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What the medical community is saying about StairMaster exercise systems:

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In light of recent reforms and attacks from parallel organizations and associations, I would like to enlighten each member of the powerful and exemplary National Athletic Trainers’ Association with the heartfelt (and personally very meaningful) words of Kent Falb:

“We are here . . . because we are the future. We have been commissioned with an incredible legacy, stable leadership, goals that are solid, clear, and sharp as any diamond, and we have achieved the rank of professional. Our mission is not to invade but to conquer that uncharted and unknown mystical expanse we think of as the future. Before we hurl ourselves aimlessly into tomorrow, we need to inspect our fundamental intangibles. If certification of the individual members and more recently our governing body exemplifies professionalism, why cannot we as Certified Athletic Trainers demand of ourselves the common notion that we are just “a trainer” or some form of second class ancillary personnel, we will remain as such in the eyes of others and our very selves.

“The cure for this individual and collective malady is a very fundamental program. It is an exercise in self-confidence. It is not in the form of personal arrogance but an amalgamation and revelation of our education and competence. Until we cure this syndrome of negative self-appraisal, we will never be totally professionally healthy, run that ultimate race, not appreciate the aura of respect and dignity of being an Athletic Trainer.

“The second cure is not a magic elixir or some revolutionary electronic modality on display in the exhibit hall. Rather it is a thunderous awakening of your inner pride: Pride in yourself and pride in your profession, the talents we possess, and humanitarian values that we practice. Until we reflect our maximum capabilities, the entire athletic, medical, and general public will continue to envision us as just “the good old trainer.” The first to arrive, the last to leave; when everybody and everything else fails, call the trainer because everyone knows he or she can fix it, cure it, and they know darn well it will get done correctly.

“If we enter our next frontier, the future, with apprehension, trepidation, or the lack of self-confidence, our endeavors will reflect only a waste of brilliant human potential, and only mediocrity and failure will ensue. TAKE A GOOD LOOK AT YOURSELF individually and en masse. We do possess the tools, talents, and the basic ingredients. The future is ours to successfully conquer if once and forever we would realize, WE ARE BETTER AND MORE THAN WE THINK WE ARE!

“Why cannot we be proud of ourselves when we stand and say “I am an Athletic Trainer.” ATC! It does distinguish you as someone special. BELIEVE IT! PRACTICE IT!

“I take great pride in what I am, what I do, and above all in you, my friends and peers. So, as we begin the future with reforms and those who will still take doubt in our qualifications, remember these words of the highly respected Mr. Falb. We, as the National Athletic Trainers’ Association, are only as good as WE WANT TO BE. Take the initiative and above all take pride in yourselves and in YOUR future.”

Matthew B. Cummins, MEd, ATC/R
4545 Laclede Apt. 110
St. Louis, MO 63108

Reference
Athletic Trainers as HIV/AIDS Educators for Athletes

Barry P. Hunt, MA
Thomas J. Pujol, EdD

Abstract: HIV/AIDS continues to spread among the population at large. The age group 20 through 29 is the fastest growing demographic group in terms of AIDS diagnosis. This study examined a specific subgroup of that population: male and female college athletes. Subjects were 821 scholarship basketball players from 53 NCAA institutions across the nation. A survey instrument required respondents to identify common sources of HIV/AIDS information and preferred instructional formats for HIV/AIDS education. Mass media (92.4%), parents (62.2%), and teammates/peers (54.8%) were most commonly identified. Athletic trainers and team physicians were identified by 32.2% and 43.4% of the sample, respectively. The athletes indicated preference for video presentations (66.5%), small group discussions (58.8%), and question and answer sessions with expert panels (52.4%) as the most preferred instructional formats. Athletic trainers and team physicians can use the information presented in this paper to enhance their important roles in HIV/AIDS education for student athletes.

Approximately 20% of AIDS cases involve people 20 to 29 years of age, and this age group is the fastest growing demographic group for AIDS diagnosis. It follows logically that college students are at increasing risk of exposure, HIV infection, and subsequent development of AIDS.

At one institution, 5% of the visits to the student health center resulted from concerns about sexually transmitted diseases. The American College Health Association examined blood specimens from 16,863 students on 19 college campuses, finding seroprevalence rates (prevalence rates of positive serum reactions to HIV) ranging from 0% to 0.9%, with an overall rate of 0.2%. Seroprevalence for the age group 18 through 24 years, traditionally the typical age range of most college students, was reported at .08% overall.

Little research has been completed concerning seroprevalence rates for specific subgroups of the college population such as athletes. A study which gathered data from athletic trainers at 548 NCAA member institutions found eight institutions reporting athletes who had tested positive for HIV and four others with athletes who had been diagnosed with AIDS. Sport and/or gender-specific data is unavailable at present.

The importance of primary preventive measures in the form of universal precautions and education is widely acknowledged. The National Athletic Trainers’ Association lists education and counseling of athletes as one of the domains in which expertise must be demonstrated in order for an athletic trainer to be certified. Team physicians and athletic trainers are in a unique position to use routine contact with athletes to provide HIV/AIDS information, facilitate awareness of HIV/AIDS, decrease risk of infection, make referrals for follow-up care or diagnosis, and otherwise assist in risk reduction.

The purpose of this study was to examine the sources of HIV/AIDS information most commonly used by college athletes, along with their instructional format preferences. Given the medical and health-related educational preparation of athletic trainers, it is feasible that many members of the profession may be providing information regarding HIV/AIDS to athletes on an informal basis.

Methods

Participants in this study were scholarship basketball players at NCAA Division I colleges and universities across the United States. We randomly selected three institutions from each of 33 conferences participating in men’s and women’s basketball. We mailed survey instruments to Assistant Athletic Directors for Compliance at selected institutions. Athletes agreeing to take part in the study completed informed consent forms, and completed surveys were returned to us in postpaid envelopes. Confidentiality of responses and individual anonymity of study participants were assured. A cover letter also made clear that those choosing to complete the survey document could withdraw from participation at any time and/or not answer any question which made them feel uncomfortable.

Subjects were asked to indicate their sources of HIV/AIDS information and their preferred instructional format for receiving HIV/AIDS education. Nine potential choices of information sources were offered, and subjects were asked to identify those sources from which they personally had received information concerning HIV/AIDS. Six possible choices of preferred instructional format were offered.

Data were analyzed by analysis of variance using a significance level of p < .05. Descriptive statistics are reported in this paper along with comparisons made according to gender and ethnic background.

Results

A total of 53 of 99 (53%) of the institutions agreed to participate, resulting
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in 821 athletes completing the survey. The majority of institutions that did not participate gave no specific reason for this choice; however, one did cite religious objections to the content of the survey, while another felt that the questionnaire was designed to provide inappropriate information to the NCAA. Respondents ranged in age from 18 through 22 years with a mean age of 19.8 years. Demographics of the sample according to gender and ethnic background are presented in the Table. Figure 1 illustrates percentages of the study sample indicating each information source. Results are reported according to gender.

Mass media, identified by 773/821 athletes (92%); parents, identified by 510/821 (62%); and teammates/peers, identified by 500/821 (61%), were the most common sources of information for all demographic groups. Athletic trainers served as information sources for 264/821 respondents (32%); however, significantly more males had received information from an athletic trainer than females (F(2,830) = 19.66, p = .0001). Males were also more likely than females to have received information from team physicians (51 to 38%; F(2,824) = 9.99, p = .0001) and coaches (33 to 15%; F(2,813) = 13.14, p = .0001). There were no differences between ethnic groups.

Video presentations were the preferred instructional format identified by 546/821 athletes (67%). Small group discussions were preferred by 483/821 (59%), and question/answer sessions with a panel of experts were preferred by 430/821 athletes (52%) (Fig 2). There were no differences between gender.

Comparisons of instructional format preferences on the basis of ethnicity demonstrated significant differences in only one area. Black respondents were significantly more likely than Caucasian respondents to prefer instruction from individual counselors (49 to 28%; F(2,831) = 11.04, p = .0001). There were no differences between gender.

Given that mass media and video presentations were identified as the most common sources of information in this cohort of college athletes, it may be useful to employ such social marketing approaches as using athletic role models in television commercials to present and reinforce the message of prevention. This approach has been successful as a part of efforts to reduce other health problems, such as drinking and driving, and holds promise as an HIV/AIDS education mechanism. Video presentations can also be used within athletic departments as a means of vicarious performance, which has been shown to enhance an individual’s ability to maintain performance of preventive skills and behaviors.1

Parental and teammate/peer influence also appears to be a potentially effective means of addressing HIV/AIDS education. Both of these groups can be effective vicarious role models and may be used as part of the small group discussion educational format which is preferred by many student athletes. This can be addressed through the use of discussions involving problem-solving techniques or role playing in which a number of behavioral options may be examined (eg, how to remain assertive in the face of peer pressure, how to use a condom properly, etc).

Team physicians and athletic trainers were also listed as sources of information by some of the athletes. These sources may, however, be underused. Question-and-answer sessions were the third most commonly indicated instructional format among study participants. It is feasible that team physicians and athletic trainers could play an important role in this type of education. Calabrese et al2 noted that the actions of these professionals (ie, the emphasis on universal precautions when risk of seroconversion resulting from injury...
treatment or body contact during competition is considered minimal) sometimes creates mixed messages for athletes. Uncertainty is often a precursor of unnecessary fear, and education is an important method for overcoming irrational fears while accurately appraising risk.

**Recommendations**

Because of their contact with athletes, athletic trainers are a logical vehicle for HIV/AIDS education of this population. Athletic trainers and other health care providers for athletes should educate themselves and those in their care with respect to this deadly disease. Programs should use instructional formats to which athletes are most receptive and use them in such a way as to reduce risk of both iatrogenic transmission (induced inadvertently by medical treatment or procedures) along with more common methods of transmission, such as sexual contact and intravenous drug use. The potential for athletic trainers to design and implement formal educational programs for college athletes may be an untapped resource in preventing the spread of this disease.

Finally, future research projects should examine the reasons for variations in sources of information according to gender and ethnicity. This may be an important part of the process of appropriately targeting HIV/AIDS education to unique demographic groups.

**References**

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Prevention of Hepatitis B Virus in Athletic Training

Barton P. Buxton, EdD, ATC
Jon E. Daniell, BS
Bertram H. Buxton, Jr., MD
Eric M. Okasaki, MEd, ATC
Kwok W. Ho, PhD

Abstract: Hepatitis B virus (HBV) infection is highly communicable and is the leading cause of acute and chronic liver disease worldwide. In recognition that 10,000 to 15,000 health care workers are becoming infected with HBV annually, the Occupational Health and Safety Administration has instituted strict regulations and guidelines concerning the handling of blood-borne pathogens. Due to the exposure to blood-borne pathogens and potentially infectious materials, athletic training is an allied health care profession that has an increased risk of exposure to HBV. Therefore, it is essential that athletic trainers employ extensive preventive strategies to decrease the exposure to this health- and life-threatening infection.

In 1981, the discovery of the human immunodeficiency virus (HIV) as the causative agent of acquired immunodeficiency syndrome (AIDS) brought about radical changes in the methods of infection prevention and protection. The health care community was quick to use HIV as the springboard towards increased awareness concerning blood-borne pathogens. However, the communicability of HIV is low compared to that of the hepatitis B virus (HBV). In fact, exposure to HBV is approximately 100 times (0.3% versus approximately 30%) more likely to result in transmission than is HIV.² Whereas HIV has become an established life-threatening icon to health care workers such as athletic trainers, HBV should be considered a pathogen of equally life- and health-threatening capabilities. The daily treatment of cuts, lacerations, and potential handling of other bodily fluids places athletic trainers at an increased risk of exposure to blood-borne pathogens. Therefore, the purpose of this paper is to discuss the pathogenesis, epidemiology, transmission, and prevention of HBV in the clinical athletic training setting.

Pathogenesis

HBV is the most studied member of the Hepadnaviridae viruses.² It exists as a partially single-stranded, circular DNA strand with an inner core and an outer surface that are immunologically distinct. The nucleocapsid core contains the antigen HBcAg which replicates within the nuclei of infected hepatocytes.² The viral replication within the liver creates an excessive surface material and is detected in serum, by immunological means, as hepatitis B surface antigen (HBsAg).² HBV is the primary cause of acute and chronic liver disease throughout the world.⁶

Epidemiology

In the last decade, the incidence of HBV infection has increased by 40%.⁴ Approximately 1 in 20 individuals in the United States will become infected with HBV.⁷ It is estimated that approximately 200,000 to 300,000 Americans are infected annually with HBV.⁵,⁶ One fourth of these infections develop icteric disease (jaundice), 10,000 are hospitalized, and 250 die from acute, fulminant hepatitis. Additionally, 400 cirrhotic and 800 hepatocarcinomal deaths are associated with HBV chronic carriers.

Chronic carriers of HBV are individuals who usually show little or no signs of infection, but are capable of transmitting the disease through percutaneous or permucosal exposure to bodily fluids (ie, needle sticks and sexual contact). Chronic carrier status can be influenced by the age that infection takes place. Ninety percent of exposed children and 10% of exposed adults become chronic carriers.⁶ The United States has an estimated 400,000 to 800,000 chronic carriers.⁷

The signs and symptoms of HBV infection range from subclinical to terminal. Subclinical individuals will be seropositive for HBV, but show few signs of disease. In fact, 55% of all seropositive individuals show no significant clinical findings.² The early acute signs of HBV infection may include malaise, fatigability, and loss of appetite. Progressive signs of infection are associated with severe fatigue, anorexia, nausea, vomiting, jaundice, scleral icterus, and hepatosplenomegaly. Fulminant hepatitis
may result in hepatocellular destruction, encephalopathy, coma, and death. In these cases the mortality rises from 30% for children to 80% for adults.\(^5\)

### Transmission

The primary method of HBV infection is percutaneous.\(^7\) The HBsAg has been identified in most bodily fluids in individuals infected with HBV. These fluids include: saliva, semen, vaginal secretions, cerebral spinal fluid, pleural fluid, ascites, breast milk, synovial fluid, gastric juice, urine, and feces. The percutaneous transmission of HBV is not limited to adults. HBV infection is becoming more commonly associated with adolescents and young adults due to increased sexual activity, and recreational and occupational percutaneous exposure.\(^6\)

### Prevention

The most effective method of preventing the transmission of the HBV in the athletic training setting is through the strict use of universal precautions and infection control. The proper organization of these practices is essential in minimizing the risk of blood-borne pathogen exposure to the athletic trainer. These procedural practices should include the immunization of all athletic training personnel (staff and students), the use of protective equipment and practices, the proper management of contaminated surfaces and equipment, the use and maintenance of a Sharps container, and the proper management and disposal of contaminated refuse. The Table outlines the basic guidelines of HBV prevention that is recommended for all allied health care personnel.

### Immunization

In 1981, licensure of a hepatitis B vaccine with an 80% to 95% efficacy was issued by the FDA.\(^10\) Currently, there are two vaccines licensed in the United States.\(^11\) These vaccines consist of a suspension of inactive HBsAg particles that have been purified from human plasma and Saccharomyces cerevisiae (common baker’s yeast), into which an HBsAg gene has been inserted.\(^11\) The vaccines are administered in a three-dose series, with the first two doses given 1 month apart and the third dose given 5 months after the second. The vaccination is intended primarily for pre-exposure prophylaxis. However, it is indicated in some postexposure situations. Since 1981, guidelines have been issued for immunization of specific high-risk groups defined by occupation, medical conditions, and lifestyle. In 1991, the Immunization Practices Advisory Committee (ACIP) strongly recommended immunization for all adults at increased risk of occupational (health-related or public safety), social, family, environmental, or illness-related exposure to HBV.\(^11\) In response to CDC estimates that 9,500 to 10,000 health care workers are infected with HBV each year, in December 1991, the Occupational Health and Safety Administration (OSHA) issued regulations requiring employers to offer hepatitis B vaccine to employees with an occupational exposure to blood, at no cost to the employees.\(^8\) In an attempt to further decrease risk of exposure, in 1992, several medical organizations, including the American Academy of Pediatrics and the American Academy of Family Physicians, recommended vaccination of all infants against the HBV infection.\(^1\) Due to the potential occupational exposure to blood and other bodily fluids, all athletic training staff and students should be immunized.

### Protective Equipment

The CDC has defined “potentially infectious materials” as semen, vaginal secretions, cerebral spinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva, any bodily fluid that is visibly contaminated with blood, and all fluids in situations where it is difficult to differentiate between bodily fluids and other fluids.\(^5\) Therefore, the use of personal protective equipment is fundamental in providing a barrier between the athletic trainer and any potentially infectious material. To minimize risk and increase safety, all protective equipment should be properly fitted and appropriate for the given situation.

Wearing gloves is an excellent means of preventing contamination for all procedures involving contact with blood, bodily fluids, mucous membranes, and nonintact skin. Gloves should be worn when handling items (ie, gauze towels) and surfaces that may be soiled with potentially infectious material. Athletic trainers who experience allergic reactions (ie, contact dermatitis) to the standard latex gloves may use any one of the various hypoallergenic products on the market. In situations of increased exposure (ie, heavy bleeding, use of Sharps) double gloving is recommended.

In situations where blood and/or other bodily fluids could be splashed, spurted, or sprayed, the use of masks and/or protective eye wear should be worn to completely cover the mucous membranes of the mouth, nose, and eyes. Standard eye wear is insufficient, unless side shields are used to decrease exposure. Gowns or aprons are also effective means of decreasing the exposure of potentially infectious contaminants to clothing and
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should be worn when needed for additional protection.

Every athletic training facility and first aid kit should be equipped with protective emergency resuscitation devices, such as covered mouth pieces, face masks, and resuscitation bags. These items aid in ensuring prudent protection from potentially infectious materials during CPR and other life-saving maneuvers. If space is a concern, pocket-sized face masks are also available and equally effective in ensuring personnel safety.

Following any exposure to potentially infectious material, hands and other skin surfaces should be washed immediately. The use of soap and water is sufficient while in the athletic training room. However, on the field or the court, the athletic trainer should use a disposable towelette following all procedural maneuvers. The combined use of gloves and hand washing will aid in maximizing protection and prevent accidental exposure for the athletic trainer.

Additional precautions should include the restriction of food and beverage consumption on work space, treatment tables, taping tables, or any other surface in the athletic training room that may be exposed to potentially infectious materials. Furthermore, refrigerators that store potentially infectious materials, such as urine or blood samples, should not be used for any food storage to eliminate the risk of contamination or ingesting any potentially infectious pathogens. Lastly, the application of cosmetics, lip balm, and contact lens solutions should be prohibited in the athletic training room to further minimize potential risk.

Housekeeping

It is suggested that HBV may be transmitted through the direct contact with HBV-contaminated surfaces. Therefore, it is critical that all surfaces in the athletic training room be disinfected with antiseptic/germicidal solutions following all potentially infectious exposure. All horizontal surfaces (ie, treatment tables, taping tables, work space, and floors) should be cleaned on a regular basis, after patient use and immediately after spills or soiling occurs. Many disinfectants are available commercially; however, common household bleach in a 1:10 (10%) solution with water is adequate. Caution should be used when using this solution near therapeutic modalities or skin due to the caustic and corrosive properties of the bleach.

Routine disinfectant cleaning of the athletic training room is an effective method of reducing pathogen risk, but the physical removal of pathogens requires a scrubbing process. Large spills of bodily fluids and blood-borne pathogens require flooding of the contaminated area with disinfectant prior to the removal of the spill. Following removal, the area should be disinfected again and thoroughly scrubbed.

Linens and towels soiled with potentially infectious materials should be separated from regular laundry and handled as little as possible. The soiled items should only be handled with gloves and placed in leakproof bags that are visibly designated for biohazardous items. All items should be washed with detergent and water for 25 minutes, at a minimum of 71°C. For heavily contaminated items, disinfectant solution should be added to the water. All disposable products (ie, gauze, paper towels, cotton) that have been contaminated with potentially infectious materials should be handled only with gloves and placed in leakproof bags that are visibly designated for biohazardous waste. These bags or containers should be located in conspicuous areas throughout the athletic training facility. Biohazardous waste containers or bags should also be available on the practice field, court, or room. When the containers or bags show signs of damage or become full, disposal and replacement is required. The disposal of contaminated waste should be done in compliance with the OSHA standards and the requirements of the individual institution.

Sharps

The use of a Sharps container should be standard in all athletic training facilities. In fact, this is a requirement under 1993 OSHA occupational safety requirements. These containers should be leakproof, puncture-resistant, red in color, and visibly designated with a biohazardous sign. All Sharps containers should be located in a conspicuous area near the areas of common Sharps use (physicians office, taping table, treatment table, and workstations). A Sharps container should be available during all travel or if Sharps are required on the practice field or court. Reusable Sharps, such as pointed scissors and tweezers, should be sterilized following use and stored in containers that would preclude the athletic trainer from retrieving the item with his/her hands. Autoclave trays or forceps retrieval is preferred.

Scheduled maintenance and inspection of Sharps containers are essential in reducing the risk of accidental percutaneous exposure. Periodic checks for container integrity and overflow is necessary. In compliance with the OSHA standards and the requirements of the individual institution, containers that show signs of damage or become full should be disposed of properly and immediately replaced.

Additional precautions should always be used with regard to needle use and self inoculation. The recapping of needles is strongly discouraged and a two-handed procedure is strictly prohibited. Mechanical recapping devices and self-sheathing needles are available and dramatically decrease the risk of exposure.

Discussion

The role delineation of the athletic trainer should include the use of universal precautions for blood-borne pathogens, instrumentation, and daily sanitation of the athletic training facility. Furthermore, athletic trainers should possess a clear understanding of the pathogenesis, epidemiology, transmission, and prevention of HBV in the clinical setting.

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Although the transmission of HBV and other blood-borne viruses may not appear to be a paramount concern in an athletic training setting, incidents can occur that unwittingly expose athletic trainers to risk. An example of an occupational percutaneous exposure took place following a collegiate football game in the fall of 1992. During the game, five players began showing signs of dehydration. The team physician treated them with intravenous lactate ringers. Following the procedures, he placed the contaminated Sharps in an empty, noncorrugated tape box, closed the box with white adhesive tape and wrote “SHARPS” on it. After the game, a student athletic trainer picked up the box to transport it back to the campus athletic training room. As she did so, she was stuck with a contaminated needle. She quickly showed the head athletic trainer and team physician, who referred her to the university student health center for HBV testing and counseling. The student athletic trainer was treated with an immunoglobulin and repeatedly tested.

Following this incident the institution involved began to examine and enforce the recommended policies and procedures for biohazardous materials. Pursuant to the incident, a mandatory in-service training program on biohazardous materials was initiated. Because the institution had an athletic training curriculum, the Athletic Training Education Program Director and the Director for Student Health Services instituted a vaccination program for all athletic training students. This program was presented to the Vice President for Student Affairs at the university with a request for funding. After brief review, immediate funding was allocated, allowing the student athletic trainers to be vaccinated at no cost to the students.

It is imperative that information concerning the prevention of HBV in the athletic training setting be disseminated to all athletic training staff and students, through in-service training sessions, symposia, and lectures. Furthermore, institutions sponsoring student athletic trainers (curriculum and internship) should provide immunization for those students. The preventive precautions outlined in this paper should become standard practice in all athletic training facilities. The safety requirements of the allied health care professional should never be overlooked. The consequences can be fatal.

References


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Abstract: Recent announcements in the news of HIV/AIDS contraction by famous sports figures have focused world attention on the fact that athletes are not immune to this deadly virus. In view of this, we reviewed the literature to examine what studies have been directed specifically at the athletic population and HIV/AIDS. Unfortunately, because of the relatively new nature of this problem, little data exists for examination. A panel of experts was assembled to participate in a Delphi methodology project. This educational study was designed to examine three issues surrounding the athletic community and HIV/AIDS. The three questions examined in this study were: 1) should medical testing be undertaken within the athletic community to determine exposure to the virus; 2) if testing is undertaken, what privacy/confidentiality measures should be incorporated to protect the individual and the results of the test; and 3) what educational interventions should be developed and implemented to help the athlete understand the disease and prevent the spread. The responses from the Delphi participants indicate that the HIV/AIDS dilemma is a societal issue and should not single out a segment of the population—in this case the athletic community. The panel also indicated that privacy and confidentiality are crucial in protecting the individual athlete and test results. The development and implementation of educational interventions is the most important component in the entire issue of HIV/AIDS and the athletic community.

Methodology

The Delphi process is an iterative procedure for eliciting and refining the opinions of a group of experts by means of a series of individual questions. This process is characterized by three items: anonymity of the respondents, iteration, and controlled feedback. Recent developments have caused worry by those involved in athletic competition as to the safety of the participants and the possibility of transmission of infection as they relate to the HIV/AIDS dilemma.1,2,5,9,10,14-16,19,29 One aspect of this problem is the amount of knowledge versus myth that surrounds this virus.3,9,12,17,21,23,25,28,33,36

There have been a number of studies undertaken that have addressed the issue of HIV/AIDS, but only recently have groups (ie, National Football League and NCAA) specifically targeted the athletic community.12,13,27,28,31,33,35 There have been projects that have studied the college student, IV drug users, and homosexuals.3,5,7,11,13,21,25,26,34 While these studies are important and valuable, they do not address the particular characteristics of the athlete and the scrutiny involved with the sport community. The athletic community is under the watchful eye of the news media, drug-tested, and held to a different standard of conduct.

This Delphi study examined the specific issues of the athletic community. The project addressed three principle issues: testing for the virus, privacy/confidentiality of test results, and educational interventions.

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panel proposed six additional questions in the testing section, eight questions in the privacy/confidentiality section, and five questions in the educational section. The first round gave direction and served as the starting point for the continuation of the study. All respondent's comments were recorded and included in the second round mailing. The second and third rounds were conducted in a similar manner. The overall response rate, for the completion and full participation of the respondents, was 80%.

A Delphi study is based on the premise that the panel is composed of experts in the profession. The responses and comments, additions and deletions, and incorporation of new information allows for a descriptive analysis throughout the project. Therefore, the only hard statistical information that is appropriate is the mean for each question on the final round of the study. The final survey instrument is presented in the three sections of: testing, privacy/confidentiality, and educational interventions along with the mean and standard deviation of each statement.

Results

The responses from the respondents were grouped into three tiers. The first tier represented the "extremely important" considerations in the testing versus nontesting issue. Two ideas emerged from this group: 1) testing should be done in accordance with existing state and federal laws, and 2) testing of those athletes who request to be tested. Two statements stood out in the second tier, represented by "very important" or "important." The first was to test those athletes that volunteer for the test and secondly to test those athletes in any established "at risk" group. From the breakdown of the third tier represented by "not very important" or "not important," it became obvious that no group of athletes should be subjected to the testing of HIV/AIDS just because of their participation in athletics.

