The prevention of ankle sprains in sports: a systematic review of the literature

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Authors' objectives
To assess the effectiveness of various approaches to the prevention of ankle sprains in athletes.

Searching
Citations were identified from the reference sections in textbooks of sports medicine, family practice and other primary care specialities, orthopaedics and general surgery. Searches were conducted of MEDLINE (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'. The search was limited using the terms prevention and control, etiology, and epidemiology. Further citations were identified from articles retrieved, from contacting experts in the field (including first authors of all randomised controlled trials or cohort studies addressing prevention of ankle injuries) and from the Cochrane Collaboration.

Study selection
Study designs of evaluations included in the review
No limitations were applied to study designs. This abstract only includes a subset of studies on the effectiveness of alternative methods of ankle support. Studies of methods to prevent ankle sprains included randomised controlled trials (RCTs) and retrospective and prospective cohort studies. Duration of studies where stated ranged from 2 months to 7 years. Studies that addressed treatment or rehabilitation only rather than prevention were excluded. Papers were excluded if they did not provide primary research data, or provided previously published data.

Specific interventions included in the review
Studies that reported the risk of ankle sprain 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 were included. The following methods to prevent ankle sprains were included and compared with each other or no intervention: taped; cloth strapped; cleats; heel plates; soccer shoes; swivel shoes; J-Flex tape; prevention programme (including before training, mid-season and post prevention programmes); stabilizer; low-tops, high-tops, and high-tops with inflatable chambers; orthotics; cloth orthosis; ankle training; and Air-Stirrup.

Participants included in the review
Participants of both sexes included football and soccer players with and without a history of ankle injury (college, high school, adult soccer), basketball players (college intramural and intramural) and experienced volleyball players. Inclusion criteria for participants were not defined a priori.

Outcomes assessed in the review
Inclusion criteria were reported as the effectiveness of ankle injury prevention methods. In the review this was assessed by rates of ankle sprains.

How were decisions on the relevance of primary studies made?
All articles were screened by the same author.

Assessment of study quality
The authors developed a scoring instrument (maximum score 100 points) to evaluate the validity of cohort studies and RCTs using the following criteria: experimental design (randomisation, prior hypothesis, source of sample, blinding, selection bias and information bias addressed, intervention description, decliners compared to sample, participants compared to drop-outs, independent validation of data, power calculation, clear method to evaluate outcome and appropriateness of method); addressed possible confounders (age, sex, skill level, conditioning, prior lower extremity injury, sport, competition vs practice, playing surface, medical supervision, shoes, taping or bracing, and education) and
appropriateness of method of adjustment; data presentation and statistical analysis (description of tests, use of relative
risk or odds ratio, use of confidence intervals or P values, multivariate techniques, regression coefficients); and
presentation of data (demographic data, confounders, comparability groups, collinearity, multiple testing). Three
reviewers, blinded to primary authors' names and affiliations but not to study results, independently scored validity.
Disagreements were resolved by discussion.

Data extraction
Tables reported in the review included the following information on field studies comparing alternative methods of
prevention: author and country; year of publication; study design; participants; study intervention groups; sample size;
and outcomes. When neither significance levels nor confidence intervals were presented it was assumed that injuries
occurred independently for any one participant and that the average number of playing hours was constant for all
participants. Two authors independently extracted data from analytic studies and RCTs to determine whether pooling
was appropriate. It was not stated how many authors were involved in data extraction.

Methods of synthesis
How were the studies combined?
The studies were combined in a narrative review.

How were differences between studies investigated?
The authors stated that they did not pool the data because of heterogeneity.

Results of the review
A total of 113 articles were included.

Seven RCTs (6181 athletes), 2 prospective cohort studies (3558 athletes) and one retrospective cohort study (297
athletes) were included in the assessment of effectiveness.

The number of sprains in individual studies ranged from 8 to 224).

