Role of ankle taping and bracing in the athlete

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Abstract

Adhesive tape is often used to help athletes recover from ligament sprains of the ankle or to prevent further injury. The choice of taping technique or material is often decided by personal preference, superstition, or anecdote. More recently, the use of ankle braces has become more prevalent, but reasons for their use are similarly variable. As ankle sprains are a major cause of an athlete's disability and time off sport, the choice of the method of support should be more scientifically reasoned. This paper attempts to review the literature concerning the effects of various methods of ankle support on swelling, stability, range of movement, proprioception, muscle function, gait, and performance tests. There is still some contradiction in the literature about the effects of taping and braces in both the acute and chronic phases of ligament sprains of the ankle.

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Athletes from many sports consider taping and bracing to be important in the acute and chronic phases of an ankle injury. Indeed, many sportspeople consider ankle support to be essential to their performance, with the corollary that their performance may suffer without such support. Most published reports on the efficacy of taping and bracing focus on their use on the ankle joint. This is probably, in part, because ankle sprains are the most common sports injury,¹ with the incidence varying from 10% to 30% of all musculoskeletal injuries.² In a soccer season, players have a 25% chance of having an ankle sprain if they have had a previous sprain, and 11% if they were previously problem free.³ The focus on the ankle may also be because it is easy to measure the effects of tape and braces on range of motion, gait, functional and muscle performance.⁴ Ankle support is used to control swelling and range of motion in the acute stage, and to provide support or stability to the ligaments and joint in the chronic stage when the athlete returns to sport. However, the use of different taping techniques and braces is dictated more by considerations of cost, comfort, ease of application, personal preference, age, and the type of sport.⁵ Physiotherapists and other personnel who apply tape and braces to athletes need to be aware of the evidence for and against the use of both these methods. In this way, rehabilitation procedures after an ankle injury, or prophylactic advice, can be applied more scientifically.

This paper sets out to review the literature on taping and presents the scientific evidence available to suggest why taping helps support ankles and prevents ankle sprains. It also considers the role of ankle braces, which increasingly are being investigated and used instead of taping.

Methods

Computerised searches were performed using Medline, Excerpta Medica, and CINAHL for studies published between 1966 and 1996. Only English language publications were considered. Keywords used alone or in combination were: ankle sprain, taping, orthosis, brace, inversion injury, rehabilitation, athletic performance, proprioception, peroneal muscle. Other references were identified from some existing reviews and from other papers cited in the publications searched. There were also some other papers found in the author's personal collection.

Anatomy and pathomechanics

The ankle joint receives its strongest support from the medial and lateral collateral ligaments. The lateral collateral ligament is composed of three bands: the anterior talofibular ligament, which attaches from the neck of the talus to the tip of the fibula; the posterior talofibular ligament, which runs from the body of the talus to the tip of the fibula; and the calcaneofibular ligament, which runs from the calcaneus to the tip of the fibula.

Acute lateral ankle sprain is generally accepted to be the most common sports related ligamentous injury,⁶ accounting for 85% of all sprains.² This results in damage to the lateral ligament complex with the anterior talofibular ligament being most often damaged; this is probably because it has the weakest tensile strength of the lateral complex.⁶ The most common mechanism for an ankle sprain is excessive inversion usually accompanied by slight plantarflexion and some internal rotation. Some sports like basketball and volleyball have high ground reaction forces when players land from a high jump, which accentuates the sprain and the rate of injury. This accounts for these sports having 79% and 87% of inversion sprains respectively and 2.5 times more ankle injuries than walking or hiking.⁷ The incidence of ankle sprains in football (soccer) is 31%, in American football 17%, and in ballet 17%.

Taping technique

The taping technique used by athletes and physiotherapists is often governed by personal preference, the experience of the person applying the tape, and a general "feel" as to the

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correct technique. This may be due, in part, to the lack of comparative studies between the different taping techniques.

