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GUA SHA THERAPY REDUCES THORACOLUMBAR FASCIA THICKNESS AND IMPROVES LUMBAR FLEXIBILITY: A PILOT RANDOMIZED CONTROLLED TRIAL

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LEVEL OF EVIDENCE: 2b

ABSTRACT

Background: Chronic low back pain (LBP) is associated with changes in the thoracolumbar fascia (TLF) structure. Gua Sha is a traditional manual therapy that can relieve LBP, but there is a lack of clinical evidence on whether it can affect fascial properties.

Objectives: To investigate the immediate effects of Gua Sha on TLF thickness and functional parameters in healthy adults.

Methods: In this pilot randomized controlled trial, 24 healthy participants were randomly assigned to a Gua Sha group (n = 12) or a control group (n = 12). The intervention group received a single 15-minute Gua Sha session, while the control group rested in a prone position. Outcomes, including TLF thickness, tissue hardness, pressure pain threshold , skin temperature, and lumbar flexibility, were measured before and immediately after the intervention.

Results: Compared to the control group, the Gua Sha group showed a significant reduction in bilateral TLF thickness (right: mean difference -0.40 mm, 95% CI -0.71 to -0.09, p = 0.017; left: -0.36 mm, 95% CI -0.68 to -0.05, p = 0.027). Significant improvements were also observed in skin temperature (p < 0.001), left-side pressure pain threshold (p <0.01), and lumbar flexibility (p <0.001). Tissue hardness slightly increased post-intervention, but not significantly.

Conclusion: A single Gua Sha session reduced TLF thickness and enhanced lumbar flexibility in healthy adults, supporting its potential as a fascia-targeted intervention. Further studies in LBP populations are warranted.

KEYWORDS

Gua Sha, myofascial therapy, thoracolumbar fascia, ultrasound imaging, healthy adults, fascia thickness, lumbar flexibility

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INTRODUCTION

Chronic low back pain (LBP) is a major global health concern, significantly impairing daily functioning and contributing to substantial socioeconomic burden. Its prevalence continues to rise, with an estimated 619 million individuals affected in 2020, projected to reach 843 million by 2050[1]. Beyond persistent pain and discomfort, Chronic LBP severely limits physical activity, reduces work productivity, hinders social participation, and adversely affects mental well-being, ultimately diminishing quality of life. While structural spinal damage and unhealthy lifestyle factors are established contributors to LBP[2-6], recent studies have indicated that the thoracolumbar fascia (TLF) may play a crucial role in LBP. Understanding the structure and function of the TLF in healthy individuals might be key to comprehending its contribution to the development of LBP[7,8]. The TLF is a deep fascial structure that envelops the spine and internal organs, and serves mechanical, stabilizing, and protective functions[9]. Studies have shown that compared with healthy individuals, the TLF of LBP patients is more sensitive to stimulation, while muscle tissue is not[10]. In addition, ultrasound imaging has been used to observe abnormalities such as changes in TLF thickness[11] or in fascia deformation[12] in patients with LBP, which may affect the function of the lower back muscles and cause LBP. Biomechanical studies have found that the compliance of the TLF in patients with chronic LBP is reduced[13]. The TLF loses part of its capacity to absorb mechanical stress, rendering the spine more vulnerable to injury.

Given the potential involvement of TLF in LBP, exploring fascia-targeted interventions is warranted. Although myofascial release techniques have demonstrated potential benefits for TLF remodeling[14,15], their complexity and high cost limit broader application. Gua Sha is a traditional Chinese manual therapy with a long history and increasing global interest. Studies have shown that Gua Sha can increase local blood flow, elevate body temperature, and relieve pain and inflammation in patients with chronic LBP[16-18]. As a low-cost and easily administered intervention, Gua Sha may serve as a feasible alternative if its effects on fascial tissues are empirically supported.

