Research Article
http://dx.doi.org/10.17784/mtprehabjournal.2014.12.203

Kinesio taping® does not alter joint position sense in healthy subjects: randomized, clinical trial.

O KT® não altera o senso de posição articular em sujeitos saudáveis: ensaio clínico, randomizado

Caio Alano de Almeida Lins[1], Francisco Locks Neto[1], Anita Barros Carlos de Amorim[2], Daniel Tezoni Borges[1], Liane de Brito Macedo[1], Jamilson Simões Brasileiro[3].

Laboratório de Análise da Performance Neuromuscular (LAPERN). Departamento de Fisioterapia, Universidade Federal do Rio Grande do Norte (UFRN), Natal (RN), Brasil.

Abstract
Introduction: The Kinesio Taping® is an elastic functional tape with specific characteristics that, when applied on muscles, aims to assist and functionally support them. Its effect on proprioception, a component of the somatosensory system, is still poorly understood. Objective: To assess the immediate effects of the application of Kinesio Taping® (KT) on knee joint position sense (JPS) of healthy subjects. Method: This is a controlled, randomized-blinded clinical trial. Sixty females volunteers (age: 23.3 ± 2.5 years, BMI: 22.2 ± 2.1 kg/m^2) were randomly divided into 3 groups with 20 members each, and they performed one of three protocols: control - 10 minutes of resting; nonelastic adhesive tape - application over the rectus femoris (RF), vastus lateralis (VL) and vastus medialis (VM) muscles; and KT - application of KT over the same muscles. All were subjected to knee JPS evaluation on an isokinetic dynamometer, in which the analyzed variable was the absolute error, before and after interventions. Results: There were no significant changes in knee JPS in the assessed groups, using absolute error (control group p=0,14; nonelastic adhesive tape group p=0,32; KT group p=0,91). Conclusion: The application of KT on the RF, VL and VM muscles was not able to significantly improve the knee JPS of healthy women.
Key Words: Propriocepcion, Postural balance, Mechanoreceptors.

Resumo
Introdução: O Kinesio Taping® é uma bandagem elástica funcional com características próprias que, aplicada sobre ou ao redor dos músculos, objetiva assistir e dar suporte funcional. Seu efeito na propriocepção, que é um componente do sistema somatossensorial, ainda é pouco compreendido. Objetivo: Analisar os efeitos imediatos da aplicação do KinesioTaping®(KT) no senso de posição articular (JPS) do joelho em sujeitos saudáveis. Método: Trata-se de um ensaio clínico, controlado, randomizado, cego. Sessenta voluntárias, do sexo feminino (idade: 23,3 ± 2,5 anos; IMC: 22,2 ± 2,1 Kg/m^2) foram aleatoriamente distribuídas em 3 grupos, com 20 integrantes cada, e realizaram um dos 3 protocolos: controle - 10 minutos em repouso; eJPSradrapo – aplicação de esparadrapo nos músculos reto femoral (RF), Vasto lateral (VL)e Vasto Medial (VM); e Kinesio Taping – aplicação do KT nos mesmos músculos. Todas foram submetidas a avaliação do JPS do joelho em um dinamômetro isocinético, onde a variável analisada foi o erro absoluto, antes e após as intervenções. Resultados: Não foram observadas alterações significativas no JPS do joelho em nenhum dos grupos avaliados, a partir do erro absoluto (grupo controle p=0,14; grupo esparadrapo P= 0,37; grupo KT P= 0,91). Conclusão: A aplicação do KT nos músculos RF, VL e VM não é capaz de alterar de forma significativa o JPS do joelho, de mulheres saudáveis.
Palavras-chave: propriocepção; equilíbrio postural; mecanorreceptores.

Submission date 30 May 2014, Acceptance date 29 August 2014, Publication date 15 September 2014.

