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Adhesion of Three Brands of Elastic Therapeutic Tape

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Purpose: The purpose of this study was to compare, over a period of 5 days, the rate of adhesion of TheraBand® Kinesiology Tape (TKT) with either KT Tape® (KT) or Kinesio® Tex Gold (KTEX) under 25% elongation among healthy adults.
Methods: In this study, 2 independent cohorts of 20 healthy volunteers were randomly assigned to simultaneously receive applications of 2 brands of deidentified elastic therapeutic tape (ETT) applied to their lower back at 25% elongation. Cohort 1 received TKT and KTEX tape, whereas cohort 2 received TKT and KT. Data were collected at 1 h (D1), 3 days (D3), and 5 days (D5) following the initial application of the ETT. Data collected included 3 digital photographs of the subjects' lower back. The percentage of the tape that remained adhered (0%–100%) was assessed independently by 3 evaluators and then averaged to arrive at a percentage of tape adhesion for each brand of tape at each data collection point.
Results: Repeated-measures ANOVA of cohort 1 indicated no differences ($P > .05$) in adhesion between the TKT and KTEX at any data collection point, although post hoc analysis of the significant time effect indicated that the rate of adhesion of the KTEX brand declined from D1 (97%) to D3 (74%) to D5 (59%), whereas that of the TKT tape did not change over the duration of the study (97%, D1; 86%, D2; 70%, D3). In cohort 2, the analysis indicated a significant interaction effect with the KT brand (99%, D1; 67%, D2; 35%), declining over the course of the study and exhibiting lower rate of adhesion than the TKT (99%, D1; 83%, D2; 76%, D3) brand at D3 and D5. The rate of adhesion of the TKT tape did not significantly decline in cohort 2.
Conclusions: Clinicians can use evidence from this study when choosing different ETT brands.

Keywords: Elastic therapeutic tape; kinesiology tape; adhesion

Key point: The percentage of adherence of the kinesiology tape decreases over 5 days. Different brands of kinesiology tapes have varying adhesion times.

Elastic therapeutic tape (ETT) was popularized by Dr. Kenzo Kase in the 1970s.[1] ETT has been reported to provide a number of potentially beneficial effects including reduction in pain,[2,3] change in muscle activation,[4] improvement in circulatory and lymphatic flow,[5] and improvement in joint proprioception.[6] However, authors of recent systematic reviews reported little to no effect of ETT in reducing pain in individuals with musculoskeletal injury.[7,8] These inconclusive findings regarding the effectiveness of ETT are in part attributable to varying application techniques, different methods of measuring the outcomes, and different characteristics of the ETT including adhesion.[9] Even with inconsistent evidence regarding the efficacy of ETT, this treatment has been widely adopted in clinical settings[10,11] and it has become increasingly popular among professional and amateur athletes.[12,13]

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No studies have compared the differential effects of the leading ETT brands. A critical prerequisite to the efficacy of any brand of ETT is that it remains adhered to the skin for the duration of the prescribed treatment. Previous clinical trials have applied ETT from 3 to 7 days[14,15]; however, no author has mentioned the adhesion properties of the tape or compared the adhesion properties of the leading ETT brands in a blinded trial. The purpose of this study was to compare, over a period of 5 days, the rate of adhesion of the TheraBand® Kinesiology Tape (TKT) with either KT Tape® (KT) or Kinesio® Tex Gold (KTEX) at 25% elongation among healthy adults. A secondary purpose was to examine the relationship between adhesion of 3 ETT brands and the duration of time participants spent in physical activity or showering.

These purposes were addressed by evaluating the following 2 research hypotheses and 1 research question:

H1: There will be a difference in adhesion over 5 days between TheraBand Kinesiology Tape and Kinesio Tex Gold applied at 25% elongation when applied to the lower backs of healthy adults.

H2: There will be a difference in adhesion over 5 days between TheraBand Kinesiology Tape and KT Tape applied at 25% elongation when applied to the lower backs of healthy adults.

RQ1: Is there a relationship between adhesion over 5 days of TheraBand Kinesiology Tape with either Kinesio Tex Gold or KT Tape under 25% elongation and the time spent in physical activity or showering.

METHODS

Here, 2 independent cohorts of 20 healthy volunteers were randomly assigned to receive applications of two brands of deidentified ETT. The rate of adhesion of each brand of ETT was assessed at 1 h (D1), 3 days (D3) and 5 days (D5) following the initial application of the ETT. At D3 and again at D5, the duration of time subjects spent for showering or indulging in physical activities over the previous 2 days was also recorded.

