical aspects of knee pathology and integrating those variables into a clinical decision-making process based on the problem-solving paradigm presented in Chapter 3. A series of considerations to facilitate effective clinical problem solving using specific “case” and “problematic” examples are also presented which further contributes to this uniquely written approach to studying knee rehabilitation.

John E. Kovaleski PhD, ATC

Sport, Physical Activity, and the Law
Neil Dougherty, EdD, David Auxter, EdD, Alan Goldberger, JD, Greg Heinemann, MEd, and Guest Contributor Hilary A. Findlay, PhD, LLB
Human Kinetics Publishers, Champaign, IL
1993
328 pages
ISBN: 0-87322-512-0
Retail Price: $36.00

In today’s litigious society, knowledge of the law is vital for anyone in administering sport and physical activity programs. Sport, Physical Activity, and the Law takes a practical approach, showing you how to use the law as a management tool to address day-to-day issues like the right to participate, liability for injuries, the effective assertion of legal rights, the legal status of organizations that govern sport, and statutes such as the Americans with Disabilities Act.

The authors of the book include Neil Dougherty, EdD, a professor of sport law in the Department of Exercise Science and Sport Studies at Rutgers University, who has experience consulting for attorneys, insurance, and professional groups on liability and safety in sport; David Auxter, EdD, legislative chairman
This textbook provides a basic treatment of many of the major issues related to sport today. The book is comprehensive in some areas (i.e., who may participate, rights of the participant, who is in charge, player violence), survey in others (i.e., tort liability, standard of care, supervision, legal system in America, legal research), and lacking in a number of areas (i.e., exculpatory agreements [warnings and releases]; risk management planning [reduction of risk through operations control and management of financial risks]; liability concerns relating to facilities and equipment [construction, design, and condition of premises or piece of equipment]; sport medicine issues [emergency care and physical condition]; contractual liability; administrative issues such as independent contractors, transportation, licensure and trademark issues, IRS and the sport; copyright issues; spectator concerns; instruction and teaching methodology; professional malpractice).

Finally, this textbook is appropriate for college introductory classes that are providing a survey of the legal issues relating to sport and physical activity. It is not appropriate for advanced undergraduate or graduate classes. The most comprehensive book for professionals in the fields of sport, physical education (activity), leisure services, recreation and parks, and camping and adventure activities is Betty van der Smiessen's textbook entitled Legal Liability and Risk Management for Public and Private Entities, published by Anderson Publishing (1990). If the professional is interested further there are two other volumes of the van der Smiessen's text. Further, athletic trainers should seriously consider the purchase of the following books:

2. Webster DL, John CM, Thomas MK. 1992 Guidelines for Professional Practice in Athletic Training. Canton, OH: Professional Reports Corporation; and

Thomas H. Sawyer, EdD
New Shoulder Joint Stabilizer from CADLOW

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The stabilizer is new to the field of sport medicine and is already helping many athletes play with success at the high school, collegiate, and professional levels. To receive a free video and information about the CADLOW Stabilizer please call or write: CADLOW Enterprise Inc., 113 McHenry Rd., Suite 202, Buffalo Grove, IL 60089, Tel: 708-786-3929.

Optimize Exercise Programs

There is a common problem with most exercise programs—athletic trainers have to purchase an entire system, whether they use all of the exercises or not. Orthopedic Physical Therapy Products (OPTP) thinks athletic trainers shouldn’t have to pay for what they don’t use. That is the difference with Exerpak, a truly customized exercise program. With Exerpak, the athletic trainers selects only the exercises they need. There are no unused exercises clogging the files and wasting resources.

The entire Exerpak selection consists of 200 commonly used exercises. Each exercise is clearly illustrated and described on a 4 1/4” x 5 1/2” card. The cards are the perfect size for handing out to patients and eliminate the need for photocopies.

Designed with Certified Athletic Trainers, the Evac-U-Splint Athletic Mattress is easy to use and replaces the need for various backboards, straps, and head immobilizers. The University of Alabama, Wake Forest, Texas Christian University, and the University of South Carolina are just a few of the universities now using the Athletic Mattress. Durable stain resistant material is easy to clean and disinfect. It is x-ray-lucent and MRI-compatible. Seeing is believing. For more information or to purchase the “Athletic Mattress” contact Hartwell Medical at 1-800-633-5900 today.

