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# INFLUENCE OF TWO TAPINGS ON THE REACTION TIME OF THE PERONEAL MUSCLES

**A Ferreira, P Monteiro, P Carvalho and Camilo Moreira**

**Centre for the Study of Human Movement and Activity (CEMAH) / School of Health Technology of Oporto (ESTSP) / Polytechnic Institute of Oporto (IPP) / Vila Nova de Gaia, Portugal**

This study aimed to investigate the influence of two different types of tapings on the reaction time of the peroneal muscles, using surface electromyography, in female volleyball athletes with sprain history and indicators of instability. A quasi-experimental study with a sample of 15 athletes was conducted. Adhesive elastic tapings *heel-lock* and kinesiotape, with peroneus and ligament application, were compared. For data analysis the parametric tests repeated measures ANOVA and T test for paired samples were used. The application of the kinesiotape reduced the reaction time of peroneal muscles significantly while the adhesive elastic band had no significative influence on it.

**KEYWORDS:** Ankle, Sprain, Peroneal Reaction Time, Kinesiotape, Taping.

**INTRODUCTION:** The injury mechanism by stretching the lateral structures of the ankle and the resulting inflammatory process, may lead to changes on the neuromuscular structures, including the muscle-tendon and capsule-ligament mechanoreceptors, that are closely linked to muscle response, which may lead to a change in joint stability (Delahunt, 2007; Hopkins et al, 2009). The peroneus muscles are the main eversors and have an important role in opposing the mechanism of injury and in maintaining the foot position during functional movements. When these muscles have an inappropriate activation it can result in poorly controlled alignment of the hind foot (Hopkins et al, 2009). The evaluation of the reaction time (RT) of the peroneal muscles is referred as a good indicator of the dynamic stability of the ankle (Rosenbaum et al, 2000; Eechaute et al, 2009; Cordova et al, 2010). The fact that athletes with sprain history are twice as prone to undergo further sprain, raises the need for information on the advantages and disadvantages of types of tapings available, mainly on its ability to reduce levels of loading and increased ability of the individual to tolerate or respond to load patterns. For the present study two different types of tapings were selected, both with the aim of reducing the instability of the ankle. It was chosen the elastic adhesive taping with the heel-lock application which results in a decreased range of inversion. On the other hand, it was selected a material, known by various classifications, including kinesiotape, with application on peroneal muscles and lateral ligaments without limiting the range of motion (Sijmonsma, 2007; Pijnappel, 2009). This study aimed to investigate whether the application of elastic adhesive taping in a heel-lock or application of kinesiotape taping with peroneus and ligaments components have influence on the RT of the peroneal muscles.

**METHODS:** Athletes of two female volleyball teams were selected through a questionnaire, and the athletes who had experienced at least one sprain at the ankle and had previous feel instability after the ankle injury were included in the study (Hubbard et al, 2007; Docherty & Arnold, 2008). Athletes who had suffered a sprain in any of the feet for less than six weeks, or another leg injury and/or vestibular, balance or neurological disorders were excluded (Hopkins et al, 2009; Refshauge et al, 2009; Vries et al, 2010). 15 athletes presenting ankle instability index, through the Y Balance Test (YBT) (reliability intra-rater from 0,99 to 1,00 and inter-observer 0,85 to 0,91) were then included (Gribble & Hertel, 2003; Hertel et al, 2007). Sample demographic data mean (± Standard deviation) was 19,33 (± 4,77) years old, 65,03 (± 10,06) kg body weight, 1,69 (± 0,075) cm height and 22,81 (± 2,64) kg/m$^2$ of body mass index (BMI).
The surface electromyographic signal was collected from the muscles peroneus longus (PL) and peroneus brevis (PB) by using MP100WSW Biopac (Biopac Systems Inc. Santa