Participants

A convenience sample of 40 healthy adults between the ages of 21 and 65 years without a history of previous back pain volunteered in response to word-of-mouth recruitment efforts among patients and staff members in an outpatient chiropractic clinic. Individuals who responded to this recruitment effort were then referred to a project coordinator who explained the study and obtained written consent from the subject (IRB approval #SSR.2015.1). Once enrolled, subjects completed a brief demographic form and were assigned by order of enrollment alternatively to 1 of 2 study cohorts. Each cohort completed a 5-day trial, during which 2 pieces of ETT were applied to their lower back. Subjects assigned to cohort 1 received TKT and KT, while subjects in cohort 2 received TKT and KTEX. At D1, D3, and D5, 3 digital photographs (left side, right side, and straight on) of the subjects' lower backs where the ETTs were applied were collected by the project coordinator.

Procedures

A single project coordinator, with 5 years of experience in applying ETT as a licensed athletic trainer, applied ETTs to each subject's back for 5 days. Only the project coordinator was aware of the ETT brands used until data were unblinded following completion of data analysis. The ETT brands were consistently applied to the same side of the subject's back within each cohort, with cohort 1 receiving TKT applied to the right side and KTEX applied to the left. In cohort 2, TKT was applied to the right side and KT was applied to the left. All the ETTs were of the same color (black) and were devoid of any product identifiers. Each ETT was bilaterally applied at 25% elongation beginning at L5 along the lateral erector spinae approximately 2 inches lateral to the spinous process, consistent with guidelines established by Kinesio® Taping Association.[1] The subjects were not told which ETT brand they received. Subjects were told to engage in their "usual" activities including physical activity and showering with no special care instructions for the taped areas over the next 5 days. Subjects were also instructed not to reattach the ETT if it became disconnected from their skin. Following the final data collection point, both ETTs were removed from the subject.

Data Collection

At D1, D3, and D5, 3 high-resolution digital photographs were taken of each subject's lower back where the ETTs were applied. These photographs were taken from the right side, left side, and straight on while the subject was standing, approximately 24 inches away from the subject's skin in the same room under the same lighting conditions to ensure consistency and background of the photo (see Figures 1 and 2). Each of these sets of photographs was sent electronically to 3 independent evaluators, each of whom had had least 3 years of experience working with ETTs. These evaluators were blind to the ETT brands and the time point at which the pictures were collected. After studying each set of the 3 photographs, the evaluators provided an "adhesion score" on the basis of their judgment of the percentage of each ETT that remained adhered to the skin ranging from 0% to 100%. At data collection points D3 and D5, subjects were asked to

FIGURE 1. Set of 3 digital photographs of 2 ETT brands with 100% adhesion on the right and left sides.

recall the duration of time, in minutes, they spent showering and engaging in physical activities that resulted in perspiration over the previous 2 days.

Statistical Analysis

Interclass correlations between the 3 evaluators' adhesion scores indicated a high degree of agreement of the evaluators' scores at D3 ($r = 0.99$, $P < .00$) and D5 ($r = 0.99$, $P < .00$). The adherence scores reported by the evaluators at D1, 1 h following ETT application were almost all 100%, yielding a moderate interclass correlation ($r = 0.83$, $P < .00$). Because there was a high degree of agreement between the reviewers' scores, the 3 reviewers' scores were averaged to obtain 1 adhesion score at each data collection point for each brand of ETT that was used in the analysis to address the 2 hypotheses and 1 research question.

Analyses of the data were completed in three steps. The first step involved comparing the 2 cohorts' discrete measures with chi-square analysis, and the continuous variables with *t*-tests to determine whether the 2 cohorts of subjects were similar. The second step of the analysis addressed the 2 hypotheses by calculating 2 separate repeated-measures ANOVA statistics to determine if adhesion scores of the 2 brands of tape differed within or between the brands over the 3 data

FIGURE 2. Set of 3 digital photographs of 2 ETT brands with 93% adhesion on the left and 35% on the right.

collection points. If a significant main or interaction effect ($P < .05$) was detected by the repeated-measures ANOVA, then Bonferroni post hoc comparisons were completed to determine the specific differences between means. The final step in the analysis addressed the research question by calculating Pearson *r* correlations to determine whether adhesion of the ETT brands at D3 or D5 was significantly ($P < .05$) related to the duration of time spent indulging in physical activity or showering during the 2 days before the adhesion measurements at D3 and D5.

RESULTS

Table 1 indicates the 2 cohorts had similar gender and racial characteristics and were 27.20 ± 4.20 years old with a BMI of 25.32 ± 4.11 kg/m^2. Cohort 1 engaged in significantly fewer minutes of showering prior to D5 and trended nonsignificantly in fewer minutes of showering prior to D3 compared with cohort 2. By contrast, cohort 2 engaged in significantly less physical activity before both D3 and D5 than cohort 1.