Privacy and Confidentiality of Reporting Test Results

This section saw responses that could be divided into four tiers. The first tier was identified by either the "extremely" or "very important" classification. These included the reporting of the test results to the athletes themselves and to those people held in confidence (doctors), those mandated by law (federal, state, or local health officials), or sexual partners (including significant others). The second tier was represented by the "important" classification. Groups or individuals that might receive test results in this category would include parents (especially if the athlete was under the age of 18) and other health care providers (university health center personnel and athletic trainers). The third tier included other athletic or educational institution personnel who have a relationship with the athletic population and represented by "not very important." The final tier of the privacy and confidentiality section, represented by "not important," was composed of only one group, the news media. The respondents were unanimous in this single category. The news media should not be notified of the results of a HIV/AIDS test.

Educational Interventions

The responses are grouped into three tiers. The best intervention, from the experts' perspective, was the development of policies and procedural guidelines related to the HIV/AIDS dilemma and a combination of all other educational strategies and represented by "extremely important." The second tier identified the individual strategies that could function independently in the overall educational program. These educational interventions were represented by "very important" and would include films/videos, group instructional programs, pamphlets on responsible sex, professional counseling sessions for individuals, pamphlets on the HIV/AIDS virus (myths versus reality), AIDS telephone hotline, posters, moral/ethical counseling at home, and contraceptives. The third tier, represented by "important" included two additional alternatives: moral/ethical counsel-

Discussion

The first section of the Delphi study addressed the issue of whether or not to test athletes for HIV/AIDS. The questions that were included in this section of the survey instrument are presented in Table 1. The most frequent comment on this issue was that the HIV/AIDS dilemma is not an athletic issue but a societal problem, and the standards established for the society as a whole should be applied to the athletic population. There should not be double standards created just because of a person's involvement with sports.

The second tier of responses included those items that were considered "very important" in the testing of athletes. This includes "at risk behaviors" (unprotected sex and sharing of intravenous needles). The respondents then grouped the remaining statements into a third tier that consisted of either "important" or "not very important" concerns. There is not enough evidence to warrant HIV/AIDS testing, and the resulting implications would far outweigh the benefits to mandate the procedure. Even those athletes involved with high-risk sports should not be tested. High-risk sports are categorized by the National Athletic Trainers' Association, Inc (NATA) according to the susceptibility to sustain an injury during participation in that sport. Those sports that are classified as high risk by the NATA include: football, basketball, wrestling, lacrosse, hockey, gymnastics, volleyball, soccer, and rugby. In addition to the NATA categories, the United States Olympic Committee has established a system to categorize sports specifically on the risk of HIV transmission.

The consensus of opinion from the Delphi group indicates that there is not enough evidence to warrant testing based on athletic participation. This is supported in the literature by the lack of documented cases of athletes acquiring the virus through
Privacy and Confidentiality of Reporting Test Results

The second part of the instrument addressed the issue of privacy and confidentiality of reporting test results. This section was completed under the assumption that testing was a standard procedure for the athletic population. The questions that were included in this section are presented in Table 2.

The reporting of medical test results is often governed by law. Certain groups or individuals have vested interests in medical test results, including parents, guardians, and health care providers. Legal considerations would need to be identified either through federal regulations or state statute as to the legitimacy of the release of this information to these groups.9 A second group would be: teammates, coaching staffs, athletic department officials, or university administrators. Although each of these groups have a direct impact on the athlete, the participants of this Delphi study felt that the classification of “not very important” be assigned to these groups regarding the results of a test for HIV/AIDS. The final group was composed of the news media. The sensitive nature of this disease and the implications associated with the virus precludes the disclosure of the results to this group. Although the news media contends that they have the right to report the news, the athlete has the right to privacy and the confidentiality of a medical condition. The disclosure of any medical condition must be done voluntarily, on an individual basis, and by the person with the medical condition.9

Educational Interventions

The third component of the instrument addressed the critical issue of educational interventions.3,7,12,13,21,23,26,32,33 Although the athletic population was the focus of this study, the materials and interventions that were identified would be applicable to the general population. The questions in this section of the instrument are presented in Table 3.

The institution must develop a comprehensive approach to the dissemination of information that will heighten the awareness of the athlete to the ramifications of HIV/AIDS and methods to avoid acquiring this deadly virus.1,2,9,15,19,37 Each inter-

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Table 1.—Delphi Study Questions and Responses (Mean ± SD of 12 Responses) Concerning Testing Versus Nontesting (1 = Extremely Important; 2 = Very Important; 3 = Important; 4 = Not Very Important; 5 = Not Important)

| A. NO athletes | 1 2 3 4 5 | 3.8 ± .9 |
| B. Professional athletes | 1 2 3 4 5 | 3.5 ± 1.1 |
| C. Yearly | 1 2 3 4 5 | 3.8 ± 1.0 |
| D. ONLY high risk sports | 1 2 3 4 5 | 4.3 ± .9 |
| E. ALL athletes | 1 2 3 4 5 | 3.8 ± 1.7 |
| F. Intercollegiate athletes | 1 2 3 4 5 | 3.7 ± 1.4 |
| G. Randomly | 1 2 3 4 5 | 3.3 ± 1.6 |
| H. Secondary school athletes | 1 2 3 4 5 | 4.1 ± 1.2 |
| I. Boxers | 1 2 3 4 5 | 2.9 ± 1.4 |
| J. Amateur wrestlers | 1 2 3 4 5 | 3.2 ± 1.3 |
| K. In accordance with existing state and federal laws | 1 2 3 4 5 | 1.4 ± .7 |
| L. Athletes who request testing | 1 2 3 4 5 | 1.6 ± 1.0 |
| M. Athletes in defined “at risk” categories | 1 2 3 4 5 | 2.6 ± 1.3 |
| N. Quarterly | 1 2 3 4 5 | 4.0 ± 1.2 |
| O. Athletes who volunteer for testing | 1 2 3 4 5 | 2.1 ± 1.2 |

Table 2.—Delphi Study Questions and Responses (Mean ± SD of 12 responses) Concerning Privacy and Confidentiality of Reporting Test Results (See Table 1 for Key)

All categories are prefaced with: “We should make test results available to . . .”

| A. Athlete only | 1 2 3 4 5 | 1.9 ± 1.7 |
| B. Team/family physician | 1 2 3 4 5 | 2.5 ± 1.4 |
| C. Head athletic trainer | 1 2 3 4 5 | 3.3 ± 1.2 |
| D. Parents of athlete | 1 2 3 4 5 | 3.6 ± 1.5 |
| E. Athletic director | 1 2 3 4 5 | 4.6 ± .9 |
| F. Teammates | 1 2 3 4 5 | 4.7 ± .7 |
| G. Head coach | 1 2 3 4 5 | 4.5 ± .9 |
| H. News media | 1 2 3 4 5 | 5.0 ± 0 |
| I. State and local health officials, if required | 1 2 3 4 5 | 2.1 ± 1.2 |
| J. University student health services | 1 2 3 4 5 | 3.7 ± 1.0 |
| K. Sexual partners including significant others | 1 2 3 4 5 | 2.8 ± 1.3 |
| L. University administration | 1 2 3 4 5 | 4.8 ± .6 |
| M. Parents, if athlete is under 18 years old | 1 2 3 4 5 | 3.0 ± 1.5 |
| N. Parents, if athlete is claimed on parent’s tax forms | 1 2 3 4 5 | 4.4 ± .8 |
| O. Parents, if athlete is on parent’s health insurance | 1 2 3 4 5 | 3.6 ± 1.1 |
| P. University health services, if for group data only | 1 2 3 4 5 | 3.6 ± 1.1 |
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Table 3.—Delphi Study Questions and Responses (Mean ± SD of 12 Responses) Concerning Education (See Table 1 for Key)

All categories are prefaced with: “We should provide the athlete with the following materials and interventions . . .”

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Conclusions

Based on the results of this Delphi study, the experts suggest that athletes should not be singled out for HIV/AIDS testing. The consensus indicated that any testing be done within the framework of state and federal law. Athletes, as members of society, should have the ability to request to be tested if they feel that their particular activities have placed them in a “high risk” group.1,2,19 If testing of athletes for HIV/AIDS becomes a regular practice, then the following should be taken into consideration. Only the individual athlete should be notified of the results of his or her test. It then becomes the decision of that athlete to report his/her test results to others. Until definitive studies indicate that HIV/AIDS is unquestionably transmitted through sporting contact, then the test results of HIV/AIDS must be treated as a medical issue and disclosure of results should not be available to athletic administrators. The indiscriminate reporting of HIV/AIDS test results has far-reaching ramifications because of the associated moral and ethical issues surrounding the transmission of this virus. In this context, the Delphi panel of experts unequivocally responded that the news media should not be notified of test results.

The issue of education of the athlete and the deadly effects of HIV/AIDS is the key to this entire dilemma. The respondents placed great emphasis on a diverse and comprehensive program of educating the athlete (and the general population). Myths and misconceptions surrounding the virus must be eradicated and facts must be presented. Interventions must be developed and implemented that address the activities that place people at greater risk of contracting the virus.3,10–12,23,26 Included are the sensitive issues of sexual activities and drug practices. These educational interventions must be targeted to diverse racial, ethnic, and religious groups. Consideration must also be given to age, geographic location, and economic status of the target populations in order to positively modify behavior.5,25,29,32,35

This Delphi panel was asked to respond to only three areas of concern in the HIV/AIDS and the athletic population. Numerous other issues were not addressed within the scope of this project. Issues that need to be addressed in future studies include the reliability of existing HIV/AIDS tests, costs associated with testing athletes, moral and ethical questions on testing, and the realization that an athlete tested one day may well compromise those test results by engaging in sexual or drug-related activities the following day.

Further study needs to be undertaken to ascertain the HIV/AIDS dilemma and the athletic community from the perspective of the athlete. An instrument needs to be developed that will address the same issues that were presented in this Delphi study, except that the athletes should be the respondents in that study. Responses to additional issues such as the knowledge the athlete has of HIV/AIDS, attitudes about AIDS, and demographics of the athlete will assist researchers to better understand the issue of HIV/AIDS and the athlete and provide another perspective that has not been explored.

References

9. Gail T. AIDS in athletics: does a collision on
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Athletic Trainers’ Attitudes Toward Drug Screening of Intercollegiate Athletes

Chad Starkey, PhD, ATC
Thomas E. Abdenour, ATC
David Finnane, MS

Abstract: Since the inception of NCAA-mandated drug screening in 1986, college athletic trainers have found themselves involved at various levels in institutional drug-screening programs. Several legal, moral, and ethical questions have been raised regarding the drug screening of college athletes, and studies have been conducted to rate athletes’ attitudes toward this practice. We examined the responses of certified athletic trainers employed in college settings to ascertain their attitudes toward the drug screening of athletes in general, and, specifically, how they view their role in this process. Surveys were distributed to 500 college athletic trainers randomly selected from the membership database maintained by the National Athletic Trainers’ Association, Inc (Dallas, TX). The results of this study indicate that the majority of athletic trainers feel that their association with the drug-screening process places them in the dual role of police and counselor, but that this relationship does not negatively affect their rapport with their athletes. Opinions regarding the drug-screening process and the importance of education in deterring drug use are somewhat dependent upon the athletic trainer’s involvement in the drug-screening process. Athletic trainers possess a stronger desire to serve as resource persons who organize substance abuse education programs rather than serving as administrators of the sampling process.

The National Collegiate Athletic Association (NCAA) formed a Drug Education Committee in 1973 in an effort to thwart the use of drugs and alcohol by athletes at its member institutions. During 1986, the NCAA began random drug screening of athletes participating in national championships. Motivated in part by the NCAA-sponsored postseason screening, as well as an attempt at the institutional level to curb the use of drugs and alcohol among its athletes, many institutions implemented “in-house” programs designed to deter drug use among its athletes. The NCAA’s list of banned drugs includes 76 individual substances grouped into six classifications (Table 1). Individual institutions may choose to expand or condense the list of substances to be identified during the screening process based on factors such as the capabilities of the analysis laboratory used and the associated cost.

There is little disagreement that the use of illegal drugs and alcohol occurs in college athletics, although it has been suggested that the rate is less than that of the student body as a whole. A recent study conducted by Schneider and Morris examined the prevalence of drug use among 197 college athletes at a single institution. Twenty-four (12%) respondents claimed to have used banned substances, including alcohol, at least once a month; 112 (57%) claimed to have experimented with illegal substances at least once; and 85 (43%) knew of other athletes who regularly use illegal substances. Eighty (41%) of the student-athletes questioned in this study indicated that drug use (including alcohol) was socially acceptable.

The athletic trainer’s participation in the drug-screening process is not mandated or even endorsed by the NCAA. Institutional administrators have delegated this task to the athletic training staff because of their proximity to the athletes, the coaching staff, the administrative staff, and the health care community. Additionally, athletic trainers have been called upon to serve as the first line of detection in identifying athletes who may be suspected of drug use through the physical and psychosocial changes in student-athletes using steroids and the behavioral patterns of drug-dependent student-athletes.

The same relationships that place the athletic trainer in the “ideal” position to conduct drug-screening programs also create some inherent personal and professional hazards. Ehrlich warned that athletic trainers involved in drug testing of their student-athletes run a risk of compromising any positive relationships with their athletes. Professionally, many athletic trainers lack the qualifications and education necessary to properly assess the needs of the drug-dependent athlete.

While prior studies have surveyed student-athletes regarding their attitudes about substance abuse programs, and others have called upon the athletic trainer to be aware of the signs and symptoms of drug use, little is known about how athletic trainers regard these programs, the related issues, and their “ideal” role in...
the drug-screening process. The purpose of this study is to determine the attitudes of athletic trainers regarding their roles in various types of drug-screening programs. Data should provide functional feedback for athletic trainers and administrators relative to the policies and procedures of these programs.

**Methods**

A portion of the survey tool was constructed using the instrument employed by Abdenour et al1 as a model. We expanded this instrument to obtain data specifically regarding the athletic trainer’s attitudes and opinions toward the drug-screening process.

The instrument identified the division of the college or university where the athletic trainer was employed and the administrative unit housing the athletic training services component. We collected demographic information identifying the number of years the respondent has been certified as an athletic trainer, the number of years of employment at the current institution, and gender. Additional information regarding the health counseling practices of the athletic training department regarding contemporary social issues was also included on the survey instrument for use in a related study. We did not ask for the identity of the respondents or the institution where employed, in order to assure confidentiality.

We collected information regarding the type of drug-screening and drug education programs at randomly selected colleges and universities and, if applicable, whether a legal opinion had been made regarding the institution’s drug-screening policies and procedures. The survey instrument used a five-point Likert scale that ascertained athletic trainers’ attitudes toward drug screening in general and the specific process as it relates at their institution. We asked the participants to rate (on a scale of Strongly Agree to Strongly Disagree) how much they supported or rejected each of 16 statements. Our instrument was pilot-tested and any needed corrections were made.

We randomly selected the names and addresses of 500 certified athletic trainers, who indicated that they were employed in the college or university setting during the 1992-1993 academic year, from the membership database maintained by the National Athletic Trainers’ Association, Inc (Dallas, TX). We then distributed the survey instrument with a cover letter describing the purpose and intent of our study. A self-addressed, stamped envelope was included for return of survey. Because of the confidentiality promised to the respondents, no second mailing was conducted.

Returned surveys were entered into a database using an IBM-compatible computer. Frequencies, means, standard deviations, and statistical tests were performed using SPSS-PC (SPSS, Inc, Chicago, IL). We identified p values of less than .05 as being significant for t test analysis.

**Results**

Of the 500 surveys mailed, 218 (43.6%) were returned in usable form. The respondents were predominantly male (183 (83.9%)), had been certified for an average of 17.6 ± 6.17 years, and had been employed at their present institution for an average of 13.6 ± 8.29 years. The majority of our returns were from NCAA Division I athletic trainers, with this group accounting for 141 (64.7%) of the responses. The percentage of returns based on gender does not accurately represent the university setting as 37% of collegiate athletic trainers are females and is most likely representative of a sampling error.

Of the 218 athletic trainers responding to the survey, 132 (61%) indicated that their institution was involved in non-NCAA-mandated drug-screening programs. In those institutions conducting these drug-screening programs, 86 of the 132 (65.2%) had received a legal opinion supporting the athletic department’s testing policies and procedures.

Institutions tended to implement educational programs designed to inform the student-athlete about the hazards associated with the use of performance-enhancing drugs, recreational drugs, and alcohol (Table 2). The most common type of drug use awareness program was educational campaigns against the use of alcohol, with 183 (83.9%) of the respondents indicating that their institution conducted this type of program. Athletes who tested “positive” for the use of recreational drugs were the primary subjects of rehabilitative and punitive programs. Twenty-two (10.1%) of the respondents indicated that their institutions were not involved in

<table>
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<th>Classification</th>
<th>Common Examples</th>
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<tr>
<td>Stimulants</td>
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<tr>
<td>Anabolic agents</td>
<td>Clenbuterol, nandrolone, testosterone</td>
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<tr>
<td>Depressants</td>
<td>Alcohol</td>
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<tr>
<td>Diuretics</td>
<td>Benzbamide, chlorothalidone, triamterene</td>
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<td>Street drugs</td>
<td>Heroin, marijuana</td>
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<td>Hormones and analogues</td>
<td>Growth stimulating hormones</td>
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<th>Rehabilitational</th>
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<td>Performance enhancing drugs</td>
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<td>173 (79.4%)</td>
<td>77 (35.3%)</td>
<td>75 (34.4%)</td>
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<tr>
<td>Recreational drugs</td>
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<td>21 (9.6%)</td>
<td>179 (82.1%)</td>
<td>102 (46.8%)</td>
<td>89 (40.8%)</td>
</tr>
<tr>
<td>Alcohol use</td>
<td></td>
<td>22 (10.1%)</td>
<td>183 (83.9%)</td>
<td>99 (45.4%)</td>
<td>61 (28.0%)</td>
</tr>
</tbody>
</table>
any type of drug education or drug-screening program.

The aggregate results of athletic trainers’ opinions regarding the drug-screening process are presented in Table 3. Athletic trainers indicated that their involvement with the institution’s drug-screening program placed them in the dual role of being “police” and counselors, with 134 (62.1%) agreeing with this statement. This opinion coincides with 161 (73.8%) respondents objecting to the practice of athletic trainers organizing the urine specimen collection process. Contrary to the warnings made by Ehrlich, 3 104 (47.7%) of the respondents felt that this role had jeopardized their rapport with their athletes.

Athletic trainers strongly agreed that educational sessions should be a major component of the process. However, 141 (64.7%) of the respondents indicated that educational sessions must be reinforced by actual implementation of the drug-screening process. There is a strong opinion that a single educational session, combined with at least one drug test, has a year-round influence on the habits of student-athletes.

Table 3.—Aggregate Opinions of Athletic Trainers’ Attitudes Toward Intercollegiate Drug Screening (N = 218)

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regarding drug screening, athletic trainers are often times forced to assume the role of both police and counselor.</td>
<td>(4.6%)</td>
<td>(7.8%)</td>
<td>(25.2%)</td>
<td>(23.9%)</td>
<td>(37.6%)</td>
<td>(0.9%)</td>
</tr>
<tr>
<td>Drug testing has compromised my relationship and rapport with athletes in some sports.</td>
<td>(28.0%)</td>
<td>(19.7%)</td>
<td>(20.2%)</td>
<td>(11.9%)</td>
<td>(11.0%)</td>
<td>(9.2%)</td>
</tr>
<tr>
<td>Athletic trainers should facilitate the organization of a substance abuse education program.</td>
<td>(9.6%)</td>
<td>(9.6%)</td>
<td>(38.1%)</td>
<td>(23.4%)</td>
<td>(18.8%)</td>
<td>(0.5%)</td>
</tr>
<tr>
<td>Student-athletes should have an educational session at least once a year.</td>
<td>(3.2%)</td>
<td>(0.9%)</td>
<td>(7.3%)</td>
<td>(15.1%)</td>
<td>(73.4%)</td>
<td>(0.0%)</td>
</tr>
<tr>
<td>Administrators genuinely support health/wellness educational programs.</td>
<td>(5.1%)</td>
<td>(12.8%)</td>
<td>(31.7%)</td>
<td>(27.5%)</td>
<td>(22.9%)</td>
<td>(0.0%)</td>
</tr>
<tr>
<td>Coaches genuinely support health/wellness educational programs.</td>
<td>(5.5%)</td>
<td>(18.8%)</td>
<td>(40.5%)</td>
<td>(21.6%)</td>
<td>(13.3%)</td>
<td>(0.5%)</td>
</tr>
<tr>
<td>Athletic trainers should be a resource for the organization of drug rehabilitation programs.</td>
<td>(8.3%)</td>
<td>(15.1%)</td>
<td>(35.8%)</td>
<td>(24.3%)</td>
<td>(16.5%)</td>
<td>(0.0%)</td>
</tr>
<tr>
<td>Education, without testing, will be an effective deterrent to substance abuse.</td>
<td>(33.0%)</td>
<td>(31.7%)</td>
<td>(26.6%)</td>
<td>(7.3%)</td>
<td>(1.4%)</td>
<td>(0.0%)</td>
</tr>
<tr>
<td>Athletic trainers should be the organizers of urine specimen collecting for drug testing.</td>
<td>(53.2%)</td>
<td>(20.6%)</td>
<td>(18.8%)</td>
<td>(5.5%)</td>
<td>(1.8%)</td>
<td>(0.0%)</td>
</tr>
<tr>
<td>Coaches have been, or would be, supportive of a player in drug rehabilitation.</td>
<td>(3.2%)</td>
<td>(15.1%)</td>
<td>(36.2%)</td>
<td>(26.2%)</td>
<td>(17.4%)</td>
<td>(1.8%)</td>
</tr>
<tr>
<td>I feel that drug screening is an invasion of privacy.</td>
<td>(49.1%)</td>
<td>(26.6%)</td>
<td>(16.5%)</td>
<td>(3.7%)</td>
<td>(4.1%)</td>
<td>(0.0%)</td>
</tr>
<tr>
<td>Targeting athletes only, rather than the student body as a whole, is an inherently discriminatory practice.</td>
<td>(22.0%)</td>
<td>(21.1%)</td>
<td>(24.3%)</td>
<td>(15.6%)</td>
<td>(17.0%)</td>
<td>(0.0%)</td>
</tr>
<tr>
<td>If required, I would submit to a drug screen in order to keep my job.</td>
<td>(3.7%)</td>
<td>(2.3%)</td>
<td>(12.4%)</td>
<td>(18.8%)</td>
<td>(62.3%)</td>
<td>(0.5%)</td>
</tr>
</tbody>
</table>
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screening programs, and those that did not have such programs revealed some statistically significant differences in opinions. Those athletic trainers employed at institutions having no drug-screening program held a lower opinion of administrators’ support of these programs than those athletic trainers actually involved in the process, with mean scores of 3.30 and 3.64 (t(216) = -2.15, p < .05), respectively. This perception extended to the support from the coaching staff, with athletic trainers from institutions with no programs rating support lower (3.00) than those athletic trainers from institutions with drug-screening programs (3.30) (t(215) = -2.06, p < .05). Those athletic trainers employed at institutions that do not conduct drug screening also expressed a stronger opinion that drug education programs alone would be an effective deterrent to use (2.36) than those involved in the drug-screening process (1.97) (t(216) = -2.86, p < .05).

Athletic trainers who were not involved in the drug-screening process felt more strongly that such practices against student-athletes only was a discriminatory process (3.09) compared to the responses from those individuals involved in drug screening (2.68) (t(216) = 2.16, p < .05). Although both groups were opposed to athletic trainers being the organizers of urine-specimen collecting for the test, those athletic trainers not currently involved in the process held a significantly stronger opinion (1.62) than those responses from athletic trainers involved in the process (1.95) (t(216) = -2.38, p < .05).

The opinions regarding the drug-screening process held by females and males were analyzed using a t test with pooled variances to account for the large discrepancy in sample size. This analysis revealed that the drug-testing process was viewed as having compromised the relationship of male athletic trainers with their athletes (2.64) more than female athletic trainers (1.96) (t(193) = -2.37, p < .05). Additionally, females were more likely to disagree with the statement, “Drug-screening programs are only effective in the season in which they are done,” than male athletic trainers, 1.84 to 2.34 (t(210) = -2.56, p < .05). No other differences in opinion between genders were found.

Discussion
Substance-abuse education programs or drug-screening programs were conducted by 170 (78%) of the athletic trainers responding to this survey. The program’s emphasis was placed on the educational aspect, but 187 (85.6%) of the respondents involved in drug-screening programs indicated that their institutions also implemented rehabilitational programs. Repeated positive tests could result in punitive actions against the student-athlete at 160 (73.5%) of the institutions conducting drug screening.

Although education has been identified as a primary ingredient in preventing drug use in this and other studies, 1,4,6 both athletic trainers and student-athletes agree that the actual act of testing is necessary to deter drug use. The majority of athletic trainers sampled in this study expressed the opinion that a single test and/or a single educational session would be effective in preventing year-round drug use. This is in disagreement with the opinions expressed by athletes. 1,6 The athletes sampled in these studies felt that both testing and education were only effective in the season in which they were done, and, the more testing performed, the better the deterrent.

Student-athletes held the coaching staff’s support for a player in drug rehabilitation following a positive test at a higher level than did athletic trainers. A study of 407 college football players indicated that 264 (65%) expressed the opinion that a coach would be supportive of an athlete in drug rehabilitation, 1 compared to 95 (44%) of the athletic trainers questioned in this study.

Athletic trainers and student-athletes are in agreement that drug screening is not an invasion of privacy. Our results indicate that 17 (7.8%) of athletic trainers held the opinion that this practice was an infringement of an athlete’s rights, compared to “only” 31 (17%) of the athletes surveyed by Schneider and Morris. 6 The distribution of responses for the statement, “Targeting athletes, rather than the student body as a whole, is an inherently discriminatory practice,” indicated that athletic trainers hold varied views as to whether or not this practice should be extended to the student body as a whole (2.84 ± 1.4).

Institutions designing a drug-screening program have been encouraged to seek an opinion on its legality prior to implementation. 2,4,5,7 One third of the athletic trainers involved in drug screening who responded to our survey indicated that no such opinion had been passed on to the advice of the institutions’ drug-screening policies and procedures. Such practices could expose the athletic trainer, the athletic department, and the institution itself to undue liability.

Conclusion
Athletic trainers are attempting to not be placed in the position of conflicting interests such as those described by Ehrlich. 3 The results of this study indicate that athletic trainers are uncomfortable serving as the agent used to identify and detect student-athletes who may have a substance-abuse problem and then serving as a counseling resource for them. The respondents of this study indicated that athletic trainers did not view themselves as the individuals to be designated to design and implement the drug-screening programs. Rather, the results of this study indicate that athletic trainers prefer to serve as the resource persons for the organization of substance-abuse and substance-rehabilitation programs.

