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Elastic therapeutic tape: Applications at the ankle

Research on the use of elastic therapeutic tape in patients with chronic ankle instability is limited, but recent findings do suggest that leaving the elastic tape on for several days is associated with improvements in proprioceptive awareness that are not observed acutely.

By Janet Simon, MS, ATC; Emily Hall, MS, ATC; and Carrie Docherty, PhD, ATC

Ankle sprains account for 15% of all injuries in college athletes¹ and are estimated to occur 23,000 times a day in the general US population.² Previous research has reported that 66% of collegiate and high school athletes have sprained an ankle at least once in their lifetime.³ Additionally, once an ankle sprain has occurred, patients are at greater risk of sustaining a recurrent injury.⁴ These repetitive ankle sprains often lead to chronic ankle instability (CAI) and residual symptoms such as instability, pain, and weakness.^{5,6}

In one study, 31% of high school and collegiate athletes who had a history of lateral ankle sprains went on to develop CAI.³ Individuals with CAI report episodes of giving way, weakness during physical activity, and self-reported disability.^{7,8} CAI also results in deficits in strength⁹ and proprioception,¹⁰ as well as altered functional performance.^{11,12} These deficits put the ankle joint at risk for recurrent injury, which can eventually lead to ankle osteoarthritis.^{13,14}

Intervention strategies such as external support or balance and coordination training are recommended to improve the deficits associated with CAI and recurrent sprains.¹⁵ The use of external ankle support, including taping and bracing, improves stability of the joint by restricting range of motion,^{16,17} but research also suggests these taping and bracing techniques may enhance proprioception and balance at the ankle.¹⁸⁻²⁰ Ankle taping with nonelastic white cloth tape is commonly used to reduce the risk of sports-related ankle sprains. The primary goal of this taping technique is to provide mechanical stability to the joint. However, some researchers have proposed that the tactile stimulation the tape provides to the skin may also improve proprioception and neuromuscular control of the joint.

Three recent studies²¹⁻²³ have investigated the effects of ankle taping for improving balance in individuals with CAI. Two^{21,22} used the star excursion balance test (SEBT), which measures dynamic balance, to investigate ankle taping for improving reach distances. These studies found no significant differences in reach differences among the taping conditions (no tape, mechanical/closed basket weave, placebo, lateral subtalar sling, and fibular repositioning).

Future research should focus on identifying a specific elastic therapeutic tape application that has the primary purpose of enhanced proprioception.

A third study²³ that used a different balance task reported the same conclusion. The results of the Gear et al²³ article demonstrated that three taping conditions (no tape, lateral subtalar sling, and fibular repositioning) did not affect balance as measured through an overall stability index.

Elastic therapeutic tape

Although the majority of athletic trainers use nonelastic white cloth tape for ankle taping, an array of other types of tape has been developed. Elastic therapeutic tape, sometimes called kinesiology tape, is a relatively newly developed taping material compared with traditional white athlete tape. Elastic therapeutic tape may provide more neuromuscular and kinesthetic affects versus pure mechanical stability to the joint than traditional white tape, as it can be applied to the skin for longer periods and does not loosen over time like athletic white tape. It was developed in the 1970s by a chiropractor named Kenzo Kase²⁴ and is a 100% cotton elastic tape with an adhesive backing that can stretch to almost double its original size.

Researchers have theorized that elastic therapeutic tape mimics the properties of the skin's epidermis. Specifically, the tape's elasticity creates a constant pull on the skin,²⁵ subsequently providing constant proprioceptive information to the area of the body it covers. Elastic therapeutic tape also has some unique attributes: it's heat activated, retains its skin-adhesion properties for up to five days, and is water resistant. According to manufacturers, elastic therapeutic tape lifts the skin away from the underlying tissue to facilitate a release of pressure on injured structures.²⁶ Elastic therapeutic tape is purported to have many physiological and biological effects on the body including: improved muscle function, improved circulation of blood and lymphatic systems, improved proprioceptive function, decreased pain, and regulation of irregular muscle tension and muscle imbalances.^{27,28}

