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Effects of Kinesio Taping vs Conventional Treatment on Pain Pressure Threshold and Tissue Hardness among Females with Non-specific Lower Back Pain

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ABSTRACT

One of the highly prevalent conditions among the adult females, particularly in Pakistan is Non-Specific Lower Back Pain (NSLBP), and it has a continuous association with reduced levels of pain pressure threshold (PPT) and increased levels of tissue hardness (TH) of the musculature of the lumbo-pelvic region. This study is focused to know the comparative effects of Kinesio Taping (KT) versus Conventional Therapy (CONV) on PPT and TH in females with NSLBP.It was a randomized, two-arm, parallel-group clinical trial that was conducted at the outpatient department of Al-Tibri Medical College & Hospital and The Care Medical Centre, Karachi. Fifty females, aged between 25-38 years old, presenting with NSLBP which persists for more than three months were included into the study through purposive sampling and randomly allocated to two equal groups (n=25). The KT group received the lumbar star correction technique with 25%-35# tape tension, which was applied for three times per week for a duration of three weeks. The Conventional Therapy group received the conservative therapy which consisted of hot pack for 10 minutes and TENS on burst mode for 15 minutes at the same frequency. PPT (kg/cm^2) was measured through pressure algometer and TH (N/cm^2) with the tissue hardness algometer. It was measured bilaterally over the lower thoracic erector spinae, gluteus maximus, gluteus Medius and tensor fascia latae, at baseline and at the three weeks at the end of treatment. The changes within group were analysed by paired-samples t-test with significance set at $p<0.05$.Statistically significant improvements were produced by the KT in PPT at all the eight measured sites, ($p<0.05$), and the largest gain was at the right side of tensor fascia latae (3.72 → 4.19 kg/cm^2, $p=0.001$). Conventional therapy produced significant results only at the site of bilateral lower thoracic erector spinae muscle and on the left side of gluteus maximus muscle. TH was significantly reduced at bilateral tensor fascia latae and at the right side of glutes maximus and Medius as a result of KT while conventional only brought minor changes in the TH which were not significantly meaningful.KT produced significant and clinically relevant improvements in PPT and TH than conventional therapy in females with non-specific lower back pain.

Introduction

Non-specific Lower back pain (NSLBP) is described as a lower back pain that cannot be linked to any recognizable, identifiable specific pathology for instance infection, or fracture, or neoplasm or any radicular compression (Maher, Underwood, & Buchbinder, 2017). Worldwide, in the years that are lived with disability it is the single largest cause, making it approximately 7.4% of all years, across 204 countries and territories as Global Burden of Disease estimates (Wu et al., 2020). Globally the point prevalence has been estimated about 7.5% while the one-month prevalence reaches to 30.8% in many different populations. (Hoy et al., 2012). For primary care consultations NSLBP is one of the leading reasons, and it is found more prevalent n women than men. (Buchbinder et al., 2018).

In Pakistan, a substantial burden has been imposed by NSLBP, which varies among different demographics and occupations. A seven-day prevalence of 32% has been documented among undergraduate medical students in Karachi (Bibi et al., 2024), in traffic wardens and security personelle a point prevalence of 81.5% has been reported in Lahore (Arooj et al., 2018), and among the female university lecturers in Lahore a recurrent rate of NSLBP was recorded to be around to be 68% (Riaz et al., 2024). Women are disproportionately impacted because the illness often interferes with activities of daily living, their productivity in occupation, and quality of life

Pain pressure threshold (PPT) and tissue hardness (TH) are two clinically relevant and objective measures that define the mechanical condition of muscle in NSLBP. PPT is the lowest mechanical pressure applied to soft tissue that evokes a sensation of pain, measured by means of a hand-held pressure algometer, and is considered a valid index of mechanical hyperalgesia and peripheral and central sensitization (Reeves, Jaeger, & Graff-Radford, 1986; Fischer, 1990). The PPT is reproducibly decreased in individuals with persistent low back pain (Ohrbach & Gale, 1989). The mechanical stiffness of muscle and superficial fascia is quantified as tissue hardness, evaluated using a durometer, and is consistently raised in chronic musculoskeletal pain situations (Andersen, Arendt-Nielsen, Danneskiold-Samsøe, & Graven-Nielsen, 2006).

