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# A comparison of the effects of ankle taping styles on biomechanics during ankle inversion

## *Une comparaison des effets de différents styles de taping sur la biomécanique de l'inversion de la cheville*

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**Abstract**

*Objective.* – This study was designed to compare the effects of different ankle taping methods on lower leg EMG and subtalar kinematics.
*Methods.* – Twelve healthy volunteers were tested on an inversion platform in one of three taping conditions: non-elastic basketweave, elastic adhesive bandage wrap and non-taped control. Muscle activation and range of motion data were collected during an inversion of 35 degrees using a Biometrics® datalogger. Testing was done before and after 30 minutes of treadmill running.
*Results.* – Significant differences were noted in total inversion, time to peak inversion and rate of inversion. While total inversion did not differ between tape conditions, the rate of inversion in the non-elastic condition was lower than the elastic adhesive condition, which was lower than the control. There was no effect of ankle taping style on latency of the *peroneus longus*.
*Conclusions.* – The choice of ankle taping style can have significant effects on ankle biomechanics and the use of non-elastic tape reduces the rate of inversion. While the rate increased after 30 minutes of running, it was still lower than the other conditions.


*Keywords:* Ankle; Tape; Inversion; Sprain; EMG

**Résumé**

*Objectif.* – Cette étude fut mise en place pour comparer les effets de différentes méthodes de taping de la cheville sur l'activité EMG de la jambe ainsi que sur la cinématique sous-talienne.
*Méthodes.* – Douze volontaires en bonne santé physique furent testés sur une plateforme à inversion suivant une des trois conditions de taping : un bandage tissé non élastique, un bandage adhésif élastique et un groupe témoin sans bandage. L'activité musculaire et la gamme de mouvement ont été collectées durant une inversion de 35 degrés en utilisant un enregistreur de données Biometrics®. Les tests furent réalisés avant et après 30 minutes de course sur tapis roulant.
*Résultats.* – Des différences significatives ont été notées au niveau de l'inversion totale, du temps pour atteindre le pic d'inversion et du taux d'inversion. Alors que l'inversion totale ne différait pas entre les différentes conditions de taping, le taux d'inversion en condition non élastique était inférieur à celui en condition adhésive élastique, qui était lui-même inférieur à celui du groupe témoin. Il n'y a pas eu d'effet du style de bandage sur le temps de latence du muscle long fibulaire.
*Conclusion.* – Le choix du style de taping de la cheville peut avoir des effets significatifs sur la biomécanique de la cheville et l'utilisation de bande non élastique réduit le taux d'inversion. Alors que le taux augmentait après 30 minutes de course, il continuait de rester inférieur aux autres conditions. Par conséquent, le taping peut être un complément utile au support de la cheville, limitant l'inversion au cours d'un programme de réhabilitation.


*Mots clés :* Cheville ; Taping ; Inversion ; Entorse ; EMG

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## 1. English version

### 1.1. Introduction

There is abundant literature to indicate that the ankle is one of the most commonly injured structure in the body and results in significant time-loss to participation [8,9,36]. In sports, ankle injuries account for 15% of all reported injuries [12], while a lateral ankle sprain has been reported to make up 83.4% of all ankle injuries [23].

With the epidemiological evidence regarding ankle sprains, it has been common practice to tape the ankle to prevent injury. As a prophylactic measure, ankle taping has resulted in a reduction in either the incidence or severity of ankle sprains [11,22,35] although one report stated that there was no change in the incidence of sprains [29]. There is also debate in the literature about the effectiveness of ankle taping with regard to the duration of support offered. Some studies have reported that taping support is significantly reduced following exercise [19,20] while others have found that taping still retains significant restriction [18,28]. Perhaps the main reason that taping is used so often is that it can accommodate individual requirements such as demands of the sport, body shape, and severity of the injury [3]. Ankle taping is thought to reduce the risk of injury, or the severity, by providing additional limitation to the ranges of motion that may overload connective tissues, for example by reducing the absolute inversion or the rate of ankle inversion [11,14,32].