However, the effects of Gua Sha on TLF structure have not yet been systematically examined. To explore its potential utility in LBP management, this pilot study investigated the immediate effects of a single Gua Sha session on TLF thickness and related physiological parameters in healthy individuals. This pilot study aims to optimize experimental parameters, assess feasibility, and inform the design of future clinical trials. We hypothesized that a single Gua Sha session would lead to reduced TLF thickness and improvements in functional parameters.

MATERIALS AND METHODS

Study design

This randomized controlled trial was conducted to investigate the effects of Gua Sha on TLF thickness and related parameters in healthy young adults. The study design is classified as Level 2b evidence according to the Oxford Centre for Evidence-Based Medicine Levels of Evidence, as defined by the Muscle, Ligaments and Tendons Journal. This classification is appropriate due to the study's nature as a pilot trial, which typically involves a smaller sample size and focuses on feasibility, potentially affecting the overall quality of evidence.

The study was conducted in the sports therapy room of the Graduate School at Khon Kaen University, Thailand, between October 3 and October 15, 2024. Data were collected before and immediately after the intervention (15 minutes of Gua Sha or 15 minutes of prone rest). Experimental measurements and interventions were performed in an air-conditioned room with a temperature maintained at 26°C and relative humidity of 50%.

The study was officially approved by the Ethics Review Board of Khon Kaen University, Thailand (Approval No. HE67217). In addition, the study protocol was registered with the Thailand Clinical Trials Registry (Registration No. TCTR20241124004). All study procedures adhered to the principles of the Declaration of Helsinki, and written informed consent was obtained from all participants prior to study enrollment.

Subjects

Participants were recruited via social media platforms (WeChat and LINE) affiliated with student groups at Khon Kaen University.

Inclusion criteria

1) *Age:* Participants were aged between 18 and 40 years. This range was chosen to minimize the confounding effects of age-related degenerative changes in fascia on the study outcomes[19].
2) *Body mass index (BMI):* Participants had a BMI between 18.5 and 29.9 kg/m^2. This criterion was set to reduce the variability in tissue properties and thickness, which could influence ultrasound measurements. It also helped to exclude individuals with obesity, a condition known to be associated with altered fascial properties and an increased risk of LBP[4].
3) *LBP status:* Participants had no history of LBP in the three months prior to the study. This was crucial for establishing a healthy baseline and accurately assessing the immediate effects of Gua Sha without the influence of a pre-existing pathological state.
4) *Physical compliance:* Participants were able to comfortably lie prone for 15 minutes, ensuring compliance with the intervention and control protocols.

Exclusion criteria

1) *Prior treatments:* Individuals who had received Gua Sha or other fascial treatments within the past three months were excluded to prevent residual effects from

confounding the results.

2) *Safety concerns:* Participants with open wounds on the waist, pregnancy, or lactation were excluded for safety reasons. Pregnancy and lactation involve significant hormonal changes that could affect tissue laxity and pain perception.
3) *Menstruation:* Female participants were excluded if they were menstruating during the study period, as hormonal fluctuations can influence pain sensitivity and tissue properties[2].
4) *Existing pathology:* Individuals with current LBP were excluded to focus the study on healthy subjects and to avoid conflating the effects of Gua Sha with existing conditions[13].

Basic information of the subjects

A total of 46 volunteers were initially screened. Twelve were excluded due to current low back pain, five due to BMI >29.9 kg/m^2, and five due to menstruation. The final sample consisted of 24 healthy volunteers (9 males, 15 females) with a mean age of 27.42 ± 6.53 years. Mean height was 166.67 ± 7.57 cm, weight 61.96 ± 10.71 kg, and BMI 22.21 ± 2.77. Mean systolic and diastolic blood pressures were 112.42 ± 12.18 mmHg and 78.33 ± 9.70 mmHg, respectively, and mean heart rate was 82.08 ± 9.12 beats per minute. All participants met the inclusion criteria and were considered in good health.

Sample size estimation and group allocation.