Barbara, CA, USA) and acquisition and analysis software Acqknowledge ® version 3.9. To cause the mechanism of sudden inversion (30º rotation in the frontal plane), a Trap Door was used. For the adhesive elastic taping were used Cramer ® taping 5 cm and for the kinesiotape the SportTex ® brand beige 5 cm were used. Before collecting, the skin was prepared to reduce the impedance. The active electrode corresponding to the PL was placed 3 cm below the head of the fibula in line with the lateral malleolus and the active electrode corresponding to the PB 5 cm above the lateral malleolus just behind the fibula (Rosenbaum et al, 2000; Benesch et al, 2000). The ground electrode was placed on the styloid apophysis of the ulna. The evaluation of reaction times of the peoneus muscles was collected in three conditions: 1) Without taping, 2) with elastic adhesive taping and 3) with kinesiotape. The application of the two taping types was alternated, to avoid any possible order effect.
Athletes were asked to stand up over the platform and keep the weight distributed on both limbs. They were asked to listen to music through headphones and try to solve a mathematical equation on a sheet of paper placed at eye level. The Trap Door opening was made with random intervals of time for both sides to a total of three measurements. The average of the three measures has recorded (Vaes, Duquet & Gheluwe 2002). The application of the elastic adhesive tape (Alt, Gollhofer & Loher, 1999) and kinesiotape (Sijmonsma, 2007; Pijnappel, 2009) were performed by a physiotherapist, with training and experience in both techniques. The raw signal was processed on the Acqknowledge ® software. RT was defined as the period from the opening of the Trap Door to the beginning of the electromyography activity of the peroneal muscles. The basal activity of both muscles was defined during the 150 ms before the opening of the Trap Door. The time point of the activity maintained for more than 30 ms higher than the average baseline activity plus 3 standard deviations was regarded as the beginning of the activity after the stimulus. Each activation time was also examined visually to ensure that there would be no interference from any noise. The onset of activation examined visually was identified as the point where the electromyography activity stood out from the baseline (Hopkins et al, 2009).
After all collection, data was analyzed using SPSS Statistics 17.0. Statistics summary measures were used to describe and characterize the sample. The ANOVA for repeated measures was used in order to investigate whether there were significant differences in RT of the peroneal muscles between the three conditions "without taping (S)," With Elastic Taping "(A) and" With kinesiotape "(B). When a difference was confirmed t-tests for paired samples were carried out in order to identify between which conditions there were differences and in what way they occur. For each test the necessary assumptions of normality were determined by Shapiro-Wilk (Maroco, 2007). All statistical tests were performed at a 0,05 significance level.
This study was conducted according to the Declaration of Ethical Principles.

**RESULTS AND DISCUSSION:** Through statistical analysis of reaction times of the peroneal muscles, by the use of ANOVA for repeated measures, it could be verified at a significance level of 0,05, that at least one of the means would be different ($p<0,001$). The figure 1 shows the distribution of means ± SD associated in the three experimental conditions. The t-test for paired samples showed that there is statistical evidence to claim that the mean of the RT for the PL without taping (S1) was superior to the RT of the PL with kinesiotape (B1) ($p/2<0,001$). It was also shown, at the same level of significance, that the RT of the PL with the adhesive elastic taping (A1) was higher than the RT of the PL with the kinesiotape ($p/2<0,001$). The comparison of the RT of PL without taping (S1) and the RT of the PL with elastic adhesive taping (A1), presented no statistical evidence to claim that the two means were statistically different ($p=0,129$). The same was obtained in the three conditions of the peroneus brevis: the mean of the RT with kinesiotape (B2) was significantly lower compared with the others conditions ($p/2<0,001$), while there was no evidence that S2 and A2 were significantly different ($p=0,058$).

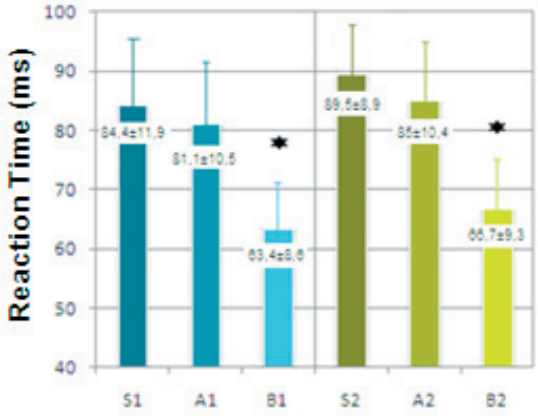


**Figure 1: Reaction Time of Peroneus Longus (1) Brevis (2) and Without Taping (S), with elastic adhesive taping (A) and kinesiotape (B); n=15.**
*, Significant differences between: S1/B1; A1/B1; S2/B2; A2/B2. p/2 <0.001 <0.05 (one way test)

For the evaluated tapings were selected different materials with different applications, with the goal to reduce the ankle instability. Present results showed that the RT of the PL and the PB was lower with kinesiotape (63,4 ± 8,6 ms and 66,7 ± 9,3 ms respectively) compared with the RT of the same muscles without taping (84,4 ± 11,9 ms and 89,5 ± 8,9 ms) and with the elastic adhesive taping (81,1 ± 10,6 ms and 85 ± 10,4 ms). Benesch et al (2000) described what would be a normal RT of the peroneal muscles for a sudden inversion of 30° indicating that the RT of the PL would be 63 ms and 66 ms for the PB, without sex differences. Konradsen & Ravn (1990) compared the RT of individuals without ankle instability with individuals with ankle instability. Individuals without instability showed a RT of 65 ms for the PL and the 69 ms for the PB, whereas those with instability had a higher RT for both muscles showing a RT of 82 ms for the PL and 84 ms for PB. Karlsson & Andreasson (1992) found that the limb with chronic ankle instability, presented a RT for the PL of 81,6 ± 5,2 ms and for the PB of 84,5 ± 4,0 ms, times that were greater compared with the uninjured limb, that presented a RT for the PL of 69,2 ± 4,1 ms and 68,8 ± 4,5 ms for the PB. Making a comparison with the mentioned authors, the RT of the peroneal muscles, when the kinesiotape was applied, resembled the population without instability of those studies. This may be explained by the possible influence of taping on the intrafusal fibers, which are responsible for muscle stiffness. Due to the findings of the RT of the peroneal muscles, as the application of the elastic adhesive taping was not significantly different from the condition without taping, our study is in agreement with the hypothesis that this kind of external support does not alter the reaction time of peroneal muscles in athletes with instability indicators (Alt & Lohrer Gollhofer, 1999). It was also observed that the elastic adhesive band showed an average reaction time lower than that of the condition without any taping, which although not statistically significant, may have some clinical relevance. Firer (1990) noted that the correction of joint alignment can be a facilitator to muscle activity, which may be the mechanism present in the elastic adhesive taping. However, other authors state that taping limit joint mobility and decrease muscle activity, reducing the need for protective activation (Hume & Gerrard, 1998). This study does not present information about the influence of time of use, both in the effectiveness of the material as well as regarding the possible physiological effects, not allowing for an extrapolation of the improvement of the dynamic stability.