OPTP Introduces Custom Exercise Program

There is a common problem with most exercise programs—athletic trainers have to purchase an entire system, whether they use all of the exercises or not. Orthopedic Physical Therapy Products (OPTP) thinks athletic trainers shouldn’t have to pay for what they don’t use. That is the difference with Exerpak, a truly customized exercise program. With Exerpak, the athletic trainers selects only the exercises they need. There are no unused exercises clogging the files and wasting resources.

The entire Exerpak selection consists of 200 commonly used exercises. Each exercise is clearly illustrated and described on a 4 1/4” x 5 1/2” card. The cards are the perfect size for handing out to patients and eliminate the need for photocopies.

Out of the inventory of 200 exercises, the therapist selects the 40 exercises that they use most. For each exercise they have selected, the athletic trainers receive 40 exercise cards, 20 loose cards to use immediately, and 20 banded cards to use as a back-up. The exercise cards are indexed and filed in a sturdy filing case. The therapist receives a total of 1600
exercise cards, 40 cards for each of the 40 exercises.
Exerpak can be further customized. For a minimal charge, custom exercise cards can be designed to the athletic trainer’s specifications. In addition, the therapist can request customized envelopes to hold the patient’s exercise cards.

Call or write OPTP, the conservative care specialist, for more information about Exerpak. Ask about OPTP’s free 24-page catalog. Call toll-free 1-800-367-7393 or write OPTP, PO Box 47009, Minneapolis, MN 55447.

**OPTP Introduces Stretch Out**
The “Stretch Out” Strap is now available from OPTP, the conservative specialists. Developed for use by professional athletes, the Stretch Out Strap delivers the benefits of partner resistance stretching without the assistance of a partner. This type of stretching combines isotonic, isometrics, and prolonged stretch.

Stretch Out allows the patient to stretch most major muscle groups with greater safety and effectiveness than is possible unaided. Using the Stretch Out is easy; warm up the muscles, use the Stretch Out, exercise and stretch again with Stretch Out.

The multiple position grips allow gradual stretching and relaxing for more complete results. The grips can be anchored with the hand, foot, or wrist, allowing the Stretch Out to be used by most patients.

The versatile “Stretch Out” Strap, originally designed for self-activated PNF stretching, has multiple rehabilitation applications, from quad ladders to wheelchair exercising.

Stretch Out is easy to use and comes with an illustrated guide book. For more information about the Stretch Out and other conservative care products, write OPTP at PO Box 47009, Minneapolis, MN 55447-0009 or call 1-800-3647-7393.

**New One-Size-Fits-All Neoprene Supports**
Safe-T-Gard introduces adjustable neoprene supports for improved fit with adjustable compression.

The Velcro® closures used for the One-Size-Fits-All Neoprene Supports allow athletes to easily attach and remove from the injured area. Manufactured from Rubatex® closed cell UBL neoprene, this product relieves pain through constant pressure and retention of body heat.

One-Size-Fits-All Neoprene Supports are available in Wrist, Thigh, Waist, Knee, Ankle, and Elbow with Black/Red nylon on both sides.

Safe-T-Gard, located in Lakewood, CO, has manufactured a quality line of specialized athletic protective equipment for more than 30 years.

For more information contact Safe-T-Guard Corp. at P.O. Box 1468, Golden, CO 80402 or call 303-763-8900.

**MSC Cold Pack Provides Alternative**
The MSC Cold Pack is filled with a special Crylon Gel which gives the product non-ice properties and allows it to remain therapeutic for 25 to 30 minutes. The user is provided with all the benefits of cold therapy without the hassles of dealing with messy ice or conventional products. These products stay flexible when frozen and their Velcro straps are designed to provide a comfortable level of compression to the injured area.
resistance force as the inversion force increases and is now available with the user friendly QT lacing feature.

For a free brochure or ordering information please contact Omni Scientific at 1-800-448-6664.

Lifeline Introduces the Lifeline Gym

The Lifeline Gym can be used to exercise all major muscle groups, train balance, and provide a cardiovascular workout. Quality construction and innovative design make the Lifeline Gym a cost-effective system for the clinic as well as the home.

