International Journal Series in Multidisciplinary Research (IJSMR), ISSN: 2455–2461
Vol. 2, No. 1, 2016, 1-10 http://ijseries.com/

Does "Kinesio-Taping" Influence Dynamic Standing Balance?

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ABSTRACT: The possible effects of Kineso-Tape (KT) on the dynamic balance in healthy adults is investigated. A total of 24 healthy males with no foot or lower limb deformities participated in the study. The study was composed of 2 experiments (A and B). The "A" experiment consisted of a comparison between the effects of KT and rigid tape on standing balance. The "B" experiment consisted of a test-retest study of the short-term effects of the both tapes (B1 and B2 respectively). The measured variable was the pressure distribution during 30s.

Results: The pressure distribution was significantly lower with application of KT than barefoot concerning the left and conversely ($P<.05$). The pressure distribution was higher with tape application than barefoot in the front side and conversely. Effects of KT and rigid tape were not significantly different ($p>.05$). The B1 revealed that pressure distribution on the left side was higher after 48-72h of rigid tape retention. The KT presented suitable simulative properties which were still present after 2-3 days. Accordingly, it should be used for proprioceptive therapy purposes. Contrary, rigid tape results in stabilizing the ankle joint which makes it appropriate for immobilizing joints.

KEYWORDS: taping, posture, kinesthetic, Kinesio

1. INTRODUCTION

Currently, a new adhesive tape exists and is used widely by gait and posture specialists. The *Kinesio-Tape* (*KT*) was invented by Kenso Kase in the 1970s. It is a thin elastic tape that can be stretched up to 140 % of its original length. According to its inventor, *KT* is meant to be able to reduce pain, swelling and muscle spasms [7, 10], in addition to preventing sport injury [6, 9 and 25]. In a study Kase argued that the benefits of the *KT are* by two principles; the neurofacilitation and the mechanical stimulus. Both approaches seem plausible since it has been reported that afferent stimulation (induced by skin stretch) could enhance the contraction of the underlying muscles [12] by increasing the motor unit firing potential [16, 17].

In various literature reviews local benefits of applying *KT* applications on the skin and thereby influencing the musculotendinous system are mentioned. For instance, Lee [14] demonstrated that *KT* application could improve the muscle activity of the calf muscle, reducing Achilles tendon loading. This improvement of contractility properties has been confirmed by the study of Hsieh [11] who showed an enhancement of the triceps surae contraction, during vertical jumping, with elastic taping application.

The impact of both taping techniques and their possible effects on body function has been studied in the literature [4, 5, 8 and 19]. To our knowledge, literature presents a weak and disparate information of the different tapes' biomechanical properties as well as the adaptability to human-specific movements. Especially for lower limb stimulation this has never been-studied accurately. Even though *KT* is permeable the tapes properties could be affected by extreme perspiration and enclosed spaces such as shoe and tight clothing. Hence the observed improvement of balance and movement witnessed in the clinic after the *KT* application need serious investigations. Moreover none of the literature data verified the real plus-values of such a paramedical product compared to the "standard" and widely used white athletic tape. Therefore, the aims of this study are to investigate:

(I) The possible effects of *KT* on the dynamic balance in healthy adults.

(II) The longevity of the mechanical properties of both *KT* and *Rigid-Tape.*

2. METHODS

The study was composed of 2 experiments (A and B). The "A" experiment consisted of a comparison between the effects of *KT* (5cm x 5m, Biviax®) and *Rigid-Tape* (6cm x 2.5m of large, 3M®) on standing balance. The "B" experiment consisted of a test-retest study of the short-term effects of the both tapes (B1 and B2 respectively).

3. PARTICIPANTS

A total of 24 healthy males with no foot or lower limb deformities participated in the studies. Group A included 10 adults *(age: 26.87 ±5 years, height: 1.80 ±0.06 m, mass: 75 ±7.7kg)*, while groups B1 and B2 included 7 adults *(age: 27.28 ±5.4 years, height: 1.74 ± 0.03 m, mass: 76.7 ±9.2 kg)* and 7 adults *(age: 23.1 ±2.2 years, height: 1.87 ±0.08 m, mass: 71 ±8.2 kg)*, respectively. Participants wore shorts to avoid any additional skin stimulation on the lower limbs and they did not wear socks to avoid skin stimulation in the feet as well [2]. All participants provided a written informed consent for participation in the study. The Local Research Ethics Committee approved the study and it was conducted according to the ethical principles stated in the Declaration of Helsinki (1975).