This pilot study aimed to assess feasibility and estimate effect sizes to inform future trials. A sample size of 12 participants per group was selected based on similar pilot studies that reported moderate effect sizes (Cohen's d ≥0.6) in changes in TLF thickness[20], while also considering ethical concerns to minimize participant burden.

An independent researcher assigned participant numbers in the order of recruitment and sealed them in opaque envelopes. The randomization scheme was generated by visiting the website https://www.randomizer.org/. The block randomization method was used, and the random block size was set to a variable value to ensure a balanced allocation of the experimental group (n = 12) and the control group (n = 12). Due to visible Gua Sha marks, assessor blinding was not feasible, potentially introducing detection bias. The flow of the study is shown in *Figure 1*.

Intervention measures

Gua Sha group

The Gua Sha intervention in this study was implemented by a senior therapist with a professional qualification certificate in Gua Sha in China and ten years of extensive clinical experience. This therapist specializes in traditional Chinese medicine and rehabilitation therapy, and his profound professional knowledge and rich clinical experience ensured the standardization and effectiveness of implementing the Gua Sha intervention in this study.

The participants lay prone with their lower backs exposed, and the operator applied olive oil as a lubricant to their lower back. A smooth buffalo horn Gua Sha board was used to scrape on the skin along the fascia areas of the lower back *(Fig. 2)*. According to previous researchers who performed Gua Sha on patients with LBP, the Gua Sha site is generally on the skin of the lower back from the seventh thoracic vertebra to the fifth lumbar vertebra[16,17], and the Gua Sha length is generally 25-30 cm. Therefore, this study's specific Gua Sha site is from the seventh thoracic vertebra to the coccyx.

The Gua Sha sequence is shown in *Figure 2*. First, follow the bladder meridian on both sides of the spine, from the seventh thoracolumbar vertebra to the fifth lumbar vertebra (line 1).The next Gua Sha was about 3 inches from the midline of the lower back spine, from the first lumbar vertebra to the fifth lumbar vertebra (line 2). Finally, scrape from the fifth lumbar vertebra to the tail vertebra (line 3).

According to the measurement results of the AlgoMed system, the Gua Sha pressure was mild (487 ± 21 g) and moderate (626 ± 11 g)[21], depending on each participant's threshold of feeling of discomfort. Each part was scraped for 2-3 minutes for 15 minutes. Previous studies have found that 15 minutes of Gua Sha can improve low back pain[16,17].