Rarick *et al* investigated the resistance provided by different zinc oxide techniques on plantarflexion and inversion of the ankle.⁸ After 10 minutes of vigorous exercise they found the greatest tensiometer readings of mean resistance were offered by a basketweave with stirrup and heel lock technique, closely followed by basketweave and heel lock. Frankney *et al* compared four zinc oxide taping techniques ("Hinton-Boswell"; basketweave; "basic"; "Gill") with an unspecified brace and an untaped group.⁹ They analysed their resistance to mechanical inversion and concluded that the Hinton-Boswell method (in which the ankle is taped in a relaxed plantarflexed position) provided greatest resistance to inversion. They speculated that this may be due to a combination of factors, such as mechanical limitation, kinaesthetics, and the subconscious effect on the athlete. Whereas these two studies could be classed as "in vivo" work, Pope *et al* used a model construction of an ankle to perform, in effect, an "in vitro" study of different taping techniques.¹⁰ They measured the ability of the 2.5 cm zinc oxide tape to resist applied torque, angular deflection, and "stiffness"—the last being calculated by dividing torque by angular deflection. They found angular deflection greater than 8° was prevented by a figure of eight plus stirrup technique; torque load to 420 Nm was withstood by a figure of eight with three wraps technique; the stiffest configuration was a figure of eight plus stirrup technique. Although the authors conceded that there were many dangers in extrapolating their results to the human ankle, it indicated the amount of force needed to make tape fail.

Bracing

Ankle braces have advantages over tape in being self applied without needing the expertise of qualified personnel, convenient to apply and remove,¹¹ reusable, readjustable, and washable. Also, skin problems are less common, especially among those athletes who have an allergic reaction to Elastoplast or zinc oxide. These ready made braces are of various materials, thus providing varying amounts of support and stability and are broadly differentiated as "non-rigid" or "semirigid". The non-rigid braces are often made of canvas or a neoprene-type material, which can easily be slipped on and off, some with additional lacing. The semirigid braces mostly consist of bi-malleolar struts made of thermoplastic materials attached by Velcro straps. A number of studies have established the role of braces in restricting the amount of movement, especially inversion at the ankle, on healthy uninjured athletes. These studies have measured the effects of braces such as the non-rigid "Nessa ankle support" and "Leuko functional ankle brace" on inversion in 42° plantarflexion after 40 minutes' exercise¹²; the non-rigid "subtalar stabiliser" on calcaneal inversion after 15 minutes' vigorous exercise¹³; and on inversion/eversion total motion using the semirigid

Aircast airstirrup¹⁴⁻¹⁶; the semirigid Donjoy ALP¹⁶⁻¹⁸; the non-rigid canvas Swede-O-universal brace.¹⁶ All these studies found significant reduction of ankle movement after applying a brace to an α level of 0.05 or greater. However, it is important to note that the Swede-O-universal brace could be converted to a semirigid type by sliding plastic struts in the side pockets on the brace. The authors do not stipulate which version they used.

Taping and bracing for acute ankle sprain

After an acute ligament sprain compressive strapping is often recommended and applied to control oedema.¹⁹ Few studies have been performed or published to evaluate the efficacy of taping to achieve limb or joint compression. Hall (unpublished data) used volumetry to study the control of ankle joint swelling with treatment after an acute ankle lateral ligament sprain. He found that ice and compression taping (which included a horseshoe shaped felt pad around the lateral malleolus) achieved better control of swelling than ice and ultrasound over a period of 10 days.

Capasso *et al* compared the effect of adhesive and non-adhesive tape on swelling.²⁰ They concluded that non-adhesive tape should be renewed after three days owing to insufficient compression, but that adhesive tape could last five days before renewal. This study measured the compressive forces of each type of tape by using a sphygmomanometer cuff included in the taping. However, this has been criticised in earlier work by Viljakka as being an inexact method of measurement.²¹ The latter study used a plastic fluid chamber as measurement and compared Elastoplast and Tensoplast with various padded and elastic bandages.²¹ In ankle taping the most significant decrease in pressure was found after 15 minutes' walking and thereafter stayed constant, indicating that either the padded adhesive or the elastic bandage was the most suitable for bandaging the ankle.