**CONCLUSION:** The reaction time of the peroneal muscles was lower with the application of the kinesiotape compared with elastic adhesive or without taping condition. It was also found that elastic adhesive taping had no significant influence on the reaction time of the peroneal muscles.

## REFERENCES:

Alt, W., Lohrer, H., & Gollhofer, A. (1999). FunctionalProperties of Adhesive Ankle Taping: Neuromuscular and Mechanical Effects Before and After Exercise. *Foot & Ankle International ,* 20(4), 238-45.

Benesch, S., Putz, W., Rosenbaum, D., & Becker, H.-P. (2000). Reliability of Peroneal Reaction Time Measurements. *Clin Biomech ,* 15.

Cordova, M. L., Bernard, L. W., Au, K. K., Demchak, T. J., Stone, M. B., & Sefton, J. M. (2010). Cryotherapy and ankle bracing effects on peroneus longus response during sudden inversion. *J Electromyogr Kinesiol* , 20, 248-53.

Delahunt, E. (2007). Peroneal reflex contribution to the development of functional instability of the ankle joint. *Phys Ther Sport* , 8, 98-104.

Docherty, C. L., & Arnold, B. L. (2008). Force sence deficits in functionally unstable ankles. *J Orthop Res ,* 26(11), 1489-93.

Eechaute, C., Vaes, P., Duquet, W., & Gheluwe, B. v. (2009). Reliability ans discriminative validity of sudden ankle inversion measurements in patients with chronic ankle instability. *Gait & Posture ,* 42(1), 82-6.

Frier, P. (1990). Effectiveness of taping for the prevention of ankle ligament sprains. *Br J Sp Med ,* 24(1), 47-50.

Gribble, P. A., & Hertel, J. (2003). Considerations for normalizing measures of the star excursion alance test. *MPEES ,* 7(2), 89-100.

Hertel, J., & Olmsted-Kramer, L. C. (2007). Deficits in time-to-boundary measures of postural control with chronic ankle instability. *Gait & Posture ,* 25, 247-51.

Hopkins, J. T., Brown, T. N., Christensen, L., & Palmieri-Smith, R. M. (2009). Deficits in Peronial Latency and Electromecanical Delay in Patients with Functionl Ankle Instability. *J Orthop Res ,* 27(12), 1541-6.

Hubbard, T., Kramer, L. C., Denegar, C. R., & Hertel, J. (2007). Correlations Among Multiple Measures of Functional and Mechanical Instability in Subjects with Chronic Ankle Instability. *J Athl Train ,* 42(3), 361-6.

Hume, P., & Gerrard, D. F. (2007). Effectiveness of external ankle support bracing and taping in rugby union. *J Athle Train ,* 42(3), 361-6.

Karlsson, J., & Andreasson, G. O. (1992). The effect of external ankle support in chronic lateral joint instability: an electromyographic study. *Am J Sports Med ,* 20(3), 257-61.

Konradsen, L., & Ravs, J. B. (1990). Ankle instability caused by prolonged peroneal reaction time. *Acta Orthop Scand ,* 61(5), 388-90.

Maroco, J. (2007). *Análise estatística comutilização do SPSS.* Lisboa: Edições Sílabo.

Pijnappel, H. (2009). *Medical Taping Concept Handbook.* Aneid Press.

Refshauge, K. M., Raymond, J., Kilbreath, S. L., Pengel, L., & Heijnen, I. (2009). The effect of ankle taping on detection of inversion-eversion movements in participants with recurrent ankle sprain. *AmJ Sports Med ,* 37(2), 371-5.

Rosenbaum, D., Becker, H. P., Gerngro, H., & Claes, L. (2000). Peroneal reacton times for diagnosis of functional ankle instability. *Foot Ankle Surg ,* 6, 31-8.

Sijmonsma, J. (2007). *Taping Neuromuscular Manual.* Espanola.

Vaes, P., Duquet, W., & Gheluwe, B. v. (2002). Peroneal reaction times ans eversion motor response in healthy andunstable ankles. *J Athl Train ,* 37(4), 475-480.

Vries, J. S., Kingma, I., Blankevoort, L., & Dijk, C. v. (2010). Difference in balance measures between patients with chronic ankleinstability and patents after an acute ankle inversion trauma. *Knee Surg Sports Traumatol Artgrosc ,* 18(5), 601-6