New Dynatron 500PLUS Adds Microcurrent to Give More Options to Practitioners

Dynatronics Laser Corporation, a Salt Lake City-based manufacturer of physical medicine modalities, and testing and rehab equipment, announce the shipping of a new product—the Dynatron 500PLUS—that will give practitioners more treatment options for their patients.

The Dynatron 500PLUS is an upgrade of Dynatronics' best-selling interventional unit, the Dynatron 500. The Dynatron 500PLUS offers interventional, premodulated, Russian, and biphasic stimulation, plus microcurrent at the same price as the former Dynatron 500.

Microcurrent, interventional, and premodulated therapies help relieve pain, relax muscle spasms, and increase local blood circulation. Russian and biphasic stimulation help re-educate muscles, increase range of motion, and prevent disuse atrophy. The Dynatron 500PLUS began shipping to customers in November.

The Dynatron 500PLUS has all the unique features of Dynatronics equipment, including four independently programmable channels, the patented Target system to precisely pinpoint the exact area of pain and to treat (sweep) up to 75% of the area within the electrodes, and on-screen instructions for treatment setup. The Dynatron 500PLUS also has the ability to program up to 10 treatment parameters for fast treatment application.

For more information on the Dynatron 500PLUS and the complete line of Dynatronics products call 1-800-874-6251.

SwimEx Adds to Length of Its Multidepth Aquatic Therapy Pool

SwimEx Systems, a division of TPI, Inc. in Warren, RI, has unveiled for 1993 an optional version of its SwimEx Multidepth Pool for aquatic therapy. After several requests, the company has added two feet of length to the Multidepth Pool's 12' x 6'2" exercise area, thereby creating the ability to effectively treat up to four patients at one time.

The Multidepth pool's optional added length has been engineered as a separate formed fiberglass section that increases the number of the unit's distinct P.N.F. stations (including plyometric pads, open and closed kinetic exercise benches and steps, and a deep water running platform) from eight to nine. The SwimEx Multidepth Pool was introduced in 1991 and is acclaimed for its adjustable water depths of 45, 50, and 60 inches and its powerful, controllable current, unmatched by any therapy pool on the market. The unit circulates over 30,000 gallons of laminar water flow per minute and generates over 40 water speeds from 0 to 6.3 mph, giving the physical therapist, trainer, or physician the ability to individually tailor the hydroenvironment.

SwimEx Systems sponsors a series of aquatic therapy clinics, and its pools are found in physical therapy and sports medicine clinics across the country. Five professional sports teams—three NFL Football and two Major League Baseball—have incorporated SwimEx pools into their training and rehabilitation programs, while two of the country's largest rehabilitation corporations—Baxter and Health South—recently have installed SwimEx aquatic therapy units.

For a brochure on SwimEx aquatic therapy pools, contact SwimEx Systems, P.O. Box 328, Warren, RI 02885; Tel: 800-877-7946.

New Knee Brace For Sliding Sports Now Available

Intrepid, Smith & Nephew DonJoy's latest addition to its line of
knee braces, is an all-action knee system for patients who require extended wear bracing for ACL, MCL/LCL, or combined instabilities of the three. Because it is designed with a lightweight, thermoplastic composite and contains no metal parts, athletes can wear Intrepid for soccer, baseball, softball, rugby, and wrestling. A special sliding sleeve comes with the brace.

Intrepid incorporates DonJoy’s patented 4-Point Leverage System that actively resists both straight translocation of the tibia and translocation of either tibial condyle. DonJoy’s Dynamic “Y” Strap Leverage system that resists abnormal varus and valgus bending is incorporated as well.

Dupont’s CoolMax® lines the brace, keeping the leg cool and free from irritation during all-day wear. For more information contact Steve Oordt at 800-336-5690.

Cat Eye Granted US Patent on Data Card System

Cat Eye Company, Ltd. has announced that their unique Data Card System for the instant set-up of a customized exercise program on Cat-Eye ergocizer models EC-1200, EC-1600, and EC-3600 has been granted US Patent 5,230,673.