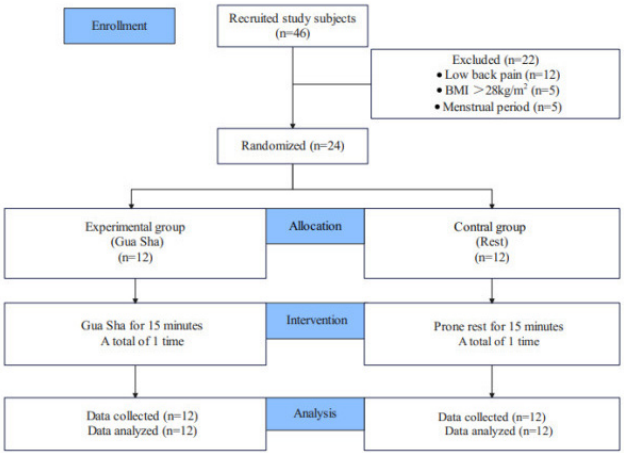


Figure 1. *Participant recruitment flowchart.*

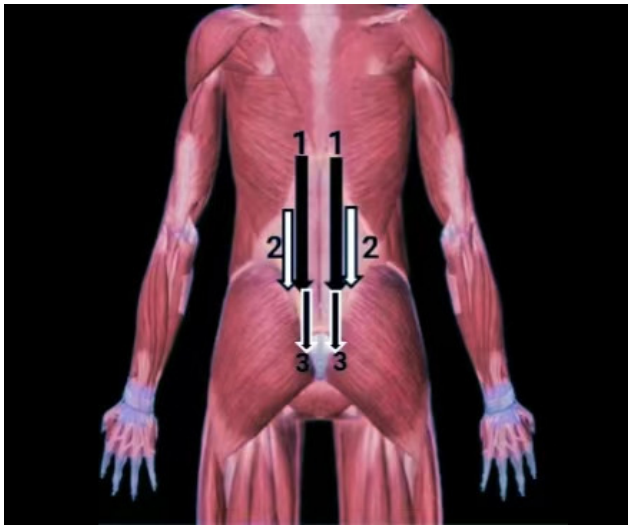


Figure 2. *Gua Sha sequence.*

After completing the Gua Sha, the researchers used disposable tissues to wipe off the oil on the participants' lower backs.

Control group

Participants in the control group also lay in a prone position for 15 minutes, matching the posture and duration of the Gua Sha group. They were instructed to remain relaxed and avoid movement or discomfort during the rest period. The researchers ensured that participants remained quiet and comfortable throughout the session.

Outcome measures

To minimize measurement bias,all outcome variables were assessed by trained personnel using validated instruments. The primary outcome was TLF thickness. Secondary outcomes included tissue hardness, pressure pain threshold (PPT), skin temperature, and lumbar flexibility. Ultrasound measurements were conducted by a physical therapist with over eight years of experience in musculoskeletal ultrasound, while all other outcomes were assessed by trained research staff.

TLF thickness

TLF thickness was assessed using a wireless medical ultrasound system (Konted C10, China) in B-mode with a 7.5–14 MHz linear probe and a display depth of 3.0 cm. This method has demonstrated high inter-rater reliability (ICC >0.80)[22,23] and strong correlation with magnetic resonance imaging (MRI)[24].

Measurements were taken bilaterally at the L2–L3 level, 2 cm lateral to the interspinous ligament in the sagittal plane, following protocols established in previous studies[7,25]. This method has shown good intra-observer (ICC: 0.67–0.77) and inter-observer (ICC: 0.82–0.92) reliability[19,22].

To account for local variability, four equidistant points were measured on each ultrasound image using the device's built-in measurement tool. The average of these four values was recorded as the final thickness for each side *(Fig. 3)*.

Tissue hardness

Tissue hardness of the lumbar erector spinae muscles was measured using a digital tissue hardness meter (Algometer Combo, OE-220, Japan), a device with high test-retest reliability (ICC = 0.97)[26]. A trained researcher first palpated the lumbar erector spinae muscles to identify the point of lowest pain threshold on each side, marking the locations on the skin. The algometer, equipped with a 10 cm-diameter plastic disc, was applied perpendicularly to the marked point. The device automatically recorded the tissue hardness value upon reaching the threshold pressure. Measurements were repeated three times on each side, and the average value was used for analysis.

Pressure pain threshold

The PPT on the bladder meridian near L3-L4 was measured using a tissue hardness meter (Algometer Combo, OE-220, Japan). This method was highly reliable (ICC = 0.77-0.94)[27]. Participants were instructed to hold a stop switch and to press it immediately upon experiencing discomfort from the applied pressure. A trained examiner applied pressure to the marked point at a rate of 1 kg/cm^2 per second until the participant pressed the switch, indicating their PPT. The applied force at that moment was automatically recorded. Each measurement was repeated three times per side, and the average value was used for analysis.

Skin temperature

Skin temperature of the lower back was measured bilaterally using a non-contact infrared thermometer (Hikvision DS-2TP31B-3AUF), positioned 2–5 cm away from the L3 level. This method has demonstrated excellent reliability (ICC = 0.949–0.998)[28]. Three measurements were taken on each side, and the average value was recorded for analysis.