4. CONDITIONS

Participants were measured in three conditions during the same day: standing 30s barefoot without application, with *KT* and with *Rigid-Tape*. The specific measurement times were: T0. Before application; T1 directly, after application; T2, after 24 hours and T3 after 48-72 hours. Each condition was repeated three times (3× 30s) following the recommendations of Pinsault [20]. Standing position was freely chosen during the first trial and repeated during all sessions using a piece of paper with a gap that represents the plantar edge. Tapes were kept on during the experiment in order to insure reliable and comparable measurements.

5. PROCEDURES

After a baseline questionnaire on health history of participants, equilibrium disorders, neuropathy and lower-limb and foot deformities, participants were tested in different taping conditions in a laboratory setting. During testing sessions, participants wore boxer shorts only. They were asked to comfortably stand on the pressure platform during 30 seconds with arms resting along the body. The *KT* was pre-stretched at 10% and applied on calf muscle using the Y-shape according to Kase (1980) recommendations. First, the base of the Y-shaped *KT* was applied to the surface of the calcaneous bone on the foot sole with the participant in a relaxed prone position. Then the two *KT* strips were applied onto the soleus muscle and ending on the surface of both medial and lateral gastrocnemius muscles below the knee joint (Figure 1). The ankle joint was put into dorsiflexion when the tape was being applied.

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Figure 1 This Y-shaped *KT* technique was applied to the calf muscle using both tapes.

For the *Rigid-Tape* application the same Y-shaped technique was applied to allow complete comparability between both tape types. Between-trial rest consisted of 1 minute of comfortable walking. Standing position was controlled by a visual target, drawn on the wall in order to optimize the body verticality. Dynamic plantar pressures were measured at 100 Hz sampling rate using a baropodometry platform (WinPod®, Medicapteurs, Balma, FRANCE).

6. DATA ANALYSIS

Data of post urography platform were analyzed using Microsoft Excell® and Matlab, Version R2007b (Mathworks®, CA, and USA). The pressure point matrix was divided into 4 equidistant "anatomical" regions, which were further named the 2 hind-foot and fore-foot regions of each foot. For each region, the peak pressure–time integral was calculated first as the time integral of the peak pressure measured in any pressure point (i.e. sensor) within the region during 30s. This is the area under the peak pressure–time curve of a particular region. Then, each area was expressed as a percentage of the sum of the 4 areas, representing a "pressure distribution' (%)". Hence, the pressure distribution over the support polygon was redistributed into 4 zones. These zones are the variables of the studies, as follows:

- Right side = sum of the 2 right equidistant regions
- Left side = sum of the 2 left equidistant regions
- Front side = sum of the 2 fore-foot regions
- Back side = sum of the 2 hind-foot region

7. STATISTICAL ANALYSIS

All descriptive statistics were used to verify whether the basic assumption of normality of all studied variables was met. In a study Shapiro-Wilk tests revealed no abnormal data pattern. A one-way analysis of variance (ANOVA) with Fisher's post-hoc test was used to detect any differences between the means of the 3 trials of each condition. The statistical tests were processed via STATISTICA, version 7 (Statsoft®, Tulsa, OK, USA). The alpha level was set at ($p < .05$).

8. RESULTS

The results of the experiment A are shown in Figure 2 and Figure 3. The ANOVA shows that the pressure (weight) shift/redistribution was significantly lower with application of *KT* than barefoot on the left side [F (2, 21) = 2.31, p=.01] and inversely on the right side [F (2, 21) = 2.59, p = .00] (Figure 2). However the *KT* and *Rigid-Tape* effects are not significantly different (p>.05).

The shift /redistribution was higher with the *Rigid-Tape* application than in control condition (barefoot) on the front side [F (2, 21) = 3.65, p = .00] and inversely on the back side [F (2, 21) = 3.21, p = .01]. Nonetheless the *KT* and *Rigid-Tape* effects are not significantly different (p>.05).

