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Writing Tips

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Letters to the Editor

Historical Inaccuracy in Previously Published Article

First, I would like to congratulate Steve Simpson, Brad Bettis, and James Herbertson on their recent publication "Unloaded Treadmill Training Therapy for Lumbar Disc Herniation Injury" (*JAT*, 1996;31:57–60). I feel that this was a good functional description of the progression using the principles of unweighting. This is similar to my own experience. I concur with progressive precision loading, but would like to offer some insight as to what I consider an historical inaccuracy in their case report.

The authors stated that "unloading was developed by DD Kelsey, PT in 1986. . . " On this point I beg to differ. In 1986, Kelsey attended a course I taught in Hawaii, in which he learned of Oddvar Holten's partial weight-bearing exercise ideas. The terms Holten used were negative weight or weight load. This concept was first developed in the 1960s by Holten. Kelsey gained a more complete exposure in a course I taught in California, in which I further detailed Holten's method. This included the testing and treatment by means of partial weight-bearing exercises while weight-bearing is painful or while functional deficits (such as gait deviations) exist. To this end, it would behoove the authors to give Holten due credit for developing the undergirding concepts and principles now in use in progressive precision loading and unloading.

Bjorn Svendsen, DHSc, PT
Svendsen Consultants, Inc.
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Author's Response

Thank you for the positive comments on our findings concerning our article "Unloaded Treadmill Training for Lumbar Disc Herniation Injury." Your input is graciously received. Mr. Kelsey trademarked the term "unloading" and therefore our sources refer to him as the creator of the term. We acknowledge that Holten and Svendsen also particpate in this area of training. We appreciate this opportunity to clarify our position on this topic.

Steve Simpson, EdD, ATC, LAT
Director of Sports Medicine
Tarleton State University

Brad Bettis, BS, PT
Stephenville Sports Rehabilitation

Student Athletic Trainers and Library Instruction

I found the article, "Navigating the Library Maze," [Whitehill WR et al. 1996;31:50-52—Ed.] to reflect exactly what we have been doing at Ohio University for several years. At the beginning of every fall quarter, Skip Vosler, the Head Athletic Trainer at Ohio University, insists that all new student trainers come to the library for instruction. Serving as Subject Bibliographer for Recreation and Sports Sciences, I personally demonstrate all of the CD databases mentioned in the article: ERIC, MEDLINE, CINAHL, and *Sports Discus*, the CD version of the Sport database. Immediately after my demonstration, students must go to CD-ROM terminals and use all of the above databases, which happen to be networked on a LAN in our Library. Student trainers work in small groups to find article citations pertinent to a subject of their choosing. They must also find at least one of the journal articles and bring it to me so that I can compare the citation with the journal in hand to make sure that they understand how journals are arranged within the library.

In addition to these electronic sources, the *Physical Education Index* has proven to be very useful. The distinctive difference between *Sports Discus* and the *Physical Education Index* is that all of the journals indexed in the *Physical Education Index* are in English and readily available through interlibrary loan. *Sports Discus* tends toward the esoteric. Although I appreciate the fact that *Sports Discus* offers document delivery, even for the esoteric items, the charges are prohibitive for the ordinary student.

In an attempt to forge a closer bond between the Library and the Athletic Department, Mr. Vosler has assigned a few student trainers to assist in keeping an up-to-date bibliography of all sports medicine books received by the Library. The second task that they assist with is requesting conference proceedings that are indexed on *Sports Discus*. The folks at *Sports Discus* publish a list of upcoming conferences that we have used for many years to get proceedings.

It was interesting to read how other universities manage information retrieval. Here at Ohio University, we throw the kids in and let them swim around. Of course, Mr. Vosler and I keep a loving eye on them so they don't sink in this sea of abundant information.

In addition to the student trainers, all new student athletes must do a library assignment which is coordinated by Dr. Kim Brown, Assistant Athletic Director for Academic Advancement. I check the library assignment and, if any students are having difficulties, I sit down with them and explain a couple of databases and take them through at least one search on a topic related to their major. This is done the very first quarter on campus. Dr. Brown and Mr. Vosler want our students in the Athletic Department to do as well as possible academically. That means that they must know the electronic sources, the print sources, and their special librarian. Every student athlete knows my face, my name, and that I am there to help. I'm delighted to see that other universities are making use of the same resources, including the librarian, who is the ever-present information specialist.

Susie Rohrbough
Bibliographer for Recreation and Sports Sciences
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Structure of a Scholarly Manuscript: 66 Tips for What Goes Where

Kenneth L. Knight, PhD, ATC; Christopher D. Ingersoll, PhD, ATC

Objective: To share with potential authors tips for constructing a scholarly manuscript and for organizing information in various types of scholarly manuscripts: experimental reports, literature reviews, case reports, and clinical techniques.

Description: The goal of writing a scientific/technical/medical article is to communicate new information that hopefully has clinical relevance and will improve health care. This information must be organized and presented clearly and logically. We present 66 tips for organizing a scholarly manuscript. We tell not only what goes where in the manuscript but also how to construct each of the elements so as to logically communicate the author's message. The tips are numbered to facilitate referencing.

Conclusion: By becoming familiar with these tips, potential authors can avoid making mistakes that may hinder publication of their manuscripts.

There are three major elements to a journal manuscript: content, structure, and clarity of presentation. A manuscript may have Nobel Prize caliber content, but if it is not presented logically and with clarity, readers may not understand the content. Logical delivery enhances completeness (ie, all information is there) while avoiding redundancy.

There are many different types of scholarly manuscripts, each with a slightly different structure or format. In this article, we will address the structures of the four types of manuscripts most commonly published in the *Journal of Athletic Training*: Experimental Reports, Literature Reviews, Case Studies, and Clinical Techniques.

Be sure to consult and adhere to the "Authors' Guide" of the specific journal. We have chosen to organize this material in a numbered list format to facilitate reference of specific points by educators and editors as they work with authors. Our experience is that numbered points are easier to locate than concepts within the text.

ORGANIZATION

1. All manuscripts should contain the following, organized in the order listed below, with each section beginning on a separate page:
   a. Title page (Tips 3–6)
   b. Acknowledgments
   c. Abstract, including Key Words (first numbered page) (Tips 7–11)
   d. Text (body of manuscript) (Tips 12–40)
   e. References (Tips 41–48).
   f. Tables, each on a separate page (Tips 52–58)
   g. Legends to illustrations
   h. Illustrations (Tips 59–64)

Kenneth L. Knight is a professor of Physical Education at Brigham Young University in Provo, UT and Retiring Editor-in-Chief of the *Journal of Athletic Training*.

Christopher D. Ingersoll is an assistant professor and Chair of the Athletic Training Department at Indiana State University in Terre Haute, IN 47809.

The only difference among manuscript types is how text (body of the manuscript) is handled.

2. All pages from Abstract (page 1) through Illustrations should be numbered.

TITLE PAGE

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

4. Current thought among scientific/technical/medical editors is to reflect the study's outcome in the title. For example, "Cooling the peroneals does not affect agility test times."

5. The phrases "The Effects of," "A Comparison of," "The Treatment of," and "Reports of a Case of" should not be used in the title.[1]

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

ABSTRACT

7. A comprehensive abstract of 75 to 300 words is required by most scholarly journals. Number the abstract page one, type the complete title (without the authors' names) at the top, skip two lines, and begin the abstract. It should be structured as outlined in Tip 8 and should succinctly summarize the major intent of the manuscript, the major points of the body, and the author's results and/or conclusions.

8. Structured Abstracts
   a. **Literature Reviews**
      Objective—What was the purpose of the review?

Data Sources—What sources did you search to find the studies you reviewed? Include key words and years searched.
Data Synthesis—Summary of the major themes, organized by themes-not by authors.
Conclusions/Recommendations—Advice for the athletic trainer and other related professionals and clinical applications of the information.
Key Words—Three to six words to describe the article.

b. **Experimental Reports**
Objective—Problems or need for the study.
Design and Setting—How was the study set up? Where did it take place?
Subjects—Characteristics of the subjects.
Measurements—What was being measured? What types of tests were used? How were the subjects distributed within the study?
Results—Of the tests and measurements.
Conclusions—Major conclusions, particularly related to theory and clinical application of the information.
Key Words—Three to six words to describe the article.

c. **Case Reports**
Objective—Problem or need for the case to be presented.
Background—On the particular injury or illness.
Differential Diagnosis—What was it or what could it possibly have been?
Treatment—What was done for it? What is normally expected for this condition?
Uniqueness—What was different from the expected, or was it the same?
Conclusions—Clinical applications of the information.
Key Words—Three to six words to describe the article.

d. **Clinical Techniques**
Objective—Problem or need for the information.
Background—Injury or illness, and normal treatment and rehabilitation.
Description—Of the technique, purpose of use.
Clinical Advantages—Why and when should this technique be used? How does the technique compare with standard practice?
Key Words—Three to six words to describe the article.

9. Do not confuse the abstract with the introduction; the abstract is a summary of the entire manuscript while the introduction develops and proposes the manuscript's problem or purpose.

10. It is unacceptable to state in the abstract words to the effect that "the significance of the information is discussed in the article." Instead, succinctly tell the reader why the information is important.

11. Following your abstract, list three to six key words or phrases that can be used in a subject index to refer to your paper.

INTRODUCTION

12. In a scientific manuscript the introduction serves two purposes: to stimulate the reader's interest and to outline the reason for the study, that is, the controversy or "knowledge gap" that prompted the study.

13. 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 end with a statement of the problem (or controversy).

14. Introductions are usually much too long. Authors tend to follow the traditional thesis format, which includes a complete review of the literature before the methods. While this is good policy for novice researchers, it is not recommended for scientific manuscripts.[3,4]

15. The introduction is not the place for great detail. Highlights of the most prominent works of others as related to the subject at hand are often appropriate for the introduction, but a detailed review of the literature should be reserved for the discussion section. Identify and develop the magnitude and significance of the controversy (or problem) with *brief* specific statements (referenced, of course). This is often done by pointing out differences among others' results, conclusions, and/or opinions. Remember to keep the detail in the discussion.

16. The following two examples from Thomas & Nelson[4] illustrate the above principles. They clearly and concisely acquaint the reader with the problem, provide some background and necessary information, bring out areas of needed research, and then skillfully and logically lead to the specific purpose of the study. (NOTE: In this and other examples, the references are for example only. They do not refer to the references at the end of this paper.)
    - "Vertical jumping ability is of considerable importance in numerous athletic events, and coaches and physical educators have used various training methods to improve this ability. Two of the most recent training methods are isokinetic and plyometric exercises. The purported advantage of isokinetic exercises is that they allow the muscles to work at maximal force throughout the entire range of motion for each and every repetition, thereby providing a greater training stimulus. The effectiveness of such exercises in improving vertical jumping performance has been demonstrated in several studies during the past decade (7,11,25,27)."
    - "Plyometric exercise is a relatively new concept of training that applies the information specificity principle regarding the preset stretch condition of the muscle before explosive contraction (18). The effects of plyometric exercises in increasing vertical jumping performance have been studied experimentally (3,7,22), but no attempt has been made to determine if they are more effective than isokinetic exercises."

BODY OF MANUSCRIPT

17. The body or main part of the manuscript varies according to the type of article you are writing (examples follow); however, regardless of the manuscript type, 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, subheadings, charts, graphs, and figures is recommended.

18. The body of an **experimental report** consists of a methods section, a presentation of the results, and a discussion of the results.

Methods

19. The term "methods" is more appropriate than "methodology." "Methodology" suggests a study of methods, whereas "methods" suggests a description of methods used, which is what the section is.

20. Begin with a description of the experimental design, which will serve as a roadmap to the entire section. Follow with descriptions of subjects, instruments, procedures, and statistical analysis. Confusion is often introduced when authors combine the instruments and procedures sections. Describe the instruments used in the instruments section, but describe how they were used in the procedures section.

21. The methods section should contain sufficient detail concerning the methods, procedures, and apparatus used so that others can reproduce the experiment.

22. Methods used by others to study problems such as yours should be reviewed and referenced in your paper. Reference the methods of others as well as reliability and validity information in the methods section. The pros and cons of various methods and why you chose one over another should be discussed and referenced in the discussion section.

Results

23. Writing results is similar to writing a review of literature; you state facts and then reference your source. In a results section, the statistics are your evidence or reference for the facts (conclusions) you reach. **The results should summarize the important results of the experiment, using descriptive and inferential statistics and a few well-planned and carefully constructed illustrations.**

24. Report results by stating your conclusions in clear, concise statements that a layperson could understand. Don't use jargon or statistical terms.

25. Too often writers make the statistical test the focus of the sentence (as in the "statisticalese" example following). Writing in statisticalese often obscures the conclusions you derive from the results by emphasizing the method rather than the meaning. The important information is the meaning of the results themselves, not the statistical tests used to analyze them. Those readers who are interested in the statistics can read the methods that describe the statistical tests used and the statistical test results at the end of the sentence.
    - **Statisticalese**: Tukey post-hoc testing revealed a significant decrease ($p < .05$) in perceived pain in groups that received cold, TENS, or the combined treatment.
    - **Clearer**: Perceived pain was less in the cold, TENS, and combined treatment groups than in the control group (Tukey post-hoc, $p < .05$).

26. Reference your evidence for making the conclusion (ie, your statistics) in parentheses following each conclusion. Note that the reference includes the statistical test, degrees of freedom (in parentheses), the test results, and the degree of probability. This format gives the most important information from the test and eliminates the need for a statistical table. For example:
    - There was no difference between the three training groups ($F(2,32) = 1.09$, $p = .23$).
    - Football players had higher test anxiety scores than basketball players ($t(15) = 4.62$, $p < .01$); or ($F(3,25) = 3.62$, $p = .003$).

27. If you have many variables, they can usually be presented more clearly in tables (see Tips 52–58 for information on compiling).

Statistics

28. Statistics don't indicate or prove anything; they simply provide you with support for making a decision. When you are reviewing literature, you make a statement and reference others' writings to support your statement. Use an analogous approach when reporting results; make a statement and then reference that statement with your statistical results as illustrated in Tip 26.

29. Statistical tests don't **find** differences. They provide evidence that a difference between groups is probably real. Looking at the group means tells you if the groups are different; however, you must decide if the differences are real or if they occurred by chance. Real differences mean they were caused by your experimental intervention (ie, the independent variable) and not by chance. By chance means the differences were caused by variables other than your independent variable.

30. The symbol "*p*," when used to refer to the level of probability, is written italicized and in the lower case.

31. When indicating the level of significance or probability, use only two numbers if the first is not a zero (ie, .36 not .364). If the first number is a zero, continue numbers until the first nonzero (ie, .0002; not .00 or .00023).

Discussion

32. Put your results in perspective with your expectations and compare your results with the rest of the world. Don't repeat or rehash the results; discuss them.

33. The emphasis of a discussion should not be on other authors but rather on what they reported and how it relates to your work.
    - For example: "The greater use of . . . by athletes in my study agrees with others (1, 7) who reported . . . but disagrees with those (4) who . . . ."

34. The discussion must address the contribution the study makes toward theory. Another brick in the brickyard is of little value; it should be placed into the sidewalk of understanding.

35. The last part of the discussion must suggest how readers might apply the information presented. While the application may be apparent to you, it may not be apparent to first-time readers unless you point it out.

Bodies of Other Types of Manuscripts

36. 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.

37. The body of a **case study** should include the following components: personal data (age, sex, race, marital status, and occupation when relevant–but not name), chief complaint, history of present complaint (including symptoms), results of physical examination (example: "Physical findings relevant to the rehabilitation program were . . ."), medical history (surgery, laboratory results, exam, etc.), diagnosis, treatment, and clinical course (rehabilitation until and after return to competition), criteria for return to competition, and deviation from the expected (what makes this case unique). NOTE: It is mandatory that the *Journal of Athletic Training* receive, with the manuscript, a release form signed by the individual being discussed in the case study. Case studies cannot be reviewed if the release is not included.

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

SUMMARY

39. The manuscript does not need a separate summary section; the abstract serves as a summary. It is appropriate, however, to tie the article together with a summary paragraph or list of conclusions at the end of the discussion section.

40. Some authors write a summary as the last part of the manuscript and then compare it with the abstract. If information is present in the summary that is absent from the abstract, they add it. Then they throw away the summary.

REFERENCES/CITATIONS

41. Each citation in the text of the manuscript takes the form of a superscripted number that 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.

42. The reference page(s) accompanying a manuscript should list authors numerically and in alphabetical order and 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), issue month if journal is not consecutively paged from issue to issue, year, volume, inclusive pages; b) Books: author(s), title of book (italicized or underlined), city and state of publication, publisher, year, inclusive pages of citation. Examples of references to a journal, book, and presentation at a meeting are illustrated below. See the *AMA Manual of Style* for other examples.
    a. Knight KL, Ingersoll CD. Optimizing scholarly communication: 30 tips for writing clearly. *J Athl Train.* 1996;31:209–213.
    b. Day RA. *Scientific English: A Guide for Scientists and Other Professionals.* 2nd ed. Phoenix, AZ: Oryx Press; 1995:73–74.
    c. Leadbetter WB. An introduction to sport-induced soft-tissue inflammation. In: Leadbetter WB, Buckwalter JA, Gordon SL, eds. *Sport-Induced Inflammation.* Park Ridge, IL: American Academy of Orthopaedic Surgeons. 1990:3–23.
    d. Stone JA. Swiss ball rehabilitation exercises. Presented at the 47th Annual Meeting and Clinical Symposium of the National Athletic Trainers' Association; June 12, 1996; Orlando, FL.

43. All statements and ideas of others must be referenced. If the author(s) is (are) not mentioned by name, the reference should be placed after the phrase or first mention of the idea.

44. Anytime you mention another author by name he/she must be referenced immediately after his/her name.
    - "Jones (21) reported . . . four.", not "Jones reported . . . four." (21).

45. When referring by name to a work with multiple authors do the following:
    If two authors, use both names.

- "Smith and Jones" (21) or "Smith & Jones" (21)
  If there are three or more authors, use the name of the first author and "et al," which means "and others."
- "Black et al (5) reported . . ."

46. When the reference is at the end of a sentence, it should be placed after the period and after any quotation marks.
    - "body." (23) not "body (23)."

47. It is often appropriate, especially in an introduction or discussion, to refer to ideas or results from numerous authors in the same sentence. The following illustrates how to do so:
    - "Most people prefer red apples, (6, 9, 21, 33) but some prefer yellow (6, 10, 21) or green (6, 9, 24, 30) ones." Note: All three of the ideas in this sentence were mentioned by reference #6, and two of the three ideas were mentioned by reference #21.

48. Always refer to the research and writing of others in the past tense ("Jones believed" not "Jones believes"; "Smith reported" not "Smith reports"). Maybe that person has changed his mind since the article was written.

OTHER INFORMATION

Department of Redundancy Department

49. Put things where they belong and don't repeat them elsewhere. For instance, don't rehash results in the discussion section.

Headings

50. Subheadings should be used liberally. Main or first level headers should be placed flush left, typed in all capitals, bolded, and not underlined. If the information under a header needs to be subdivided into two or more sections, use second-level or subheaders. These should be flush left and bolded with the first letter of each word capitalized. If third-level headers are needed to further subdivide information, they should be identical to a second-level header except they are indented and part of the paragraph. The first sentence of the paragraph begins on the same line, immediately after the header.

Page Numbering

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

Tables

52. The purposes of tables are to centralize large amounts of data, to save space, and to eliminate long paragraphs of forced and redundant text.

53. Tables must not be redundant of text. Put your information either in the text or a table, not both. You must refer the reader to the table. You should point out the highlights in the table so as to stimulate interest, but do not ramble on in the text concerning information that is in the table.

54. Don't put information in a table that can more easily be presented in the text. For instance, height, weight, and age of subjects are often necessary but should be placed in the text rather than in a separate table as illustrated in the following sentence:
    - Ten male volunteers (age = 21.3 ± 2.1 yr, ht = 67.3 ± 4.2 in, wt = 183.4 ± 10.3 lb) were the subjects for this study.

55. Readers must be able to understand the information in the table without referring to the text.

56. Tables should contain no vertical lines and only three full-length horizontal lines (one between the title and header descriptions, one between the column headers and the first line of data, and one following the last line of data). Smaller horizontal lines may be used in the header to separate a general heading from subheadings under it, or in columns of data to indicate a break between a column of numbers and a total or average of that column of numbers (see Table).

57. Identify the units of measurement of the tabled data in the most general way possible. If all data in the table have the same unit of measurement, that unit should be in parentheses following the table title. If the columns or rows have different units of measurement, but all data in a particular column or row have the same unit, identify the unit (within parentheses) as part of the column header or row identifier.

Example of a Table (With Units of Measure)*

	Header2			Header3		
Header 1	Sub2a	Sub2b	Sub2c	Sub3a	Sub3b	Header 4
Row identifier	Info	Info	Info	Info	Info	Info
Row identifier	Info	Info	Info	Info	Info	Info
Row identifier	Info	Info	Info	Info	Info	Info
Total	Info	Info	Info	Info	Info	Info

*See Tip 57 concerning units of measure.

58. When a table contains data that have been averaged, report the mean ± SD (or SE) [eg, 24.6 ± 3.7].

ILLUSTRATIONS

59. Illustrations are often helpful in presenting concepts that are difficult to describe, such as testing set-ups, x-ray abnormalities, and trends within data.

60. Each illustration should have a legend that describes the illustration and emphasizes its important points. Legends should be consecutively numbered according to the illustration's placement in the text. A list of legends should be typed on a separate page following the last table.

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

62. 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 a second (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. The author pays for color.

63. If preparing illustrations on the computer, do not include frames, titles, or other markings that are not used by the journal. Consult a recent issue of the journal you are submitting to if unsure about what is included.

64. Only one original copy of illustrations is necessary; however, include xerox copies of all illustrations with each copy of the manuscript, including the original.

HELPFUL RESOURCES

65. The following three texts amplify the above tips and present much more helpful information for writers of all skill levels. In fact, skilled writers are the ones who consult such resources most often. We encourage you to become familiar with them.
    - Day's *How to Write and Publish a Scientific Paper*.[3] This is the best "how-to" manual on writing we've seen. It should be required reading for every writer. Time spent reading this will be repaid in time saved in writing and revising your manuscript.
    - A style manual is a collection of rules and regulations that editors get tired of repeating to authors. The answers to most questions can be found here. The *AMA Manual of Style*[1] has been adopted as the official style manual for the *Journal of Athletic Training*. However, *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers*[2] has some information not found in the *AMA Manual of Style*. We often consult it also.

66. Structure is only half the battle. Grammar and style are equally important. See the accompanying article, "Optimizing Scholarly Communication: 30 Tips for Writing Clearly," for clear writing tips.

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Optimizing Scholarly Communication: 30 Tips for Writing Clearly

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Objective: To share with potential authors tips for communicating their ideas more clearly in a scholarly manuscript.

Description: Communicating scientific, technical, or medical information so that readers can understand its meaning requires logical organization and proper use of language. These 30 tips review basic English grammar and suggest ways authors can clearly and concisely present their material. We admonish authors to avoid common errors such as writing in the passive voice, overusing abbreviations, and emphasizing unimportant facts.

Conclusion: Attention to matters of writing style enhances clear communication, which must be the prime objective of scientific writing.

Why do you want to write a scholarly manuscript: to get your name in print; to impress your boss, spouse, parents, colleagues, or friends; to add a few lines to your resume; to get tenure or a promotion; or to communicate your ideas to those who read your manuscript? Most of the above goals are easily accomplished; the last is not. It takes great effort to clearly communicate even simple ideas.

Clear communication must be the prime objective of scientific writing.[18] It requires good thinking, not fancy word processing.[15] Ideas must be presented precisely and logically, in an orderly manner that flows smoothly from idea to idea. This process of developing ideas clearly and logically captures readers' attention, keeps them reading, and maximizes the possibility that they will apply the information to their clinical practice, teaching, or research.

Content, structure, and clarity of presentation are the major elements of effective scholarly communication. You are on your own with content. We address proper structure in a companion manuscript;[14] here we present the following 30 tips for clear writing. As with the companion manuscript, we present this material in a numbered list format for the reasons given there.

PARTS OF SPEECH AND GRAMMAR

1. Manuscripts are a collection of paragraphs, which are a collection of sentences, which are a collection of phrases and clauses, which are made from words. Words are classified as one or more of the nine parts of speech. These are reviewed in Tables 1 and 2 and are discussed in any grammar text; our favorite was written by Day.[4]

2. **Sentence**: Try to write in short sentences. Usually, they are easier to understand than long ones.

3. **Paragraph**: Paragraphs are not just chunks of text; rather they are logically constructed passages organized around a single major idea[16] presented in the first sentence of the paragraph. All other sentences in the paragraph develop and amplify the idea. Construct, order, and connect paragraphs to guide readers from one topic to the next, along a logical train of thought.[16] Each paragraph should be able to be read and understood in isolation from the rest of the manuscript.

4. **Voice**: Voice refers to the action of a verb, which can be active or passive. A verb with a direct object is in the active voice. When the direct object is converted into a subject, the verb is in the passive voice (see the sentences below). A passive verb is always a verb phrase consisting of a form of the verb *be* followed by a past participle. The subject of a passive verb does not act. The active voice is usually preferred, for reasons presented later [see Active Versus Passive Voice].

ACTIVE VOICE	PASSIVE VOICE
Priscilla *applied the brace.*	The brace *was applied* by Priscilla.
We *measured* temperature every 5 minutes.	The temperature *was measured* every 5 minutes by the authors of this study.

5. **Person**: Person is the form of a verb or a pronoun which indicates whether a person is speaking (first person), is spoken to (second person), or is spoken about (third person). Use first person when telling what you did, second person when describing how to perform a technique, and third person to explain what others did.

FIRST PERSON	
I see the boy.	*We* recommend this technique.
SECOND PERSON	
Can *you* see the boy?	*Apply* two strips vertically.
THIRD PERSON	
He sees the boy.	*Each subject* lifted 100 lbs.

6. **Tense**: Tense is the form of the verb that indicates its relation to time. Inflection (eat, eats, eating, ate, eaten) and

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Table 1. The Parts of Speech

1. Articles—a, an, or the
   a. Indefinite article
   b. Definite article

2. Nouns—words for people, places, things, or ideas
   a. Proper and common nouns
   b. Concrete and abstract nouns
   c. Collective and mass nouns

3. Adjectives—words that modify a noun or pronoun

4. Pronouns—words used to replace nouns
   a. Personal pronouns
   b. Demonstrative pronouns
   c. Relative pronouns
   d. Interrogative pronouns
   e. Indefinite pronouns
   f. Reflexive pronouns

5. Verbs

6. Adverbs—words that modify verbs, adjectives, or other adverbs

7. Conjunctions—used to connect words, phrases, or clauses
   a. Coordinating conjunctions
   b. Subordinating conjunctions
   c. Coordinating adverb

8. Prepositions—combine with nouns or pronouns, usually expressing direction or location

9. Interjections—words, phrases, or sentences expressing emotion

the use of auxiliaries (will eat, have eaten, had eaten, will have eaten, etc) show the tense of the verb. Use past tense when referring to events of the past, present tense when giving instruction, and future tense when referring to events yet to occur. A common error involving tense is failing to use past tense when describing previous research or writing.

Table 2. Parts of Speech*

Three little words you often see
Are ARTICLES, a, an, and the.
A NOUN's the name of anything;
As *school* or *garden, hoop* or *swing.*
ADJECTIVES tell the kind of noun;
As *great, small, pretty, white,* or *brown.*
Instead of nouns the PRONOUNS stand;
Her face, *his* face, *our* arms, *your* hand.
VERBS tell of something done;
To *read, count, sing, laugh, jump,* or *run.*
How things are done the ADVERBS tell;
As *slowly, quickly, ill,* or *well.*
CONJUNCTIONS join words together;
As men *and* women, wind *or* weather;
The PROPOSITION stands before
A noun, as *in* or *through* a door.
The INTERJECTION shows surprise;
As *oh! how pretty! ah! how wise!*
The whole are called nine parts of speech,
Which reading, writing, speaking teach.

* Anonymous, quoted by Day[5]

7. **Number**: Number refers to whether a noun, a pronoun, a demonstrative adjective, or a verb is singular (book, I, this, was) or plural (books, we, these, were). Sentences and paragraphs must be internally consistent concerning number. "John and Roy taped using his own technique" is incorrect because "John and Roy" is plural and "his" is singular.

WRITE CONCISELY

8. Vigorous writing is concise[22] and direct.[9] A sentence should contain no unnecessary words and a paragraph no unnecessary sentences.[22] This does not mean that all sentences and paragraphs should be short or lacking in detail, but that every word should be purposeful.[22]

9. Write directly. State the conclusion; then reference it. If the conclusion needs amplification, do it following statement of the main idea. **Note:** This advice refers to presenting results where your reference is your statistical test—see Structure Tip 26[14] as well as when discussing others' results and writings.

Be as Brief as Possible

10. Whatever you write, shortening—*condensing*—almost always makes it tighter, straighter, and easier to read and understand. Following are six suggestions to help you write concisely[23]:
    a. Present your points in logical order. Attempt to communicate your thoughts clearly in the fewest possible words.
    b. Don't waste words telling people what they already know, but be careful in your assumptions of how much people know.
    c. Cut out excess evidence and unnecessary anecdotes and examples.
    d. Look for windy phrases, the most common word wasters. For example, replace "at the present time" with "now," and "in the majority of instances" with "usually."
    e. Look for passive verbs that you can make active. Invariably, this produces a shorter sentence.
    f. When you've finished, stop. This means don't keep rambling on and on when you have already said what you wanted to say. For example, the previous sentence (and this one too).

Keep Vocabulary Simple

11. Your prime purpose should be to *explain* something, not to prove that you are smarter than your readers.[16] Using big, uncommon words tends to slow down (and perhaps annoy) the reader, while familiar words and phrases enhance understanding. Day[4] used the following five statements to condemn complicated vocabulary in writing.
    a. Thoughts are communicated more effectively with a forceful, simple, and direct vocabulary than with tech-

nical or scientific jargon and worship of polysyllables.[5]

b. "Long words name little things. All big things have little names, such as life and death, peace and war, or dawn, day, night, love, or home. Learn to use little words in a big way. It is hard to do. But they say what you mean. When you don't know what you mean, use big words. They often fool little people."[20]

c. "Big words can bog down; one may have to read them three or four times to make out what they mean. . . . Short words are bright like sparks that glow in the night, moist like the sea that laps the shore, sharp like the blade of a knife, hot like salt tears that scald the cheek, quick like moths that flit from flame to flame, and terse like the dart and sting of a bee."[25]

d. "Too many scientists, and perhaps members of all professions, want to 'sound' scholarly. Therefore, they sometimes dress up a simple thought in an outrageous costume. Sometimes, the thread of the idea gets lost along the way, and all we see is the frayed costume. As for me, I don't want the costume. If I have learned anything from my years of experience in scientific writing, editing, and publishing, it is this: Simplicity of expression is a natural result of profound thought."[4]

e. "We have not known a single great scientist who could not discourse freely and interestingly with a child. Can it be that the haters of clarity have nothing to say, have observed nothing, have no clear picture of even their own fields?"[21]

12. Don't use words, expressions, or phrases known only to people with specific knowledge or interests. For example: "A scientist, using scientific jargon, wrote, 'The biota exhibited a one hundred percent mortality response.' He could have written: 'All the fish died.'"[23]

13. **Use "first-degree" words**. "These words immediately bring an image to your mind. Other words must be 'translated' through the first-degree word before you see the image."[23]

a. For example: The logic for when to use or not use abbreviations [Tip 14] applies here.

b. "A speech writer for President Franklin D. Roosevelt wrote, 'We are endeavoring to construct a more inclusive society.' FDR changed it to, 'We're going to make a country in which no one is left out.'"[23] By using more common words, FDR communicated his thoughts more clearly.

Avoid Overusing Abbreviations

14. Most abbreviations, acronyms, and initialisms are strongly discouraged in scientific writing.[1,3,5,12,13] Use only abbreviations that are widely known and accepted.[1,3,5,13] Other abbreviations are usually a sign of lazy writing and confuse and/or slow down readers.[1,5] An unknown abbreviation causes the reader to pause, search for the abbreviation's meaning, and mentally 'translate it.' For instance, "IBM" is instantly recognized; most readers do not have to pause and translate it. Therefore, it is an acceptable abbreviation. And since most readers would pause after reading "International Business Machines" and mentally translate it into "IBM," the abbreviation is preferred. The same logic applies to using first-degree words [Tip 13].

15. Keep "abbreviations to a minimum. The editor will look more kindly on your paper, and the readers of your paper will bless you forever."[5]

Prune Empty Words

16. One of your chief tasks when rewriting is to prune all words that lack meaningful content.[23] "Empty words" are words that cloud rather than clarify meaning. For example, *there* or *it* at the beginning of a sentence are often empty words; they deemphasize the important elements in the sentence. The sentence conveys its message better if the subject is at the beginning of the sentence. Consider the following:

a. **poor**: There are several techniques that could be utilized to tape an ankle.
better: The ankle can be taped several ways.

b. **poor**: It is my opinion that knee braces are helpful.
better: My opinion is that knee braces are useful.
better still: I think knee braces are useful.

EMPHASIZE FACTS—NOT WHO WROTE THEM

17. Many writers unintentionally put too much emphasis on names of other writers. This often occurs when they begin a sentence with the authors' names. Such writing tends to emphasize the authors and diverts the reader's attention from the facts. Compare the clarity of the following two sets of examples. [NOTE: References are part of the examples; they do not refer to references at the end of this paper.]

a. **Muddled Example A**
Coppin, Livingston, & Kuehn (4) used the same procedure as Johnson and Leider (10) but found different results. Coppin et al (4) found that grip strength significantly decreased immediately following immersion of the forearm. Strength recovery returned to normal after 40 minutes and no increases in postimmersion strength were recorded. This differs with Johnson & Lieder (10) who stated that they observed significant strength increase 80 minutes posttreatment.
Clearer Example A
Controversy exists concerning the effect of ice water immersion on strength. (4, 10) Forearm strength has increased 80 minutes postimmersion (10) and decreased immediately following immersion but returned to normal within 40 minutes postimmersion (4) in studies using similar procedures.

b. **Muddled Example B**
Still another of the body's systems affected by overtraining is the cardiovascular system. Dressendorfer and associates (2) determined that overtrained athletes exhibited elevated exercise heart rates. Additionally,

overtrained athletes required longer time periods for return to normal heart rate following activity.

The literature is unclear regarding the effect of overtraining on blood pressure. Mallerowicz and Barron (10) reported increases in resting blood pressure in overtrained athletes. Wolf (14) showed a lowered resting blood pressure. Verma et al (13) observed a lengthened time to return to basal blood pressure levels after exercise in overtrained athletes.

Clearer Example B

Still another of the body's systems affected by overtraining is the cardiovascular system. Overtrained athletes exhibit elevated exercise heart rates (2) and require longer for their heart rates (2) and blood pressure (13) to return to normal following activity. The literature is unclear regarding whether overtraining results in increased (10) or decreased (14) resting blood pressure.

