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Original Article

Acute and 48 h effect of kinesiotaping on the handgrip strength among university students

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ABSTRACT

Merino-Marban R, Mayorga-Vega D, Fernandez-Rodríguez E. Acute and 48 h effect of kinesiotaping on the handgrip strength among university students. *J. Hum. Sport Exerc.* Vol. 7, No. 4, pp. 741-747, 2012. This study aimed to determine the acute and 48 h effect of kinesiotaping (KT) on the maximal grip strength of wrist flexor muscle, and the comfort level immediately and after 48 h with the KT applied on the forearm. A sample of 31 university students (eight females and 23 males) (mean age 23.71 ± 2.78 years; mean body mass 72.05 ± 13.54 kg; mean body height 173.81 ± 8.91 cm; mean body mass index 23.69 ± 3.24 kg/m2) participated in the present study. The left or right forearm of the participants was taped randomly. Only one of the forearms of each participant was taped (EH) while the other acted as a control (CH). Handgrip strength and the comfort of wearing the KT were tested: (1) without taping; (2) 15 min after taping; (3) 48 h after taping with the KT remaining in situ and (4) 15 min after removing the tape. The results of the ANOVA showed no interaction effects between the group variable (EH, CH) and time (1, 2, 3, 4) [F (3, 156) = 1.140; p= 0.332; η2p = 0.021; P = 0.282] in the handgrip strength. No changes were found in maximal grip strength immediately and 48 h after KT application. The level of comfort after 48 h wearing the KT on the forearm was very high. **Key words**: KINESIO TAPE, GRIP STRENGTH, Y TECHNIQUE, FOREARM MUSCLE.

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INTRODUCTION

Kinesiotaping (KT) may increase or reduce muscle strength, and many investigators hypotheses to explain the possible underlying mechanism (Fu et al., 2008). The explanation for relaxing or tonifying effect of KT in the musculature is so far quite unsatisfactory, but apparently based on a neurofacilitation, rather than a purely mechanical mechanism (Sijmonsma, 2007).

There are two basic application directions of the KT for treatment of muscles. The KT is applied from insertion to origin to inhibit muscle function and where increased contraction is desired the KT is applied from origin to insertion to facilitate muscle function (Kase et al., 2003).

According to Espejo and Apolo (2011) none research can say categorically that the KT increases or decreases the strength. O'Sullivan and Bird (2011) stated in their review that the therapeutic value of KT have yielded evidence of significant improvements in range of motion and reduction of pain, but there is limited research evidence pertaining to the effect of KT on strength.

Regarding the application of KT for strength changes, there have been done several studies with conflicting results. Chang et al. (2010) did not found changes in maximal grip strength after application of KT on the forearm. Vithoulk et al. (2010) studied the effect of KT on quadriceps strength. The results suggested that KT application could increase the eccentric muscle strength. Fu et al. (2008) analyzed strength of the quadriceps without finding changes after application of KT. Rodriguez-Moya et al. (2011) found a 20% decrease in maximal isometric strength following the application of KT on the quadriceps. Wong et al. (2012) examined the maximal concentric knee extension and flexion after the KT application over the vastus medialis. The application of KT did not alter the muscle peak torque generation and total work done but shortened the time to generate peak torque.
The KT is regarded as hypoallergenic (Murray, 2000; Zajt-Kwiatkowska et al., 2007) and is manufactured to minimize discomfort of the skin (Huang et al., 2011). However, in some researches about KT one of the exclusion criteria for the participants is to be allergic to KT adhesive (Rodriguez-Moya et al., 2011; Schneider et al., 2010).

In conclusion, currently there has been a lack of conclusive scientific data on the use of KT as a valid option to modified strength, and due to the paucity of consistent results, further research is necessary to clarify this issue. Furthermore it has not been found any research about comfort or discomfort of wearing KT. The aims of this research were to determine: a) The acute and 48 h effect of KT on the maximal grip strength of wrist flexor muscle among university students, and b) the comfort level immediately and after 48 h with the KT applied on the skin of the forearm.

MATERIAL AND METHODS

Participants
A sample of 31 university students (eight females and 23 males) (mean age 23.71 ± 2.78 years; mean body mass 72.05 ± 13.54 kg; mean body height 173.81 ± 8.91 cm; mean body mass index 23.69 ± 3.24 kg/m^2) participated in the present study. None of the participants reported any form of musculoskeletal disorder at the time of testing. Participants were thoroughly informed of the protocols and procedures before their participation, and informed consent was obtained from them all. The study was approved by the Ethics and Research Committee of the University of Malaga.