The role of an ankle brace in controlling oedema after acute ankle sprain was investigated by Stover using the Aircast airstirrup.²² Wishing to highlight the brace's "milking effect on oedematous tissues", he noted that the brace with its inner airbag exerted 25 mmHg pressure, which increased to 50 mmHg when weight bearing and 75 mmHg in full dorsiflexion.

Epidemiological studies have tried to establish the ability of tape and braces to prevent an acute ankle injury over a playing season or year. The most commonly cited study on injury prevention is that of Garrick and Requa,¹ which studied the effect of taping on 2563 basketball players with previous ankle sprains over two successive seasons. They observed that a zinc oxide stirrup with horseshoe and figure of eight technique in conjunction with a high support basketball shoe gave an injury incidence of 6.5/1000 games. The untaped players with the same shoe had an incidence of 30.4/1000 games. Taping with a low support shoe gave an injury incidence of 17.6/1000 games. From these data they concluded that taping had a

protective influence for preventing ankle sprains, though the role of high or low top shoes in helping stability is unclear.²³

Ankle braces may also reduce the incidence and severity of acute ankle sprains in competition,²⁴ as has been examined, for example, in basketball players.²⁵ The use of an Aircast stirrup in a control group and in 1601 players was compared over two years. It was calculated that the brace significantly reduced the frequency of ankle injury; the players without the orthosis had three times the risk of ankle injury. Tropp *et al* studied the effect of an ankle brace compared with a proprioception programme in 450 soccer players and a control group over a six month period.³ In previously uninjured players the incidence of ankle sprain was 3% for bracing, 5% for proprioception training, 11% controls. However, if a player had previous ankle injuries, the incidences were 2% for bracing, 5% proprioception, and 25% controls. This indicated that both proprioception training and bracing had significantly lowered the incidence of ankle sprains, especially if the ankle had been previously sprained. The preventive effect of braces on sprains in soccer players was confirmed by a later prospective, randomised study using a large sample of 600 players.²⁶ This finding (also noted in laboratory studies²⁷) was thought to be due to improving the defective stabilisation of the peronei muscle group. Although the studies reviewed provide important information about the efficacy of tape or a brace, the study design, external validity, confounding variables, and sample size have been criticised.²⁸ These factors should also be considered before selecting the appropriate technique or device.

Other studies have directly compared traditional taping methods and ankle braces in the prevention of acute ankle sprain. Rovere *et al*²⁹ conducted a retrospective study over a seven year period on 297 American footballers and concluded that, compared with taping, an apparently non-rigid (but not specified) lace up ankle brace halved the risk of ankle sprain injury. They speculated that this may be because the athletes can readjust the tension of the brace regularly during exercise. Ankle bracing also provided greater socioeconomic benefits as shown when comparing compressive bandaging with a semirigid Aircast airstirrup.³⁰ Two matched groups were treated for three weeks by either method after an acute ankle sprain. The group treated with the Aircast airstirrup was more mobile in the initial phase of rehabilitation and had a shorter sick leave. They also calculated that the cost of the semirigid brace was regained after a half day earlier return to work.