Lumbar flexibility

Lumbar flexibility was assessed using the modified

Characteristics	Experimental group (*n* = 12) mean ± SD	Control Group (*n* = 12) mean ± SD	p value
Gender (male/female)	4/8	5/7	0.69
Age (years)	28.58 ± 7.18	26.25 ± 5.88	0.39
Height (cm)	165 ± 6.58	168.33 ± 8.39	0.29
Weight (kg)	59.5 ± 7.49	64.42 ± 13.06	0.27
BMI (kg/m^2)	21.85 ± 2.33	22.58 ±3 .2	0.53
Systolic BP (mmHg)	111 ± 13.87	113.83 ± 10.64	0.58
Diastolic BP (mmHg)	76.33 ± 9.62	80.33 ± 9.76	0.32
Heart rate (times/minute)	83.08 ± 6.6	81.08 ± 11.32	0.60

Table 1. *Baseline characteristics of participants in the experimental and control groups.*
Abbreviations: SD, standard deviation; BP, blood pressure; n, number.

Schober's test, a widely accepted and reliable clinical tool (ICC = 0.83–0.94)[29]. Participants stood with feet approximately 30 cm apart. A horizontal mark was made at the level of the L5 spinous process, with additional marks placed 5 cm below and 10 cm above this point, establishing a baseline distance of 15 cm. Participants were then asked to bend forward maximally while keeping their knees extended. The distance between the upper and lower marks was measured. This procedure was repeated three times at 30-second intervals, and the average value was calculated. The final flexibility score was obtained by subtracting the original 15 cm from the average post-bending distance.

Statistical analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA), and results are presented as mean ± standard deviation (SD). Normality of data distribution was assessed using the Shapiro–Wilk test. Paired-sample t-tests were used to compare pre- and post-intervention outcomes within each group. For between-group comparisons, independent samples t-tests were applied to normally distributed continuous variables. A p value <0.05 was considered statistically significant.

RESULTS

Demographic characteristics

A total of 24 participants were included in the study: 12 in the experimental group and 12 in the control group. Baseline characteristics, including age, height, weight, BMI, systolic and diastolic blood pressure, and heart rate, were comparable between groups. No significant differences were observed (all p >0.05) *(Table 1)*.

Thickness of TLF

Table 2 presents changes in thoracolumbar fascia (TLF) thickness before and after the intervention. In the Gua Sha group, TLF thickness significantly decreased on both sides following the intervention (left: p = 0.027; right: p = 0.017). In contrast, the control group showed minor reductions that were not statistically significant (left: p = 0.077; right: p = 0.962).

Inter-group comparisons of TLF thickness are shown in *Table 3*. No significant baseline differences were observed between groups. Post-intervention, right TLF thickness was significantly lower in the Gua Sha group compared to the control group (p = 0.013), while the difference on the left side was not significant (p = 0.208). This suggests that the Gua Sha intervention may have a greater effect on right-side fascial thickness.

Secondary outcomes

Table 3 and *Figure 4* summarize the results of secondary outcome measures. Prior to the intervention, no significant differences were found between groups across all variables (p >0.05). Following the intervention, significant increases in skin temperature were observed bilaterally in the experimental group (left: p <0.001; right: p <0.001), whereas no significant changes were noted in the control group. Inter-group comparisons also revealed significantly higher post-intervention skin temperature in the Gua Sha group (left: p <0.001; right: p <0.001).