The Cat-Eye Data Card System provides each ergociser user a programmable plastic card which is encoded with all the specifics of the exercise program for that user. This could include resistance levels, target heart-rate zones, hill profiles, and other critical parameters that must be entered into the ergociser controller to create the customized user program. Each time a user starts to exercise with one of the Cat-Eye Data Card models, all the pertinent data can be instantly loaded into the controller via the data card. Competitive exercise equipment requires that the user enter any control data manually.

This feature is especially attractive to the many health club and rehabilitation institutions having many users for each unit.

The full line of popular CAT EYE exercise products are distributed in the Eastern US by Fuji America, 118 Bauer Drive, Oakland, NJ 07436, Tel: 800-631-8474; in the Western US by Maximus, 208 East Second Ave., La Habra, CA 90631, Tel: 800-634-6294; and in Canada by Norco Products Ltd., 7950 Enterprise Street, Burnaby, B.C. V5A 1V7; Tel: 604-420-6616.

New Conformable Hydrocolloid Dressing Provides Optimum Healing Environment

3M Health Care introduces 3M™ Tegasorb™ THIN hydrocolloid dressing, a unique, transparent dermal wound dressing that provides an optimum healing environment for chronic wounds.

3M Tegasorb THIN dressing provides a moist wound environment for rapid healing, and acts as a barrier to outside contaminants, such as bacteria and body fluids. The dressing will absorb three to four times its weight of fluid or exudate.

Available in two shapes, oval and square, 3M Tegasorb THIN dressing easily conforms and adheres to difficult body areas, thereby eliminating the need for edge taping. Its transparent film border allows excellent length of wear, up to seven days, for many applications.

For more information on 3M Tegasorb THIN hydrocolloid dressings, call 800-228-3957 or write to 3M Health Care, Attn: 93-HC-351, Building 275-4E-01, St. Paul, MN 55133-3275.

Mettler Shows Therapists How To Get It Together

Mettler Electronics proudly introduces the Sonicator® Plus, a complete portable treatment center that combines therapeutic ultrasound with two-channel, high-volt stimulation, in one easy-to-use package.

The Sonicator Plus allows therapists to deliver combination therapy at the touch of a button. Or they can use it to treat opposing muscle groups, different body sites, or even different patients at the same time. It offers the most versatile and efficient treatment capabilities available in a single unit.

The full line of popular CAT EYE exercise products are distributed in the Eastern US by Fuji America, 118 Bauer Drive, Oakland, NJ 07436, Tel: 800-631-8474; in the Western US by Maximus, 208 East Second Ave., La Habra, CA 90631, Tel: 800-634-6294; and in Canada by Norco Products Ltd., 7950 Enterprise Street, Burnaby, B.C. V5A 1V7; Tel: 604-420-6616.
apy. A large, liquid crystal display makes it easy to check all treatment parameters, while bright bar graph and numeric displays allow the operator to continuously monitor treatment intensity. The device also features self-diagnostic circuitry to monitor treatment integrity. Pre-set error codes will alert the therapist if they need to check ultrasound coupling, tuning, or cable connections, as well as electrode impedance.

To receive a free brochure on the Sonicator Plus or the new Mettler Treatment Cart, or to schedule a product evaluation, contact Jennifer Rohl at 800-854-9305.

Rich-Mar Theratouch 4.7
Release 2.0!

Rich-Mar Corporation of Inola, OK, revolutionized the electrotherapy industry with the introduction of the Theratouch 4.7 in June of '93. The 4.7 is a multi-waveform 4-channel stimulator that utilizes a touch screen to greatly improve and simplify stimulation. Also, due to its advanced design and touch-screen interface, the Theratouch 4.7 is upgradable and expandable.

Rich-Mar is proud to announce that Release 2.0 of the Theratouch 4.7 is now available and all subsequent units will come standard with this advanced software release. Also, all existing 4.7’s will be supplied with the upgrade chips FREE OF CHARGE! Release 2.0 adds many beneficial features to the 4.7, but it still keeps its most integral aspect, its ease of use. The benefits in Release 2.0 include: the addition of the Russian waveform (2500-Hz carrier frequency), totally independent channels (any waveform out of any channel at any time), six user-defined treatment presets, adjustable up and down ramp times, a polarity switch for the monophasic waveform, and a print screen function.