It is likely that restriction of the range of motion (ROM) is not the only mechanism for avoiding ankle sprains. The primary function of the *peroneus longus* muscle is eversion and thus may play an important role in the prevention of ankle sprains. When an inversion movement is applied to the foot, the *peroneus longus* plays an important role as the primary defense mechanism [4,16]. With regard to muscle activity and external ankle support, the data has been mixed. While some papers have indicated a detrimental effect of prophylactic ankle support on muscle activity [10,13,30], other publications have indicated no significant effect on muscle activity [4,7,31].

Many different taping techniques exist and these vary across sports and regions. It has been stated that appropriate and effective ankle taping is both an art and a science [6]. There are certainly times when styles of taping can be outdated or not rooted in science, as was shown by Yamamoto et al. who stated that newer methods of ankle taping can offer greater support and protection compared to traditional methods [37]. The most common type of tape used is non-elastic (NE) zinc-oxide tape and uses stirrups, horseshoes, figure-of-eight wraps and heel locks. Care must be taken when non-elastic tape is used, especially when the technique involves applying the tape circumferentially around a limb. If the tape is applied too tightly, the risk of impeding blood flow is increased and this could lead to tissue damage and even tissue necrosis. At best, comfort and performance could be detrimentally affected by taping that is too restrictive.

To avoid these potential problems, an alternative taping technique using elastic adhesive bandaging (EAB) has been developed. This alternative technique involves the use of three zinc-oxide stirrups for primary restriction, followed by figure-of-eight wraps using EAB. The theory is that the EAB not only provides adequate support but also allows functional movement without restricting blood flow to and from the tissues distal to the taping.

Unfortunately, there is a lack of research regarding the kinematic, kinetic and functional effects of different taping styles. The purpose of this study, therefore, is to answer a fundamental question: is there any difference between EAB taping and NE taping in the rate of ankle inversion or peroneal longus latency, both before and after exercise?

### 1.2. Methods

Twelve participants volunteered to take part in this study. All participants were free from lower extremity pathology and were in general good physical condition. All subjects were instructed in the data collection procedures, and then signed an informed consent, as approved by the local ethics board. The physical characteristics for the participants were age of $24.1 \pm 6.8$ years; a height of $174.2 \pm 10.1$ cm; and body mass of $76.7 \pm 19.9$ kg.

Subjects were randomly assigned to one of three test conditions: control, EAB taping, and NE taping (Figs. 1 and 2). Each subject was tested in all three conditions, using a Latin Square design to counterbalance the testing sequences. The NE taping procedure used in this study was identical to that described by Perrin [26] and outlined in Table 1. For inversion testing, we provided a standard sports shoe to the subjects, in order to eliminate the variability of footwear in the test results.

Kinematic data were collected using an electrogoniometer (Biometrics Ltd, Gwent, Wales) in a procedure that had previously been validated [18,28]. The electrogoniometer's sensors were fixed with double-sided tape to the heel of the shoe and the proximal calcaneal tendon. An extra strip of 2.5 cm non-stretch tape was placed over the electrogoniometers to ensure their continued adhesion to the subject during testing. The positions of the electrogoniometer's sensors were marked for accurate replacement after exercise and on subsequent testing days. Data were collected at 1000 Hz using a Biometrics® datalogger equipped with an electrogoniometer and preamplified EMG electrode.

Table 1
Steps used in the application of the different taping styles.

| EAB | NE (using entirely 3.8 cm zinc oxide) |
|---|---|
| 1. Adhesive spray | 1. Adhesive spray |
| 2. Pre-wrap | 2. Pre-wrap |
| 3. 2.5 cm zinc oxide anchors | 3. Anchors |
| 4. Stirrups, start and finish medially 2.5 cm zinc oxide (Fig. 2) | 4. Three stirrups, starting medially and finishing laterally |
| 5. Figure-of-8 | 5. Figure-of-8 |
| 6. Close, continuous, with 7.5 cm elastic adhesive bandage | 6. Heel locks–2 each, medial and lateral (Fig. 3) |
| | 7. Close, non-continuous |

EAB: elastic adhesive bandage; NE: non-elastic.