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The Prevention of Ankle Sprains in Sports

A Systematic Review of the Literature

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ABSTRACT

To assess the published evidence on the effectiveness of various approaches to the prevention of ankle sprains in athletes, we used textbooks, journals, and experts in the field of sports medicine to identify citations. We identified 113 studies reporting the risk of ankle sprains in sports, methods to provide support, the effect of these interventions on performance, and comparison of prevention efforts. The most common risk factor for ankle sprain in sports is history of a previous sprain. Ten citations of studies involving athletes in basketball, football, soccer, or volleyball compared alternative methods of prevention. Methods tested included wrapping the ankle with tape or cloth, orthoses, high-top shoes, or some combination of these methods. Most studies indicate that appropriately applied braces, tape, or orthoses do not adversely affect performance. Based on our review, we recommend that athletes with a sprained ankle complete supervised rehabilitation before returning to practice or competition, and those athletes suffering a moderate or severe sprain should wear an appropriate orthosis for at least 6 months. Both coaches and players must assume responsibility for prevention of injuries in sports. Methodologic limitations of published studies suggested several areas for future research.

The ankle sprain is one of the most common injuries in athletes,[9] particularly in sports in which participants frequently jump and land on one foot or are expected to make sharp cutting maneuvers (for example, basketball, soccer, football, and volleyball).[35] Because ankle sprains are common and may result in days or weeks lost from practice and competition, efforts have been made to prevent such injuries either through directly protecting the athlete with better shoes, ankle wrapping, taping, or bracing, or by altering the environment through revised rules, changes in the sport environment (for example, improved playing fields),[51] and instruction of coaches and trainers in methods of injury prevention.[9,21,89] The purpose of this report was to review the evidence on the effectiveness of each of these approaches and to make recommendations for practice and for further research. In this review, we placed particular emphasis on evidence from randomized controlled trials and cohort studies because they are generally acknowledged to provide the best available scientific evidence in the study of human health.[118]

MATERIALS AND METHODS

We identified citations from the reference sections in textbooks of sports medicine, family practice and other primary care specialties, orthopaedics, and general surgery. We searched electronic databases (MEDLINE from 1966 to 1998, Current Contents, 1996 to 1997, Biomedical Collection, 1993 to 1997, and dissertation abstracts) in all languages using the following subject terms: ankle sprain, ankle injury, and sports injury. We then limited the search using the terms prevention and control, etiology, and epidemiology. We identified further citations from the reference sections of papers retrieved, from contacting experts in the field (including the first authors of all randomized controlled trials or cohort studies addressing prevention of ankle sprains), and from the Cochrane Collaboration, an international network of experts who search journals for relevant citations.[52] We excluded papers that did not provide primary research data, that addressed treatment or rehabilitation only rather than prevention, or that provided previously published data. All articles were screened by the same author (SBT). From 621 citations identified in the search, we identified 113 articles

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reporting the risk for ankle sprains in various sports, alternative methods to provide external support to the ankles, the effect on performance of ankle taping or bracing, the identification of risk factors for ankle injury, or comparisons of alternative methods to prevent ankle sprains. Of these, 10 reports compared alternative methods to prevent ankle sprains.

We developed a scoring instrument to evaluate the methodologic quality of the cohort studies and randomized controlled trials based on published examples of such instruments (Table 1).[8,14,25,104] Reviewers were blinded to primary authors' names and affiliations, but not to study results (which have been shown to have little effect on the validity of quality scores).[16] Each citation was then evaluated independently by the three reviewers. After independent evaluation, the authors met to compare scores and to review and reconcile substantive differences in interpretation.

TABLE 1
Quality Scoring Form Used for Manuscripts

Variables	Score
Experimental design	
Statement of research question (prior hypothesis)	4
Source of sample	5
Inclusion/exclusion criteria	6
Randomization	10
Examiner/analyst blinding	4
Selection bias addressed	2
Information bias addressed	2
Description of intervention	7
Comparison of participants with eligible decliners	3
Comparison of participants with dropouts	3
Independent validation of data	1
Power calculations (sample size requirements)	3
Clear method to evaluate outcome variable defined	3
Appropriateness of method	3
Addressed possible confounders	(1 point each)
Age	
Sex	
Skill level	
Conditioning	
Prior lower extremity injury	
Sport	
Competition vs. practice	
Playing surface	
Medical supervision	
Shoes	
Taping or bracing	
Education	
Appropriateness of method of adjustment	4
Data presentation and statistical analysis	
Description of tests	6
Use of relative risk or odds ratio	2
Use of confidence intervals or *P* values	3
Multivariate techniques	4
Regression coefficients (if relevant)	3
Presentation of data	(2 points each)
Demographic data	
Confounders	
Comparability groups	
Collinearity	
Multiple testing	
Total	possible 100