All of these advances are in addition to the existing advances that include: 3 Quick Sets for Pain, Edema, and Rehab, 5 Waveforms (Classic Quadpolar IF, Premodulated Bipolar IF, Biphasic, Monophasic, and Micro), PC capabilities, and the touch-screen. The 4-channel stimulator unit also has patient safety features such as low current sensor, patient surge protectors, and pending CSA approval.

Combine the technological advances and patient safety with the experience and quality of the Rich-Mar name and you can see why the Theratouch is revolutionizing electrotherapy. For more information please call 800-762-4665 or write Rich-Mar Corp., P.O. Box 879, Inola, OK 74036.

Training Room Equipment

Chosen from Bailey Manufacturing’s more than 300 products are pieces of equipment which give variety and versatility to athletes and trainers when rehabilitating in the training room.

The pieces of equipment shown are the Stall Bars and Stall Bar Bench. The Abdominal Exercise Board can be attached to the Stall Bar as shown or it can be attached to it’s own Ladder so that it can stand alone. The Wall Mounted Shoulder Wheel is just one of several designs available. The Treatment Table features an Adjustable Backrest and Divided Shelf. The Step Stool with handle makes it easy for storage as well as extra stability for the patient. The Stool with castors is one of many available to suit the different needs of the trainer.

For detailed information on any of the products shown and a catalog of Bailey’s complete line of sports medicine products contact Bailey Manufacturing, P.O. Box 130, Lodi, OH 44254. Tel: 216-948-1080; Fax: 216-948-4439.

Dumbbells and Fitbells
Lodi, OH—Introducing a variety of Dumbbells and Fitbells from Bailey Manufacturing. Model 1860 is an adjustable dumbbell set with speed locks. They have cast iron plates and are finished in black enamel. No wrenches are needed as they are designed with chrome plated speed lock handles and collars. Model 1833 is a 3-pound ruggedly built cast iron dumbbell with a black finish. Model 1835 is 5 pound in weight, and Model 1840 is a 10-pound in weight. Bailey’s Fitbells are solid cast iron dumbbells with a vinyl coating for maximum comfort, safety and style. The weights are available in 1, 2, 3, 4 and 5-pound pairs and each pair comes in a different designer color.

For further information on the Dumbbells and Fitbells shown contact Bailey Manufacturing, P.O. Box 130, Lodi, OH 44254. Tel: 216-948-1080; Fax: 216-948-4439.
The NATA Board of Certification accepts this continuing education offering for .5 hours of prescribed CEU credit in the program of the National Athletic Trainers’ Association, Inc, provided that the test is used and completed as designed.

To participate in this program, read the material carefully, photocopy the test, and answer the test questions. Mark your answer by circling the correct letter. Then fill in your name, address, and other information and mail with $15 for processing to the address below. FOR CREDIT, the form must be postmarked by May 20, 1994.

A passing score is 70% and those who pass are entitled to .5 CEU credit. Letters will be sent to all persons who participate, and will serve as proof of CEUs for those who pass. It is the individual’s responsibility to report his/her CEUs to the NATA Board of Certification at the end of the year or when asked. Participation is confidential.

This CEU Credit Quiz contains questions drawn from the following articles:
Fincher. Use of the otoscope in the evaluation of common injuries and illnesses of the ear.
Kahanov/Fairchild. Discrepancies in perceptions held by injured athletes and athletic trainers during the initial...
Potteiger/Stilger. Anabolic steroid use in the adolescent athlete.
Street, et al. Athletic medical insurance practices at NCAA Division I institutions.
Zemper. Analysis of cerebral concussion frequency with the most commonly used models of football helmets.
Zimmerman. Carpal tunnel syndrome.

CEU CREDIT QUIZ

Instructions

1. Photocopy these pages and write on the copy.
2. Read the articles listed above.
3. Answer the questions.
4. Mail with $15 fee (checks made payable to Indiana State University) postmarked by May 20, 1994, to:

JAT—CEU Quiz
Physical Education Department
Indiana State University
Terre Haute, IN 47809

Answers to Winter ’93 CEU Quiz
Volume 28, Number 4
1. d 4. a 7. d 10. e 13. a
2. a 5. d 8. b 11. a 14. b
3. a 6. e 9. b 12. c 15. a
Circle the correct answer.