Kinesio Taping (KT) is an elastic-tape method, non-invasive, developed by Dr. Kenzo Kase (Kase et al., 2003) that mechanically lifts the skin, facilitates lymphatic and microvascular drainage, activates cutaneous mechanoreceptors, and modulates nociceptive input through the gate-control mechanism (Halseth, McChesney, DeBeliso, Vaughn, & Lien, 2004; Thelen, Dauber, & Stoneman, 2008; Chang, Chou, Lin, Lin, & Wang, 2010). KT has been extensively investigated in heterogeneous musculoskeletal conditions, but the available systematic reviews have found only small and inconsistent effects, particularly when KT is applied alone (Csapo & Alegre, 2015; Parreira et al., 2014; Kalron & Bar-Sela, 2013). Its effects on objective tissue measures i.e. PPT and TH in females with NSLBP are not well defined, especially in the South Asian scenario. Thus, the present investigation investigated the effects of three weeks of KT with conventional therapy on PPT and TH of major lumbo-pelvic muscles in females with NSLBP.

Material and Methods

Study design and setting. This was a randomized, two-arm, parallel-group clinical trial conducted in the outpatient physical therapy departments of Al-Tibri Medical College and Hospital and The Care Medical Centre, Karachi, Pakistan, for a duration of twelve months.

Ethical considerations. The protocol was approved by the Institutional Bioethical Committee, University of Karachi (Approval no. IBC KU-223/2021, dated 23 September 2021) and registered with ClinicalTrials.gov (NCT05649774). The study was done in conformity with the Declaration of Helsinki (1964) and its amendments. All participants gave written informed consent and were advised about discontinuation of the intervention if any adverse impact was reported.

Population and sampling. Fifty female outpatients in the age group of 25-38 years with a history of NSLBP for more than 3 months were selected by purposive sampling. Sample size was estimated using Primer of Biostatistics with $\alpha = 0.05$ and power = 0.80. A minimum of 25 participants per group was required. All participants were examined with a systematic questionnaire to rule out disc herniation, disc bulging, compression fracture, segmental instability and radicular involvement and to confirm the diagnosis of NSLBP.

Inclusion criteria were female gender, age between 25–38 years, and clinically diagnosed NSLBP for the duration of more than three months.

Exclusion criteria were progressive neurological deficit, red-flag signs (unexplained weight loss, fever, night pain), known spinal pathology (tumor, ankylosing spondylitis, spondylolisthesis), inflammatory rheumatic disease, corticosteroid therapy

within the preceding three months, sensitive or allergic skin, dermatologic disorders, and any rehabilitative intervention for lower back pain within the preceding two months. Participants were instructed to refrain from analgesic medication on the days of intervention.

Randomization and intervention. Each eligible participant picked a folded slip from an opaque bowl designated KT or CONV, resulting in equal distribution to the two groups (n=25 each). The lumbar star-correction method was given in the KT group. Four I-strips of Kinesio tape were put across the lumbar area with the subject in a position of lumbar flexion and rotation. Each strip was applied with therapeutic stress of 25-35% in the middle and no tension at the ends, with adhesive activation by friction. 3 times a week for 3 weeks the tape was replaced. The CONV group got standard therapy with application of hot-pack for 10 minutes and transcutaneous electrical nerve stimulation (TENS) in burst mode at a tolerable intensity for 15 minutes, three times per week for three weeks.

Outcome measures and data collection. Pain pressure threshold (PPT, kg/cm²) was assessed with a hand-held pressure algometer that was applied perpendicular to the skin. Pressure was raised at a rate of ~1 kg/s until the subject first reported the sensation of pain. Tissue hardness was assessed using a hand-held tissue hardness meter (TH, N/cm²). PPT and TH were bilaterally measured over four muscles, lower thoracic erector spinae, gluteus maximus, gluteus Medius and tensor fascia latae at baseline and immediately post-intervention (3 weeks). All measures were conducted by the same professional therapist to maintain uniformity. Baseline demographic data (age, duration of pain) were also collected.

Statistical analysis. Data were analysed using IBM SPSS. Continuous variables are reported as mean ± standard deviation. Within-group pre- versus post-intervention comparisons were performed using paired-samples t-tests. The level of statistical significance was set at $p<0.05$.

Results

Demographics. The mean age of the KT group was 30.72 ± 2.35 years (range 27–36 years) and that of the CONV group was 31.00 ± 1.98 years (range 28–36 years); the two groups were equivalent at baseline. There were no dropouts, and all 50 participants were available for pre- and post-intervention data.

Pain Pressure Threshold (PPT). Comparison of PPT within groups demonstrated statistically significant improvement in the KT group at all eight locations assessed (Table 1). The highest absolute increase was found in the right tensor fascia latae (3.72 → 4.19 kg/cm², p=0.001), followed by the right lower thoracic erector spinae (3.38 → 3.70 kg/cm², p<0.001). Statistically significant within-group change was only observed in the CONV group at the bilateral lower thoracic erector spinae (p=0.022 left; p=0.008 right) and left gluteus maximus (p=0.005). No significant change was noted in the right gluteus maximus, bilateral gluteus Medius and bilateral tensor fascia latae.