ACTIVE VERSUS PASSIVE VOICE

18. Personal pronouns (I, we) and the active voice *should be used* in scientific and technical writing. At one time, people thought it was improper to use personal pronouns and to write in the active voice, and these thoughts persist. But, medical editors and scientific and technical writing experts have been trying to change these ideas for more than 30 years.[7,17,24]

19. Writing in the passive voice often is dry, dull, rigid, pompous, ambiguous,[6,7,17,24] " . . . weak, evasive, convoluting, confusing, tentative, timid, sluggish, amateurish, obscene, and immoral."[2] Furthermore, "it is not 'more scientific' and 'objective' to use the passive voice; it is only more imprecise—and cowardly, . . . weasel-worded."[19]

20. "Authors sometimes resort to the passive voice to avoid the presumed immodesty of the personal pronoun 'I.' In doing so, they often introduce ambiguity."[6] "The passive voice, of course, is appropriate in certain circumstances. . . . Use of the passive voice, however, to avoid the personal pronouns 'I' and 'we' to evade a direct statement or identification of the opinion, is merely false modesty."[8]

21. The passive voice is characterized by weak verbs. *To be* is a prime offender among weak verbs. Try this easy step in reviewing your work: Scrutinize every *is*, *are*, *was*, or *were*. Can you create a stronger sentence by eliminating it? This trick will not apply in every case, but you might be surprised at how often you can put it to work.[11]

22. "Circumstances sometimes necessitate use of the passive voice to avoid absurdities or convoluted phraseology. Here, as everywhere and always, good sense and judgment—hallmarks of the good editor—will prevail and will suggest the choice. If it is not really important to know which specific unit did the laboratory studies, for example, the passive voice is appropriate."[19]

PARALLELISM

23. The essence of parallelism is that similar ideas are expressed in a similar, or parallel, fashion.[10] Writers often fail to observe parallelism in a serial list (items separated by commas). This occurs, for example, when noun phrases and verb phrases are intermingled in the serial list [see Example A]. This also applies to phrases in an indented list [see Example B]. You can use numbers or letters or bullets, but it is still a list, and the items in a list should be parallel whether they are single words, phrases, or sentences.

    a. **Nonparallel Example A**

    The manufacturer claims the new dynamometer is more user friendly [a verb phrase], has more data storage capability [a verb phrase], and faster printing [a noun phrase].

    Parallel Example A

    The manufacturer claims the new dynamometer is more user friendly, has more storage capability, and prints faster.

    b. **Nonparallel Example B**

    The Lachman test is preferred over the anterior drawer test for evaluating anterior cruciate ligament tears because:

    1. moving the knee to 90° is sometimes painful,
    2. it negates the chance that joint mice will lock the joint,
    3. less influence of hamstring guarding

    Parallel Example B

    The Lachman test is preferred over the anterior drawer test for evaluating anterior cruciate ligament tears because it:

    1. is sometimes painful to move the knee to 90°,
    2. negates the chance that joint mice will lock the joint,
    3. lessens the influence of hamstring guarding.

24. An easy way to check for parallelism is to read the sentence repeatedly, each time eliminating all but one phrase. For instance, from Example A of Tip 23, "The manufacturer claims the new dynamometer faster printing" does not sound right; ". . . dynamometer prints faster" does sound right.

REPORTING NUMBERS AND UNITS

25. In general, numbers of a single digit (1–9) should be written out (ie, "nine," not "9"). Numbers of multiple digits (ie, 2.3 or 10 and greater) are written in numerical form unless they occur at the beginning of a sentence, in which case they are written out. Exceptions: addresses, ages, dates, designators (chapter 3), figure/table numbers (Fig 1), money, temperature (8°C), time (2 weeks, 2 seconds, etc), time of day, and units of measure (25 mm, 2 g, etc).

26. Report numbers to the same precision or one more decimal place than what you measured. For example, if you measured torque in whole numbers, you report "113.5

Newtons" not "113.45 Newtons." If you measured to the nearest 10 pounds you can report to the nearest pound, not to the nearest 1/10 of a pound. Precision of the instrument dictates the precision you report.

27. Units must be reported according to the style of the journal; ie, English or metric.

GENERAL HINTS

28. The word "data" refers to many numbers and is therefore plural. Use adjectives such as "these" and "those" with data, not "this" or "that."

29. Researchers don't "find," "discover," or "prove" things; they "observe" and "report" them.

30. Forget all the above rules while writing your first draft; focusing too much on style may hinder your thought processes. Get the concepts on paper first; then rewrite and rewrite until the concepts are clear.

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1994 Athletic Trainer Employment and Salary Characteristics

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Objective: The purpose of this study was to determine: 1) demographics and professional credentials of recently hired athletic trainers, 2) the association between these characteristics and the high school, clinical, and collegiate setting, and 3) which of these factors best predicted salary.

Design and Setting: A survey was sent to all prospective employers. Of the 472 surveys sent, 282 (60%) were returned.

Subjects: Prospective employers who were listed on the NATA job vacancy notices from January 1, 1994 to October 1, 1994.

Measurements: Employers selected a job description for their position opening and indicated the characteristics of the people they hired. The job descriptions were placed into three categories. A chi-square analysis was used to determine the degree of association between applicant characteristics and job descriptions. Employee characteristics were coded and a stepwise multiple regression analysis was performed to determined which of the characteristics best predicted salary. Analyses of variance were performed to determine differences among the three practice settings and as follow-up analyses to the multiple regression. An analysis of variance was also performed to compare salaries based on job description and teaching responsibilities.

Results: No association was found between the employment setting and gender, ethnicity, marital status, educational route, physical therapy, credential, or EMT certification. There was an association between the CPR instructor's credential and employment setting and between highest degree attained and employment setting.

Conclusions: The results suggest that these factors were most closely associated with employment in the collegiate setting. With regard to salary, it was determined that a doctoral degree, a master's degree, and marital status were the best predictors of salary.

Key Words: Survey, employment setting, credentials

In recent years, Moss[2–4] has studied the entry-level salaries of athletic trainers (ATs). For the hiring period of June 1, 1990 to June 1, 1991, Moss[3] reported that the high school athletic trainer with a teaching position earned significantly more than athletic trainers hired for a clinic, college, or nonteaching high school position and that college ATs who also taught for their institution made significantly more than those who did not. Additionally, Moss reported that there were no differences between individuals with master's degrees and those with only bachelor's degrees and that athletic trainers in NATA districts 4 and 5 earned significantly less than ATs in districts 6, 7, 8, and 10. However, in a second study for entry-level positions posted in 1992, Moss[3] reported salary levels similar to those in 1991 but did not report any statistically significant differences.

In contrast, Lawton et al[1] reported higher salaries for collegiate athletic trainers. However, they did not limit their study to entry-level positions. They also reported that educational level, teaching responsibilities, professional certifications, and institutional sponsorship of football did not significantly affect the salary of head athletic trainers.

The above studies[1–4] provide salary information within various employment settings and factors that may or may not influence salary. Furthermore, they address specific factors which may affect hiring for collegiate and entry-level positions. The purpose of our study, which was part of a larger study, was to assess a greater number of factors (eg, certification route, academic degree, ethnicity, etc) associated with employment and to expand the research to include the three primary practice settings and nonentry-level positions. Additionally, we attempted to determine which of these factors or combination of these factors best predicted an athletic trainer's salary.

METHODS

A survey was sent to all prospective employers listed on the NATA job vacancy notices from January 1, 1994 to October 1, 1994. Of the 472 surveys mailed, 282 (60%) were returned with a sample error rate of 1.9%. For this portion of the study, employers were asked to select a job description for their position opening and to indicate certain characteristics of the person they hired.

Initially, the 15 job descriptors were collapsed into three categories: high school (including teacher/trainer), clinic (including clinic-based athletic trainers with high school or college responsibilities), and college (including faculty). A

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descriptive cross-tabulation of the collapsed job descriptions with highest degree earned, gender, ethnicity, marital status, route to certification, and the additional certifications of EMT, PT, and CPR instructor was performed with a chi-square analysis. The chi-square analysis was used to determine the degree of association between these applicant characteristics and the job description. Additionally, the employee characteristics were dummy-coded, and a stepwise multiple regression analysis was performed to determine which of the characteristics best predicted salary. ANOVAs were also performed to determine differences among the three practice settings and as follow-up analyses to the multiple regression. Finally, to make a direct comparison with the results of Moss,[3] an ANOVA comparing salaries based on job description and teaching responsibilities was performed. The alpha level for all statistical analyses was set at $p = .05$.

RESULTS

The percentages of ATs with highest degree earned, gender, ethnicity, marital status, and route to certification in each of the practice settings are presented in Table 1. The chi-square analysis revealed a significant association between the highest degree attained and practice setting ($\chi^2 = 56.3$). Additionally, the chi-square analysis was significant ($\chi^2 = 7.03$) for the association between practice setting and CPR instructor certification with 33 (25.4%), 40 (30.8%), and 57 (43.8%) of ATs in the high school, clinic, and college setting possessing the certification, respectively.

The stepwise multiple regression analysis identified three factors that predicted salary. The first was possession of a doctoral degree (R = .21); the second was possession of a master's degree (R change = .16); and the third was marital status (R change = .13). An ANOVA revealed that the high school salary was significantly less than either the clinic or college salaries and that there was no difference between clinic and college salaries, $F(2,242) = 6.62$, $p = .0016$. The mean salaries for each of the practice settings is presented in Table 2. A second ANOVA revealed significant salary differences, $F(2,222) = 9.99$, $p < .0005$ dependent upon the highest degree attained (Table 3) as well as marital status (Table 4), $F(1,222) = 5.84$, $p = .017$. There were no significant interactions. Tukey post hoc testing revealed that ATs with a doctorate earned more than ATs with a master's or bachelor's degree and that those individuals with a master's degree earned significantly more than those with a bachelor's degree. Finally, the comparison of salaries based on job description and teaching (Table 5) produced a significant interaction, $F(1,240) = 7.6$, $p = .006$. Tukey post hoc testing revealed that high school teacher-athletic trainers earned more than full-time high school athletic trainers and college athletic trainers who did not teach. However, there were no differences between clinical ATs, college ATs who taught, and high school teacher-athletic trainers.

DISCUSSION

One of the primary findings of our study was the association between highest degree attained and practice setting. Table 1

Table 1. Characteristics of Athletic Trainers Hired in 1994 From the NATA Job Vacancy Notices

	High School		Clinic		College	
	No.	%	No.	%	No.	%
Degrees						
Bachelor's	37	64.9	47	43.5	10	10.6
Master's	19	33.3	61	56.5	76	80.9
Doctorate	1	1.8	0	0.0	8	8.5
Total	57		108		94	
Gender						
Females	23	38.3	35	32.4	48	48.5
Males	37	61.7	73	67.6	51	51.5
Total	60		108		99	
Ethnic group						
Black	1	1.7	3	2.8	4	4.0
Hispanic	4	6.8	0	0.0	2	2.0
Asian/Pacific islander	1	1.7	1	0.9	2	2.0
Native American	2	3.4	1	0.9	0	0.0
White (non-Hispanic)	51	86.4	102	95.3	92	92.0
Total	59		107		100	
Marital status						
Married	18	30.5	28	25.9	33	12.3
Not married	41	69.5	80	74.0	67	24.5
Total	59		108		100	
Educational route						
Internship	11	19.6	25	22.7	24	24.2
Undergraduate	28	50.0	56	50.9	47	47.5
Graduate	17	30.4	29	26.4	28	28.3
Total	56		110		99	

Table 2. Salaries for Each Practice Setting (Mean ± SD)

	Salary
High school*	$22,781 ± 8,182
Clinic	26,344 ± 3,876
College	25,835 ± 6,160

* High school < clinic and college ($p < .05$).

Table 3. Salaries for Highest Degree Attained (Mean ± SD)

	Salary
Bachelor's*	$23,684 ± 6,282
Master's	25,868 ± 5,537
Doctorate	33,786 ± 2,857

* Bachelor's < master's < doctorate ($p < .05$).

Table 4. Salaries for Marital Status (Means ± SD)

	Salary
Married*	$27,061 ± 6,165
Single	24,706 ± 5,928

* Married > not married ($p < .05$).

Table 5. Salaries for Practice Setting and Teaching Responsibilities (Means ± SD)

	No Teaching	Teaching	Total
High school*	$19,547 ± 8651	27,191 ± 4890	22,781 ± 8182
Clinic	26,344 ± 3876	0	26,344 ± 3876
College	24,561 ± 6228	26,802 ± 5984	25,835 ± 6160
Total	24,705 ± 6095	26,914 ± 5660	25,390 ± 6039

* High school, no teaching < high school, teaching; clinic, no teaching; college, no teaching; and college teaching ($p < .05$). College, no teaching < high school, teaching ($p < .05$).

indicates that 64.9% of the high school ATs possessed a bachelor's degree. This suggests that a bachelor's degree is the primary requirement for employment in the high school setting. Conversely, the data suggest that a master's degree is preferred in collegiate settings with 80.9% of collegiate athletic trainers possessing master's degrees. This finding was expected. Typically, academic institutions require instructors to possess an advanced degree at least one level above the level at which they teach. For example, if instructors teach at the bachelor's level, they would be required to possess at least a master's degree. This is the most likely explanation for the large number of collegiate athletic trainers possessing master's degrees. In fact, examination of the raw data indicates that 44 (58%) of the 76 collegiate ATs with a master's degree teach at their institution.

In contrast to the collegiate and high school settings, there was a much narrower split between bachelor's degrees and master's degrees in the clinical setting. Specifically, 47 (43.5%) and 61 (56.5%) of the clinical athletic trainers possessed a bachelor's or master's degree, respectively. These percentages were very similar to the percentages for the total study population (ie, 36 and 60% for bachelor's and master's degrees, respectively). Thus, it is likely that these differences in the clinical setting represented the natural differences within the study population and not employer preferences.

In addition to academic degree, there was a significant association between being a CPR instructor and being located within the practice setting. A breakdown of the chi-square test as well as the raw data suggested that having CPR instructor's certification was associated with employment in the collegiate setting. As with the master's degree, this was probably due to many collegiate settings needing CPR instructors to train student athletic trainers.

In predicting salary levels, possession of a doctoral degree was the best predictor. As indicated in Table 3, individuals with a doctoral degree averaged approximately $8,000 more per year than individuals with a master's degree. This was not surprising considering these salaries most likely represent academic rather than clinical appointments. The second factor that predicted salary was possession of a master's degree. Based on the data presented in Tables 1 and 2, this result was not surprising. Table 1 indicates that the majority of individuals with a master's degree were in the clinical and collegiate environments [137 (53%)] which also had the highest salaries (Table 2). Finally, the last factor that predicted salary was marital status. Specifically, the analysis suggests that married individuals earned more than single individuals (Table 4). It was unclear as to whether the married employees negotiated for higher salaries, were offered more by the employer because they were married, or were offered more because they were older and had more work experience.

Our results are slightly different than those of Moss.[2,3] Moss reported that the high school teacher-athletic trainers earned more than any other athletic trainer and that the college teacher-athletic trainer earned more than their nonteaching counterparts. Our results (Table 5) suggest that individuals with teaching positions in the three settings had equivalent salaries and that these salaries did not differ from individuals working in the clinical setting. Additionally, Moss[3] reported that there were no salary differences between individuals with bachelor's and master's degrees. Our results indicated that athletic trainers with a master's degree earned approximately $2,200 more on average, than athletic trainers with a bachelor's degree (Table 3). One possible reason for these differences is that we did not limit our study to entry-level positions. This possibility was supported by Lawton et al[1] who produced results similar to ours using data not limited to entry-level positions. It should also be noted that, in his study of 1994 salaries, Moss[2] did report larger salaries for athletic trainers with a master's degree.

CONCLUSION

Our data suggest that athletic trainers interested in working in clinical or collegiate settings should possess a master's degree, and those interested in working in the collegiate setting should also possess the CPR instructor's certification. With respect to employee characteristics, our results suggest that possession of a doctoral degree was the best predictor of salary.

Finally, our data suggest that the higher salaried jobs were positions in the clinical setting and those positions which include teaching.

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Awareness and Identification of Athletes With Sickle Cell Disorders at Historically Black Colleges and Universities

J. David Jones, MS, ATC; Douglas M. Kleiner, PhD, ATC

Objective: Information regarding the incidence or complications of sickle cell disorders in athletes has not been well reported in the literature. In this study we identify the amount of exposure that athletic trainers have to athletes with sickle cell disorders at historically black colleges and universities and describe the precautions, screening procedures, and treatment techniques used to identify and manage this population.

Design and Setting: A 12-question survey was mailed to head athletic trainers asking about their exposure to athletes with sickle cell disorders.

Subjects: Athletic trainers at 94 historically black colleges and universities.

Measurements: Descriptive data were compiled as frequencies and reported as a percentage of the total responses (n = 34). The data were also grouped by NCAA division or as non-NCAA member institutions.

Results: Of the 94 surveys, 34 (36%) were returned. Respondents reported that 4.9% of their athletes had the genetic trait, yet only 12% of the schools required screening for the trait during their athletic preparticipation examinations. Three of the schools (9%) reported a total of 10 incidents of athletes having sickle cell crises at their facilities.

Conclusions: We suggest that there is a likelihood for athletic trainers to encounter athletes with sickle cell disorders. Further education regarding sickle cell disorders may be needed.

Key Words: athlete, sickle cell anemia, sickle cell disorder, sickle cell trait

Sickle cell disorders are conditions that have long been associated with African-Americans.[6,18] Individuals who carry the sickle cell trait are considered by the medical profession as being mostly "healthy persons,"[22] whereas sickle cell anemia, the more severe form of the disorder, can limit physical performance and, in extreme cases of intense physical activity, can cause sudden death.[4] There have been few reports about preventive measures taken by colleges or universities to identify or treat athletes who may have sickle cell disorders.

Sickle cell trait, the benign disorder characterized by the heterozygous Hb-AS blood type, and sickle cell anemia, the homozygous disorder (Hb-SS blood type), are both genetic conditions.[11] Collectively, these are categorized as sickle cell disorders, with each having associated complications.[9,16]

The incidence of sickle cell trait is reported to be between 8% and 10% of the American black population,[18] while worldwide the number increases to 12% to 40%.[1,5,9] Studies involving athletic populations have indicated an incidence similar to that of the general population. A survey of National Football League players indicated that approximately 7% of the black players have sickle cell trait,[13] while it is reported that 18.6% of West African college athletes have the trait.[13,23] Despite these numbers, routine screening for sickle cell trait is not currently recommended by the National Collegiate Athletic Association (NCAA) or other sports-governing bodies.[14]

In its heterozygous state, sickle cell trait represents approximately 20% to 45% of red blood cell total hemoglobin, while the majority of the hemoglobin is normal.[1] Persons with sickle cell trait are regarded as carriers of the disorder and will normally show no signs or symptoms. However, with intense physical activity, individuals with sickle cell trait can develop a greater amount of sickling.

With sickle cell anemia, 80% to 100% of the hemoglobin in the red blood cells is abnormal and the red blood cells possess the distinctive crescent-shaped cell.[1] In the United States, it is estimated that 0.2% to 1.0% of black Americans suffer from chronic sickle cell anemia, while worldwide the incidence can rise to greater than 30% depending on the region.[1,15] Even though sickle cell trait is considered much more benign than sickle cell anemia, both disorders are considered risk factors for sudden death when associated with intense physical activity.[1,9,10,12,19]

The tendency toward sickling is influenced by factors associated with intense exercise including acidosis (such as lactic acidosis), hypoxia (induced by physical exertion at altitude), and dehydration.[7,9] Exertional rhabdomyolysis, or the catabolism of muscle tissue, can be a severe complication of sickle cell disorder and is frequently present when dehydration leads to sickling.[20] The waste products that are produced as a result of rhabdomyolysis are potentially lethal to the body's systems, particularly to the liver and kidneys. Once the kidneys have been affected by rhabdomyolysis, the situation becomes more critical and can ultimately lead to death.[2,3]

It is important for athletes to understand that extreme physical exertion often creates conditions conducive to sickling.[8] Complications often associated with sickling include: muscle cramps, painful episodes of tissue ischemia, musculoskeletal pain, delayed growth and sexual maturation, chronic pulmonary dysfunction, renal disorders, orthopedic problems (such as vasocclusion, bone infarction, and avascular necrosis), and, in some instances, sudden death.[6,17,24] When the signs and

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symptoms of these associated complications are present, it is said that the athlete is in "crisis." Previous studies have suggested that exercising individuals who have sickle cell disorder may be susceptible to a crisis, and, therefore, should not participate in intense activities.[10,19] Although this practice is no longer accepted, it does stress the importance of black athletes being aware of their sickle cell status. Considering the potential for complications in athletes with a sickle cell disorder, it is also important that athletic trainers be knowledgeable regarding screening, recognition, and treatment of these disorders.[8]

The purpose of this study was to identify what exposure the athletic trainers (ATs) working at historically black colleges and universities had to athletes with sickle cell disorders. A secondary purpose was to describe the precautions, screening measures, and treatment techniques used to identify and manage this population. Finally, as descriptive information, we attempted to identify whether the athletic trainers at the historically black colleges and universities who responded to survey were certified by the National Athletic Trainers' Association (NATA).

METHODS

The head athletic trainers at 94 historically black colleges and universities were each mailed a 12-question survey. The addresses of the colleges and universities were obtained from a mailing list provided by the NCAA. Historically black colleges and universities were specifically chosen because of their greater likelihood to have athletes with sickle cell disorders.

Each instrument was accompanied by definitions of sickle cell trait and sickle cell anemia, to better enable the respondents to clearly understand the differences between these two different, but related, blood disorders. Schools not responding to the first mailing of the survey were sent a follow-up instrument.

All returned instruments were compiled by the researchers and kept on file. To ensure confidentiality, each school and each instrument was coded with a number known only to the principal investigators. Descriptive data were compiled as frequencies and are reported as a percentage of the total responses (n = 34). The data were also grouped by NCAA division or in a non-NCAA member classification.

RESULTS

Of the 94 instruments, 34 (36%) were returned and classified according to their NCAA division (Table 1). Questions were asked about the amount of exposure the ATs had to athletes with sickle cell disorders (Table 2). Three (9%) of the colleges (one from each NCAA division) reported a total of 10 incidents of athletes developing sickle cell crisis while at their institutions. When asked what percentage of their athletes they thought had sickle cell trait, 15 (44%) of the ATs at these institutions reported that it was their perception that less than 1% of their athletes had the trait. Five (15%) of the ATs believed that less than 5% of their participating athletes had the trait. Four (11%) of the respondents reported having more than 5% of their athletes test positive for sickle cell trait. These data indicate that the ATs at these historically black colleges and universities believe that a small number of athletes with sickle cell trait participate in their colleges' athletics programs or that they may be unaware of the number of athletes with sickle cell trait. Furthermore, 10 (29%) of the ATs did not respond to this particular question of the survey which might also indicate a lack of awareness.

Table 1. Number of Respondents Who Completed the Sickle Cell Survey, Grouped by NCAA-Division

NCAA Division	Frequency	Percentage
Division I	09	26.5
Division II	13	38.2
Division III	04	11.8
NCAA nonmember	08	23.5
Total population	34	100.0

Additional questions were designed to determine the health care prevention strategies used by the ATs for athletes with sickle cell trait. The ATs were asked if their schools routinely paid for the cost of sickle cell screening. In this study, 4 (12%) of the schools required blood screening for sickle cell trait as part of their athletic preparticipation examinations. However, an additional 6 athletic departments (17%) said they would pay for the cost of the screening if the athlete wanted to be tested for sickle cell trait. Fifty percent of the schools asked about sickle cell trait in the athlete's medical history. Fifty percent also asked if sickle cell trait was present in the medical history of the athlete's immediate family. In 6 (17%) of the cases, the athletes were not asked about sickle cell trait, but were referred to the student health center for their preparticipation examinations.

Another question on the instrument asked the ATs if they had ever heard of the law case of *Sorey v Kellett* involving a college athlete who died of sickle cell complications.[21] In this lawsuit, the team physician, the athletic trainer, and the coach were all sued by the family of the athlete who died because he was not properly cared for by the university's medical staff.[21] Only 3 (9%) of the respondents in our survey reported knowing of this lawsuit.

The respondents were then asked if their institutions employed a full-time athletic trainer, and if he/she was certified by the NATA. Twenty-five of the 34 respondents (74%) employed athletic trainers. Of the AT respondents, 21 (62%) reported that they were certified by the NATA. However, it is likely that this statistic is biased. It is possible that the schools which responded did so because there was an AT there to receive the survey, and those that did not employ an AT were unable or unwilling to complete the survey. Therefore, we urge caution when interpreting these results. We would also recommend that historically black colleges and universities hire full-time NATA-certified athletic trainers, if they do not already.

DISCUSSION

It is our opinion that the current practice of screening athletes for sickle cell trait may not be sufficient and should be

Table 2. Sample Questions Taken From the Instrument

1. How many intercollegiate athletes do you have at your college or university?
2. Do you require blood screening for sickle cell trait as part of your preseason participation requirements?
3. Which of the following are included as part of the athlete's preseason examination? (Check all that apply)
   _ Blood screening specifically for sickle cell trait.
   _ Asking if the athlete has sickle cell trait on a medical history form.
   _ Asking if the athlete has any immediate family members with history of sickle cell trait.
   _ Does not apply to my program.
4. Does your student health center ask about sickle cell anemia on their medical history form?
5. Does the athletic department at your university or college provide and pay for sickle cell trait screening if the athlete requests it?
6. Have you ever had an athlete that has had complications (crisis) related to sickle cell trait?
7. If your response was "yes" to number 6, how many cases (s) have you seen or do you have on record?
8. Do any athletes with sickle cell anemia participate in any of your athletic teams at your college or university?
9. What percentage of your athletes DO YOU THINK have sickle cell trait?
10. Have you heard about the case of the athletic trainer who was sued by the family of an athlete who died of a sickle cell disorder?
11. Does your institution employ a full-time athletic trainer?
12. If your response was "yes" to number 11, is the AT certified by the National Athletic Trainers Association?

scrutinized further. Screening is needed to identify sickle cell status. Individuals with sickle cell trait may not know they are carriers for the disorder and may therefore be unaware of possible complications related to their condition. We believe that, as professionals, it is the responsibility of every athletic trainer to ensure that athletes at risk are identified and educated regarding their specific conditions. We recommend that questions designed to identify sickle cell trait be included in the medical history and that screening be provided to student-athletes during their preparticipation examinations.

The data from this study suggest there is a likelihood for athletic trainers to encounter athletes with sickle cell disorders. Furthermore, the respondents in this study probably underestimated the incidence of athletes with sickle cell disorders at their institutions. It was also apparent by several of the responses that there is still confusion regarding sickle cell anemia and sickle cell trait. Because of this, further education of ATs regarding sickle cell-related complications may be needed. Without current knowledge regarding sickle cell disorders, the possibility for ATs to encounter legal action remains. It is the responsibility of each AT to continually educate himself/herself regarding all aspects of sports medicine. ATs assume liability when treating athletes with sickle cell disorder, as with all athletes, and should be knowledgeable about screening, recognition, and treatment. It is hoped that the information presented in this study will encourage all ATs to seek further education regarding sickle cell disorders and its related complications.

Additional studies including ATs from other settings (high schools, professional teams, and other colleges and universities) in addition to historically black colleges and universities are needed to determine what screening measures, prevention strategies, and treatments of sickle cell-related complications are currently being practiced. Further research and continuing education of sickle cell-related complications for athletic trainers appears to be warranted.

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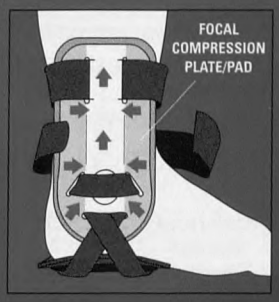

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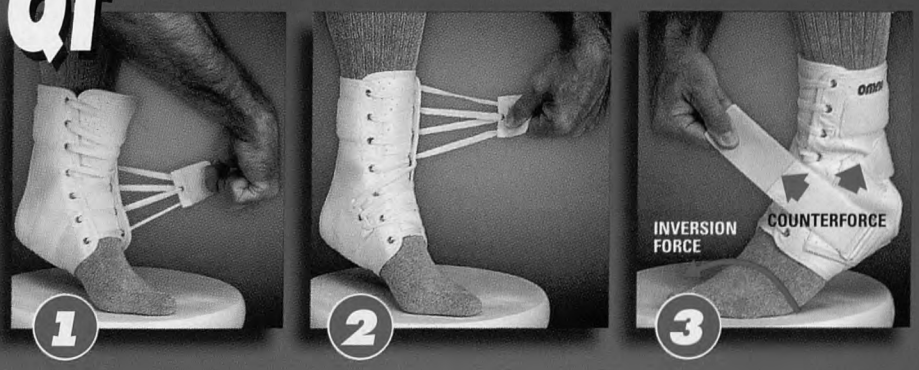

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Seasonal Mood Disturbances in Collegiate Hockey Players

Lionel W. Rosen, MD; Carol Smokler, PhD; David Carrier, MA, ATC; Christine L. Shafer, MD; and Douglas B. McKeag, MD

Objective: The purpose of this paper is to: 1) describe the seasonal affective disorder syndrome using a case illustration, 2) provide a simple and reliable method for identifying seasonal affective disorder, and 3) provide data as to the prevalence of the syndrome in a subset of collegiate hockey players.

Design and Setting: Collegiate hockey players were selected, because their practices begin in the fall and play is completed in the spring. The teams selected for participation were from the far Northwest and the upper Midwest regions.

Subjects: Sixty-eight Division I hockey players volunteered for the study. The three teams from which the subjects were chosen were located above latitude 42°/45′ north. Subjects were from the northern latitudes.

Measurements: The Seasonal Pattern Assessment Questionnaire was used to screen for seasonality. A sample of the athletes was also examined using the Hamilton Rating Scale for Depression together with the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed) criteria for Seasonal Pattern Specifier.

Results: Thirty-three (51%) were asymptomatic, 7 (11%) met the criteria for seasonal affective disorder, and 25 (39%) hockey players scored in the range that could classify them as candidates for subsyndromal seasonal affective disorder.

Conclusions: The prevalence of seasonal affective disorder among our sample approximated the national norm for the northern latitudes. However, the prevalence of subsyndromal seasonal affective disorder in our population was 25% compared to 13% reported nationally. Light therapy has been shown to reverse the effects of the disorders; however, further research needs to be conducted to determine its acceptance and effectiveness by the athletic population.

Key Words: hockey players, seasonal affective disorder, athletes, subsyndromal seasonal affective disorder, SAD

Investigators have described psychological variables that are likely to affect athletic performance, or even predispose an athlete to injury. Such variables include stress, compulsivity, attentiveness, self-image, and mood states.[2-4,11,12,16] As athletic competition intensifies and the demand for enhanced performance increases, athletes must master not only the mechanical aspects of their sport, but also the psychological variables that affect their performance and susceptibility to injury. Conversely, we have observed that many athletes, as a rule, avoid presenting themselves to their coaches, teammates, and opponents as being stressed, anxious, fearful, or depressed. Thus, factors that play a destructive role in the life of an athlete can go unrecognized.

The certified athletic trainer is in the unique position of identifying problems associated with the emotional and cognitive aspects of the athlete's life. This is by virtue of his or her integral role in the day-to-day health and well-being of athletes, and yet not being part of the coaching staff who routinely passes judgment on the performance and conduct of these individuals. The athletic trainer is often the recipient of the athlete's health history that is not elsewhere forthcoming. Despite this access and significant opportunity for the athletic trainer to play a major role in this area, too many health professionals have insufficient information regarding biologically based mood disorders that can seriously affect the performance of competitive athletes.

Recently, a psychiatric disorder that occurs with significant frequency has been described in the general population. This condition, seasonal affective disorder (SAD), can easily be overlooked or attributed to extraneous factors. It produces a variety of symptoms that occur most frequently during the fall and winter months, leading to possible misidentification. A pattern of decreased energy and physical capacity, anhedonia, impaired social functioning, increased appetite (particularly carbohydrate craving), hypersomnia, and decreased libido are characteristic of winter SAD.

Seasonality is described as the extent to which seasonal changes affect mood, sleep patterns, energy, libido, eating patterns, and social activity.[9] Anecdotal descriptions of changes in mood and behavior on a seasonal basis date back to antiquity, but only within the last decade have these changes been systematically examined and described as a clinical entity.[15] Additionally, Kasper et al[9] have defined subsyndromal SAD as a mildly dysfunctional state, experienced by people in the winter, which is insufficient in intensity to meet criteria for a major depressive disorder. These individuals were unlikely to seek medical or psychological treatment.

The following case study is provided to demonstrate typical features associated with the syndrome that has been identified as SAD.

CASE STUDY

A 19-year-old freshman collegiate hockey player was referred to a psychiatric consultant by a certified athletic trainer

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who believed that there might be a psychiatric explanation relating to the onset of his problems. This young man was highly regarded when he was recruited, but his performance deteriorated during the fall practice session. He was unable to correct mechanical errors in his skating and checking. The player was repeatedly criticized by the coaching staff for being inattentive and not following instructions. He complained of feeling chronically fatigued. A thorough medical evaluation, including a drug screen and tests for hypothyroidism, infectious mononucleosis, and anemia revealed no explanation for his fatigue.

Although his high school grades were good, it became evident that he was struggling simply to pass his courses in college. When he attempted to study, he found it was necessary to turn on all the lights to be able to concentrate. He frequently slept through his early morning classes and repeatedly failed to complete assignments.

At the time of his evaluation, he appeared downcast and was repeatedly apologetic for his poor performance on and off the ice. He described himself as being sleepy and tired all the time, stating that he never felt rested or refreshed even after prolonged periods of sleep. On the ice, his legs felt weak, he lacked confidence, and he avoided giving or taking checks. He also indicated that he found himself "grazing" on food, especially sweets, throughout the day, although not particularly enjoying what he ate. He described his dormitory room as "a mess," which was uncharacteristic for him. He had significantly curtailed any social activities because he "felt unsociable." He described an increasing lack of sexual interest. He noted that his mood seemed to match the ongoing gloomy weather. He said that he would have chosen another college if he had known winters were going to be so dreary.

He grew up and played junior hockey in a western Canadian province where sunshine prevailed, even in the winter. He acknowledged that in the past, he tended to feel more energetic in the spring and summer. When asked if he felt depressed, he forcefully said, "Not me. I don't sit around crying or anything."

Further history revealed that his mother suffered from repeated episodes of depression, especially during the Thanksgiving through Christmas time frame. One of his two sisters also had been treated for depression, although he was unclear as to whether she demonstrated a seasonal pattern.

The diagnosis of winter SAD was determined to be the likely explanation for his clinical presentation. He was treated with light therapy, using a commercial 10,000-lux light box. The treatment ultimately involved two 30-minute exposures, one in the morning on awakening and a second in the early evening. Within 10 days he reported that he felt much more optimistic, his studying was coming more easily, and he was, once again, enjoying himself on the ice. The coaches and athletic training staff noted a marked improvement in his play as well as his attitude.

PREVALENCE OF SAD

The prevalence of SAD in the United States varies from 1.4% in southern latitudes, to 9.7% in northeastern states.[13] The prevalence in patients with coexisting mood disorders is even higher, ranging from 10% to 38%.[5,7,8] There currently is little information regarding the prevalence of SAD, subsyndromal SAD, or even the extent to which seasonality exists among competitive athletes, a disturbing fact because mood states can significantly affect athletic performance and the potential for injury.