1. Ways to keep athletic insurance costs down include:
   a. riders.
   b. secondary insurance plans.
   c. deductibles.
   d. all of the above.
   e. a and c only

2. Treatment of carpal tunnel syndrome includes:
   a. splinting in severe cases to avoid costly surgery.
   b. job reassignment.
   c. ergonomic redesign of the work place.
   d. all of the above.
   e. b and c only

3. Observable indicators of anabolic steroid use might include:
   a. increased acne.
   b. abnormal development of body hair in males.
   c. gynecomastia.
   d. increased susceptibility for tendon strains and injuries.
   e. all except b.

4. Many unmet educational needs of athletic trainers exist primarily in:
   a. the sports medicine clinic.
   b. the corporate/industrial setting.
   c. the college/university setting.
   d. both a and b
   e. none of the above. Studies show that most athletic trainers feel that their continuing education needs are adequately met.

5. A fracture of the tibial plateau:
   a. is a relatively common knee injury in sports.
   b. usually results from high impact incidents, such as automobile accidents.
   c. is often associated with non-contact, twisting injuries to the knee.
   d. is always associated with deformity and swelling.
   e. both b and c

6. In a hardness testing of casting materials, it was found that:
   a. Scotchcast proved to be the “hardest.”
   b. RTV11 proved to be one of the “least hard” but more impact-absorbing than any other single underlying material.
   c. Fiberglass was one of the “least hard.”
   d. Ezeform was one of the “least hard.”
   e. none of the above.

7. Excessive or impacted cerumen in the external ear canal can be safely treated with:
   a. Q-tips.
   b. dilute hydrogen peroxide.
   c. commercial preparations.
   d. b or c
   e. a or c

8. Exercises especially useful for athletes who use the upper extremity in a closed kinetic chain fashion are:
   a. balancing on the hands on a Gymnastikball.
   b. rhythmic stabilization.
   c. double- and single-arm balancing on the floor, a wobble board, or a trampoline.
   d. mirroring upper extremity.
   e. both a and c

9. The major factor affecting an athlete’s perception of his/her injury is:
   a. personality.
   b. past experience.
   c. communication.
   d. emotional state.
   e. none of the above.

10. Recently developed information on the occurrence of second impact fatalities and the increased risks following an initial concussion indicate that:
    a. sports medicine personnel should reconsider the current practice of sending a kid back in as soon as he can see straight.
    b. it is safe to return a player to the game after a “bell ringer” incident.
    c. any loss of awareness incident should signal a switch to a different type of helmet before returning to play.
    d. relatively conservative guidelines that athletes be symptom-free for 1 to 2 days after a concussion before return to play is a safe rule to follow.
    e. a and d

11. Otitis externa:
    a. is also known as “swimmer’s ear.”
    b. is not commonly seen in athletes.
    c. may be prevented with a mixture of alcohol and water following prolonged exposure to water.
    d. does not need to be treated by a physician.
    e. both a and c

12. Rehabilitation for carpal tunnel syndrome should be directed at:
    a. decreasing edema.
    b. reducing scar tissue.
    c. release of nerve entrapment.
    d. controlling effusion.
    e. all of the above.

13. In counseling the adolescent athlete suspected of steroid use, the athletic trainer should note that:
    a. open communication and trust can be his/her best weapon.
    b. listing negative aspects of steroid use is highly recommended.
    c. coming right out and asking the athlete up front about steroid use is usually a good starting point.
    d. all of the above.
    e. a and b only

14. The new rule of the National Federation of State High School Associations allows players to participate with hard casts or splints on the hand, wrist, forearm, or elbow for the 1994 season, provided that the device is covered with 1/4-inch thick, high density closed-cell polyurethane or similar material and written verification from a licensed medical physician attesting to the necessity of the playing cast to protect an injury.
    a. True
    b. False