In 2007, a group of researchers used elastic therapeutic tape to treat various injuries, including an ankle sprain, epicondylitis of the elbow, inflammation of the biceps brachii muscle, tightness of the lateral fascial compartment, and inflammation of the plantar aponeurosis.²⁹ All participants reported decreased pain and a visible reduction in edema following the tape application. The authors therefore concluded that elastic therapeutic tape can be used in the treatment of an array of injuries.²⁹

According to the Kinesio Taping Association International, elastic therapeutic tape can be applied using four different types of application strips. These include an "I," "Y," "X," and "fan" strip. Each

strip has a different application depending on the goal of taping and the anatomical makeup of the body part being treated.

Due to the elastic nature of elastic therapeutic tape, there are also different tension guidelines used during application. These refer to how much the tape should be stretched before applying it to the skin. Minimal tension (0%-15%) will affect the epidermis and the lymphatic system. Light tension (15%-25%) might inhibit muscle function, while moderate tension (25%-35%) facilitates muscle function. Severe or full tension (50%-100%) is used for mechanical and functional corrections, as well as ligament corrections.²⁷

Manufacturers have suggested the majority of these concepts, and it is therefore important to review the scientific evidence performed by independent researchers. The purpose of this paper is to evaluate the impact of elastic therapeutic tape specifically on lower body proprioception.

Postural stability

Proprioception is an individual's awareness of the position of a joint in space. It can be evaluated in a variety of ways, from conscious proprioceptive sense to postural stability measures. Static postural stability was one of the initial measures used for evaluating proprioception, and it continues to be commonly used in the ankle literature. A static single-leg balance test requires regulation of muscle tone and joint stiffness and continuous adjustment for altered loads as the center of pressure shifts throughout a balance trial.³⁰ Dynamic or semidynamic postural control is evaluated through reach tasks as well as more with dynamic activities, such as the time it takes for an individual to stabilize following a jump.

Researchers have frequently used the SEBT, a test of dynamic balance, for evaluating people with CAI. Generally, people with CAI have balance deficits associated with reaching in the anteromedial, medial, and posteromedial directions.³¹ The theory of the SEBT is that, by requiring a person to maximally reach in each of these directions, the test forces the body's center of gravity to the limits of its base of support and subsequently stresses the postural stability of the body. We will consider several of these postural stability measures in evaluating the effectiveness of

elastic therapeutic tape.

Previous investigations have used the SEBT to evaluate the effectiveness of elastic therapeutic tape applied to the ankle for improving balance in healthy uninjured individuals.³²⁻³⁵ These studies have consistently found that elastic therapeutic tape does not improve balance in this group.³²⁻³⁵ There are several potential reasons for these findings, but the results lead us to believe that initial pro-



Figure 1. Elastic therapeutic tape application. (Reprinted with permission from reference 28.)

proprioceptive deficits must exist for the elastic therapeutic tape to have a detectable impact on these reaching tasks. Since clinicians normally use elastic therapeutic tape in patients with some sort of pathology, the next logical step is evaluating the effectiveness of elastic therapeutic tape in participants with either an acute injury or a history of a recurrent injury.

Studies lead us to believe that initial proprioceptive deficits must exist for elastic therapeutic tape to have a detectable impact on reaching tasks.

Research

Evaluating how elastic therapeutic tape affects performance on the SEBT in patients with CAI has an important clinical application. Two previous studies have investigated this topic^{36,37} and, surprisingly, both concluded that elastic therapeutic tape had no impact on reach distances.