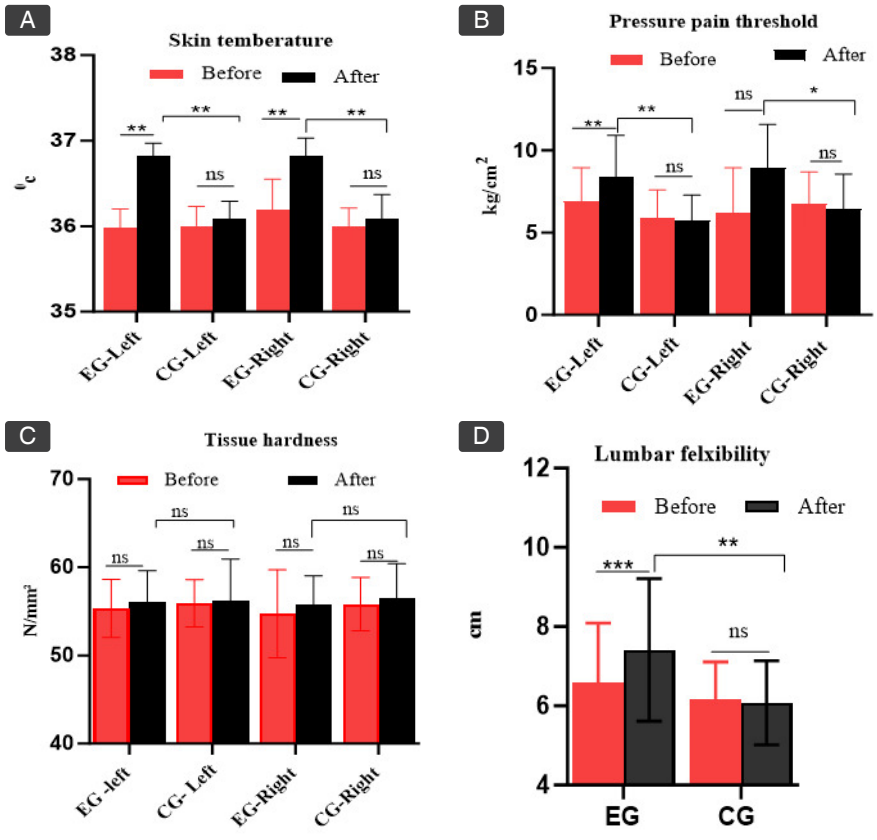


Figure 4. *Comparison of secondary outcomes within and between groups. A) Skin temperature (°C); B) Pressure pain threshold (PPT, kg/cm²); C) Tissue hardness (N/mm²); D) Lumbar flexibility (cm); Abbreviations: EG, experimental group; CG, control group.*
*p <0.05, ** p <0.01, *** p <0.001; ns: not significant.*

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Outcomes	Group	Before (mean ±SD)	After (mean ±SD)	Mean difference (95% CI)	p value
Left TLF thickness (mm)	Gua Sha	3.47 ± 0.0.77	3.11 ± 0.51	0.36 (0.05, 0.68)	0.027
	Control	3.67 ± 0.95	3.49 ± 0.79	0.18 (-0.02, 0.38)	0.077
Right TLF thickness (mm)	Gua Sha	3.17 ± 0.46	2.78 ± 0.46	0.40 (0.09, 0.71)	0.017
	Control	3.54 ± 0.88	3.53 ± 0.84	0.01 (-0.46, 0.48)	0.962

Table 2. *Within-group comparison of TLF thickness before and after intervention.*
Abbreviations: TLF, thoracolumbar fascia; CI, confidence interval; SD, standard deviation. Statistically significant differences are indicated by p <0.05.

PPT significantly increased on the left side in the Gua Sha group (p <0.01), with a non-significant upward trend on the right. Compared to the control group, post-intervention PPT was significantly higher on both sides (left: p = 0.004; right: p = 0.018). No significant changes in PPT were observed in the control group.

Tissue hardness showed no significant changes within or between groups (all p >0.05). Interestingly, although an