15. In selecting the right medical insurance policy for your institution:
    a. you must first set departmental policy.
    b. be aware that secondary insurance is not a good alternative in keeping costs down.
    c. it is important to keep in mind that schools with more sports and larger teams must pay higher premiums than schools with smaller programs.
    d. a and b
    e. b and c
Cervical Spine Injured Athlete Transfer Protocol
Northern Virginia Spine Institute (copyrighted 1993)
Thomas C. Schuler, MD
Orthopaedic Spinal Surgeon
1830 Town Center Drive
Suite 409
Reston, VA 22090 or
Jon Almquist, ATC
Athletic Training Program Specialist
Fairfax County Public Schools
Fairfax, VA
Color-VHS
Playing time: 18 minutes
Price: $14.95 plus $4.50 shipping and handling

Cervical Spine Injured Athlete Transfer Protocol is copyrighted and sold by the Northern Virginia Spine Institute. This very informative instructional video covers proper management of a suspected cervical-spine-injured athlete.

The first important point made in this video is the significance of a meeting between medical personnel of all levels before the school year begins. This is where all questions on management or protocols are addressed and cleared up before the need arises. In addition, it goes through a quick, thorough evaluation to be done on the field. Proper facemask removal techniques are then reviewed so that in the event of respiratory distress, care is not compromised. In this video, a modified PVC pipe cutter is employed to cut the facemask “snubbers.”

The second part instructs the rescue personnel on the Head/Shoulder Stabilization Technique with the shoulder pads and helmet intact as well as removed. One point of emphasis that is clearly made is how important it is to leave both the shoulder pads and helmet on the injured athlete in order to maintain stabilization of the cervical spine. Demonstration of the Life and Slide method of backboard placement is very clear and conscientious. The producers also mention the advantage of a flat wooden spine board to that of the more modern concave or plastic spine board.

The third part of this video deals with the importance of being familiar with the athletic equipment of all sports that you provide coverage for and proper removal techniques. The producers do allude to the importance of properly fitting helmets and the fact that they should stabilize the head even without the chin strap in place. One important comparison made is between an athletic helmet and a motorcycle helmet and how injuries to people wearing these protective devices can be unique and therefore managed differently. Lastly, guidelines and a step-by-step demonstration of proper helmet and shoulder pad removal by emergency room personnel in included.

Cervical Spine Injured Athlete Transfer Protocol is a very educational and instructional video for athletic trainers, team physicians, emergency room personnel, and emergency medical technicians. This would be an invaluable addendum to any athletic training curriculum program. It could help you establish your own protocol or refine an existing one. This video would be a worthwhile addition to the library of any medical profession dealing with injuries to the cervical spine. In addition, a part of the proceeds from the sale of this video will be donated to a student athletic trainer scholarship.

Larry Cooper, ATC
U - Titles should be brief within descriptive limits (a 16-word maximum is recommended). The name of the disability treated should be included in the title if it is the relevant factor; if the technique or type of treatement used is the principle reason for the report, it should be in the title. Often both should appear.

10. The title page should also include the names, titles, and affiliations of each author, and the name, address, phone number, and fax number of the author to whom correspondence is to be directed.

11. A comprehensive abstract of 75 to 200 words must accompany all manuscripts except Tips From the Field. Number this page one, type the complete title (but not the author's name on the top), skip two lines, and begin the abstract. It should be a single paragraph and succinctly summarize the major intent of the manuscript, the major points of the body, and the author's summary and/or conclusions. It is unacceptable to state in the abstract words to the effect that "the significance of the information presented in this article." Also, do not confuse the abstract with the introduction.

12. List three to six key words or phrases that can be used in a subject index to refer to your paper. These should be on the same page as, and following your abstract. For Tips From the Field, the key words should follow immediately after the title on the first numbered page.

13. Begin the text of the manuscript with an introductory paragraph or by stating or by posing a hypothesis that the article is clearly developed and stated. Tell why the study needed to be done or the article written and culminate with a statement of the problem (or controversy). Highlights of the most prominent works of others as related to your subject are often appropriate for the introduction, but a detailed review of the literature should be reserved for the discussion section. The introduction is not the place for great detail; state the facts in brief specific statements and reference them. The detail belongs in the discussion. Also, an overview of the manuscript is part of the abstract, not the introduction.