Measures

Handgrip strength. Handgrip strength was measured using a digital hand dynamometer (T.K.K. 5401 Grip-D; Takey, Tokyo, Japan), and the scores were recorded in kilograms. The reported precision of the dynamometer was 0.1 kg. In brief, the participants were standing during the entire test with the arm at the side with the shoulder slightly abducted, the elbow extended, and the forearm and wrist in neutral position. Each participant performed the test twice (alternately with both hands) in random order and allowing a 1-minute rest between measures. For each measure, the hand to be tested first was chosen randomly (Ruiz-Ruiz et al., 2002). The grip spans used were 5.5 for women and 6 cm for men (Fransson & Winkel, 1991). For each hand the best result was retained.

Comfort level

An 11-point rating scale was used to monitor the comfort feel associated with wearing the KT. The anchors on the scale ranged from 0 = "very uncomfortable" to 10 = "very comfortable". The scale was administered after 15 minutes of application of the KT and after 48 h of being wearing the KT.

Procedure

The present study was conducted as a randomized controlled experimental design. Muscle strength of the participants was assessed under four conditions: (1) without taping; (2) 15 min after taping; (3) 48 h after taping with the tape remaining in situ and (4) 15 min after removing the tape. No warm-up was performed by the participants prior to the test measurements. The left or right forearm of the subjects' arms was taped randomly. So, that only one of the forearm of each subject was taped (Experimental Hand, EH) while the other acted as a control (control Hand, CH). All measurements were carried out during two sessions, with a difference of 48 h, at the same time (from 11 to 15 pm) with the same conditions (24ºC) at the Human Movement Laboratory of the University of Malaga College of Education.

Taping technique

A white 5 cm wide kinesio tape (Kinesiology tape®, Korea) was used. Guidelines for KT of the forearm were consistent with the protocol for medial epicondylitis of the elbow as suggested by Kase et al. (2003). Kinesio tape was applied on the wrist flexor muscle of the hand. Before applying the tape, the length of tape was measured from 2 cm inferior to the medial epicondyle of the humerus to the wrist joint line. A roll of tape was cut into a strip and then cut down the middle of the strip to produce 2 tails or a "Y-strip." The Y-strip was applied on the common wrist flexor muscle from its insertion to origin with 15-20% stretch tension. The first tail of the Y strip was applied on the middle of the forearm with the wrist in a hyperextended position and with the elbow in full extension and the forearm in full supination. The second tail of the Y-strip, also applied from insertion to origin with 15-20% stretch tension, was taped along the medial edge of the forearm to wrap the common wrist flexor muscles. The CH went through the same procedure of stretching but the KT was not applied. Participants were taped by the same physical therapist.

Analysis

Descriptive statistics (means and standard deviations) of height, body mass, body mass index, handgrip strength and comfort were calculated. A two-way analysis of variance (ANOVA) with the group (EH, CH) was carried out as between-subjects factor and time (baseline, 15 min after taping, 48 h after taping with the tape remaining in situ and 15 min after removing the tape) repeated measures factor on the values obtained in testing handgrip strength. For *post hoc* analysis, α values were corrected using the Bonferroni adjustment. The effect size (g) was used to determine the magnitude of treatment effects (Hedges, 1981). Statistical power (P) for the n size was determined as well. Because comfort variable did not follow a normal distribution, the Wilcoxon signed-rank test was used to compare comfort scores. The internal

consistency for handgrip strength test was estimated using the intraclass correlation coefficient from two-way ANOVA ($ICC_{3,k}$) (Shrout & Fleiss, 1979). Furthermore, as suggested by Baumgartner and Chung (2001), 95% interval of confidence was calculated. Statistical analysis was performed using SPSS 15.0 for Windows (SPSS ® Inc., Chicago, IL). The statistical significance level was set at $p < 0.05$.