To determine the extent to which seasonality prevails in competitive athletes, a sport was chosen that overlapped the months in which the level of risk for SAD or subsyndromal SAD was highest. We selected collegiate ice hockey, as practice begins in the fall and tournament play is completed in the spring. Most ice hockey players have grown up in northern latitudes; thus, responses to changes in temperature was not a confounding variable in this study. The teams that were selected to participate were from the far Northwest and the upper Midwest regions.

METHODS

Sixty-eight Division I hockey players (age = 21 ± 3 yr) volunteered for this study. They were from three teams located above latitude 42°/45′ north. Their home states or provinces were uniformly in the northern latitudes.

Rosenthal et al[14] developed a single-paged, two-sided, self-administered instrument, the Seasonal Pattern Assessment Questionnaire, that has been widely accepted for use as a screen for seasonality. This instrument rates a variety of behaviors and emotions on a month-by-month basis, thus providing a picture of an individual's feelings and functioning over the course of a year. Although subjects are analyzing these items retrospectively, the results have been clinically validated.[14] A Seasonality Score provides information pertaining to the severity of seasonal changes that are noted in sleep, socialization, mood, weight, appetite, and energy. When combined with the information pertaining to the intensity of the seasonal changes, a simple mechanism is provided for identifying the prevalence of SAD and subsyndromal SAD.[10]

There was concern that the Seasonality Score might tend to exaggerate the extent to which problems exist in the athlete population. This may be particularly significant for athletes who compete in the fall and winter. Grueling practices, rugged competition, difficult travel schedules, and academic demands are likely to influence the responses to the portion of the Seasonal Pattern Assessment Questionnaire comprising the Seasonality Score. Thus, although a response pattern reflecting hyperphagia, hypersomnolence, weight fluctuations, and decreased social activity suggests a diagnosis of SAD or subsyndromal SAD, the athlete may, in fact, not be suffering from a depressive disorder.

To reduce the number of false-positive Seasonal Pattern Assessment Questionnaire Seasonality Scores in the student athlete population, additional inquiry was conducted by questionnaire. The supplemental questions provided an opportunity for the athletes to elaborate why they think they are experiencing changes in the parameters of sleep, appetite, weight change, social patterns, and mood. Explanations for changes that included staying up late to complete academic assignments, injuries, extra practice sessions, and long road trips

enabled us to consider alternative possibilities, despite the presence of high seasonality scores on the Seasonal Pattern Assessment Questionnaire. Whenever an athlete, on the basis of the Seasonal Pattern Assessment Questionnaire Seasonality Score, met criteria for SAD or subsyndromal SAD, the supplemental items were reviewed. If the Seasonality Score on any specific item was attributed partially or completely to artifacts of practice or study by the athlete's response to the supplemental questionnaire, their score for that item was subsequently lowered by one point or completely deleted if their explanation completely accounted for their response.

To obtain external validation of the survey group, another psychiatrist, blind to both the testing instruments being used and the scores, examined a sample of the athletes using the Hamilton Rating Scale for Depression together with the *Diagnostic Statistical Manual* (4th ed) Criteria for Seasonal Pattern Specifier.[1,6]

Several questions asking about a family history of alcoholism, substance abuse, and depression were added to the supplemental questionnaire. If a positive pedigree for depression, alcoholism, or substance abuse is established for an athlete, there should be a heightened index of concern that the athlete may be at an increased risk for the development of a mood disorder. Finally, questions relating to the use of caffeine and alcohol were included. Increased use, particularly of caffeine, in the fall or winter, could point to an attempt at self-medication to counteract seasonal lethargy.

The results derived from the Seasonal Pattern Assessment Questionnaire and the supplemental questionnaire were examined independently by four of the investigators. This group consisted of a primary care physician, a certified athletic trainer, a psychiatrist, and a clinical psychologist. Most findings reported in this section are based on simple frequency counts of responses to survey items. The data presented are derived from the Seasonal Pattern Assessment Questionnaire Seasonality Score. The criteria for scoring was based upon the system described by Kasper et al.[10]

RESULTS

Three questionnaires were incomplete and were not included in the results. This report, therefore, represents the findings from 65 players. When the supplemental questionnaire was used to eliminate false-positive findings from the Seasonal Pattern Assessment Questionnaire, the inter-rater reliability between the four investigators was 0.90. The reliability between the independent clinical assessor who conducted direct clinical evaluations of a sample of the athletes (n = 14) and the four raters was 0.91.

Unmodified Seasonality Data

Thirty-three (51%) ice hockey players were asymptomatic. Seven athletes (11%), on the basis of their responses, met criteria for SAD, while 25 hockey players (39%) scored in the range that suggested they were sufficiently impacted by adverse seasonal changes and therefore could be classified as candidates for subsyndromal SAD.

Modified Seasonality Data

Taking into account the extent to which practices and competition impact upon sleep patterns, eating behavior, and social activity, 43 of the players (66%) were asymptomatic. Of the seven athletes originally classified as having SAD, one was reclassified as subsyndromal SAD; thus, a revised total of six players (9%) appeared to experience the major symptoms associated with SAD. Of the original 25 players who appeared to meet criteria for subsyndromal SAD, only 15 met criteria after modifying the data. Thus, a total of 16 athletes (25%), including the one athlete who was reclassified from the SAD group, appeared actually to experience subsyndromal SAD symptomatology.

DISCUSSION

For many years, the depressive syndrome characterized by hypersomnolence, hyperphagia, anergia, and social withdrawal was viewed as an atypical presentation of the more classical, biological major depressive disorder. However, recent landmark studies by investigators such as Kasper, Hardin, Rosenthal, Terman, and others[7-10,15] have systematically described and developed treatment strategies for a group of disorders that are unique, and can be distinguished from other conditions affecting mood.

The prevalence of SAD among our sample of collegiate ice hockey players approximates the national norms for the northern latitudes. The prevalence rate of 9% differs little from the 10% prevalence reported in New Hampshire.[13] A survey of individuals residing in the Washington DC area reported a 4% prevalence rate for SAD.[7] The prevalence rate of subsyndromal SAD for our athlete population was 25% compared to 14% reported in the Washington DC area.[7] The prevalence of subsyndromal SAD was considerably higher among hockey players than the reported norms. This may be related to the differences in latitude between Washington DC and the regions from which our subjects were derived. At this time we are unaware of any other studies that have reported prevalence rates of subsyndromal SAD in the latitudes from which this study was conducted.

It has been noted that the experience of seasonal changes in function and mood may vary in intensity among individuals so as to immobilize one person, while creating only a mild disruption in another. The latter group of people might never come to the attention of a treating clinician, since a minor loss of energy, mild lethargy, a tendency to graze throughout the day on high density calories, with accompanying weight gain, might simply be written off as the consequences of the "winter blahs." However, an athlete who competes in a sport in which winning and losing can be measured in milliseconds, and who must be able to maintain intensity, speed, and strength throughout a contest can ill afford to concede even a mild decrement in function, let alone a major impairment in the parameters affected by a seasonal mood disorder.

The Seasonal Pattern Assessment Questionnaire is a reliable, easily administered instrument for the identification of athletes suffering from major mood disorders relating to the seasons,

and who are likely to benefit from phototherapy. The athletes suffering from SAD were accurately identified by their Seasonality Scores derived from the Seasonal Pattern Assessment Questionnaire. When the effects of practice and competition were taken into consideration, only one athlete was identified as a false-positive and subsequently reclassified as falling into the subsyndromal SAD category. The Seasonal Pattern Assessment Questionnaire is also useful in the identification of a significant subset of athletes who, although perhaps not as impaired as the former group, may well benefit by further evaluation and, if warranted, treatment. However, it was clear that the rigors of sport had a marked effect upon the responses to the Seasonal Pattern Assessment Questionnaire when athletes experienced less than the full seasonal syndrome. These findings were supported by the clinical evaluation of a subsample of 14 of the athletes.

Because it has been amply demonstrated that phototherapy can reverse the symptoms of individuals afflicted by SAD and subsyndromal SAD, it becomes particularly important to identify these disorders in the case of athletes where success and failure, not to mention the risk of injury, may depend upon the recognition and treatment of a seasonal mood disorder. Certified athletic trainers who are familiar with the clinical signs and symptoms of SAD and subsyndromal SAD are in a key position, by virtue of their close day-to-day involvement with individual athletes throughout the year, to make critical observations regarding changes in the athlete's weight and appetite, energy levels, mood, social interactions, and sleep. This will facilitate early identification and treatment of an athlete struggling with a seasonal disorder of mood.

We have initiated a light therapy regimen for athletes suffering from SAD and subsyndromal SAD. Preliminary evaluation of the data being collected suggests that the procedure has been accepted by the athletes. Athletes receiving treatment have reported notable improvements in mood and behavior. Objectively, improvement has been noted in terms of coaches' daily rating scores of on-ice performance. While nonspecific intervention by the training staff as the result of diagnosis, or increase in attention by the athlete to self-regulation of appetite and sleep may have occurred, improvement was not demonstrated before therapeutic exposure to light.

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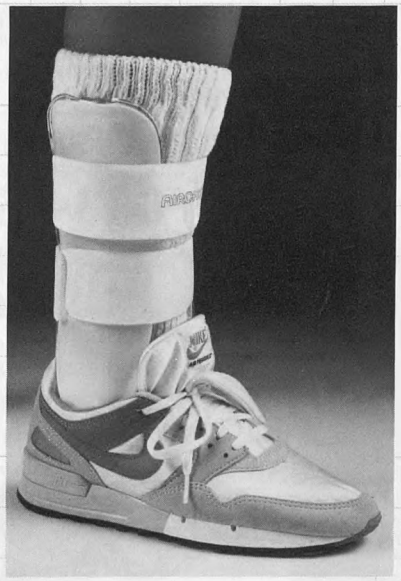

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Prevention of Injuries in Excessive Pronators Through Proper Soccer Shoe Fit

Michelle A. Sandrey, PhD, ATC; Carole J. Zebas, PED; Matthew Adeyanju, PhD

Objective: Properly fitting shoes are important in the prevention of injuries. When it involves the lower extremity and pronation, proper fitting of shoes is considered as a treatment for gender variations in shoe fit and excessive pronators. The purpose of the study therefore, is to compare static and dynamic foot tracings in excessive pronators to determine if there were differences between right and left feet of male and female soccer athletes.

Design and Setting: Multivariate analysis with static and dynamic foot tracing measurements of foot length, first metatarsal length, fifth metatarsal length, metatarsal width, and heel width as the dependent variables and male and female (gender) as the effect. Interscholastic soccer players who were excessive pronators were used in the study.

Subjects: Volunteers were solicited from a boys and girls interscholastic soccer team (level C to varsity). From this pool of 40 subjects, a group of 20 (10 males and 10 females, n = 40 feet), with excessive pronation were used in the study. Criteria for selection was based on navicular height (≥ 10 mm) and arch index (≥ .26).

Measurements: Static and dynamic foot tracings were determined. From these tracings, foot length, first metatarsal length, fifth metatarsal length, metatarsal width, and heel width were determined. Multivariate analysis of variance (MANOVA; $p < .05$), one-way repeated measures analysis of variance (ANOVA; $p < .05$), and pairwise comparisons ($p < .05$) were performed to determine significance, as well as intraclass correlation coefficients for intraclass reliability of the measurements.

Results: For between genders, male foot tracings for static and dynamic right and/or left feet were statistically greater in all foot parameters except heel width. Comparison of same side static and dynamic measurements for the right or left foot indicated differences for foot length, metatarsal width, and heel width for males, and foot length, fifth metatarsal width, metatarsal width, and heel width for females. There were no significant differences between static and dynamic foot measurements for either foot between genders and within genders.

Conclusions: Foot length should not be the only consideration used for determining proper shoe fit. Static and dynamic measurements for the right or left foot, as well as metatarsal width, fifth metatarsal length, and heel width should also be included.

Key Words: pronation, static and dynamic foot measurements, female foot

One concern of athletic trainers is the prevention of injuries. When the lower extremity is involved, the focus turns to strains, sprains, and overuse injuries. If biomechanical abnormalities are considered as a cause, the attention then turns to the foot, knee, or hip. If the foot is the primary concern, one thinks of excessive pronation or supination, which must be controlled as part of the treatment of overuse injuries such as posterior tibial tendinitis, shin splints, and patellofemoral pain syndrome.[1,14] Orthotics[1,14] and taping techniques[1,14] are reported in the literature as treatments used most often. Rarely does one consider the proper fit of the shoe or shoelace patterns as other means of controlling excessive pronation.[6,13]

The fit of a shoe depends on length, width, last, shape, and type of material used in its construction.[9,11] Because of limited sizes and shapes of soccer shoes, soccer athletes have become accustomed to wearing ill-fitting shoes.[3] This is a problem for athletes who pronate excessively and for women. Excessive pronation leads to a medial breakdown of the shoe, a lack of rearfoot control, and overuse injuries. Some women who have big or wide feet resort to buying men's or boy's shoes, which are cut wider for the same length.[17]

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Carole J. Zebas is a professor and **Matthew Adeyanju** is an associate professor in the Department of Health, Physical Education and Recreation at The University of Kansas in Lawrence.

Few studies have been done to determine whether there are anatomical differences in the female athletes' feet.[2,12] No comparisons of female to male athletes' feet, of soccer players, or of excessive pronators have been done, however. Therefore, the purpose of this study is to compare static and dynamic foot tracings in excessive pronators to determine if there were differences between right and left feet of male and female soccer athletes.

METHODS

Volunteers were solicited from the boys' and girls' soccer teams of a local high school (level C to varsity) after obtaining permission from the principal and the parents. Upon explanation of the study, the subjects signed an informed consent in accordance with the guidelines for the protection of human subjects. From this pool of 40 high school soccer players, we used a group of 20 (10 males and 10 females) with excessive pronation. Since both the right and left foot fulfilled the criteria for excessive pronation from navicular height (≥10 mm) and arch index (≥.26), a total of 40 feet were used for the quality-of-fit analysis.

We used a Ground Reaction Floor Imprinter (Uco International, Chicago, IL) to determine static and dynamic foot tracings. The manufacturer's protocol for static and dynamic foot tracings was followed. The individual stood on the membrane with weight equally distributed on one foot only,

with the other foot relaxed on the floor and off the membrane. The hands of the subjects were placed on the tracer's shoulders for balance. From this position, the foot was traced with the plastic scribe. Dynamic foot tracings were also completed as the individual walked over the membrane. From these tracings (Fig 1), measurements of foot length (heel to the tip of the longest toe), first metatarsal length (back of heel to the medial prominence of the first toe), fifth metatarsal length (back of heel to the prominence of the fifth toe), ball width (width of the diagonal between first and fifth metatarsophalangeal joint lines), and heel width (maximum heel width) were determined following the protocol established by McPoil[11] and Hawes et al.[8] These measurements were used to compare differences between right and left static and dynamic foot tracings between and within genders.

Descriptive statistics (mean, SD) and between-trial reliability for foot tracings were assessed using intraclass correlation coefficients (ICCs). [The reliability ratings for ICCs used in this study were .90 to .99 (high), .80 to .89 (good), .70 to .79 (fair), and below .69 (poor).[15]] We performed MANOVA ($p \leq .05$) to determine significance between gender right and left static and dynamic foot measurements, and one-way repeated measures ANOVA ($p \leq .05$) with pairwise comparisons ($p \leq .05$) for same and opposite side static and dynamic foot measurements within gender.

RESULTS

Foot length, first metatarsal length, fifth metatarsal length, and metatarsal width were greater in males than in females for both static [$F(1,18) = 21.11$, $p < .02$; Fig 2] and dynamic [$F(1,18) = 18.01$, $p < .02$; Fig 3] foot tracings. Heel width [$F(1,18) = 3.64$, $p = .14$] was not significant between genders.

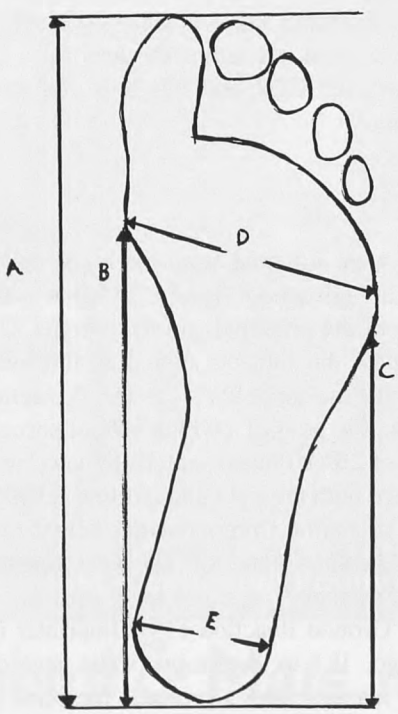

Fig 1. Illustration of foot length (A), first metatarsal length (B), fifth metatarsal length (C), ball width (D), and heel width (E).

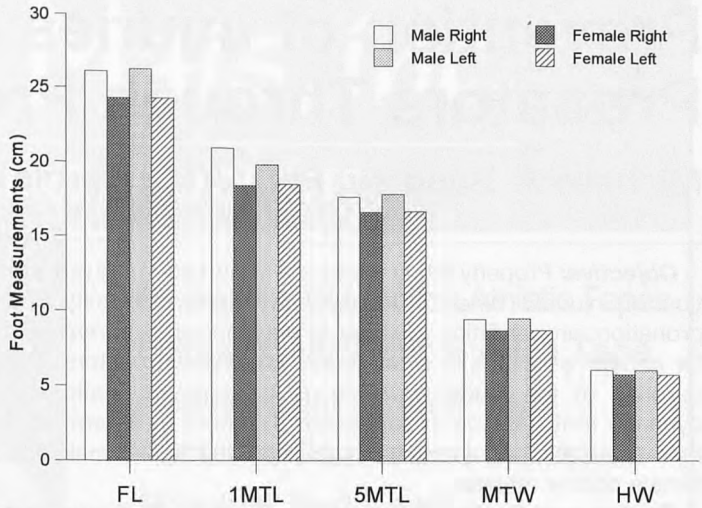

Fig 2. Gender means for right and left foot static measurements (n = 10 males, n = 10 females; FL = foot length; 1 MTL = first metatarsal length; 5 MTL = fifth metatarsal length; MTW = metatarsal width; HW = heel width).

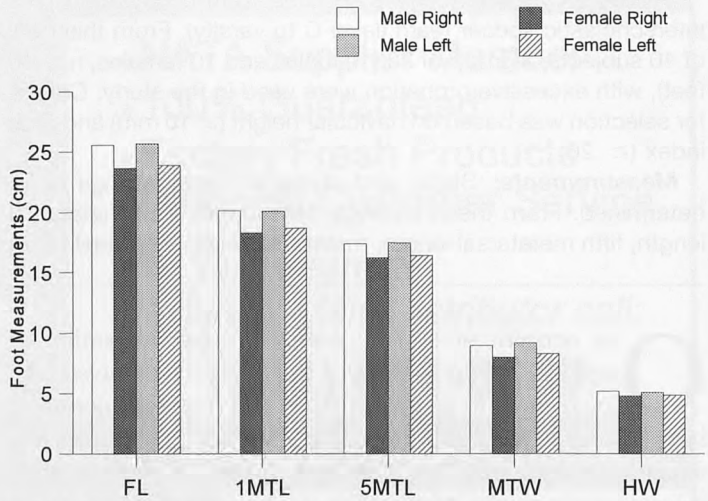

Fig 3. Gender means for right and left foot dynamic measurements (n = 10 males, n = 10 females; FL = foot length; 1 MTL = first metatarsal length; 5 MTL = fifth metatarsallength; MTW = metatarsal width; HW = heel width).

Among males, same side static and dynamic measurements in both the left and right foot were different for foot length, metatarsal width, and heel width [$F(1,9) = 96.0$, $p < .01$; Fig 4], but were not different for first and fifth metatarsal lengths [$F(1,9) = 1.36$, $p = .29$].

Among females, same side static and dynamic measurements in both the left and right foot were different for foot length, fifth metatarsal length, metatarsal width, and heel width [$F(1,9) = 90.0$, $p < .03$; Fig. 5]. The first metatarsal length was not different [$F(1,9) = 2.03$, $p = .55$].

Within-gender foot parameters of foot length, first and fifth metatarsal length, metatarsal width, and heel width were evaluated to note differences for the opposite (right versus left) side static and dynamic foot measurements. In all cases, MANOVA indicated no significant differences between both right and left static [$F(1,8) = 1.80$, $p = .91$] and right and left

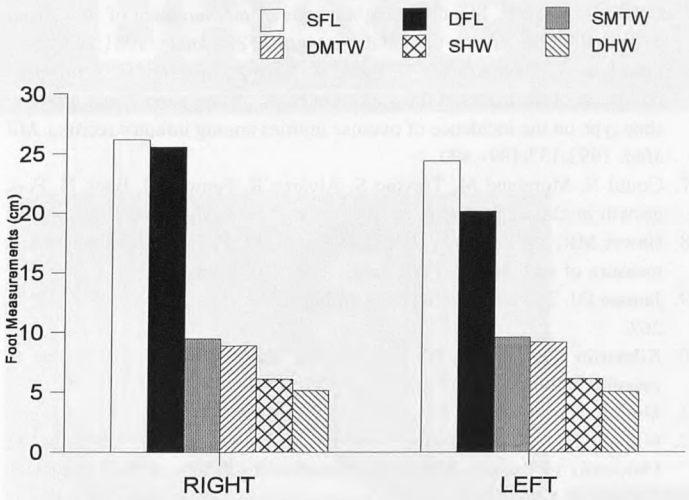

Fig 4. Within-gender means for same side static and dynamic foot measurements (n = 10 males; S = static; D = dynamic; FL = foot length; MTW = metatarsal width; HW = heel width).

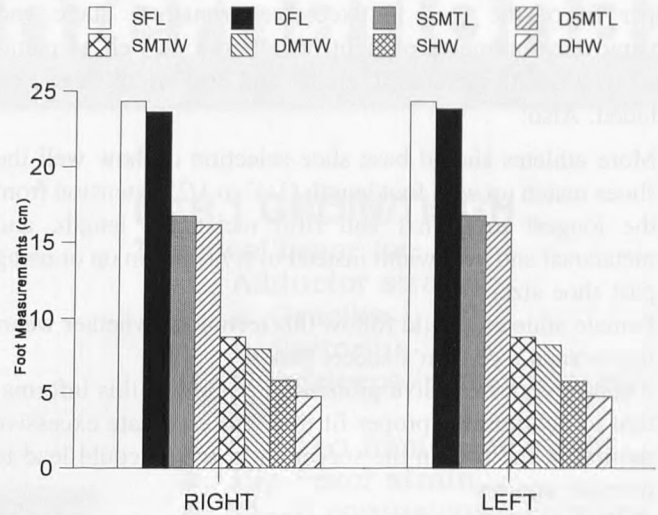

Fig 5. Within-gender means for same side static and dynamic foot measurements (n = 10 females; S = static; D = dynamic; FL = foot length; 5 MTL = fifth metatarsal length; MTW = metatarsal width; HW = heel width).

dynamic measurements [$F(1,8) = 2.07, p = .79$] for both males and females; therefore, the results were not reported here.

DISCUSSION

Reliability of forming a footprint on an inkpad was .86 ± .02 for both the right and left foot, with a standard error of the mean equaling .005. From guidelines used (between .80 and .89), a good reliability was indicated.[15]

Various authors have reported differences among females and between males and females in foot length and width patterns.[2,7,12] Throughout their growing years, boy's feet in general are one size longer and one size wider than girl's feet even though their growth during the 5-year time period paralleled growth of the girl's feet.[7] Differences between 100 female basketball players and 100 runners were observed in foot length (24.17 cm and 22.9 cm, respectively), ball length (17.8 cm and 16.9 cm, respectively), heel width (4.86 cm and 4.56 cm, respectively), and ball width (8.9 cm and 8.5 cm, respectively).[2] When comparing 200 females to results from a previous study,[2] McPoil[12] noted slight differences between the basketball players in foot length (24.22 cm) and ball length (17.64 cm), but more obvious differences between heel width (5.70 cm) and ball width (9.27 cm). In comparison with the runners, foot length, ball length, heel width, and ball width differed for all four measurements.

Because 15 of the 20 comparisons between static and dynamic measurements for the same side foot were different, it is important to use both static and dynamic measurements to fit shoes. With the static footprints, the subjects were weight bearing as the foot was traced with a scribe. Feet of similar structure can exhibit differing footprints (as determined by x-ray) due to soft tissue influences[5] and individual variability of soft tissue in the arch area.[4] There is even a within-day and between-day individual variability of soft tissue measurements.[10] This variability may be determined by the biomechanical conditions under which the footprint is measured or the difference of the muscle and ligamentous constraints on the normal, pronated, or supinated foot in various activities. Tracing the pronated foot in the static position widened the foot area by allowing the individual to place the foot more in a resting calcaneal stance position. This, in turn, dropped the arch and placed more of the total foot on the membrane.

During the dynamic movement, as subjects walked across the Ground Reaction Floor Imprinter, their entire foot was not in contact with the imprinter at the same time. This caused more of the body weight to be distributed to the midfoot area at initial contact instead of the heel, thus leading to a narrow heel. A narrow heel in a dynamic footprint, as was observed in this study, may be related to a tight Achilles tendon,[16] which is not uncommon in soccer players.

The importance of a modified low-dye taping technique for short-term management and orthotic intervention for controlling abnormal subtalar joint pronation has been reported in the literature.[1,14] Proper shoe fitting for excessive pronation should also be looked at in the same light. When excessive pronators are fitted in soccer shoes that match up with their foot length, first and fifth metatarsal length, and metatarsal and heel width, rear foot angles, as measured from videography, are less during running then while wearing improperly fitted shoes.[13]

We anticipated that both male and female soccer players would have one foot longer than the other, which is common in about 50% of the general population.[3] Having one foot longer than the other has frustrated many people when buying shoes because they have to either go a size larger or settle with the smaller pair because it is the policy of shoe stores to avoid mixing sizes.[3] Future research is needed to determine if this phenomenon exists in the soccer population.

CONCLUSIONS

Foot length or past soccer shoe size should not be the only considerations when determining the proper fit of the shoe. Very rarely are the foot size and shape matched up to shoe size or based on anthropometric measurements. Therefore, foot length should not be the only consideration in determining the

proper fit of the shoe in excessive pronators. Static and dynamic measurements of right or left foot as well as metatarsal width, fifth metatarsal length, and heel width should be included. Also:

1. More athletes should base shoe selection on how well the shoes match up with foot length (1/4″ to 1/2″ extension from the longest toe), first and fifth metatarsal length, and metatarsal and heel width instead of trying them on or using past shoe size.
2. Female athletes should follow this technique whether wearing women's or men's soccer shoes.
3. Athletes with excessive pronation should use this information to determine a proper fit that will eliminate excessive motion of the foot in the soccer shoe, which could lead to overuse injuries.

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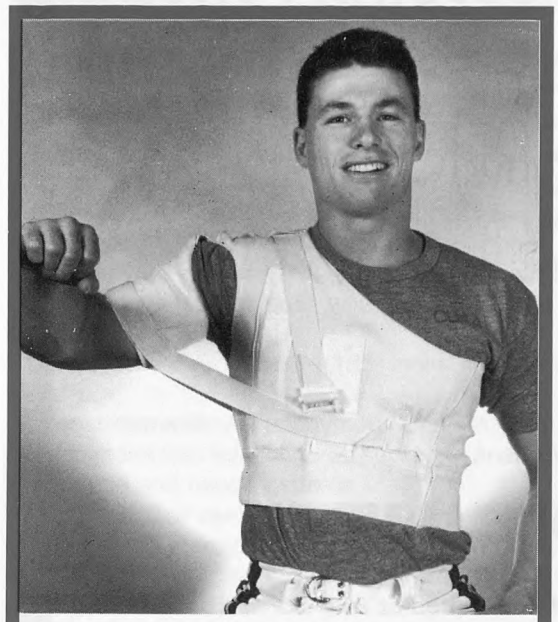

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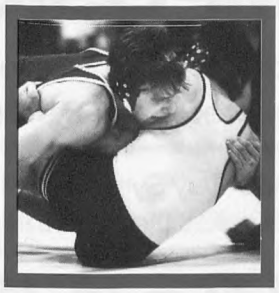

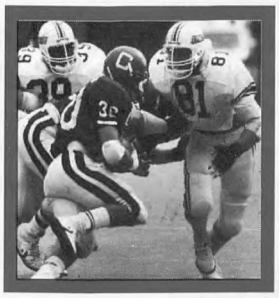

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Anabolic-Androgenic Steroid Use Among California Community College Student-Athletes

Robert D. Kersey, PhD, ATC, CSCS

Objective: To determine the incidence of anabolic-androgenic steroid use among a sample of community college student-athletes; also, to compare various aspects of users and nonusers, as well as to describe usage patterns.

Design and Setting: A survey following random stratified cluster sampling techniques was administered to 10 California community colleges.

Subjects: A group of 1,185 male and female student-athletes.

Measurements: An anonymous 27-item, valid, and reliable questionnaire was administered surveying anabolic-androgenic steroid use and usage patterns.

Results: Of all student-athletes sampled, 3.3% were anabolic-androgenic steroid users. Gender-specific incidence rates were 4.2% for males and 1.2% for females. Anabolic-androgenic steroid users tended to be older males, usually in their second year of college. The users were more often minorities. Users believed that they were knowledgeable about anabolic-androgenic steroids, and that the rates of usage were higher than reported. Their sources of steroid information were often lifting partners and fellow athletes. Use of these drugs was most often in cycles (mean of 6.7 weeks) and was frequently done using multiple anabolic-androgenic steroids at a time. The average number of cycles completed was 2.9. A wide variety of steroids were used by the student-athletes, of which most were obtained from illegal sources.

Conclusions: Anabolic-androgenic steroid use among California community college student-athletes were similar to other previous research studies involving high school and university student-athletes.

Key Words: anabolic steroid(s), athlete, ergogenic aid(s)

Certified athletic trainers are often called upon to provide information about various aspects of athletic medicine. It is important that they know, understand, and disseminate to their athletes the most current and correct information available. With the increasing pressure on athletes to perform at higher levels, the use of ergogenic aids has become a health care issue of concern.

Anabolic-androgenic steroids are drugs that are believed by many to increase athletic performance.[4,12–14,35] Unless prescribed by a physician for a particular illness, these drugs are illegal to use, with or without a prescription.[30] The use of these types of ergogenic aids by athletes (and nonathletes) has been reported at many levels, including high school, university, elite, and health club athletes.[1–3,5,7–12,15–28,31–33,36]

An extensive literature review indicated no current or previous information concerning junior college, 2-year college, or community college student-athletes and their involvement with anabolic-androgenic steroids. This population is a unique group of considerable size. While elite high school athletes often receive athletic scholarship offers and marginal high school athletes choose not to continue in athletics, community college student-athletes may be unable to participate academically, financially, or physically at the university level. They often compete at a community college to improve to a level that allows them to move on to university athletics. No other group of student-athletes has these same characteristics. Due to their unique traits, the significance of the population size, and the lack of previous research, a study of community college student-athletes and their relationship with anabolic-androgenic steroids was conducted.

The purpose of this study was to determine the frequency of anabolic-androgenic steroid use among student-athletes from a random, stratified, cluster sample of California community colleges. In addition, those who identified themselves as anabolic-androgenic steroid users were compared to those who identified themselves as anabolic-androgenic steroid nonusers. Patterns concerning the nature of abuse among users were also identified and described.

METHODS

The California Community College Anabolic-Androgenic Steroid Survey was designed to obtain information regarding California community college student-athletes and their use of anabolic-androgenic steroids. Through a review by a panel of experts, the 27-item survey was deemed to have both face and content validity. Reliability of the instrument was determined to be .90 through a test-retest procedure.

Population and Sample

The population pool for the present study included all student-athletes enrolled in the California community college system. This educational system included 71 districts with 106 community colleges, of which 99 had athletic teams. Total enrollment in the system was over 1.4 million students.[6] The number of student-athletes was approximately 23,000 (personal communication with Walt Rillet, California Commissioner of Athletics).

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The sample for the current research was determined through a random, stratified, cluster sampling technique. The use of individual colleges (clusters) was used, as it was logistically impossible to produce a current and accurate list of all 23,000 student-athletes in the California community college system and then survey a random sample of this group. The stratification of the colleges within the state was used to get equal representation of the various types of institutions throughout California. The sample included 10 community colleges: two each from the North-Large and South-Small divisions and three each from the North-Small and South-Large divisions. These sampling methods allowed for the surveying of a representative sample of community colleges in both size and locale, while achieving a sufficient sample size.

Data Collection

Data were gathered on all student-athletes at each selected college throughout the given academic year. A National Athletic Trainers' Association-Board of Certification (NATA-BOC) certified athletic trainer acted as the site administrator at each institution. They were selected to allow for maximal accuracy and rate of return of the survey questionnaires, while allowing for minimal disruption of the student-athletes. Each site administrator emphasized the need for truthful and honest answers and informed participants that the questionnaire was anonymous. A standardized instruction manual was provided to each site administrator. The instrument was administered without incident.

Data Treatment and Statistical Analysis

All questionnaires were returned to the final collection site by the site administrator. Each individual instrument was coded and recorded. The resulting data file was printed and rechecked by hand against each survey questionnaire to insure accuracy.

RESULTS

California Community College Anabolic-Androgenic Steroid Survey Institutions

The institutional population of the 10 randomly selected community colleges ranged from 5,700 to 24,000, ($\bar{x}$ = 11,960). The mean population for the institutions sampled in this study was similar to the median for all California community colleges with athletics, 12,000. The average number of sports offered at the various schools was 12, while the range was from 1 to 17. Both men's and women's sports were offered at 8 of the 10 institutions. Sports offered at the selected schools included: men's and women's basketball, cross-country, soccer, swimming, tennis, track and field, and volleyball; men's baseball, football, golf, and wrestling; and women's softball.

Survey returns (n = 1,185) varied among institutions. The range of returned surveys from each institution was 15 to 238 with a mean of 118.5 (83 male and 35 female).

California Community College Anabolic-Androgenic Steroid Survey Sample

Student-athlete participants ranged in age from 17 to 39 years with a mean of 19.6 ± 2.2 years. The sample included 833 males (70.3%) and 352 females (29.7%). Most of those sampled [640 (54%)] considered themselves to be academic freshmen (less than 30 semester units completed). Five hundred twenty-one of the sample (44%) were academic sophomores (30 to 60 semester units completed). Twenty-three subjects (2%) were neither freshmen nor sophomores. The majority [736 (62.1%)] considered their current athletic eligibility status as that of a first-year collegiate athlete (athletic freshmen). Second-year collegiate athletes (athletic sophomores) comprised 396 (33.4%) of the sample. Those who were neither athletic freshmen nor sophomores (redshirts) accounted for 55 (4.6%) of the subjects. The ethnic makeup of the sample is presented in Table 1. Multi-sport athletes comprised 190 (16.1%) of the respondents. There were 175 (14.8%) two-sport athletes; 17 (1.4%) of the sample participated in three sports.