14. The body of the main part of the manuscript varies according to the type of article (examples follow); however, the discussion section is a major subsection in which the importance of the material presented is discussed and related to other pertinent literature. The detail belongs in the discussion section. The body of a Review of the Literature article should include a two paragraph review of the literature, identify and list all references cited in #5 or #6, and after return to competition), criteria for re-employment, and after return to competition); criteria for return to competition, and deviation from the expected (what makes this case unique). NOTE: It is mandatory that the Journal of Athletic Training receive, with the manuscript, a release form signed by the individual being discussed in the case study. Case studies cannot be reviewed if the release form is not included.

d. The body of a Technique Article should include both the how and why of the technique, a step-by-step explanation of how to perform the technique, supported with photographs or illustrations; and why the technique should be used. The discussion of why should review similar techniques, point out how the new technique differs, and explain the advantages and disadvantages of the technique in comparison to the other techniques.

c. A Tip From the Field is similar to a technique article but much shorter. The tip should be presented and its significance briefly discussed and related to other similar techniques.

17. The manuscript should not have a separate summary section—the abstract serves as a summary. It is appropriate, however, to tie the article together with a summary paragraph or list of conclusions at the end of the discussion section.

18. Citations in the text of the manuscript take the form of a superscripted number, which indicates the number assigned to the citation. It is placed directly after the reference or the name of the author being cited. References should be used liberally. It is unethical to present others' ideas as your own. Also, use references so that readers who desire further information on the topic can benefit from your scholarship.

19. The reference page(s) accompanying a manuscript should list authors numerically in alphabetical order, should be in the following form: a) articles: author(s) (list all with the family names then initials), title of article, journal title with abbreviations as per Index Medicus (italicized or underlined), volume, year, inclusive pages; b) books: author(s), title of book (underlined), city, state, publisher, year, inclusive pages of citation. Examples of references to a journal, book, presentation at a meeting are illustrated below. See the AMA Manual of Style for other examples.


d. Behnke R. Licenure for athletic trainers: problems and solutions, presented at the 29th Annual Meeting and Clinical Symposium of the National Athletic Trainers' Association; June 15, 1978; Las Vegas, NV.

20. Tables must be typed. Type legends to illustrations on a separate page. See references cited in #5 or #19a for table formatting.

21. Photographs should be glossy black and white prints. Graphs, charts, or figures should be of good quality and clearly presented on white paper with black ink in a form that will be legible if reduced for publication. Do not use paper clips, write on photos, or attach photos to sheets of paper. Carefully attach a write-on label to the back of each photograph so that the photograph is not damaged.

22. All artwork to be reproduced should be submitted as camera-ready black and white line art. If artwork is to be reproduced in black and white (or color, it should be submitted as black and white line art. Clearly mark each area of color, or areas of shading or screening (a percent or tint of black or a color). Separate photocopy. Authors will pay for color.

Submissions should be accompanied by a letter signed by each author, and must contain the statements below. By signing the letter, the author(s) agrees to comply with all statements. Manuscripts that are not accompanied by such a letter will not be reviewed. "This manuscript contains original unpublished material that has been submitted solely to the Journal of Athletic Training, is not under simultaneous review by any other publication, and will not be submitted elsewhere until a decision has been made concerning its suitability for publication by the Journal of Athletic Training. In consideration of the acceptance and publishing action in reviewing and editing my (our) submission, the author(s) undersigned hereby transfers, assigns, or otherwise conveys all copyright ownership to the NATA, in the event that such work is published by the NATA."
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With AIM™ Athletic Injury Management software you spend less time on injury records so you can spend more time helping athletes avoid injury. Like its predecessor, ALFIE, AIM has modules for physical data, injury reporting and daily treatment records. But it adds an athlete roster and an inventory control program. AIM PLUS adds modules for insurance and prescription records.

AIM is easy to use. "Point and click" mouse operation and pull down menus minimize data entry. And, AIM is affordable. In fact, AIM and AIM PLUS together cost less than ALFIE. Available for Macintosh and IBM-compatible machines.

For a free demo disk contact Cramer Software Division, P.O. Box 1001, Gardner, KS 66030, or call 1-800-255-6621.