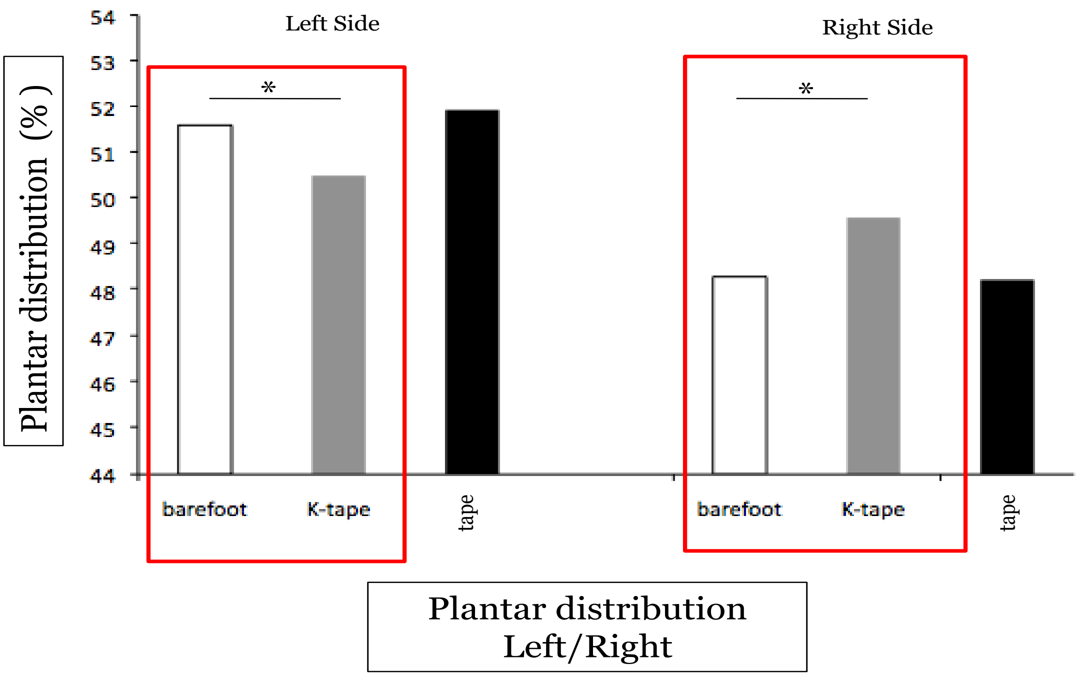

Figure 2 Comparison of plantar pressure redistribution/division of the right and left sides' when *barefoot* in Kinesio-tape with *rigid tape* applied.

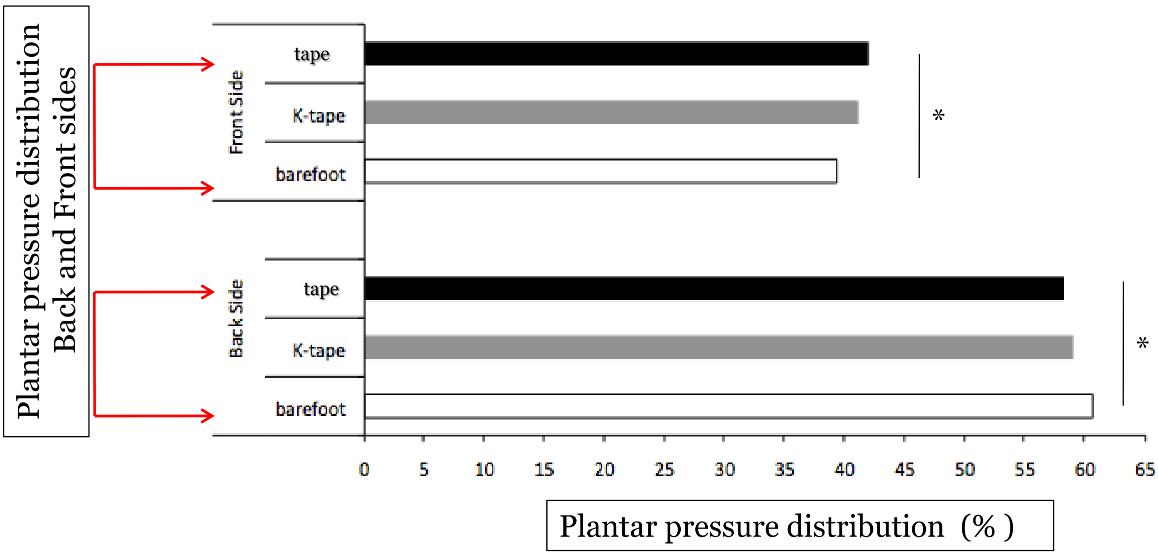

Figure 3 Comparison of front and back sides' plantar pressure redistribution/ division among *barefoot, Kinesio-tape* and *rigid tape* conditions.