Incidence of Anabolic-Androgenic Steroid Use

Overall, 38 respondents used anabolic-androgenic steroids (3.3%). Thirty-four male subjects (4.2%) used, while only 4 females (1.2%) were users.

User and Nonuser Comparisons

Respondents described their perceived knowledge about anabolic-androgenic steroids. While the most common response for users was "very knowledgeable" [18 (48.7%)], only 169 (15.2%) of the nonusers responded similarly. Of the nonusers, 315 (28.3%) felt they were "not very knowledgeable" compared to only 2 (5.4%) of users who responded in a similar manner.

While nonusers indicated their primary source of knowledge was coaches/instructors [312 (32.8%)], users indicated that lifting partners/fellow athletes were their main source [14 (42.4%)] of perceived steroid knowledge. A large percentage of both nonusers [235 (24.8%)] and users [6 (18.2%)] got their information from magazines/trade literature.

Table 1. Ethnic Composition of Sample

	African-American	Caucasian	Hispanic	Native American	Asian Pacific	Other
Anabolic-androgenic steroid user	11 (29%)	17 (44.7%)	6 (15.8%)	1 (2.6%)	1 (2.6%)	2 (5.3%)
Anabolic-androgenic steroid nonuser	217 (19.6%)	640 (57.8%)	145 (13.1%)	15 (1.4%)	53 (4.8%)	37 (3.3%)
Total sample	228 (20.1%)	657 (57.0%)	151 (13.2%)	16 (1.4%)	54 (4.8%)	39 (3.5%)

Users felt that use of these drugs among their peers was much more prevalent than did nonusers. Of the nonusers, 773 (70.4%) felt the use of these drugs was low (under 10%), while only 7 (18.4%) of the users responded in a similar fashion.

Nonusers' mean age was 19.6 years, with the median and mode both being 19 years. Alternatively, users' mean age was slightly older (19.8 years), with the median and mode both being 20 years. Of the users, 23 (62.2%) were no longer teenagers, compared to 398 (35.4%) of the nonusers.

Most of the respondents were male, 777 (69.8%) of nonusers and 34 (89.5%) of users. The sample included 337 (30.3%) nonuser females and 4 (10.5%) user females. Most respondents were Caucasian; only 21 (55.3%) of the users were ethnic minorities, compared to 467 (42.2%) of the nonusers (Table 1).

Most users were academic sophomores [25 (65.8%)] compared with only 13 (34.2%) freshmen. The majority of nonusers were academic freshmen [613 (54.7%)] and 484 (43.2%) were sophomores.

Respondents classified themselves as being either athletic freshmen, athletic sophomores, or redshirts. Nonusers were most often athletic freshmen [702 (62.5%)] as compared with 371 (33%) of athletic sophomores. Nineteen of the users (50%) considered themselves to be athletic sophomores, while 16 (42.1%) of the users were athletic freshmen. The percentage of redshirts was low for both groups, although higher for users [3 (7.9%)] than nonusers [51 (4.5%)].

Anabolic-Androgenic Steroid Abuse Patterns

The average length of a cycle was 6.7 weeks in duration. The mean cycle length was 4.7 weeks for females and 7.2 weeks for males, with a range of 29 weeks (from 1 to 30 weeks). The average number of completed cycles was 2.9. Males averaged 2.7 cycles, while females averaged 3.3 cycles, with a range of 9.5 (from 0.5 through 10 cycles).

Of the users, 18 (47.4%) had used more than one anabolic-androgenic steroid at a time (stacking), while 20 (52.6%) said they had never stacked anabolic-androgenic steroids. No female respondents admitted to stacking anabolic-androgenic steroids.

Most steroids were obtained through illegal methods such as friends and coaches [20 (59%)]. Over one-fourth of the users [9 (26.5%)] obtained their drugs from physicians without a prescription, while 3 (8.8%) got their drugs through doctors with a prescription. Anabolic-androgenic steroids were obtained from pharmacists, veterinarians, athletic trainers, or other medical sources by 2 (5.9%) of the users.

Of the users, 19 (51.4%) reported using some form of testosterone, making it the most commonly abused anabolic-androgenic steroid. Other commonly used steroids are presented in Table 2. Percentages total to more than 100%, because most users used multiple drugs.

DISCUSSION

Anabolic-Androgenic Steroid Incidence of Use

California community college student-athletes sampled use anabolic-androgenic steroids at a rate of 3.3%. These results are similar to findings reported by others who studied high school and collegiate student-athletes.[1–3,5,8–10,15–16,19,23,25,27–28,31–33]

An interesting trend may be emerging judging from the results of this study and previous studies. Patterns of anabolic-androgenic steroid use appear to have declined. A recent study[23] of high school student-athletes found one of the lowest incidences of use of all studies when looking at males (2.9%) and females (0.4%) independently. A series of studies among collegiate student-athletes[1–3] also indicated a similar decline.

The apparent drop in anabolic-androgenic steroid use may result from increased underreporting. The Anabolic Steroids Control Act,[30] which was passed in 1990, made the possession of anabolic-androgenic steroids a felony. (These drugs are now a Schedule III Controlled Substance.) The effects of this law on the reporting of anabolic-androgenic steroid use is unknown, but it may lead to underreporting. Others have indicated that the usage rates found by steroid surveys were probably valid and reliable, but were likely the lower end of a range.[5,7,19,25,26,33,36]

Anabolic-Androgenic Steroid User Profile

The present study indicated that users tended to be chronologically older than nonusers and most often second-year students. One previous study on high school and college student-athletes indicated similar findings.[16] Past high school studies[16,27] seemed to yield no apparent trends or patterns regarding the relationship between educational level and steroid use. Previous collegiate studies did not consider this issue.[1–3,10,25]

As reported in previous research,[1–3,8,15–18,20,23,27,29,33] the present study determined that males used much more often than females. Talk of the use of anabolic-androgenic steroids is often guarded, and admitted use of these drugs may lead to negative feedback from others. Admitted use by females may be more covert than for males.

Although slightly more minorities than Caucasian were users, the present findings did not appear to reveal any definite trends or use patterns among the various ethnicities. Nor has any known previous study found any statistically significant differences with regard to ethnicity and use.

Anabolic-Androgenic Steroid Knowledge

Anabolic-androgenic steroid users in the present study believed that they knew more about these drugs than others. Almost one-half of the users considered themselves to be "very knowledgeable" about anabolic-androgenic steroids, while only 15% of the nonusers answered similarly. The ability to differentiate between perceived and actual steroid knowledge was beyond the scope of the present research.

The primary sources of information concerning anabolic-androgenic steroids among all student-athletes in the current study were instructors/coaches. Those who considered themselves to be users obtained their steroid information most often from lifting partners/fellow athletes (42%). It is critical that educators (including athletic trainers) become more knowledgeable about anabolic-androgenic steroids.

Table 2. Most Commonly Used Anabolic-Androgenic Steroids

(Brand Name)	(Generic Name)	No. Used	(%*)
Testosterones	Varies	19	51.4
Dianabol	Methandrostenolone	11	29.7
Anadrol	Oxymetholone	8	21.6
Deca-Durabolin	Nandrolone decanoate	4	10.8
Winstrol	Stanozolol	4	10.8
Anavar	Oxandrolone	4	10.8
Equipoise	Boldenone undecylenate	3	8.1
Durabolin	Nandrolone phenylproprionate	2	5.4

* Percentage totals more than 100% due to use of multiple anabolic-androgenic steroids by student-athletes.

Current results found that anabolic-androgenic steroid nonusers underestimated the rate of usage among their peers, while users overestimated the incidence of use among peers. With this in mind, it is interesting to note that one of the present reasons cited for the use of anabolic-androgenic steroids was to maintain competitive ability against others who were also taking anabolic-androgenic steroids. Results from this study indicate this reasoning is invalid for anabolic-androgenic steroid use.

Patterns of Anabolic-Androgenic Steroid Usage

Anabolic-androgenic steroids are typically taken in time frames known as "cycles." The time period for completing a cycle varied among the specific users of these drugs and their goals or objectives. In reviewing earlier studies, it seemed that the most common length of a cycle was 6 to 12 weeks.[5,20,36] Data collected through this study paralleled these findings, as the average cycle length was 6.7 weeks.

The number of cycles completed by individual athletes varied. Most previous studies reported 70% to 80% of anabolic-androgenic steroid users had completed two or more cycles.[5,20,36] In my sample, fewer users (62%) had completed two or more cycles.

Previous research indicated that slightly less than one-half of high school and college anabolic-androgenic steroid users stacked these drugs.[5] Researchers who studied health club, gym, or elite athletes found a rate of anabolic-androgenic steroid stacking of at least 50%,[17,20] about the same as the 47% of my sample who stacked these drugs.

Almost 59% of the users in my study obtained their steroids through illegal sources, and 41% received theirs from medical suppliers, similar to past research.[5,10,17,18,20,32,33,36] As stated before, these drugs are illegal to use,[30] and, although many stated they got their steroids through medical suppliers, only a small percentage (9%) reported having a prescription from a physician.

The specific anabolic-androgenic steroids used by athletes and nonathletes for ergogenic purposes have been changing over the years. Many have been discontinued; some are being counterfeited; and new anabolic-androgenic steroids are always being developed. The present research paralleled previous findings.[17,29,33,36] The most commonly used anabolic-androgenic steroids as reported in this study are indicated in Table 2.

Future Research

More research is needed concerning athletes and their relationship with anabolic-androgenic steroids. Trends and patterns of use will change over time; it is important to follow such variations. Additional information should be collected about the actual knowledge of users and nonusers. Further studies may be helpful in determining if the student-athletes' sources of steroid information are actually knowledgeable about steroids. The role of age, gender, and ethnicity, as they relate to the use of anabolic-androgenic steroids, should be studied in more detail.

Many athletes will face the dilemma of whether or not to use these ergogenic aids at some point in their athletic lifetime. Individuals need to be well-informed to make good choices. Information by itself is not necessarily good; information must be accurate and correct. Athletes often look to athletic trainers for advice and guidance. Athletic trainers should strive to be well-informed and then provide accurate and honest information so that good choices can be made by the athletes under their care.

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Hot and Cold Whirlpool Treatments and Knee Joint Laxity

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Objective: To examine the influence of clinical applications of heat and cold on arthrometric laxity measurements of the knee.

Design and Setting: The knee joint was submersed 4 inches above the patella in hot and cold whirlpools containing water of 40°C and 15°C for 20 minutes. A control was also performed to provide a neutral temperature comparison group.

Subjects: Eight males and 7 females with no history of knee injury.

Measurements: The knee was maintained at 20° flexion and tibial rotation at either 15° of internal rotation, 15° of external rotation, or a neutral measurement with a modified KT-1000 knee arthrometer equipped with an LCCB-50 strain gauge that allowed for the digital display of the applied distraction forces. Order of testing was counterbalanced. Subjects underwent each condition once, with each trial on separate days. Two 2-factor repeated measure analyses of variance were performed to test effects of temperature on knee laxity for the dependent measure (laxity at 89N and at maximal displacement forces).

Results: There was no thermal effect on displacement at 89N nor at maximal distraction ($p > .05$). A difference was found with respect to test position, with external rotation showing a greater displacement than internal rotation ($p < .05$).

Conclusions: There was no evidence that hot or cold whirlpool treatments alter knee laxity as assessed with the KT-1000. Rotation of the tibia does affect the magnitude of displacement of the knee. Further research is needed to determine if these findings can be applied to ACL-deficient or ACL-reconstructed knees.

Key Words: Arthrometry, KT-1000, cryotherapy, thermotherapy

The anatomy and function of the knee has been classified into muscular, or dynamic, components, and ligamentous, or static, components.[6,10] The quadriceps, hamstrings, popliteus, gracilis, sartorius, iliotibial band, and gastrocnemius all cross the knee and, with the inclusion of the synovial capsule of the knee, can be viewed as secondary restraints.[8,10,15] The hamstring[6,10,18,24] and popliteus[10,16] have been most definitively viewed as secondary muscular restraints to anterior translation of the tibia on the femur. The ligamentous or static component has been viewed as the primary stabilizer of the knee. The role and function of the medial and lateral collateral ligaments and the anterior and posterior cruciate ligaments are well documented.[1,3,4,7,12,13,15,16,19,20] The anterior cruciate is perhaps the subject of the most research and viewed as the most important ligament in terms of maintaining knee stability and function.[5]

The role of knee arthrometry in quantifying knee laxity has been extensively covered in the literature.[2,9,11,17,22,28,29] The KT-1000 knee arthrometer (MEDmetric Corporation, San Diego, CA) is one of the most accurate and reliable methods of quantifying knee joint laxity when compared to other arthrometers.[2,9,17,22,26,28,29]

Although the effects of exercise on knee joint laxity have been reported,[14,25,27,30] the effect of clinical modalities on knee joint laxity has not been studied. Thermal effects which may influence tissue elasticity, muscle tonus, muscle spindle activity, and patient pain threshold[23] have not been investigated in research pertaining to the knee. The purpose of this study was to examine the effects of a hot and cold whirlpool treatment on knee joint laxity assessed with the tibia in the neutral, internally rotated, and externally rotated positions, with 89N and maximal displacement forces applied by a KT-1000.

METHODS

Fifteen subjects volunteered for this study (8 males and 7 females; age = 22.8 ± 2.5 yr; ht = 67.5 ± 5.5 in; wt = 166.7 ± 49.4 lb). Criteria for selection was that all subjects reported no history of knee injury. Before enrollment in the study, each subject read and signed a consent form approved by the University of Virginia's Institutional Review Board.

A modified KT-1000 knee arthrometer was used to measure anterior laxity in all subjects. The arthrometer was equipped with an LCCB-50 strain gauge (Omega Technologies, Inc, Stamford, CT) that allowed for digital display of the applied distraction forces. The Tibial Fixator Device[21] was used to maintain knee angle at 20° flexion and to control tibial rotation during the laxity measurements. Applications of heat and cold were administered by submersion of the knee joint 4 inches above the patella in whirlpools containing water of 40°C and 15°C, respectively.

Procedure

Subjects, wearing shorts, were asked to sit on an examining table with knees extended and supported for 20 minutes. This was done to allow for a common beginning joint temperature of all subjects and to reduce the effects of any pretesting

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Anterior Tibial Displacement (mm) During Normal, Cold, and Hot Conditions (Mean±SD)

	External Rotation		Neutral		Internal Rotation	
	89N	Maximal	89N	Maximal	89N	Maximal
No whirlpool	4.1 ± 2.0	6.8 ± 2.8	3.5 ± 2.1	6.1 ± 2.7	3.1 ± 2.1	5.7 ± 2.9
15°C whirlpool	4.2 ± 2.1	6.7 ± 3.0	3.8 ± 2.0	6.9 ± 3.4	3.3 ± 1.4	6.0 ± 2.2
40°C whirlpool	3.8 ± 1.9	6.3 ± 2.9	3.4 ± 1.7	5.9 ± 2.7	2.7 ± 1.5	5.4 ± 2.2

activity by the subjects. Subjects were then required to spend 20 minutes with their knee in a hot or cold whirlpool, or in a control position with the knee at 90° flexion and the leg hanging off the table in the air. The control was performed to provide a neutral temperature comparison group for the hot and cold trials. The hanging of the limb off of the table was done to provide gravity effects similar to those present during the whirlpool protocols. Each subject underwent each condition once, with each trial occurring on a separate day. The order of trial conditions was counterbalanced.

Following each whirlpool condition, the subject was placed in the Tibial Fixator Device at 20° knee flexion in either 15° of internal rotation, 15° of external rotation, or a neutral position. The order of testing positions was counterbalanced. The KT-1000 was then positioned on the subject according to standard protocol.[9] The tibia was anteriorly displaced with a recorder marking the newtons of force being applied to elicit 1 mm increments of displacement, until no further displacement could be achieved. The subject was then repositioned and retested at each of the remaining two positions of tibial rotation. All testing was performed by the same individual throughout the study.

Data Analysis

Statistical analysis was performed on the data using the Statview 512+ (Abacus Concepts, Inc, Calabasas, CA) statistical package. Two two-factor (thermal condition and rotation) repeated measure analyses of variance were performed to test effects of temperature on knee laxity for the dependent measures. Laxity at 89N and at maximal displacement forces were the dependent measures.

RESULTS

There was no thermal effect on displacement at 89N of distraction nor at maximal distraction ($p > .05$; see the Table). A difference was found with respect to test position, with external rotation showing a greater displacement than internal rotation ($p < .05$).

DISCUSSION

Since hot and cold whirlpool treatments had no effect on anterior displacement of the tibia as assessed with instrumented knee arthrometry, we feel that athletes with uninjured knees undergoing pre-exercise thermal treatment are not predisposed to increased anterior knee laxity.

Our observation that a significant difference in anterior laxity occurred when the knee was in 15° of external rotation as compared with the knee at 15° internal rotation is in agreement with other researchers.[11,21] The degree of tibial rotation is important in determining intratester and intertester reliability with the KT-1000.[11,25]

Clinicians using the KT-1000 for repeated assessments of patients should consider tibial position as an important factor in obtaining more consistent results.

Future research is needed to determine whether the findings of this study can be applied to ACL-deficient or ACL-reconstructed knees. The presence of greater anterior knee laxity may show differing results when subjected to similar thermal conditions, because injured or reconstructed knees may have a greater muscular stability component than do uninjured knees.

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Gender Differences in Anterior Cruciate Ligament Injury Rates in Wisconsin Intercollegiate Basketball

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Objective: The incidence of anterior cruciate ligament (ACL) injuries in women basketball players has been shown to exceed that of male basketball players. The purpose of this study was to determine the ACL injury rate for both male and female intercollegiate basketball players in the state of Wisconsin and to determine if certain factors played a significant role in the number of ACL injuries incurred.

Design and Setting: The design was a 5-year retrospective survey study. The study took place in the state of Wisconsin at 22 colleges and universities.

Subjects: Certified athletic trainers were selected from the colleges and universities to answer the surveys.

Measurements: The survey consisted of close-ended questions about the incidence of ACL injuries and the circumstances surrounding these injuries.

Results: The injury rate was high in the female basketball players. The female athletes had a 2.3 times higher ACL injury rate than the male athletes. No other factors were found to be significant.

Conclusions: ACL injuries were higher in the female athletes than the male athletes examined.

Key Words: anterior cruciate ligament, ACL injuries, basketball injuries, female basketball injuries, knee injuries

In recent years, the incidence of anterior cruciate ligament (ACL) injuries in female basketball players has been shown to exceed that of male basketball players.[1,2,7,8,10] This issue has recently raised interest and has been the focus of attention by athletes, coaches, athletic trainers, and team physicians.

The purpose of this study was to determine the ACL injury rate for both male and female intercollegiate basketball players in the state of Wisconsin and to determine if the following factors, along with gender, played a significant role in the number of ACL injuries incurred: contact/noncontact mechanism, game or practice, time of season, and right- or left-hand dominance.

METHODS

We sent a 5-year retrospective survey to certified athletic trainers (ATCs) at 22 Wisconsin colleges and universities. Institutions selected were those with both a men's and a women's intercollegiate basketball program. The survey asked ATCs to list the number of ACL injuries per year for the past 5 years during the basketball season. For each ACL injury identified, the following information was requested:

1. Was the injured athlete male or female?
2. Was the right or left knee injured?
3. Was the athlete right- or left-hand dominant?
4. What time of the season did the injury occur: early (October and November), middle (December and January), or late (February and March)?
5. Was the mechanism of injury contact or noncontact?
6. Was surgical reconstruction required?
7. Did the injury occur during practice or a game?

To determine the total number of different athletes who participated on each team during the 5-year period between 1987 and 1992, a letter was sent requesting this information to the sports information directors of the institutions and to a commissioner of one of the conferences involved in the sample population.

A 2 × 2 chi-square formula was used to analyze the relationship between gender and the number of injured and uninjured athletes. Chi-square and/or the Pearson Product Coefficient was used to determine if there was a significant relationship between gender and the remaining factors. Percentages of each factor were also determined to compare differences in gender.

RESULTS

Of the 22 surveys mailed, 17 (77%) were returned. Of these, only 14 (64%) were used because 3 had incomplete data, either due to an uncertain ACL injury history or because the institution did not have a team during the time period. The conference commissioner and all of the sports information directors responded with the number of athletes in their respective programs. Two of the reporting institutions were NCAA Division I, one was Division II, and the remaining 11 were at the Division III level. Only one of the responding institutions did not have any ACL injuries to report. Two female teams and six male teams had no ACL injuries. One institution reported having six ACL injuries (three men and three women) during the 5-year period. In this study, the average number of ACL injuries per program was 1.86 for females and 0.93 for males.

The Table shows the number of male and female injuries and the percentages of the total. There were 13 ACL injuries for

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ACL Gender Difference Factors

	Female		Male		Total	
Factors	N	%	N	%	N	%
Number of injuries*	26	66.7	13	33.3	39	100.0
Injury setting						
Practice	11	42.3	7	53.8	18	46.2
Game	15	57.7	6	46.2	21	53.8
Mechanism						
Contact	5	19.2	4	30.8	9	23.1
Noncontact	21	80.8	9	69.2	30	76.9
Time of season						
Early	13	50.0	6	46.1	19	48.7
Middle	10	38.5	4	30.8	14	35.9
Late	3	11.5	3	23.1	6	15.4
Knee injured						
Right	15	57.7	9	69.2	24	61.5
Left	11	42.3	4	30.8	15	38.5
Hand dominance						
Right	26	100.0	11	84.6	37	94.9
Left	0	0.0	2	15.4	2	5.1

* $p < .02$.

621 male athletes involved, an injury rate of 2.1%, and 26 ACL injuries for 545 female athletes, an injury rate of 4.8%. The chi-square was found to be 6.44 when comparing the incidence of gender with the number of injured and uninjured. This was statistically significant at $p < .02$.

The Table also shows the number and percentages of the injury setting, contact and noncontact, and time of season injured. A large majority of the ACL injuries were caused by a noncontact mechanism for both males and females. The early and middle parts of the season produced more injuries, whereas the number of injuries in games and practices was fairly constant. There was no statistical significance when these factors were compared to gender.

There was no correlation between right- and left-hand dominance and right and left knee injured. Only 26 of the 39 ACL injuries (66%) reported were surgically reconstructed.

DISCUSSION

Early authors[3,6] who looked at the rates and types of injuries suffered by male and female athletes reported little gender difference. Later studies comparing male and female basketball injury trends did find some differences. A comparison of men's and women's professional basketball injuries during the short time that women's professional basketball was in existence in the United States was reported.[17] The women's injury rate was 1.6 times greater than that of the male counterparts. The incidence of knee injuries was greater in female athletes, although the incidence of ACL injuries was not documented.

Gender specific injury patterns in high school varsity basketball were analyzed from data provided by the National Athletic Trainers' Association and the National High School Injury Registry.[18] This study reviewed data gathered over a 2-year period at 196 high schools around the nation from 1987 through 1988. The rate of injury was the same for both genders; however, the distribution of injuries was different. Female athletes had a higher proportion of moderate and major injuries, particularly to the joints. The incidence of knee injuries was high in both genders although a breakdown was not given on the number of ACL injuries suffered.

Wirtz[16] was one of the first to report that there were more ACL injuries in female basketball players than male basketball players. In a survey of high schools in central Iowa during the 1981-1982 season, 14 females and only 1 male suffered ACL injuries. Clinicians at a sports medicine clinic in British Columbia looked at the injury rate reported over a 30-month period.[4] Their results concluded that the ACL was injured five times more frequently in female basketball players than male basketball players. They felt that the difference was due to the inherent physiologic characteristics of women that differ from men.

Malone et al[10] reported on the relationship of gender and ACL injuries by looking at three National Collegiate Athletic Association (NCAA) Division I basketball conferences. There was an eight times greater prevalence of ACL-injured female basketball players than male. The documented ACL injuries per program was 2.1 for female athletes versus 0.31 for male athletes. The NCAA through its Injury Surveillance System has reported the ACL-injury rate in women's basketball versus men's to be between three and six times higher.[1,2,7,13] Of those athletes who participated in the United States 1988 Olympic basketball trials, female athletes had approximately a five times greater ACL injury rate than their male counterparts.[9]

Our findings agree with others who reported that the ACL injury rate for female basketball players exceeds that of male basketball players[1,2,4,7,8,10,13] although our ratio of 2.3 times is lower. One reason for this difference may be the method of reporting the occurrences. Our study, like that of Malone et al,[10] was retrospective and compared the number of injuries to the number of different athletes, whereas the NCAA Injury Surveillance System[1,2,7,11,13] is prospective in its data collec-

tion and makes the determination of injury rate per 1,000 athlete exposures.

Another reason for this difference may be the level of competition. When comparing this study to that of Malone et al,[10] which this study is closely tailored after, the difference is substantial. Malone et al looked only at Division I athletes and focused on prevalence while this study primarily consists of Division III athletes and is incidence related. The level of skill, size, strength, and speed of Division I athletes may well dictate why there were more injuries at that level. The NCAA Injury Surveillance System[1,2,7,11,13] information covers Division I, II, and III institutions and could possibly indicate that there are more ACL injuries at the Division I and II levels as well. To determine if Division I basketball players suffered more ACL injuries than Division III players, the authors requested and received the injury statistics from the Injury Surveillance System reports for 1993-1994 for both male and female basketball players at the Division I and III levels from the NCAA Sports Sciences Department.[11] Interestingly enough, the injury rate for Division I females was higher than Division III, but the difference in the injury rate between females and males was greater for Division III than that for Division I (3.7 versus 2.6 times greater). Further studies are needed to determine if there is a different injury rate between all levels of competition and, if so, which level is more susceptible.

This study agrees with past studies that the majority of the ACL injuries are noncontact in nature.[1,2,10] Most occurred in the early and middle portions of the season for both genders. This may indicate that conditioning and skill levels are not as high as they are in the latter parts of the season.

Why is there such a large difference in ACL injuries between male and female basketball players? Potera,[12] in a review of the increased injury rate for female athletes, suggested possible etiologies: differences in conditioning or strength, the question of skill and socialization, and anatomical differences in terms of knee alignment. Other etiologies for this gender difference have been theorized as well: position played,[4] quadriceps[4] and hamstring[4,10] strength, hormonal effect,[4] hamstring flexibility,[5,10] knee joint laxity,[15,16] level of competition,[10] skill,[10,12] inadequate training and conditioning,[12,15] ligament size,[15] biomechanics,[15] and a narrow intercondylar notch.[5,14] Additional possibilities could be the types of shoes worn by the athlete and the type of playing surface (wood or composite).

Improper conditioning, which at one time could be blamed for an increase in female athletic injuries, is most likely discountable in the intercollegiate athletic setting of today. In regard to ligament laxity, one study found no inherent knee laxity between the ACLs of female and male intercollegiate basketball players.[15] Overall strength and flexibility of the quadriceps and hamstring muscles may be an area of focus for female basketball players. Knapik et al[9] reported that female collegiate athletes were more likely to have a higher injury rate in the lower extremities if they had imbalances of 15% or more in the strength of their knee flexors or flexibility of their hip extensors on either side of the body.

This study has shown that the difference in ACL injury rate between male and female basketball players is significant. Further studies are needed to determine the exact etiologies for this difference. Once the etiologies are determined, screenings could be done to identify those at a greater risk. Those who are at a greater risk could opt for an increase in strength training and/or sports-specific movement training. The current trend of an increased ACL injury rate could possibly decline for female basketball players because they are starting to play at a younger age, are becoming stronger, and are adapting to the up-tempo style of play similar to that of the men's game.

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Dehydration, Hyperthermia, and Athletes: Science and Practice

Robert Murray, PhD

Objective: To present the recent research that underscores the value of preventing both dehydration and hyperthermia. Such efforts will improve the athlete's capacity to perform physical activity and reduce the risk of heat-related problems.

Data Sources: Data were drawn from an extensive review of the scientific literature over the past 50 years with an emphasis on recent research (>1990) that focuses on the physiological and performance benefits of fluid replacement.

Data Synthesis: Even low levels of dehydration (eg, less than a 2% loss of body weight) impair cardiovascular and thermoregulatory response and reduce the capacity for exercise. Heat exposure also reduces the athlete's ability to train and compete, an effect that can be independent of hydration status. Even if athletes are well hydrated, hot weather alone will reduce their capacity to exercise. Optimal performance is possible only when dehydration and hyperthermia are minimized by ingesting ample volumes of fluid during exercise and by taking common-sense precautions in keeping cool. Recent research has demonstrated that consuming fluid in volumes approximating sweat loss maintains important physiological functions and significantly improves exercise performance, even during exercise lasting only 1 hour. Carbohydrate ingestion also improves exercise performance, an effect that is independent of, and additive to, preventing dehydration.

Conclusion/Application: Athletes should follow an aggressive fluid replacement and temperature regulation regimen. Successful implementation of this regimen requires that athletic trainers, coaches, athletes, and support personnel are made aware of the benefits of adequate fluid replacement, that appropriate fluid replacement strategies are developed and implemented, that athletes have the opportunity to train themselves to ingest larger volumes of fluid more frequently, and that other practical steps are taken to keep athletes cool during both training and competition.

Key Words: dehydration, hyperthermia, exercise performance, heat illness, sports drinks

An increase in body temperature and the onset of sweating are two normal responses to physical activity. However, the dehydration and hyperthermia that often accompany sports training and competition are perhaps the most common and most preventable causes of premature fatigue among athletes. Dehydration often contributes to hyperthermia by reducing the body's capacity for heat loss, and even low levels of dehydration can impair performance.[35]

Although overheated athletes are often dehydrated, dehydration is not necessarily a prerequisite for hyperthermia; it is possible—but far less likely—for hyperthermia to occur even in well-hydrated athletes. Regardless of the manner in which hyperthermia develops, it is now more apparent than ever that it is in the best interest of the athlete's health and performance to take steps to prevent dehydration and limit the rise in core temperature that naturally occurs during exercise.

DEHYDRATION AND HYPERTHERMIA: PHYSIOLOGICAL CONSEQUENCES FOR PERFORMANCE AND HEALTH

When body temperature rises too high, performance is reduced, an impairment that can be caused by both central and peripheral factors. For example, exercise in the heat increases the use of muscle glycogen,[9,10] potentially hastening fatigue. Increases in body temperature can also result in premature fatigue, ostensibly due to the effect of increased temperature upon brain function.[22] The negative impact of increased core temperature upon brain and nervous system function, although not well understood, can occur independent of decrements in peripheral responses such as muscle blood flow and metabolism.

"The ultimate cause for the exhaustion in the severely hyperthermic condition may be due to an effect of heat stress on brain function. The central nervous system and mental functions are susceptible to high temperatures, as can be observed in the dizziness and confused behavior of heat-stressed subjects in long distance sports events. . . it may be that core temperatures >39°C (102.2°F) reduce the function of motor centers and the ability to recruit motor units required for the activity, perhaps via an effect on the 'motivation' for motor performance."[22]

The performance consequences of this "central inhibition" have been demonstrated by Febbraio et al[9] who required subjects to cycle to exhaustion at three different ambient temperatures. At the coolest temperature (37°F), subjects exercised for 95 ± 10 minutes before fatiguing. When exposed to moderate temperature (68°F), fatigue occurred at 75 ± 12 minutes. At 104°F, subjects were only able to exercise for 33 ± 3 minutes, their high core temperatures resulting in reduced performance capacity. Interestingly, the subjects had plenty of muscle glycogen remaining and no metabolic perturbations were noted. The likely cause of fatigue was central inhibition due to high body temperatures.

PROTECTING PHYSIOLOGICAL FUNCTION AND PERFORMANCE

Sweating is a thermoregulatory response for which there is no substitute in terms of the quantity of heat that can be lost by

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evaporative cooling. The evaporation of 1 gram of sweat from the skin liberates approximately 0.58 kcal of heat, allowing for large rates of heat transfer to the environment. During light physical activity in a cool and dry environment, sweat loss can be as little as 250 mL/h; in a hot and humid environment, the sweat rate of a well-acclimated, physically fit athlete can be in excess of 2,500 mL/h.[29] The high sweat rates that are needed to sustain heat loss during vigorous exercise inevitably lead to dehydration unless fluid is ingested to match the volume of sweat lost.

Dehydration in athletes is most often produced by the inadequate replacement of sweat loss during and following training and competition. During exercise, one of the most-important benefits of fluid intake is to prevent the additional rise in body temperature that accompanies even low levels of dehydration.[17] Unfortunately, dehydration occurs frequently during physical activity, because humans rarely ingest enough fluid to match their sweat loss, even when fluid is readily available. The voluntary ingestion of fluid during physical activity can result in wide ranges of fluid intake, but generally approximates only 50% of sweat loss, even on those occasions when fluid is conveniently available.[7,15,24] This "voluntary dehydration" was recognized long ago and has been well characterized by researchers since then.[12,27]

"In the course of experiments in both the desert and the hot room, we found that men failed to replace by ingestion all of the water they lost by sweating, even when adequate supplies of drinking water were available. In some cases this failure to maintain water balance resulted in considerable dehydration, even approaching dehydration exhaustion."[27]

The dehydration that inevitably results from inadequate fluid intake causes an inevitable deterioration in cardiovascular and thermoregulatory responses, the details of which may be found in the Table. (For more-detailed reviews, see References 15, 19, 20, 28, and 29.)

Physiological Responses to Dehydration[18]

Gastric emptying rate	Decreased
Incidence of gastrointestinal distress	Increased
Splanchnic and renal blood flow	Decreased
Plasma volume	Decreased
Plasma osmolality	Increased
Blood viscosity	Increased
Central blood volume	Decreased
Central venous pressure	Decreased
Cardiac filling pressure	Decreased
Heart rate	Increased
Stroke volume	Decreased
Cardiac output	Decreased
Sweat rate at a given core temperature	Decreased
Core temperature at which sweating begins	Increased
Maximal sweat rate	Decreased
Skin blood flow at a given core temperature	Decreased
Core temperature at which skin blood flow increases	Increased
Maximal skin blood flow	Decreased
Core temperature at a given exercise intensity	Increased
Muscle glycogen use	Increased
Endurance performance (simulated races)	Decreased
Endurance capacity (exercise to exhaustion)	Decreased

The deterioration in thermoregulatory function that accompanies dehydration markedly increases the risk of heat-related problems. The least serious of these disorders is *heat syncope*, which is likely related to acute cutaneous vasodilatation and a concomitant drop in central venous pressure. Although the symptoms of heat illness can vary widely among individuals, *heat exhaustion* due to dehydration is often evidenced by irritability, sudden fatigue, and lightheadedness, with nausea and headache also possible. Skin color is often pale with normal-to-profuse sweating. *Heat stroke* is characterized by high core temperature, reddened skin, and normal-to-profuse sweating. Severe heat stroke is characterized by central nervous system dysfunction (eg, loss of motor coordination, delirium), and, in the most serious cases, loss of consciousness leading to coma. In these circumstances, sweating may be minimal or absent. The "classical" form of heat stroke that often occurs during summer heat waves primarily affects older adults, particularly those suffering from illness or disease. The victims of exercise-induced heat stroke are often young, healthy, competitively minded males who overextend themselves during intense training and competition in warm weather.[4] All forms of heat illness are usually responsive to aggressive fluid replacement (oral or intravenous), with severe hyperthermia treated most effectively by immersing the victim in an ice or cool-water bath for as little as 15 to 20 minutes, making certain that core temperature does not drop below 37°C.[23] Because heat stroke is a life-threatening disorder, the best approach is to use whatever cooling method is available (ice baths, fans, alcohol rinses, ice packs, etc) to reduce core temperature quickly.