Outcomes	Time point	Gua Sha Group mean ± SD	Control Group mean ± SD	Mean difference (95% CI)	p value
Left TLF thickness (mm)	Baseline	3.47 ± 0.77	3.67 ± 0.95	-0.20 (-0.93, 0.53)	0.575
	After	3.13 ± 0.55	3.49 ± 0.79	-0.36 (-0.93, 0.21)	0.208
Right TLF thickness (mm)	Baseline	3.17 ± 0.46	3.54 ± 0.88	-0.36 (-0.96, 0.23)	0.218
	After	2.78 ± 0.46	3.53 ± 0.84	-0.75 (-1.32, -0.18)	0.013
Left skin temperature (°C)	Baseline	35.98 ± 0.22	35.99 ± 0.24	-0.01 (-0.20, 0.19)	0.931
	After	36.82 ± 0.15	36.08 ± 0.21	0.73 (0.58, 0.89)	< 0.001
Right skin temperature (°C)	Baseline	36.19 ± 0.36	35.99 ± 0.22	0.20 (-0.05, 0.45)	0.115
	After	36.82 ± 0.21	36.09 ± 0.28	0.73 (0.52, 0.93)	< 0.001
Left tissue hardness (N/mm^2)	Baseline	55.33 ± 3.30	55.93 ± 2.68	-0.60 (-3.14, 1.94)	0.629
	After	56.08 ± 3.53	56.15 ± 4.77	-0.75 (-3.62, 3.47)	0.965
Right tissue hardness (N/mm^2)	Baseline	54.72 ± 4.98	55.83 ± 3.03	-1.12 (-4.61, 2.38)	0.514
	After	55.82 ± 3.21	56.56 ± 3.85	-0.74 (-3.74, 2.26)	0.613
Left PPT (kg/cm^2)	Baseline	6.90 ± 2.05	5.93 ± 1.67	0.98 (–0.61, 2.56)	0.216
	After	8.43 ± 2.48	5.73 ± 1.55	2.70 (0.95, 4.45)	0.004
Right PPT (kg/cm^2)	Baseline	6.17 ± 2.67	6.72 ± 1.97	-0.55 (–2.54, 1.44)	0.572
	After	8.93 ± 2.65	6.41 ± 2.15	2.51 (0.47, 4.56)	0.018
Lumbar flexibility (cm)	Baseline	6.58 ± 1.51	6.17 ± 0.94	0.41 (-0.66, 1.47)	0.436
	After	7.41 ± 1.80	6.08 ± 1.06	1.33 (0.07, 2.58)	0.039

Table 3. *Comparison of TLF thickness, skin temperature, tissue hardness, PPT, and lumbar flexibility between the GuaSha and control groups before and after intervention.*
Abbreviations: SD, standard deviation; CI, confidence interval; TLF, thoracolumbar fascia; PPT, pressure pain threshold.
Statistically significant differences are indicated by p <0.05.

increase in hardness was noted in the Gua Sha group, the difference was not statistically significant.

Lumbar flexibility significantly improved in the experimental group ($p < 0.001$) and was also significantly greater than that of the control group post-intervention ($p = 0.039$). In contrast, the control group showed a slight, non-significant decrease in lumbar flexibility.

DISCUSSION

This study is the first to use ultrasound imaging to assess changes in bilateral TLF thickness following a Gua Sha intervention. The results demonstrated that 15 minutes of Gua Sha significantly reduced TLF thickness, particularly on the right side. In addition, this study explores the effects of Gua Sha on other physiological indicators, including skin temperature, PPT, tissue hardness, and lumbar flexibility. These findings provide preliminary evidence supporting the potential role of Gua Sha as a fascia-targeted intervention.

To our knowledge, this is the first study to demonstrate that Gua Sha reduces TLF thickness in healthy adults, as quantified by ultrasound imaging. This is consistent with the hypothesis that Gua Sha enhances local blood circulation and alleviates muscle tension[30,31]. Enhanced blood flow may help deliver nutrients and oxygen to the fascia, promote tissue repair, and relieve the congestion of lymph and waste products in the fascial layers. Moreover, Gua Sha may modulate the autonomic nervous system, enhance proprioceptive feedback, and facilitate nerve conduction. These effects collectively help relieve muscle tension, reduce fascial stress, and alleviate pain. This is consistent with our findings that a single session of myofascial technique intervention can immediately reduce TLF thickness and temporarily relieve pain in patients with LBP[32]. By contrast, a study involving healthy male participants undergoing 15 minutes of percussive massage therapy reported no significant reduction in TLF thickness, although a decrease in TLF echogenicity was observed[25].