1. Master in Physical Therapy - Universidade Federal do Rio Grande do Norte (UFRN), Natal (RN), Brazil.
2. Physiotherapist - Universidade Federal do Rio Grande do Norte (UFRN), Natal (RN), Brazil.
3. Professor of Physical Therapy Department, Universidade Federal do Rio Grande do Norte (UFRN), Natal (RN), Brazil.

Corresponding Author:
Prof. Dr. Jamilson Simões Brasileiro. - Departamento de Fisioterapia. Universidade Federal do Rio Grande do Norte. - Av. Senador Salgado Filho, 3000. Campus Universitário. Lagoa Nova. Natal – RN - Zip Code 59.078-970. e.mail: brasileiro@ufrnet.br. Tel – 55+08433422008

INTRODUCTION

Physically active individuals who engage in activities whether recreational, amateur or professional level, constantly seek resources that can improve their muscle performance.

Within this context, the Japanese chiropractor Kenso Kase developed Kinesio Taping® (KT), which is an elastic bandage with functional characteristics that applied on the muscles, aims to assist and support function.[1,2] This technique consists of a thin elastic band which can be stretched up to 50% of its original length, resulting in lower restriction compared to conventional tapes.[1,2] Applying the same is proposed to decrease pain and swelling, increase joint stability and improve muscle performance.[2,3]

The mechanisms by which the application of KT reach the expected result are not well understood. Some researchers claim that their application directly on the skin activates some cutaneous mechanoreceptors, which would cause a reduction in pain by the gate of pain mechanism. Furthermore, its elastic and adhesive characteristics, the bandage might provide an increase of the interstitial space, permitting a better blood and lymph flow.[2,3] Murray and Husk[4] also propose that KT through cutaneous stimulation could improve proprioception.

However, the effect of the application of KT in proprioception, which is a component of the somatosensory system is still poorly understood.[5-7] The proprioceptive acuity is defined as the ability of an individual to determine joint position sense, movement and limb strength,[8] and thus an essential tool for injury prevention and rehabilitation component. However, it is often ignored, with serious consequences because the proprioceptive deficits may be responsible for many acute joint injuries.[9,10]

Proprioception is the result of afferent inputs generated from the integration of neural impulses arising from several mechanoreceptors to the CNS. These receptors are located in joint capsules, ligaments, muscles, tendons and skin, being sensitive to stimuli such as pain, pressure, touch and movement. Therefore, their role is critical to the individual's performance in sport and activities of daily living.[11,12]

Many techniques to examine the proprioceptive acuity are described in the literature, among them are the joint position sense (JPS). The evaluation of an individual JPS determines mainly the ability to realize the target angle or the position of the joint, and may be conducted in an active or passive manner and by positioning open kinetic chain (CCA) or closed (CCF).[12,13] The ability to position a joint, consciously, is a highly specialized proprioceptive function and is a measure of great clinical importance, which involves both control of movement and stability.[14]

Thus proprioception is a decisive element for both recovery and for the prevention of injury. In addition to the proprioceptive training, the KT has been widely used in clinical practice to aid in the treatment of acute soft tissue injuries and various joints and also in order to prevent injury,[15] but there is no evidence that ensures the use of KT to improve proprioception.[5-7] Thus, this study aims to examine the immediate effects of the application of KT knee JPS in healthy women.

METHOD

Subjects

The study included 60 healthy volunteers, female, mean age 23.3 ± 2.5 years and body mass index (BMI) of 22.2 ± 2.1 kg/m^2. All were between 18 and 28 years, active in recreational character[16] with no history of musculoskeletal injury to the lower limbs in the past six months and no history of surgery of the lower limbs, non-corrected neurological, vestibular, visual and/or hearing impairments, and showed no allergy to adhesive. Volunteers who reported pain during the collection procedures or that did not perform assessment procedures correctly were excluded from the study.