References
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Minimizing Liability Risks of Head and Neck Injuries in Football

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Michael P. Weis, PT, ATC
James M. Gartland, Esq
Craig R. Weis, Esq

Abstract: Although catastrophic head and neck injuries in football occur infrequently, their occurrence is almost always followed by litigation. The athletic trainer has to be sure he/she has adequate liability insurance to cover the costs of a defense and a possible judgment. General claims filed against athletic staffs usually deal with instruction, equipment, matching of participants, supervision, and/or postinjury care. The defenses to these claims include: statutory immunity, assumption of risk, releases or waivers, and the reckless disregard standard. The athletic trainer plays a key role in head and neck injury prevention and care, and must be aware of litigation possibilities, along with methods of risk management. We present recommendations aimed at minimizing the risk of head and neck injuries and the risk of liability. The areas covered are: preparing for head and neck lawsuits, preventing head and neck injuries, and postcatastrophic injury care. We base these recommendations on principles that the athletic trainer can easily apply to other areas, broadening the risk management concept presented.

Catastrophic head and neck injuries in football are among the most devastating in all of sports. These injuries not only have a tremendous impact on the athlete and his family, but also can affect the entire athletic community. Fortunately, these injuries occur rather infrequently. However, the occurrence of a catastrophic head or neck injury is almost certain to be accompanied by litigation. The seriousness and finality of these injuries demand that everyone involved take all possible steps to decrease the risk of head and neck injuries. The athletic department should make the commitment to provide the care and expertise an athlete deserves if he is injured. The cost of a judgment can easily exceed $1 million. It is the responsibility of those involved to be aware of potential litigation while decreasing the risk of being at fault for an injury.

The athletic trainer is a key component in the prevention and care of head and neck injuries. But his/her responsibility in this area entwines closely with the team physician, coaching staff, equipment manager, and the administration (Fig 1). The efficacy of one is highly dependent upon the others. For this reason, the purpose of this article is to address the responsibilities of the entire athletic program.

Legal Concerns

It is of paramount importance for the athletic staff to understand pertinent legal terms. The application of this information is the foundation of a risk management program.

Tort

A civil wrong, other than breach of contract, for which the court will provide a remedy in the form of an action for damages. It has also been defined as "... an act or omission which unlawfully violates a person's right created by law, and for which the appropriate remedy is a common law action for damages by the injured person."

Negligence

Conduct which falls below the standard established by law for the protection of others against unreasonable risk of harm. The general standard of conduct imposed by law is that you act like a "reasonable man or person" would under like circumstances. Negligence is one type of a tort.

Gross Negligence

A step beyond negligence, the person demonstrates a lack of even slight or scant care. It has been described as a failure to exercise even that care which a careless person would use.

Wilful, Wanton, or Reckless Negligence

In practice, these three terms have been treated as meaning the same thing. The usual meaning is that the person whose conduct is so described has intentionally done an act of an unreasonable character in disregard of a known or obvious risk that was so great as to make it highly probable that harm would follow and which thus is usually accompanied by a conscious indifference to the consequences.

Contributory Negligence

Prosser and Keeton describe this as, "conduct on the part of the plaintiff that contributed as a legal cause
to the harm that he (or she) has suffered, which conduct falls below the standard to which he was required to conform for his own protection." A finding of any degree of contributory negligence on the part of the plaintiff would generally act as a complete bar to the plaintiff’s action for damages, even though a negligent defendant’s conduct also helped cause the plaintiff’s injuries. Prior to the modern trend in America of abolishing the doctrine of contributory negligence and replacing it with comparative negligence (in one form or another), it was a strong defense. Currently only six states recognize contributory negligence as a complete defense.

Comparative Negligence

Appointment of the responsibility for damages suffered in proportion to the degree of fault of each person for an accident. The various states using a system of comparative negligence have generally adopted a system of “pure” or “modified” comparative negligence. Under a system of “pure” comparative negligence, “... a plaintiff’s contributory negligence does not operate to bar his recovery altogether, but does serve to reduce his damages in proportion to his fault.”

Under the two most common systems of “modified” comparative negligence “... the plaintiff’s contributory negligence does not bar recovery so long as it remains below a specified proportion of the total fault.“ Under the “equal fault bar” approach, the plaintiff cannot recover if his fault is equal to or greater than the defendant’s. Under the “greater fault bar” system, the plaintiff is prevented from all recovery only if his fault exceeds the defendant’s.

Assumption of Risk

Where the plaintiff is injured as a result of his/her having voluntarily exposed himself to the known and appreciated risk(s) of that injury, the doctrine of assumption of risk will bar the plaintiff’s recovery for damages. In some states the defense of assumption of risk has been abolished outright. In other states it has, to varying degrees, “merged” or been “abolished” into the system of comparative negligence adopted by the state.

Informed Consent

In order for the consent of the patient that is a prerequisite to any proposed course of medical treatment or medical procedure to be effective, it must be knowingly and intelligently given. The medical provider, prior to performing the treatment or procedure, must provide the patient with sufficient information to make an “informed” or intelligent decision on whether to submit to the proposed treatment or procedure.

Joint and Several Liability

The defendants are responsible together and individually for damages. Application of the common law principle is that a defendant “... is liable for all consequences proximately caused by the defendant’s wrongful act” has led to the rule that joint tort feasors are jointly and severally liable. Each defendant is liable for the entire loss sustained by the plaintiff, even though his/her act concurred or combined with that of another wrongdoer to produce the result. If a defendant is found to be a joint tort feasor, the injured person can collect the full amount of the damage award from the defendant regardless of that defendant’s percentage of fault.

This is illustrated in Walt Disney World v Wood. In this case, a woman was injured in a bumper car collision. The jury found the woman 14% responsible, the amusement park 1% responsible, and the driver of the other bumper car 85% responsible. However, because the other driver had no assets, the amusement park had to pay 86% of the damages.

Need for Adequate Liability Insurance

In the last two decades, there has been an explosion of tort litigation in this country. The increasing incidence of school districts, coaches, and other athletic staff members being sued as a result of an athlete’s injury mirrors the trend that exists in American society-at-large. In today’s legal climate, being joined as a defendant in a lawsuit filed by a catastrophically injured athlete can be financially and emotionally devastating. Even if a defendant ultimately proves that he/she was not responsible in any way for
the athlete’s injuries, the legal fees and costs incurred in a defense could bankrupt all but the most wealthy individual. The high cost of presenting a defense may actually prevent an individual who does not have proper liability insurance coverage from presenting a proper and complete defense. Thus, for the athletic trainer, proper risk management begins with the acceptance of a position at an institution. It is absolutely essential that the athletic trainer confirm that he/she is covered under the institution’s liability insurance policy. Waiting until after an injury has occurred will be too late. Any liability coverage that you obtain after an injury would not cover claims arising prior to the inception date of coverage.

To be certain that you are covered under an institution’s liability policy, ideally you should request and receive from the institution a certificate of insurance expressly naming the athletic trainer as an additional insured under their liability policy. At a minimum, you should obtain a letter from the administrator of the institution confirming that the athletic trainer is covered under the institution’s policy for activities relating to athletic events. Confirmation of liability insurance coverage is especially important if you are not a full-time employee of the institution. In this situation, a court could decide that you are an “independent contractor” who is not an insured under the standard policy provisions giving coverage to an institution’s “employees.” This same reasoning could also operate to prevent the statutory immunity that is conferred in some jurisdictions on public institutions, such as schools, from being extended to include the activities of the athletic trainer.

If the school is unable or unwilling to provide liability insurance coverage to the athletic trainer, then you should meet with a competent insurance agent and obtain appropriate liability insurance coverage individually. If you are employed by a clinic, coverage for your scholastic activities may possibly be obtained, at a reasonable cost, through the insurance company that provides liability coverage for the clinic. In any event, the athletic trainer should obtain the advice and assistance of a competent insurance professional to confirm that he/she has sufficient liability insurance coverage to protect his/her interests.

General Claims Asserted Against Athletic Staffs
A general review of the cases involving claims by injured athletes shows that the claims asserted against the schools, coaches, and other members of the athletic staff allege breaches of duty. The breaches of duty were in one or more of the following five areas.

Failure to Give Adequate Instruction
In Wissel v Ohio High School Athletic Association, the complaint alleged negligence by two members of the coaching staff against the state athletic association for failure to provide the player with a “head up” chin strap or other protective device to prevent dropping of the tackler’s head at impact. A complaint was also filed against the state athletic association for failure to adopt a rule change requiring neck protection equipment.

Failure to Supply Proper Equipment
In Gerrity v Beatty, the complaint alleged negligence against the defendant school district in furnishing the athlete with an ill-fitting and inadequate football helmet. In Low v Texas Tech University, the complaint was against the football coaching staff, management, and trainers for negligence in failing to furnish proper equipment and supporting devices and in failing to allow the student-athlete to wear proper equipment and supporting devices.

Failure to Reasonably Select or Match Participants
For example, in Vendrell v School District No 26C, the complaint was against the high school coaching staff. It alleged negligence contributing to the injury in which a freshman athlete sustained a fracture of the cervical vertebra. The grounds included the fact that the injured athlete was too young, small, uncoordinated, and inexperienced in playing football to participate on the varsity level.

Failure to Provide Nonnegligent Supervision
In Balet v Brunswick Corporation, the complaint was filed by a junior varsity football player who was rendered a quadriplegic as a result of a serious neck injury. The complaint alleged negligence against two of the coaches for failure to properly supervise, instruct, and train the injured athlete to participate in the football program. The complaint against the coaches was dismissed on grounds of governmental immunity.

Failure to Use Proper Postinjury Procedures
For example, in Jarreau v Orleans Parish School Board, the complaint alleged negligence by two members of the coaching staff and the school board for unreasonable delay in referring the injured athlete to a physician for diagnosis. The delay resulted in exacerbation of the injury. On appeal, the judgment of $80,000 was reduced to $61,816.91.

General Defences Against Lawsuits
A review of the cases also show that the courts, at times, apply various doctrines to the benefit of the school and its athletic staff in defending claims filed by injured athletes or their families. Following are the most commonly used doctrines.

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immunity exists in a particular state and the scope and limits of any such immunity should be investigated and understood by the athletic trainer. For example, the immunity statute did not apply to allegations of negligence in providing defective sports equipment. Colorado limits the recovery against a governmental entity to $150,000 per person, and $600,000 per occurrence.17

Assumption of the Risk

Almost every state recognizes, in some form, the concept of assumption of the risk. Simply stated, this doctrine would apply where the injuries complained of result from known risks (physical contact and collisions) inherent in the sport which the athlete has voluntarily undertaken.30 As was stated by the California Court of Appeals, the doctrine of assumption of the risk is “... another way of stating that the defendant’s duty of care has been reduced in proportion to the hazards attendant to the event. Where no duty is owed with respect to a particular mishap, there can be no breach; consequently, as a matter of law, a personal injury plaintiff who has voluntarily—and reasonably—assumed the risk cannot prevail.”42 The important point to remember is that in order to have the advantage of this doctrine, it must be shown that the plaintiff (injured athlete) knew of and appreciated the risks involved in the activity.

It, therefore, is vitally important that athletes be informed of the risks and dangers (serious injury, including death or quadriplegia) involved in football and, in particular, the prohibited conduct (spearing). These warnings must be given and the adequacy of the content of the warnings should be provable at some later date, should it be necessary.

This can be accomplished by having the athletes (or parents/guardians, if the athlete is a minor) sign appropriate acknowledgement of risk forms. The forms should clearly and specifically apprise the athlete of the risks involved in football. The form should state that, knowing the risks involved, the athlete is voluntarily participating in the activity (Fig 2).

In addition, some schools and athletic associations have used videotapes showing experts (well-known coaches, doctors, etc) explaining, in detail, the risks associated with football and dangerous techniques such as spearing. The use of such videotapes not only reinforces the message being conveyed to the athlete but also allows a jury to view the warnings that were given. This can clear up any question regarding the adequacy of the information that was given to the injured athlete. Use of a written acknowledgement form, signed and dated by the athlete immediately after viewing the tape would eliminate any question as to whether a particular student was apprised of the risks involved in football.

Express Release and/or Waiver

There is a recent judicial trend that began in California where courts are recognizing the validity of express release agreements to bar suits for injuries sustained in recreational and sports activities.10,41,47 Under these decisions, in order for a release instrument to be effective, it must “... clearly and explicitly ...” release the party being released from liability.41 It must use clear and unambiguous language, and specifically state that all claims for personal injury are being released and must specifically include the word “negligence” if the intent of the document is to release those claims for damages (Fig 3). Use of a document with convoluted language or arcane legal terms (“legalese”) will render the in-

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Fig 2.—An example of an acknowledgement of assumption of risk form for a high school athlete.
Third, the law regarding the validity of releases to bar personal injury claims varies widely from state to state. If you are contemplating use of a release as a risk management tool, you should do so only with the advice and assistance of competent legal counsel.

Reckless Disregard Standard
Some states have limited the ability of a participant in an athletic contest to bring a claim for damages by applying what is known as the reckless disregard standard: "Courts and legislatures have espoused the view that torts which might be actionable in other arenas if negligence is shown, should only be actionable in the sports arena if the aggrieved person demonstrates gross negligence or reckless disregard by the defend-
read aloud the NOCSAE warning on the helmet at the time of fitting.

Other pertinent instructions include proper helmet maintenance and the reporting procedure for problems and repairs. Only qualified personnel should repair or replace helmet parts. The helmet should never be altered or modified. Athletes should be informed that they are not to switch helmets with other players. An option is to have the players sign an exit sheet that states they were fitted for their helmet and instructed on its proper maintenance.

**Medical History/Physical.** Each athlete should fill out a complete medical history, which includes information on prior head or neck injuries or problems. A physician with sports medicine experience should then do a complete physical examination.

**Acknowledgement Of Risk.** The athletic administration, in conjunction with legal counsel, should construct a form clearly stating the potential catastrophic injury risks associated with football. This form should state that the athlete is voluntarily choosing to participate in football. Each athlete (and parent, if a minor) should sign this form before participating (Fig 2).

**Informed Consent.** The athletic administration, along with the athletic trainer and legal counsel, also should construct a consent for treatment form. This form should state that the school employs a certified athletic trainer. It should summarize the athletic trainer’s qualifications and role in injury prevention, care, and rehabilitation. A statement giving or denying consent for the athletic trainer to treat the athlete must be included. This form should be signed by the athlete (and parent, if a minor) before participation begins (Fig 4).

**Medical Release.** For high school athletes, the athletic administration and legal counsel should construct a form giving permission for emergency medical treatment by a hospital in the parent or guardian’s absence. These forms should be readily available to the athletic trainer and coach at every practice and game.

**Preventing Head and Neck Injuries**

**Educating the Athlete.** The athlete should know, understand, and appreciate the risk of serious injury. To accomplish this, the athletic trainer should take the entire team into a classroom and educate them about the mechanisms of head and neck injuries.

The athletic trainer should discuss the severity, prognosis, and incidence of catastrophic injuries, along with contact techniques that minimize the risk of these injuries. We feel an excellent vehicle for this subject is the video, “Prevent Paralysis: Don’t Hit With Your Head.”

These educational sessions should be

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**Fig 4.** An example of an informed consent form for a college athlete.

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All helmets should be permanently dated at the time of purchase and records of purchasing information should be kept. The athletic department should use this information to appropriately recondition their helmets. Any helmets that are reconditioned must repass the NOCSAE safety standards before use. Finally every helmet must have the NOCSAE Football Helmet Warning Statement attached at all times.

**Fitting Helmets.** The fit of an athlete’s helmet is important in injury prevention. Only appropriate personnel, including athletic trainers, equipment managers, and the coaching staff, should fit athletes for helmets. These individuals should strictly follow the guidelines set by the manufacturer and never permit athletes to fit themselves. We also recommend that the athlete should...
run at least twice per season. Athletes should sign a form stating they participated in these sessions.

For high school athletes, we also strongly suggest providing a similar session for parents. Recently, in a national survey, Goldhaber found that parents were uninformed about both the risk of severe brain injury from playing high school football and the existing helmet warnings about that risk.

The athletic trainer also should educate the athletes regarding other injured players. It is vitally important that athletes realize they should never move a player who is down on the field. They should not try to pick him up or roll him over. If the injured athlete cannot get up on his own, then the other players should wait for the athletic training staff to arrive.

Recognizing the Dangers of Spear ing. Spear ing (contact with the crown of the helmet) has been shown to be an integral cause of head and neck injury. Torg et al identified spearing as a mechanism of axial loading to the cervical spine that may result in fracture/dislocation of the vertebrae and paralysis (Fig 5). Head-first contact also can generate enough force to cause a concussion. Spearing is a rule infraction and the NCAA and NFHS banned it in 1976. For these reasons, the coaching staff must spend adequate time teaching, demonstrating, and practicing correct contact techniques.

Rules Enforcement. The coaching staff should have a strict enforcement policy for dealing with spearing in practice that is well communicated to the team (Fig 6). Minimally, the coaches and athletic trainers must attempt to correct a player’s technique any time they see him lower his head and spear.

Regarding rule enforcement, we feel officials play the most important role in this area. It is the officials who have a potentially large impact on reducing the incidence of spearing. Officials can accomplish this by calling the penalty during games and making the rule a true deterrent to players. However, it seems that officials are not calling the penalty with enough frequency to accomplish this.

Matching Athletes. Once contact drills begin, the coaching staff should match athletes as appropriately as possible. Factors the staff should consider include skill level, experience, maturity, size, and age.

Strength Training. Strengthening neck musculature is an accepted part of neck injury prevention. The athletes should have access to some type of neck strengthening equipment, and the strengthening program, ideally, should be year-round. If this is not possible, then it should allow adequate time for strength gains (4 to 6 weeks before the season begins). During the season, athletes should continue to lift at least 1 day per week to maintain their strength levels.

Flexibility. Many authors feel flexibility plays a role in injury prevention. Flexibility of the neck musculature is believed to play a role in the prevention of neck injuries. A stretching routine designed for the neck musculature should be a part of the athlete’s daily warm-up.

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should be distributed to all members of the coaching staff and athletic personnel, and strictly adhered to in emergency situations. 31,35

Keep the Helmet On. Removing the helmet of an athlete with a potential cervical spine injury may increase the risk of permanent damage to the athlete’s spinal cord. For this reason, the helmet should be left on and the head immobilized until the athlete reaches the hospital facility. 12,22,52,64

In the event the athlete needs rescue breathing or CPR, the athletic trainer should have a method of removing the face mask while keeping the neck immobilized and the helmet on. 46

Emergency medical technicians (EMTs) often follow a different protocol for helmet removal. To prevent problems on the field, the athletic trainer (and team physician) should meet with their responding ambulance squad and discuss helmet removal before the season begins. 12,46,52 It is an excellent opportunity to educate the EMTs to the educational background and role of the athletic trainer.

Conclusion
While we have directed this article at head and neck injuries, the legal concepts used are broad. The athletic trainer can use the legal concepts and recommendations made to formulate a risk management program for areas much wider in scope.

Acknowledgments
We would like to thank Kevin McKnight, ATC, and Larry James, MPP, for their contributions and assistance in editing this article; also, thanks to Bob Vaughan for his timely reproduction of our photos.

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Glucose Emergencies: Recognition and Treatment

David E. Martin, MS, ATC

Abstract: Millions of Americans have pathologies related to glucose regulation. Many of these individuals have diagnosed diabetes. There are, however, countless others who are unaware that they have glucose regulation disorders. Athletic trainers may find themselves called upon to work with individuals with documented and undocumented disorders. The purpose of this article is to define three primary glucose emergencies (diabetic ketoacidosis, diabetic hyperosmolar state, and hypoglycemia) and discuss the treatment for each. Attention is focused on signs and symptoms which allow the athletic trainer to differentiate between the conditions.

Athletic trainers and other allied health professionals have the opportunity to interface with a multitude of medical emergencies during the course of clinical practice. One category of medical emergencies that tends to be poorly understood is glucose emergencies. Sports medicine professionals will undoubtedly be confronted with glucose emergencies many times. It is essential that they understand the etiology, recognition, and treatment of glucose-related pathologies. Incidence of glucose emergencies in the athletic population is not established in the literature. Athletic trainers and team physicians may work with individuals with documented and undocumented glucose regulation disorders and therefore need to be able to detect possible glucose emergencies and know appropriate treatment protocols.

Traditionally, glucose emergencies have been presented in a cursory manner in the context of an overview of the multifaceted disease, diabetes. Many first aid instructors are not well-versed in diabetes and therefore limit didactic attention to glucose emergencies. This lack of training may contribute to the fact that many errors in the provision of emergency medical care relate to inadequate monitoring of glycemic states. The purpose of this presentation is to present glucose emergencies in three steps: first, terminology will be introduced; second, the pathophysiology will be presented; and finally, clinical interventions will be detailed.

Paramount to understanding glucose emergencies is the realization that these conditions are not limited to individuals with diagnosed diabetes. It is estimated that only 54% of individuals with diabetes actually have the condition diagnosed. This means that over 5 million Americans have diabetes and are uninformed about the disease process affecting their lives. In addition, glucose emergencies, while less frequent, can occur in "healthy" individuals. It is essential to realize that glucose emergencies may happen in an individual with no known diabetic medical history.

Diabetic coma and insulin shock are two terms associated with diabetic emergencies. These terms are intuitively troublesome, because they do not describe a pathologic mechanism. Hyperglycemia and hypoglycemia or hyperinsulinism more adequately describe the conditions, but few practitioners remember which glycemic condition goes with which term (diabetic coma refers to hyperglycemia and insulin shock refers to the hypoglycemic or hyperinsulinism condition). The Figure illustrates the interaction of insulin and other endogenous chemicals which play important roles in glucose regulation within the body.

**Hyperglycemia**

Hyperglycemia is a condition resulting from an absolute insulin deficiency (inadequate levels in the blood) or acute insulin resistance (often a receptor fail...
Hyperglycemia can be divided into two autonomous conditions: diabetic ketoacidosis and diabetic hyperosmolar state. In both conditions, blood glucose rises to dangerous levels. Diabetic ketoacidosis is the hyperglycemic condition which most trained emergency personnel readily recognize. Mortality from diabetic ketoacidosis accounts for less than 1% of all diabetes-related deaths, possibly due to proper management assisted by the presence of trademark signs, particularly the "fruity smelling" breath.

Uncontrolled breakdown of fats are central to the ketoacidosis condition. Insulin inhibits lipolysis (Figure), the hepatic process in which fatty acids are broken down into glucose and ketones. When inadequate insulin levels exist or when an acute insulin resistance is present, glucagon stimulates the breakdown of glycogen and fats, which can cause blood glucose to increase from normal (100 mg/dL) to as high as 1200 mg/dL.

As blood glucose levels rise above 225 to 250 mg/dL, glomerular filtration in the kidneys cannot reabsorb the additional glucose which is excreted into the urine. Impairment of normal renal reabsorption of glucose increases osmotic diuresis (water loss), leading to dehydration. While the body is experiencing dehydration, ketone production continues. The resultant ketosis leads to acidosis with pH falling below 7.3. This acidosis can lead to tissue damage and electrolyte loss. Potassium excretion is often remarkable. The body attempts to protect the brain by forming osmoprotective molecules which attract and retain water.

The lack of ketone formation in the diabetic hyperosmolar state. Lipolysis is controlled and, therefore, acidosis is not a problem. As glucose levels rise, from ingested glucose or from glycogen stores, the body’s osmolality increases. This increase, coupled with dehydration and the formation of osmoprotective molecules in the brain, leads to stuporous or comatose conditions.

**Table 1.—Diagnostic Criteria for Diabetic Ketoacidosis, Diabetic Hyperosmolar State, and Hypoglycemia**

<table>
<thead>
<tr>
<th>Laboratory</th>
<th>Diabetic Ketoacidosis</th>
<th>Diabetic Hyperosmolar</th>
<th>Hypoglycemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum glucose (mg/dL)</td>
<td>≥250</td>
<td>&gt;600</td>
<td>≤50</td>
</tr>
<tr>
<td>Osmolality (mOsm/kg)*</td>
<td>Variable</td>
<td>≥320</td>
<td>Variable</td>
</tr>
<tr>
<td>pH</td>
<td>&lt;7.3</td>
<td>&gt;7.3</td>
<td>&gt;7.3</td>
</tr>
</tbody>
</table>

*Normal osmolality is approximately 280 mOsm/kg. Osmolality is calculated: Osm = [2(Na+ + K+) + (glucose • 18)] where sodium and potassium are measured in mEq/L and glucose is measured in mg/dL.

Hypoglycemia is seen frequently in active individuals who have diabetes or glycemic instability. Athletes who are insulin-dependent are often challenged by the need to balance insulin dosage with physical activity. Hypoglycemia may be drug-induced or may come as a result of physical activity, starvation, drinking alcohol, or adrenal insufficiency. Regardless of the cause, glucose levels fall precipitously, and the body fails to respond with glucose production. In the presence of too much insulin, hepatic glycogenolysis and gluconeogenesis cannot effectively supply glucose to metabolically active tissue.
The hypoglycemic patient will present with pale, moist skin, severe headache, feeling of hunger, mental confusion, and a normal or rapid, full pulse. These signs and symptoms may be seen several hours after physical activity which reinforces the need to monitor the unstable patient.

Hypoglycemia can be effectively treated with oral glucose administration. Glucose in a tablet form is the optimal way to administer glucose. Glucose tablets have been demonstrated to be more effective than fruit juices or other liquids. Intramuscular or subcutaneous injection of glucagon is beneficial to stimulate hepatic production of glucose. Untreated, hypoglycemia can lead to shock and death.

**Differential Diagnosis**

Understanding the physiology of glucose emergencies allows the athletic trainer to be confident in the recognition of glucose disorders. Table 2 presents a summary of common signs and symptoms associated with glucose emergencies. Athletic trainers must familiarize themselves with these signs and symptoms to provide adequate on-field management.

In some settings, athletic trainers may be authorized by a supervising physician to monitor blood glucose levels using a portable blood chemistry analyzer. Using aseptic technique, a finger-prick blood sample is extracted and placed on a slide in the analyzer. While less precise than laboratory blood chemistry techniques, finger-prick blood glucose results may aid the medical team in providing rapid, appropriate intervention.

Effective emergency medical care for glucose emergencies begins with prompt recognition of the signs and symptoms. Identification of patients with predispositions for glucose emergencies and prompt referral of athletes suspected of having glucose metabolism disorders is the first line of defense in the prevention of serious glucose emergencies.

The association of dehydration with hyperglycemia greatly assists the athletic trainer, who must differentiate between glucose emergencies. Aggressive intervention is beneficial when the proper pathology is being treated. If an athlete with no history of diabetes presents with any of these pathologies, prompt medical referral is necessary.

Correct identification of glucose emergencies is essential for appropriate treatment. Differentiation between hyperglycemic and hypoglycemic conditions can be done with a great deal of confidence. Assisted by a basic awareness of the pathophysiology of glucose imbalances, determination of a course of action is facilitated. Successful management of glucose emergencies is dependent on prompt recognition and treatment. The informed athletic trainer will remember that glucose emergencies are life-threatening and their occurrence may not be limited to patients with diabetes.

