
Purpose: The purpose of this article was to find the best strategy for ankle rehabilitation and post injury treatment.

Methods: They used four different methods of treatment in order to see which method would be most efficient. They first began with proprioceptive training. They measured the difference between the two ankles in order to see the difference in balance skills from the healthy ankle to the injured ankle. Starting with a harder surface one would balance with eyes opened progressing then to balancing with the eyes closed and making their way to a softer surface. The next method of treatment was training of the evertor muscles. They began with isometric exercises where the object is in a still position but the ankle is putting force on the object trying to gain strength. After the isometrics the athlete moves on to dynamic resistive exercises including high knees, resistive bands, and ankle weights. The third method of treatment was a simple air cast. The cast covers both medial and lateral sides of the ankle and they were instructed to wear these during every practice and game. The final method of treatment was a control group with no intervention meaning no treatment; it’s time for the ankle to rest.

Results: Ankle sprains occurred less often in players of the proprioception training group than the controlled group. Otherwise there was no significant difference in each individual case study.

Quality of article: 7/10
Grammar: 4/4
Abstract Interpretation: 5/6
Bibliography: 5/5
19/20
Conclusion: Proprioception was the best form of treatment. The athletes had less recurring ankle sprains when doing the proprioception treatment than any other form of treatment.

Personal interpretation: This article is practical because it proves that strengthening the ankle after an ankle sprain is the best way to rehabilitate an athlete, keeping them healthy longer, and getting them back out on the field sooner. Any form of an injury, especially such a weight barring part of the body has to be strengthened before it can become healthy again. When the injury happens and time is taken off, the muscle memory is gone causing that ankle to be so weak. The ankle forgets how to do the everyday movements so by doing proproceptive treatment; the athletic trainer can help to strengthen the ankle to regain that muscle memory.
Comparison of 3 Preventive Methods to Reduce the Recurrence of Ankle Inversion Sprains in Male Soccer Players
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Comparison of 3 Preventive Methods to Reduce the Recurrence of Ankle Inversion Sprains in Male Soccer Players

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Background: Ankle sprains are frequent injuries in soccer. Several strategies can be used to prevent further ankle sprains in athletes: the most common are proprioceptive training, strength training, and orthoses.

Objective: To investigate which of these 3 interventions is the most effective in preventing ankle sprains in athletes with previous ankle inversion sprain.

Study Design: Randomized controlled trial; Level of evidence, 1.

Methods and Measures: Eighty male soccer players (age, 24.6 ± 2.63 years; height, 175.60 ± 4.36 cm; weight, 64.26 ± 8.37 kg) in the first division of a men’s league who had experienced previous ankle inversion sprain were randomly selected from an original population of 120 players. The subjects were individually and randomly assigned to 4 study groups: group 1 (n = 20) followed the proprioceptive program, group 2 (n = 20) followed the strength program, group 3 (n = 20) used orthoses, and group 4 (n = 20) was the control group. Data on the frequency of ankle sprain reinjury were collected at the end of the session.

Results: There were no significant differences among the groups in the number of exposures. The incidence of ankle sprains in players in the proprioceptive training group was significantly lower than in the control group (relative risk of injury, 0.13; 95% confidence interval, 0.003-0.93; P = .02). The findings with respect to the strength and orthotic groups in comparison with the control group were not significant (relative risk of injury, 0.5; 95% confidence interval, 0.11-1.87; P = .27 for strength; relative risk of injury, 0.25; 95% confidence interval, 0.03-1.25; P = .06 for orthotic group).

Conclusion: Proprioceptive training, compared with no intervention, was an effective strategy to reduce the rate of ankle sprains among male soccer players who suffered ankle sprain.

Keywords: ankle sprains; prevention; male soccer players

Soccer is one of the most popular sports throughout the world, with more than 250 million players in 2000.5 It has a high injury rate, and most injuries occur to the lower extremities, especially the ankle.6 Ankle inversion sprains are the most common injuries in soccer7 and occur during plantar flexion and inversion of the foot.8 Athletes who suffer from ankle sprains are most likely to reinjure the same ankle.9 The high incidence of ankle sprains in sports and their negative consequence for further sports participation call for preventive measures.