Participants were recruited among students from a local university, informed about the study objectives and signed a consent form, according to Resolution 196/96 of the Conselho Nacional de Saúde. The study was approved by the local Ethics Committee search, obtaining protocol number 604/11 and is in accordance with CONSORT recommendations.

Procedures

Initially, all subjects performed warm up on a stationary bicycle (Fit®-Ergo, Ergo Cycle 167, Pirmasens, Germany), with adjusted saddle height on the greater trochanter of the femur for five minutes with a load of 20 W.[17] Soon after the evaluation of knee JPS of the dominant lower limb was performed. After this assessment, subjects were randomly distributed through the site www.randomization.com in one of three groups with 20 participants in each, namely: control group, group tape and kinesio taping group.

The control group performed the initial assessment, and allowed to rest for ten minutes, and then perform the final evaluation. After initial assessment, the kinesio taping (KT) group was submitted to KT application (kinesio tex gold®) to rectus femoris (RF), VL and VM muscles in the dominant limb, longitudinally, from the proximal to the distal, with 50% tension on the strip, as suggested by Kase et al (2003). Kinesio taping was applied to the RF from 10cm below the anterior superior iliac spine to the upper edge of the patella. The strip was fixed on the VL muscle from the greater trochanter to the lateral edge of the patella. For the VM muscle KT

was applied to the middle third from the medial region of the thigh to the medial edge of the patella. This application was performed with subjects standing on one foot, with the hip of the dominant limb at 0° and knee flexed at 90° (Figure 1).

Nonelastic adhesive tape were applied to individuals from the bandage group (Cremer® S.A Brazil) also on RF, VL and VM muscles, longitudinally from the proximal to the distal, assuming the same position adopted in the KT group. Following intervention, subjects underwent a second evaluation, identical to the first.

JPS Assessment

The evaluation was performed using an isokinetic dynamometer (Biodex Multi-Joint System 3 ®, Biodex System Biomedical Inc, New York, USA) calibrated weekly according to the specifications and manufacturer's recommendations.

The JPS was evaluated in the active form, as a more functional test and analyze more predominant muscle receptors when compared with the evaluation of passive manner.[18] The volunteer was positioned adjustable chair sitting on the dynamometer, the non-dominant leg of the lower limb was fixed by a belt, like the chest and pelvic region. The rotation axis of the dynamometer was aligned with the lateral epicondyle of the femur (anatomical axis of rotation of the knee) and the lever arm was adjusted at the distal leg and secured approximately 5cm above the medial malleolus of the ankle. All these adjustments followed the recommendations by Dvir [19] (Figure 02)

After positioning, the participant was instructed to perform active knee extension at a constant speed of 2°/s, with starting from 90° of flexion member. When the target angle of 45° was reached, the arm of the dynamometer remained in this position, holding it for five seconds, so that voluntary knew what the angle to be achieved. This procedure was performed once for each volunteer. Then, we requested an active extension from 90° of knee flexion (2°/s) to the target angle, second trial of the subject. At that moment, voluntary flipped a device, and recorded the angle achieved. At this stage, was also performed only a repetition.

The variable analyzed was the absolute error, given by the difference between the target and the angle achieved by voluntary, in degrees, without considering directional trends over or underestimation of the target angle. To avoid induction of results throughout the assessment visual feedback was blocked by protective eyewear.

Figure 01. Application of kinesio taping in muscles VM, VL and RF.

Figure 02. Positioning of the volunteer on the isokinetic dynamometer (Biodex Multi-Joint System 3 ®, Biodex System Biomedical Inc, New York, USA) for evaluation of the JPS.

Table 01. Mean values and standard deviation (SD) of variables: absolute error of joint position sense (JPS absolute error) before and after application of the protocol in the three groups: control, tape and KT.