**References**

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Medical Considerations and Planning for Short Distance Road Races

Douglas M. Kleiner, PhD, ATC/R, CSCS
Stephen E. Glickman, RPT, ATC, LMT

Abstract: Short distance road races are popular in most communities, and athletic trainers are often asked to coordinate the medical coverage for such events. The medical support needed to successfully cover marathons, triathlons, and other endurance events has been well documented. However, little information has been presented regarding medical considerations for shorter distance races. Heat illness is often seen in short distance races, especially when the environmental conditions are extreme. Successful coverage of races of any length includes thorough planning and preparation, adequate supplies, and competent personnel. Medical coverage includes organizing the medical tent at the finish line, selecting appropriate protocols for treatment, and identifying a physician who will act as the race’s medical director. It may also be necessary to provide medical coverage on the race course, at other areas, and at the finish line. The purpose of this paper is to inform the medical community, and athletic trainers in particular, of some of the details that should be considered when planning race coverage. The information detailed within may also be applied to other sports-related medical coverage provided by athletic trainers.

The medical support needed to successfully cover marathons, triathlons, and other endurance events is well documented. However, little information has been presented on how to provide medical coverage for races of shorter (less than marathon) distances. It is now commonplace for outpatient, sports-related physical therapy clinic personnel to be present at such races and to render care to injured athletes. This provides these clinics with an excellent opportunity for exposure and community involvement. Unfortunately, these events also pose a certain amount of inherent risk. The Gasparilla Distance Classic in Tampa, FL, simultaneously runs a 5-km, a 15-km, and a wheelchair race. Over the past 8 years, the medical coverage for these races has been organized by athletic trainers. They have refined the race’s medical coverage to where it now may serve as a working model for other races and also may set the standard for medical coverage for races of less-than-marathon distance.

Although physicians are usually the medical directors, athletic trainers are often the ones asked to coordinate and plan the medical coverage of these events. During the past 8 years, the medical coverage for the Gasparilla Distance Classic has been coordinated by athletic trainers from the Sports Medicine Center of the Tampa General Hospital, an outpatient, sports-therapy facility. The purpose of this paper is to describe, by example, what factors should be considered when planning the medical coverage of such races.

The Gasparilla races (15K, 5K, and Wheelchair), which annually have 10,000 to 15,000 participants running simultaneously, have been held under various environmental conditions. Covering any race with that many participants is a challenge. The challenge becomes even greater when the environmental conditions are stressful, which is often the case in Tampa. Although not all races will experience the same number of participants or the extreme environmental conditions seen in Tampa, the key to all race coverage is knowledge and preparedness. Medical coverage of these events begins with establishing a medical tent at the finish line and anticipating what kind of problems you may encounter. Short distance races often pose unique problems not often seen in races of longer duration.

Types of Problems
Some controversy currently exists in the marathon and ultramarathon populations concerning the etiology of collapse in runners. However, in shorter distance races, such as the Gasparilla, there is little uncertainty about the cause of collapse. It is likely that the runners are dehydrated (hypovolemic) and have elevated core temperatures (hyperthermic). We therefore anticipate that most of our casualties will be admitted to the medical tent with heat illness and prepare accordingly. Athletic trainers are often familiar with heat illness; however, the etiology of heat illness in runners may differ slightly from that of football players or other athletes with which athletic trainers might be more familiar.

There are several reasons why we might see more heat illness in these runners specifically. A great number of participants in the 5K race are untrained, unfit, unacclimatized, and generally unprepared for racing.
These are all known risk factors for heat illness. However, a greater number of problems will be seen from the 15K race participants, because they tend to train for races of greater distance and feel as though they do not have to train specifically for short distance races. Additionally, the participants in the 15K race are often marathoners (or at least greater distance runners) and feel that they can sprint through the race course. This creates several additional problems. First, the runners do not drink as much fluid along the race course as they should. One reason for this is that often the racers are running at a faster pace than will allow them to drink. Additionally, the runners know that they will be finished in less than an hour, and often feel that they can wait to replenish their fluids. Second, as Noakes has noted, elevated rectal temperatures (and heat illness) are often the result of the metabolic intensity of the exercise and not dehydration alone. When these factors are combined with such environmental conditions as were present at the 1990 race (84°F and 90% relative humidity), many race participants are admitted to the medical tent.

The Medical Tent Set-up

The medical tent is staffed by over 30 volunteers, including the medical director (an emergency room/trauma center staff physician), orthopaedic surgeons, podiatrists, and a cardiologist. The remainder of the staff is comprised of registered nurses trained in emergency medicine, athletic trainers, and other paramedical personnel. All the members of this medical team are selected on the basis of their training, qualifications, and special abilities, such as pediatric experience or bilingualism. All medical tent personnel are required to follow universal precautions, and are encouraged to have personal professional liability insurance.

There are also nonmedical personnel present in the tent, whose duties are predominantly logistical/secretarial. Among these nonmedical personnel are our communications personnel, who, with the use of cellular telephones and two-way radios, are able to link the medical tent with the hospital and other areas of the race for which medical coverage is provided. The finish line, recovery area, and massage tent are areas that require medical supervision as well as communication with the medical tent.

Another crucial nonmedical member of our team is an attorney. An attorney is essential for a medical tent situation in today’s society. Our attorney is primarily responsible for making sure that release forms are signed by each patient before receiving treatment. It is helpful to have an attorney present because of the many potential legal ramifications involved in patient treatment, as patients with heat illness occasionally become incoherent or delirious. Uniformed police officers are also assigned to the tent for security and are available to assist the attorney if needed.

All members of the medical team, including the support staff (those who set up the tent and transport the supplies) are given and required to wear windbreakers and baseball caps with the hospital logo on them. The apparel distinguishes them and also aids in maintaining security within the tent.

The medical director and medical coordinator also dress accordingly, but wear different colored baseball caps to make them more identifiable. The medical tent is the center of the medical activities and houses most of the staff. The tent is located at the end of the finish line and near the recovery area. It is comprised of three main areas: Critical-Medical, Non-critical Medical (podiatric, blisters, abrasions, etc), and Communications

Fig 1.—Diagram of the medical tent showing the: (A) communications table, (B) registration table, (C) critical-area gurneys, (D) supply table, (E) noncritical area with chairs, (F) check-out table, (G) annex, (H) plastic-covered area.
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also conducted bedside with critical patients. The patient is taken to a hospital gurney, where the staff awaits him/her. A group of four such beds are staffed by one physician, four nurses, two athletic trainers, and two secretaries. The medical director, also part of this bedside staff, circulates throughout the entire medical area. All medical areas are accessible to wheelchair participants.

Tent personnel follow strict protocols set by the medical coordinator, including record keeping. Upon discharge, the patients receive brief written instructions from a member of the medical team informing them what to do in the next few days.

**Protocols**

An aggressive protocol, appropriate for situations specific to intense athletic activities, is used in our tent. Once admitted into the critical area of the medical tent, each subject is triaged, and classified, and then has his/her vital signs taken (pulse, respirations, pupils, and temperature). Rectal temperatures are also taken in patients suspected to be hyperthermic/hypovolemic.

In patients who are predominantly hyperthermic/hypovolemic, intravenous (IV) fluid replacement 1000 ml bag of D5 1/4 NS is started immediately. Patients are given IV fluid replacement because of how quickly they respond to this type of therapy. After the IV is started, it can be maintained, or discontinued, or an additional IV can be started in the contralateral arm at any time, as warranted. If the patient does not begin to respond to the IV therapy, he/she may have an underlying medical problem, or another condition, which would require transport to a tertiary facility anyway. In such cases, it is prudent to maintain an open line during transport to a medical facility.

In addition to IV treatment, patients respond well to the administration of oral fluids, cold towels, mist bottles, fans, etc, and most are discharged after receiving only 1 liter of fluid intravenously. A record of fluid administration is kept by our support personnel. Our protocol states that the medical director must re-evaluate the patient after 2 liters are given IV.

While a patient is receiving an IV, he/she is also encouraged to consume fluids orally. The patient will also be cooled with ice packs, cold towels, fans, and mist bottles. It is necessary to cool the patient before large amounts of IV fluids are administered, in order to prevent pulmonary edema. The use of fans and mist bottles has been extremely beneficial. The application of fans, along with a fine mist of water on the patient’s skin, produces evaporation and intense cooling.

**Additional Areas of Coverage**

The remainder of the medical staff is assigned to one of four other areas. These include: the race course, the finish line, survey areas, and an area
just outside of the medical tent which is used as a tent overflow and an additional recovery area. The overflow area is an annex to the medical tent and is staffed with athletic trainers. It is set up in a shaded area where heavy duty plastic covering can be spread on the ground. The purpose of this area is to create a place where runners suffering from mild heat illness/fatigue and not needing advanced care can be treated and monitored without crowding the medical tent. This area allows for easy communication and access with the medical tent should a runner’s condition become more critical. It also allows for aggressive (and often messy) treatment. Runners are encouraged to consume oral fluids while sitting or lying on the plastic covering, which is periodically covered with ice, while they are being sprayed simultaneously with a hose. This area is also extremely useful as a step-down area from the medical tent. After runners have been treated in the tent, they are transferred to this recovery area, where they may consume additional oral fluids and can take their time recuperating while being observed.

Both the finish line and the survey areas are covered by sweep teams made up of physical therapists, athletic trainers, and Emergency Medical Technicians (EMTs) who work in pairs. The sweep teams are in constant contact with the medical tent via two-way radios. The survey areas include the “massage area,” which is staffed with licensed massage therapists, and the “recovery area,” where runners eat, drink, use restroom facilities, relax, and talk with their competitors. Providing coverage to these areas enables us to encourage runners who do not feel well to go to the medical tent to be screened, monitored, and treated before their condition worsens. It is often in these areas that runners begin to experience leg cramps and other early warning signs of heat illness. Despite being mild, these symptoms can quickly progress to more advanced stages of heat illness if no intervention is taken.

There are aid stations positioned along the race course in conjunction with water stations. Each of these aid stations is staffed with one EMT and one athletic trainer, along with the normal water station personnel. The medical personnel at these aid stations have only limited supplies but are in radio contact with the medical tent and the roaming ambulances. These aid stations respond to immediate emergencies, identify runners in trouble, triage, and refer treatment to the medical tent or the hospital. Our aid station personnel do not have the authority to disqualify a runner in trouble, as some other races allow.2,3 The authority to disqualify participants by aid station personnel may lead to confrontations or legal situations that might otherwise be avoided.

The roaming ambulances are two Fire Rescue vehicles with (Advanced Cardiac Life Support). There is also another such vehicle parked at the back of the medical tent. Private Basic Life Support units are used for all non-life-threatening transports, either from the race course to the hospital, to the medical tent, or from the medical tent to the hospital. Participants requiring transfer to a tertiary medical facility are taken to the Tampa General Hospital, the closest hospital along the race course that can provide the necessary medical support. Tampa General Hospital houses the area’s Level One Trauma Center and has excellent emergency room (ER) facilities and highly skilled personnel. It is advantageous for Tampa General Hospital to also staff the medical tent, so the hospital is familiar with the tent’s personnel, capabilities, and limitations.

The hospital is placed on alert before the race, and the ER knows that the medical tent will attempt to handle the runners’ problems on-site. Therefore, ER personnel can assume that when a patient arrives from the tent, more advanced care is required. Even with its limitations, the medical tent is often better able to treat runners, especially those with hyperthermia/dehydration, faster and more aggressively, than could the ER. There is no sense in flooding the ER with patients who can be successfully treated in the medical tent. In 1990, 65 runners were successfully treated and released from our tent within a 3-hour time span, while only 8 needed to be transported to the hospital. Patients routinely transported to the ER included those who required X rays, who complained of chest pain, had underlying medical conditions, or who failed to respond to the treatment administered in the tent. Severely hyperthermic runners who may require subsequent hepatic and renal evaluations are also routinely transported.

Since it is unlikely that a race will be canceled for environmental or other reasons, it is imperative that racers be informed and that medical providers be prepared. Crude methods for predicting how many race participants will be seen in the medical tent are available. One such regression chart which we have used with good success is based on the number of race participants and the environmental conditions, and was developed at the Boston Marathon.1 We also invite the racers to attend educational clinics during the week leading up to the race. In these lectures, the runners are notified about possible environmental conditions and precautions that should be taken. Additionally, immediately prior to the race, colored flags indicating the current environmental conditions (wet bulb globe temperature) are displayed and announcements of the conditions are made at the starting line. Yet, despite taking these, and other precautions, runners may still become ill and will rely on the knowledge and preparedness of the medical providers.

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Functional ACL Bracing: A Survey of Current Opinion and Practice
DeCoster LC, Vailas JC. New Hampshire Musculoskeletal Institute, Manchester, NH 03101

Introduction: The purpose of this study was to examine current ACL bracing practice and philosophy amongst orthopaedic sports medicine physicians. Methods: The survey population consisted of Fellows of the American Orthopaedic Society for Sports medicine (AOSSM, n = 125) and alumni of the Kerlan-Jobe Orthopaedic Clinic Sports Medicine Fellowship (KJOC, n = 80). The physicians were questioned about their practices regarding nonsurgical vs. postreconstruction patients; preference for custom vs. off-the-shelf braces; weight given to various considerations regarding bracing decisions; length of time patients are kept in functional braces after reconstruction; and whether the physician’s practices with regard to functional brace prescription had changed recently. Results: Overall return was (114) 57%. Seventy (61%) prescribe functional braces (FB) for at least 75% of their nonsurgical ACL-deficient patients. Sixty-two (54%) prescribe FB for 100% of their postreconstruction patients. At least 75% of the time, 67 (59%) opt for a custom (C) brace while only 32 (28%) pick an off-the-shelf (OTS) FB that often. When asked which criteria carry the most weight in their selection of FB, 87 (77%) vs. 22 (25%) prefer C to OTS. Eighty-six (80%) consider sport/level of competition more important than degree of laxity (20) (19%) or leg strength (22%). Seventy-three (69%) prefer hard-shell designs to strap-type (31%) designs, and 63 (58%) reported that the serviceability of the brace rather than price (44%) was more important in their decision making. Regarding how long they keep postreconstruction patients in FB for sports activities, 66 (58%) reported they brace for 9 to 12 months, 11 (10%) never prescribe a FB after reconstruction, and 18 (16%) brace continuously after reconstruction. Thirty-six respondents answered the question, “Have you recently changed your practices with regard to FB prescription?” and half of those said they are prescribing braces less often. Discussion: The results of most studies designed to prove FB efficacy are equivocal. Therefore, it may be helpful to know the practice and philosophy of your peers. There was no effort in this study to determine whether one physician’s FB preferences result in better patient outcomes than another’s. We feel that the strong response to this single mailing shows a high level of interest in this topic among orthopaedic sports medicine physicians. It is challenging but necessary to study FB parameters in an effort to provide some rationale for FB regimens.

Athletes With Disabilities Injury Registry
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There have been very few epidemiological investigations to explore the injury experience of athletes with disabilities. The Athletes with Disabilities Injury Registry (ADIR) collected injury data from 1990–1992. There were 5 Disabled Sports Organizations who participated in the study. A reportable injury was defined when a participant day was missed, modified, or interrupted for a scheduled practice or competition due to injury, illness, or pain. There were 319 athletes who participated in the project in which 128 reportable injuries were recorded. The injury rate during the study period was 9.45/1000 athlete-exposures. Overall, 52% of the reported injuries were minor (0–7 days of time-loss), 29% were moderate (8–21 days of time-loss), and 19% were major (22 or more days missed). The mean days lost due to an injury or illness episode was 17.02 days. The shoulder (n = 13) and forearm/wrist (n = 7) accounted for the greatest days lost at 31.71 days each followed by the hand/fingers (n = 12) at 21.00 days, and the upper arm/elbow (n = 10) at 13.40 days. Musculoskeletal injuries accounted for 81% of the reported injuries and illness or disability-related problems accounted for 19%. The upper extremity accounted for 35.9% of the injuries, head, neck and trunk was 22.7%, lower extremity was 21.1% and illnesses were 20.3%. Fourteen percent of the moderate and major injuries were not medically evaluated. This raises questions about access to medical care and the appropriate recognition of an injury. The injury rate reported for ADIR is similar to other athletic populations. Injury prevention programs should focus on reducing the number of significant time-loss injuries and the education of athletes and coaches about appropriate referral to medical professionals.

Supported by the United States Olympic Foundation.
Nutritional Knowledge and Eating Attitudes of Collegiate Cross-Country Runners
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Due to the emphasis commonly placed on a lean body build for optimal performance in cross-country running, it is important to assess athlete's perspective on diet and nutrition. This study examined the influence of nutrition knowledge on attitudes toward food, eating, and body weight in female (F) and male (M) cross-country runners (CCR). The Eating Attitudes Test-26 (EAT), a nutrition knowledge test (NKT), and a demographic survey were administered to 60 (27 F, 33 M) NCAA Division I CCR, 41 (19 F, 22 M) adult members of a local running club (RC), and 62 (34 F, 28 M) undergraduate students (US). Both CCR and RC scored higher (p < .05). A tendency existed for female CCR to score higher than male CCR on the NKT (p < .09). On the EAT, female CCR (EAT = 14.4 ± 10.5) and female US (EAT = 12.0 ± 10.6) scored higher (p < .05) than male CCR (EAT = 7.2 ± 5.4) and male US (EAT = 4.4 ± 3.5), respectively. An EAT-26 score >20 has been identified as a clinical indicator of potential dysfunctional eating behaviors. In this investigation 26% female CCR, 6% male CCR, 21% female RC, 5% male RC, 12% female US, and 0% male US were found within that classification. Correlations between EAT and NKT for female CCR (r = .15) and male CCR (r = .32) differed from previous studies involving other types of athletes who reported a moderate to strong negative relationship. Thus, pursuit of an ideal body composition may affect CCR interpretation of nutritional information. This data indicates that increased nutritional knowledge may not contribute to healthier eating attitudes in female and male collegiate CCR. It is suggested that nutrition educational supplemented with individual nutrition counseling for these athletes.

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The Pursuit of Teacher Certification by Athletic Training Students
Curtis N. West Chester University, West Chester, PA 19383

Studies have reported that athletic training students who earn teacher certification will enhance their job marketability. The purpose of this study was to examine the number of students enrolled in NATA-approved undergraduate athletic training education programs who pursue teacher certification. A survey was mailed to the directors of the 78 programs in the Spring of 1992. Seventy-two (92%) surveys were returned. Data showed that 177 (25%) of the 703 expected graduates in 1992 and 148 (23%) of the 640 graduates in 1991 pursued teacher certification. Nine programs reported that none of the athletic training students in the classes of 1991 or 1992 pursued teacher certification. The following Table (p 154) represents the subject areas of those earning or seeking teacher certification in 1991 or 1992.
The directors estimated that 387 (20%) of the 1966 total number of student enrolled in athletic training programs were pursuing teacher certification. These students should expect to take an additional 1.61 semesters (range 0-4 semesters) to complete teacher certification requirements. Fifty-four (75%) of the programs were offered through Departments of Physical Education or Kinesiology; however, no programs required students to complete teacher certification. The majority of program directors cited increased job opportunities as the main advantage and increased time in school and the financial burden as the main disadvantages of pursuing teacher certification. A discussion relating the history of athletic training education to teacher certification and job opportunities is presented. Recommendations included formal counseling and advising for athletic training students regarding teacher certification and job opportunities to begin in the first year of study. Program directors are encouraged to examine these issues when conducting accreditation self-study. Further studies are recommended to investigate the hiring patterns and desired qualifications of high schools employing or considering employing athletic trainers.

**Reporting Behaviors of Athletes With an Upper Respiratory Illness**

Weidner TG. Ball State University, Muncie, IN 47306

Some contend that upper respiratory illness (URI) causes more disability among athletes than all other diseases combined. The purpose of this study was to describe the reporting behaviors, activity levels, and perceived physical performance levels of intercollegiate athletes with an URI. Respondents rated the severity of 14 cold symptoms and indicated to whom they reported their cold, and within how many days. Additionally, respondents were to indicate whether they self-treated their illness, whether they missed a practice or game due to the cold, and whether the cold affected their performance. The subjects for this study were 290 intercollegiate athletes (165 males, 125 females) in a large midwestern conference. The instrument was administered at three regular intervals during the sports seasons. There was a total of 118 illness episodes. Respondents reported their colds to the athletic trainer (61(50.4%)), doctor/nurse (41(33%)), and/or coach (32(28.3%)). Athletes reported their cold symptoms earliest to the coach (2.45 days) or athletic trainer (2.71 days). The number of days prior to reporting to a doctor or nurse was longer (3.64 days). Of the illness episodes reported, 21(17.8%) caused the athlete to miss a practice and 6(5.1%) caused the athlete to miss a game. Athletes with an URI felt in some instances that their illness episode affected their performance. Cold symptoms of cough, fever, laryngitis, aching muscles/joints, and nasal discharge were significantly (p < .05) correlated with reporting behaviors, activity levels, and/or perceived physical performance. Possible implications for athlete participation and education include the value of rest, medical self-help, and cold transmission intervention.

**The Effect of Cooling the Tissue Prior to Ultrasound Treatments**

Draper DO, Schulthies S, Sorvisto P, Hautala AM. Brigham Young University, Provo, UT 84602

In 1967 Lehmann discovered that ultrasound using a cool medium (18-21°C) resulted in a higher tissue temperature rise (TTR) than ultrasound used with a warm or room temperature medium (>24°C). As a result of his research many clinicians have surmised that if cool mediums are effective, cooling the tissues prior to ultrasound treatments should also have merit. A recent study has shown that 15 minutes of ice pack application prior to ultrasound actually negates the heating effects of the ultrasound treatment. We wondered if cooling the tissues slightly for just five minutes prior to ultrasound therapy would yield negative or positive results. This practice of five minutes pre-icing prior to ultrasound therapy has gone on for years, even though no in vivo studies have been performed to substantiate this protocol. Our purpose in performing this study was to see if this protocol has any merit. Participants had a 23-gauge hypodermic needle microprobe inserted 5 cm deep into the medial aspect of the anesthetized gastrocnemius muscle. Two groups consisting of eight subjects each were tested for temperature changes during: a) 1 MHz ultrasound treatment on pre-cooled tissue; or b) 1 MHz ultrasound with no preceding treatment. The treatment area was two times the size of the effective radiating area of the crystal. Each treatment consisted of 10 minutes of continuous ultrasound delivered topically by an Omnison 3000™ (Physio Technology Inc, Topeka, KS) at 1.5 watts/cm². We used a one-way ANOVA and discovered a significant difference between the two treatments methods [F = 19.06, p < .001]. Ultrasound alone increased tissue tem-
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temperature an average of 4.04 ± .83°C, whereas ultrasound preceded by 5 minutes of ice increased tissue temperature only 1.85 ± 1.2°C above original baseline level. According to Castel and Lehmann, a TTR of 4°C is vigorous heating, whereas a TTR of <2°C is considered only mild heating. At a depth of 5cm, ultrasound preceded by a five minute ice treatment yields little, or no thermal benefits. If an increase in muscle temperature is desired, we suggest that the practice of cooling the tissues prior to ultrasound application be discontinued.

The Effect of Contrast Therapy on Intramuscular Temperature in the Human Lower Leg
Myrer JW, Draper DO, Durrant E. Brigham Young University, Provo, UT 84602

Contrast therapy, although having a long history of use in sports medicine and physical therapy, remains insufficiently researched. We found no in vivo studies investigating the effects of contrast therapy on intramuscular temperature. We propose that for most of the physiologic effects attributed to contrast therapy to occur, substantial fluctuations in tissue temperature must be produced. We designed this study to explore the thermal effects of contrast therapy on intramuscular tissue. Twenty-eight college aged students were randomly assigned to either the control or contrast group, 8 females and 6 males per group. We took a skinfold measurement of the posterior lower right leg. After a 4 × 4 cm area of skin over the right medial calf was shaved and cleansed, a microprobe was inserted to a depth of 1 cm below the subcutaneous fat in the center of the gastrocnemius. The control group immersed their legs in a hot whirlpool (40.6°C) for 4 minutes then into a cold whirlpool (15.6°C) for 1 minute. Subjects repeated this sequence three additional times. We recorded intramuscular temperatures every 30 seconds over the entire treatment time for both groups. The control group had a temperature increase of 2.93 ± 1.14°C over the 20-minute treatment. The contrast group temperature increased 0.39 ± 0.46°C from baseline to the end of the treatment. The largest temperature change from the end of one contrast immersion to the end of the next was only 0.15 ± 0.10°C. None of the differences between the end of one immersion to the end of the next were significant (p > .05). Conversely, all differences between the same time periods in the control group had significant temperature increases (p < .05), Bonferroni correction for multiple tests used). In the control group by the ninth minute, we found that as skinfold increased, the rate of temperature rise slowed. The results indicate that contrast therapy as studied is incapable of producing any significant physiological effect on the intramuscular tissue temperature 1 cm below the subcutaneous tissue.

Rate of Temperature Increase During Ultrasound Treatments: Are Traditional Treatment Times Long Enough?
Castel C, Draper DO, Castel D. Brigham Young University, Provo, UT 84602

According to Lehman, an ultrasound treatment must increase tissue temperature 2°C for pain reduction, increased blood flow and reduction of muscle spasm. Increasing tendon extensibility and viscoelastic properties of collagen requires an increase of 4°C. There have been no in vivo studies that have measured rate of change in temperature during ultrasound treatments. Thus we have been left to pure speculation regarding how long to administer an ultrasound treatment. We performed this study to plot the rate of temperature increase during ultrasound treatments delivered at various intensities and at both 1 MHz (for deep tissues) and 3 MHz (for superficial tissues). Eight college students participated in the 1 MHz 2.5 and 5cm; 3 MHz .8 and 1.6cm. We applied a template to the calf muscles that was two times the size of the effective radiating area of the crystal. After we applied a gel medium, we delivered an ultrasound treatment using the Omnison 3000™ (Physio Technology Inc, Topeka, KS). Each subject underwent a total of four 10 minute treatments, one each at .5, 1, 1.5, and 2 w/cm², and temperature was measured every 30 seconds. The rate of temperature increase per minute at a frequency of 1 MHz was .5, >06°C; 1, .17°C; 1.5, .3°C; 2, .4°C. That rate of temperature increase per minute at the 3 MHz frequency was: .5, .3°C; 1, .66°C; 1.5, .72°C; 2, 1.43°C. With respect to 1 MHz ultrasound, we have shown that many of our current textbooks prescribe a treatment time that is too short (five minutes, with no specified treatment size) if the goal is to increase viscoelastic properties of collagen of deep seated structures. Regarding 3 MHz ultrasound, we are the first to plot its rapid heating effects on superficial structures. Since 3 MHz ultrasound heats tissues nearly three times as fast as 1 MHz (p < .001) and since many sport injuries lie <1.6 cm below the skin’s surface, we recommend that use of 3 MHz ultrasound for injuries such a patellar, achilles, and peroneal tendinitis, and medial and lateral epicondylitis. The results of this research should enable athletic trainers to choose the correct frequency, intensity and treatment time when using ultrasound.