Proprioception refers to the inborn kinesthetic awareness of body posture including movement. Proprioceptive training is a crucial part of preventing ankle injury.15 It usually includes exercises on devices such as balance boards, ankle disks, and tilt boards, several times a week. Sheth et al.13 hypothesized that an ankle disk training program would markedly decrease the time for onset of activation of ankle muscles.5 Those authors believed that ankle disk training is a unique method because it stimulates multiple planes of ankle movement on a weight-bearing foot. Tropp et al.16 reported a decreased rate of ankle sprains in soccer players after an ankle disk training program of 10 weeks. There is not much dispute about the actual benefits of such a program, but there are questions about how much it helps and the specific stimulation it generates.6

The evertor muscles are often suggested to play an important role in preventing ligamentous injuries. Tropp et al.16 were the first to measure muscle torque at the ankle with an isokinetic dynamometer. Their results showed that
everto muscle weakness is a component of recurrent ankle sprain. Willens et al. postulated that eccentric contraction of these muscles provides support to lateral ligaments and resists ankle inversion sprains. So strength training of evertor muscles is another part of preventing ankle sprains.

External support (with orthoses or taping) is widely used to prevent ankle sprains among athletes, and many studies have been done to establish its effectiveness. Sitter et al. reported that orthoses reduced the incidence of ankle sprains in previously sprained ankles. Surve et al. and Doxy reported that the main effect of orthoses is to improve the proprioceptive function of a previously injured ankle. Thomard et al. reported that orthoses protect the ankle by preventing inversion movement and maintaining the ankle in proper anatomical position at impact. Additional research is needed to determine the exact mechanisms underlying the effectiveness of orthoses.

I am not aware of any previous research that has compared these 3 interventions (proprioceptive training, strength training, and orthoses) in soccer players with previous ankle sprain injuries. Therefore, I conducted a randomized controlled trial study examining ankle sprain recurrences in athletes using different types of preventive strategies compared with a control group.

MATERIALS AND METHODS

Eighty male soccer players (age, 24.6 ± 2.63 years; height, 175.60 ± 4.36 cm; weight, 64.28 ± 8.37 kg) in the first division of a men's league with previous right or left ankle inversion sprain were randomly selected from an original population of 120 players (excluded were players who had a history of other lower extremity injuries). The dominant leg was designated as the testing leg. A previous ankle sprain was defined as the history of an ankle sprain that caused the player to miss a match or a practice in the previous season. Each subject was followed for only 1 soccer season after the previous sprain. All the subjects were evaluated by medical practitioners during the preseason vacation. Ankle sprain re-injury frequency of each group was collected at the end of the season. An ankle sprain recurrence was defined as any ankle inversion sprain occurring during a scheduled match or practice session. The injury diagnosis was made within 1 hour of the injury event by 1 of the medical practitioners. Intervention options included proprioceptive training, strength training, orthosis, and no intervention (control group). The subjects were individually and randomly assigned to 4 study groups.

The first group (n = 20) followed the proprioceptive training using the ankle disk each day, 30 minutes a day. The athlete is instructed to stand on the ankle disk on the injured leg and shift his or her weight, causing the disk's edge to follow a continuous circular path. Progression is to move from eyes open to eyes closed and from firm surfaces to soft and moving surfaces. 36,37

The second group (n = 20) followed a preventive program that consisted of specific strength training of evertor muscles. Strength training begins with isometric exercises performed against an immovable object and progresses to dynamic resistive exercises using ankle weights and resistance bands. Resistance was applied for 10 sets of 20 repetitions, with a hold duration of 9 seconds. Controlling the time that a maximal contraction was maintained ensured that the targeted musculature was being maximally loaded in a pain-free arc. 38

In the third group (n = 20), the subjects used a Sport-Stirrup (Aircast Inc, Summit, NJ) orthosis. It is structured as a stirrup of thermoplastic material and incorporates 2 inflatable air cells on its inner surfaces at the level of the medial and lateral malleolus. The air cells improve the fit of the orthosis. The stirrup is worn over a sock and with a laced boot. Athletes were instructed in the proper application of the orthosis at the first session and advised to wear it for each practice and game exposure.