Results addressing *H1* are presented in Table 2. This table indicates no effect of tape brand and no interaction effect between tape brand and time; however, a

Table 1. Comparison of subjects in cohorts 1 and 2

Demographic Characteristic		Cohort 1 (n = 20) # (%)	Cohort 2 (n = 20) # (%)	Total (n = 40) # (%)	Statistic
Gender	Male	14 (70%)	10 (50%)	24 (60%)	$\chi^2 = 1.67$
	Female	6 (30%)	10 (50%)	16 (40%)	$P = .20$
Race	African American	5 (25%)	9 (45%)	14 (35%)	$\chi^2 = 3.14$
	Caucasian	9 (45%)	9 (45%)	18 (45%)	$P = .21$
	Other	6 (30%)	2 (10%)	8 (20%)	
		Mean ± SD	**Mean ± SD**		
Age		27.55 ± 4.17	26.85 ± 4.32		$t = 0.52$ $P = .61$
BMI		24.98 ± 4.17	25.65 ± 4.06		$t = 0.57$ $P = .56$
Total shower duration D1–D3 (min)		47.25 ± 64.10	82.50 ± 48.30		$t = 1.97$ $P = .06$
Total shower duration D3–D5 (min)		38.25 ± 45.52	85.50 ± 56.57		$t = 2.91$ $P = .01$
Physical activity D1–D3 (min)		48.75 ± 60.89	20.25 ± 10.92		$t = 2.06$ $P = .04$
Physical activity D3–D5 (min)		30.75 ± 11.27	20.25 ± 10.91		$t = 2.99$ $P = .01$

Table 2. Cohort 1 comparing adhesion of KTEX with TKT over 5 days

Tape	1 h (D1) Mean ± SD	3 days (D3) Mean ± SD	5 days (D5) Mean ± SD	*R*-ANOVA Statistic			
					F	*P*	η^2
KTEX	97.10 ± 5.56	74.25 ± 35.50*	59.42 ± 45.71*	Time	26.75	.00	0.35
TKT	97.33 ± 2.26	85.75 ± 23.82*	67.97 ± 38.27*	Tape brand	0.87	.36	0.02
				Time × Tape	0.41	.53	0.02

* Indicates within group difference from D1 over time.
η^2 indicates partial eta square.

significant time effect ($P < .05$) was detected. The adhesion of the TKT and the KTEX brands was never significantly different at any data collection point over the duration of the study. The post hoc analysis indicated that the adhesion of the KTEX and TKT brands did similarly decline ($P < .05$) between D1 and D2 and between D2 and D3. The adhesion of the TKT brand significantly ($P < .05$) declined between D1 to D3 (97.22% to 85.75%) and between D3 to D5 (85.75% to 67.97%), whereas the rate of adhesion of the KTEX brand exhibited a similar significant ($P < .05$) decline between D1 to D3 (97.10% to 74.25%) and between D3 to D5 (74.25% to 59.42%) ($P < .05$).

The data presented in Table 3 address *H2* and indicates a significant ($P < .05$) interaction effect. The post hoc analysis indicated that the rate of adhesion of the TKT brand did not significantly change between D1 to D2 (98.75% to 83.33%), but it did significantly ($P < .05$) decline between D1 to D5 (98.75% to 76.33%). The rate of adhesion of the KT brand significantly ($P < .05$)

Table 3. Cohort 2 comparing adhesion of KT with TKT over 5 days

Tape	1 h (D1) Mean ± SD	3 days (D3) Mean ± SD	5 days (D5) Mean ± SD	*R*-ANOVA Statistic	F	*P*	η^2
KT	98.92 ± 1.89	66.58 ± 40.89*	35.42 ± 41.69*	Time	46.02	.00	0.42
TKT	98.75 ± 1.70	83.33 ± 36.13	76.33 ± 39.57*	Tape brand	6.14	.02	0.14
				Time × Tape	10.52	.00	0.22

* Indicates within-group difference ($P < .05$) from D1 over time.
Shading indicates that 2 tape brands are different ($P < .05$) at specific data collection points.
η^2 indicates partial eta-square.

Table 4. Correlations between tape adhesion and time spent showering and indulging in physical activity

	Cohort 1				Cohort 2			
	TKT adhesion		KTEX adhesior		TKT adhesion		KT adhesion	
	D3	D5	D3	D5	D3	D5	D3	D5
Total shower duration before D3 (min)	−.07		−.50*		−.67*		.15	
Total shower duration before D5 (min)		.17		.01		−.64*		.04
Physical activity before D3 (min)	.07		−.50*		−.35		.19	
Physical activity before D5 (min)		−.02		−.31		−.43		−.27

* $P < .05$.

declined between D1 to D3 (98.92% to 66.58%) and between D3 to D5 (66.58% to 35.42%). Further, the post hoc comparisons indicated that the rate of adhesion of the KT brand was significantly ($P < .05$) lower than that of the TKT brand at D5 (35.42% vs. 76.33%).