THE GOAL: FULLY REPLACE SWEAT LOSS DURING EXERCISE

There is no evidence that humans can adapt to chronic dehydration.[28] Therefore, the only way to avoid dehydration during exercise is by ingesting adequate amounts of fluid. In terms of protecting health and maximizing performance, there is no alternative.

In the 1930s and 1940s, scientists became interested in assessing the ability of soldiers to withstand the stress of physical activity in the desert. The fluid intake patterns of the soldiers were a matter of particular interest, because the importance of evaporative cooling was well appreciated. The researchers quickly realized that the large sweat rates required for evaporative cooling necessitated fluid intakes often in excess of 10 L/d, in contrast to the 2 to 3 L/d fluid intake that is typical in a temperate environment.[1]

More recently, scientists have studied the physiological effects of ingesting fluid to determine the extent to which the volume of ingested fluid affects physiological response. The work by Montain and Coyle[17] has demonstrated the physiological advantages associated with attempting to closely match sweat loss with fluid intake. In their study, subjects exercised in the heat for 2 hours on four separate occasions. On one trial, subjects ingested no fluid and lost about 4% of their body weight. During the other trials, the subjects periodically ingested enough fluid to replace 20%, 50%, or 80% of their

sweat loss, resulting in dehydration of 3%, 2%, and 1% of body weight, respectively.

"We found that the magnitude of increase in core temperature and heart rate and the decline in stroke volume were directly related to the body weight loss (and thus dehydration accrued) during exercise. Thus, when subjects exercise at 62% to 67% $\dot{V}O_2max$ under the present environmental conditions (33°C dry bulb, 50% relative humidity, wind speed 2.5 m/sec), the optimal rate of fluid ingestion to attenuate hyperthermia and cardiovascular drift is the rate that most closely matches fluid loss through sweating, at least until the rate of fluid ingestion replaces 81% of sweat loss."[17]

In the Montain and Coyle[17] study, fluid ingestion reduced the rise in body temperature by promoting higher skin blood flow. The greatest rates of skin blood flow occurred when the largest volumes of fluid were ingested during exercise.[17]

The physiological mechanisms by which fluid ingestion attenuates the rise in core temperature may include maintenance of a greater plasma volume, reduction in plasma osmolality and sodium concentration, and a blunting of the rise in catecholamines that occurs with dehydration, all of which might provide a signal for sustained skin blood flow.[19] Future research will likely elucidate the primary mechanisms by which adequate fluid intake exerts its positive thermoregulatory effects. Nonetheless, ingesting fluid in proportion to sweat loss best maintains cardiovascular function and prevents body temperature from rising too high. Montain and Coyle[17] concluded that the optimal rate of fluid replacement is the rate that most closely matches sweat loss.

The research of Walsh et al[35] underscores the performance-related value inherent in avoiding even slight dehydration. Subjects in this experiment were dehydrated by only −1.8% of body weight with 60 minutes of exercise before cycling to exhaustion at 90% $\dot{V}O_2max$. When dehydration was prevented by fluid consumption during the 60-minute exercise bout, the subjects cycled for nearly 10 minutes. With dehydration, the subjects lasted only about 6 minutes. The authors concluded that the goal of fluid ingestion should be to fully replace sweat and urine losses.[35]

The benefits of preventing dehydration have been recognized in the 1996 position stand of the American College of Sports Medicine, "Exercise and Fluid Replacement."[2] The American College of Sports Medicine (ACSM) recommendations read, "During exercise, athletes should start drinking early and at regular intervals in an attempt to consume fluids at a rate sufficient to replace all the water lost through sweating, or consume the maximal amount that can be tolerated."[2]

The ACSM guidelines also recommend that fluids be cool and flavored to enhance palatability and increase voluntary fluid intake, contain carbohydrate to enhance performance, and include sodium chloride to promote rehydration.[2]

Moreover, peak performance during exercise in the heat requires the provision of fluid *and* carbohydrate. This conclusion was illustrated by Below et al.[5] In their study, subjects cycled for 50 minutes at 80% $\dot{V}O_2max$ before completing a "sprint to the finish" that required about 10 to 12 minutes. The main finding of their study was that both fluid replacement and carbohydrate ingestion improved high-intensity cycling performance. Performance was improved by about 6% when subjects ingested either a large volume of fluid (replacing 80% vs 13% of fluid losses) and when they consumed 79 ± 4 g of carbohydrate compared to 0 g. When dehydration was prevented and carbohydrate was ingested (by consumption of a sports drink), the benefits were additive, resulting in a 12% improvement in performance.[5]

TIMING OF FLUID INTAKE IS ALSO IMPORTANT

Cardiovascular and thermoregulatory responses are also influenced by the *timing* of fluid ingestion.[16] In a study designed to assess the effects of the timing of fluid intake, subjects ingested 1,183 mL of a sports drink (~43% of predicted sweat rate during 140 minutes of cycling exercise) at the onset of exercise, or in a bolus at 40 or 80 minutes of exercise, or at 15-minute intervals throughout exercise. This protocol resulted in similar dehydration in each trial (−2.9% body weight). In all trials, drinking attenuated the increase in serum osmolality and sodium concentration, increased forearm blood flow, maintained blood volume, and reduced the rate of heat storage. When the fluid was ingested in one large bolus at 0, 40, or 80 minutes, the aforementioned changes were transient, lasting about 40 minutes postingestion. There were no differences in ratings of perceived exertion among the 0-, 40-, and 80-minute trials. When fluid was ingested at 15-minute intervals throughout exercise, the mean values at 140 minutes for esophageal temperature, rectal temperature, heart rate, and rating of perceived exertion were all lower than when fluid was ingested at 80 minutes; the only statistically significant difference was with rectal temperature. Brown[8] reported similar findings for heart rate and rectal temperature when water was ingested at regular intervals throughout 165 minutes of exercise rather than waiting until 135 minutes to drink.

Montain and Coyle[16] hypothesized that a possible advantage of drinking at regular intervals is that the act of drinking stimulates heat loss by maintaining sweat rate. For example, sweating is known to increase almost immediately following drinking in dehydrated subjects.[31] From a practical standpoint, these data indicate that ingesting ample volumes of fluid at regular intervals during exercise appears to confer "optimal" physiological response; similarly positive—but transitory—responses can be provoked by ingesting a relatively large bolus of fluid. This latter knowledge may be valuable for those circumstances when it is not possible to ingest fluid at regular intervals during physical activity (eg, during a soccer match).

Glycerol ingestion has been touted as a possible method of hyperhydrating before exercise in an attempt to provide a cardiovascular and thermoregulatory advantage during exercise in the heat. Ingestion of glycerol solutions before exercise results in a reduction in urine production and the retention of fluid.[26] This transient state of hyperhydration is provoked by the lingering osmotic effect of the glycerol molecules, which are cleared slowly from the body water. Glycerol ingestion increases the osmolality of the blood and most other body fluid compartments (the aqueous humor and the cerebral-spinal fluid being two notable exceptions), prompting a temporary reduction in urine production.

The weight gain that goes hand-in-hand with glycerol ingestion may be particularly problematic for most athletes who pay a metabolic—and perhaps a performance—cost for carrying extra body weight. All things considered, it is unwise to recommend this practice to athletes, in part because the side effects of ingesting glycerol can range from mild sensations of bloating and lightheadedness to more-severe symptoms of headaches, dizziness, nausea, and vomiting.[18]

OTHER CONSIDERATIONS: BEVERAGE PALATABILITY, GASTRIC EMPTYING, AND INTESTINAL ABSORPTION

In addition to the volume and timing of fluid intake, other factors contribute to optimizing the effects of fluid consumption. For example, beverage palatability can be a key determinant of the volume of fluid exercising subjects voluntarily ingest.[6,12,13,33] Temperature, perceived sweetness, flavor type and intensity, tartness, and feel inside the mouth are all characteristics of beverages that, when altered, can influence voluntary fluid intake.[6,12,13]

The gastric emptying characteristics of a beverage must also be taken into consideration, because slow gastric emptying "traps" fluid in the stomach, reducing the rate at which fluid can be emptied into the duodenum and made available for absorption through the intestinal epithelium into the bloodstream.[14] Carbohydrate-electrolyte beverages containing up to about 6% carbohydrate (CHO) (ie, 60 g of CHO/L) have been shown to empty from the stomach at rates similar to water during rest and exercise.[20,21] Beverages containing 8% carbohydrate exhibit gastric-emptying rates slower than water,[3] an indication that the "threshold" for reduced gastric emptying lies just above 6% to 7% carbohydrate, at least for beverages containing multiple types of carbohydrate. Dehydration, perhaps in concert with high core temperature, appears to reduce gastric emptying rate[21,25] and increases the risk of gastrointestinal distress.[25]

Assuring rapid fluid absorption across the intestinal mucosa requires the ingestion of carbohydrate (in the form of glucose, sucrose, or corn-syrup solids) and the presence of ample amounts of sodium in the intestinal lumen.[30] As has been known since the 1950s, glucose and sodium are actively cotransported across the intestinal epithelium, establishing an osmotic gradient for water absorption.[30] Once again, carbohydrate concentrations up to 6% appear to maximize the rate of water and solute absorption in the proximal small intestine.[11,32] Combinations of sucrose, glucose, fructose, and maltodextrins appear to promote similar rates of water flux, provided that the fructose and maltodextrin concentrations do not predominate.[11,32]

There are, of course, intraindividual variations in the perceptions of beverage palatability and in the rates of gastric emptying and intestinal absorption. For this reason, the "ideal" fluid replacement beverage must be determined on an individual basis, with the goal of selecting a drink that: 1) tastes good *during exercise* (to help assure adequate fluid intake), 2) is emptied rapidly from the stomach (to reduce the risk of gastrointestinal distress and optimize fluid absorption), and 3) is absorbed rapidly from the small intestine (to reduce the risk of gastrointestinal distress and assure rapid entry of fluid and carbohydrate into the bloodstream).

PRACTICAL RECOMMENDATIONS: KEEPING ATHLETES COOL

A number of practical steps can be taken to help athletes stay well hydrated and adequately nourished during training and competition. For example, a good base of aerobic training should be an integral part of an early season training program, because increased fitness helps increase the athlete's ability to train and compete in warm environments. Acclimatization is also an essential part of preparing athletes for training and competing in the heat. At least 1 to 2 weeks of training in the heat (for 60 to 90 minutes per day) are required to provoke the physiological benefits associated with acclimatization. However, even highly fit, well acclimated athletes will have difficulty coping with exercise in the heat if they become dehydrated. For this reason, make certain that athletes have easy access to cold fluids during training and competition.

Other steps that can be taken to help athletes better cope with the demands of exercise in the heat include reducing the intensity of training on warm days, extending the length of rest breaks to allow additional time for cooling as well as for fluid and carbohydrate intake, and reducing the intensity and duration of the warm-up to help prevent body temperature from rising too high too quickly. It is also wise to take advantage of the cooling effects of shade. Alternatively, electric fans can be used to help cool athletes during breaks. Minimizing the amount of equipment worn during practice can markedly increase heat loss during exercise. This is especially true with headgear which should be removed whenever possible. Finally, when the environmental conditions are particularly adverse, practice should be cancelled or, at a minimum, the amount of high-intensity exercise (eg, sprints) should be curtailed.

PRACTICAL RECOMMENDATIONS: KEEPING ATHLETES HYDRATED

The ACSM guidelines[2] recommend that athletes ingest about 500 mL (~17 oz) of fluid 2 hours before exercise to help assure adequate hydration. On particularly hot days, it would be wise for athletes to drink an additional 250 to 500 mL (8 to 17 oz) of fluid (sports drink, fruit juice, water) 30 to 60 minutes before exercise.

Athletes should be educated to pay attention to the color and volume of their urine. Within 60 minutes of exercise, passing a light-colored urine of normal to above-normal volume is a good indicator of adequate hydration. If the urine is dark yellow in color, is of small volume, and has a strong odor, the athlete should continue drinking. Ingesting vitamin supplements often results in a dark-yellow urine, so urine color, volume, and odor must all be considered as indicators of hydration status.

Educating coaches and parents about the absolute necessity of keeping well hydrated can help underscore this message with athletes. Similarly, it is important to make it easy for

athletes to drink whenever they desire by taking steps to keep cool, flavored fluid conveniently available at all times.[2] Athletes should be given the necessary instruction and ample opportunity to practice drinking during training with the goal of trying to match fluid intake with sweat loss as closely as is practically possible.[2,17,35] During training sessions in warm environments, coaches must allow athletes the opportunity to ingest fluid at 10- to 20-minute intervals. Recording preexercise and postexercise body weights is an easy way to remind athletes of the importance of minimizing dehydration and to identify those athletes who are predisposed to large weight deficits. Both proper hydration and carbohydrate intake improve performance, and ingestion of carbohydrate and water in combination (eg, a sports drink) provides an additive performance benefit.

Rapid and complete rehydration requires that athletes ingest both fluid and sodium chloride. During one-a-day training sessions, athletes usually have ample opportunity to consume the needed fluid and salt. However, during two-a-day practices or day-long bouts of competition (eg, wrestling, gymnastics, track and field, etc), special attention should be paid to assure that athletes ingest ample fluid and salt, either from sports drinks or food. Athletes should also be encouraged to take their time during meals; those who rush through their meals lose an important chance to rehydrate.

Even under the best of circumstances, 24 hours will be needed to fully restore the muscle glycogen that is used during just two hours of hard exercise. To accomplish this important goal, athletes should ingest 3.5 to 4.5 grams of carbohydrate per pound of body weight each day.[34]

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Bilateral Jones Fractures in a High School Football Player

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Objective: To present a case of a high school football player with bilateral Jones fractures who was treated both conservatively and with acute intramedullary compression screw fixation.

Background: Jones fractures tend to heal slowly, have a propensity for reinjury, and a significant number progress to delayed union or nonunion. Because of the time constraints imposed by athletic seasons, there is a need to avoid lengthy periods of immobilization.

Differential Diagnosis: Tuberosity fracture, metatarsal stress fracture.

Treatment: Treatment options include either conservative care or acute intramedullary compression screw fixation. Jones fractures are difficult to treat and can cause prolonged disability.

Uniqueness: The athlete was treated conservatively for a delayed union of an old stress fracture. X-rays revealed a sclerotic fracture line with partial union after 6 weeks. The athlete underwent open reduction and internal fixation using an intramedullary screw to obtain compression fixation and a graft to aid healing. Several months later, x-rays showed excellent resolution. One year later, he suffered a similar fracture of the other foot. Because of his history and his desire to return to play, he underwent open reduction and internal fixation using an intramedullary compression screw and was allowed to return to competition by the end of the sixth week postsurgery.

Conclusions: Treatment of Jones fracture should be individualized, based on the athlete's needs, the history and clinical presentation, and the initial radiographic appearance of the injury. The literature indicates that a rapid return to activity can be realized using rigid internal fixation and may be the treatment of choice in athletes.

Key Words: Jones fracture, rigid internal fixation, delayed union, nonunion

Fractures of the fifth metatarsal are a common injury in athletes[5] and are among the most common injuries seen by orthopedists.[2] Fractures of the proximal fifth metatarsal can be divided into two categories: those involving the tuberosity and those occurring distal to the tuberosity. Tuberosity fractures, often erroneously referred to as Jones fractures, usually occur with forced inversion. They are relatively easy to diagnose and normally heal with minimal treatment.[1,6] Fractures occurring in the proximal portion of the fifth metatarsal within 1.5 cm of the tuberosity are true Jones fractures, so named for the English physician who first described it in 1902.[3,8] This fracture tends to occur in young active individuals with 70% to 90% occurring between the ages of 15 and 22 years.[1,3,8,9] Kavanaugh et al[3] noted that the majority occur in football and basketball players.

While Jones fractures are not as common as tuberosity fractures, they are much more difficult to treat and can cause prolonged disability. They often require extended periods of immobilization for healing to occur, and a significant number of the fractures progress to delayed union or nonunion.[1,3,9]

CASE REPORT

A 15-year-old, 245-lb, 6 ft-2 inch, male football player sustained a Jones fracture of the left foot after landing from a jump while playing basketball during the spring of 1993. He was treated with cast immobilization and nonweight bearing for 1 week followed by 3 weeks of progressive weight bearing in a walking cast. The athlete was able to resume activities of daily living without problems during the remainder of the spring and summer. He began football practice 4 months postinjury and remained asymptomatic throughout the first 6 weeks of football before he complained of left lateral foot pain while playing offensive tackle during a junior varsity game. He indicated that his pain was over the proximal fifth metatarsal area and that it was "aching." He felt that he may have been stepped on during the game, but denied any pops or snaps in this area. He did admit to discomfort during practice 3 to 4 days before the game.

Physical examination revealed a bony prominence distal to the tuberosity that was consistent with old callus formation. He had tenderness with palpation of the callus area without crepitus. Ankle range of motion was full in all planes. Resisted eversion, inversion, plantar flexion, and dorsiflexion did not increase his symptoms. He was placed on crutches and toe-touch weight bearing until a follow-up exam by the team physician 4 days postinjury. A stress fracture was diagnosed with x-rays, which revealed a fracture of the proximal fifth metatarsal diaphysis with sclerosis and persistence of an old fracture line (Fig 1). We believed it to be a delayed union of the fracture incurred 6 months previously. The athlete was treated with rest, ice, cold whirlpool soaks, and partial weight bearing progressing to full weight bearing over the next 6 weeks. He improved symptomatically; however, repeat x-rays revealed a sclerotic fracture line with partial union.

Seven weeks postinjury, the athlete underwent open reduction and internal fixation using an intramedullary screw to obtain compression fixation and a graft placed to aid healing of the fracture (Fig 2). The athlete was kept nonweight bearing for the first 2 weeks and then progressed from partial to full weight bearing over the next 5 weeks. Two months postoperatively, he was asymptomatic with x-rays showing good alignment and a

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Fig 1. Oblique view of the left foot showing sclerosis and persistence of the fracture incurred 6 months previously.

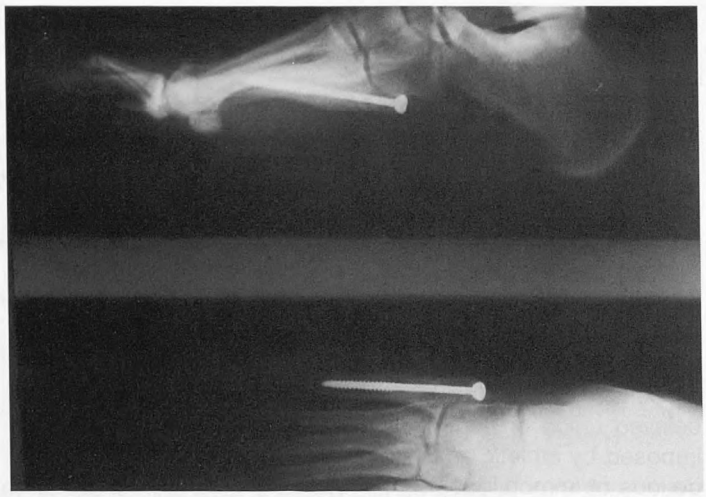

Fig 3. AP view of the left foot showing a healed fracture area with the screw in place.

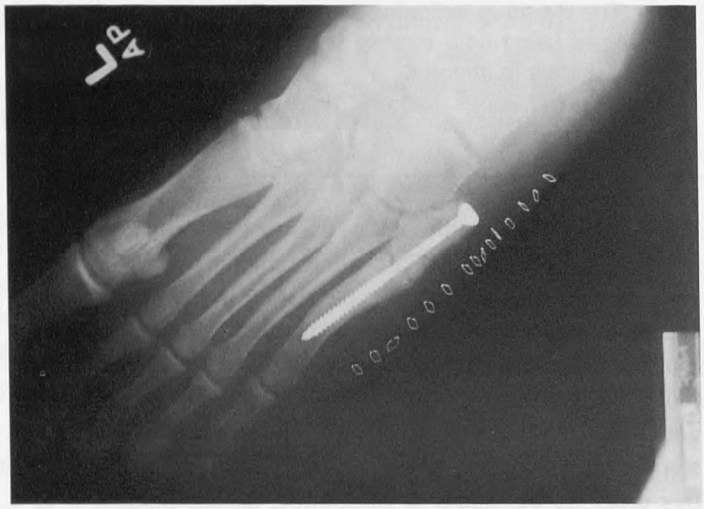

Fig 2. Oblique view of the left foot taken 2 weeks postoperatively showing compression screw and graft in place.

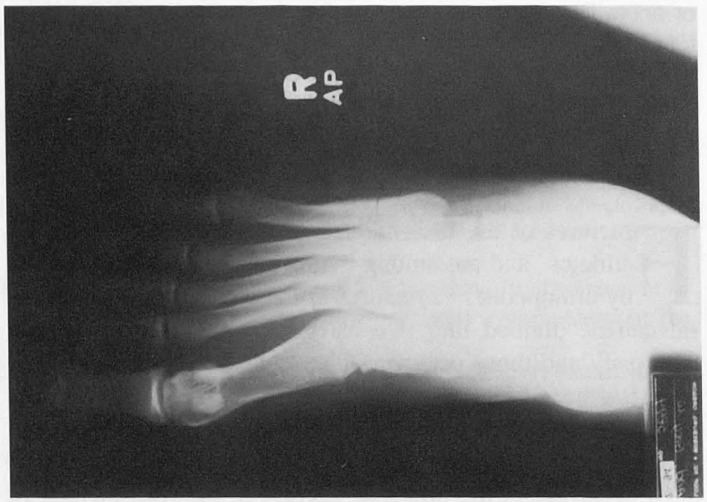

Fig 4. AP view of the right foot showing a nondisplaced transverse fracture.

healing fracture. Rehabilitation included ankle range-of-motion exercises, manual resistive exercise, proprioceptive activities, and cardiovascular workouts using a stationary bicycle and a stair climber. X-rays taken 7 months postoperatively showed excellent resolution of the fracture (Fig 3).

One year later, while at football practice, the athlete reported a pop in the lateral aspect of the right foot while running. He admitted to aching pain of 3 to 4 days duration before the acute episode. He also noted that the symptoms were very similar to those experienced in the left foot the previous year with aching and tenderness just distal to the tuberosity. A physical exam revealed a small localized area of swelling and tenderness coinciding with a transverse fracture of the proximal fifth metatarsal on x-ray (Fig 4).

With the history of delayed union and slow healing experienced with the opposite foot and the loss of the previous football season, this highly motivated athlete wished to return to activity as soon as possible. Five days postinjury, the athlete underwent open reduction and internal fixation using an intramedullary compression screw.

For the first week, the athlete was restricted to light partial weight bearing, used ice and electrical stimulation for edema reduction, and active ankle range of motion as tolerated. Following staple removal 10 days postoperatively, he was allowed to begin full weight bearing as tolerated, swimming, and stair climber workouts. At 17 days postsurgery, he was asymptomatic, full weight-bearing, and did not have any gait disturbance. X-rays showed good alignment of the fracture with significant callus formation (Fig 5). He was allowed to begin light football drills 21 days postsurgery and progressed without complaint to full practice at the start of the fifth week postsurgery and to competition by the end of the sixth week. To reduce the possibility of irritation of the healing fracture site, stationary cycling and stair climber workouts were used as alternatives to running for conditioning. The athlete was able to return to full participation without restriction for the last four games of the season. X-rays taken 10 months postoperatively showed a well-healed fracture (Fig 6). He is currently playing collegiate football without limitation.

DISCUSSION

Fractures of the proximal fifth metatarsal differ from other metatarsal fractures and the tuberosity fracture in particular, in

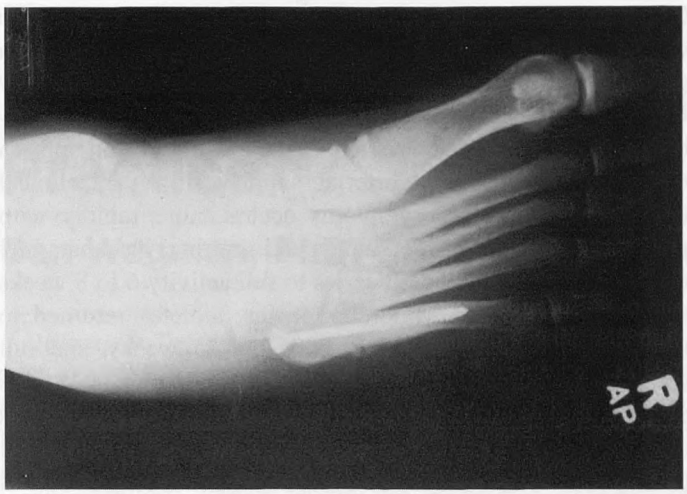

Fig 5. Oblique view of the right foot taken 17 days postoperatively showing significant callus formation and good alignment of the fracture.

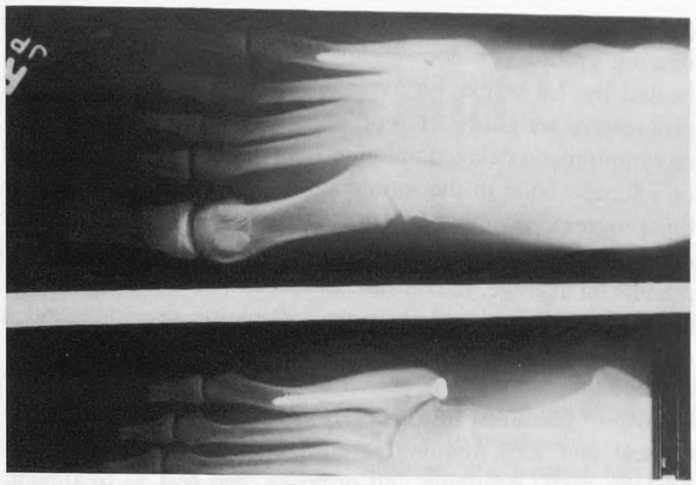

Fig 6. Oblique view of the right foot taken 10 months postoperatively showing a healed fracture with screw in place.

several important ways: inversion is not necessary to produce this injury,[3] it can be a source of prolonged disability, and it is considerably more difficult to treat.[1–3,5,9]

Inversion is commonly recognized as a mechanism for tuberosity fractures.[1] Kavanaugh et al[3] postulated through force-platform analysis that the inability or failure of the foot to invert is responsible for the forces that cause the Jones fracture. Elevation of the heel with extension at the metatarsophalangeal joints (as if landing from a jump with the heel off the ground) causes the lateral foot structures to be loaded and the forces concentrated on the diaphysis just distal to the tuberosity. Additionally, the base of the fifth metatarsal is stabilized by a multitude of strong ligamentous structures that firmly attach it to the cuboid and fourth metatarsal. Thus, it is easier to fracture distal to this area of strong stability than it is to dislocate.[3,4]

Fracture Types

The Jones fracture is often considered a stress fracture. Several investigators have noted that this injury is more commonly seen in the preseason or early-season athlete and that there is a high incidence of chronic stress reaction of the bone that predates the acute episode.[2,3,5,8–10] Kavanaugh et al[3] noted that it is similar to other stress fractures in its progression from an initial fracture of the lateral cortex, with widening of the fracture line, as it slowly traverses to engage the opposite cortex. This slow process leads to radiographic evidence of a long-standing stress reaction that includes periosteal reaction, sclerosis of the intramedullary canal, and callus formation.[3,8,9] Although this injury can present acutely without any prodromal symptoms, the etiology often is that of a stress injury that can be appreciated on radiographic examination.[3]

The Jones fracture can be categorized into several types based on the patient's history, clinical features, and initial radiographic findings.[3,8–10] Torg et al[8] categorizes these fractures by types. Type I, or acute fracture, is characterized by being clinically acute without previous fracture or injury, absent or mild prodromal symptoms, and a well-defined fracture radiographically without evidence of stress reaction of the bone. Type II, or subacute fracture, is also clinically acute with a history of prodromal symptoms of 1 to 2 weeks and possibly a previous injury. Radiographically, a lucent fracture line that involves both cortices with periosteal reaction and variable degrees of intramedullary sclerosis will be evident. This is referred to by Torg[8] as a delayed union type fracture. Type III, or chronic fractures, have a history of repetitive trauma, a widened fracture line, and obliteration of the intramedullary canal with sclerotic bone at the fracture site. These are often considered nonunions.[3,8–10]

The prognosis for Jones fractures, especially in athletes, is relatively poor. Kavanaugh et al[3] and Dameron[1] noted that delayed union of this fracture is not infrequent. Kavanaugh[3] noted a 66.7% incidence of symptomatic delayed union in their series. Laurich et al[4] suggests that ground forces are transferred proximally up the shaft during the gait cycle, causing disruption at the healing fracture site and may be responsible for delayed and nonunions. Blood supply has also been implicated as one of several possible causative factors in delayed unions and nonunions.[7] The arterial blood supply of the base of the fifth metatarsal and the proximal diaphysis merge in the area where Jones fractures occur. Fractures of the proximal diaphysis can disrupt the nutrient artery, resulting in an area of relative avascularity.[7]

Conservative Treatment

Considerable differences exist in the literature regarding acute treatment and its effectiveness in Jones fractures. Several authors advocate conservative treatment using cast immobilization, other forms of immobilization, or symptomatic treatment,[1,8–10] while others advocate a more aggressive approach such as acute intramedullary compression screw fixation.[2,3,5] Zogby[10] found subacute fractures (prodromal symptoms less than 2 weeks; signs of stress reaction without sclerosis) treated with nonweight-bearing cast immobilization for 9 weeks healed faster on average than acute fractures treated similarly. In this series of patients, 86% returned to their preinjury level of activity by 12 weeks. Torg et al[8] also noted, in their series of acute fractures, that those treated with immobilization and

progressive weight bearing healed slower than the nonweight-bearing group. The nonweight-bearing group were clinically healed by 7.4 weeks on average. The patients treated using progressive weight bearing progressed to either asymptomatic or symptomatic delayed union or nonunion requiring curettage of sclerotic bone in the intramedullary canal and grafting. In this progressive weight-bearing group of patients, clinical and radiographic healing of the delayed unions required 11.5 months on average. In contrast, Dameron's[1] series showed that healing can be quite slow using soft elastic dressings and a nonweight-bearing approach.

Radiographic union occurred between 2 months and 1 year in 60% of fractures. Fifteen percent required 15 to 21 months to heal and 25% required grafting. Zeldo et al[9] evaluated walking casts, strapping and orthoses, and rest as treatment. Only 2 of 15 patients treated with walking casts healed completely, the earliest being healed at 7 months and the other by 20 months. One of 2 treated with strapping and orthoses healed by 7 months, and the other required grafting for delayed union. Two patients treated with rest either reinjured and developed a symptomatic nonunion or were still not radiographically healed at 18 months postinjury. Kavanaugh et al[3] found that 40% of the patients in their series treated with cast immobilization for 5 to 10 weeks had refractures shortly after returning to activity, despite being clinically and radiographically healed. Overall, they found a 66.7% incidence of delayed union in those patients treated conservatively.

Surgical Treatment

A surgical approach to this problematic injury has been advocated because of the time constraints imposed by an athletic season, the lengthy period of time required for healing to occur with conservative care, and healing of this fracture in a significant number of patients is not obtained through conservative care.[1,3,8]

Grafting and intramedullary canal curettage is advocated for symptomatic delayed union and nonunion.[1,8,9] Curettage removes sclerotic bone that impedes healing and the placement of healthy bone in the form of a graft in the injury area, stimulating bony growth and recanalization, but it does not provide for rigid stabilization of the fracture site.[7] Clinical and radiographic healing postgrafting occurs in 3 to 4 months.[1,3,8,9] In the Torg et al[8] series, clinical healing was evident at 3 months postgrafting, but a return to full activity did not occur for 8 and 11.5 months in a delayed union and nonunion, respectively.

Several authorities[2,3,5] think the acute placement of an intramedullary compression screw for fixation is preferable in competitive athletes rather than a period of casting and nonweight bearing required with grafting and no rigid fixation. Compression screw fixation allows a more rapid return to activity and has low morbidity and a high success rate.[5] Smith et al[7] noted that the stability provided by compression screw fixation may be responsible for the rapid resolution of symptoms but that it could interfere with the body's attempt to re-establish the nutrient arterial supply. However, clinical union and absence of symptoms occurs more rapidly with screw fixation than with curettage and grafting. Kavanaugh et al[3] returned athletes in their series to full activity 6 to 8 weeks after fixation. In the Mindrebo[5] series, athletes returned to running by 5.5 weeks, full practice by 7.5 weeks, and full competition by 8.5 weeks, on average. Radiographic union was evident at 6 weeks postsurgically. Similarly, Delee et al[2] used compression screw fixation on subacute fractures. Clinical union (absence of tenderness and full weight bearing) occurred by 4.5 weeks and radiographic union by 7.5 weeks. All of the athletes in this series returned to full activity by 8.5 weeks on average. Treatment of the Jones fracture should be individualized, based on the patient's needs, the history and clinical presentation, and the initial radiographic appearance of the injury. The literature shows that a rapid return to activity can be realized using rigid internal fixation and may be the treatment of choice in athletes. This is true in the case of the athlete presented as he was able to return to full activity in less than 6 weeks.

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Psychological Issues in Sport Injury Rehabilitation: Current Knowledge and Practice

Dan Wagman, PhD, CSCS; Maher Khelifa, PhD

Objective: The importance of addressing psychological issues in athletic injury rehabilitation has been recognized by the medical community. When and how to address psychological ramifications of injury, however, have not been given sufficient attention.

Background: Various factors are associated with athletic injury: models of adjustment to athletic injury, a 10-point assessment inventory, and some techniques employed by sport psychologists to address psychological responses to injury will be discussed.

Description: The purpose of this paper is to outline specific guidelines to follow when assessing athletes and counseling them following athletic injuries. By implementing these guidelines, the athletic trainer can: 1) establish trust and rapport, 2) become familiar with the athlete's perception of the injury, and 3) attempt to get the athlete to commit to treatment.

Clinical Advantage: Often, athletes are treated for their physical complaints without giving attention to their psychological needs. These techniques can be used for athletes who have suffered an injury so that they may return safely both physically and psychologically to competition.

Key Words: psychology, interventions, rehabilitation, injury, sport

Most sports medicine practitioners are aware that a triumphant recovery from injury is as much a mental as a physical victory. In this sense, one must make careful estimates of the mind-sets and emotional needs of injured athletes to effectively return them to health and physical activity. Failure to do so may retard effective injury management strategies, if not preclude them entirely.[8] To this end, we introduce the reader to sport psychological research concerning athletic injury, warning signs specific to mental aberrations associated with sport injury, and interventions.

To illustrate some of the problems often associated with injury, Lynch[13] recalled an incident in which an injured patient expressed the following: "Life is absurd. Just when I begin to put it all together, I pull this muscle, I'm so depressed. Why me? Why now? I'll never be able to get to this place again. I'm so afraid I'll never fully recover. Is there any doctor who can help me to get going? The stress is unbearable, to say nothing of the physical pain itself. It's just not fair. I feel like dying. A terrible loss." Similarly, Weiss and Troxel[19] interviewed many athletes about their psychological responses to physical injury. This is what some had to say: "I couldn't deal with the reality of not being able to run. I couldn't even run to my car or to a class. It blew me away." A collegiate wrestler responded: "I felt like a low life. I didn't feel like I was part of the guys."