Table 1. *Within-group comparison of Pain Pressure Threshold (kg/cm²) before and after intervention in the KT and CONV groups.*

Muscle (Side)	Group	Pre Mean ± SD	Post Mean ± SD	p-value
Lower thoracic erector spinae (L)	KT	3.43 ± 0.55	3.68 ± 0.49	<0.001
	CONV	3.00 ± 0.45	3.12 ± 0.53	0.022
Lower thoracic erector spinae (R)	KT	3.38 ± 0.54	3.70 ± 0.46	<0.001
	CONV	2.96 ± 0.43	3.12 ± 0.51	0.008
Gluteus maximus (L)	KT	3.86 ± 0.54	4.01 ± 0.64	0.001
	CONV	2.67 ± 0.34	2.77 ± 0.28	0.005
Gluteus maximus (R)	KT	3.82 ± 0.49	4.02 ± 0.62	0.003
	CONV	2.66 ± 0.35	2.67 ± 0.32	0.827

Gluteus Medius (L)	KT	3.85 ± 0.44	3.95 ± 0.48	0.003
	CONV	2.98 ± 0.57	3.05 ± 0.53	0.221
Gluteus Medius (R)	KT	3.82 ± 0.47	3.98 ± 0.51	0.002
	CONV	2.98 ± 0.55	3.03 ± 0.55	0.204
Tensor fascia latae (L)	KT	3.96 ± 0.75	4.20 ± 0.69	<0.001
	CONV	3.02 ± 0.59	3.09 ± 0.55	0.221
Tensor fascia latae (R)	KT	3.72 ± 0.79	4.19 ± 0.68	0.001
	CONV	2.99 ± 0.58	3.07 ± 0.52	0.130

L = left; R = right.

Tissue Hardness (TH). TH measures (Table 2) were more selective in their intervention response. The KT group demonstrated statistically substantial reductions in TH at bilateral tensor fascia latae (left $p<0.001$; right $p=0.002$), right gluteus maximus ($p<0.001$), and right gluteus Medius ($p=0.003$). Within-group change in the KT group was not statistically significant for the left gluteus maximus and left gluteus Medius which may be reflective of significant baseline variability at these regions. Within the CONV group, numerous within-group changes were statistically significant, although the size of mean change was minor (<1 durometer unit at most locations) and unlikely to be clinically important. Several areas did not alter considerably, such as the left lower thoracic erector spinae and the left tensor fascia latae.

Table 2. *Within-group comparison of Tissue Hardness (*N/cm^2*) before and after intervention in the KT and CONV groups.*

Muscle (Side)	**Group**	**Pre Mean ± SD**	**Post Mean ± SD**	**p-value**
Lower thoracic erector spinae (L)	KT	55.16 ± 4.99	55.16 ± 5.20	0.001
	CONV	63.84 ± 4.58	63.03 ± 5.34	0.062
Lower thoracic erector spinae (R)	KT	56.12 ± 4.87	55.50 ± 5.23	0.054
	CONV	63.82 ± 4.64	62.80 ± 5.45	0.025
Gluteus maximus (L)	KT	81.03 ± 127.46	54.93 ± 7.22	0.305
	CONV	60.67 ± 4.58	60.07 ± 3.36	<0.001
Gluteus maximus (R)	KT	56.14 ± 7.11	55.18 ± 7.13	<0.001
	CONV	60.58 ± 3.28	59.79 ± 3.37	<0.001
Gluteus Medius (L)	KT	54.86 ± 11.34	56.09 ± 5.95	0.617
	CONV	60.50 ± 4.58	59.44 ± 4.29	0.001
Gluteus Medius (R)	KT	57.50 ± 6.10	56.34 ± 5.93	0.003
	CONV	60.86 ± 4.60	58.65 ± 4.59	<0.001
Tensor fascia latae (L)	KT	57.98 ± 4.59	56.60 ± 4.78	<0.001

	CONV	57.74 ± 12.46	59.44 ± 3.35	0.489
Tensor fascia latae (R)	KT	58.17 ± 4.38	56.80 ± 4.81	0.002
	CONV	59.91 ± 3.24	59.14 ± 3.12	0.012

L = left; R = right.

Discussion and Conclusion

The present randomized experiment showed that Kinesio Taping administered using the lumbar star-correction technique for 3 weeks led to considerably higher and more anatomically distributed changes in pain pressure threshold than traditional CONV therapy in females with NSLBP. KT was related with statistically significant within-group PPT increases at all eight assessed lumbo-pelvic locations, whereas the CONV intervention resulted in significant within-group change at just three sites and with lesser amplitude. The reduction in tissue hardness in the KT group was more selective but was consistently bigger and more clinically relevant than that achieved by CONV.