	Control			Nonelastic tape			Kt		
Variables (n= 20)	Mean ± SD			Mean ± SD			Mean ± SD		
	PRE	POST	p	PRE	POST	p	PRE	POST	p
JPS – absolute error (degrees)	7.5 ±4	6 ± 5	0.14	5.2 ± 3	6.3 ± 5	0.31	6 ± 5	6 ± 4.5	0.91

Statistical Analysis

Statistical analysis was performed using SPSS 17.0 software. First the Kolmogorov-Smirnov test (KS) was performed to verify the normality of the data. After that, it was observed that all variables were normally distributed.

Inferential statistics used in the analysis of variance two-way repeated measures (ANOVA 3X2) to check intergroup and intragroup differences before and after the interventions. In all statistical analysis was assigned a significance level of 5% and a confidence interval of 95% (95% CI).

RESULTS

There was no significant change in JPS knee compared the values of the initial assessment with the final evaluation, in the three groups evaluated (Table 01). No significant difference between groups was observed.

DISCUSSION

In the present study, the JPS (absolute error) showed no differences pre and post implementation of the protocol in any of the groups assessed. In contrast, Murray and Husk[4] observed an improvement in the JPS of the ankle joint after application of KT in 26 healthy subjects. Chang *et al.*[20] found that the KT applied to the anterior surface of the forearm improved sense of grip strength in healthy athletes. They suggest the possible technical effect may be due to a muscle receptor activation, or KT applied directly to the skin and muscles in a stretched position, can stimulate the muscle fascia lining, which would cause an activation of muscle receptors providing for regulation of muscle tone. [20]

However, Halseth *et al*.[21] examined the effects of KT in JPS ankle during plantar flexion, and concluded that the application of this technique appears to improve joint position sense in healthy individuals. As Aytar *et al.*[22] who found no effect of KT, applied to the quadriceps femoris, the JPS knee in women with patellofemoral pain syndrome. These authors suggest that the technique may not have influenced the JPS knee because it was applied in a restricted area of the lower limb, in others words, KT was applied only in some regions of the quadriceps. Moreover, they claim that may have occurred a rapid accommodation of cutaneous mechanoreceptors, so the technique did not provide a satisfying sensory stimulation during movement.

In our study it was also no significant differences in JPS knee after applying KT and tape, which contradicts other studies which found that the KT improves proprioception by increasing sensory information from muscle spindle.[4,20] We suggest that tactile stimulation provided by both the KT as the nonelastic tape was not sufficient to activate cutaneous mechanoreceptors to alter the proprioceptive response of the volunteers, probably because of different proprioceptive deficits.

In the present study, the evaluation of the JPS was performed actively, by having a greater influence of muscle components.[18] Thus, we suggest that both KT and the nonelastic tape applied in VL, VM and RF muscles, did not provide enough stimulus to alter the function of the muscle receptors cutaneous. For if this response had occurred, the JPS could have changed in the experimental groups as the active form evaluates predominantly the activity of muscle receptors.

Thus, taking into consideration that the JPS did not change after application of the protocols, it can be inferred that the application of KT and nonelastic tape in VL, VM and RF muscles do not promote immediate changes in the proprioceptive response of the knee in healthy women.

CONCLUSION

The results of this study suggest that the application of KT in RF, VL and VM muscles are not able to improve significantly the JPS knee of healthy women. The mechanisms by which the KT could change the JPS in healthy people are still not clear and would require further studies to prove them. Certainly, more research is needed to evaluate the immediate and chronic effects of applying this technique.

Finally, it is noteworthy that the results of this study should be limited to healthy active women who engage in recreational physical activity character, ie, evaluated participants had no proprioceptive changes. Thus, it is suggested further studies to assess the acute and chronic effects of KT in JPS patients in the rehabilitation process.