At the other end of the spectrum, some athletes are able to channel their competitive drive into their recovery. Still, it appears that the hardest thing for certain athletes to do is to slow down, listen to what their bodies are trying to tell them, and try not to progress too fast.[17] In these cases, the psyche may interfere with the rehabilitation process as it should be unfolding.

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PSYCHOLOGICAL ASPECTS OF ATHLETIC INJURY

As noted, a sport-related injury can often bring about certain psychological aberrations that prohibit the patient from recovering as planned. Such negative affective responses tend to be global in nature, as evidenced by elevations on multiple scales of the Profile of Mood States.[14,15,18] Conditions of concern may include psychological states and reactions such as general pain, stress/anxiety, exercise addiction, anger, treatment noncompliance, and depression.[2,5] Fear is another common reaction in injured athletes: that is, fear of not recovering, of reinjury, of losing positions, jobs, income, or family and friend support. Another common reaction is disbelief that an injury has occurred.[2,5] A recent review of sports medicine practitioners indicated that an athlete's psychological state before injury may affect how the athlete reacts to the injury.[4,5] For example, athletes who express anger in the athletic arena may be prone to becoming depressed after an injury and frustrated with their inability to carry out their anger.

Of additional importance, the psychological characteristics of athletes, as they relate to the perception and reaction to injury, may vary in such areas as level of self-esteem, trait anxiety, locus of control, self-efficacy, and motivation.[7,20] Various situational factors such as the nature and extent of injury, type of sport, time during the season when the injury occurred, and the perceived context of the injurious situation may mediate and influence an athlete's response to injury as well.[19] Moreover, some athletes' self-esteem and self-worth are often wrapped up in their bodies and their ability to perform with their bodies. This can become a major problem for an athlete whose entire identity is wrapped up in sports.[5]

MODELS OF ADJUSTMENT TO ATHLETIC INJURY

To provide a basis from which to conduct empirical investigations, several models have been proposed. Generally, these models fall into two categories: stage and cognitive models. Stage models hypothesize that an injured athlete responds to injury by sequentially passing through various stages before positive adjustment occurs. Essentially, it is speculated that injury constitutes a "loss" to which the person will respond with grief reactions similar to those of the terminally ill. The proposed stages are: denial, anger, bargaining, depression, and acceptance.[12] Although this model has intuitive appeal, the notion of a stereotypical pattern of distinct emotional responses to loss has not stood up to empirical scrutiny.[3] Foremost, it appears as if psychological reactions to injury are more global in nature and more varied across individuals than stage models would be able to predict or account for.

Cognitive models were developed in an attempt to account for individual differences. Notable here is the importance placed on how an individual *perceives* the injury, as opposed to the fact that it has occurred. As such, a cognitive model would take on the form as seen in Figure 1.

In this model, personal factors may include trait anxiety, self-esteem/motivation, coping skills, extroversion/introversion, psychological investment in the sport, and injury history. Situational factors are comprised of personal control over the injury, time of season, point in athletic career, pain, social pressures, type of sport, life-stress, duration of injury, and degree of sport performance impairment. The cognitive appraisal essentially asks: "What are you *thinking* in regard to the occurrence of this injury?" The emotional response, then, refers to what one is *feeling*, whereas the behavioral response deals with what the patient is going to *do*, ie, what are the behavioral rehabilitation consequences.

Although most studies have used retrospective and/or cross-sectional research designs to examine the claims of cognitive appraisal models in the domain of athletic injury, research findings to date suggest considerable promise for an approach that examines the joint influence of personal and situational factors on psychological responses to injury.[2]

Even though the cognitive model is one step closer to how individuals may actually respond to injury, it does not address the stress response as an antecedent to injury in any great detail. It is important to note that the stress response constitutes a bidirectional relationship between the person's cognitive appraisal of a potentially stressful situation and the physiological/attentional aspects of stress.[21] What this means is that athletes evaluate the demands of a particular situation, their ability to meet those demands, and the consequences of either failing or succeeding in meeting these demands. Any perceived imbalance between situational demands and personal response capabilities may result in anxiety reactions susceptible to altering the physiological/attentional aspects of the athlete.

Another shortcoming of the cognitive model is the inability to account for the mediating effects of psychological interventions. For the aforementioned reasons, a modified version of the Anderson and Williams'[1] model is proposed (Fig 2).

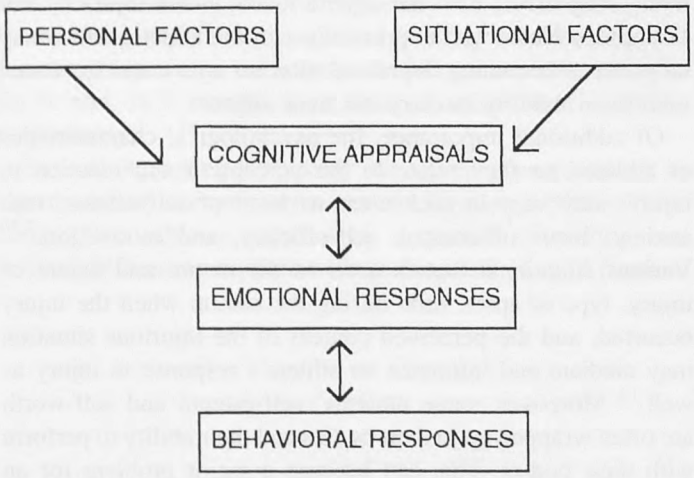

Fig 1. A cognitive model.

PATIENT ASSESSMENT

To more clearly determine whether psychological interventions may be needed, sports medicine practitioners should give some consideration to the following 10 questions as part of their patient screening process.

1. Do fear and anxiety prevent the patient from following the prescribed rehabilitation regimen?
2. Is the patient depressed beyond what seems reasonable for the type of injury sustained?
3. Is the patient lacking a support system; eg, is the patient experiencing feelings of isolation?
4. Is the reality of the injury, course of rehabilitation, and/or return to sport clouded?
5. Although all physical indications are such, is the patient not recovering as expected?
6. Does the patient choose to not adhere to the rehabilitation procedures?
7. Does the patient express a desire to return to practice before the sports medicine team gives their OK?
8. Does the patient not believe that he/she is able to recover fully?

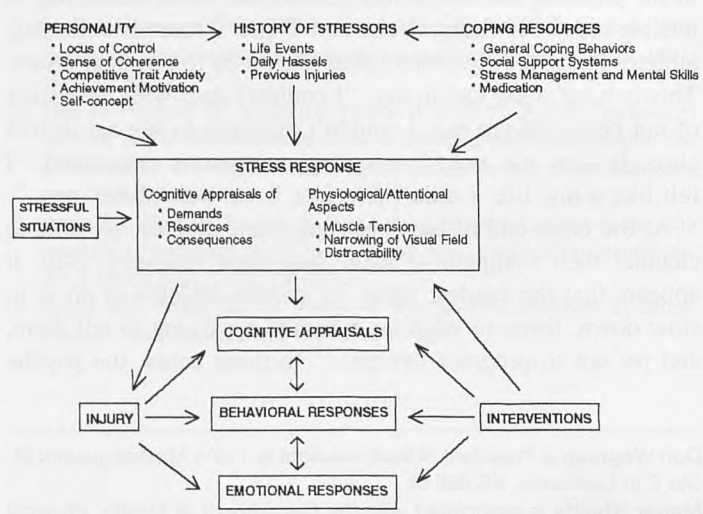

Fig 2. An interactional theoretical model of athletic injury (adapted and modified from Anderson/Williams[1]).

9. Is the patient "addicted" to exercise and unable to slow down as required?
10. Does the patient's self-worth seem "injured" as well? The presence of one or more of these psychological difficulties should be an indication to the sports medicine practitioner that some level of sport psychological intervention is warranted. It is recommended that medical personnel systematically use this 10-step checklist early in the physical rehabilitation process to promptly identify any psychological problems that the patient may be experiencing.

COUNSELING GUIDELINES

After receiving a referral, the sport psychologist's counseling will follow precise guidelines. However, before implementing any psychological interventions, the sport psychologist must first spend time with the patient in order to: 1) establish trust and rapport, 2) become familiar with the patient's assessment/interpretation of what has occurred, and 3) attempt to attain a commitment on the part of the patient. Consequently, the following steps are proposed:

Step 1. The Initial Consultation

The initial task is to gain an understanding of the patient's psychological status. It is crucial to *listen* to what the patient has to say. This initial consultation also functions to determine whether interventions designed to promote emotional adjustment are even necessary. Some of the essential questions are:

1. What events of note were happening in your life before the injury?
2. How did the injury happen?
3. What meaning have you assigned to sport involvement?
4. What meaning have you assigned to the injury?
5. What emotions do you feel now, as a result of the injury?
6. What are your fears about the future?
7. Who is affected by your injury?
8. If you were injury-free, how would life be different?

Step 2. Affect Management

Step 1 identified various affective issues. Now the emphasis ought to be shifted toward more in-depth identification, expression, and processing of those emotions that have surfaced in the patient as a result of injury. At this stage, the patient is also introduced to the process that the sport psychologist envisages to employ in an attempt to facilitate psychological rehabilitation.

Step 3. Facilitate Communication

Facilitating communication is geared to the patient's deriving an understanding of the nature, severity, and likely rehabilitation course of his/her injury. The communication of the medical team toward the patient should be clear and easily understood. That is, the patient should be able to fully understand the nature and severity of the injury. The rationale for treatment modalities should be understood as well. The key is to alleviate fear and uncertainty with regard to the patient's overriding question, "Now what?"[13,17,20]

Step 4. General Psychological Skills

Teaching general psychological skills to the injured athlete becomes the primary focus of the consultations at this point. The nature of the skills depends on what the information in steps 1, 2, and 3 has provided.

Step 5. Social and Emotional Support

Facilitating social support can be achieved through the sport psychologist, the sports medicine team, family, coach, peers, or even in group sessions. This is initiated in an attempt to ensure that the patient has an understanding that he/she is not alone and that successful rehabilitation and return to the original life-style is a true possibility.[6] The sport psychologist and physician should work in concert to stress the athlete's importance as a person and to maintain connection with the team, friends, family, and any other supportive entities.[19,20]

Step 6. Return To The Sport

An important consideration is whether the patient has the confidence necessary to return to practice and competition. It is not uncommon for athletes to experience anxiety and ask themselves, "Will I still be able to perform as I did before?" "Will I be reinjured?" At this juncture, it is important for the athlete to be able to discuss thoughts and feelings about returning to competition with a sport psychology practitioner. It becomes essential to systematically assess the athlete's level of readiness to return to sport. In this step, it is critical to alleviate any fears that may be lingering.[13]

INTERVENTIONS

Athletes invest a great deal of time and energy in the pursuit of optimal performance. Therefore, any severe injury is likely to be perceived as a traumatic life event with physical and psychological ramifications. The psychological interventions that address the troubling aspects of injury may provide a valuable adjunct to the athlete's physical rehabilitation.[21] Some interventions would include the following.

Cognitive Restructuring

Here, one focuses on replacement of any unproductive thinking patterns that may contribute to psychological distress. One might point out how the injury could allow the athlete time to rest and catch up on other important aspects of life that have been neglected, reevaluate priorities, and enjoy the absence of constant training and competition pressures.

Rational Emotive Therapy

The athlete often holds on to irrational belief systems. Rational Emotive Therapy strives to attack these irrational perceptions and unchecked assumptions and offers patients an opportunity to replace them with more realistic and productive thoughts.

Systematic Desensitization

The athlete is helped to gradually adjust his/her thinking to overcome fear and/or apprehension. This technique starts with smaller goals and works up to more complex ones. Essentially, this technique entails a gradual adjustment of perception.

Panic Mitigation

Give hope to the athlete and mitigate the anxiety and panic. Talk about the athlete's assets (positive things in his/her life) and mention how other athletes with the same condition have healed and made comebacks. Also ask the athlete to make the recovery process a challenge rather than a devastating blow.

Coping Rehearsal

A performance-enhancing audiotape can help the athlete overcome obstacles. Essentially, the athlete prepares for challenges ahead by developing a very detailed script that covers all the pertinent experiences associated with competition and/or injury. Then, this information is recorded onto a tape. This allows the athlete to focus on those issues that may present challenges and ways to successfully deal with these challenges.

Career Adjustment Techniques

In the event that the injury precludes returning to the sport, athletes receive individual or group counseling dealing with the issues of leaving the competitive arena. This process may involve coping strategies, self-esteem development, and other techniques aimed at avoiding an identity crisis.

Confidence Training

Here the individual is introduced to "volition" and the will to choose. Fundamentally, the athlete is taught that being confident is a choice that anyone can make. The athlete is made aware of the internal and controllable elements of confidence.

Positive Self-Talk

Once injured, athletes often engage in negative thoughts and self-defeating internal dialogue. Redirecting these thoughts and statements into positive, task-oriented thoughts and affirmations can help provide direction and motivation to the rehabilitation process.[11]

Thought Stoppage

Those athletes who seem to be bombarded with negative, self-defeating thoughts can be taught how to control these thoughts. The ultimate goal is to replace the negative thought patterns with positive affirmations.

Relaxation Skills

These skills can help the injured person cope with the stresses associated with injury. Relaxation can be attained by learning various skills, eg, breathing techniques or more physical relaxation skills such as progressive relaxation.

Imagery

This enables the patient to mentally practice those skills that may allow return to activities (eg, envision healing, pain management). Mental practice of physical and performance skills (mastery rehearsal) may also be used in the imagery sessions. Thus, motivation may be fostered if the athlete realizes that performance is facilitated by mental rehearsal during a time when he/she is unable to rehearse physically.[16]

Motivation

Motivating the injured athlete to adhere to rehabilitation programs is critical. Several techniques can increase motivation. One effective way is through goal setting. Here, athletes can be directed to channel their energies toward achievement of rehabilitation objectives, and a degree of control over their rehabilitation can be instilled.

Concentration Skills

Teaching how to focus on the skills required to achieve success (eg, become healthy again, decrease the probability of further injury) can be achieved by sequentially attending to those aspects most relevant at specific times in the rehabilitation process. Typically, this sequence would entail teaching the athlete to attend to cues that range from broad, general, and external areas to those that are narrow, specific, and internal.

CONCLUSION

We have presented general principles and examples from sound sport psychological theory and practice. Interestingly, those strategies that seem to work best are those geared toward the regulation of stress and fear in the patient. The individuals who recover as planned seem to have psychological profiles that facilitate recovery. Factors that have been shown to contribute to adherence to the rehabilitation regimen have included high levels of motivation, task involvement, pain tolerance, and perceived exertion.[9,10]

It is critical to the ultimate goal of recovery and return to competition that athletes be rehabilitated both physically and psychologically. Yet, most coaches, athletic trainers, and athletes lack both the knowledge and the skill concerning

psychological rehabilitation.[20] If cognitive, emotional, and behavioral manifestations associated with the injury lead the sports medicine practitioner to believe that the patient's progress is hampered, psychological intervention becomes a must. A timely referral to a sport psychologist allows for prompt management and relief from any undue emotional distress. Most of all, an immediate referral permits a timely handling of the existing psychological problems, can prevent further psychological complications, and fosters positive psychological states known to accelerate the healing process.

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Body Composition Assessment and Minimal Weight Recommendations for High School Wrestlers

Dale R. Wagner, MEd, CSCS

Objective: To describe a procedure to estimate a minimal wrestling weight based on percent body fat.

Background: Weight reduction and weight restriction are health issues that have sparked much debate among those involved with high school wrestling. Recently, programs have been developed to curtail dangerous weight loss practices and severe weight reduction in this population.

Description: Skinfold sites, measurement technique, and an equation, based on skinfolds, specific to the high school wrestling population are presented. Recommendations for minimizing error are also presented.

Clinical Advantages: This article provides a detailed program for measuring skinfold sites and interpreting these measurements.

Key Words: wrestling, skinfolds, body fat, adolescence

Body weight is often a concern for athletes for both appearance and performance. The need to control body weight is very evident in wrestling where "making weight" at a lower weight class gives one an assumed advantage over an opponent. Additionally, it is common practice for a wrestler who is not making the team to "drop weight" in order to fill a void in the team's roster at a lower weight class.[3]

Traditionally, wrestlers have used aggressive methods such as food restriction, dehydration, vomiting, diuretics, and exercise in thermal environments to accomplish weight loss.[13,14,16] These athletes also go through weekly weight fluctuations, losing weight rapidly before a match only to regain it immediately following weigh-in. Although there is a lack of research on this practice of weight cycling, investigators have suggested that it may be detrimental to the athlete's behavior, metabolism, health, and performance.[3] These practices occur despite warnings from the American College of Sports Medicine[1] and the American Medical Association.[2] Brownell and Steen[3] stated, "Legislation defining a minimum weight for competition, perhaps based on an individual's percent body fat, might be the only means for altering these practices."

Recently, programs such as the Wisconsin Wrestling Minimum Weight project[12] have been put into place to curtail the practice of excessive weight reduction among high school wrestlers. This program includes nutrition education, a limit on weekly weight loss, and skinfold measurements to estimate body fat for determination of a minimum wrestling weight. The purpose of this article is to give the clinician who is responsible for assessing the body composition of the high school wrestler a detailed description of the skinfold sites, a measurement technique, and an equation for estimating body fat and determining minimal weight standards for this population.

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BACKGROUND RESEARCH

Over two decades of research went into developing an optimal equation for estimating percent body fat and minimal wrestling weight in high school wrestlers.[8] This research culminated in a landmark cross-validation study by Thorland et al[15] involving 860 high school wrestlers from the midwestern United States. They found several equations to be acceptable for predicting body density and fat-free body mass. Of the equations with the lowest prediction error, Lohman's[9] is the most practical. The Wisconsin Wrestling Minimum Weight project[12] used a Thorland et al[15] modification of the Lohman[9] equation. This equation and a description of the skinfold sites and measurement technique associated with it are presented below.

SKINFOLD SITES

Lohman's[9] equation uses three skinfold sites: triceps, subscapular, and abdominal. The anatomical landmarks for these sites are detailed in the *Anthropometric Standardization Reference Manual*[5] and are as follows.

1. Triceps: a vertical fold in the midline of the posterior aspect of the arm at a point midway between the acromion process of the scapula and the olecranon process of the ulna (Figs 1 and 2).
2. Subscapular: a diagonal fold along the natural cleavage line of the skin just inferior to the inferior angle of the scapula (Figs 1 and 3).
3. Abdominal: a horizontal fold 3 cm lateral and 1 cm inferior to the center of the umbilicus (Figs 4 and 5).

MEASUREMENT TECHNIQUE

Several standardization procedures have been established to increase the accuracy and reliability of the skinfold measurements.[5] All measurements should be taken on the right side of the body with the clinician meticulously identifying and marking the skinfold sites. A skinfold is lifted by placing the

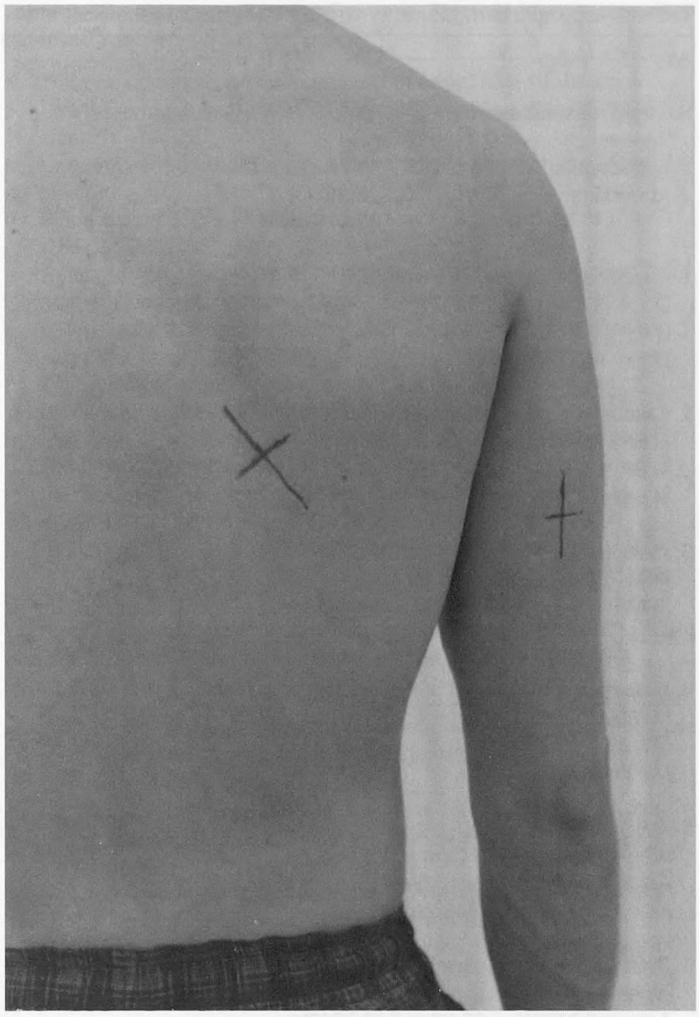

Fig 1. Sites for triceps and subscapular skinfolds.

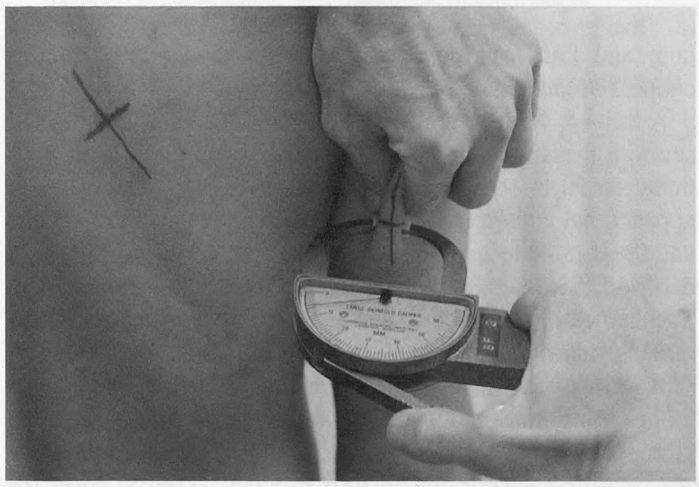

Fig 2. Measurement of triceps skinfold.

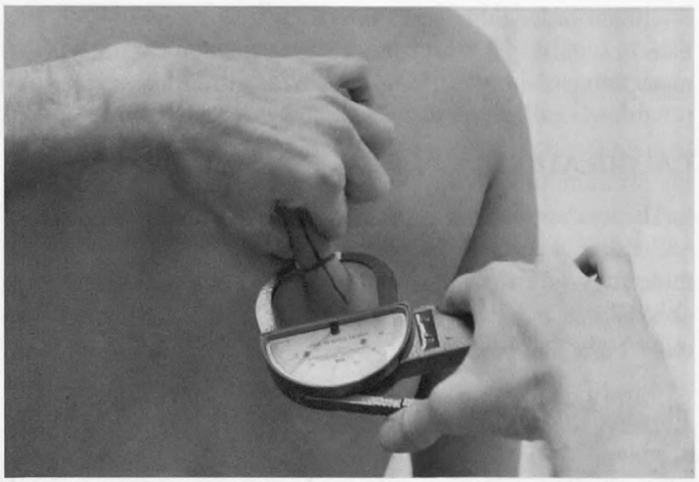

Fig 3. Measurement of subscapular skinfold.

Fig 4. Site for abdominal skinfold.

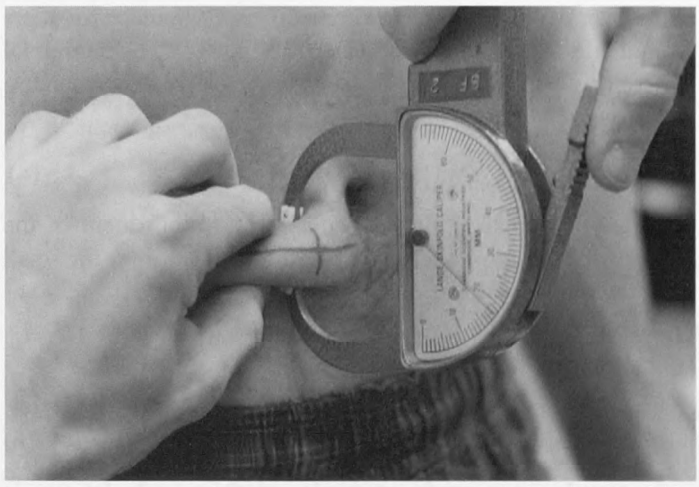

Fig 5. Measurement of abdominal skinfold.

thumb and index finger of the left hand about 8 cm apart and drawing them together so that the fold is grasped firmly. Be careful to elevate only skin and adipose tissue. Use your right hand to place the jaws of the caliper perpendicular to and 1 cm away from the left thumb and index finger, which are keeping the fold elevated. Thus, in relation to the fingers holding the skinfold, the caliper is placed below them for the triceps measurement, diagonal to them for the subscapular reading, and to the right of the fingers for the abdominal measurement. A caliper reading is taken 4 seconds after the jaw pressure is released.

Heyward and Stolarczyk[6] recommend taking a minimum of two measurements at each site. If the values differ from each other by more than ± 10%, additional measurements should be taken. The three skinfold (SKF) sites should be measured in a

rotational order rather than consecutive readings at each site. Due to shifts in body fluids, they also recommend that measurements not be taken immediately after exercise.

CALCULATIONS

The average of two measurements that are within ± 10% of each other at each site is calculated. The average values for the three sites—triceps, subscapular, and abdominal—are summed (Σ3SKF) and entered into the following equation[15] to determine body density (Db).

$$Db = [1.0973 - (0.000815 \times \Sigma 3SKF)] + [0.00000084 \times (\Sigma 3SKF)^2] \quad (1)$$

Body density (Db) is then converted to percent body fat (%BF) using the formula of Brozek et al.[4]

$$\%BF = (457.0 \div Db) - 414.2 \quad (2)$$

Subsequently, once body weight (BW) is measured, fat-free mass (FFM) can easily be calculated.

$$FFM = (1 - \%BF)BW \quad (3)$$

While there does not appear to be a definitive criterion level of body fat for making minimal wrestling weight recommendations, most experts have chosen values of 5% to 7%. Lohman[8] cited 5% as the minimal amount of body fat that male athletes should maintain, while the Wisconsin Wrestling Minimum Weight project[12] chose 7% body fat as the lowest acceptable value at which a high school wrestler should be competing. Recent recommendations from the American College of Sports Medicine[1] set minimal standards for percent body fat at 7% for males 16 years and younger, and 5% for those over 16 years. It is recommended that female wrestlers maintain a body fat of at least 12% to 14%.[1] A minimal wrestling weight (MWW) can easily be calculated from fat-free mass (FFM).

$$MWW(@5\%) = FFM \div 0.95 \quad (4)$$

Finally, Lohman[8] suggested making an adjustment in the young athlete's minimal wrestling weight to account for small differences in chemical maturity and reduce the error associated with age.

$$\text{adjustment} = 0.406(\text{age} - 17.2) \quad (5)$$

$$\text{final MWW} = \text{MWW} + \text{adjustment} \quad (6)$$

A sample case study example of these calculations is provided in Table 1.

Table 1. Example of Minimal Wrestling Weight Calculations

Age: 16.5 years Wt: 145.0 lb (65.77 kg)

Skinfold measurements			Avg
Triceps	6.0	6.0	6.0
Subscapular	10.5	11.0	10.75
Abdominal	8.5	8.0	8.25
			25.0 Σ3SKF

1. Calculation for body density (Db)
   $Db = [1.0973 - (0.000815 \times \Sigma 3SKF)] + [0.00000084 \times (\Sigma 3SKF)^2]$
   $Db = [1.0973 - (0.000815 \times 25.0)] + [0.00000084 \times (25.0)^2]$
   Db = 1.07745 g/cc

2. Calculation for percent body fat (%BF)
   %BF = (457.0 ÷ BD) − 414.2
   %BF = (457.0 ÷ 1.07745) − 414.2
   %BF = 9.9

3. Calculation of fat-free mass (FFM)
   FFM = (1 − BF) BW (in kg)
   FFM = (1 − 0.099) 65.77
   FFM = 59.26 kg

4. Calculation of minimal wrestling weight (MWW)
   MWW (@ 5%) = FFM ÷ 0.95
   MWW = 59.26 ÷ 0.95
   MWW = 62.38 kg

5. Calculation of age adjustment
   Adjustment = 0.406 (age - 17.2)
   Adjustment = 0.406 (16.5–17.2)
   Adjustment = −0.2842 kg

6. Final calculation of minimal wrestling weight (MWW) adjusted for age
   Adjusted MWW = MWW + adjustment
   Adjusted MWW = 62.38 + (−0.2842)
   Adjusted MWW = 62.09 kg (136.9 lb)

MEASUREMENT ERROR

Lohman[8] cited measurement technique, site location, and type of caliper as potential sources of technical error that can affect the accuracy of the skinfold method. Thus, the clinician must be precise in locating the proper skinfold site and taking the measurement as outlined above. Harpenden, Lange, Holtain, and Lafayette calipers are recommended high quality calipers because they exert a constant pressure (~10 g/mm^2).[6]

A trained, skilled technician is critical for valid and reliable skinfold measurements. Experts in the field recommend practicing on 50 to 100 clients to gain proficiency.[6,7] However, it appears that even relatively inexperienced testers can produce valid and reliable measurements when given training in standardized skinfold site location and measurement techniques. Morrow et al[10] reported that inexperienced testers obtained reliable measurements at the triceps and subscapular sites of adolescents after only a brief practice session. Following a 5-hour clinic that included demonstration and practice of the protocol described in this article, Oppliger et al[11] noted that clinic-trained testers are able to produce skinfold measurements with an accuracy similar to that of trained testers on a sample of high school wrestlers.

RECOMMENDATIONS

Making wrestling safer and healthier for athletes should be a goal of all coaches, athletic trainers, and clinicians involved with the sport. Determining a minimal wrestling weight based on body fat could be a big step toward eliminating some of the unhealthy weight reduction and dietary practices currently seen

Table 2. Checklist to Minimize Errors in Skinfold Measurement (adapted from Heyward/Stolarczyk[6])

- Take all skinfold measurements on the right side of the body.
- Use anatomical landmarks to carefully identify and mark the skinfold site.
- Use an 8-cm spread between thumb and index finger to form the skinfold.
- Place caliper jaws 1 cm away from and perpendicular to the elevated skinfold.
- Read skinfold measurement 4 sec after pressure is released from caliper jaws.
- In a rotational order, take a minimum of two measurements at each site (±10% variability).
- Take skinfold measurements when the skin is dry and not immediately after exercise.
- Use high quality skinfold calipers (~10 g/mm^2 jaw pressure).
- Practice, practice, practice! Do skinfolds on 50 to 100 "practice clients" of varying body types before applying your skills to determine the minimal weight of a wrestler. Compare your measurements to those of a skilled skinfold technician.

Table 3. Recommendations for Implementing a Minimal Wrestling Weight Program (adapted from American College of Sports Medicine[1])

- Advocate a state mandate for minimal wrestling weight standards so that wrestlers from all districts/regions are competing under the same stipulations.
- Assess the athlete's body composition and establish a minimal wrestling weight prior to the first practice session using the methods described in this article.
- Provide a nutrition education program/seminar prior to the start of the season for wrestlers, coaches, and parents.
- Work with a nutritionist to establish minimal caloric intakes for wrestlers.
- Place a limit on the amount of weight that can be lost per week (eg, 3 lb/wk[12]).
- Eliminate "sweat boxes," rubber suits, laxatives, and other methods of dehydration as a means of "making weight."
- Schedule weigh-ins immediately prior to competition so that wrestlers are competing at their "true" weight.
- Consider the possibility of allowing more than one wrestler from each school to compete at the same weight class.
- Have athletes, coaches, parents, athletic trainers, and physicians evaluate the program at the end of each season to address concerns and implement improvements.

in the sport. Oppliger et al[13] reported significant decreases in weekly weight cycling, fasting before weigh-in, and amount of weight lost when the Wisconsin Wrestling Minimum Weight project was mandated. Lohman[8] estimated that if measurement procedures are followed carefully, the error in estimating fat-free mass and minimal wrestling weight could be reduced to 1.2, 1.6, and 1.9 kg for lightweight, middleweight, and heavyweight groups, respectively. A checklist for proper skinfold technique to minimize measurement error is presented in Table 2. With such a small error in estimating a minimal weight, much of the guesswork associated with selecting an appropriate weight class can be removed. Oppliger et al[12] stated that although there was initially some opposition to establishing a minimal wrestling weight based on percent body fat, both wrestlers and coaches in the Wisconsin Wrestling Minimum Weight project now overwhelmingly accept this procedure.

In conclusion, wrestling programs should have a minimal wrestling weight standard based on percent body fat to protect the safety and health of high school wrestlers. A comprehensive program, such as the Wisconsin Wrestling Minimum Weight project,[12] should include nutritional counseling and limitations on weekly weight loss, as well as a minimal weight standard. Specific recommendations for establishing a minimal wrestling weight program are provided in Table 3. Ideally, skinfold technicians should undergo extensive training with experienced testers before taking measurements that will be used to determine a wrestler's weight classification. The skinfold procedures and equations outlined in this article have been developed specifically for this population. Implementing this procedure and developing a minimal wrestling weight at the time of the preseason physical examination will allow the high school wrestler to remain competitive at a healthy weight throughout the season.

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NOTICE

As of this issue, David Perrin, PhD, ATC, of the University of Virginia, has been named the new Editor-in-Chief of the journal and Leslie Neistadt of the Hughston Sports Medicine Foundation, Inc., the new Managing Editor. All editorial submissions and correspondence should be sent to:

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In an effort to promote scholarship among young athletic trainers, the National Athletic Trainers' Association, Inc. sponsors an annual writing contest.

1. The contest is open to all undergraduate members of the NATA.
2. Papers must be on a topic germane to the profession of athletic training and can be case reports, literature reviews, experimental reports, analyses of training room techniques, etc.
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Second Runner-up: Starkey C, Henderson J. Performance on the athletic training certification examination based on candidate's routes to eligibility. 1995;30:59.

Clint Thompson Award for Outstanding Clinical Article:

Winner: Pezzullo DJ, Karas S, Irrgang JJ. Functional plyometric exercise for the throwing athlete. 1995;30:22.

First Runner-up: Tie between:
Foster DT, Rowedder LJ, Reese SK. Management of sports-induced skin wounds. 1995;30:135.
and
Koester MC. Refocusing the adolescent preparticipation physical evaluation toward preventive health care. 1995;30:352.

Second Runner-up: Granito VJ Jr, Hogan JB, Varnum LK. The performance enhancement group program: integrating sport psychology and rehabilitation. 1995;30:328.

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Abstracts

Clint Thompson, MS, ATC

Stannard JP, Bucknell AL. Rupture of the triceps tendon associated with steroid injections. *Am J Sports Med.* 1993;21:482–485. Comment in: *Am J Sports Med.* 1995;23:778.