To calculate the statistical significance of data presented in the papers in which significance levels or confidence intervals were not provided, we assumed that injuries occurred independently for any one participant and that the average number of playing hours was approximately constant for all participants. Under these assumptions, the number of injuries follows a binomial distribution, and the significance of observed results can be calculated as for an exact test.[77]

Two authors independently extracted data from the analytic studies and randomized controlled trials to determine when pooling was appropriate. Because of the heterogeneity in populations examined, interventions used, and study methodology, we elected not to pool any of the individual study-effect estimates.

RESULTS

Methods of External Ankle Support

More than 50 laboratory studies on alternative methods to provide external ankle support have been published. Methods tested included tape or cloth wrapping,[1,12,24,27,33,58,61–64,70,71,76,83,87,90,94,95,99,101,109,115,120,122,124] a variety of orthotic devices,[2,3,31,40,41,43,44,50,56,59,93,106,110,114,121] high-top shoes,[4,80,102] or some combination of these three methods.[15,32,37,40,44,45,47,49,72,78,82,93,97] Using a variety of tools, these investigators have demonstrated that inversion of the ankle is substantially restricted with these interventions. Slowing the speed of inversion, however, does not provide the peroneal muscles time to contract to prevent injury,[3] and the torque generated by braces will not counteract the inversion movement that typically leads to injury.[110] Moreover, such restriction is reduced after exercise, especially in persons using tape or cloth wrapping. Although the effectiveness of orthoses is reduced by exercise, these devices can be tightened easily to provide effective deterrents to extreme inversion, and may also protect the ankle by preventing inversion movement by preloading and maintaining the ankle in proper anatomic position at impact.[110]

Effect of External Ankle Support on Performance

To address the concern that these restrictive measures might compromise performance, 20 studies measured the effect of taping or bracing on running, jumping, and cutting.[11,17,20,22,26,44,46,49,57,68,69,73,74,81,85,91,108,116,117,121] Although the majority of studies indicate that appropriately braced or taped ankles do not adversely affect performance, several studies report a small, but statistically significant, decrease in performance. Two randomized controlled trials, one assessing athletes with taped and untaped ankles[73] and the other comparing three different orthoses and unbraced controls,[85] found no significant effect of the orthoses on performance. Reports on the reactions of players to braces are inconsistent in terms of comfort, a feeling of stability, and appearance.[1–4,11,12,15,17,20,22,24,26,27,31–33,37,40,41,43–47,49,50,56–59,61–64,68–74,76,78,80–83,85,87,90,91,93,95,97,99,101,102,106,108,109,111,115–117,119–122,124]

Risk Factor Studies

Twelve analytic studies report risk factors for ankle injury.[5–7,13,38,39,53,75,96,113,119,126] Biologic factors (for example, joint laxity) were not associated with risk, although history of previous injury was found more frequently in persons sustaining ankle injury.[5,38,39,75,113,119,120,125,126] Postural instability and talar tilting were less clear-cut risk factors.[6,13,113,119]

Methods to Prevent Ankle Sprains

We found seven randomized controlled trials and three cohort studies that compared methods to prevent ankle sprains using shoes and taping, bracing, or specialized training (Table 2).[7,10,22,29,36,92,98,100,107,112]

Shoes and Taping. The use of high-top shoes was examined in a randomized controlled trial that included 622 United States, male, college-aged intramural basketball players who accumulated 39,302 minutes of play during 2 months. Results indicated that the use of the shoes did not reduce the risk for ankle sprain.[10] The addition of inflatable cuffs to the high-top shoes, however, did reduce the occurrence of sprains, although this decrease was not statistically significant. On the other hand, a randomized controlled trial of 2562 U.S. intramural basketball players observed for 2 years demonstrated a protective effect of high-top shoes.[36] This study also demonstrated the protective effect of taping, reporting a reduction from 32.8 sprains per 1000 participant-games to 14.7 sprains per 1000 participant-games. Indeed, the protective effect of shoes was due primarily to taping, although the use of high-top shoes enhanced that protective effect. Although the combination of taping and high-top shoes was particularly effective in players with previous injuries, the protective effect of the prophylactic program remained statistically significant among players without a history of ankle injury.