The fourth group (n = 20) was the control group (no intervention).

Informed consent was obtained from all the players for their participation, and they were free to withdraw from the study if they wished. No player withdrew from the study. The study was approved by the Ethical Committee of Shiraz University Hospital.

Information on exposures was abstracted from the practice and game schedules of each soccer player. A practice exposure was defined as any practice session in which the athlete participated. A game exposure was any competition with another team in which the player participated. Total exposures were the sum of the 2 exposures.

Statistical Analysis

Overall differences in the exposures among the 4 groups were tested using a 1-way analysis of variance. Chi-square analysis was used to test differences in overall ankle sprain recurrence among the groups. Where sample sizes were fewer than 5 in a cell, the Yates correction was applied. Differences among groups were tested using the Fisher exact test. The α level for all statistical tests was .05.
TABLE 2
Number, Incidence (Injuries/1000 Playing Hours), and Relative Risk of Injury (95% Confidence Interval) of Ankle Sprain in the 4 Groups

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Sprained</th>
<th>Not Sprained</th>
<th>Total</th>
<th>Percentage Sprained</th>
<th>Incidence</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proprioception training</td>
<td>1</td>
<td>19</td>
<td>20</td>
<td>5</td>
<td>0.13</td>
<td>0.003-0.93</td>
</tr>
<tr>
<td>Strength training</td>
<td>4</td>
<td>16</td>
<td>20</td>
<td>20</td>
<td>0.5</td>
<td>0.11-1.87</td>
</tr>
<tr>
<td>Orthosis</td>
<td>2</td>
<td>18</td>
<td>20</td>
<td>10</td>
<td>0.25</td>
<td>0.03-1.25</td>
</tr>
<tr>
<td>No Intervention</td>
<td>8</td>
<td>12</td>
<td>20</td>
<td>40</td>
<td>3.33</td>
<td>0.12-1.91</td>
</tr>
</tbody>
</table>

RESULTS

There were no differences in age, weight, and other characteristics of players between groups. Also, there were no differences in previous rehabilitation between groups.

Table 1 shows descriptive statistics on the exposures for each of the 4 groups. There were no significant differences among the groups in the number of total exposures ($F = 0.62, P = .49$), practice exposures ($F = 0.41, P = .68$), or game exposures ($F = 0.49, P = .62$).

Table 2 shows the number, incidence (injuries/1000 playing hours), and relative risk of injury (95% confidence interval [CI]) of ankle inversion sprains. The incidence of ankle sprains in players of the proprioception training group was significantly lower than in the control group (relative risk of injury [RR], 0.13; 95% CI, 0.003-0.93; $P = .02$). The findings with respect to the strength and orthotic groups in comparison with the control group were not significant (RR, 0.5; 95% CI, 0.11-1.87; $P = .27$ for strength; RR, 0.25; 95% CI, 0.03-1.25; $P = .06$ for the orthotic group).

DISCUSSION

In this study, I attempted to identify the effects of each preventive strategy in male soccer players with a history of previous ankle inversion sprain. Proprioceptive training was an effective strategy in reducing the rate of ankle sprains among male soccer players who suffered ankle sprain compared with no intervention.

It is widely believed that the tendency for ankle sprains to recur is attributable to a proprioceptive deficit caused by partial deafferentation of articular mechanoreceptors. This was first postulated by Freeman et al., who observed that a decrease in the ability to maintain a single-legged stance occurred in the sprained ankle versus the contralateral uninjured one. Glenross and Thornton found a deficit in ankle position sense in patients with a history of recurrent ankle sprains. Decreased ankle joint proprioception may result in a slow onset of activation of muscles across the ankle joint (especially invertors) and, thus, a failure to correct excessive ankle positions. Gross reported that an increased probability of re-injury occurs as a result of a decrease in sensory input from joint receptors.