International Journal Series in Multidisciplinary Research (IJSMR), ISSN: 2455–2461
Vol. 2, No. 1, 2016, 1-10 http://ijseries.com/

Experiment B1 revealed that the shift / redistribution on the left side was higher after 48-72h of wearing *Rigid-Tape* [F (3, 19) = 4.52, p = .00] (Figure 4). However, no effects were reported in the sagittal plane. B2 revealed no effects of wearing *KT* during 48-72h in both sagittal and coronal planes (Figure 5) (p>.05).

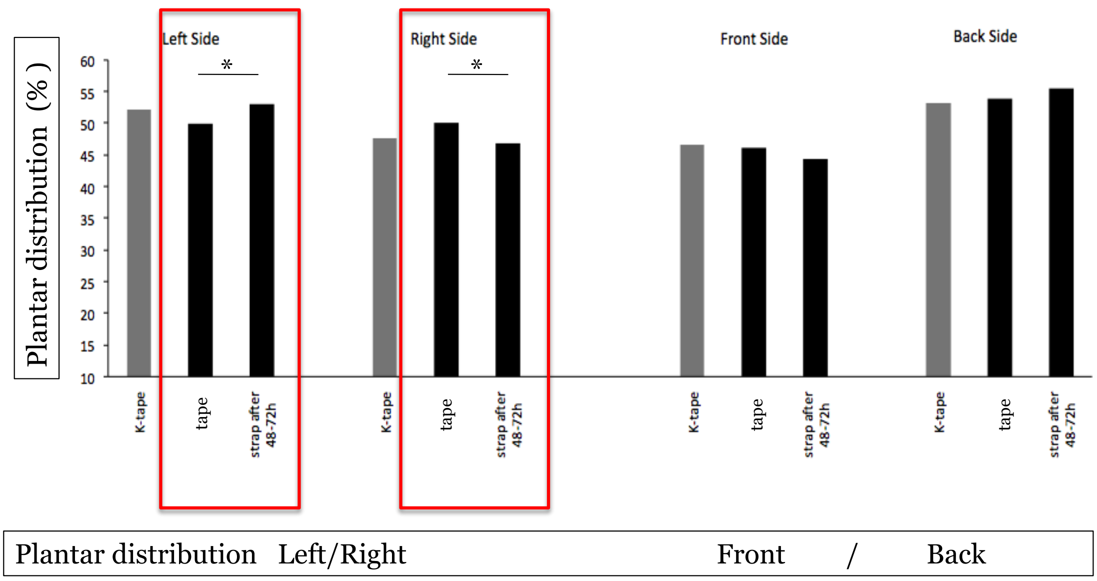

Figure 4: Longevity of *rigid tape* from the first day to 48-72 hours.