An Electromyographic Comparison of Popular Open and Closed Kinetic Chain Knee Rehabilitation Exercises
Kleiner DM, Drudge TK, Ricard MD. Illinois State University, Normal, IL 61790-5120

The purpose of this study was to investigate the electromyographic (EMG) differences between six commonly used open and closed ki-
netic chain knee rehabilitation exercises (KCEs). Sixteen college-age males with no history of knee pathology, performed five trials of each isotonic exercise. Closed KCEs were performed with the Shuttle (SH), Total Gym (TG), Nautilus leg press (LP), and wall slides (WS). Nautilus leg extension (LE) and ankle weights (Aw) were used for open KCEs. All exercises were performed from 90° of leg flexion to 180° of leg extension at a standard speed (45°/s for extension and 30°/s for flexion). Visual feedback of speed was provided by the Right Weigh. Resistances for double-leg closed KCEs were normalized with single-leg open exercises. EMG activity was measured in the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF), biceps femoris (BF), semitendinosus (ST), and gastrocnemius (GT). Subjects’ hip and knee ranges of motion were determined using electrogoniometers, and EMG activity was assessed by surface electrodes over the respective muscles. EMG signals were normalized to 1 RM and were processed to produce a linear envelope. Linear envelopes were integrated for both flexion and extension. Data revealed that EMG activity was greater in open KCEs vs closed. Peak EMG activity occurred closer to terminal extension for open KCE. With closed KCE, peak muscle activity occurred between 93–113° in all muscles, except the ST. This angle of peak activity has previously been thought to place unwanted stress on the ACL. It has also been suggested that the advantage to closed KCEs is the coactivation of the hamstrings. However, the data from the exercises performed in this study revealed that hamstring activity was similar between open and closed KCEs. Furthermore, there was no evidence of additional hamstring coactivation during knee extension (14.7 and 19.9% MVCs for closed vs open, respectively). The data from these exercises suggest that more stress is placed on the ACL with open as opposed to closed KCE. Particular attention should be paid to prescribing open KCE knee rehabilitation exercises.

Two Methods of Strength and Endurance Training for Knee Rehabilitation: A Comparative Study
Fowkes-Godek S. West Chester University, West Chester, PA 19383

Surgical techniques for correcting anterior cruciate ligament (ACL) instabilities in the knee have made functional (closed kinetic chain) rehabilitation exercises such as squatting and step-ups popular with physicians and clinicians. Open kinetic chain exercise such as isolated knee extensions have been shown to cause anterior tibial translation. This study attempted to determine differences in muscular strength and endurance gains between a closed

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kinetic chain, and an open kinetic chain method of resistance training. Ten U.S. Air Force Academy cadets participated in the study. The subjects’ legs were randomly assigned to different training methods; all subjects trained each leg either on the hip sled (HS) or Orthotron (OT) three days each week for eight weeks. Muscular strength of the quadriceps and hamstrings was obtained for both legs from a Lido isokinetic dynamometer at 60, 90, 180 and 240°/s and isotonically on a hip sled machine prior to, at four weeks, and after the eight week training period. Additionally, muscular endurance as total work performed in 20 seconds was measured on the Lido at 240°/s. The quadriceps muscle histology on the hip sled (HS) leg showed significantly greater increases in muscular strength compared to the orthotron (OT) leg when measured concentrically at 60 °/s (p < .01). When tested for muscular endurance at eight weeks at 240°/s, total work for knee extension was significantly greater in the OT leg than the HS leg (p < .000). No significant differences in muscular strength were found between the two methods when measured at 90 and 180°/s in knee flexion and extension. When measured on the hip sled, the HS leg showed significantly greater improvements in muscular strength compared to the OT leg at both four weeks (p < .03) and eight weeks(p < .001). Closed kinetic chain exercise produced strength gains in knee musculature that are greater than or equal to those of open kinetic chain exercise at all speeds tested. Closed kinetic chain exercises for increasing muscular strength are recommended as the preferred method of rehabilitation for the ACL deficient knee.

Whole Body Bone Mineral Density and Body Composition Changes in Female Runners and Gymnasts
Benage WL, Robinson TL, Snow-Harter C. Oregon State University, Corvallis, OR 97331

Forces generated through the impact loading of weight-bearing exercise have been shown to have beneficial effects on bone mass. A positive relationship exists between body weight, particularly lean mass and the forces on bone. Menstrual cycle status in female athletes also plays a role in the determination of bone mass. The relative lack of estrogen and/or progesterone, often a consequence of intense training, may result in diminished bone mineral density. The optimal training program which would increase bone mineral has not yet been determined. The purpose of this study was to investigate whole body bone mineral density (WB BMD) and body composition changes in female competitive collegiate athletes, with and without menstrual cycle irregularities, over an 8-month training period. The subjects included gymnasts (aged 20.4 ± 1.1 yr), runners (22.4 ± 2.3 yr) and non-competitive controls (19.8 ± 1.7 yr). Of the 12 gymnasts, 8 were regularly menstruating (eumenorrheic) and 4 had irregular cycles (3 oligomenorrheic, 1 amenorrheic). Of the 18 runners 11 were eumenorrheic and 7 had irregular cycles (3 oligomenorrheic, 4 amenorrheic). All 14 controls were eumenorrheic. Whole body BMD (g/cm²), lean and fat mass (kg) were assessed pre- and post-study by dual-energy x-ray absorptiometry (Hologic QDR-1000/W). The percent change in WB BMD was not significantly different among groups (p = .09). When compared to zero, however, WB BMD increased in the runners and gymnasts (1.9% and 1.4%, respectively, p = .0001). Whole body BMD in the controls also increased (0.8%), but this was not different from zero (p > .05). When comparing WB BMD changes within each athletic group, no significant differences were observed according to menstrual status. Both the eumenorrheic runners (2.0 ± 1.1%) and gymnasts (1.6 ± 0.6%), however, had a significant increase in WB BMD compared to zero (p < .001). The athletes with irregular cycles also showed an increase in WB BMD but this was not different from zero (runners: 1.8 ± 2.2%, p = .07; gymnasts: 1.0 ± 0.8%, p = .08). The change in lean mass was significantly different (p < .05) among groups, although the change in fat mass did not differ. The runners (1.5 ± 1.6 kg, p = .0001) and controls (0.8 ± 1.1 kg, p < .01) increased lean mass, while the gymnasts remained constant (0.1 ± 1.0 kg). Multiple regression analysis showed that the percent change in lean mass independently predicted the percent change in WB BMD (R² = .44), whereas the percent change in fat mass did not contribute to the model. In conclusion: 1) the mechanical loading of running and gymnasts training appeared to result in similar increases in WB BMD in these athletes; 2) increases in WB BMD were more profound in the eumenorrheic athletes compared to the athletes with irregular menstrual cycles; 3) runners increased lean mass over the 8-month period, while gymnasts maintained lean mass; and 4) the strongest relationship indicated that 44% of the change in whole body bone mineral density was accounted for by the change in lean mass.

The Response of Intact Parathyroid Hormone and Serum Calcium to a Bout of Cryotherapy and Exercise: A Pilot Study
Martin DE, Craig BW, Habansky AJ, Hickey MS. Ball State University, Muncie, IN 47304

Cryotherapy (CT) and low-intensity aerobic exercise (LAE) are frequently recommended during rehabilitation of musculoskeletal injuries to promote soft tissue repair and modulate pain. No study has assessed the effect of CT or LAE on bone anabolism and calcitropic hormone activity. The purpose of this pilot study was to assess the response of intact parathyroid hormone (I-PTH) and serum calcium (Ca²⁺) to a bout of CT and LAE. Six healthy subjects (age = 25.5 ± 2.5 yr, ht = 172.3 ± 10.0 cm, wt = 69.5 ± 15.3 kg), 3 aerobic trained (AT) and 3 resistance trained (RT), with no known endocrine disorders performed a single trial. The trial consisted of 20 minutes of ice application to one
knee, 15 minutes of stationary cycling at 50 W, and concluded with 20 minutes of ice application to the same knee. Antecubital venous blood samples (7 ml) were drawn immediately pre and post trial. I-PTH was analyzed using a IRMA I-PTH kit (Kit #DSL8000, Diagnostic Systems Lab, Inc, Webster, TX) and Ca\(^{2+}\) was analyzed using a quantitative colorimetric assay (Sigma Diagnostics, St. Louis, MO). The AT subjects had a 8.3% decrease in I-PTH (71.5 ± 5.3ng/dL to 65.5 ± 6.3ng/dL) and a 9% increase in Ca\(^{2+}\) (6.9 ± 1.1 mg/dL to 7.6 ± 1.7 mg/dL). The RT subjects demonstrated an increase of 13% in I-PTH (64.6 ± 11.9ng/dL to 72.8 ± 6.4ng/dL) and an increase of 24% in Ca\(^{2+}\) (6.6 ± 2.0 mg/dL to 82.±1.0 mg/dL). The decrease in I-PTH seen in the AT subjects is similar to the decrease following 45 minutes of submaximal running reported by Grimston et al (1993). These pilot data suggest that effects of CT and LAE may be dependent on exercise conditioning. Future in vivo studies are necessary to determine the effect of these calcium-related changes on bone remodeling following injury.

Support for this project provided by Diagnostic Systems Laboratory, Inc, Webster, TX.

**Firing Patterns of the Dynamic Stabilizers of the Ankle in Response to Sudden Stress**

Ebig MA, Leiphart SM, Burdett RG. University of Pittsburgh, Pittsburgh, PA 15219

Ankle sprains involving the lateral structures of the ankle are the most common type of sprain suffered by athletes and occur with sudden plantar flexion/inversion stress. It has been theorized that the tendency for the ankle to give way after an ankle sprain may be caused by motor incoordination due to articular de-afferentiation of the mechanoreceptors as a result of injury. Damage to the nerve fibers may cause a disturbance of the reflex response that causes the muscles to fire and stabilize the joint. The purpose of this study was to examine and compare reflex response time of the peroneus longus and tibialis anterior in response to sudden plantar flexion/inversion in normal and functionally unstable ankles. It was hypothesized that the reflex response time would be greater in the muscle groups of the functionally unstable ankles when compared to the normals. Thirteen athletes (5 males, 8 female) ages 18–20 (mean 19.2) with a history of unilateral ankle instability were used for this study. Surface electrodes were placed on the muscle bellies of the involved muscles to record EMG activity. A specially designed platform was used so that individual footplates could be triggered independently to drop the foot into plantar flexion/inversion. Each subject stood barefoot with weight...
evenly distributed on the platform. The footplates were dropped randomly with 3 trials for each ankle. EMG activity and platform release was recorded using a Watscope/Watsmart computer program which served as the data collection system. The latency time between platform release and muscle firing was recorded and the mean of the 3 trials was used for the analysis. Data analysis was done using a 2-tailed t-test with a probability level of <.05. Results showed no statistical difference in the firing time between the stable and unstable ankles. Mean firing time for the peroneus longus of the unstable ankle was 58.6 ms (±4) with the stable ankle firing in 65.3 ms (±3). The mean firing time for the tibialis anterior of the unstable ankle was 67.9 ms (±4) with the stable ankle firing in 71.6 ms (±4). The analysis also showed that the peroneus longus fired significantly faster (p < .05) than the tibialis anterior in both the stable and unstable groups. Mean firing time in the stable ankles was 65.3 ms (±3) for the peroneus and 71.6 ms (±4) for the tibialis. The results may signify that there is a lack of contribution of the joint receptors to the reflex mechanism and that the stability of the joint is provided by other passive structures. However, all of these subjects had undergone some type of proprioceptive rehabilitation following their injuries and were currently athletically active which may indicate that the proprioception training they received helped to reestablish the reflex mechanism. The fact that attention is often paid only to the injured extremity during rehabilitation may also contribute to the trend of the injured ankle firing at a faster rate than the normal due to enhanced proprioceptive awareness. The significance of the second finding addressed the importance of the role of the peroneals as the first line of defense in ankle sprains. If indeed there is a reestablishment of these reflex mechanisms with proprioception training, then the peroneals need to receive particular attention.

Case Reports

(Saturday 1:30–3:10 pm)

Shoulder Pain in a College Football Player
Allen J. Valdosta State University, Valdosta, GA 31698

This case study involved a 23-year-old college football player who developed septic arthritis in his right shoulder. The athlete reported to the training room the day after a game, complaining of severe pain in his right shoulder. No visual abnormalities were noted. Upon palpation, the athlete had extreme pain; however, there was no swelling and the joint did not feel warm. Specific tests for evaluation were not done because of the pain the athlete was experiencing. He was very apprehensive to any attempt to move or even palpate the joint. X-rays revealed no fracture and at this point, nerve damage or a contusion were thought to be the problem. The athlete was referred to the team orthopedist who, suspecting a possible infection, decided to have the joint aspirated. The fluid was sent to a medical laboratory and joint fluid analysis revealed a gram negative infection.

Left Knee Pain and Swelling
Katz NT, Moser K, Dolsen D, Ireland ML. Kentucky Sports Medicine, Lexington, KY

History: 14-year-old white male injured his left knee while playing basketball. He felt acute pain and a pop which he thought occurred going up for which he was casted for 4 weeks. He had been out of his cast for a couple of weeks and had just resumed physical education class. Otherwise, he had no previous history of knee problems. Physical Examination: Left Knee: Severe swelling and diffuse tenderness. ROM was 20 to 80°. Active extension was not possible. Pain along the tibial tubercle. Ligamentous exam was normal. Differential Diagnosis: 1) Patellar tendon rupture; 2) Epiphyseal fracture proximal tibia; 3) Lateral patella dislocation; 4) Patellar fracture; 5) Anterior cruciate ligament tear–tibial eminence avulsion vs. mid-substance interstitial; 6) Intra-articular osteochondral fracture; 7) peripheral tear meniscus, medial or lateral.

Shoulder Weakness in a Collegiate Gymnast
Hutchinson MR, Cody K, Kinney R. University of Illinois at Chicago, Chicago, IL 60612–7342

History: An 18-year-old male collegiate gymnast who had been immunized for the flu came down with mild flu symptoms a few days later (ie, mild sore throat, generalized aches, lethargy and low grade fever). Symptoms resolved but within 2 weeks of his flu shot he noted weakness in his dominant right shoulder and an inability to perform on apparatus. He had no previous history of shoulder problems. Physical Examination: Examination revealed a full range of motion of his neck and shoulder. Inspection showed no muscular wasting but asymmetry of his scapula when viewed from behind. A wall push-up produced significant scapular winging. Sensation and reflexes were normal but motor strength testing was noted to be weak in his deltoid (4/5), supraspinatus (4/5), and infraspinatus (4/5). Biceps, triceps, and distal motor strength appeared to be normal. Differential Diagnosis: 1) Scapular winging due to long thoracic nerve impingement; 2) Isolated serratus anterior weakness; 3) Viral syndrome involving long thoracic nerve; 4) Viral syndrome involving brachial plexus; 5) Post immunization viral syndrome involving brachial plexus. Tests and Results: Anterior-posterior, lateral, and axillary radiographs were normal. EMG done within the first week was negative with no nerve or muscle changes.

Groin Pain in a College Football Player
Smith J, Vanderbilt University, Nashville, TN 37212-0158

We present a normal 20-year-old black male football player with acute onset of pubic pain with no specific mechanism of injury. He awoke with severe left groin/pubic symphysis pain. He was afebrile, unable to walk, and experienced painful urina-
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tion. He was treated for a groin strain for 24 hours, after which his condition worsened and his body temperature increased. He was admitted to Vanderbilt University Hospital. Initial bone scan and CT Scan proved negative; however, blood cultures taken showed positive for staphylococcus aureus. A subsequent MRI scan revealed fluid in the symphysis pubis and a CT-guided needle biopsy of the symphysis showed positive for the staphylococcus aureus infection.

NATA Research & Education Foundation Grant Research Presentations

(Saturday 3:30–5:00 pm)

Organizational Commitment Among Intercollegiate Head Athletic Trainers
Winterstein AP, University of Wisconsin, Madison, WI.

Three-dimensional Kinematic Analysis of the Effects of Ankle Prophylactic Devices on Dynamic Ankle and Subtalar Joint Motion
Harter RA, Lew DH, Smith GA, Orendurff M, Oregon State University, Corvallis, OR.

Oral Presentations

(Monday 8:00–11:30 am)

Effect of Anesthesia on Instrumented Assessment of Knee Laxity in Anterior Cruciate Ligament Deficient Subjects
Perrin DH, McCue FC, Wilson RW. University of Virginia, Charlottesville, VA 22903

Instrumented knee arthrometry is used for assessment of knee laxity in many clinical and operative settings. As with manual tests for joint instability, muscular relaxation is essential for valid assessment of laxity. This study determined the effect of nonvolitional muscle guarding on instrumented assessment of anterior knee displacement by measuring subjects before and after general or epidural anesthesia. Six anterior cruciate ligament (ACL) deficient subjects (age = 27 ± 7.5 yrs) were measured with a modified KT1000 knee arthrometer (MedMetric Corp., San Diego, CA) on the operating table immediately before and after anesthesia. Anterior displacement was measured in one millimeter increments with a KT1000 modified with a LCCB-50 strain gauge on line with a DP41-V processor through the entire range of displacement. A relative value of joint “stability” was determined for each subject as a ratio between the net applied force (maximum force – starting force) and the net displacement (maximum displacement-starting displacement). A two factor Analysis of Variance determined the effect of injury and anesthesia on stability. Results found a main effect of injury (injured ACL stability < uninjured ACL stability, F(1,5) = 12.59, p < .05), but no main effect for anesthesia (F(1,5) = 4.15, p = .097) and no injury x anesthesia interaction (F(1,5) = 1.70, p = .249). These findings suggest that nonvolitional muscle guarding does not interfere with valid assessment of anterior displacement when using the KT1000 knee arthrometer in both ACL insufficient and healthy knees. Further research is needed to determine the role of nonvolitional muscle guarding during assessment of displacement in the acutely ACL injured knee.

Hamstring Augmentation Versus Patella Tendon Reconstruction of Acute ACL Disruption: A Randomized, Prospective Study
Cavanaugh JT, Callaway GH, Nicholas SJ, Cavo C, Warren RF, Pavlov H, Wickiewicz TL. The Hospital for Special Surgery, New York, NY 10021

The long-term results of two well-accepted techniques of anterior cruciate reconstruction were compared. We randomized 95 patients with acute (<1-month-old) ACL disruption to either patella tendon (PT, bone-tendon-bone) reconstruction or semitendinosus-gracilis (STG) augmentation. Procedures were arthroscope-assisted, with two incisions. Fixation was with interference screws (PT) or staples (STG). Motion was begun immediately, with active knee extension exercises avoided for 6 weeks. Follow-up averaged 2.8 years (range 1.9 to 4.0). Eighty percent of patients filled out a detailed questionnaire and 48% of patients returned for a physical examination. Four (8%) STG and 7 (16%) of PT patients underwent reoperation. Rehabilitation milestones did not significantly differ between the groups. 57.5% of STG patients and 52% of PT patients reported a full return to the sport of injury. Thirty-seven percent of patients in each group continue to use a brace for sports. All STG and 91% of PT patients rated their knee “good” or “excellent.” On a visual scale of 0 to 100, STG patients rated the injured knee 90.1, compared to 85.4 for PT patients (p = .08). Twenty-four (48%) STG and 22 (49%) of PT patients came back for the study-specific knee evaluation. Fourteen percent of STG and 42% of PT patients reported pain when kneeling (p = .05). Twenty-one percent of STG and 9% of PT patients had a difference in Lachman grade between the injured and uninjured knees (p = .45). Thirteen percent of STG and 14% of PT patients had a knee-to-knee difference in pivot shift grade (p = .75). Extension loss averaged 0.7° in STG and 1.4° in PT patients (p = .14). Lachman excursion averaged 3.5 mm in STG and 2.4 mm in PT patients (p = .38). The KT1000 20-lb anterior displacement side-to-side difference averaged 1.3 mm in STG and 1.0 mm in PT patients (p = .57). Twenty-two percent of STG and 5% of PT patients had a greater than 3 mm side-to-side difference (p = .26). No difference between the groups could be identified with functional testing (one-leg hop test, the 4-box jump test, and one-leg press). In conclusion, STG and PT reconstructions were functionally equivalent, but STG patients were more satisfied.
The purpose of this study was to determine intratester and intertester reliability when using the Don Joy Contour Measuring Instrument (CCMI) to assess leg circumference and contour measurements for the proper fitting of the Don Joy custom knee brace. Subjects were 20 males and 20 females between the ages of 18 and 40 years who denied histories of injuries to their knees. All subjects were measured while standing upright on a table 2 feet in height with feet placed shoulder width apart. Subjects’ tested knees were flexed to 10° via a goniometer, and knee flexion was maintained with an appropriately sized heel wedge. Measurements were taken twice by clinicians 1 and 2 to determine intratester and intertester reliability of the measuring device. Measurement consisted of thigh circumference at 15 cm above the superior aspect of the patella, calf circumference at 15 cm below the superior aspect of the patella, knee width at the femoral condyles, knee joint angle, and thigh and calf contours. Thigh and calf contour measurements each consisted of five strategically placed dial readings which reflected the shape of the anterior thigh and posterior calf. Fourteen two-way ANOVAs (p < .05) were performed on the measurement data. Between trials, the F values obtained revealed no significant differences at any of the measurement sites. Between clinicians, the F values revealed no significant differences for measurements of thigh and calf circumference, knee joint angle, thigh contour at dial 5, and calf contour at dials 1, 2, and 5. Significant differences were revealed between clinicians for measurements of knee joint width, thigh contour at dials 1, 2, 3, and 4, and calf contour at dials 3
Mean values increased from clinician 1 to 2 for measurements of knee width, thigh contour at dial 3, and calf contour at dials 3 and 4, and decreased for measurements of thigh contour at dials 1, 2, and 4. Intraclass Correlations were performed to determine reliability when using the CCMI. Intratester reliabilities were high for all measurement sites, ranging from $r = .66$ to $r = .99$. Intertester reliabilities were more varied, ranging from $r = .42$ to $r = .99$, with the lowest coefficients representing the thigh contour dial measurements. The results of this study indicate that the CCMI can be used most reliably by a single properly trained clinician. This finding has important implications for use of the device in clinical situations where patients are fitted for custom braces on a regular basis.

**Effect of ACL Reconstruction and Tibial Rotation on Anterior Knee Laxity**

Guskiewicz KM, Martin DE, Perrin DH, Kahler DM, McCue FC. University of Virginia, Charlottesville, VA 22903

The anterior cruciate ligament (ACL) is considered the primary restraint to anterior translation of the tibia on the femur. Research suggests that resistance to anterior translation changes as the tibia is rotated internally and externally. This study assessed the degree to which ACL reconstruction and tibial rotation affects anterior knee laxity. Nine subjects (age = 25.2 ± 9.5 yr, ht = 175.5 ± 8.8 cm, wt = 79.8 ± 14.6 kg) with ACL lesions and functional instabilities participated in the study. Subjects were measured 1–10 days prior to surgery and 6–8 months post ACL reconstruction using the KT-1000 knee arthrometer. A mechanical leg stabilizer was used to assess anterior translation at 20° of knee flexion in three positions: internal rotation of 15° (IR), neutral (N), and external rotation of 15°(ER). Subjects were measured at 89 newtons of anterior force. Test-retest intraclass correlation coefficients (ICC) of .94, .84, and .72 were established for IR, N, and ER, respectively, on the uninjured knees. A two-factor (position X pre/post surgery) repeated measures ANOVA revealed significant main effects for rotation ($p < .01$) and pre/post surgery ($p < .01$) on the injured knees. Post hoc analysis revealed a significant decrease in postsurgical displacement at ER (Pre = 10.1 ± 2.3 mm, Post = 6.7 ± 2.3 mm, $\Delta3.4$ mm, $p < .05$) and N (Pre = 8.1 ± 1.6 mm, Post = 5.3 ± 1.6 mm, $\Delta2.8$ mm, $p < .05$), but did not reveal significant changes at IR (Pre = 6.3 ± 1.8 mm, Post = 4.4 ± 1.3 mm, $\Delta1.9$ mm, $p > .05$). These findings suggest that ACL reconstruction using a patellar tendon graft significantly decreased anterior tibial translation when the knee was tested in both external rotation and neutral. Failure to see pre to post reconstruction changes in IR suggests that secondary restraints to anterior translation may interfere with clinical laxity tests in this position. Fixing the tibia in an externally rotated position may decrease the effect of secondary restraints and improve sensitivity in testing for ACL laxity.

**Effect of Running on Anterior Knee Laxity in Collegiate-level Female Athletes After ACL Reconstruction**

Sailors ME, Keskula DR, Perrin DH. University of Virginia, Charlottesville, VA 22903

The purpose of this study was to examine changes in anterior knee laxity after agility running exercise. Subjects ($n = 9$) were collegiate-level female athletes (age = 20.1 ± 1.5 yrs, ht = 171.7 ± 10.4 cm, wt = 65.3 ± 8.6 kg) with anterior cruciate ligament reconstruction (ACLR) (central 1/3 patella tendon graft, postop range 9 to 52 months, mean = 23.9 months). Anterior laxity measurements were made at 20 and 90° flexion with a KT-1000 knee ligament arthrometer (MEDmetric, San Diego, CA) modified with a LCCB-50 strain gauge and recorded in millimeters displacement. Data were collected prior to and immediately after a 30-minute agility exercise course and were analyzed with an analysis of variance (ANOVA) with repeated measures on all factors ($p < .05$). Results showed no statistical differences between the ACLR knee (20° pre-exercise mean = 5.7 ± 2.5 mm, post-exercise mean = 6.5 ± 2.9 mm; 90° pre-exercise mean = 4.2 ± 1.3 mm; post-exercise mean = 5.0 ± 2.2 mm) and the "normal" knee (20° pre-exercise mean = 4.4 ± 2.8 mm; post-exercise mean = 5.7 ± 3.0 mm; 90° pre-exercise mean = 3.7 ± 1.5 mm; postexercise mean = 4.9 ± 1.8 mm). The authors conclude that the central 1/3 patella tendon graft reconstruction procedure performs comparably to the normal knee when stressed with agility-type running exercise.

**Active and Passive Proprioceptive Characteristics Following Allograft and Autograft Anterior Cruciate Ligament Reconstruction**

Conley KM, Lephart SM. University of Pittsburgh, Pittsburgh, PA 15260

The treatment of injuries to the anterior cruciate ligament (ACL) remains controversial. Harvesting of the central-third patellar tendon with the autograft technique is thought by some to disrupt afferent input from intact mechanoreceptors within the tendon, thus compromising knee joint proprioception and prompting many to advocate the less traumatic allograft procedure. The purpose of this present investigation was to determine if there exists a proprioceptive benefit to either the allograft or autograft technique for ACL reconstruction of the knee. Active and passive proprioception were assessed by measuring reproduction of active positioning on the Cybex II Isokinetic Dynamometer, and threshold to detection of passive motion on a proprioception testing device, respectively, in 19 active subjects who were 12 to 48 months postreconstruction following patellar tendon autograft ($n = 6$) or patellar tendon autograft ($n = 13$) procedures. Two one-way analyses of variance (ANOVA) revealed no significant differences in proprioception measurements between the allograft and autograft groups for ei-
ther of the test conditions. Additionally, no significant differences were observed between the reconstructed knee and the contralateral normal knee for either group on any of the tests performed. These results indicate the autograft technique does not significantly compromise proprioception more than the allograft technique; and the choice of allograft over autograft on the basis of this claim is unsubstantiated.