Rupture of the triceps mechanism is an uncommon injury that has been recognized with increasing frequency in recent years. It has been proposed that such injuries commonly accompany fractures of the radial head and must be actively evaluated in the presence of such a fracture. We present a unique case of isolated rupture of the triceps tendon in an athlete who was lifting weights. This case was complicated by a history of olecranon bursitis that had been treated with numerous local steroid injections, as well as a history of anabolic steroid abuse. Both systemic steroids and local injections may predispose tendons to rupture. Triceps tendon ruptures may result in uniformly good to excellent results if recognized and treated surgically. This case also serves as a reminder of the risks of treating inflamed tissues with local steroid injections, especially in strength athletes who place high demands on their musculoskeletal structures. Finally, this case documents a second case of triceps mechanism rupture in an athlete who has abused anabolic steroids. A study by Hunter et al suggests that oral steroid abuse may be associated with detrimental effects on the mechanical properties of connective tissue, demonstrating another negative effect of anabolic steroid use in athletes.

LaPrade RF, Burnett QM, Zarzour R, Moss R. The effect of the mandatory use of face masks on facial lacerations and head and neck injuries in ice hockey: a prospective study. *Am J Sports Med.* 1995;23:773–775.

A 4-year prospective review of lost-time injuries and facial lacerations was performed for a National Collegiate Athletic Association Division I intercollegiate ice hockey team. The total injury exposure time consisted of 798.5 practice hours and 163 games. There were 16 facial lacerations, with an incidence of 14.9 per 1000 player-game hours and 0.1 per 1000 player-practice hours; both incidences were found to be less than in previous comparable studies where the use of face masks was not mandatory. In addition, there were eight lost-time head and neck injuries that accounted for 6.3% of all lost-time injuries. We found that the mandatory use of face masks in intercollegiate ice hockey results in a reduction in facial lacerations and no increase in overall head and neck injuries.

Gilbart MK, Oglivie-Harris DJ, Broadhurst C, Clarfield M. Anterior tibial compartment pressures during intermittent sequential pneumatic compression therapy. *Am J Sports Med.* 1995;23:769–772.

We studied the anterior tibial compartment pressures during the application of a JOBST sequential intermittent pneumatic compression device on five healthy human volunteers (10 legs). Intracompartmental pressures were measured using a slit catheter. The measurements of interstitial pressures were highest at maximal calf inflation, and pressures were increased for approximately 120 seconds during each cycle. Pressure measurements in the inflated pressure sleeve varied less than 10% with the measured anterior tibial compartment pressures during intermittent pneumatic compression therapy. This intermittent pneumatic compression device may elevate intramuscular pressure significantly above that necessary to render muscle ischemic. However, these periods of pressure elevation are not long enough to produce any significant adverse effects, and the beneficial effects of decreased edema fluid may be safely realized.

Pienkowski D, McMorrow M, Shapiro R, Caborn DN, Stayton J. The effect of ankle stabilizers on athletic performance: a randomized prospective study. *Am J Sports Med.* 1995;23:757–762.

The ankle is the site of more than one third of all injuries that occur to male basketball players. Although ankle bracing may prevent injury, many players believe that braces restrict athletic performance. This belief discourages use of braces and obviates the injury protection that bracing provides. The objectives of this study were to: 1) determine whether athletic performance (in four basketball-related activities) was affected by three ankle brace designs (Universal, Kallassy, and Air-Stirrup ankle training brace), 2) determine whether specific braces are better for specific athletic activities, and 3) determine whether athletic performance changes with brace use. Twelve high school basketball players wore each brace type while vertical jumping, standing long jumping, cone running, and 18.3-meter shuttle running at two test times (initially and after 1 week of acclimation). Our data showed that these braces had no significant effects on athletic performance. No brace affected athletic performance in one specific activity more than another, and athlete performance did not change with brace use. We concluded that prophylactic ankle bracing does not inhibit athletic performance.

Tierney GS, Wright RW, Smith JP, Fischer DA. Anterior cruciate ligament reconstruction as an outpatient procedure. *Am J Sports Med.* 1995;23: 755–756.

During a 27-month period, 222 patients with 227 anterior cruciate ligament-deficient knees underwent arthroscopically assisted reconstructions as outpatient procedures. Bone-tendon-bone autografts were used for 169 of these reconstructions; the other 58 were done with bone-tendon-bone allografts. Additional procedures were performed on 180 of the patients. The interval from injury to reconstruction averaged 29 months. The protocol developed at our clinic employs a general anesthetic administered with the intent of same-day discharge, infiltration of the skin and joint with bupivacaine, a cold compressive dressing, and the use of both ketorolac tromethamine and a Schedule III narcotic (acetaminophen with codeine or with propoxyphene) for postoperative pain control. At an average follow-up of 10 months, no readmissions in the immediate postoperative period had been required and no short- or long-term postoperative complications could be attributed to the protocol. This safe and effective technique offers the patient the advantage of anterior cruciate ligament reconstruction as a same-day procedure and allows the surgeon to implement its use in any outpatient setting without additional discharge planning.

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Slauterbeck JR, Shapiro MS, Liu S, Finerman GA. Traumatic fibular shaft fractures in athletes. *Am J Sports Med.* 1995;23:751–754.

A direct blow to the leg resulted in fibular shaft fractures in three elite college athletes participating in contact sports. None of the athletes had prior symptoms suggestive of a stress fracture. All three athletes had benign-appearing fractures and were treated nonoperatively. Ultimate healing was delayed, occurring on average at 23 weeks, and each case was complicated by refracture. Fractures of the fibular shaft in athletes may require more aggressive treatment than other simple fractures to allow sufficient healing to withstand the rigors of athletics.

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Miller CD, Shelton WR, Barrett GR, Savoie FH, Dukes AD. Deltoid and syndesmosis ligament injury of the ankle without fracture. *Am J Sports Med.* 1995;23:746–750.

Ankle diastasis without fracture is a rare injury with few examples reported. We report on four male patients, aged 16 to 18 years, who sustained this injury playing football. Swelling and tenderness over both the deltoid and syndesmosis ligaments are the most common physical findings. Plain ankle radiographs demonstrated lateral talus subluxation in three patients, and a stress radiograph demonstrated subluxation of the talus in one patient. Treatment consisted of reduction and fixation of the syndesmosis with a screw followed by 6 weeks of cast immobilization. Using the scale developed by Edwards and DeLee, three patients had excellent results and one had a good result. Diagnosis of tears of the deltoid and syndesmosis ligaments without fracture requires a high index of suspicion on the physician's part. In patients whose mortise is more than 1 mm subluxated, reduction and screw fixation will produce good results.

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Harner CD, Xerogeanes JW, Livesay GA, et al. The human posterior cruciate ligament complex: an interdisciplinary study. Ligament morphology and biomechanical evaluation. *Am J Sports Med.* 1995;23:736–745.

To study the structural and functional properties of the human posterior cruciate ligament complex, we measured the cross-sectional shape and area of the anterior cruciate, posterior cruciate, and meniscofemoral ligaments in eight cadaveric knees. The posterior cruciate ligament increased in cross-sectional area from tibia to femur, and the anterior cruciate ligament area decreased from tibia to femur. The meniscofemoral ligaments did not change shape in their course from the lateral meniscus to their femoral insertions. The posterior cruciate ligament cross-sectional area was approximately 50% and 20% greater than that of the anterior cruciate ligament at the femur and tibia, respectively. The meniscofemoral ligaments averaged approximately 22% of the entire cross-sectional area of the posterior cruciate ligament. The insertion sites of the anterior and posterior cruciate ligaments were evaluated. The insertion sites of the anterior and posterior cruciate ligaments were 300% to 500% larger than the cross section of their respective midsubstances. We determined, through transmission electron microscopy, fibril size within the anterior and posterior cruciate ligament complex from the femur to the tibia. The posterior cruciate ligament becomes increasingly larger from the tibial to the femoral insertions, and the anterior cruciate ligament becomes smaller toward the femoral insertion. We evaluated the biomechanical properties of the femur-posterior cruciate ligament-tibia complex using 14 additional human cadaveric knees. The posterior cruciate ligament was divided into two functional components: the anterolateral, which is taut in knee flexion, and the posteromedial, which is taut in knee extension. The anterolateral component had a significantly greater linear stiffness and ultimate load than both the posteromedial component and meniscofemoral ligaments. The anterolateral component and the meniscofemoral ligaments displayed similar elastic moduli, which were both significantly greater than that of the posteromedial component.

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Eggli S, Wegmuller H, Kosina J, Huckell C, Jakob RP. Long-term results of arthroscopic meniscal repair: an analysis of isolated tears. *Am J Sports Med.* 1995;23:715–720.

From 1984 through 1986, we performed 54 arthroscopic meniscal repairs on patients with anterior cruciate ligament-stable knees. We evaluated the repair results of 52 of these patients at an average follow-up of 7.5 years. In 40 patients, the meniscal repairs had not failed and these patients were examined clinically and radiographically; in 25 cases, magnetic resonance imaging was also performed. Significantly more failures ($p \leq .05$) occurred when the rim width of the tear was greater than 3 mm and when the tear was repaired with resorbable sutures. Conversely, the following factors were found to favorably influence meniscal healing ($p > .05$): time from injury to surgery less than 8 weeks, patient age less than 30 years, tear length less than 2.5 cm, and tear in the lateral meniscus. The overall failure rate after 7.5 years was 27% (14 of 52); 64% (9 of 14) of the failures occurred in the first 6 months after repair. The clinical and radiographic evaluation of the successfully repaired knees showed that 90% (36 of 40) had normal knee function; the remaining 10% (4 patients) had nearly normal knee function. Magnetic resonance imaging, however, showed a persisting grade 3 or 4 lesion in 96% (24 of 25) of the successfully repaired menisci and is therefore not reliable in assessing meniscal healing.

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Arendt E, Dick R. Knee injury patterns among men and women in collegiate basketball and soccer: NCAA data and review of literature. *Am J Sports Med.* 1995;23:694–701. Review Article: 34 Refs.

Women's participation in intercollegiate athletics has increased dramatically in recent years. Greater participation has increased awareness of health and medical issues specific to the female athlete. Some reports have noted a higher susceptibility to knee injury, specifically injuries to the anterior cruciate ligament, in female athletes as compared with their male counterparts. We performed a 5-year evaluation of anterior cruciate ligament injuries in collegiate men's and women's soccer and basketball programs using the National College Athletic Association Injury Surveillance System. Results showed significantly higher anterior cruciate ligament injury rates in both female sports compared with the male sports. Noncontact mechanisms were the primary cause of anterior cruciate ligament injury in both female sports. Possible causative factors for this increase in anterior cruciate ligament injuries among women may be extrinsic (body movement, muscular strength, shoe-surface interface, and skill level) or intrinsic (joint laxity, limb alignment, notch dimensions, and ligament size).

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Marcacci M, Zaffagnini S, Iacono F, Neri MP, Petitto A. Early versus late reconstruction for anterior cruciate ligament rupture. Results after five years of followup. *Am J Sports Med.* 1995;23:690–693.

We investigated the clinical and laxity testing results at 5 years' follow-up in patients who had early or late anterior cruciate ligament reconstruction. Twenty-three patients (Group I) were treated within 15 days of injury. Fifty-nine patients (Group II) were treated more than 3 months after injury. Patellar tendon reconstruction and fascia lata graft augmented with a ligament augmentation device were the techniques used in both groups. According to the International Knee Documentation Committee rating scale, 17 patients in Group I and 38 patients in Group II had satisfactory results. The Lysholm score was good in all Group I patients and in 55 Group II patients. Flexion-extension deficits were comparable for both groups. Eighteen patients (78%) in Group I demonstrated satisfactory results according to the KT-2000 arthrometer testing, compared with 44 (75%) in Group II. No associated lesions were present in 12 (52%) cases in Group I, compared with 26 (44%) cases in Group II. Return to sports at the preoperative level was obtained by 21 (91%) patients in Group I, compared with 42 (71%) in Group II. The patients who had reconstruction during the early phase returned to sports activities sooner and had better clinical and laxity testing results.

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Sgaglione NA, Del Pizzo W, Fox JM, Friedman MJ. Critical analysis of knee ligament rating systems. *Am J Sports Med.* 1995;23:660–667.

Sixty-five patients who consecutively underwent anterior cruciate ligament reconstruction were studied using four individual, categoric knee score rating systems. Different results were noted at follow-up (mean, 35 months; range, 24 to 58) depending on the rating method used. All patients were graded using the Hospital for Special Surgery, Lysholm, Tegner activity, and Cincinnati Knee Ligament rating systems. The Cincinnati Knee Ligament rating individual scores were noted to be lower than the Hospital for Special Surgery and Lysholm scores for subjective and objective outcome assessment. The Hospital for Special Surgery and Lysholm scores did not correlate highly with the Cincinnati Knee Ligament rating final rating, but they did correlate with each other. The use of ligament rating scores tended to inflate results, particularly when raw scores were converted to overall categoric ratings (eg, excellent, good). The Cincinnati Knee Ligament rating system correlates more highly with individual grading and most precisely defines outcome in athletically active patients. Sources of error may be introduced by a disproportionate combination of unrelated scores or by overrating low-activity-level individuals who avoid stressing their knees. Avoidance of data generalization remains the optimal method for studying anterior cruciate ligament surgery outcome.

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Orava S, Kujala UM. Rupture of the ischial origin of the hamstring muscles. *Am J Sports Med.* 1995;23:702–705.

We treated eight patients who had complete rupture of the ischial origin of the hamstring muscles. This uncommon injury results from a sudden forceful flexion of the hip joint when the knee is extended and the hamstring muscles are powerfully contracted. The injuries occurred during athletic exercise in six men and two women who had a mean age of 40 years (range, 22 to 53). With prompt diagnosis and surgery, the final functional results in these patients were good. If the diagnosis is delayed, it is not possible to accomplish a primary suture of the hamstring muscles to the ischial bone. Consequently, another surgical procedure will need to be performed to restore function. Unlike cases of bony avulsion of the ischial apophysis in growing children, acute complete rupture of the proximal hamstring muscles' origin in adults should be treated with prompt surgery.

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Shelbourne KD, Foulk DA. Timing of surgery in acute anterior cruciate ligament tears on the return of quadriceps muscle strength after reconstruction using an autogenous patellar tendon graft. *Am J Sports Med.* 1995; 23:686–689.

To determine if patients who delayed anterior cruciate ligament reconstruction until a convenient time regained quadriceps muscle strength allowing them to return to sports participation at a different rate than patients who had early surgery for anterior cruciate ligament reconstruction, we studied 143 patients who had the same surgical procedure and postoperative rehabilitation program. Group I delayed surgery at a mean of 40 days after injury; Group II had early surgery at a mean of 11 days after injury. Statistically, Group I patients had significantly better mean quadriceps muscle strength at 2 months ($p = .017$) and at 4 months ($p = .0055$) postoperatively. At least 65% quadriceps muscle strength was achieved by 40 of the 50 patients (80%) tested in Group I at 2 months, allowing the patients to progress to sport-specific rehabilitation. Only 35 of the 66 patients (53%) tested in Group II were able to progress toward sports activities at 2 months. By 6 months, 29 of the 40 patients (73%) tested in Group I compared with 27 of the 58 patients (47%) tested in Group II had 80% quadriceps muscle strength. This study demonstrates that the return of quadriceps muscle strength was faster for our patients who delayed anterior cruciate ligament reconstruction than for our patients who had early reconstruction. Thus, despite delaying their early reconstructions, Group I was able to progress sooner from the date of surgery to sport-specific rehabilitation.

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Hollis JM, Blasier RD, Flahiff CM. Simulated lateral ankle ligamentous injury: change in ankle stability. *Am J Sports Med.* 1995;23:672–677.

The effect of simulated ankle ligamentous injury on ankle-subtalar joint complex laxity was studied. Thirty-six intact ankles were loaded in inversion-eversion and anterior-posterior directions. Motions of the talus and calcaneus were measured with respect to the tibia. Ankles were tested at neutral, 15° of dorsiflexion, and 15° of plantar flexion. In all the specimens, the anterior talofibular ligament was sectioned and then the calcaneofibular ligament was sectioned; testing was then repeated. With sectioning of the anterior talofibular ligament, motion increased primarily in dorsiflexion with both anterior-posterior and inversion-eversion loading. This increase was primarily caused by a large increase in subtalar motion. Additional sectioning of the calcaneofibular ligament produced little change in ankle subtalar joint motion except in dorsiflexion. Clinically, these findings show that if an anterior-posterior drawer test shows less laxity in dorsiflexion than in neutral and greater laxity than the contralateral asymptomatic side, then an isolated anterior talofibular ligamentous tear exists. Similarly, laxity in 15° of dorsiflexion and in neutral suggests calcaneofibular ligament disruption. During inversion-eversion loading, the increase in ankle-subtalar joint complex rotation with calcaneofibular ligament sectioning occurred primarily in the ankle joint, implying that the calcaneofibular ligament constrains the talus through the calcaneus. Therefore, a talar tilt on stress radiographs demonstrates a torn calcaneofibular ligament.

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Mikesky AE, Edwards JE, Wigglesworth JK, Kunkel S. Eccentric and concentric strength of the shoulder and arm musculature in collegiate baseball pitchers. *Am J Sports Med.* 1995;23:638–642.

Many pitching injuries occur during deceleration of the upper extremity when the muscles of the shoulder and arm are acting eccentrically. Published information regarding eccentric muscular strength in baseball pitchers is nonexistent. The purpose of this study was to assess bilateral isokinetic eccentric and concentric muscular strength of the shoulder's external and internal rotator muscles and the elbow's flexor and extensor muscles in a group of collegiate baseball pitchers ($n = 25$). Isokinetic strength was assessed at 1.6, 3.7, and 5.2 rad/sec. Our findings indicate that the internal rotator muscles were always stronger than the external rotator muscles and that the concentric and eccentric external-to-internal strength ratios ranged from 62% to 81%. The eccentric strength of the shoulder rotator muscles averaged 114% that of concentric strength. The concentric and eccentric elbow extension-to-flexion strength ratios ranged from 71% to 110%; eccentric strength averaged 33% higher than concentric strength. No differences were noted between dominant and nondominant limbs for any of the strength measures or ratios. Clinically, the findings of

this study can serve as a reference during the evaluation, rehabilitation, and conditioning of throwing athletes.

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Branch TP, Lawton RL, Iobst CA, Hutton WC. The role of glenohumeral capsular ligaments in internal and external rotation of the humerus. *Am J Sports Med.* 1995;23:632–637.

The purpose of this study was to define the relationship between internal and external rotation of the humerus and the lengths of the anterior and posterior components of the glenohumeral capsuloligamentous complex. Six cadaveric shoulders (with intact ligaments and humeri) were stripped of all muscles. Each shoulder was mounted in its correct anatomic position. The extent of internal and external rotation of the humerus was then measured 36 times (at 10° intervals in a 360° humeral cone of motion). One component of the glenohumeral capsuloligamentous complex was lengthened, and the humeral rotation was again measured 36 times. The process of lengthening was done by cutting the ligament and replacing it with a beaded chain and catches sutured across the joint. The process of lengthening each component was repeated in 12 combinations, each with a different anterior and posterior component length. Humeral rotation was measured 36 times using a specially designed goniometer. The length of the anterior component of the glenohumeral capsuloligamentous complex most affected external humeral rotation, and the length of the posterior component most affected internal humeral rotation. However, the lengths of both the anterior and posterior components shared in limiting rotation at a number of positions.

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Holt MA, Keene JS, Graf BK, Helwig DC. Treatment of osteitis pubis in athletes: results of corticosteroid injections. *Am J Sports Med.* 1995;23: 601–606.

This study presents the results of treatment of osteitis pubis in 12 intercollegiate athletes. Early in this series, athletes were treated with prolonged rest, oral antiinflammatory medications, and hip-stretching exercises. Of the 9 athletes treated in this manner, only 1 resumed symptom-free activity after 16 weeks of therapy; 8 remained symptomatic and subsequently received a corticosteroid injection (1 ml 1% lidocaine, 1 ml 0.25% bupivacaine, and 4 mg dexamethasone) into the pubic symphysis. Of these 8 athletes, 3 returned to full participation within 3 weeks of injection, 4 required a second injection to alleviate their symptoms, and 1 was unable to resume athletic activities despite two injections and an inguinal herniorrhaphy. In recent years, we have recommended an injection if there is not reduction in symptoms after 7 to 10 days of treatment. Three athletes received a corticosteroid injection when their symptoms did not resolve. All three returned to full athletic competition within 2 weeks of the injection. The results of our study suggest that a more rapid return to intercollegiate athletics can be achieved through the judicious use of corticosteroids injections.

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MacDonald PB, Hedden D, Pacin O, Huebert D. Effects of an accelerated rehabilitation program after anterior cruciate ligament reconstruction with combined semitendinosus-gracilis autograft and a ligament augmentation device. *Am J Sports Med.* 1995;23: 588–592.

Forty patients with anterior cruciate reconstructions using semitendinosus and gracilis autografts and a ligament augmentation device were reviewed at a minimum of 20 months postoperatively to determine if an accelerated rehabilitation program was detrimental to intermediate follow-up results. The rehabilitation program included immediate full weight bearing, using crutches as aids for 2 weeks only, and a Generation II rehabilitation brace set at full range of motion for 2 weeks followed at 2 weeks by bicycle riding and strengthening exercises. Return to sports was allowed at 4 months for nonpivoting sports and at 6 months for level 1 sports involving pivoting. Thirty-seven patients were available for follow-up. At follow-up, three grafts were determined to be nonfunctional (KT-1000 arthrometer testing indicating > 4 mm of side-to-side difference). The other 34 patients had good or excellent results, with all returning to their preinjury levels of sport with a brace. Early accelerated rehabilitation after anterior cruciate ligament reconstruction with semitendinosus and gracilis tendon autograft and a ligament augmentation device does not seem to affect the results adversely. Results in this series were as good as or better than other series using the same reconstructive technique.

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Baumhauer JF, Alosa DM, Renstrom AF, Trevino S, Beynnon B. Test-retest reliability of ankle injury risk factors. *Am J Sports Med.* 1995;23:571–574.

Ligamentous instability, ankle muscle weakness, foot-ankle alignment, and generalized joint laxity may be predisposing factors for ankle ligament injuries. The purpose of this study was to examine the reliability of these risk factors before and after the season in healthy individuals and to determine if any significant differences developed during the athletic season (range, 12 to 16 weeks). Twenty-one healthy college-aged athletes were tested for generalized joint laxity, anatomic alignment of the foot and ankle, ligamentous stability, and isokinetic strength of the ankle muscles. This study showed that generalized joint laxity, ankle ligamentous stability, and ankle strength measurements demonstrated high correlation coefficients ($r > .75$). The high correlation coefficients suggested reliable measures. Some of the range of motion measurements had lower correlation coefficients, which suggested more variability in these measurements. After establishing the reliability in 24 of

the 28 measurements with standardized methods, further work is underway to evaluate the role of these factors in inversion ankle sprains.

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McCrory MA, Gomez TD, Bernauer EM, Mole PA. Evaluation of a new air displacement plethysmograph for measuring human body composition. *Med Sci Sports Exerc.* 1995;27:1686–1691.

A new air displacement plethysmograph, the BOD POD (BP), was evaluated in comparison to hydrostatic weight (HW). Sixty-eight adult subjects (26 F, 42 M) varying widely in age (range 20 to 56 yr), ethnicity, and fatness participated in this study. Same-day test-retest reliability was assessed in a subsample of 16 subjects (9 F, 7 M) and validity was assessed in all subjects (n = 68). The test-retest coefficients of variation (CV) for %FAT measured by BP (%FATBP) and HW (%FATHW) were not significantly different (1.7% ± 1.1% and 2.3% ± 1.9% for BP and HW, respectively (mean ± SD)), indicating excellent reliability for both methods. Validity of percent fat measured by the BP (%FATBP) was also excellent. The mean difference in %FAT (BP − HW) was −0.3 ± 0.2 (SEM), with a 95% confidence interval of −0.6 to 0 %FAT. The regression equation (%FATHW = 1.86 + 0.94 %FATBP; r^2 = 0.93, SEE = 1.81) was not significantly different from the line of identity (%FATHW = %FATBP), and did not differ by gender. These findings indicate that the BOD POD is a highly reliable and valid method for determining %FAT in adult humans in comparison to HW. This new method has several advantages over HW in that it is quick, relatively simple to operate, and may be able to accommodate special populations such as the obese, elderly and disabled.

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Pichon F, Chatard JC, Martin A, Cometti G. Electrical stimulation and swimming performance. *Med Sci Sports Exerc.* 1995;27:1671–1676.

The purpose of the study was to examine the influence of a 3-wk period of electrostimulation training on the strength of the latissimus dorsi m. and the swimming performances of 14 competitive swimmers divided into 7 electrostimulated (EG) and 7 control swimmers (CG). The peak torques registered during the flexion-extension of the arm was determined with the help of an isokinetic dynamometer at different velocities (from $-60°s^{-1}$ to $360°s^{-1}$). Performances were measured over a 25-m pull buoy and a 50-m freestyle swim. For EG, a significant increase of the peak torques was measured in isometric, eccentric, and concentric conditions ($p < 0.5$). The swimming times declined significantly ($p < .01$) by 0.19 ± 0.14 s, for the 25-m pull-buoy, and by 0.38 ± 0.24 s, for the 50-m freestyle. For CG, no significant difference was found for any of the tests. For the whole group, the variations of the peak torques, measured in eccentric condition ($-60°s^{-1}$) were related to the variations of the performances ($r = 0.77$; $p < .01$). These results showed that an electrostimulation program of the latissimus dorsi increased the strength and swimming performances of a group of competitive swimmers.

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Sleivert GG, Backus RD, Wenger HA. The influence of a strength-sprint training sequence on multi-joint power output. *Med Sci Sports Exerc.* 1995;27:1655–1665.

The purpose of this study was to determine whether adaptation to single- versus multi-joint strength training and sprint training was different and whether sequencing strength prior to sprint training was beneficial for increasing power. Thirty-two untrained males were assigned to control (C), sprint-sprint (SS), multi-joint (MJS), or single-joint (SJS) strength-sprint groups. Subjects were tested before training, after 8 weeks of strength or sprint training, and after an additional 6 weeks of sprint training. By midtraining both SJS and MJS increased 10 repetition maximum strength, but this was not transferable to isometric or isokinetic strength or rate of torque development. SS showed no improvement in these variables. All training groups increased cycle ergometer power output by 8 weeks and had similar fiber hypertrophy with no EMG changes. Subsequent sprint training continued to increase maximum power with no further hypertrophy. Tibial nerve conduction velocity increased in all training groups. These results indicate little difference in adaptation to single- and multi-joint strength training. Strength or power improvements caused by training in these models does not transfer to isometric or isokinetic movements. Further, sequenced strength-spring training provided no additional power gain over sprint training alone.

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Shi X, Summers RW, Schedl HP, Flanagan SW, Chang R, Gisolfi CV. Effects of carbohydrate type and concentration and solution osmolality on water absorption. *Med Sci Sports Exerc.* 1995;27:1607–1615.

We studied intestinal absorption of solutions containing either one (glucose, Glu, or maltodextrin, Mal) or two (fructose, Fru, and Glu or sucrose, Suc) transportable carbohydrate (CHO) substrates using segmental perfusion technique in eight healthy male subjects. These CHO were either free or directly transportable monosaccharides (Glu, Fru), bound as the disaccharide (sucrose, Suc), or as oligomers (maltodextrins, Mal). [CHO] was varied from 6% to 8% (120–444 $mmol.l^{-1}$). All solutions contained low [Na+] (15–19 mEq) and [K+] (3–4 mEq). Solutions osmolalities varied from 165 to 477 $mOsm.kg^{-1}$). Osmolalities in the test segment ranged from 268 to 314 $mOsm.kg^{-1}$. The regression line of osmolality with water absorption differed from single as compared with multiple

substrate solutions. The significantly different intercepts of these two regression lines suggest that solutions with multiple substrates produce greater water absorption at a given osmolality than those with one. Comparing all solutions, test segment solute flux (partial r = 0.69) was more important than mean osmolality (partial r = 0.32) In conclusion, solutions with multiple substrates stimulate several different solute absorption mechanisms yielding greater water absorption than solutions with only one substrate.

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Neal RJ, Kippers V, Plooy D, Forwood MR. The influence of hand guards on forces and muscle activity during giant swings on the high bar. *Med Sci Sports Exerc.* 1995;27:1550–1556.

To investigate the influence of hand guards on the loads experienced by gymnasts during giant swings on the high bar, forces applied to the bar by each hand and muscle activity of the extrinsic finger flexor and wrist extensor muscle groups were measured in 10 male gymnasts as they completed a minimum of three backward giant swings on the high bar. Measurements were made under four conditions of performance: bare hands, with webbing loops, with doweled hand guards (DHG), and a wind-up swing using DHG. Peak reaction forces at the hands were of the order of 2.2 times body weight (BW) on each hand, and were significantly ($p < .05$) lower when swinging bare-handed, compared with the other three conditions. By contrast, the integrated electromyograms showed that both wrist flexor and extensor muscle activity was unchanged across conditions. These results indicate that the use of hand guards allows greater tensile forces to act across the wrist without a measurable increase in forearm muscle activity. Thus, it is possible that there is extra stress on the ligaments of the wrist or at the epiphyseal plates. In adolescent and preadolescent gymnasts, the additional tension on the distal epiphyses of the radius and ulna may have implications for bone growth.

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Almeida GL, Latash ML. Paradoxical effects of practice of fast single-joint movements. *Med Sci Sports Exerc.* 1995;27:1540–1549.

We studied the effects of extensive practice of fast, unidirectional, single-joint elbow flexions against a small extending torque bias upon the kinematic and electromyographic (EMG) characteristics of the movements as well as upon the reconstructed hypothetical control patterns (equilibrium trajectories). The subjects were tested at different distances, both with and without the bias torque prior to and after the practice sessions. The basic finding was paradoxical: The subjects did not improve their performance at the practiced task (against the bias) and at other distances in the same condition; however, they showed an increase in movement speed and a decrease in movement times at all distances in unpracticed conditions (without the bias). Changes in the EMG patterns were similar in both conditions. We hypothesize that the principle of learning the dynamics of interaction with the experimental setup in combination with a very steep learning curve form the basis for the observed paradoxical effects of practice. The equilibrium-point hypothesis of movement control provides the least controversial description of these effects as compared to the force-control and EMG-control approaches.

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ISBN: 0-87322-771-9
Price: $26.00 (paper)

Many questions exist about the theory and application of cryotherapy. As applications of cryotherapy become accepted one way, new research develops theories for an altogether different approach.

This text is the most complete, up-to-date instructional tool for the theory and therapeutic application of cryotherapy in physical medicine and athletic health care. The combination of 766 references from 10 subject areas allows readers a greater understanding of the theory and application of cryotherapy, so that they can revise or establish their own step-by-step protocol. The text demonstrates many different protocols for immediate and long-term care of athletic injuries. The terminology and wording is easy to follow and makes a great starter text for the novice, as well as a terrific reference for all health care professionals. Likewise, the material is current and can be used in the development of new research questions.

The text contains three sections, allowing the reader a systematic approach to the complete understanding of cryotherapy. Part I introduces and defines concepts involved in cryotherapy. The definitions established in this section will be the reference for future research in this area of athletic training. This section also outlines the historical development of the therapeutic application of cold from the beginning to the present. The author simplifies the theory and application by asking some essential questions. He also clarifies most of the confusion surrounding the therapeutic application of this modality with a detailed explanation of these historical events.

Part II, *The Scientific Basis of Cryotherapy*, devotes 12 chapters to in-depth discussions of the physiological basis for the use of cryotherapy, including: Inflammation and Wound Repair; Metabolism and Inflammation; Circulatory Effects of Therapeutic Cold Applications; Neurologic and Neuromuscular Effects of Cold Application; Pain and Cold Application; and Dr. Knight concludes this section with Problems, Precautions, and Contraindications in Cold Therapy. Each physiologic effect is discussed in detail from a collection of research findings, and their clinical implications are presented. This section is a terrific lead-in for the final seven chapters, or Part III, where the clinical application of various cryotherapy techniques are discussed.

These last chapters include complete protocols for treating musculoskeletal injuries and sports-related conditions, as well as postsurgical applications and cryotherapy for the treatment of headaches.

The true strength of this text is that it provides the answers to questions concerning the most widely used modality in the therapeutic treatment of sports-related injuries. This text is the culmination of a lifetime of research, hard work, and devotion to the subject. This material is the most current collection of its kind, and is presented in a simple, easy-to-follow format. The combination of 766 references in 10 subject areas proves to be a thorough collection of available literature on cryotherapy. The reader will get the impression that researchers may only be scratching the surface and that there are volumes of information that have not yet been written.

I highly recommend this text for all health care professionals who are involved with cryotherapy and its therapeutic applications. Dr. Knight's text is an excellent text and reference for all health care professionals, even those who feel they already have a good working knowledge of the subject matter.

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The Crucial Ligaments
John A. Feagin, Jr.
Churchill Livingstone, New York, NY
1994
2nd edition
864 pages
Price: $195

The primary objective of *The Crucial Ligaments* is to supply the reader with a reference book about the knee joint. *The Crucial Ligaments* was written primarily with the orthopedic surgeon or student in mind; however, it would be a valuable reference book for the entire medical field. Almost everything one would need to know about the various components of the knee can be found in this book. Changes in the 2nd edition include almost 300 additional pages of text, more case studies, and additional chapters in each section. These features make this book one of the most comprehensive texts written about the knee.

The text is organized into nine sections. Section I supplies the reader with 21 different case studies dealing with various injuries or conditions of the knee. Section II enlightens the reader on the history, evolution, and epidemiology of the knee joint and various components. Section III deals with anatomy and kinematics of the knee. Section IV supplies the reader with information about diagnosis and diagnostic tests. Section V deals with the natural history of an untreated anterior cruciate ligament, prevention of cruciate injuries, and counseling for career-ending injuries. Section VI addresses the surgical treatment of various injuries, and Section VII describes possible sequelae associated with untreated knee injuries. Section VIII incorporates information about various aspects of knee rehabilitation, and Section IX deals with prosthetic ligaments.

The Crucial Ligaments supplies the reader with great detail about the knee. I found the case reports very beneficial because they are written in a way that allows readers to gather valuable information that can be related to actual cases they have encountered. I also found Section VI beneficial because it discusses various tests for the knee from a biome-

chanical and kinematic standpoint, giving the reader different perspectives on the various tests. Each of the sections is structured in a way that allows for fluent reading. The book has an in-depth anatomical section on the anterior cruciate ligament but fails to discuss other components of the knee in great detail. It would be valuable to have an in-depth chapter on the anatomy of the entire knee.

I would recommend this text as a supplement to assist in teaching about the knee and associated structures. Two additional texts are: 1) *The Knee* by W.N. Scott (Mosby, St. Louis, MO, 1994, 2 volumes, 1481 pages) and 2) *Knee Ligaments Injury and Repair: In-Depth Anatomy of the Knee* by J.C. Hughston (Mosby, St. Louis, MO, 1993, 485 pages).