Taping and bracing for chronic ankle sprain

The paucity of work published on the effects of tape and braces on acute ankle injury is in contrast with the volume of research into the effects of taping on the chronically sprained ankle. Tape and braces are applied at this stage when the athlete has recovered from the acute

phase and is returning to sport. Their use in the chronic phase addresses the problem of ankle instability, which may be mechanical or functional.³¹

MECHANICAL INSTABILITY

Preventing extremes of range of movement and reducing abnormal movement of the ankle is the most obvious role of ankle taping. Researchers measure non-weight-bearing (NWB) range of motion or mechanical instability in the frontal plane (the talar tilt) using *x* rays. Tape reduced extremes of range of movement on normal subjects after 15 minutes' running over a figure of eight course.³² On patients with proven mechanical ankle instability, a zinc oxide Gibney basketweave technique significantly decreased the amount of NWB talar tilt.^{33 34} Those patients with the greatest instability received the greatest benefit from the tape. Taping also limited talar tilt in full weight bearing (FWB) in four judo players with chronic instability after 90 minutes' training.³⁵ However, these results should be regarded with caution as, unlike other studies, they claim to have recorded zero degrees talar tilt with taping.

FWB investigations using kinetic and kinematic assessment showed that ankle tape did not alter loading patterns but did affect sagittal ankle range of motion, causing increased rotation about the metatarsal heads.³⁶

Although taping does seem to improve mechanical instability, the restricting effect is lost after varying periods of exercise. Rarick *et al* claimed that 40% of the effect of taping was lost after 10 minutes of vigorous general circuit exercises.⁸ Frankney *et al* found similar reduction of about 50% after 15 minutes of standard vigorous exercises including jumping, pivoting, and running.⁹ Larsen recorded a 20% decrease after 20 minutes' start/stop running on uneven ground and jumping.³⁴ Greene and Hilman found that a basketweave with heel lock and figure of eight technique resulted in 37% loosening in total passive range of motion ($P < 0.01$) after 20 minutes of volleyball training¹⁷; after three hours of training the loosening worsened to 63%. Myburgh *et al* measured a 10–20% restriction loss in all movements except dorsiflexion after 60 minutes of squash.³⁷ One study made a direct comparison between traditional taping methods and ankle braces,³⁷ which used an electrogoniometer to measure and compare NWB restriction of ankle motion with zinc oxide tape or Elastoplast against a simple non-rigid elastic stocking-type support. The zinc oxide tape restricted plantarflexion/inversion movement after 10 minutes of squash. However, after one hour of squash there was no significant difference between the tape or support. Studies comparing the semirigid Donjoy ALP brace on normal subjects with tape showed contrasting results.^{17 38} Gross *et al* performed NWB measurements of the foot after 10 minutes' running and showed that both methods provided equal and significant restrictions of inversion and eversion.³⁸ Interestingly, they reported that most of the subjects found the brace more comfortable than the tape.

Table 1 Comparison of orthoses and tape

Author	Orthosis	Taping technique†	Conclusions‡
Rovere <i>et al</i> ²⁹	Laced ankle brace	z.o. clb/w fig 8 HL	Risk of injury halved using orthosis rather than tape
Myburgh <i>et al</i> ²⁷	Elastic stocking	z.o. b/w St HL	z.o. tape better than orthosis and Elastoplast to restrict NWB ROM
Gross <i>et al</i> ¹⁵	Aircast airstirrup	Elastoplast z.o. b/w fig 8 HL	Aircast airstirrup better than tape to restrict NWB ROM
Gross <i>et al</i> ²⁸	Donjoy ALP	z.o. subtalar sling	No difference in NWB ROM
Greene and Hilman ¹⁷	Donjoy ALP	z.o. b/w fig 8 HL	Donjoy ALP better than tape to restrict NWB ROM
Paris <i>et al</i> ²⁹	Swede-O-universal	z.o. clgb/w	Swede-O-universal better than subtalar brace and tape to restrict NWB ROM
Mackean <i>et al</i> ²⁶	Subtalar brace	z.o. clb/w	Active ankle brace showed least overall performance impairment
	Aircast airstirrup		
Frankney <i>et al</i> ⁶	Swede-O-universal	Hinton-Boswell	Hinton-Boswell better than orthosis and other taping techniques to restrict NWB ROM
	Active ankle brace		
Lindley and Kernozek ⁵⁵	Laced ankle brace	b/w Gill	ALP showed decreased functional NWB ROM
	Aircast airstirrup		
Fitzgerald and Callaghan*	Active ankle brace	z.o. clb/w St	ALP showed decreased functional NWB ROM
	Donjoy ALP		
Fitzgerald and Callaghan*	Vulcan	z.o. gb/w fig 8 HL	No difference in kinetic gait parameters between braces or tape
	Swede-O-universal		
Verbrugge ⁶³	Aircast airstirrup	z.o. gb/w St HL	No difference in motor performance
	"Tubigrip"		
	Laced ankle brace		
	Aircast airstirrup		