A cohort study assessing specially designed swivel shoes for football demonstrated a 2.7-fold decrease in the occurrence of ankle injuries in athletes wearing the swivel shoes compared with those wearing cleats, heelplates, or soccer shoes.[22] In another randomized controlled trial, the varsity football team at State University of New York at Buffalo was divided alphabetically into two groups for both the 1967 and 1968 spring practice seasons.[98] During 1967, players with names beginning with A through L had their ankles wrapped daily using "Louisiana wrap"; players with names beginning M through Z had their ankles taped daily using double stirrups, double figure-eights, and medial and lateral heel locks. The intervention groups were reversed in 1968; A through L were taped and M through Z were wrapped. All players wore heel disks, except for defensive backs. Persons with ankle problems or who were not compliant were excluded. During the 2 years, 73 players had taped ankles during 1270 practice-days, and 75 players had wrapped ankles over 1323 practice-days. Four ankle injuries leading to loss of practice time were observed in each group, indicating no difference in the protective effect of either procedure.

Bracing. When compared with an orthotic stabilizer in the retrospective cohort study of 297 U.S. football players, taping was found to be not as effective as the orthosis (4.9 sprains per 1000 participant-games versus 2.6 sprains per 1000 participant-games).[92] In this study, athletes were allowed to choose the means of protection in the final year of the study. In a randomized controlled trial of 1601 U.S., male, college-aged intramural basketball players with no history of recent ankle sprain, a semirigid orthosis had a significant protective effect compared with the unprotected ankle (1.6 ankle sprains per 1000 athlete-exposures versus 5.2 sprains per 1000 athlete-exposures).[100] Another randomized controlled trial of 629 senior male soccer players from South Africa demonstrated the protective effect of the same orthosis among athletes with a previous history of ankle sprains (0.46 sprains per 1000 playing hours versus 1.16 sprains per 1000 playing hours), but no difference was noted in players with no previous history of sprains (0.97 sprains per 1000 playing hours versus 0.92 per 1000 playing hours).[107]

In Sweden, 25 teams with 439 adult male soccer players were randomized into three groups: those offered a semirigid ankle orthosis (7 teams with 124 players), those offered an ankle disk§ training program (8 teams with 144 players), and 10 control teams with 171 players.[112] None of the 439 players used taping. Sixty of the 124 players who were offered the orthosis elected to use it. The rate of sprains was higher among those with previous history of sprains (25% versus 11%) ($P = 0.001$) and among those players without interventions. Both the players who used the orthosis and those in the ankle disk training program had significantly lower rates of injury than did the controls (3%, 5%, and 17%, respectively). This difference was accounted for entirely by prevention of injury among those with previous sprains.

Training. In Sweden, a study of 12 soccer teams, with 15 men each, in which the teams were randomized into an intensive season-long prevention program or a standard training program, found that intensive, sustained conditioning reduced the occurrence of ankle sprains over the course of a 6-month season.[29] In this study, all players with previous ankle sprains were forced to have their ankles taped and to participate in a specific rehabilitative program. The Swedish study described earlier[112] also showed that ankle disk training significantly lowered injury rates.

A prospective study of volleyball players in Norway, for whom an injury prevention program was developed, demonstrated a substantial decrease in the incidence of ankle sprains with no change in the occurrence of other injuries.[7] The interventions focused on the prevention of ankle sprains, including a 1-hour didactic session on risk factors, treatment, rehabilitation, and ankle disk training, and a 2-hour training session on the ankle disk and safe side-to-side and take-off techniques. The difference in both these studies was seen primarily in athletes with a history of

§ The ankle disk or balanced board is a device made up of a platform attached to a hemisphere used to strengthen ankles and enhance proprioception.