The literature contains many reports on the various proprioceptive training programs. Tropp used an ankle disk training program for 10 weeks in Swedish soccer players and reported a decreased rate of ankle sprains. Sesh et al. reported that after 8 weeks of training with an ankle disk, the efficacy of the peroneus longus muscle (an invertor) in controlling inversion was improved because of delayed reaction time of the tibialis muscles (invertors). Balogun et al. noted improvement in isometric strength and static balance performance after ankle disk training in normal subjects. Elis and Rosenbaum conducted a 6-week multistation proprioceptive exercise program (consisting of 12 different exercises) in patients with ankle instability and reported that after the exercise program, joint position sense, postural sway, and muscle reaction time showed significant improvements. Stasinopoulos compared 3 preventive methods to reduce the incidence of ankle inversion sprains among female volleyball players and reported that proprioceptive training was effective in preventing further sprains. Our results confirm the importance of proprioceptive training in the prevention of ankle injuries. These exercises may effectively aid stabilization of an unstable ankle and break the vicious cycle of recurrent sprains.

Many investigators have found a relationship between peroneal (invertor) muscle weakness and chronically unstable ankles. Others have found significant invertor weakness in chronically unstable ankles. Ryan suggested that invertor weakness could be the result of an interruption of the muscles' nerve supply or the result of selective inhibition of the invertors' ability to start moving in the direction of the initial injury. Docherty et al. examined the effects of a 6-week progressive ankle strengthening exercise using elastic tubing on joint position sense and strength development in 20 subjects with functionally unstable ankles and reported improvement in those parameters. They believed that the most likely mechanism of their results was a change in muscle spindle sensitivity or in central mechanisms related to the spindles rather than joint mechanoreceptor sensitivity. They suggested that the training protocol may have increased the gamma motor activity, improved motor control, or produced a combination of central or spindle mechanisms. Willems et al. found no relationship between invertor muscle strength and ankle sprains, although they found a significant difference for invertor muscle strength between subjects with chronic ankle instability and the control group. They suggested that a possible cause of recurrent sprain is the combined action of diminished proprioception and invertor muscle weakness.
Although several studies have shown the effectiveness of strength exercise in short-term programs, it is unclear whether these programs have long-term effects. The results reported here showed no significant difference in ankle sprain reinjury frequency between the strength training and the control group.

The application of orthoses has long been advocated as a method for preventing ankle sprains. The ankle stabilizer has become increasingly popular. This increased use is purportedly attributable to ease of application, maintenance, and cost-effectiveness compared with other stabilizers. More studies have reported on the efficacy of ankle orthoses in preventing ankle injuries. Tropp studied the effect of an ankle orthosis on ankle injury incidence in a 6-month prospective randomized study of male soccer players. Of the subjects in the group using the ankle orthosis, 2% sustained an ankle sprain; whereas in the control group, this percentage was significantly higher (17%). For subjects with previous ankle sprains, a significant effect was also found: the percentages for the brace and control group were 5% and 25%, respectively. Stitler et evaluated the effect of a semirigid ankle orthosis in a 2-year randomized clinical trial of basketball players. They found an injury rate of 1.6 per 1000 athlete-exposures for the group wearing orthosis and a rate of 5.2 per 1000 athlete-exposures for the group wearing no orthosis. In a similar study, Surve et evaluated the effect of semirigid ankle orthoses during 1 soccer season. In the group with previous ankle sprains, a significantly lower incidence of ankle sprains was found in the braced group compared with the control group. Thonnard et proposed that orthotic devices prevent the start of the inversion movement by maintaining the ankle in a proper anatomical pattern. Clinical evidence indicates that the use of orthoses reduces the incidence of ankle sprains. The results reported here showed no significant difference in ankle sprain reinjury frequency between the orthosis group and the control group.

Although the findings with respect to the strength and orthosis groups in comparison with the control group are not statistically significant, they appear significant clinically. This could be a problem of low study power attributable to the relatively small sizes of the groups, so these 2 modalities might prove effective in a larger study.

My study had some limitations. Because I visited the players at the start of the session, I had no information about how the players complied with their protocols. The results would probably have been better if regular reinforcement had been given. Moreover, it was possible that the players' interest in the study changed during the session when the study was conducted. Future studies will not have these limitations.

Further studies are needed to investigate the effectiveness of these 3 preventive strategies in female soccer players. Studies are also needed to determine which of the preventive strategies is most effective in players with no history of ankle sprain.

**REFERENCES**