RESULTS

Four participants´ data were rejected because they did not attended the second session of evaluation. Mean values and standard deviations obtained in the handgrip strength test, as well as the results of repeated measures ANOVA and the Bonferroni adjustment, are in Table 1. The results of the ANOVA on the average obtained in the handgrip strength showed no interaction effects between the group variable (EH, CH) and time (1, 2, 3, 4) [$F (3, 156) = 1.140$; $p= 0.332$; $\eta^2_p = 0.021$; $P = 0.282$]. For *post hoc* analysis, ANOVA with Bonferroni adjustment showed no statistically significant differences for EH (ps = 1.000) and CH (ps $\geq$ 0.121). The reliability for the handgrip strength test was 0.97 (0.95-0.98).

Table 1. *Effect of Kinesio taping on handgrip strength (kg).*

Hand	Baseline (1) (M ± SD)	15 min (2) (M ± SD)	48 h (3) (M ± SD)	No KT (4) (M ± SD)	p^a	Effect size[b]		
						1-2	1-3	1-4
EH	41.76±11.75	42.59±12.46	42.63±11.95	42.70±13.09	0.332	-0.01	0.08	0.12
CH	42.23±10.92	43.13±11.29	42.23±11.81	41.86±11.80				

Note. M = mean; SD = standard deviation; EH = Experimental hand; CH = Control hand; p^a = Significance level from ANOVA; Effect size[b] = Hedges'g effect size.

Rating of comfort after 15 minutes of wearing the KT was 9.15 ± 1.03 and 48 h after of being wearing the KT was 9.19 ± 0.92. The results of the Wilcoxon signed-rank test showed no statistically significant differences (p = 0.809). No one of the participants reported any type of complaint or chafes during the intervention (rank = 7-10).

DISCUSSION

The results of the present study demonstrated that forearms that received KT with a insertion to origin technique exhibited no effective change in maximal grip strength 15 min after taping, 48 h after taping with the tape remaining in situ and 15 min after removing the tape, when compared to the no taped forearms. Regarding the measurement of maximal grip strength, the results of the present study agrees with Chang et al. (2010) who did not find facilitation or inhibition acute effects for maximal grip strength by using KT, with the same insertion to origin technique on the forearm. Unlike Chang et al. (2010) the present study examine the long-term effects on muscle strength following application of KT, but likewise found no effects after 48 h wearing the KT. Schneider et al. (2010) using the same KT technique, Y-shape from insertion to origin, but on the forearm extensors muscle in healthy collegiate tennis players also did not find changes on the strength. However, KT was associated with less of a decrease in muscular strength than that seen in a no tape condition. In the present study, it could be that the simple hand dynamometry assessment was unable to show the effect of KT in controlling the descent of force.

In the same way, other studies has produced no effects on the strength performance with the difference to the present research that in all of them the KT was applied from origin to insertion. Thus, Fu et al. (2008) applied KT to the quadriceps of fourteen healthy young athletes assessing muscle strength by an isokinetic dynamometer under three conditions: without taping, immediately after taping and 12 h after taping with the KT remaining in situ. The result revealed no significant difference in muscle power among the three conditions. Wong et al. (2012) examined the maximal concentric knee extension and flexion by an isokinetic dynamometer with and without the KT application onto the skin overlying the vastus medialis in 30 healthy participants. There was no significant main effect between taping conditions. In contrast, Vithoulk et al. (2010) study revealed a significant statistical increase of the peak torque during eccentric isokinetic exercise of quadriceps muscle when the KT application was compared with the placebo taping and without tape application in 20 healthy women. Hsu et al. (2009) investigated the effect of KT on lower trapezius strength in 17 baseball players with shoulder impingement. The results showed a trend that the KT increased the lower trapezius strength in comparison to the placebo taping.