These findings are in agreement with the postulated mechanisms of action of KT. KT reduces mechanical pressure on subcutaneous nociceptors, enhances cutaneous microcirculation and lymphatic drainage, and activates cutaneous mechanoreceptors that inhibit the spinal nociceptive transmission through the gate-control mechanism by elevating the epidermis and superficial fascia under the elastic tension of the tape (Kase, 2003; Halseth et al., 2004; Thelen, Dauber, & Stoneman, 2008; Chang et al., 2010). The intended clinical outcome is a reduction of mechanical hyperalgesia that is quantifiable as an increase in PPT and softening of muscle and superficial fascia that is quantified as a decrease in TH, both of which were found in the KT group.

The clinical magnitudes obtained in this investigation are in agreement with the literature. Castro-Sánchez et al. (2012) found that KT application to the lumbar muscles produced small but statistically significant improvements in pain and disability in chronic NSLBP patients. Paoloni et al. (2011) also reported that KT application to the lumbar muscles improved clinical and electromyographic parameters in chronic low back pain. In a meta-analysis of KT in musculoskeletal pain and disability, Lim and Tay (2015) concluded that KT had a modest but reproducible effect on PPT of around 0.4–0.5 kg/cm^2 over placebo, which closely matches the bilateral PPT gains observed in the present trial at the lower thoracic erector spinae (≈0.25–0.32 kg/cm^2) and tensor fascia latae (≈0.24–0.47 kg/cm^2). Al-Shareef et al. (2016) also observed substantial improvements in PPT following KT treatment in chronic NSLBP, while Hashemirad et al. (2016) reported the same in piriformis trigger-point myofascial pain. However, the systematic review by Parreira et al. (2014) concluded that the current evidence does not support the routine use of KT as a stand-alone intervention. The meta-analysis by Csapo and Alegre (2015) reported only modest and inconsistent effects of KT on muscle strength, range of motion and force sense. Similarly, Kalron and Bar-Sela (2013) rated the overall quality of KT evidence as low to intermediate. In this perspective, the stable and bilateral PPT increases seen in the present investigation must be viewed as physiologically reasonable and therapeutically valuable, but not as an overestimated impact. The finding that the CONV intervention also resulted in small but statistically significant changes at a minority of sites is consistent with well-documented contextual and placebo effects in manual therapy and electrotherapy research (Bialosky, Bishop, Robinson, Barabas, & George, 2008; Bialosky, Bishop, Price, Robinson, & George, 2009). Hot pack and TENS produced non-specific effects on central pain processing via patient expectation, therapeutic interaction and segmental neuromodulation, but the amplitude of these effects was limited in the present experiment and topographically constrained compared with KT. With respect to TH, we should note on the differential pattern found in the KT group with statistically significant decreases bilaterally at the tensor fascia latae and at the right gluteal muscles but not consistently at the left gluteal muscles. The high baseline standard deviations in the KT group at the left gluteus maximus and left gluteus Medius (especially the left gluteus maximus pre-treatment SD of ±127.46) suggest that it was the baseline heterogeneity and not the failure of the intervention that explained the non-significant within-group comparisons at these specific sites. KT-induced decreases in tensor fascia latae hardness are in line with the mechanical decompressive impact of KT on superficial fascia (Kase, 2003) and with the study of Hashemirad et al. (2016) of quantifiable changes in tissue characteristics when KT was administered to trigger-point-rich muscles.

Limitations

There are various limitations to the present trial. The intervention duration was limited to three weeks, no long-term follow up was performed, and the outcome assessor was not blinded. The sample was all female and recruited from two locations in Karachi and the KT and CONV groups were not stratified by profession, body mass index or duration of pain. The lack of a real

placebo tape and the inherent challenge of blinding participants for recording treatments limits causal inference. Generalizability to males, to non-Pakistani groups and to longer treatment periods cannot be taken for granted.

Conclusion

Three weeks of Kinesio Taping with the lumbar star-correction technique in females with non-specific lower back pain produced statistically significant and clinically relevant improvements in pain pressure threshold at all eight lumbo-pelvic sites measured and meaningful reductions in tissue hardness at the tensor fascia latae and right gluteal muscles. Minimal and topographically limited effects were seen only after conventional CONV treatment with heat pack and TENS. Kinesio Taping is therefore a therapeutically beneficial addition to the conservative care of NSLBP in adult females and deserves official inclusion in evidence-based physical therapy programs. Future studies should use bigger sample numbers, longer follow-up, blinded outcome assessors, active control comparators and stratification by occupation and body mass index to better define the therapeutic function of KT in this group.

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