The Effects of Cooling the Ankle, the Triceps Surae, or Both on Functional Agility
Knight KL, Ingersoll CD, Trowbridge CA, Connolley TA, Cordova LL, Hyink LL, Welch SM. Indiana State University, Terre Haute, IN 47809

In a previous investigation from our laboratory, cooling the foot and ankle did not affect functional agility. Since that study involved only joint cooling, it has not been established whether cooling muscles, or both joints and muscles, will affect agility. The purpose of this study was to determine if cooling the foot and ankle, the triceps surae, or both affected performance of three agility tests: the carioca maneuver, cocontraction test, and a shuttle run. Nineteen male volunteers were tested during four different treatment sessions following an orientation session. The treatments were a 20-min ice bag treatment to the dominant foot and ankle, ice bag treatment to the triceps surae, ice bag treatment to both the ankle and foot and the triceps surae, and a 20-minute rest period. Following each treatment, subjects performed three trials of each agility test, with 30 seconds between each trial, and 1 minute between each test. Agility test order was determined by a balanced latin square. A MANOVA with repeated measures was used to determine if differences in the agility times existed between the different treatments and if ordinal position of the treatment sessions affected the scores. Mean agility scores were not different for the treatments (F(9,127) = .68, p = .73). There was an ordinal position effect (F(9,171) = 2.09, p = .03). Cocontraction scores im-
proved each session (F(3,72) = 5.24, p = .002). We concluded that cold treatments may be applied to either the foot and ankle, the triceps surae, or both without negatively affecting functional agility.

The Effects of Sensory Information on the Perception of Cold-induced Pain
Streator SS, Ingersoll CD, Knight KL. Indiana State University, Terre Haute, IN 47809

Specific terms are often used to describe the pain athletes will experience during cold treatments. It is not clear whether providing athletes with such sensory information will decrease their perceived pain during the treatments. The purpose of this study was to determine if subjects’ perception of cold-induced pain can be influenced by the type of information provided before treatment, such as “pain will be excruciating” or “pain will be minimal.” Ninety Division I intercollegiate athletes were randomly assigned to one of five groups: traditional terms (cold, burning, aching, numbness); high level (freezing, crushing, pounding, heavy), medium level (cold, gnawing, pulsing, achng), or low level (cool, pinching, flickering, dull) terms from the McGill Pain Questionnaire (MPQ); or no terms at all (control). The four groups that received a set of terms were told that they would feel during cold immersion, although it doesn’t seem to matter what terms are used.

Effect of Ibuprofen on Pain, Decreased Range of Motion, and Decreased Strength Associated With Delayed Onset Muscle Soreness of the Elbow
Grossman JM, Arnold BL, Perrin DH, Kahler DM. University of Virginia, Charlottesville, VA 22903

This study examined the effectiveness of ibuprofen in treating the physiological characteristics of delayed onset muscle soreness (DOMS) of the elbow flexors when taken prior to and following exercise. Twenty college-age subjects (age = 22.1, ht = 172.5 cm, wt = 66.8 kg) were randomly assigned on a double-blind basis to a group receiving either ibuprofen or an identical placebo. Ingestion of 2400 mg/day ibuprofen or a placebo q.i.d. began at 0 hours and was continued for 5 days. At 24 hours, the subjects performed intense eccentric exercise of the elbow flexors to elicit DOMS. Pretest values of concentric and eccentric peak torque production against an isokinetic resistance at 30°/sec and range of motion at the elbow were measured immediately prior to eccentric exercise. Post-testing took place 72 hrs and 120 hrs after the ingestion of medication to determine concentric and eccentric peak torque, elbow range of motion, and subjective soreness felt in the elbow flexors. Analysis via a repeated measures ANOVA indicated no significant group-by-time interaction for concentric peak torque, eccentric peak torque, or pain. A significant interaction was revealed for range of motion (p = .007). A Tukey post hoc test indicated a significant decrease within each groups’ ROM from 24 to 72 hrs, but there were no differences between the groups’ ROM at either the pretest or post-test measurements. There was a significant main effect across time (p < .001) for all four test parameters, but because the physiologic characteristics of DOMS vary in intensity over time, the main effect was expected by design of the study. It was concluded that the use of 2400 mg/day ibuprofen prior to and following intense eccentric exercise was no more effective than a placebo in the treatment of DOMS of the elbow flexors.

The Effect of Snorkel Use on Back Rotations
Norton CO, Self BP, Bagle, AM. The Orthopedic Specialty Hospital, Salt Lake City, UT 84107

Introduction: Aquatic therapy is often prescribed for patients with back pain. The unloading of the body due to the buoyancy of the water is thought to reduce the compressive loads on the spinal column, particularly on the intervertebral discs. Torsional stresses, however, may also aggravate back conditions. Rotational stresses on the back during the breathing cycle may contribute to back pain during freestyle swimming, prompting aquatic therapists to recommend using a snorkel to alleviate this problem. The present study will quantify the amount of back rotation with and without a snorkel for a normal population and for spine rehabilitation patients. Methods: A cinematic analysis was performed on five normal swimmers and five aquatic therapy patients. Three video cameras were hung from the truss structure above the pool at the Orthopedic Specialty Hospital (TOSH). Black kinematic markers were placed on the backs of the subjects. Three pairs of targets were placed along the same horizontal plane at the levels T3, T12, and L5. Each subject performed three trials freestyle swimming with and without the snorkel. Trials were randomized and sufficient rest was given between tests. Each subject completed a subjective evaluation of their swimming ability, pain levels, and snorkel use comfort level. Using the Peak Motion Analysis system, lines were constructed which con-
nected each pair of markers. The lines were then projected onto the horizontal plane, and relative twist angles calculated for each target pair. These measurements reflected the amount of rotation occurring in the thoracic and lumbar spine. A Student’s t-test was used to compare back rotation when swimming with and without the snorkel. Results and Discussion: The back rotation during snorkel use tended to be less than that achieved when swimming without the snorkel. While desired statistical significance (p < .05) was not achieved, it is believed that this outcome is clinically relevant. The majority of the patients strongly preferred using a snorkel while swimming. This is thought to be due to the decreased metabolic demand associated with this mode of swimming. The study shows that the use of a snorkel during freestyle swimming decreases back rotations and back pain; therefore, at this clinic the standard protocol for back patients included the use of a mask and snorkel during freestyle swimming.

The Effect of Preload on Concentric and Eccentric Isokinetic Torque Values of the Shoulder Rotators
Roorda BL, Dolan MG, Bibi KW, Harris DH. Canisius College, Buffalo, NY 14208-1098

Contemporary isokinetic dynamometers allow for the customization of exercise and testing protocols. Preload is the force that must be overcome before the movement is initiated. The purpose of this study was to examine the effect of preload on concentric (CON) and eccentric (ECC) torque values of the shoulder internal (INT) and external (EXT) rotators. Nineteen volunteers (age 23.6 ± 4.4 yr, ht 172.0 ± 7.7 cm, wt = 67.6 ± 11.0 kg) were assessed on a Kin-Com® isokinetic dynamometer. A range of motion 85°-0° was selected for this study. Subjects reported for two test sessions, a preload of 0 or 50 Newtons (N) was randomly assigned. Each subject was seated and stabilized in an upper extremity chair and performed a standardized warm-up consisting of three submaximal and one maximal CON and ECC contractions. The subject’s dominant shoulder was gravity corrected and tested at 90°/s for internal and external rotation, concentrically and eccentrically. Correlated t-tests were used to compare concentric and eccentric torque values, for internal and external rotation, at 0 and 50 N. The results are shown in the Table above.

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The joint line of the knee was aligned with the axis of the dynamometer, and velcro straps were placed across the hips, thigh, and ankle for stabilization. Prior to testing, subjects performed a 5-minute warm-up on a stationary cycle. At each velocity, subjects performed two submaximal and one maximal concentric and eccentric contraction for familiarization followed by three alternating concentric and eccentric maximal contractions. A 1-minute rest was given between the familiarization contractions and the maximal contractions. Additionally, a 1-minute rest was given between the maximal contractions and the next set of familiarization contractions. For data analysis, peak torque (PT) and average torque (AT) were collected from the three maximal contractions of the first (test 1) and ninth (test 2) set of contractions. PT was identified as the highest value on the mean curve of the three maximal contractions, and AT was identified as the mean torque of the mean curve. A separate repeated measures ANOVA with two crossed within factors (type of contraction by test) was performed for PT and AT. The results demonstrated no significant differences for the interaction or for the test main effect for either PT or AT. As expected, there was a significant difference for the contraction main effect for PT (F = 23.09; df = 1,10) and AT (F = 35.23; df = 1,10) at p < .01. These data suggest that with appropriate rest intervals, as many as 96 submaximal and maximal concentric and eccentric contractions can be performed in one test session without fatigue affecting peak and average torque measures.

Effect of Repeated Isokinetic Concentric and Eccentric Contractions on Quadriceps Muscle Fatigue
Arnold BA, Perrin DH. University of Virginia, Charlottesville, VA 22903

Eleven university females (age = 20.8 ± 1.3 yr, wt = 61.7 ± 7.7 kg, ht = 162.3 ± 6.6 cm) performed concentric and eccentric isokinetic contractions at 9 different velocities on the Kin-Com (Chattecx Corp, Hixon, TN) isokinetic dynamometer. None of the subjects weight trained on a regular basis, and all were injury-free. Subjects were tested at eight velocities of 25, 50, 75, 100, 125, 150, 175, and 200°/s in a counterbalanced order with the original velocity repeated for the ninth test velocity.
Effects of External Compression on Isokinetic Muscular Endurance of the Quadriceps and Hamstring Muscles
Joyce CJ, Bernier JN, Perrin DH. University of Virginia, Charlottesville, VA 22903

It is a common practice to apply compression wraps to athletes returning from injuries to the thigh musculature. It has been hypothesized that compression could decrease muscular performance. The purpose of this study was to determine if external compression would cause a decrease in the isokinetic muscular endurance of the quadriceps and hamstring muscle groups. Fifteen college-age males (age = 21.5 ± 2.8 yr, ht = 179.6 ± 4.9 cm, wt = 78.5 ± 8.0 kg) were tested on the Cybex II dynamometer under two conditions: external compression applied to the thigh and without external compression applied to the thigh. Subjects were randomly assigned to have either the external pressure applied or not applied during the first test. Each subject returned at least 72 hours later to complete the second test, under the opposite condition. External compression was applied with a lower extremity blood pressure cuff inflated at a predetermined clinically standardized pressure of 30 mm Hg. The subjects performed an isokinetic endurance test consisting of 30 maximal repetition at 180°/s under both conditions. Total work was computed by the Cybex Data Reduction Computer. Paired t-tests showed no statistical differences (p > .05) between the mean total work, work over the first five repetitions, and work over the first five repetitions between the two conditions for the quadriceps and the hamstring muscle groups. These results indicate that external compression applied to the thigh at 30 mm Hg caused no significant decrease in the isokinetic muscular endurance of the quadriceps or hamstring when using work over 30 maximal repetitions as the measurement criterion. Further research is indicated to determine if external compression could influence other aspects of muscular performance.

Case Reports
(Monday 1:30-3:10 pm)

Chest Pain in a Collegiate Football Player
Horsmon G, Volk CP, McFarland EG. The Johns Hopkins University, Baltimore, MD 21218

A 21-year-old collegiate tight end came to the sidelines complaining of shortness of breath. Three plays earlier, he had sustained a blow to his right chest wall while catching a pass. He presented with right chest wall pain and of "having the breath knocked out of me." He had no previous history of asthma, pulmonary processes or cardiovascular disease. On physical examination, he was in obvious discomfort, with splinting toward the right side. He was alert and oriented, but pale. His respirations were shallow and rapid with a rate of 40. His pulse was 94 beats per minute with a regular rate and rhythm. He had diffuse, right-sided chest-wall discomfort to palpation. After a few minutes his shortness of breath worsened, but crowd noise prevented auscultation of his lungs. The differential diagnosis initially included exertional dyspnea, chest wall contusion, rib fracture, hypertension syndrome, celiac plexus contusion or occult cardiovascular disease. He was taken to the training room for examination.

Chest Pain in a Collegiate Soccer Player
Savaloj KM, Hafner RJ, Baisley MJ. Saint John's University, Collegeville, MN 56321

The patient is an 18-year-old white male intercollegiate soccer player who presented to the University Health Center on October 18, 1993 with complaints of left posterior pleuritic chest pain and progressive dyspnea. On October 16, 1993, while competing in a varsity soccer game, he slipped on the grass and landed on his back. He noted no immediate pain and was able to finish the game. Postgame evaluation by the attending athletic trainer noted only positive mild muscle soreness. Over the next 36 hours the athlete noted some increase in his pain and increasing shortness of breath. By the time he presented to the clinic he had marked dyspnea on exertion and mild orthopnea. Differential diagnosis is lengthy and includes a variety of muscle strains, bony injuries, and injuries to the organs of the chest cavity. Physical examination was normal with the exception of mild tachypnea and total absence of breath sounds on auscultation of the left chest.

Hand Pain in a Collegiate Gymnast
Cody K, Hutchinson MR, Kinney R. University of Illinois at Chicago, Chicago, IL 60612-7342

History: An 18-year-old male collegiate gymnast made an attempt to dismount the pommel horse when the ulnar three fingers of his nondominant left hand slipped off the edge leaving only his thumb and index finger to maintain his weight. His index finger sustained a radially directed force and he immediately had severe pain and was unable to continue.

Physical Examination: Examination revealed swelling and pain of the patients left (nondominant) index finger primarily at the ulnar side of his metacarpophalangeal joint. He had normal sensation and circulation but limited flexion and extension secondary to pain. He was able to actively resist flexion and extension. Radial deviation of his index finger exacerbated his pain. Differential Diagnosis: 1) MCP Dislocation/Subluxation; 2) Ulnar Collateral Ligament Tear; 3) Ulnar Collateral Ligament Avulsion; 4) Fracture of the proximal phalanx or distal metacarpal.

Thoracic Pain in a Collegiate Baseball Player

A 19-year-old while left-handed collegiate baseball pitcher
developed right-sided chest pain 1 week prior to presentation. The pain originally appeared while bench pressing but was exacerbated by pitching. He was treated with ice and anti-inflammatory medications. Plain x-rays were negative. However, his pain persisted and a bone scan was pending when he developed a fever of 102°F immediately preceding a game. Only on careful questioning did he admit to some cough and shortness of breath for two days. Physical examination showed he was slightly ill, but in no acute distress. His temperature was 102°F, BP 120/70, P 110, and RR 24. There were no rash or nodes. On lung examination there was no dullness to percussion, but there were decreased breath sounds in the right lower lobe where he splinted with deep inspirations. There were no rubs heard. The heart was tachycardic without murmur, his abdomen was benign without HSM or tenderness. The differential diagnosis included a rib stress fracture, pneumonia, pleurisy, pulmonary embolus, and hepatitis. A chest x-ray showed normal cardiac silhouette with right pleural effusion and possible interstitial infiltrate. Blood tests showed a CBC of WBC 6100 W/77 polys, 6 bands, 6 lymphs, and Hct. 42%. Liver function tests were normal. His HIV was negative and his chemistry profile was normal.

Oral Presentations

(Monday 3:30–5:00 pm)

Proprioception of the Shoulder Joint in Normal, Unstable, and Postcapsulolabral Reconstructed Individuals

Borsa PA, Lephart SM, Warner JP, Fu FH. University of Pittsburgh, Pittsburgh, PA 15261

The purpose of these studies was to investigate proprioception by measuring kinesthesia and joint position sense of the shoulder in groups of normal, unstable, and postcapsulolabral reconstructed individuals. Using a specially designed proprioception testing device (PTD), kinesthesia was measured as the threshold to detection of passive motion (TTDPM), and joint position sense was measured by reproduction of passive positioning (RPP) in normal, nonsurgical unstable, and surgical joints. In the shoulder TTDPM of internal and external rotatory motion was measured from a starting position of neutral rotation and 30° external rotation. Subjects included: 30 normal college age (NS), 40 anterior chronic, unilateral, traumatic recurrent unstable (US), and 20 chronic, unilateral, traumatic, recurrent unstable subjects who underwent capsulolabral reconstructive surgery at least 6 months prior (RS). One-way analysis of variance was used to determine significant mean differences between dominant or involved shoulders and nondominant or uninvolved shoulders under the four test conditions for both TTDPM and RPP. The results revealed no significant differences (p < .05) in TTDPM between dominant and nondominant shoulders in the NS group for any test condition with the mean range of angular displacement from 1.4 ± 0.1° to 2.2 ± 0.2°. Significant differences (p < .05) were revealed in the US group between the unstable and uninvolved contralateral shoulder for TTDPM (unstable, 2.0 ± 0.2° to 2.8 ± 0.3°; uninvolved, 1.7 ± 0.2° to 1.8 ± 0.2°) and for RPP (unstable, 2.5 ± 0.3° to 4.1 ± 1.0°; uninvolved, 1.4 ± 0.9° to 3.3 ± 0.4°). There were no significant mean differences revealed between the surgical and uninvolved contralateral shoulder in the RS group for TTDPM (surgical, 1.5 ± 0.2° to 2.2 ± 0.5°; uninvolved, 1.5 ± 0.2 to 2.2 ± 0.6°) and RPP (surgical, 2.3 ± 0.4 to 2.7 ± 0.7; uninvolved, 2.0 ± 0.5° to 3.5 ± 0.3). It is concluded that proprioception of the shoulder joint is not related to shoulder dominance, diminishes following capsuloligamentous injury, and restored following capsulolabral reconstruction for shoulder instability. This series of investigations provides the first comprehensive assessment of shoulder proprioception in normal, unstable, and postreconstructed groups.
Comparision of Subjective
and Objective Assessment of
Balance
Lebsack D, Perrin DH. University of
Virginia, Charlottesville, VA 22903

Traditional balance performance
measures have been based on subject-
itive, static measures. These mea-
surements are easily administered
and are applicable to most clinical
situations. More recently, balance
performance has been measured ob-
jectively during static and dynamic
conditions using a force platform.
This type of assessment is thought to
be a more accurate and thorough
means of examining balance perfor-
ance. The Chattanooga Group, Inc
has developed a system that is de-
gined to measure postural sway
during static and dynamic condi-
tions. The purpose was to determine
the relationship between a subjective
assessment of balance performance
and an objective assessment of bal-
ce using the Chattecx Balance Sys-
tem. Thirty females (mean age = 40.0
± 24 yr, ht = 161.6 ± 7.7 cm, wt =
66.3 ± 14.9 kg) were asked to per-
form subjective and objective bal-
ce performance tasks. The sub-
jective balance assessment consisted of
the sharpened Romberg (SR) and
one-legged stance test (OLST), dur-
ing which the subjects were asked to
balance under the specified criteria
with their eyes open and then closed.
The OLST was performed on the
dominant and nondominant legs.
Data for both subjective measures
were performed on the dominant and
nondominant legs. Pearson correla-
tion coefficients were calculated at the
p < .05 level for each of the sub-
jective and objective comparisons.
The following objective methods of
balance assessment correlated the best with the subjective methods of
balance assessment (SR and OLST).
The SR test (eyes closed) with the
dominant static leg test (eyes closed)
(r ± .48). The dominant OLST (eyes
open) with the nondominant leg test
(eyes open) (r = .71). The domi-
nant OLST (eyes closed) with the
dominant static test (eyes closed) (r
= .49). The nondominant OLST
(eyes open) with the nondominant
dynamic test (eyes open) (r = .70).
The nondominant OLST (eyes closed)
with the nondominant static test
(eyes closed) (r = .50). These find-
ings suggest that subjective methods of
balance assessment correlate moderat-
ely well with objective
methods of balance assessment us-
ing the Chattecx balance system.
Further research should examine
the reliability and validity of both
subjective and objective assess-
ments of balance in a broad spec-
trum of young, old, healthy, and dis-
cabled populations.

Intertester Reliability of
Assessing Postural Sway
Using the Chattecx Balance
System
Mattacola CG, Lebsack DA, Perrin
DH. University of Virginia,
Charlottesville, VA 22903

This study examined intertester re-
liaibility of dynamic and static bal-
ce using the Chattecx Balance Sys-
tem (Chattecx Corporation, Hixson,
TN). Ten females and two males
(mean age = 24.7 ± 3.3 yr, wt = 62.2
± 7.5 kg, ht = 164.8 ± 7.1 cm) vol-
unteered and gave informed consent
to participate in the study. Subjects
were randomly assigned to two
testers and completed ten, 10-second
preprogrammed double and single leg
protocols. Balance was measured as
postural sway in centimeters by the
Chattecx Balance System. Static bal-
cence consisted of the platform re-
maining stable while dynamic bal-
cence consisted of the platform
moving up and down during testing.
The protocols were double leg static
eyes open (DLSDEO, X = .28 cm),
double leg static eyes closed
(DLSDEC, X = 3.7 cm), double leg
dynamic eyes open (DLDEO, X =
.86 cm), double leg dynamic eyes
closed (DLDEC, X = 1.72 cm), sin-
gle leg static dominant eyes open
(SLSDEO, X = .99 cm), single leg
static dominant eyes closed
(SLSDEC, X = 1.70 cm), single leg static
nondominant eyes open (SLSNEO,
X = .65 cm), single leg static nondom-
nant eyes closed (SLSNEC, X =
1.48 cm), single leg dynamic domi-
nant eyes open (SLDDEO, X = .99
cm) and single leg dynamic nondom-
nant eyes open (SLDNEO, X = .91
cm). The mean values of postural
sway ranged from .28 to 1.72 cm for
double leg stance measures and from
.65 to 1.70 cm for the single leg
stance measure. Intraclass corre-
lations (ICCs) (2,1) ranged from poor
to excellent (R = .06–.90). The ICCs
and standard error of measurement
(SEM) for the 10 trials were DLSDEO
= .75 (.06), DLSDEC = .96 (.26),
DLDEO = .78 (.18), DLDEC = .84
(.27), SLSDEO = .57 (.14), SLSDEC
= .57 (.34), SLSNEO = .41 (.21),
SLSNEC = .49 (.32), SLDDEO =
.63 (.32), SLDNEO = .90 (.06). The
results of the study suggest variabil-
ity exists between subjects and/or
 testers between trials. The expan-
sive range of reliability suggests that
further research should determine
both intratester and intertester reli-
bility of a variety of protocols for
assessment of static and dynamic
balance.

The Effects of Ankle Bracing
on Postural Sway
Kinsey SJ, Ingersoll CD, Knight
KL. Indiana State University, Terre
Haute, IN 47809

Ankle braces are thought to pro-
tect the ankle by providing mechan-
ic support of the joint and enhancing
proprioceptive input. Measurement
of postural sway provides a reason-
ably well-controlled evaluation of
proprioceptive input at the ankle. The purpose of this study was to determine the effects of three selected ankle braces on postural sway. Twenty-four male volunteers (age = 19 to 27 yrs) without ankle injuries served as subjects. Postural sway variables were measured during a one-legged modified Romberg test with six variations. The six tests were used to systematically conflict or eliminate the three sensory modalities that control posture: visual input, vestibular input, and proprioceptive input. The bracing conditions used were the Active Ankle Trainer, AirCast Sport Stirrup, the McDavid lace-up brace, and no brace (control). Each subject performed three 16-s trials of each Romberg variation for each brace condition. Center of pressure transmitted through the bottom of the foot was monitored during each trial and transformed into total, anterior-posterior (AP), and medial-lateral (ML) sway. Sway was increased (for AP, *p* = .03; ML, *p* = .03) during brace wearing when all sensory modalities were functioning normally, but not during the five conditions when visual, vestibular, and/or proprioceptive inputs were eliminated or conflicted. We concluded that ankle braces inhibit proprioceptive input at the ankle joint. The proprioceptive role of ankle bracing in injury prevention may be inhibitory rather than facilitory as previously suggested.

The Effects of Interferential Current on Perceived Pain and Serum Cortisol in a Delayed Onset Muscle Soreness Model
Schmitz RJ, Martin DE, Perrin DH, Iranmanesh A, Rogol AD. University of Virginia, Charlottesville, VA 22903

Interferential current (IFC) is commonly used for pain control. It has been proposed that low frequency, high intensity electrical current (duration = 200-500 μsec; 10 bps) may facilitate the release of endogenous opiates from the anterior pituitary. Beta-endorphins share the prohormone proopio-melanocortin with adrenocorticotropic hormone (ACTH). ACTH is responsible for the release of cortisol into the blood. Cortisol has thus been used as a marker of the release of these substances. The purpose of this study was to assess the effect of IFC on perceived pain (PN) and serum cortisol (SC) using a delayed onset muscle soreness (DOMS) model. Ten subjects (age = 22.8 ± 2.5 years; ht = 107.9 ± 7.5 cm; wt = 64.8 ± 10.4 kg) had DOMS induced in the elbow flexors. Forty-eight hours post exercise, subjects were transported to a clinical research facility where they were randomly assigned to receive high (100 bps) frequency (HI) or low (10 bps) frequency (LO) IFC. IFC treatments lasted for 30 minutes. Blood samples were drawn from an antecubital venous catheter at 5-minute intervals prior to, during, and for 30 minutes post treatment. Talag PN scores were obtained prior to insertion of the catheter and three times post treatment. PN scores were analyzed with analysis of variance with repeated measures. PN scores were not significantly different [F(1,8) = 4.556, *p* = .0651] between LO and HI, however PN scores decreased significantly (4.13 cm ± .96 pre to 3.00 cm ± 0.91 post) in both groups across time [F(3,24 = 25.561, *p* = .0001]. For serum cortisol levels, the area under the curve for treatment (T) (samples 1-7) and posttreatment (samples 8-14) was calculated and difference scores obtained by subtracting T from PT were analyzed via regression analysis. There was no difference between treatment groups [R² = .206; F(1,8) = 2.07, *p* = .1882] on SC (ΔHI = −19.14 μg/dL/65 min ± 44.21; ΔLO = 24.5 μg/dL/65 min ± 51.43). These data indicate that a 30 minute HI or LO IFC treatment lowered Talag pain scores, but failed to produce a significant difference in cortisol levels between treatment groups. Further study is needed to determine the mechanism of the pain modulation observed in this study.
Assessment of In Vivo Meniscal Kinematics in the Normal Knee By Magnetic Resonance Imaging

Knee meniscal motion has been assessed by magnetic resonance imaging (MRI) in cadaveric knees. The objective of this study was to determine in vivo meniscal dynamics in the normal knee with the use of MRI. Fifteen knees (8 males, 7 females) of normal volunteers (21 to 31 years of age) who denied previous history of knee pain or injury were examined by MRI. Sagittal spin echo T1 weighted (500/16) images were obtained with the knee held by plexiglass splints at 0, 30, 60, and 90° of unloaded passive knee flexion. A 1.5 Tesla Magnetic (GE Signa System) and dual 3-inch surface coils were used. Interleaved 3 mm slices using a field of view of 16 cm were obtained. Using the MRI computer console, medial and lateral meniscal anteroposterior excursion was measured from the respective midfemoral condyle sagittal image. All knees displayed normal soft tissue and bony anatomy on MRI. The mean medial meniscal excursion was 5.97 ± 2.19 mm and the mean lateral meniscal excursion was 3.33 ± 2.50 mm. The ratio of lateral to medial excursion was 1:1.8 and was statistically significant (p < .005 by paired t-test analysis). The mean posterior horn excursion was significantly less (p = .04) than the mean anterior horn excursion for the medial meniscus, but not significantly different for the lateral meniscus (p = .04). The ratio of mean posterior to anterior horn excursion was 1:2.2 medially and 1:1.2 laterally. An ANOVA with repeated measures revealed no significant differences (p = .97) in left to right medial or lateral meniscal motion. The menisci demonstrated contact with both articular surfaces throughout the range of motion in all knees. This study indicated that MRI may be used as a noninvasive method to accurately depict meniscal motion. Limitations of this model included the nonweight bearing mode of the knees studied due to restrictions of presently available MRI technology. Differences of these results to that of cadaveric data may be explained by the in vivo nature of this model and the limitation of knee flexion to 90° by the MRI gantry, particularly in regards to the lateral meniscus. Possible clinical uses of this model include assessment of meniscal dynamics after meniscal injury, repair, or transplantation.