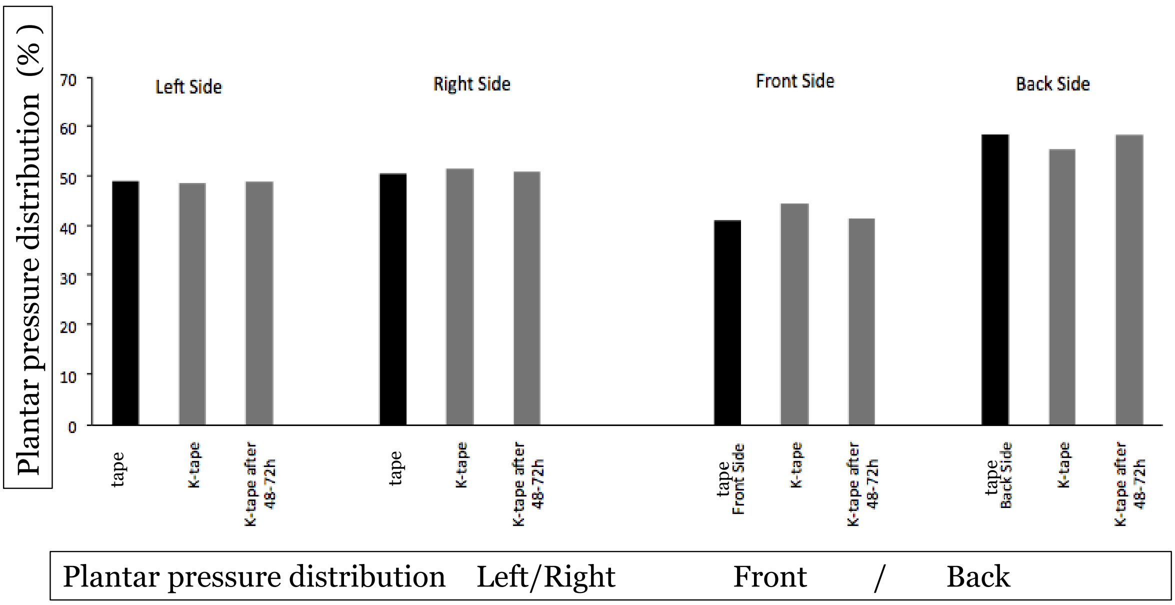

Figure 5 Longevity of *Kinesio-Tape* between the first day and 48-72 hours

9. DISCUSSION

The *KT* is an adhesive tape which is widely used in rehabilitation. In order to investigate the efficiency of a specific *KT* application, dynamic standing posture tasks have been studied in order to highlight (A) the plus-values of *KT* compared to standard tape - and (B) to detect the possible balance benefits in healthy adults during the first day of application as well as after 72 hours.

The experiment A showed that *KT* induces pressure (weight) shift / redistribution from the left to the right side, without affecting the anterior-posterior pressures. However, *KT* did not affect the medio-lateral distribution and unexpectedly increased the pressures on the forefoot. Accordingly, *KT* is more likely to affect medio-lateral balance adjustments since it has more elastic properties that *Rigid-Tape*. This elasticity determines the skin movement which is closely related to ankle mobility as reported in the literature [1].

The experiments B1 and B2 clearly showed the long lasting effects of *KT* with no effects on anterior-posterior plane in accordance to the findings of Slupik et al. [23]. Slupik et al. [23] reported an increase in the bioelectrical activity of the muscle after 24 hours of *KT* and the maintenance of this effect for another 48 hours following the removal of the tape. In regards to *Rigid-Tape* use, it is most likely to instantly disturb the balance by moving the participants forward while the balance on the platform was maintained. However, retention properties seem to weaken after 48 hours of taping, which proves low longevity of properties. Longevity issues could be explained by two hypotheses: 1) mechanical properties of the tapes themselves or 2) mid-term postural adaptation. Looking at the results of this study, *Rigid-Tape* could involve instant somesthesic stimulations that occur in the taped lower limb. This could possibly dissipate in time as the initial sensory input recovers after 2 or 3 days.

Subsequently *Rigid-Tape* mainly acts as a restraint “handbrake” in accordance with Boelens and Loos [3]. The longevity of the *KT* elastic properties as observed in the current study shows that this tape is designed to act as an active “stimulus” allowing for improvement of postural control. In our case for example the Y-shaped *KT* was applied to the Triceps Surae. In a study Lin et al. [15] found correlations between improvements in electromyography activity in trapeze muscle and *KT*. This corroborates with the findings of Kunzler et al. [13] who reported postural enhancement after the application of elastic adhesive tape over the Achilles tendon in non-fatigued subjects. Moreover, the literature shows that such cutaneous stimulation reduced postural perturbations in the young and elderly persons presenting with peripheral neuropathic disorders [18]. Skin touch in healthy adults presenting lower limb sensory loss has effected on stability during standing [21].

Degraded postural performance after muscle fatigue can be compensated by skin stimulation [24] and light touch influences postural stability in post stroke patients [22].

10. CONCLUSION

KT presented suitable simulative properties which were still present after 2-3 days. For this reason it should be used for proprioceptive therapy purposes. On the contrary, *Rigid-Tape* results in stabilizing the ankle joint which makes it appropriate for immobilizing joints. The use of both *KT* and *Rigid-Tape*, whether simultaneously or alternately, deserves further investigation.

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