TABLE 2
Results of Field Studies Comparing Alternative Methods to Prevent Ankle Sprains

Author (Country)	Year	Study design[a]	Population	Study groups (N)	Outcomes	Median quality score
Simon[98] (US)	1969	RCT	148 M college football players over 2 Spring practice sessions.	1) Taped (73) 2) Cloth strapped (75)	8 ankle injuries 1) 4/1270 practice days 2) 4/1323 practice days	40
Cameron[22] (US)	1973	Prospective cohort	2839 M high school football players over 1 season.	1) Cleats (2055) 2) Heel plate (52) 3) Soccer shoes (266) 4) Swivel shoes (466)	207 ankle injuries 1) 174 (8.5%) 2) 4 (7.7%) 3) 15 (5.6%) Total = 193 (8.1%) 4) 14 (3.0%)	11
Garrick and Requa[36] (US)	1973	RCT	2562 M intramural basketball players observed over 2 years	1) Taped (1159) 2) Untaped (1097) 3) J-Flex tape (288)	55 sprains 1) 14.7/1000 participant games 2) 32.8/1000 participant games 3) 6.9 (small numbers)/1000 participant games High-top, 15.9/1000 participant games Low-top, 23.5/1000 participant games	23
Ekstrand et al.[29] (SWE)	1983	RCT	12, 15-man adult soccer teams observed for 6 months	1) Prevention program (6 teams) 2) Control (6 teams)	13 sprains 1) 2 2) 11	45
Tropp et al.[112] (SWE)	1985	RCT (of teams)	439 M senior soccer players on 25 teams	1) Controls (171) 2) Offered cloth orthosis (60 used and 64 did not) 3) History of sprain (ankle training), no history of sprain (control)	1) 30/171 (17%) 2) 2/60 (3%) 3) 7/142 (5%)	31
Rovere et al.[92] (US)	1988	Retrospective cohort	297 college football players over 7 years. 51,931 game/practice exposures.	1) Taped (233) 2) Stabilizer (127)	224 sprains 1) 190 (4.9/1000 participant games) 2) 34 (2.6/1000 participant games) High-top = 85 (5.8/1000 participant games) Low-top = 139 (3.7/1000 participant games)	48
Barrett et al.[10] (US)	1993	RCT	622 M college intramural basketball players. 39,302 player minutes over 2 months.	1) Low-tops (158) 2) High-tops (208) 3) High-tops with inflatable chambers (203)	15 sprains 1) 4 (4.06×10^{-4}/player minute) 2) 7 (4.8×10^{-4}/player minute) 3) 4 (2.26×10^{-4}/player minute)	68
Sitler et al.[100] (US)	1994	RCT	1601 players on 36 intramural basketball teams. 13,430 athlete-exposures over 2 years	1) AS[b] (789) 2) Control (812)	46 sprains 1) 11 (1.6/1000 athlete-exposures) 2) 35 (5.2/1000 athlete-exposures)	60
Surve et al.[107] (S AFR)	1994	RCT	Senior M soccer players. 258 with history of ankle sprain (H). 371 with no history of ankle sprain (NH).	1) H-AS (127) 2) H-Control (131) 3) NH-AS (117) 4) NH-Control (129)	123 sprains 1) 16 (0.46/1000 player hours) 2) 42 (1.16/1000 player hours) 3) 32 (0.97/1000 player hours) 4) 33 (0.92/1000 player hours)	39
Bahr et al.[7] (NOR)	1997	Prospective cohort	719 experienced players on 13M and 13F volleyball teams. 23.2 ± 4.2 years (M); 22.4 ± 4.3 years (F) 149,968 player-hours over 3 seasons.	1) Before prevention training program (year 1) 2) Midseason prevention training program (year 2) 3) Postprevention training program (year 3)	110 sprains 1) 48 (0.9/1000 player hours) 2) 38 (0.8/1000 player hours) 3) 24 (0.5/1000 player hours)	32

[a] RCT, Randomized controlled trial.
[b] Air-Stirrup (Aircast Inc., Summit, New Jersey).

previous ankle sprain. The differences found in both these studies are due primarily to the prevention of injuries among athletes with previous sprains.

Study Quality

Overall, quality scores for individual papers ranged from 7 to 70 for the individual scorers. Papers in the upper tertile had a median score (over the three scorers) from 45 to 68 (of a total possible of 100), those in the middle tertile were from 36 to 44, and those in the lowest tertile were from 11 to 32. Studies with a randomized design were scored consistently higher than cohort studies (median of the median scores 45 versus 34); this relationship remained even when points assigned for "randomization" were excluded from the computation (median, 41 versus 34).