Poster Presentations

Authors present (Saturday, 10:00-11:30; posters to be displayed Saturday, Sunday, and Monday)

Effects of Computer-Assisted Instruction on Both Student Learning and Student Perception of Instructional Methods
Wright W, Thomas B, Smith M. The University of Alabama, Tuscaloosa, AL 35487-0312

The primary purpose of this study was to compare the impact of computer-assisted instructional supplementation with video (CAI/V) to traditional instructional (TI) on student learning. The specific comparisons were: a) student acquisition of instructional material was compared between subjects in the CAI/V group and those in the TI group; and b) student retention of instructional material was compared between subjects in the CAI/V group and those in the TI group. The secondary purpose was to ascertain whether students preferred a particular method of instruction. This was accomplished by comparing instructional preference responses of the subjects in the CAI/V group to those of the subjects in the TI group. The 43 subjects consisted of undergraduate students enrolled in one of two sections of an introductory athletic training course who were randomly assigned to either the CAI/V group (20) or the TI group. (23) Subjects participated in three testing and two treatment sessions, for a total of five class meetings. Statistical analyses were conducted using repeated measures analysis of variance, with group as the independent variable and scores from each testing time as three separate dependent variables. Each of the scores for the pretest, posttest, and retest was simultaneously analyzed according to the group assignment. The Wilkes lambda was used to test the null hypotheses. Results of the analysis indicated that the null hypotheses could not be rejected. The overall test was nonsignificant [Wilkes lambda = .92, p > .05]. After the Wilkes lambda statistic was reported, the procedure yielded separate F values for average test scores on the three occasions as well as a breakdown by group assignment. The breakdown suggested a significant difference existed among the pretest, posttest, and retest means, [F(2,82) = 6.95, p < .01]; however, when these means were further classified according to group assignments, there was no significant difference. Student preference as to method of instruction was statistically analyzed using a t-test to compare differences between CAI/V and TI groups. A significant difference existed between the CAI/V and TI group, favoring the CAI/V method of instruction (p < .05).

Comparison of the Status and Roles of Certified Athletic Trainers in NCAA Institutions
Lawton RJ, Johnson MB, Moore R, Horbeck F. San Diego State University, San Diego, CA 92182

The status and roles of certified athletic trainers in NCAA institutions vary greatly. Limited research has indicated variance in athletic trainers' salaries, budgets, staff, benefits, and duties in NCAA member institutions. No research compares these categories with NCAA division and geographical region of the United States. This study surveyed head athletic trainers in NCAA member institutions in Divisions IA, IAA, IAAA, II, and III, and four geographical regions of the country. Three hundred fifty (70%) questionnaires were returned. All institutions sponsored men's and women's sports. Divisions IAAA, II, and III were equally divided into football and
nonfootball institutions. Categories assessed were head, assistant, and graduate assistant athletic trainers’ salaries, spending budget, head athletic trainer’s tenure at the institution, continuing education budget, organization and staff, education and certifications, teaching status, duties, and head trainers’ benefits. The data indicate most categories have a direct relationship with the institution’s NCAA division. Geographical region was a significant factor in some categories, but with no direct relationship. Salaries reported were higher than previous studies: $34,973 for head athletic trainers and $28,971 for assistant trainers. Four factors were not significant in determining head athletic trainers’ salaries: education, teaching status, professional certifications, and sponsorship of intercollegiate football. These findings are important because they affect both the trainer’s workload and hours spent on the job. Acquiring a master’s degree and additional certifications may increase the trainer’s competence, but does not result in increased salaries. Further research is needed to aid in the determination of baseline salaries for college athletic trainers. This research will help advance the profession by allowing athletic administrators to formulate salary levels and duties for athletic trainers.

Athletic Training and Sport Psychology: Skills Used in Athletic Training
Larson GA. Boston University, Boston, MA 02215

The purpose of this study was to investigate the application, attitudes, and beliefs of a variety of psychological strategies and techniques used by athletic trainers in the treatment and rehabilitation of athletic injuries. The Athletic Training and Sport Psychology Questionnaire (ATSPQ) was adapted from a questionnaire developed by Wiese, Weiss, & Yukelson (1991); and from Brewer, Van Raalte, & Linder (1991). There was a 50% return rate of the ATSPQ. Results revealed that 47% of the athletic trainers responding believe that every injured athlete suffers psychological as well as physiological trauma. Also, athletic trainers in this study often encounter the conditions of stress/anxiety, anger, lack of treatment compliance, and depression in association with athletic injuries. Of the 482 athletic trainers surveyed, 24% reported that they have referred an athlete for counseling for situations related to their injury. The top 5 psychological skills used by athletic trainers in assisting injured athletes were identified. Athletic trainers identified six traits for athletes who successfully cope with an athletic injury. Traits of athletes who do not cope with their injury were also identified. This study concludes that future training of athletic trainers should include the psychological aspect of injury treatment and rehabilitation specifically designed for athletic trainers.

Influence of the Strength Shoe and Three Plyometric Drills on Peak Torque, 40-yard Dash, and Vertical Jump of High School Football Players
Ramsey JK, Kimura I, Sitler M, Kendrick Z. Temple University, Philadelphia, PA 19122

The purpose of this study was to investigate the influence the Strength Shoe and three plyometric drills had on concentric and eccentric peak torque values of the triceps surae, 40-yard dash, and vertical jump height. Subjects were 30 high school football players who were randomly divided into three groups of 10. All subjects participated in their regular football practice regimen. Two of the groups performed three additional plyometric drills. The first group, exercising in the Strength Shoe (EXSS), wore the Strength Shoe for these drills. The second group, Exercising in Conventional Shoes (EXCS), wore their own...
The most common injury to the ankle is a sprain of the lateral ligaments. Ankle bracing is routinely used to maintain the inversion range of motion (ROM) within normal limits. Since bracing also limits dorsiflexion, it potentially inhibits the ankle’s contribution to energy absorption during landing. The purpose of this study was to evaluate the effects of ankle braces and landing style on vertical ground reaction forces (GRF) in drop landings. Four male and six female college students volunteered as subjects. The ankle bracing conditions were unsupported, taped, Swede-O, AirCast, and Active Ankle. In each braced condition, subjects performed 5 trials each of soft and hard landings. Dorsiflexion was measured before and after a self-paced 10-minute run. Subjects were suspended using an overhand grip. The lateral malleolus was 60 cm above the force platform. Subjects landed on both feet, with only the right foot landing on the force platform (sampling rate = 1000 Hz). GRF variables of maximum forefoot (F1) and rearfoot (F2) forces and times to maximum forefoot (T1) and rearfoot (T2) forces were quantified. Data were analyzed using a repeated measures ANOVA (α ≤ .05). Dorsiflexion ROM was significantly decreased with ankle support. F1 and F2 were not significantly different across bracing conditions, although there were significant differences in T1 and T2. Conversely, both F1 and F2 were significantly higher with hard landings, but T1 and T2 were relatively consistent. The differences in temporal variables suggest that shock absorption is altered with ankle bracing. (Braces provided by Swede-O, AirCast, and Cramer.)

**Effects of Position and Velocity on the Eccentric Peak Torque Values of the Shoulder Rotators**


The purpose of this study was to investigate the effect shoulder joint position and velocity had on eccentric peak torque values of the shoulder internal and external rotators when tested on the Biodex B-2000. The subjects were 34 college-age males with no previous shoulder pathology. Subjects’ right shoulders were tested in the frontal plane, first in a modified abducted position (80° of abduction), then in a modified neutral position (20° of abduction). Testing was performed through an 80° arc of motion at velocities of 60 and 150°/s in random order, and peak torque was corrected for gravity. Each subject attended one practice session to become familiar with the Biodex B-2000 and the testing procedure. This practice session consisted of three submaximum and two maximum contractions for the internal and external shoulder rotators in each of the four combinations of shoulder position and velocity. A minimum of 7 days and no more than 14 days separated the practice and data collection sessions. The data collection sessions involved a warm-up of three submaximum and one maximum contraction, followed by a five maximum contraction test. A 5-minute rest period was administered between velocities and test positions. Two analyses of variance with repeated measures were used to compare the effect shoulder joint position and velocity had on the eccentric peak torque values of the internal rotators and external rotators of the shoulder. The F values indicated significant differences (p < .01) for the internal rotators with regard to position and velocity. Greater eccentric internal rotator peak torque data were generated in the modified abducted position than in the modified neutral position at both velocities. Greater eccentric internal rotator peak torque data were generated at 150°/s than at 60°/s in both positions. The F values indicated significant differences (p < .01) in external rotator peak torque data with regard to position. Greater eccentric external rotator peak torque data were generated in the modified abducted position than in the modified neutral position at both velocities.
Analysis of Shoulder Instability Bracing
DeCarlo MS, Malone KN, Gerig BK, Hunker ME. Methodist Sports Medicine Center/Thomas A. Brady Clinic, Indianapolis, IN 46202

The purpose of this investigation was to evaluate three types of shoulder braces commonly used to limit glenohumeral motion during athletic participation. Ten male subjects (age = 27.2 yr, ht = 180.3 cm, wt = 79.8 kg) with no history of shoulder problems performed isokinetic exercise while wearing each of 3 types of shoulder braces: the Sawa, Duke Wyre, and Shoulder Subluxation Inhibitor (SSI). Subjects performed 10 maximum effort repetitions of forward flex/ext and abd/add at isokinetic speeds of 120 and 180⁰/s for each brace. Goniometric measurements were taken by the same investigator after brace fitting, and following exercise. Subjects also ranked each brace in three categories: 1) comfort, 2) ability to limit motion, and 3) preference for sports participation. Rankings were from 1 to 3 with “1” being the best and “3” being the worst. Each brace received a Final Subjective Score (FSS) based on the cumulative rankings in each category. Results of a paired t-test indicated that all three devices had significant (p < .05) increases from pre to post exercise for flexion. The Sawa demonstrated significant changes in abduction and also received the most favorable overall subjective evaluation. When choosing a brace for participation, the clinician should consider the ability of the brace to limit motions leading to injury, comfort, and patient preference. Further study is recommended.

Semitendinosus/Gracilis Autograft With Modified Losee for Anterior Cruciate Deficiency: A Six-year Follow-up Study

Eighty-six (35%) of 245 patients who had a combined intra- and extra-articular anterior cruciate ligament (ACL) reconstruction surgery consented to participate in a retrospective, long-term follow-up study. All of the surgeries were performed by one surgeon, exclusively using the semitendinosus/gracilis tendon autograft with modified Losee Temple hamstring autograft. Subjects were stratified into one of two groups: Group A (surgery within 3 months postinjury, n = 30) and Group C (surgery long than 3 months postinjury, n = 56). Time from surgery to follow up for Group C (76.95 months, ±
14.86) was significantly (t = 5.10, p < .0001) longer than for Group A (70.20 months, ±12.49). Analysis consisted of subjective and objective evaluations using the Standard Knee Evaluation Form (SKEF) with radiographic assessment, Cincinnati Knee Rating System (CKRS), and KT-1000 (20 lb and manual max). Standing A/P and prone skyline x-rays were taken to assess the extent of knee DJD and Fairbank’s changes. The total sample scored in the nearly normal range on the SKEF (2.27 ± .61) and 88.89 (±14.42) on the CKRS. When stratified by group, Group A and Group C scored 2.07 (±.474) and 2.39 (±.655) on the SKEF, respectively, and 93.58 (±8.23) and 86.35 (±2.36) on the CKRS, respectively. These differences were statistically different (SKEF, t = 2.02, p = .023; CKRS, t = 2.52, p = .014). Fifty-five (64%) subjects submitted to x-ray examination. Forty-nine (89%) of the sample had zero or less than 25% joint space narrowing. Forty-two (76%) subjects had tibial spine hypertrophy and 35 (64%) subjects had joint line spurring. These results were independent of treatment group. KT-1000 bilateral measurement differences for the total sample were less than 2 mm for the 20 lb (1.69 mm, ±1.44) and MMAX tests (1.98 mm, ±1.55). The 20-lb test for Group A and Group C measured 1.96 mm (±1.52) and 1.53 mm (±1.38), respectively. The MMAX test for Group A and Group C measured 2.15 mm (±1.22) and 1.86 mm (±1.76), respectively. The differences between the groups were not statistically significant (20 lb, t = -.45, p = .657; MMAX, t = -1.11, p = .270). Fifty-nine (69%) of the total sample were able to return to strenuous activities postsurgery, as defined by the SKEF. Twenty-three (82%) of Group A returned to strenuous activity levels compared to 36 (64%) of Group C. In conclusion, the findings of this study demonstrate that the semitendinosus/gracilis tendon autograft with a modified Losee procedure is a reliable procedure for reconstructing the ACL-deficient knee.

Incidence and Severity of High School Athletic Injuries: A Five-Year Retrospective Study
Wissen WT, Laughlin MS, Russell JA. Alief Hastings High School and Joe W. King Orthopedic Institute, Alief, TX 77411

A 5-year retrospective athletic injury study was undertaken at a suburban high school of about 4,000 students, of which approximately one quarter are athletes. The purpose of this study was to determine incidence and severity of injuries occurring during boys’ and girls’ interscholastic athletics. Two full-time certified and licensed athletic trainers employed by the school collected these data on injured athletes: sport, gender, and time lost from athletics. Football and soccer were classified as collision sports (COL). Volleyball, basketball, and baseball were categorized as contact sports (CON). Noncontact and endurance sports (NON) were tennis, cross country, track, and swimming and diving. Injury severity was coded 1 to 5, according to the number of days lost: 1, none; 2, 7 days or less; 3, 8 to 21 days; 4, more than 21 days; and 5, unable to return. For all injuries, the mean lost code was 1.31. The mean time lost codes for COL, CON, NON were 1.36, 1.28, and 1.21, respectively. A one-way analysis of variance showed a significant difference (p < .002) among these, with Tukey post hoc analysis indicating the difference was between COL and NON. This suggests statistically that collision sports generate more severe injuries than do noncontact sports. Using exposure data, injury rates were calculated per 1000 exposures (exp) and per 100 athletes (ath). An exposure was a single athlete’s attendance at a single practice or game session. Injury rates for the entire population were 3.88 injuries/1000 exp and 72.4 injuries/100 ath. For boys, these rates were 4.96 injuries/1000 exp and 76.3 injuries/100 ath; for girls they were 3.56 injuries/1000 exp and 71.0 injuries/100 ath. The injury rates for the different sport types were COL, 6.56 injuries/1000 exp and 108.8 injuries/100 ath; CON, 4.43 injuries/1000 exp and 74.3 injuries/100 ath; and NON, 1.55 injuries/1000 exp and 34.6 injuries/100 ath. In 95% of cases, injured athletes returned to practice or competition in 21 days or less. Injured athletes did not miss a single practice or game in 81% of cases. This study suggests that collision sports result in a larger number of injuries of a more severe nature than do contact sports. The same is true of contact sports versus noncontact sports. Also, the injury rates reported in this study suggest the need for more than one full-time certified athletic trainer at large high schools. More research about scholastic injury rates and injury risks is needed.

A Study Regarding the Management of Collegiate Athletes With Sickle Cell Disorders
Jones JD, Kleiner DM. Illinois State University, Normal, IL 61761

Information related to the complications of sickle cell disorders has not been well reported in the sports medicine literature. The incidence of sickle cell trait (SCT) is reported at between 8% and 10% of the black population. However, routine screening for SCT is not recommended by the National Collegiate Athletic Association. The purpose of this study was to identify athletic trainers’ exposure to athletes with sickle cell disorders. The athletic trainers at 94 historically black colleges and universities were mailed surveys asking what exposure they had to athletes with sickle cell related complications. Thirty-six percent of the instruments were returned. The athletic trainers surveyed in this study reported a mean of 4.95% of their athletes having the trait. In addition, three colleges each reported ten incidents of sickle cell crisis at their facilities. In this study, 16% of the schools required blood screening for SCT in their athletic preparticipation examinations.
Seventeen schools asked about SCT in the athlete's medical history, and 16 schools asked if SCT was present in the medical history of the athlete's immediate family. In six cases, the athletes were not asked about SCT, but were referred to the Student Health Center for their preparticipation examinations. Additional analysis of the data revealed that 83% of the respondents reported being certified by the National Athletic Trainers' Association. To conclude, this preliminary study suggests that there is a likelihood for athletic trainers to encounter athletes with sickle cell disorders, and that further education regarding sickle cell complications is needed. Further research regarding sickle cell disorders is also warranted.

Effect of Unilateral Functional Instability of the Ankle on Postural Sway and Eccentric Strength of the Ankle Evertors
Bernier JN, Perrin DH, Rijke AM. University of Virginia, Charlottesville, VA 22903

Functional ankle instability is a common symptom following an acute ankle inversion sprain. Decreased proprioception, decreased strength of ankle evertors and mechanical instability as the cause of functional instability has been questioned. The purpose of this study was to determine if individuals with a unilateral functional ankle instability possess a decrease in isokinetic eccentric strength of ankle evertors as well as a decreased ability to maintain postural stability. Four women and nine men (age = 22.9 ± 3.4 yr, ht = 1.8±.1 m, wt = 80.3 ± 12.2 kg) made up the functional instability (FI) group. Eight women and five men (age = 27.2 ± 4.7 yr, ht ± 1.7±.1 m, wt = 63.2 ± 11.6 kg) were used as the non-disabled (ND) group. Subjects were tested on a Chattecx Balance System (Chattecx, Div of Chattanooga, TN) under static and dynamic conditions with eyes open and eyes closed for both dual limb and single limb stance. Strength tests for ankle inversion and evasion were then performed eccentrically at 90°/s using a KinCom III (Chattecx, Hixson, TN). Peak torque was taken from the average of three maximal repetitions. Mechanical instability was determined through a series of stress radiographs using a Telos GA-II/E stress device (Austin & Associates, Inc, Fallston, MD). A MANOVA for repeated measures revealed no significant differences (p > .05) between injured vs. uninjured ankles in the FI group and dominant vs. nondominant in the FI vs. ND groups for strength or postural sway. Pearson product moment correlation showed very low (.03-.45) relationship between degree of mechanical instability and postural sway or eccentric strength deficits. More research is indicated to determine the effects of functional instability of the ankle on motor performance.

This research was funded in part by a NATA District III research grant.

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Trochlear Groove Osteochondral Defect
Ireland ML. Kentucky Sports Medicine, Lexington, KY

A review of patients with arthroscopic findings of isolated trochlear groove osteochondritis fracture, chondromalacic change, or osteochondritis dissecans was done. The purpose of this retrospective study is to increase awareness of these isolated considerations of possible etiologies. Review of office charts, radiographs, and arthroscopies in 15 patients with isolated trochlear groove lesions were performed. Arthroscopic treatment included debridement and removal of loose bodies. Other intra-articular structures were normal. Only patients with isolated trochlear groove lesions were included. Follow-up ranged from 1 to 6 years. Age range was 13 to 46 years. All of the athletically active patients have returned to full activities without knee complaints. Radiographic abnormalities of the lateral aspect of the trochlear groove were present in seven patients,
A Common Practice Scrutinized: Is a 15-minute Ice Pack Treatment Prior to Ultrasound Application Wise?
Rimington S, Draper DO, Durrant E, Fellingham G. Brigham Young University, Provo, UT 84602

Therapeutic ultrasound is administered in one of three ways: 1) ultrasound with no preceding treatment, 2) on preheated tissues, and 3) on precooled tissues. The justification for precooling tissues prior to ultrasound treatments is founded on the premise that ultrasound requires a transmission medium for wave propagation. The denser this medium, the greater the wave penetration. Thus the application of cold to a treatment area prior to an ultrasound application decreases the tissue temperature leading to an increase in tissue density. This increase in tissue density should result in significant heating of tissues via ultrasound. The purpose of this study was to test this theory by measuring muscle temperature changes during a 15-minute ice pack application and an ultrasound treatment immediately following. Participants had a 23-gauge hypodermic needle microprobe inserted 3 cm deep into the medial aspect of the anesthetized gastrocnemius muscle. Two groups consisting of eight subjects each were tested for temperature changes. Group one received a 1 MHz ultrasound application with no preceding treatment. Group two received a 1 MHz ultrasound treatment following a 15-minute ice pack application. The treatment area was two to three times the size of the soundhead. Each treatment consisted of 10 minutes of continuous ultrasound delivered topically with a Sonicator 710™ (Mettler Electronics) at 1.5 watts/cm². We used an independent t-test and discovered a significant difference between the two treatment methods (t(14) = 16.26, p < .01). The mean baseline muscle temperature of the 16 subjects was 35.8°C. Ultrasound with no preceding treatment raised the tissue temperature to a mean of 37.8°C (range = 36.6–39.9°C). At the end of the 15-minute ice pack application, the tissue temperature dropped over 5°C (30.2°C) and it continued to drop during the first 2 minutes of ultrasound. At the end of the 10-minute ultrasound application, the temperature peaked at 31°C, still 4.8°C lower than the original baseline. We have shown from this investigation, that at a depth of 3 cm, a 15-minute ice treatment negates the effectiveness of an ensuing ultrasound treatment. If an increase in muscle temperature is warranted, we suggest that ultrasound not be delivered immediately after an ice treatment.

Self Selection of Transcutaneous Electrical Nerve Stimulation (TENS) Parameters for Pain Relief in Injured Athletes
Buxton BP, Okasaki EM, Hetzler RK, Ho W. University of Hawaii at Manoa, Honolulu, HI 96822

The purpose of this investigation was to examine the effects of self-selected TENS parameters on subjective, subacute, musculoskeletal pain in intercollegiate athletes. The single blind TENS treatment consisted of three parameter selections: High TENS (120 pps, 75 μ, submotor), Low TENS (4 pps, 400 μ, motor), and placebo (2 pps, 50 μ, submotor). TENS was delivered by a Stayodyn® Maxima II unit. One hundred and twenty subjects (mean age 20.6 ± 3 yr) were exposed to the three treatment parameters in random order and allowed to self-select treatment. Sixty-four subjects selected High TENS, 35 subjects selected Low TENS and 21 subjects selected the placebo treatment. All treatment consisted of only TENS and lasted for 40 minutes. Each subject completed a modified Talag pain scale prior to and at the completion of treatment. The pain scale ranged from 0 (no pain) to 6 (unbearable pain). The delta pain scores were analyzed using a one-way ANOVA and Scheffe post hoc test. There were no significant differences between groups for pretreatment pain scores. The means (±SD) for the High, Low, and placebo TENS treatment groups were 2.72 ± 1.0, 2.91 ± .95, and 2.29 ± 1.1, respectively. Following treatment, the mean delta score for the High, Low, and placebo TENS treatment groups were -0.92 ± .91, -0.7 ± .74, and -0.38 ± .49, respectively. Significant differences (p < .05) in pain relief were observed between the High TENS and the placebo group. No significant differences were observed between the High TENS and the Low TENS treatment or the Low TENS and the placebo group. Although the clinical application of TENS is often varied (eg, frequency, phase duration, and intensity), different theories of pain control endorse the use of distinct parameters for optimum pain reduction in specific conditions. However, the ultimate effectiveness of the TENS treatment is measured by the subjective feedback of the patient. The findings of this investigation support the use of High TENS (sensory stimulation) for the treatment of subjective, subacute, musculoskeletal pain in intercollegiate athletes.
A Comparison of Two Intermittent External Compression Devices and Their Effect on Postacute Ankle Edema

Angus J, Prentice W, Hooker D, Shields E. University of North Carolina, Chapel Hill, NC 27514

The purpose of this study is to determine the effectiveness of intermittent pneumatic compression, using the Jobst Boot, and intermittent compression with cold, using the Jobst Cryo/Temp, in reducing postacute ankle lymphedema. A third group was treated with just elevation and acted as the control group. A pretreatment and posttreatment water displacement measurement were taken after one 30-minute treatment as an indirect method to determine the effectiveness on pitting ankle edema. Thirty college-age male and female subjects were used in this study. Each subject was evaluated by a graduate/staff athletic trainer or by a physician at the University of North Carolina Student Health Service. Each subject presented a unilateral ankle sprain with pitting edema that did not require cast immobilization or surgery. The subjects were assigned to one of the three treatment groups. A significant repeated measures effect was found (p < .0006) showing the treatments did reduce the pitting ankle lymph edema. There was also a significant interaction effect found (p < .0046). However, no significant effect was found for either treatment condition (p < .6709). Therefore, a Tukey’s HSD post hoc test was performed yielding a 15.645 ml minimum difference between treatment means necessary for significance. The mean reduction values for the JCT and JP were (–32.50 ml) and (–6.70 ml), respectively. It was concluded from these findings that the Jobst Cryo/Temp is significantly more effective in the reduction of post-acute ankle lymph edema than either the control treatment or the Jobst Intermittent Compression Pump.

The Effects of Cold Application on Functional Agility

Evans TA, Ingersoll CD, Knight KL, Worrell TW. Indiana State University, Terre Haute, IN 47809

Cold applications are commonly used prior to strenuous exercise due to their hypalgesic effects. Some have questioned this procedure because of reports that cold may decrease isokinetic torque; however, there have been no investigations of actual physical performance. The purpose of this study was to determine if a 20-minute ice immersion treatment to the foot and ankle affected performance of three agility tests: the carioca maneuver, co-contraction test, and a shuttle run. Twenty-four male athletic subjects were tested during two different treatment sessions following an orientation session. The treatments were a 20-minute 1°C ice immersion treatment to the dominant foot and ankle, and a 20-minute rest period.