* Unpublished data.

† z.o. = zinc oxide tape; b/w = basketweave; clb/w = closed basketweave; gb/w = Gibney basketweave; fig 8 = figure of eight; HL = heel locks; St = stirrups; NWB = non weight bearing; ROM = range of movement.

However, earlier work recorded no differences between the same brace and tape.¹⁷ The contradiction may be explained by the different taping techniques used in each study. In contrast, the semirigid "Swede-O-universal" and non-rigid "subtalar support" braces provided better NWB restriction on plantarflexion, dorsiflexion, inversion, and eversion than taping after 15 minutes of activity.³⁹ Similar superiority over taping was recorded for the semirigid Aircast airstirrup on normal subjects for passive inversion/eversion¹⁵ and for an individually moulded orthosis (described as semirigid) on inversion after 20 minutes' exercise (table 1).⁴⁰ Similarly, in injured athletes, a "strong" thermoplastic semirigid ankle brace significantly reduced talar and subtalar motions of plantarflexion, inversion, and adduction of 14 subjects with symptoms of chronic ankle instability.⁴¹ Kinetic and kinematic analysis has been performed to examine the Aircast airstirrup, which was found to reduce the mediolateral force component and maximum calcaneal eversion angles. This moderation of gait was considered to be within normal values for walking.⁴²

It is this inability to maintain mechanical stability during exercise that raises fundamental questions about the efficacy of taping and bracing. It seems that tape and braces, however

well applied, cannot withstand the huge forces involved in an inversion ankle sprain.

FUNCTIONAL INSTABILITY

More recently, researchers have become more interested in the concept of functional instability of the ankle and the role of taping and bracing to alleviate it. Freeman *et al* described functional instability as "a term...to designate the disability to which the patients refer when they say that their foot tends to 'give way'" (page 678).⁴³ Taping and bracing may help through their effect on the neuromuscular mechanisms via cutaneous input, which improves the muscular responses. The most commonly investigated muscle group is the peronei owing to their role in preventing ankle inversion, a position which causes most lateral ligament ankle sprains.

Two studies have been performed on normal, healthy subjects that indicate the importance of peronei function and its role in preventing lateral ankle sprain.^{44 45} Konradsen and Hojsgaard used electromyographic assessment of peroneus longus and brevis in nine patients running on a treadmill.⁴⁴ They concluded that the foot-ankle complex requires an inversion (supinated) position at the pre-heel strike phase of the running cycle to stimulate the peronei to correct for inversion strain. A further study simulated an ankle sprain by local anaesthetic regional block.⁴⁵ It established that whereas *passive* joint angle reproduction was "virtually impossible" after the anaesthesia, *active* angle reproduction and peroneal reaction time were far less affected. It was concluded that a mechanically unstable ankle can be helped by the peronei and other muscle activity. Later work by Feuerbach *et al* made similar observations about active angle reproduction of the ankle joint after anaesthetising two components of the lateral ligament complex.⁴⁶