Some studies were conducted to determine the effects of KT on changing the transdermal electromyography of the muscles. Slupik et al. (2007) found significant increases in the bioelectric activity of the vastus medialis after 24 h of KT and in maintaining this effect for two days following removal of the KT. Hsu et al. (2009) found a significant increased lower trapezius muscle activity compared to the placebo taping. Murray (2000) studied the effects of KT applied to the quadriceps after anterior cruciate ligament-repair in two healthy adults, and found an immediate increase of electromyography (EMG) amplitude under KT condition compared to no tape and athletic tape conditions. Despite the encouraging results in some of the EMG studies, increase in the bioelectric activity of the muscles may not be expressed in the necessary force output to change the muscle strength (Chang et al., 2010). On the contrary, Martínez-Gramage et al. (2011) analyzed the immediate effect of KT with two techniques (inhibition and facilitation). Superficial EMG was recorded to compare the reflex response of the vastus medialis under three different conditions: without KT, with KT origin to insertion and with KT insertion to origin. The results suggest that the application of KT origin to insertion and KT insertion to origin does not have an immediate effect on the reflex response of the analyzed muscle. In the same line, Vera-Garcia et al. (2010) analyzed the immediate effect of the KT application on reflex response of biceps femoris and gastrocnemius lateralis in 11 healthy participants, and did not found immediate effect on the reflex response of the analyzed muscles. A possible explanation for the negative results observed in the current study is that KT insertion to origin technique slightly inhibits the muscles at first moment (Schneider et al., 2010). But the magnitude of cutaneous afferent stimulation generated by KT may not have been strong enough to modulate the muscle strength (Fu et al., 2008; Chang et al., 2010).

The KT is manufactured to minimize discomfort and being wearable for various days (Kase et al., 2003; Huang et al., 2011). But KT could cause allergies and/or chafes, so there is need for cautious application, particularly in neurological patients with possible sensory disorders or consciousness disorders (Mikołajewska, 2011). In the current study the level of comfort and feel of wearing the KT after 15 minutes of its application was almost very comfortable, and 48 h after of being wearing the KT the level even raised slightly. There was no difference in comfort immediately and 48 h after being wearing the KT. No one of the participants reported any type of complaint or chafes during the intervention. This is in agreement with the unique study found that assessed the comfort of wearing KT. Ten patients with breast oedema were applied KT to the breast weekly for a period of three weeks. All patients reported the KT to be comfortable while in place (Finnerty et al., 2010).

Perhaps the employed hand dynamometer assessment does not have the necessary precision to capture the subtle changes in the strength caused by the KT. It would have been necessary to use an EMG to measure changes in muscle bioelectrical activity of the forearm flexor muscles. Another limitation is that we did not include an alternative taping technique or a sham tape application to compare with it.

CONCLUSIONS

The results revealed no changes in maximal grip strength immediately and 48 h after Kinesiotaping application on the wrist flexor muscles in healthy university students. The level of comfort after 48 h wearing the KT on the forearm is very high in healthy college students.

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REFERENCES

1. BAUMGARTNER TA, CHUNG H. Confidence limits for intraclass reliability coefficients. *Meas Phys Educ Exerc Sci.* 2001; 5(3):179-88. doi:10.1207/S15327841MPEE0503_4 [Back to text]
2. CHANG H-Y, CHOU K-Y, LIN J-J, LIN C-F, WANG C-H. Immediate effect of forearm Kinesio taping on maximal grip strength and force sense in healthy collegiate athletes. *Phys Ther Sport.* 2010; 11(4):122-7. doi:10.1016/j.ptsp.2010.06.007 [Back to text]
3. ESPEJO L, APOLO MD. Bibliographic review of the effectiveness of kinesio taping. *Rehabilitación.* 2011; 45(2):148-58. doi:10.1016/j.rh.2011.02.002 [Back to text]
4. FINNERTY S, THOMASON S, WOODS M. Audit of the use of kinesiology tape for breast oedema. *J Lymphoed.* 2010; 5(1):38-44. [Back to text]
5. FRANSSON C, WINKEL J. Hand strength: the influence of grip span and grip type. *Ergonomics.* 1991; 34(7):881-92. doi:10.1080/00140139108964832 [Back to text]
6. FU TC, WONG AM, PEI YC, WU KP, CHOU SW, LIN YC. Effect of Kinesio taping on muscle strength in athletes-a pilot study. *J Sci Med Sport.* 2008; 11(2):198-201. doi:10.1016/j.jsams.2007.02.011 [Back to text]
7. HEDGES LV. Distribution theory for Glass's estimator of effect size and related estimators. *J Educ Stat.* 1981; 6(2):107-28. doi:10.2307/1164588 [Back to text]
8. HSU YH, CHEN WY, LIN HC, WANG WTJ, SHIH YF. The effects of taping on scapular kinematics and muscle performance in baseball players with shoulder impingement syndrome. *J Electromyogr Kinesiol.* 2009; 19(6):1092-9. doi:10.1016/j.jelekin.2008.11.003 [Back to text]
9. HUANG CH-Y, HSIEH T-H, LU S-CH, SU F-CH. Effect of the Kinesio tape to muscle activity and vertical jump performance in healthy inactive people. *Biomed Eng Online.* 2011; 10:70. doi:10.1186/1475-925X-10-70 [Back to text]
10. KASE K, WALLIS J, KASE T. *Clinical therapeutic applications of the kinesio taping method.* Albuquerque, NM: Kinesio Taping Association; 2003.
11. MARTÍNEZ-GRAMAGE J, IBÁÑEZ SEGARRA M, LÓPEZ RIDAURA A, MERELLÓ PEÑALVER M, TOLSÁ GIL FJ. Efecto inmediato del kinesio tape sobre la respuesta refleja del vasto interno ante la utilización de dos técnicas diferentes de aplicación: facilitación e inhibición muscular. *Fisioterapia.* 2011; 33(1):13-8. doi:10.1016/j.ft.2010.12.001 [Back to text]