In Table 4, correlations between tape adhesion and time spent in physical activity and showering are presented. The rate of adhesion of the TKT tape in cohort 1 was unrelated to the duration of both showering and indulging in physical activity. The rate of adhesion of the KTEX in cohort 1 was significantly and inversely correlated with the duration of showering before D3 ($r = -0.50$) and the duration of indulging in physical activity before D3 ($r = -0.50$). In cohort 2, the rate of adhesion of the KT tape was unrelated to the duration of showering or indulging in physical activity. The rate of adhesion of the TKT tape in cohort 2 was negatively correlated with the duration of showering before D3 ($r = -0.67$) and D5 ($r = -0.64$) and was unrelated to the duration of physical activity before D3 or D5.

DISCUSSION

These findings partially support *H1*. In cohort 1, the TKT and the KTEX exhibited similar adhesion over the 5-day trial. When examining the adhesion scores of the tape brands individually over time, the KTEX exhibited a significant decline of 22.85% between D1 to D3 followed by an additional decline of 14.83% between D3 to D5. This is similar to the significant declines in the rates of adhesion of the TKT brand between D1 to D3 of 15.42% and between D3 to D5 of 17.78%. Thus, the KTEX and the TKT brands exhibited similar declines in adhesion over the 5-day trial. Table 2 also indicates that this decline exhibited a small-to-moderate effect over the trial ($\eta^2 = 0.35$).

The findings also support *H2*. In cohort 2, the adhesion of the TKT brand did not significantly decline from D1 to D3, but did demonstrate a significant decline between D1 to D5 of 22.42%. The rate of adhesion in the KT brand significantly declined from D1 to D3 by 32.34%, followed by an additional significant decline of 31.16% between D3 and D5. In addition, the declines in the rate of adhesion in the KT brand over the duration of the study resulted in the TKT tape exhibiting significantly greater adhesion compared with the KT brand at D5 (76.33% vs. 35.42%). Table 3 indicates that the effect of the interaction of time with tape was small ($\eta^2 = 0.22$). One explanation for these differences may be the different adhesive properties of the KT and the TKT brands. Thus, the KT brand exhibited significant declines in the rate of adhesion to values that

were significantly lower than the TKT brand at D5 over the duration of the trial.

In cohort 1, the rate of adhesion of the KTEX tape was negatively correlated with the duration of time spent showering and indulging in physical activity at D3, while the rate of adhesion of the TKT tape was unrelated to duration of time spent showering or indulging in physical activity. In Cohort 2, the rate of adhesion of only TKT was significantly and negatively affected by duration of time spent showering at D3 and D5, although subjects in cohort 2 spent less time showering than those in cohort 1. These inconsistent findings of the effect of duration of time spent in indulging physical activity or showering on the rate of adhesion of the ETT brand tape may be attributable to several factors. First, although the data on duration of time spent showering and indulging in physical activity were collected, the subjects were not instructed to document these activities, resulting in these data being susceptible to the individual's memory. Further, there was no quantification of the intensity of the physical activity or the temperature of the water or soaps used while showering. Finally, there may be an interaction between showering, physical activity, and other factors on the rate of adhesion of the ETT brands. Future researchers in this area may wish to study the duration of time spent showering and indulging in physical activity by using instruments with greater validity and reliability.

LIMITATIONS

These findings must be interpreted cautiously owing to several threats to the internal and external validity of the study. First, the protocol attempted to mirror the clinical application of ETTs for lower back pain and allowed the comparison of only 2 tape brands on a single individual in each of the 2 cohorts. This methodology minimized the effect of within-subjects' confounding variables, but did not allow simultaneous comparisons of the 3 ETT brands on the same individual. This design also did not allow simultaneous comparisons of the TKT brand with the other 2 brands. A second limitation of the study is that a number of potential confounding factors that may have affected the rate of adhesion may not have been reliably measured, including characteristics of physical activity and bathing. Finally, the method of determining the rate of tape adhesion used in this study does not possess preexisting validity and reliability, although the methodology did exhibit a high degree of internal consistency.

CLINICAL IMPLICATIONS & FUTURE RESEARCH

Practitioners applying ETTs can use the results of this study when deciding which brand to use in their practice. The results of this study indicate that different ETT brands have different adhesive properties and may be influenced by physical activity and showering. Future researchers and clinicians may choose to study different ETT brands and study clinical patients with active back pain.

CONCLUSION

This study compared, over a period of 5 days, the rate of adhesion of 3 different ETT brands applied at 25% elongation on the backs of healthy adults. The findings indicate that the rate of adhesion of these 3 ETT brands differed over 5 days and it may be differentially affected by physical activity and showering.

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