Experimental work on patients with mechanically unstable ankles and on control subjects has shown differences in peroneal function between the groups. Trends, but no statistically significant differences, have been found between the peroneal response times of patients with ankle instability and control groups.^{47 48} Comparisons between injured and good sides of patients with chronic instability showed reaction times of 68 ms *v* 84 ms²⁷ and 49 ms *v* 65 ms,⁴⁹ with the injured side having a longer reaction time. The differences between the figures in the two studies were probably due to dissimilar recording methods. Recent investigations discovered that peroneal reaction time rather than peroneal strength was a discriminating factor after ankle sprain.⁵⁰

Taping and bracing for ankle proprioception

As has already been mentioned, although some limitation of ankle range of movement can be achieved with taping and bracing, it is doubtful whether tapes and braces will withstand the forces of an inversion sprain. As a result, some authors have investigated the protective role of taping and bracing in the chronically injured

ankle against injury through proprioception and awareness of foot position.^{27 51-54} Glick *et al*, using electromyographic analysis of runners, found that ankle taping allowed the peroneii muscle group to contract for a longer period of time at the pre-heel strike stage in four mechanically unstable ankles.⁵⁰

Karlsson and Andreasson used a trapdoor mechanism on 20 subjects with chronic ankle instability and found that the Gibney basketweave technique significantly shortened the reaction time of the peroneii muscle group, thus bringing it closer to times on the normal side.²⁷ They also noted that the more unstable the ankle, the greater the improvement. As well as the peroneii muscle group, deficits can also be shown in tests for proprioception, such as passive joint angle reproduction. This gives further insight into the complexity of functional instability of the ankle and the effect of tape. Jerosch *et al* compared two types of brace and a closed Gibney basketweave taping technique with figure of eight supplementation on 16 unstable ankles.⁵¹ Although they found significant differences in angle reproduction before the test between stable and unstable ankles (thus concurring with Lentell *et al*⁵²), taping did not significantly improve this; the authors were unable to offer an explanation for this finding. Proprioception has also been evaluated by postural sway and single leg balancing tests. Robbins *et al* evaluated taping on estimation of perceived direction and amplitude on surface slope in FWB.⁵³ In contrast with Jerosch *et al*,⁵¹ they concluded that ankle taping did improve foot position awareness and so may have a role in the prevention of ankle sprain in athletes.

The Aircast airstirrup has also been shown to facilitate joint proprioception in uninjured ankles with an anaesthetised lateral ligament complex. This improvement in joint position sense was thought to be due to the stimulation by the brace of the cutaneous receptors in the foot and shank, which might have increased the afferent feedback.⁴⁶

These studies assume that assessing ankle proprioceptive function with NWB or open kinetic chain position indicates that such methods of support will prevent trauma to the ankle and foot in the FWB or closed kinetic chain position. Some studies have addressed this problem by comparing braces with taping in the FWB position.

Hamill *et al* using kinetic and kinematic analysis compared a Gibney basketweave with an unspecified brace and found no significant differences between the two types of support, concluding that neither tape nor brace affected foot motion.⁵⁴ Functional FWB outcome measures were recorded on healthy subjects comparing a lace up brace, the Aircast airstirrup, and a taping technique.⁵¹ Braces improved the proprioception and functional ability of the injured and normal ankles, whereas the taping technique had no effect. FWB video analysis has been used to compare the effect of a zinc oxide tape with various braces on dorsiflexion and plantarflexion of the ankle.⁵⁵ Only the Donjoy ALP brace affected sagittal range of motion.

Potentially negative effects of taping and bracing

Although, to date, there has not been a specific study on the subject, there is little evidence to support the view that long term use of both forms of ankle support may result in detrimental effects to the tissues around the ankle or joints within the kinetic chain. Garrick and Requa found no increase in the frequency of knee sprains occurring as a result of using a high topped shoe and prophylactic taping.¹ They further commented that the increased likelihood of an ankle support causing a knee injury was overshadowed by the protection that the ankle support offered. A similar claim was made by Glick *et al*⁵⁰ but with few supporting data. Other studies have used kinetic and kinematic analysis to evaluate the potentially negative effects of taping of the ankle. Contradictory results have shown that ankle taping can have disadvantageous secondary effects around the metatarsal heads in walking,³⁶ or that neither taping nor bracing causes any alteration in foot motion in running.⁵⁴