DISCUSSION

A systematic review of the literature indicated that measures can be undertaken to prevent the occurrence of ankle injuries in sports. Certain factors that can influence the occurrence of ankle injuries are beyond the athlete's control—rules to control and minimize unnecessary or hazardous contact with other players, appropriate officiating to ensure compliance with event rules, responsible coaches to train athletes and prepare them for competitive activities, and safe and well kept fields and floors that are free of unnecessary hazards that could place athletes at risk for ankle injury. Few of these factors have been subject to rigorous scientific review (and will not be addressed here). They may warrant implementation based on other considerations, including their positive effect on the quality of play. Similarly, the debate concerning natural and artificial turf[18,86,103,111] lacks the support of controlled studies and is beyond the scope of this paper.

Several interventions that could lower the rate of occurrence of ankle sprains in a variety of sports have undergone scientific review. Conditioning, both before the competitive season and during the course of the season, has been emphasized to improve individual and team performance, and our review produced some evidence of its protective effect among those players with previous ankle injury.[29] The trial of soccer players in Sweden suggests that training that focuses both on agility and flexibility decreases the risk for ankle injury.[29] Similar results are seen in a study of knee injuries among soccer players in Italy.[23] At the same time, other elements of the prophylaxis program, especially rehabilitation and taping for previously injured players and information given to coaches and players, contributed to the reduction of ankle sprains. The intervention developed for volleyball players in Norway, based on targeted education and specialized ankle disk training, provides further evidence for the benefits of focused conditioning.[5] The lack of benefit of semirigid orthoses among soccer players from South Africa with no history of sprain is consistent with the belief that this intervention may not be effective among athletes with previously uninjured ankles,[107] although a U.S. study of basketball players suggests a protective effect in previously injured athletes.[100]

For decades, taping the ankle has been the preventive method of choice for coaches and trainers in many sports. Data from one randomized controlled trial indicate that taping can prevent ankle sprains, despite the fact that tape loosens in approximately 10 minutes and provides little or no measurable support to the inverting ankle within 30 minutes.[36] The residual protection may be associated with increased proprioception that allows the peroneal muscles to react more rapidly to inhibit extreme ankle inversion,[34,38,42,58,66,79] although other authors have questioned the effect of taping or have found that reflex contraction of the peroneal muscle is too slow to prevent sprains.[48,54,60] Elastic wrap or bandages are inexpensive, reusable, and effective in reducing edema from acute injury, but there is no evidence that wrapping supports the ankle effectively.[101,115]

High-top shoes have also been recommended for the prevention of ankle sprains, particularly when used in combination with taping.[10,36] The use of high-top shoes with inflatable support chambers results in a slightly (although not statistically significantly) lower risk of ankle injury.[10] Variation in the design of footwear for basketball has led to recommendations such as increased ankle collar height, maintenance of flexibility in the sagittal plane at both the ankle and metatarsophalangeal joints, use of external support straps or stays to strengthen upper shoes, and independently tied internal boots to increase both stability and proprioception,[84] but evidence to support such changes is scant. Innersoles restrict inversion, but the evidence for their effectiveness varies. Data collected routinely by the National Basketball Association suggest possible differences in the risk of ankle injury by shoe style (that is, high top, three-quarter top, or low top) and shoe brands.[67] None of these studies of shoes for basketball provide convincing evidence of a role for shoe style in the prevention of ankle injuries. Another study of specially designed football shoes demonstrated that stiff high-top shoes best limited inversion, but acceptability by players was not measured.[55] In one study, on the other hand, athletes using specially designed swivel football shoes were less likely to suffer ankle injuries than those wearing conventional cleats, with no significant effect on performance.[22] However, this innovation was never adopted for widespread use.

The inadequacy of shoes and the high cost and questionable effectiveness of taping have led, in recent years, to the widespread use of several semirigid orthoses made of cloth or plastic to prevent sprains. Orthoses provide external support, may enhance proprioception, and are less costly and more adjustable than tape.[56,101] Data from randomized controlled trials demonstrate the effectiveness of some of these devices, especially for the prevention of reinjuries (Table 2), although clinical research indicates that some devices will be more effective or more acceptable to athletes than others. For example, lace-up ankle supports are also inexpensive and reusable but may be uncomfortable and do not provide uniform compression. Stirrup-type orthoses have been effective and acceptable to wearers, but they are expensive and may decrease performance levels.[41]

Although the research in the area of injury prevention is

rather extensive, the most important data, those based on randomized controlled trials designed to address the effectiveness of an intervention in the prevention of ankle sprains, are limited in both scope and implementation. A review of the literature on the use of prophylactic ankle braces revealed major methodologic flaws in studies and cited the paucity of evidence to support definitive recommendations.[19,88]