Each of these studies used a different elastic therapeutic tape application. The first,³⁷ by Hettle et al, used a manufacturer-recommended ankle taping method specifically designed for lateral ankle sprains. However, Bici et al³⁶ used a taping technique the investigators' team developed. These researchers applied elastic thera-

peutic tape to the lateral aspect of the lower leg and the dorsum of the ankle, covering the peroneal muscles and the tibiofibular ligament. The authors' stated rationale was that this would provide support to the peroneals to facilitate better feedback for proprioception. These different taping techniques may have impacted the results, but the fact remains that neither technique improved reach distances. A potential concern in both of these studies^{36,37} is that researchers failed to include a control group, so it is unknown whether these participants actually had reach deficits at the beginning of the study.

More recent investigations used different measures of proprioception to evaluate the impact of elastic therapeutic tape and found slightly different results.^{28,30} First, Shields et al³⁰ used a single-leg balance task to evaluate the effectiveness of elastic therapeutic tape in individuals with and without a history of ankle injuries. The authors identified small improvements in postural stability after elastic therapeutic tape was applied to the joint for 24 hours. However, because the magnitudes of these improvements were very small, the authors questioned their clinical meaningfulness.³⁰ This was the first study to require participants to wear the tape for several hours (24) prior to evaluating its effect on performance. If the elastic therapeutic tape had been applied for a longer period, it's possible greater improvements would have been elucidated. According to the manufacturers, the tape can be worn for three to five days at a time and does not loosen over time like conventional white athletic tape.

The second study²⁶ evaluated force sense in individuals with CAI. Force sense is a conscious proprioceptive sense that describes an individual's ability to detect muscular force or tension. Researchers have used force sense to evaluate proprioceptive func-

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tion in persons with CAI.³⁸ Simon et al tested both healthy individuals and those with CAI, but elastic therapeutic tape was applied only to chronically unstable ankles using a taping technique for lateral ankle sprains. At baseline the CAI group had significant force sense deficits compared with the control group. After 72 hours of tape application, participants with CAI showed an improvement in proprioceptive awareness compared with baseline measures. The magnitude of these improvements resulted in a level of conscious proprioceptive awareness similar to that seen in the control group.²⁸

The different findings seen in these articles may be attributed to length of time that the tape was applied. First, the testing done by Bicici et al³⁶ and Hettle et al³⁷ was completed immediately following elastic therapeutic tape application. Elastic therapeutic tape has distinctive properties that allow it to adhere to the skin for several days.³⁹ This provides constant neural feedback and tactile enhancement, which may facilitate proprioception or balance performance.¹⁸ Because participants were tested immediately after tape application, it is doubtful that any of these potential enhancements could have been realized.

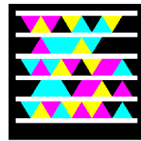
In the study by Shields et al,³⁰ researchers applied the tape 24 hours before testing and identified minor improvements. The study that yielded the most promising improvements²⁸ involved application of the tape for 72 hours before testing, and researchers identified significant improvements in conscious proprioceptive sense. It may also be possible that the use of force sense is more sensitive to changes in proprioception, whereas other measures of proprioception may evaluate more gross motor patterns and are not as sensitive to changes. Future research should follow clinical guidelines and leave the tape applied to the skin for multiple days.

Conclusions

Compared with other external support interventions, there is relatively limited research on the proprioceptive benefits of applying elastic therapeutic tape in an injured population, especially in individuals with CAI. It has been theorized that elastic therapeutic tape will improve the reactive (feedback) postural control pathway in those with CAI through increased stimulation of cutaneous mechanoreceptors associated with joint motion, but the results of this review have revealed divergent findings. Future research should focus on identifying a specific elastic therapeutic tape application that has the primary purpose of enhanced proprioception.

The studies reviewed here used an array of kinesiology taping techniques so it is difficult to compare and contrast the findings; in addition, the duration of tape application varied greatly between studies. Based on the limited amount of quality research conducted on this topic it is difficult to make a clinical recommendation. However, the most recent evidence does lead us to believe that enhancement of proprioceptive performance can be achieved if elastic therapeutic tape is applied for an extended period. 

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