In addition to adverse effects on the lower extremity, it has been the opinion of some researchers that the potential benefits of wearing ankle braces to prevent ankle injury must be weighed against the possible detrimental effect on actual performance of the athlete.⁵⁶ The consensus is that the various braces available have little detrimental effect on sprint or agility tests, but the results for vertical jump tests are contradictory (table 2). These contradictory results may be due to between study differences of sample size, types of sports analysed, age and proficiency of the athlete selected.

MacKean *et al*⁵⁶ considered functional performance between zinc oxide tape and three types of semirigid brace: Aircast airstirrup; Swede-O-universal; active ankle training brace. It was one of the few studies to assess metabolic

Table 2 Effect of orthoses on performance on tests of vertical jump, sprint and agility

Author	Orthosis	Effect of orthoses on:		
		Vertical jump	Sprint	Agility
Paris ⁵⁷	Swede-O-universal	No effect	No effect	No effect
	McDavid	No effect	No effect	No effect
Burks <i>et al</i> ⁵⁹	New Cross	Detrimental	No effect	No effect
	Swede-O-universal	Detrimental		No effect
Bocchinfuso <i>et al</i> ⁵⁸	Kallassy	Detrimental		No effect
	Aircast airstirrup	No effect	No effect	No effect
Robinson <i>et al</i> ⁶¹	Active ankle brace	No effect	No effect	No effect
	"Plastic stiffeners"			Detrimental
Greene and Hilman ¹⁷	Donjoy ALP	No effect		
	Aircast airstirrup	No effect	No effect	
MacPherson <i>et al</i> ⁶⁰	Donjoy Rocketsoc	No effect	No effect	
	Swede-O-universal	Detrimental	No effect	
MacKean <i>et al</i> ⁵⁶	Active ankle brace	No effect	No effect	
	Aircast airstirrup	No effect	No effect	
Greene and Wight ¹⁶	Swede-O-universal	No effect	No effect	
	Donjoy ALP	No effect	Detrimental	
Pienkowski <i>et al</i> ⁶²	Aircast airstirrup	No effect	No effect	No effect
	Swede-O-universal	No effect	No effect	No effect
Verbrugge ⁶³	Kallassy	No effect	No effect	No effect
	Aircast airstirrup	No effect	No effect	No effect
Wiley and Nigg ⁶⁴	Malleoloc	No effect	No effect	No effect

cost of these types of support and found that the Aircast airstirrup increased both VO_2 and energy expenditure.

Summary

The studies reviewed suggest that both mechanical and functional stability of the ankle can be improved with taping. The restrictive effect is lost after short bouts of exercise, which indicates that the mechanical restriction of movement may be less important than the neuromuscular and sensory mechanisms; the peronei muscle group, in particular, has been implicated. Ankle braces are being used increasingly by sportspeople as these devices are more convenient and cost effective than tape. Most studies have shown that braces restrict ankle movement less than taping without affecting performance. Furthermore, they retain their restrictive properties for longer periods after exercise, but have also been shown to have a proprioceptive role. Both taping and braces have been shown to prevent ankle sprains in basketball and soccer players, though the study design should be considered before applying tape or recommending a brace for the prevention of ankle sprains.

Key points

ANKLE TAPE AND BRACES

- Restrict range of movement
- Reduce reinjury rate
- Improve proprioception
- Limitation of movement is lost after exercise
- No negative effect on most performance tests
- Little negative effect on other joints.

BRACES

- Minimal expertise needed
- Reusable
- Readjustable
- Washable
- Non-allergic.

TAPE

- Individually applied
- Less bulky than brace
- Athletes' preference
- Caters for unusual anatomy.

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