12. MIKOŁAJEWSKA E. Side effects of kinesiotaping-Own observations. *J Health Sci.* 2011; 1(4):93-9. [Back to text]
13. MURRAY H. Kinesio taping, muscle strength and ROM after ACL repair. *J Orthop Sports Phys Ther.* 2000; 30(1, A-14). [Back to text]
14. O'SULLIVAN D, BIRD SP. Utilization of kinesio taping for fascia unloading. *Int J Athl Ther Train.* 2011; 16(4):21-7. [Back to text]
15. RODRIGUEZ-MOYA A, GONZÁLEZ-SÁNCHEZ M, CUESTA-VARGAS AI. Short-term effects of neuromuscular tape on knee extension force. *Fisioterapia.* 2011; 33(6):256-61. doi:10.1016/j.ft.2011.07.007 [Back to text]
16. RUIZ-RUIZ J, MESA JLM, GUTIÉRREZ A, CASTILLO M. Hand size influences optimal grip span in women but not in men. *J Hand Surg.* 2002; 27(5):897-901. doi:10.1053/jhsu.2002.34315 [Back to text]
17. SCHNEIDER M, RHEA M, BAY C. *The effect of kinesiotextape on muscular strength of the forearm extensors on collegiate tennis athletes.* Kinesiotaping. 2010 [updated 2011 December 29]. Retrieved from http://www.kinesiotaping.com [Back to text]
18. SHROUT PE, FLEISS JL. Intraclass correlations: Uses in assessing rater reliability. *Psychol Bull.* 1979; 86:420-8. doi:10.1037/0033-2909.86.2.420 [Back to text]
19. SIJMONSMA J. *Manual de taping neuro muscular* (1st Ed.). Portugal: Aneid press; 2007. [Back to text]
20. SLUPIK A, DWORNIK M, BIALOSZEWSKI D, ZYCH E. Effect of Kinesio Taping on bioelectrical activity of vastus medialis muscle. Preliminary report. *OrtopTraumatol Rehabil.* 2007; 9:644-51. [Back to text]
21. VERA-GARCÍA FJ, MARTÍNEZ-GRAMAGE J, SANMIGUEL R, ORTIZ R, VILANOVA P, SALVADOR EM, et al. Effect of Kinesio taping on reflex response of biceps femoris and gastrocnemius lateralis. *Fisioterapia.* 2010; 32(1):4-10. doi:10.1016/j.ft.2009.06.004 [Back to text]
22. VITHOULKA I, BENEKA A, MALLIOU P, AGGELOUSIS N, KARATSOLIS K, DIAMANTOPOULOS K. The effects of kinesio taping on quadriceps strenth during isokinetic exercise in healthy non-athlete women. *Isokinet Exerc Sci.* 2010; 18(1):1-6. [Back to text]
23. WONG OMH, CHEUNG RTH, LI RCT. Isokinetic knee function in healthy subjects with and without Kinesio taping. *Phys Ther Sport.* 2012. Advance online publication. doi:10.1016/j.ptsp.2012.01.004 [Back to text]
24. ZAJT-KWIATKOWSKA J, RAJKOWSKA-LABON E, SKROBOT W, BAKULA S, SZAMOTULSKA J. Application of Kinesio taping for treatment of sports injuries. *Medsportpress.* 2007; 13(1):130-4. [Back to text]