Several methodologic issues were identified in this review.[123] First, most of the randomized controlled trials failed to report methods of randomization and whether allocation of subjects was blinded. Second, the lack of attention to possible confounding factors and both information and selection biases hampered interpretation of results from these studies. For example, when players are allowed to select their own method of protection,[92] selection bias may result. Cohort studies that use an observational design to assess differences in injuries among two groups using different protection may not allow analysis for confounding variables such as skill level, prior injury, or playing surface.[22] Third, a lack of attention to statistical methods was evident. For example, power calculations were never reported, denominators for rates varied across studies (for example, ankles, players, or player-hours), with no justification given, and the potential effect of multiple interventions was not assessed.

The following research questions need to be addressed to advise coaches and athletes on injury prevention strategies.

1. Is a program of conditioning modeled on that developed for Swedish soccer players adaptable to other populations (for example, high school- and college-aged football or basketball players)?
2. Will such programs effectively prevent ankle injuries, especially in athletes with no previous history of injury?
3. Which orthoses are most effective?
4. Which orthoses are most acceptable in terms of cost, comfort, and appearance?
5. Are these interventions equally effective in girls and women? (Few studies, and none of the randomized controlled trials, have included women.)
6. Are these interventions appropriate for all athletes or do kinesiological and sport-specific considerations require different interventions?
7. Which interventions are most effective in athletes with a history of previous ankle injury?
8. How long should orthoses be used after injury?
9. What clinical indicators can be used to help coaches and athletes determine when the player can return to competition without increased risk of reinjury?
10. What, if any, biologic and anatomic measures can be ascertained easily before the season that would warrant special preventive actions (for example, ankle training or orthosis use)?
11. Do inherent behavioral aspects associated with sports injuries present particular challenges of access to data and compliance of study subjects (for example, will coaches give greater priority to injury intervention or what will motivate athletes to wear protective equipment)?

These questions warrant study and validation in well-designed and implemented randomized controlled trials.

For future studies in this field, persons in both intervention and control groups should be subject to a uniform, consistent, and ongoing approach to monitoring (surveillance and case ascertainment) for occurrence of injuries. Whereas a double-blind study is often not feasible for studies of athletic injuries (for example, wearers of braces are evident), blinded allocation of subjects is essential to the strength of evidence. In calculating rates of injury, consideration must be given to the choice of denominators (for example, hours of participation versus number of games).[105] Finally, the reporting of results should be improved so that the published data clearly support the conclusions.

Despite these research needs and unanswered questions, on the basis of this review, we can make one clear recommendation to coaches, trainers, and athletes: athletes with a sprained ankle should complete supervised rehabilitation before returning to practice or competition, and those athletes suffering a moderate or severe sprain should wear an appropriate orthosis for at least 6 months. Research suggests that the benefit of the orthosis persists up to 1 year after injury.[7] A physician or trainer can be helpful to coaches and players in determining when they can return to play.

Actions often endorsed for injury prevention could not be supported in this review of published evidence. Some, such as adequate shoes, may have benefits beyond the prevention of ankle sprains. Similarly, the assurance of safe fields and floors simply makes sense, although studies that focus on these as prevention for ankle injuries are lacking. Preseason conditioning should be planned thoughtfully since this may optimize performance and prevent injury.[23,29] Strength, agility, and flexibility must be emphasized in the preseason and during the season. Coaches could emphasize injury prevention as much as individual and team skills; athletes could be taught basic principles of injury prevention and conditioned adequately before undertaking competitive activities. Special emphasis on proprioception and ankle strengthening should be considered.[7] Such effort is likely to improve performance and reduce some types of injuries. Whether general or targeted training will reduce ankle injury rates awaits better research. Stretching and warming up should precede all intensive practices or games. In the course of games or practice, the coach should be sensitive to the effects of fatigue, recognizing that not only is performance compromised in tired players, but they may be at greater risk for injury.[28,30]

Sports at all levels are popular and healthy activities practiced by millions of persons worldwide, but they are also a leading cause of preventable injury. Research into the most effective means of preventing injury is crucial, as is effective interpretation of the science and its translation into practice.[65] This review of the prevention of ankle injury, one of the most common injuries among athletes, suggests that much still needs to be done in this field.

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