Shoes and taping (three RCTs and one prospective cohort).
One RCT (validity score 68) found high-tops with inflatable cuffs to be associated with a non-significant trend towards
fewer sprains than low-tops or high-tops alone in basketball players (2.26 vs 4.06 vs 4.8 all 10 to the power to -4/player
minute).
One RCT (validity score 23) found J-taped Flex was associated with fewer sprains than taping or untapped in basketball
players (6.9 vs 14.7 vs 32.8/1000 participant games).
One RCT (validity score 40) found similar sprain rates for taped and cloth strapped ankles in football players (4 injuries
over 1270 practice days vs 4 injuries over 1323 practice days).
One cohort study (validity score 11) found swivel shoes to be more effective in preventing sprains than soccer shoes,
heel plates or cleats in football players (3% vs 5.6% vs 7.7% vs 8.5%).

Bracing (three RCTs and one retrospective cohort).
One RCT (validity score 60) found Air-Stirrup was associated with significantly fewer sprains than no intervention in
basketball teams (1.6 vs 5.2 sprains/1000 athlete games exposures.
One RCT (validity score 39) found Air-stirrup was associated with fewer sprains than no prevention in basketball
players with a past history of ankle sprain (0.46 vs 1.16/1000 player hours) but no difference between groups in players
without previous ankle injury (0.97 vs 0.92/ 1000 player hours).
One RCT (validity score 31) found that soccer players who used a cloth orthosis or those in an ankle disk training programme experienced significantly fewer sprains than the controls (3% vs 5% vs 17%).

One retrospective cohort (validity score 48) found orthosis to be more effective than taping in reducing sprains in football players (2.6 vs 4.9/1000 participant games).

Training (one RCT and one prospective cohort).

One RCT (validity score 45) found intensive sustained conditioning reduced sprain rates in soccer teams (2 vs 11 sprains).

One prospective cohort (validity score 32) reported a decrease in the incidence of sprains over years 1, 2, and 3 of an injury prevention programme for volleyball players (year 1: 0.9, year 2: 0.8, year 3: 0.5/1000 player hours).

Validity score: RCTs scored from 23 to 68 points and cohort studies scored from 11 to 48 points. Methodological flaws included: failure to report methods of randomisation and degree of blinding; lack of attention to possible confounding factors; information and selection bias; lack of attention to statistical methods; and failure to assess the effect of multiple interventions.

Authors’ conclusions
Based on the review, the authors 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 six months. Both coaches and players must assume responsibility for prevention of injuries in sport. Methodological limitations of published studies suggested several areas for future research.

CRD commentary
The aims were stated but no a priori inclusion criteria were defined for study design, participants, intervention, and outcome. No details were given of criteria used to determine the outcome 'ankle sprain'. Only one reviewer assessed the eligibility of studies. Searches were made of several relevant databases and attempts were made to locate unpublished material. No language restrictions were applied. Validity criteria were applied using defined methods and validity scores reported. Methods used to extract data were described and relevant details of ten of the 113 included studies presented in tabular format. Differences between interventions were not presented as point estimates with confidence intervals and levels of significance were not reported making interpretation of results difficult. Given the heterogeneity among studies, a narrative review was appropriate. In the narrative of the review, no account was taken of study validity when discussing the results.

In view of the above limitations and the methodological flaws listed by the authors, the conclusion should be interpreted with caution.

Implications of the review for practice and research
Practice: The authors recommend that athletes with a sprained ankle complete supervised rehabilitation before returning to practice or competition; that those athletes suffering a moderate or severe sprain should wear an appropriate orthosis for at least six months; and that both coaches and players assume responsibility for prevention of injuries in sport.

Research: The authors suggest that future research should address the efficacy and generalisability of conditioning programmes; the relative efficacy, cost, comfort and appearance of different orthosis; the generalisability of the results to women and girls and other sports; interventions for those with previous ankle injuries; the length of time orthosis should be used after injury; indicators for successful return to competition after injury; biologic and anatomical risk factors for injury; and behavioural aspects influencing sports injuries.

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Record Status
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contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on
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