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Following each treatment, subjects performed three trials of each agility test, with 30 seconds between each trial, and 1 minute between each different agility test. The order which each subject performed the agility tests was determined by a balanced Latin square. A MANOVA with repeated measures was used to determine if there was an overall significant difference in the agility times recorded between the cold and control treatments and if ordinal position of the treatment sessions affected the scores. Although the mean agility scores were slightly slower following the cold treatment, cooling the foot and ankle caused no difference in agility ($F(3,21) = .78, p = .15$). There was also no difference between the treatment conditions for ordinal position ($F(1,46) = .99, p = .59$). The slight difference may have been caused by tissue stiffness caused by the cold and/or subjects apprehension immediately following the cold treatment. Cold application can safely be used prior to strenuous exercise without altering agility.

**Effect of Cryotherapy on Eccentric Peak Torque and Endurance**


The purpose of this study was to examine the effect of cryotherapy on plantar flexor eccentric peak torque and endurance. Twenty-two male and female volunteers from Temple University who denied history of injury to the lower leg, knee, and ankle and contraindications to cryotherapy were selected for the study. Each subject underwent four randomly ordered conditions. The conditions were: a) peak torque measurement at 30 and 120°/s following leg immersion to mid thigh in a 10°C ice bath for 30 minutes, b) peak torque measurement at 30 and 120°/s without leg immersion in an ice bath (control), c) endurance measurement at 120°/s following leg immersion to mid thigh in a 10°C ice bath for 30 minutes, and d) endurance measurement at 120°/s without leg immersion in an ice bath (control). All testing was performed on the Biodex B-2000 isokinetic dynamometer in eccentric mode. Subjects participated in two practice sessions before data collection and all practice and data collection sessions were separated by at least 7 and no more than 14 days. The immersion condition involved right leg immersion to mid thigh in a trash can and the control condition involved standing in an empty trash can. Subjects were seated with their hip and knee flexed to 55° and the ankle was limited to 40° of plantar flexion and 10° of dorsiflexion. Peak torque testing consisted of five warm-up repetitions followed by five maximum repetitions at each velocity. A 5-minute rest was given between randomly ordered velocities. Endurance testing consisted of five warm-up repetitions followed by 100 maximum repetitions at 120°/s. Criterion measure for the endurance test consisted of the total work performed over 100 repetitions. Peak torque and total work was corrected for gravity. A $2 \times 2$ analysis of variance (ANOVA) with repeated measures was used to examine the effect of cryotherapy on eccentric plantar flexor peak torque and one-way ANOVA was used to examine the effect of cryotherapy on eccentric plantar flexor endurance (total work). The $F$ value at the $p < .05$ level indicated no significant difference in peak torque between immersion and control conditions regardless of velocity. The $F$ value at the $p < .05$ level revealed a significant difference in endurance as measured by total work in immersion and control conditions. These results indicated that cryotherapy did not significantly affect peak torque, but did significantly increase endurance.

**The Effect of Cryotherapy on Selected Balance Parameters**

Whittaker T, Lander J, Brubaker D, Burke E, Pfleger B. Life College, Marietta, GA 30060

This study was driven by the discrepancies within the literature concerning ankle proprioception and cryotherapy. Some studies in the literature have shown a decrease in performance after cryotherapy, while others have not. This study was intended to provide evidence as to the possible negative effects of cryotherapy on proprioception and subsequent balance. The purpose of the study was to examine the effects of cryotherapy on balance. Ten subjects from Life College rugby team volunteered for the study. The testing required three different appearances in the lab for ice bath immersion times of 0-20-30 minutes at 1-2°C. Subjects were pretested and posttested using four balance tests: double leg with eyes open/closed and single leg with eyes open/closed. Using a randomly assigned testing order, data were collected with an AMTI force platform interfaced to a 386 PC compatible computer via an analog to digital converter. Fifty-three variables were generated from force platform data. A factor analysis was used to reduce the number of variables. Based on factor analysis, three variables (path length of the center of pressure, torque, and radial displacement) were statistically analyzed using a $2 \times 3$ factor ANOVA with repeated measures. A total of 12 ANOVAs were run for the three variables across the four stance conditions. Five significant differences ($p < .05$) were observed. For example, path length increased with icing time for double leg eyes open condition (0 min—12.8 cm, 20 min—13.4 cm, 30 min—14.2 cm). Since a majority of the variables examined were not significantly different, investigators concluded that icing had little or no effect on balance performance. In conclusion, if icing alters proprioception it appears as though other structures in the nervous system may compensate.
Effects of Body Position and Velocity on Eccentric Quadriceps Peak Torque
Seals T, Kimura I, Sitler M, Kendrick Z. Temple University, Philadelphia, PA 19122

The purpose of this study was to investigate the influence of the prone, supine, and seated body positions on quadriceps peak torque production when tested eccentrically on the Biodex B-2000 isokinetic dynamometer at 60 and 120°/s. Hip angle positions were 180, 180, and 90° in the prone, supine, and seated body positions, respectively. Eccentric peak torque data were gravity corrected. Body position and velocity were randomly ordered. Subjects were 34 female volunteers between the ages of 18 and 28 yr. All subjects denied history of right lower extremity pathology or prior eccentric isokinetic experience. Subjects performed a warm-up, consisting of 3 submaximum and 1 maximum eccentric knee isokinetic contractions, prior to each test condition. Each of the 6 test conditions involved 5 maximum eccentric knee isokinetic contractions. Five-minute rest periods occurred between velocities and 10-minute rest periods occurred between body positions. The first test session was used as a practice session to enable the subjects to become familiar with the Biodex B-2000 isokinetic dynamometer eccentric mode and the test conditions. The data collection session was administered at least 7 and no more than 10 days later. An 2 x 3 analysis of variance with repeated measures was used to examine the effect body position and angular velocity had on eccentric quadriceps peak torque. The F value for the main effect of body position was significant at the p < .05 alpha level. A Tukey post hoc test revealed a significant increase in quadriceps peak torque production in the seated body position when compared to the prone and supine body positions. However, no significant differences were found between the prone and supine body positions at both velocities. The F value for velocity revealed significantly (p < .05) higher peak torque at 120°/s than at 60°/s for all three body positions. The interaction effect was not statistically significant.

Fatigue Response of the Quadriceps and Hamstrings During Concentric and Eccentric Contractions at Two Angular Velocities
Emery L, Sitler M, Kimura I, Kendrick Z. Temple University, Philadelphia, PA 19122

The purpose of this study was to investigate the effects of fatigue on the hamstrings and quadriceps muscles during concentric and eccentric contractions of the knee at two angular velocities performed on the Biodex B-2000 isokinetic dynamometer. The dominant leg of 12 subjects, 6 males (mean age = 22.5 ± 1.9 yr) and 6 females (mean age = 22.5 ± 1.9 yr) was tested on the Biodex B-2000 isokinetic dynamometer. Reciprocal hamstrings and quadriceps muscle testing consisted of each subject completing four test treatments: concentric at 60°/s, concentric at 150°/s, eccentric at 60°/s, and eccentric at 150°/s. Subjects were tested in a seated position (110° hip flexion) with knee range of motion limited from 10 to 90° flexion. A fatigue test consisted of maximal reciprocal hamstrings and quadriceps contractions un-
Comparison of Bilateral Isokinetic Peak Torque, Total Work, and Average Power of the Shoulder Rotator Musculature in the Frontal and Scapular Planes

Maxwell T, Tis LL. Georgia State University, Atlanta, GA 30303

Shoulder rotator musculature has traditionally been assessed in the frontal plane (FP). Recent research has compared nondominant reciprocal muscle group ratios produced by the shoulder rotator musculature in the FP and scapular planes (SP). However, no data have been presented examining bilateral strength ratios in both the FP and SP. Therefore, the purpose of this study is to compare bilateral peak torque (PT), total work (TW), and average power (AP) ratios obtained in the FP and SP. Ten recreationally active females (age = 24.9 yr; ht = 163.3 cm; wt = 60.7 kg) were randomly assessed in the FP and SP for dominant and nondominant side shoulder internal and external rotator PT, TW, and AP. All testing was performed on a Cybex 6000 isokinetic dynamometer (Lumex Inc, Ronkonkoma, NY) at 60°/s in the supine position. Bilateral ratios were calculated as dominant/nondominant (see Table above).

Paired t-tests revealed no significant differences between the bilateral muscle group ratios in the FP and SP (p < .05), indicating that testing in both planes will produce similar bilateral muscle group ratios. Comparison of strength values between and among subjects is difficult when various testing protocols have been used. The findings of this study may enable comparison of strength values produced in the FP and SP through bilateral muscle group ratios.

Interrater Reliability of Isokinetic Measures of Knee Extension and Flexion

Kesluka DR, Dowling JS, Davis VL, Finley PW, Dell’Omo DL. Medical College of Georgia, Augusta, GA 30912-0800

The purpose of this investigation was to determine the interrater reliability of peak torque (PT) and total work (TW) measures obtained from isokinetic assessment of knee extension and flexion. Eight males and eight females (age = 25.6 ± 4.5 yr, ht = 68.6 ± 3.6 in, wt = 161.5 ± 37.2 lb) volunteered to participate in this investigation. Four clinicians (range of isokinetic test experience = 0-10 yr) assessed each subject using a standardized isokinetic measurement protocol. Subjects were evaluated on 4 occasions with 3 to 5 days separating test sessions. To control for order effect, subjects were randomly assigned to a sequence of test examiners according to a 4 x 4 balanced Latin square. A Cybex 6000 (Division of Lumex, Ronkonkoma, NY) was used to obtain gravity-corrected PT and TW values at 60 and 180°/s for concentric performance of knee extension and flexion. Intraclass correlation coefficients (ICCs) and standard error of measurement (SEM) values were used to estimate the interrater reliability for each test condition (test speed X muscle group). ICCs ranged from .90-.96 for PT and .90-.95 for TW. SEM values ranged from 6.6-9.8 ft-lb for PT and 8.3-12.4 ft-lb for TW. The results of this investigation demonstrate that reliable measures of PT and TW may be obtained by 4 clinicians with varied experience when following a standardized isokinetic measurement protocol to assess knee extension and flexion.

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<th></th>
<th>Peak Torque</th>
<th>Total Work</th>
<th>Average Power</th>
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<td>Scapular plane</td>
<td>1.13 ± .37</td>
<td>1.22 ± .59</td>
<td>1.21 ± .55</td>
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Isokinetic Knee Extension Resistance Training

Kovaleski JE, Heitman RJ, Trundle TL. Indiana State University, Terre Haute, IN 47809

Active robotic dynamometry provides both isokinetic or isotonic preload (constant) resistance. Rehabilitative training with isotonic preload movement could provide a means for increasing muscular strength and power that reflects contraction conditions similar to natural strength-re-

Isotonic Preload Versus Isokinetic Knee Extension
quiring movements. To examine differences in isotonic preload (IT) and isokinetic (IK) concentric knee extension resistance training on full ROM strength development and peak power, 21 men and 11 women (age = 22.9 ± 2.6 yr) were randomly assigned to either an IT training group (n = 11), an IK training group (n = 11), or a control (CON) group (n = 10) that did not train. The IT and IK groups trained 3 d/wk for 6 wk and completed 12 sets of 10 reps of 90°ROM during each training session using the LIDO Active System. With IT training, velocity was variable while the load was controlled using a preload resistance that was initially set at 25% of peak isometric torque produced at 70° of knee flexion and then increased 5 N-m each week. The IK training was performed at 120, 150, 180, and 210°/s.

Pretraining ANOVAs revealed no differences (p > .05) among the 3 groups for maximal voluntary isometric torque (N-m) at 10, 30, 50, 70, and 90° of knee flexion, peak IT power (W), and peak IK power (W) at the four velocities. Posttraining ANOVAs and Scheffe tests revealed the IT trained group produced greater (p < .05) isometric and IT power than both the IK and CON groups. For IK power at all speeds, the IK group was not different (p > .05) from either the IT or CON groups. These data indicate that: 1) IT is superior to IK resistance training in terms of increasing muscle strength and power; 2) IT preload knee extension training elicits full ROM strength development; and 3) increases in power are specific to training and to the mode of testing.

An Electromyographic Comparison of the Biodex Open and Closed Kinetic Chain Knee Exercises
Drudge TK, Kleiner DM, Ricard MD. Illinois State University, Normal, IL 61790-5120

The use of open kinetic chain exercises (KCEs) for anterior cruciate (ACL) rehabilitation has recently come under scrutiny and has prompted isokinetic manufacturers to develop closed KCE attachments. However, little research has been reported comparing the muscle activity produced by each of these methods. The purpose of this study was to determine the differences in electromyographic (EMG) activity in six lower extremity muscles with the Biodex open and closed KCEs. Sixteen college-age males with no history of knee pathology performed five maximal-effort repetitions of isokinetic exercise at 90°/s. EMG activity was obtained from the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF), biceps femoris (BF), semitendinosus (ST), and gastrocnemius (GT). Subjects’ hip and knee ranges of motion were determined using electromiometers, and EMG activity was assessed by surface electrodes placed over the respective muscles. EMG signals were normalized to 1 RM and were processed to produce a linear envelope. Linear envelopes were integrated for both flexion and extension. Data revealed that open KCEs produced more work and muscle activity than the closed KCEs. EMG values were 48 & 32%MVCs for the VM, 50 & 32 for VL, and 31 & 12 for RF for open vs. closed KCEs, respectively. Greater EMG activity was found in knee extension during the open KCE compared to the closed. For knee flexion, greater EMG activity was found in the closed KCE in the VM (9 vs 38%MVCs), VL (8 vs 29), and RF (11 vs 12), for open vs. closed, respectively. Although more muscle activity was observed with the open KCE, the peak activity occurred closer to terminal extension. This angle of peak activity has previously been thought to place stress on the ACL. It has also been suggested that an advantage to closed KCE is the coactivation of the hamstrings. However, the data from the KCEs performed in this study revealed that hamstring activity was similar between open and closed exercises. To conclude, particular attention should be paid when prescribing knee rehabilitation exercises.

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Dorsi-Flex helps to develop strength and stability in the ankles, knees, and muscles of the upper and lower legs, as well as muscles in the wrists, arms, and shoulders. It is also an aid in rehabilitating shin splints, by isolating the tibialis anterior muscles at the front of lower legs.

To order the Dorsi-Flex ($39.95) or other products offered by SPRI Performance Systems, consumers may call 1-800-488-SPRI.

New Fiberglass Custom Length Splint System From 3M Health Care Allows Easy Customization

3M Health Care has introduced a custom length splint system that makes it easier for health care professionals to create strong, lightweight fiberglass splints that conform to their patients’ shape and enhance patient comfort. The new 3M® Scotchcast® Custom Length Splinting System packages a continuous-length fiberglass splint in a unique, self-sealing dispenser. The Scotchcast custom length splint can be cut to the exact length needed for each patient, allowing health care professionals to tailor each splint without wasting material.

Designed to take up minimum storage space, the self sealing dispenser helps minimize waste and enhances productivity and performance. The dispenser door allows for one-handed opening and closure, and automatically seals after use, ensuring that the splinting material stays soft and conformable. This allows users to cut a splint length and store unused splinting material within the dispenser for later use.

The Scotchcast custom length splint is composed of multiple layers of knitted fiberglass that are impregnated with a water-activated resin. Set time for the splint is controlled by the amount of water used. The fiberglass is surrounded by an air and moisture-permeable non-woven fabric on the external side, and a water-resistant felt padding on the interior side to enhance patient comfort and reduce moisture retention. The moldable splint conforms easily to contours for better patient fit.

For more information on 3M Scotchcast custom length splint system, call 1-800-228-3957 or write to 3M Health Care, Attn: 94-HC-501, BLDG. 275-4E-01, St. Paul, MN 55133-3275.

New Nonsurgical Treatment Offers a Safe Cost-effective Way for Health Professionals to Treat Lower Back Pain

Medical professionals know that eight out of ten people suffer from lower back pain at some point in their lives and that appropriate therapy can be elusive or expensive. But a new, nonsurgical, therapeutic treat-
ment offers hope to many of those affected, relieving the discomfort and often severe pain that results from pressure on the vital structures of the lower back.

The new VAX-D Therapy Table is a device used in innovative vertebral axial decompression therapy for patients experiencing lumbar pain. Under precisely controlled conditions, medical professionals are able to release pressure on the lower back by decompressing intervertebral lumbar discs without costly and painful surgical intervention.

A majority of patients with herniated discs achieve remission of disabling symptoms with a course of VAX-D therapy. Muscle spasms are also significantly reduced.

The VAX-D equipment applies precisely controlled and monitored tension along the linear axis of the vertebral column, in sufficient strength to distract the vertebral bodies and decompress the intervertebral discs and posterior facets of the lumbar spine-relieving pain and disability associated with neurocompression.

For more information contact MediTek Therapy, Inc., 8875 Hidden River Parkway, Suite 110, Tampa, Florida 33637; Tel: 813-971-5574.

Innovative Therapy Program Offers New Hope for Patients Suffering from Low Back Pain

Unloading® Exercise Therapy mechanically reduces body weight (known as Unloading®) through the use of specialized equipment, allowing patients to exercise in various weight bearing positions. Body weight is reported in terms of percentage of body weight and can be closely monitored during treatment. Patients benefit greatly from this highly specialized form of physical therapy because they can begin active rehabilitation sooner, without risking re-injury of joints or tissue.

This innovative therapy program offers a custom designed, functionally oriented exercise regimen that enables patients to now exercise in a pain free environment. Body weight is gradually added as patients improve and recoveries have found to be at a faster and more effective rate than with conventional rehabilitation equipment.

For more information call Somu, Inc. at 800-441-7662.

New Portable Dynatron 150 Ultrasound Lets Practitioners Take Dynatronics Technology Anywhere

A portable, multifrequency ultrasound, the Dynatron 150, is the latest in high-tech equipment to be introduced by Dynatronics. This new modality gives practitioners the ability to take Dynatronics' multifrequency ultrasound anywhere. Practitioners can use any size sound head at 1, 2, or 3 MHz to treat specific-sized areas and precise depths. The Dynatron 150's compact dimensions (8" x 7" x 3") and lightweight design make it easy to use in the clinic, for home health care, or at the hospital. Practitioners can use the Dynatron 150 with any one of the sound heads in sizes 2, 5, and 10 cm². Each of these sound heads can be operated at 1, 2, and 3 MHz. Dynatronics also provides a new 1-cm² sound head for treating smaller parts of the body, especially around the hands or feet. This new sound head operates at 2

Ultrasound is useful for managing pain, increasing blood flow, changing motor and sensory nerve conduction, and increasing range of motion. For more information call 1-800-874-6251.

“Neck’s Time” Cervical Sleep Pillo

Medic-Air Corp. of America has announced the introduction of its new air-filled “Neck’s Time” Cervical Sleep Pillo. A full size, air-filled cylinder that slips into your pillowcase in front of your regular pillow, the Cervical Sleep Pillo comfortably supports the neck while your head rests on your regular pillow.

The Cervical Sleep Pillo is easily inflated with a few puffs of air. The user can adjust the height and firmness by slightly varying the amount of air. It can be instantly deflated and folded to the size of a paperback novel for the traveler who can never find a comfortable hotel pillow.

For more information, write Medic-Air Corp. of America, 6 East 46th Street, New York, NY 10017; Tel: 800-247-7455.
The Journal of Athletic Training welcomes the submission of manuscripts that are of interest to persons engaged in or interested in the property of the authors' athletic training profession (athletic injury prevention, evaluation, management, and rehabilitation; administration of athletic training facilities and programs; and athletic health care counseling and evaluation). Manuscripts should conform to the following:

1. Submit one original and three copies of the entire manuscript (including photographs, artwork, and tables) to the editor.
2. All manuscripts must 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 NATA’s taking action in publishing the Journal of Athletic Training, uses a double blank review process. Authors should not be identified in any way except on the title page.

Submissions Policies

1. Submit one original and three copies of the entire manuscript (including photographs, artwork, and tables) to the editor.

7. The active voice is preferred. “I” or “we” (if more than one author) for describing what you did, and “you” or the imperative for instruction. Each page must be typewritten on one side of 8.5 x 11 inch paper, double spaced, with one-inch margins. Do not right justify pages.

9. Manuscripts should contain the following, organized in the order listed below, with each section beginning on a separate page:
   a. Title page
   b. Acknowledgements
   c. Abstract and Key Words (first numbered page)
   d. Tables (start of manuscript)
   e. References
   f. Tables—each on a separate page
   g. Legends to illustrations
   h. Illustrations

10. Begin numbering the pages of your manuscript with the abstract page as #1; then, consecutively number all successive pages.

11. Titles should be brief and 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 treatment used in the principle reason for the report, it should be in the title. Often both should appear.

12. The title page should also include the names, titles, and telephone numbers of the corresponding author, address, phone number, and fax number of the author to whom correspondence is to be directed.

13. A comprehensive abstract of 75 to 200 words must accompany all manuscripts except Tips From the Field. Number this the complete title (but not the author’s name(s)) on the top, skip two lines, and begin the abstract. It should be a single paragraph and summarize the major points 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 is discussed in the article.” Also, do not confuse the abstract with the introduction.

14. 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.

15. Begin the text of the manuscript with an introductory paragraph or two in which the purpose or hypothesis of 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. In the one to two paragraph review of the literature, identify and develop the magnitude of the controversy, pointing out differences between others’ results, conclusions, and/or opinions. 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.

16. The body or main part of the manuscript varies according to the type of article (examples follow); however, the body should include a discussion section in which the importance of the material presented is discussed and related to other pertinent literature. Liberal use of headings and subheadings, charts, graphs, and figures is recommended.

a. The body of an Experimental Report consists of a methodology section, presentation of the results, and a discussion of the results. The methodology section should contain sufficient detail concerning the methods, procedures, and apparatus employed so that others can reproduce the results. The results should be summarized using descriptive and inferential statistics, and a few well planned and carefully constructed illustrations.

b. The body of a Review of the Literature article should be organized into subsections in which related thoughts of others are presented, summarized, and referenced. Each subsection should have a heading and brief summary, possibly one sentence. Sections must be arranged so that they progressively focus on the problem or question posed in the introduction.

19. Citations in the text of the manuscript take the form of a superscript 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.

20. The reference section 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 of publication, 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.

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

22. 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-in label to the back of each photograph so that the photograph is not damaged.

23. All artwork to be reproduced should be submitted as camera-ready black and white line art. If artwork is to be reproduced in black plus one or more 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), on a separate photocopy. Authors will pay for color.
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 August 30, 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:
Hunt/Pujol. *Athletic trainers as HIV/AIDS educators for athletes.*
Kleiner/Glickman. *Medical considerations and planning for short-distance road races.*
Whitehill/Wright. *Delphi study: HIV/AIDS and the athletic population.*

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**CEU CREDIT QUIZ**

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☐ High School  ☐ Junior College  ☐ College

☐ University  ☐ Sports Medicine Center

☐ Other (please specify) _________________________

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**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 August 30, 1994, to:

**JAT—CEU Quiz**

Physical Education Department

Indiana State University

Terre Haute, IN 47809

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Answers to March '94 CEU Quiz

*Volume 29, Number 1*

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Circle the correct answer.

1. The fastest growing demographic group for AIDS diagnosis is:
   a. 15 to 25 years.
   b. 30 to 40 years.
   c. 20 to 29 years.
   d. 35 to 45 years.
   e. 40 to 49 years.

2. Differences between HIV and HBV transmission are:
   a. HIV is transmitted through contact with bodily fluids; HBV is not.
   b. HBV is limited to adults; HIV is not.
   c. HIV is becoming more commonly associated with adolescents and young adults due to increased sexual activity; HBV is not.
   d. Communicability of HIV is low compared to that of HBV.
   e. None of the above.

3. HIV/AIDS testing is problematic because:
   a. an athlete tested one day may compromise those test results the next day.
   b. moral and ethical questions on testing need to be addressed.
   c. existing HIV/AIDS tests are not necessarily reliable.
   d. All of the above.
   e. a and b only.

4. The majority of athletic trainers feel that their association with the drug screening process:
   a. places them in the dual role of police and counselor.
   b. negatively affects their rapport with their athletes.
   c. is “ideal” because of the close association with athletes.
   d. is inherently discriminatory and that universities should be concerned with drug screening and the student body as a whole rather than having programs targeting athletes.
   e. Both a and d.

5. Proper risk management for an athletic trainer includes:
   a. making sure he/she is covered under the institution’s liability insurance policy upon hire.
   b. obtaining liability insurance immediately after an injury occurs.
   c. a letter from the employing institution saying that insurance is not needed because the athletic trainer cannot be held liable should an injury occur.
   d. All of the above.
   e. None of the above. Public institutions and their employees have statutory immunity from lawsuits.

6. When the athletic trainer observes dehydration signs and symptoms in a person who has no history indicating dehydration risk (strenuous exercise, exercise in the heat, etc), hyperglycemia should be considered as a possible pathology.
   a. True
   b. False

7. Heat illness is more prevalent in shorter distance races than marathons because:
   a. many runners are untrained, unfit, and unacclimatized.
   b. racers run at a faster pace than will allow them to drink.
   c. runners feel they can wait until the race is over to replenish their fluids.
   d. All of the above.
   e. a or b only.

8. Most athletes prefer _____ as an instructional format for HIV/AIDS education.
   a. video presentations
   b. small group discussions
   c. question and answer sessions with expert panels
   d. books and pamphlets
   e. guest speakers

9. Prevention of HBV transmission in the athletic training setting should include:
   a. immunization of all athletic training personnel (including students).
   b. proper disposal of all sharp and contaminated refuse.
   c. no application of cosmetics.
   d. no eating at work stations.
   e. All of the above.

10. The most important component in the entire issue of HIV/AIDS and the athletic community is the development and implementation of educational interventions.
    a. True
    b. False

11. Some ways the athletic trainer can avoid possible litigation include:
    a. making sure all helmets used pass NOCSAE safety standards.
    b. obtain written informed consent from the athlete (and parent, if a minor) before participation begins.
    c. educate the athlete about risks of injury.
    d. teach correct techniques throughout the year and emphasize them at least four times per season.
    e. All of the above.

12. Glucose regulation disorders:
   a. are always related to diabetes.
   b. may occur in healthy individuals.
   c. are extremely difficult to differentiate.
   d. are rarely life-threatening.
   e. Both a and c.

13. Common household bleach in a 1:10 solution with water is an adequate disinfectant for HBV-contaminated surfaces (tables, floors, etc).
   a. True
   b. False

14. The primary difference between the diabetic hyperosmolar state and diabetic ketoacidosis is:
    a. renal absorption of glucose is impaired in the diabetic hyperosmolar state, but not in diabetic ketoacidosis.
    b. osmotic diuresis, dehydration, and cerebral edema can occur in diabetic ketoacidosis but not in the diabetic hyperosmolar state.
    c. the lack of ketone formation in the diabetic hyperosmolar state.
    d. acidosis is a problem in the diabetic hyperosmolar state, but not in diabetic ketoacidosis.
    e. All of the above.

15. In treating hyperthermic/hypovolemic race participants, it is necessary to cool the patient before large amounts of IV fluids are administered in order to prevent pulmonary edema.
    a. True
    b. False
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