REFERENCES

1. Kase K, Tatsuyuki H, Tomoko O. Development of Kinesio tape. Kinesio Taping Perfect Manual. Kinesio Taping Association. 1996
2. Kase k, Wallis J, Kase T. Clinical therapeutic aplications of the kinesio taping method. (2nd edition). Kinesio Taping Association. 2003
3. Thelen MD, Dauber JA, Stoneman PD. The Clinical Efficacy of Kinesio Tape for Shoulder Pain: A Randomized, Double-Blinded, Clinical Trial. J Orthop Sports PhysTher. 2008;38(7):389-395.
4. Murray H, Husk L. Effects of Kinesio taping on proprioception in the ankle. J Orthop Sports PhysTher. 2001;31:A-37.

5. Morris D, Jones D, Ryan H, Ryan CG. The clinical effects of Kinesio® Tex taping: A systematic review. Physiother Theory Pract. 2013;29(4)259-270.
6. Mostafavifar M, Wertz J, Borchers J. A systematic review of the effectiveness of kinesio taping for musculoskeletal injury. Phys Sportsmed. 2012;40(4):33-40.
7. Williams S, Whatman C, Hume PA, Sheerin K. Kinesio Taping in Treatment and Prevention of Sports Injuries: A Meta-Analysis of the Evidence for its Effectiveness. Sports Med. 2012;42(2):153-164.
8. Muaidi QI, Nicholson LL, Refshauge KM. Proprioceptive acuity in active rotation movements in healthy knees. Arch Phys Med Rehabil. 2007;89(2):371–376.
9. Bleakley C, McDonough S, MacAuley D. The use of ice in the treatment of acute soft-tissue injury: a systematic review of randomized controlled trials. Am J Sports Med. 2004;32(1):251–261.
10. Zazulak BT, Hewett TE, Reeves NP, Goldberg B, Cholewicki J. The effects of core proprioception on knee injury: a prospective biomechanical-epidemiological study. Am J Sports Med. 2007;35(3):368–373.
11. Wassinger CA, Myers JB, Gatti JM, Conley KM, Lephart SM. Proprioception and throwing accuracy in the dominant shoulder after cryotherapy. J Athl Train. 2007;42(1):84–89.
12. Ribeiro F, Mota J, Oliveira J. Effect of exercise-induced fatigue on position sense of the knee in the elderly. Eur J Appl Physiol. 2007;99:379–385.
13. Dover G, Powers ME. Reliability of joint position sense and force-reproduction measures during internal and external rotation of the shoulder. J Athl Train. 2003;38(4):304–310.
14. Bennell K, Wee E, Crossley K, Stillman B, Hodges P. Effects of experimentally induced anterior knee pain on knee joint position sense in healthy individuals. J Orthop Res. 2005;23(1):46–53.
15. Kneeshaw D. Shoulder taping in the clinical setting. J BodywMovTher. 2002;6:2–8.
16. Pincivero DM, Gandaio GB, Ito, Y. Gender-specific knee extensor torque, flexor torque, and muscle fatigue responses during maximal effort contractions. Eur J Appl Physiol. 2003;89:134–141.
17. Farina D, Merleti R, Enoka RM. The extraction of neural strategies from surface EMG. J Appl Physiol. 2004;96:1489-95.
18. Proske U, Wise AK, Gregory JE. The role of muscle receptors in the detection of movements. ProgNeurobiol. 2000;60:85-96.
19. Dvir Z. Isocinética – Avaliações Musculares, Interpretações e Aplicações Clínicas. Barueri, SP: Manole, 2002.
20. Chang HY, Chou KY, Lin JJ, Lin CF, Wang CH. Immediate effect of forearm Kinesio taping on maximal grip strength and force sense in healthy collegiate athletes. PhysTher. 2010;11:122-127.
21. Halseth T, McChesney JW, DeBeliso M, et al. The effects of Kinesio taping on proprioception at the ankle. J Sports SciMed. 2004;3:1—7.
22. Aytar A, Ozunlu N, Surenkok O, Baltaci G, OztopP,Karatas M. Initial effects of kinesio® taping in patients with patellofemoral pain syndrome: A randomized, double-blind study. Isokinetics and Exercise Science. 2011;19(2):135-142.