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Soft Tissue Injuries in Sport
S. Lachmann and J. R. Jenner
Blackwell Scientific Publications
1994
2nd Edition
228 pages
ISBN: 0-632-03508-0
Price: $49.00

Soft Tissue Injuries in Sport is based upon the clinical practice of the Addenbrooke's Peter Wilson Sports Injury Clinic in Cambridge, UK. Lachmann and Jenner have written a condensed text that provides a general and brief description of the most common soft tissue injuries occurring in sport. The text is presented in two sections and divided into 18 chapters.

Section I (chapters 1 to 6) effectively provides a concise general overview of the effects of trauma on connective tissue beginning with inflammation at the cellular level and continuing through the various stages of physiological healing. Illustrations are provided to enhance the narrative description. Included in Section I are characteristic effects and treatment of trauma in tissues and various factors which may affect the healing process. Tissues included are the skin, muscles, tendons, ligaments, bones, and nerves. Chapter 3 describes the role of physiotherapy on soft tissue injuries and includes a brief description of physical, thermal, and electrical therapeutic modalities used in the treatment of soft tissue injuries. It does not provide protocols for the application of these modalities, and it omits the role of therapeutic exercise on tissue healing. A highlight of Section I is a short but informative chapter (chapter 6) addressing the effects of age on soft tissue injury in sport, which is not often presented in other athletic training/sports medicine texts. This chapter illustrates a life span approach to sports medicine starting with the child and adolescent athlete through middle aged and older athletes.

Section II (chapters 7 to 18) provides a general overview of common soft tissue injuries seen in sport activity. The authors introduce the reader to this section with a chapter describing diagnostic techniques of sport injury including a brief overview of injury history, inspection, palpation, range of motion, stress testing, and the uses of various diagnostic investigations. Diagnostic investigations include descriptions of, and indications for use in the assessment of sport injuries of, radiology/imaging techniques, nuclear medicine, blood tests, urinalysis, bacteriology, and nerve conduction studies. Section II continues with chapters under headings of specific body parts: foot, ankle, leg, knee, thigh, abdomen/pelvis, lumbar spine, thorax/thoracic spine, shoulder/upper arm, lower arm/hand, and head/neck. Each chapter provides concise and general information beginning with mechanisms of injury and continuing with diagnosis and treatment of common soft tissue injuries found in sports. Illustrations of specific injuries include anatomical diagrams and magnetic resonance imaging radiographs.

This text provides a general overview of soft tissue injuries in sports. The authors frequently refer to critical components of soft tissue injury but fail to provide explanation for practical application. The highlights of the text are the chapters addressing the physiological response of soft tissue to trauma and the effects of age on tissue healing. The remainder of the text provides general information that is found in many existing athletic training/sports medicine texts. *Soft Tissue Injuries in Sport* will best serve as a supplementary text to an undergraduate introductory course in athletic training and as a quick reference for the practicing athletic trainer.

It is my opinion that, at $49, this text is overpriced compared to other texts on the market.

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Weight Training Instruction: Steps to Success
T. R. Baechle and B. R. Groves
Human Kinetics, Champaign, IL
1994
197 pages
ISBN: 0-87322-618-6
Price: $19.95

Weight Training Instruction: Steps to Success was written to complement two additional books in the *Steps to Success Activity Series*. The two other books are *Weight Training: Steps to Success* (designed for the participant) and *Instructional Design for Teaching Physical Activities* (designed for the classroom teacher). These books are designed to accompany each other in order to help students learn both the cognitive and psychomotor domains.

The instructors guide (*Weight Training Instruction*) is written for the person who plans to take weight training out of the classroom and bring it into the laboratory setting. The text is most suitable for courses focusing on weight training and conditioning, as might be taught in the college to meet a general education requirement, or therapeutic exercise, with a strong emphasis on reconditioning. For students or courses designed in preparation for the Certified Strength and Conditioning Specialist Examination, this text would fit nicely as a supplement to books such as *Essentials of Strength Training and Conditioning* by T. R. Baechle.

The major focus of this book is to organize and integrate basic weight training areas in order to help the instructor teach performance skills. Many sections of the book could be beneficial for just about anyone. However, it is primarily written for instructors with little experience in the weight room and for the

beginning to upper-intermediate weight lifter. The organization of this book is such that it "walks" the instructor through an entire weight training course. The book is divided into sixteen steps. The primary areas are Class Preparation, Equipment Safety, Lifting and Spotting Fundamentals, Teaching Exercise Techniques, Teaching Various Exercises, Preparing Students for Workouts, Program Design, and Assessment.

What differentiates this text from others is that it is a comprehensive instructors' guide. It is designed to go into the weight room. The teaching sections in this book are helpful for the inexperienced as well as the experienced lifter. Special areas within each step help the instructor detect lifting errors, describe easy ways to correct common mistakes, and list hints for student success.

The book is easy to follow and has illustrations that are useful for the instructor. This text would be helpful for any person teaching students in a class setting or for teaching athletes specific weightlifting exercises. This book could be an excellent reference for the athletic training room or weight room for teaching individual lifts.

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Concepts of Athletic Training
R. P. Pfeiffer and B. C. Mangus
Jones and Bartlett Publishers
1995
400 pages
ISBN 0-86720-839-2
Price: $38.75

Concepts of Athletic Training was written as an introductory text for coaches, physical education teachers, and first-year athletic trainers. The purpose of the text is to supply readers with enough basic information to facilitate effective communication between members of the sports medicine team. The primary focus is on the recognition of potentially life-threatening situations and the actions that should follow.

The text is organized as follows: Chapter 1 defines relevant terms needed to facilitate effective communication among the sports medicine team; Chapter 2 identifies the key players of the sports medicine team; and Chapters 3 through 5 supply the reader with the legal, preventive, and psychological aspects of injury, respectively. Chapter 6 presents an overview of nutritional considerations; Chapters 8 and 9 discuss the importance of emergency planning and injury evaluation, as well as the injury process; Chapters 9 through 16 address the anatomy, common injuries, and treatment of various joints throughout the body; and Chapters 17 through 19 present skin conditions, thermal injuries, and other medical concerns relevant to sports medicine.

The overall content of this text supplies readers with a strong introductory knowledge that will enable them to converse with other members of the sports medicine team and administer appropriate injury treatment. Strong points of the text include: 1) easy reading, 2) an introductory chapter allowing the reader to get a firm grasp of important definitions in sports medicine, 3) appendices supplementing important aspects in the field, 4) an instructor's resource manual and videos, 5) "athletic trainers speak out" accompanying most chapters, and 6) anatomical charts and a pharmacological section in chapter 8. Key terms for each chapter and a chapter on the basics of diagnostic testing (x-ray, MRI, and CT) could possibly enhance the text's effectiveness but are not imperative additions.

This text supplies the reader with a strong knowledge base of athletic training. As recommended by the authors, it is imperative that coaches have a strong grasp of the important aspects of athletic training in order to supply quality initial care. This text accomplishes that and much more. I strongly recommend this text for coaches, physical education teachers, and first-year athletic trainers.

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Laboratory Manual to Accompany Therapeutic Modalities in Sports Medicine
William S. Quillen, PhD, PT, SCS and Frank B. Underwood, PhD, MPT, ECS
Mosby-Year Book, Inc.
St. Louis, MO
1995
149 pages
ISBN: 0-8016-7921-4
Price: $19.95

This manual is written to accompany *Therapeutic Modalities in Sports Medicine*, 3rd edition, by William E. Prentice. The manual assists with the application and understanding of physical agent modalities for the student. The major focus of the manual is to assist the student to obtain the skills necessary to become competent with certain therapeutic modalities.

The strength of this manual is its ability to provide the student a sequential method of modality application. Each modality presented has a list of steps to be checked off by an instructor with the completion or proper demonstration of each progressive step of the total application. There is also a Master Competency Checklist that allows students to be checked off as they complete each modality. The manual provides laboratory projects that allow students to become confident in their ability with, and understanding of, each modality.

The manual provides easy-to-read charts, such as "Guidelines for Using Physical Agent Modalities in Sports Medicine" and "Critical Decision Making on the Use of Various Therapeutic Modalities in the Treatment of Acute Injury." The manual also provides a brief description of each modality, physiological and therapeutic effects, indications, contraindications, and helpful illustrations on patient positioning for the use of certain modalities.

I would specifically recommend this manual as a supplement to *Therapeutic Modalities in Sports Medicine* for undergraduate or first-time students who are beginning their understanding of, and competency in, modality usage.

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Video Review

Sports Risk: You Be The Judge
The BASIC Foundation
113 W. Michelle Dr.
Phoenix, AZ 85023
602-863-7919
1995
21 minutes
Price: $50 (Video and Instructional Guide); $40 (Video only)

Sports Risk: You Be The Judge is sold through the BASIC Foundation or through CAPS (Coalition of Americans to Protect Sports, 200 Castlewood Dr., North Palm Beach, FL 33408). The package includes a 21-minute color VHS tape and a 53-page Instructional Guide. Its purpose is to provide schools with a method of warning parents and athletes about the risks of participating in sports and a method of obtaining their informed consent for that participation. This warning and the concept of informed consent are each school's legal responsibilities to their athletes and parents. The package serves those purposes well both by providing information to the parent and athlete in the video and by giving guidance to school personnel through the use of the manual.

The video encourages the viewer to accept a balance between the benefits of sports participation and the risks that participation may bring. While pointing out that sports participation is only one of many activities that individuals may be involved in at school, the video also makes clear to both the parent and athlete that there is a risk of injury in sports participation. Therefore, there are several factors that should be considered when making the decision of whether or not to participate: 1) the nature and magnitude of the injury; 2) the likelihood of significant injury; 3) the balance between risk and benefit; 4) the sports risk compared with everyday life. Each of these factors is discussed by "experts" in the field who provide information to help individuals decide whether the risks of sports participation are worth the benefits to them. In the end, the video leaves that decision entirely up to the viewer.

The Instructional Guide is the component that is unique to this program. It is a manual providing school officials with information to answer questions that might come from a discussion of the video as well as examples of possible forms that the school might use. First, it provides the school with guidelines on its responsibility to the parents and athletes involved in its programs. It describes the purpose of the warning and of informed consent from both a legal and moral point of view. Second, it discusses the procedures or methods of delivery of that information to the parents and athletes. Third, it provides specific risk information on issues of procedure (activity sites, transportation, gender, preparticipation screening, staff training, etc) as well as sports-specific risks and prevention techniques for 15 sports and activities. Finally, 11 sample forms are provided that may be copied for use in a school athletic program. These include consent forms that the parent and athlete may sign, documentation forms for the school, and the instructions for the staff on the use of the forms and conduct of the meetings. The manual is only 53 pages, but is very comprehensive and informative.

It is difficult in 20 minutes to present information on the risks of sports that meets the needs of a varied audience. I feel this program covers the topic of warning and informed consent better than any previous efforts. The combination of the video and instructional guide should give schools the information they need to meet their moral obligation to both athletes and parents and also to minimize their own legal exposure.

One weakness I found was that, on first viewing, the video was sometimes hard to follow. The material is covered by "sound bites" from experts in the field. These experts are attorneys, physicians, and athletic trainers. It seemed that topics jumped from one to the next rather abruptly. The second time I viewed the tape, the message was clearer and easier to follow. A presenter might consider showing the tape, answering questions, and then allowing the audience to review the tape. Let me emphasize that this is not a major problem but one that should be considered.

I recommend this video package to help schools and their employees protect themselves.

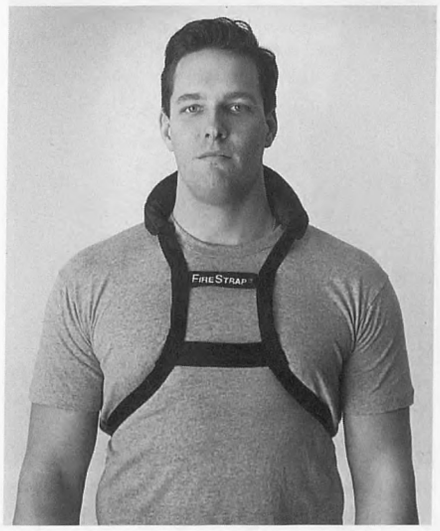
Larry J. Leverenz, PhD, ATC
Purdue University

New Products

FireStrap

The **FireStrap** neck support system was developed by a group of athletic trainers and football players to improve the effectiveness of the traditional neck roll. Frustration with systems that could not maintain consistent positioning and support led to the development of an independent strapping design fixed to the body—not the pads. This patented product provides continuous support during both contact and noncontact stress to the neck.

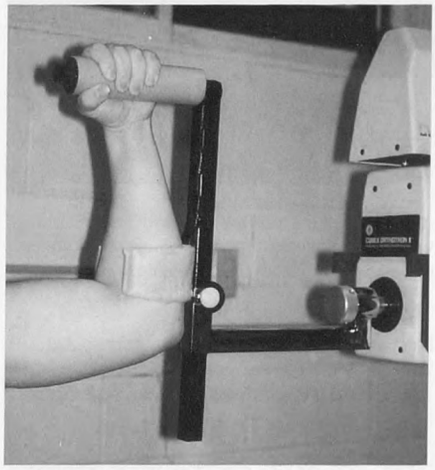
Features of the **FireStrap** include a fully adjustable back strap that can accommodate a wide range of body types and sizes. It can be easily worn under all shoulder pad designs and allows for full normal range of neck motion. The nylon roll body and strapping is washable. It comes in two sizes: Varsity (under 185 lbs) and Pro models (over 185 lbs).



For more information, call 800-285-4460.

Internal/External Rotation Shoulder Device

Increase your shoulder rehabilitation options of the Orthotron II (a registered trademark of the Cybex Co) Isokinetic Knee, Ankle, Shoulder, and Hip System with the internal/external rotation shoulder device. This device connects to the Orthotron via the ankle adapter



and allows patients to rehabilitate their arms in a more natural throwing position while seated. It can also be used for general conditioning of the shoulder.

For more information, call 304-782-3330.

SelfGrip

Dome Industries' **SelfGrip** is a self-adhering tape/bandage (cohesive compression bandage) that provides support and flexibility for preventing or rehabilitating injuries. Made of a highly breathable material (98% cotton/2% latex weave) with a 60% to 70% extensibility that maintains consistent compression when used for strains and sprains. SelfGrip wicks away perspiration and stays in place during strenuous activity and even under water. Because it will not stick to hair or skin, it can be used on any body part, even over primary bandages, without fear of lacerating the skin or ripping the bandage covering a wound. It tears easily and evenly for a proper wrapping length and economical use. It is washable and reusable and comes in four colors and 1″, 1½″, 2″, 3″, 4″, and 6″ widths.

For more information, call 800-432-4352.

AliMed Turnbuckle Knee Orthosis

AliMed's Turnbuckle Knee Orthosis is a knee flexion contracture splint that allows minute, progressive adjustments in force to reduce contractures. Flexion angle is controlled with the unique turnbuckle, which can be adjusted in very fine increments and stays where it is set until you adjust it again. Flexion contractures of as much as 20° can be gently reduced to full extension with carefully controlled, low-load force.

Once applied, the splint is set to a comfortable level of extension by simply twisting the turnbuckle. When the contracture has relaxed and stretched, another twist of the turnbuckle exerts a new increment of force for further extension. Generous terry cloth-covered foam padding protects the skin and keeps the wearer comfortable. The Kydex® splint shell can be custom-modified with a heat gun if necessary. Splints are available for other body parts as well.

For more information, call 617-329-2900, extension 172.

Portable Body-Composition Analyzer

Biodynamics Corporation manufactures the **Biodynamics Model 310 Body Composition Analyzer**. The Model 310 allows you to measure and print percent body fat, lean weight, fat weight, basal metabolic rate, total body water, and target recommendations. Weighing just 4 lb, it is portable and is powered by a rechargeable battery pack.

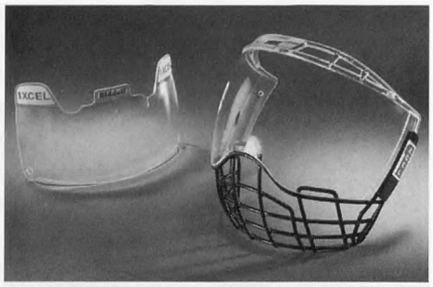
The Model 310 uses proprietary regression equations which account for body type, age, and sex when determining body composition. By using a specific equation that was developed for each body type, measurement accuracy is improved. It has a precision AC ohmmeter that accurately measures resistance over the entire range of test subjects. Test results are accurate to within ± 1.5% body fat, with a correlation coefficient of 0.97.

A built-in, 40-column Seiko thermal printer quickly generates a printout of body-composition test results and recommendations, eliminating the need for a separate computer or printer. Other features include a two-line, 40-column LCD display that provides operator instructions, subject data, and test results. It has a 24-key numeric and functional command keypad and is powered by rechargeable nickel-cadmium (NICAD) batteries.

For more information, call 800-869-6987.

ONE XCEL™ Sports Eye Shields

ONE XCEL, Inc has advanced the design of protective sports eye shields by responding to the optical and visual implications of them. Two new features of their hockey and football shields are: they have the greatest visual field available, with a lateral extent of 205 and they have curvatures that make them the only shields to meet the ANSI Z87.1 power error tolerance.



For more information, call 800-561-9235.

BIKE Announces New Hot & Cold Sports Therapy Line

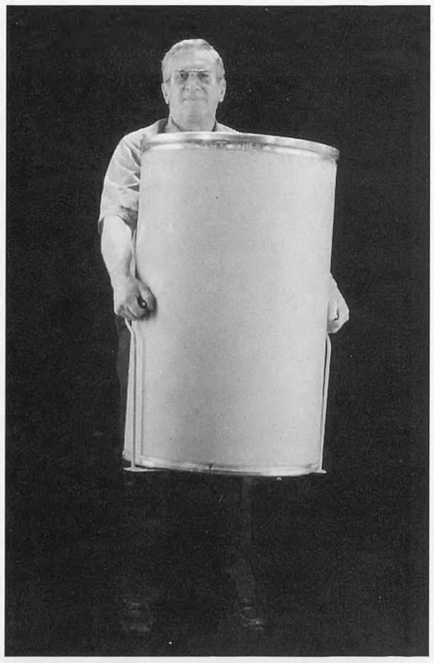
Continuing its tradition of providing innovative, high-quality, sports medicine products that meet athletic demands, Bike Athletic Company introduces its all new **ThermoCel™ Hot/Cold Wraps**.

Fast, convenient, and simple to use, **ThermoCel™ Hot/Cold Wraps** are microwave and freezer safe and can be used to treat sprains and strains, sore muscles and joints, and other aches and pains. **ThermoCel™ Hot/Cold Wraps** are available in styles for multipurpose Knee/Elbow, Back/Shoulder, and Ankle use. They are made of segmented body-conforming pillows, suspended in a non-toxic gel. This unique combination of thermo pillows and gel is the very latest technological advance in sports medicine and allows extended "real" treatment relief, while remaining dry and comfortable.

For more information, call 800-251-9230.

Reduce Lower Back Strain by 30%

Back Buddy™, invented by a veteran UPS delivery driver, is a low-cost, effective, hands-on ergonomic tool for lifting and handling. Recent biomechanical test results indicate that when using the **Back Buddy** to lift an object from the floor, both strain on the back and duration of the lift are reduced by 30%, greatly reducing fatigue. This product marks a major advance in the fight against pain and financial losses of on-the-job back injuries, the nation's number one workplace safety problem.



Sturdy and lightweight, the US patented **Back Buddy** can be used in all phases of handling materials from floor level in both office and industrial settings. One Back Buddy set handles 75 lb with ease. Suggested retail price is $29.95.

For more information, call 617-329-2900.

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Clint Thompson, MS, ATC

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Authors' Guide

(Revised July 1996)

The *Journal of Athletic Training* welcomes the submission of manuscripts that are of interest to persons engaged in or concerned with the progress of the athletic training profession (athletic injury prevention, evaluation, management, and rehabilitation; administration of athletic training facilities and programs; and athletic health care counseling and education). Manuscripts should conform to the following:

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2. All manuscripts must be accompanied by a letter signed by each author and must contain the following statements: "This manuscript 1) contains original unpublished material that has been submitted solely to the *Journal of Athletic Training*, 2) is not under simultaneous review by any other publication, and 3) 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 reviewing and editing my submission, I the undersigned author hereby transfer, assign, or otherwise convey all copyright ownership to the NATA, in the event that such work is published by the NATA. Further, I verify that I have contributed substantially to this manuscript as outlined in item #3 of the current Authors' Guide." By signing the letter, the authors agree to comply with all statements. Manuscripts that are not accompanied by such a letter will not be reviewed.
3. Each author must have contributed to the article. This means that all coauthors should have made some useful contribution to the study, should have had a hand in writing and revising it, and should be expected to be able to defend the study publicly against criticism.
4. Financial support or provision of supplies used in the study must be acknowledged. Grant or contract numbers should be included whenever possible. The complete name of the funding institution or agency should be given, along with the city and state in which it is located. If individual authors were the recipients of funds, their names should be listed parenthetically.
5. Authors must specify whether they have any commercial or proprietary interest in any device, equipment, instrument, or drug that is the subject of the article in question. Authors must also reveal if they have any financial interest (as a consultant, reviewer, or evaluator) in a drug or device described in the article.
6. Materials taken from other sources, including text, illustrations, or tables, must be accompanied by a written statement giving the *Journal of Athletic Training* permission to reproduce the material. Photographs of individuals must be accompanied by a signed photograph release form. Accepted manuscripts become the property of the National Athletic Trainers' Association, Inc.
7. The *Journal of Athletic Training* uses a double blind review process. Authors should not be identified in any way except on the title page.
8. Manuscripts are edited to improve the effectiveness of communication between the author and the readers, and to aid the author in presenting a work that is compatible with the style policies found in the *AMA Manual of Style*, 8th ed. (Williams & Wilkins) 1989. The author agrees to accept any minor corrections of the manuscript made by the editors. Page proofs are sent to the author for proofreading when the article is typeset for publication. It is important that they are returned within 48 hours. Important changes are permitted, but authors will be charged for excessive alterations.
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STYLE POLICIES

10. The active voice is preferred. Use the third person for describing what happened, "I" or "we" (if more than one author) for describing what you did, and "you" (the imperative) for instruction.
11. Each page must be typewritten on one side of 8½ × 11 inch plain paper, double spaced, with one-inch margins. Do not right justify pages.
12. Manuscripts should contain the following, organized in the order listed below, with each section beginning on a separate page:
    a. Title page
    b. Acknowledgments
    c. Abstract and Key Words (first numbered page)
    d. Text (body of manuscript)
    e. References
    f. Tables-each on a separate page.
    g. Legends to illustrations
    h. Illustrations
13. Begin numbering the pages of your manuscript with the abstract page as #1; then, consecutively number all successive pages.
14. Titles should be brief within descriptive limits (a 16-word maximum is recommended). If a disability is the relevant factor in an article, the name of the disability treated should be included in the title. If a technique or type of treatment is the principal reason for the report, it should be in the title. Often both should appear.
15. The title page should also include the names, titles, and affiliations of each author, and the name, address, phone number, fax number, and E-mail address of the author to whom correspondence is to be directed.
16. A structured abstract of 75 to 200 words must accompany all manuscripts. Number this page one, type the complete title (but not the authors' names) on the top, skip two lines, and begin the abstract. Items that are needed differ by type of article and should include: **Literature Review:** Objective, Data Sources, Data Synthesis, Conclusions/Recommendations, and Key Words; **Original Research** articles: Objective, Design and Setting, Subjects, Measurements, Results, Conclusions, and Key Words; **Case Reports:** Objective, Background, Differential Diagnosis, Treatment, Uniqueness, Conclusions, and Key Words; **Clinical Techniques:** Objective, Background, Description, Clinical Advantages, and Key Words. Definitions of these terms can be found in reference a, item 21, below.
17. 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 end 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 a one- to two-paragraph review of the literature, identify and develop the magnitude and significance of the controversy, pointing out differences among 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.
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    a. The body of an **Original Research** article consists of a methodology section, a 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 **Literature Review** 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.
    c. The body of a **Case Study** should include the following components: personal data (age, sex, race, marital status, and occupation when relevant—but not name), chief complaint, history of present complaint (including symptoms), results of physical examination (example: "Physical findings relevant to the rehabilitation program were . . ."), medical history (surgery, laboratory results, exam, etc), diagnosis, treatment and clinical course (rehabilitation until and after return to competition), criteria for return to competition, and deviation from the expected (what makes this case unique). NOTE: It is mandatory that the *Journal of Athletic Training* receive, with the manuscript, a release form signed by the individual being discussed in the case study. Case studies cannot be reviewed if the release is not included.
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19. The manuscript should not have a separate summary section—the abstract serves as a summary. It is appropriate, however, to tie the article together with a summary paragraph or list of conclusions at the end of the discussion section.
20. Each citation in the text of the manuscript takes the form of a superscripted number that 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.
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    a. Knight KL, Ingersoll CD. Structure of a scholarly manuscript: 66 tips for what goes where. *J Athl Train.* 1996;31:201–206.
    b. Day RA. *Scientific English: A Guide for Scientists and Other Professionals.* 2nd ed. Phoenix, AZ: Oryx Press; 1995:73–74.
    c. Leadbetter WB. An introduction to sports-induced soft-tissue inflammation. In: Leadbetter WB, Buckwalter JA, Gordon SL, eds. *Sports-Induced Inflammation.* Park Ridge, IL: American Academy of Orthopaedic Surgeons; 1990:3–23.
    d. Stone JA. Swiss ball rehabilitation exercises. Presented at the 47th Annual Meeting and Clinical Symposium of the National Athletic Trainers' Association; June 12, 1996; Orlando, FL.
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CEU Quiz

NOTE: New cost for CEU quiz. The Board of Directors voted in December 1995 to increase the cost of the CEU quiz to $20.00

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.

Please note the new procedure for participating in this program. Read the material in this issue carefully, photocopy this page, and record your test answers on this page. It is no longer necessary to photocopy the test. Fill in your name, address and other information and mail with $20 for processing to the address below. **FOR CREDIT, the form must be postmarked by December 13, 1996.**

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Answers to June '96 CEU Quiz
Volume 31, Number 2

1. a	4. c	7. a	10. d	13. d
2. e	5. e	8. a	11. b	14. e
3. e	6. d	9. e	12. c	15. d

❑ Please check here if this is your first CEU Quiz or if your address has changed since your last quiz.

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(please check one)_____

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Please indicate below the setting in which you work:

❑ High School ❑ Junior College ❑ College

❑ University ❑ Sports Medicine Center

❑ Other (please specify) _____

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1. Carefully read the articles in this issue.
2. Photocopy this page.
3. Record your answers below by darkening the appropriate letter of your answer.
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CEU Quiz Evaluation

1. Questions challenging enough? . . . ❑Yes ❑No
2. Presented clearly? . . . . . ❑Yes ❑No
3. Material covered well? . . . . . ❑Yes ❑No
4. Will information be useful to you in your work? . . . . . ❑Yes ❑No

Please add any suggestions on how to improve the CEU Quiz on the back of this form when you are finished.

RECORD ANSWERS HERE - Darken the appropriate letter. Example: 1 a ● c d e

1	a	b	c	d	e	6	a	b	c	d	e	11	a	b	c	d	e
2	a	b	c	d	e	7	a	b	c	d	e	12	a	b	c	d	e
3	a	b	c	d	e	8	a	b	c	d	e	13	a	b	c	d	e
4	a	b	c	d	e	9	a	b	c	d	e	14	a	b	c	d	e
5	a	b	c	d	e	10	a	b	c	d	e	15	a	b	c	d	e

MARK ANSWERS ON PREVIOUS PAGE.

1. Writing in the passive voice is:
   a. characterized by strong verbs.
   b. a way to avoid ambiguity.
   c. dry, dull, rigid, and pompous.
   d. important because personal pronouns should be avoided in scientific writing.
   e. None of the above.

2. The author of the study on anabolic-androgenic steroid use in California Community Colleges reported that:
   a. more than 4% of the student-athletes were users.
   b. more African-American athletes used steroids than Caucasian athletes.
   c. users felt that they were very knowledgeable about steroids, while nonusers did not feel very knowledgeable.
   d. All of the above.
   e. a and c only

3. When writing the Discussion section of a manuscript,
   a. be sure to emphasize the work of other authors (mention their names and their contributions to the issue).
   b. address the contribution the study makes toward theory.
   c. suggest how readers might apply the information presented.
   d. All of the above.
   e. b and c only.

4. The "ideal" fluid replacement beverage:
   a. must be determined on an individual basis.
   b. tastes good during exercise.
   c. is emptied rapidly from the stomach.
   d. is absorbed rapidly from the small intestine.
   e. All of the above.

5. Sickle cell trait is:
   a. a genetic condition.
   b. is usually carried by a "healthy" person.
   c. is more severe than sickle cell anemia.
   d. affects more than 40% of the American black population.
   e. a and b only.

6. Which of the following is/are characteristic of winter SAD (seasonal affective disorder)?
   a. decreased appetite
   b. insomnia
   c. decreased energy
   d. hyperhedonia
   e. a and c

7. Reasons given for differences in ACL injuries between male and female basketball players include:
   a. knee joint laxity.
   b. inadequate training.
   c. anatomical differences.
   d. All of the above.
   e. a and b only

8. When writing for a scholarly publication, you should never write in the first person, but rather should use the third person because it is more scientific.
   a. True
   b. False

9. Hot and cold whirlpool treatments:
   a. significantly affected anterior displacement of the tibia as assessed with instrumented knee arthrometry.
   b. had no effect on anterior displacement of the tibia as assessed with instrumented knee arthrometry.
   c. showed that athletes with uninjured knees undergoing pre-exercise thermal treatment are predisposed to increased anterior knee laxity.
   d. None of the above.
   e. All of the above.

10. The best predictors of athletic trainer salaries (in order) according to the study on athletic trainer employment and characteristics are:
    a. doctoral degree, marital status, master's degree.
    b. doctoral degree, master's degree, teaching credentials.
    c. doctoral degree, master's degree, marital status.
    d. doctoral degree, teaching credentials, master's degree.
    e. doctoral degree, marital status, teaching credentials.

11. Ways to minimize errors in skinfold measurement of body fat include:
    a. use a 6-cm spread between thumb and index finger to form the skinfold.
    b. place caliper jaws 1.25 cm away from and perpendicular to the elevated skinfold.
    c. read skinfold measurement 8 seconds after pressure is released from caliper jaws.
    d. take a minimum of two measurements at each site.
    e. All of the above.

12. The strategies that seem to work best in psychological intervention in injury situations are those geared toward:
    a. imagery.
    b. the regulation of stress and fear in the patient.
    c. increasing motivation.
    d. thought stoppage.
    e. All of the above.

13. When writing a scholarly manuscript, it is important to keep in mind that:
    a. the abstract and introduction are the same thing.
    b. the manuscript should not have a separate summary section; the abstract serves as the summary.
    c. when writing the introduction, you should follow the standard thesis format with a complete review of the literature.
    d. the body or main part of the manuscript is the same for all types of manuscripts.
    e. All except d.

14. Some good guidelines for writing a scholarly manuscript include:
    a. write concisely.
    b. be as brief as possible.
    c. keep your vocabulary simple.
    d. use abbreviations liberally.
    e. All except d.

15. Keeping athletes hydrated might include:
    a. recommending that athletes ingest about 500 mL of fluid 2 hours before exercise.
    b. educating athletes to pay attention to the color and volume of their urine.
    c. instructing athletes and giving the opportunity to practice drinking during training with the goal of trying to match fluid intake with sweat loss as closely as possible.
    d. All of the above.
    e. b and c only

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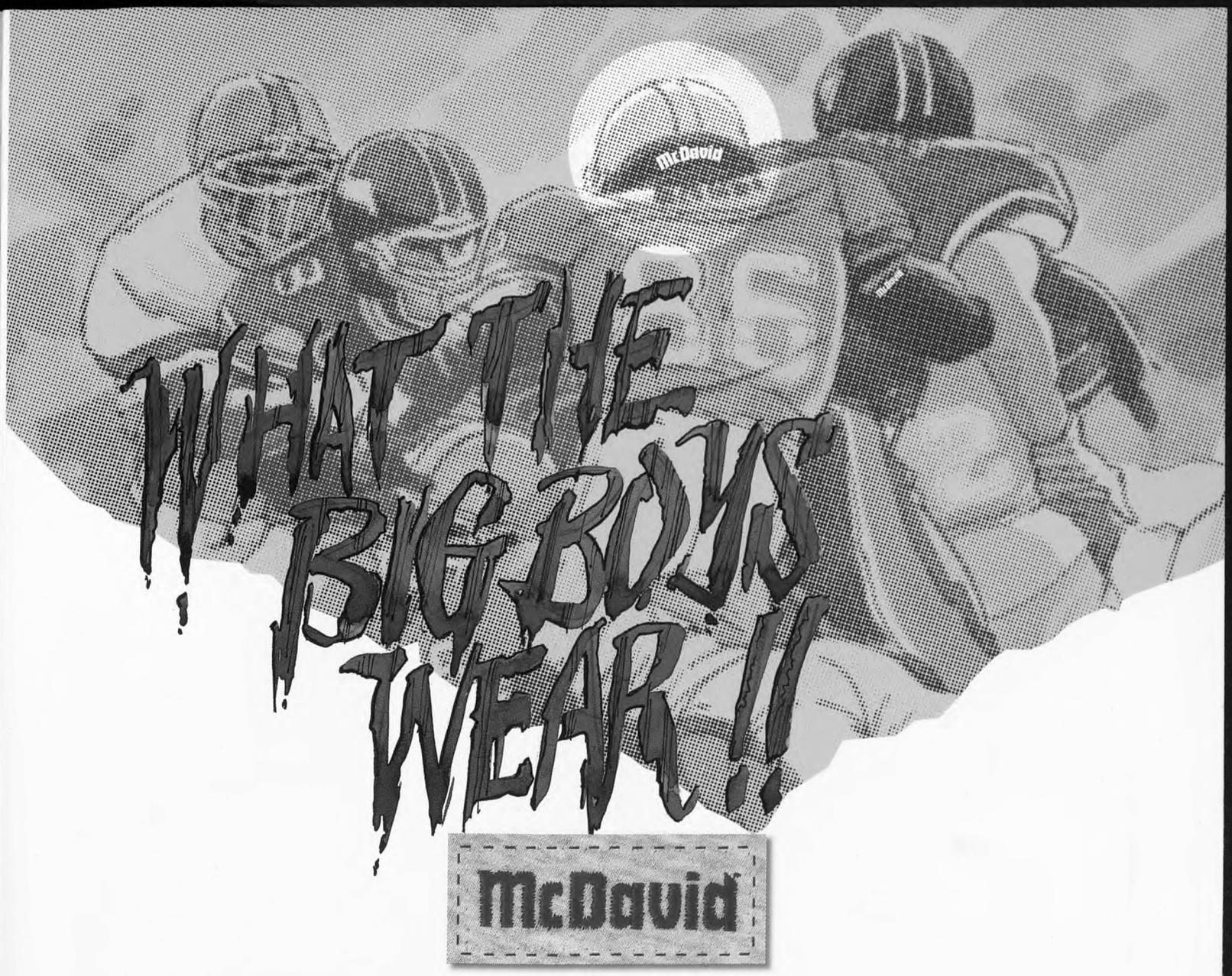

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