Interestingly, a comparison between the two groups showed that only the reduction in right TLF thickness was statistically significant ($p < 0.05$), suggesting that Gua Sha may have a more significant impact on the right TLF. The observed asymmetry may be attributed to several factors. First, individual anatomical variations or imbalances in muscle tone between the left and right sides may influence the responsiveness to Gua Sha. Second, although a senior therapist with extensive experience performed the Gua Sha, inadvertent subtle variations in pressure, angle, or stroke consistency between the left and right sides during the 15-minute session might have affected the outcomes. Third, as a pilot study with a small sample size ($n = 12$ per group), it is possible that a larger study would be needed to detect more subtle, yet statistically significant, differences on both sides consistently. Further studies are needed to determine the specific reasons for the different effects of Gua Sha on left and right TLF thickness.

This finding may have clinical implications for chronic non-specific LBP. Pirri et al.[7] found that patients with chronic non-specific LBP had thicker TLF than healthy subjects, possibly due to fascial fibrosis and inflammation. In our study, Gua Sha significantly reduced TLF thickness on both the left and right sides (0.36 mm on the left and 0.40 mm on the right), suggesting that it may be possible to reverse such pathological changes partially. Reducing thickness may correlate with improved fascial pliability, potentially alleviating pain and enhancing mobility. Although the present findings are based on healthy participants, they may offer mechanistic insights relevant to future research in populations with chronic non-specific LBP.

Skin temperature increased significantly bilaterally following Gua Sha intervention ($p < 0.001$ vs baseline). This is consistent with Gua Sha, which improves local blood circulation and increases local temperature in the treated area[30,33]. Enhanced blood flow delivers more nutrients and oxygen to tissues, potentially helping relieve pain and aid tissue healing[34]. This is also consistent with the fact that 15 minutes of percussive massage therapy can significantly increase skin temperature[25]. From a clinical perspective, this enhanced blood flow delivers more nutrients and oxygen to tissues, which is crucial for pain relief and tissue healing, suggesting a tangible physiological benefit for both patients and therapists.

The Gua Sha intervention significantly improved PPT on the left side compared to the control group ($p < 0.01$), with a trend toward improvement on the right side. This is consistent with Gua Sha, which has long been used clinically to relieve pain[35,36]. The analgesic effect of Gua Sha may be due to its inhibition of the expression of pro-inflammatory cytokines[18]. Studies have shown that Gua Sha can reduce inflammatory cytokines, increase anti-inflammatory factors, elevate nitric oxide levels, and inhibit neuronal responses triggered by microglial activation, producing anti-nociceptive and neuromodulatory effects[18]. These mechanisms may achieve analgesic effects by regulating pain signaling pathways through the nervous and immune systems or promoting the release of endogenous analgesics[37]. This finding, which indicates a decrease in pain sensitivity, aligns with the traditional clinical use of Gua Sha for pain relief. The analgesic effect is a direct clinical benefit for patients, as a higher PPT means they can tolerate greater pressure before feeling discomfort, which is a key goal in managing pain conditions like LBP.

Contrary to our hypothesis, Gua Sha did not reduce tissue hardness but instead increased tissue hardness immediately after Gua Sha (an increase of 3.24 kg/cm^2 on the left; an increase of 2.43 kg/cm^2 on the right), although the difference was insignificant. We propose several explanations for this unexpected outcome: First, acute inflammatory response. The transient increase in tissue hardness may reflect acute inflammatory responses to mechanical stimulation, as seen in eccentric exercise[38], rather than long-term fibrosis. However, this is counterintuitive, as Gua Sha is often thought to relieve

muscle tension and reduce tissue hardness. Second, reflexive muscle contraction or transient microtrauma. The mechanical pressure from Gua Sha could trigger reflexive muscle contraction or transient microtrauma, leading to temporary tissue swelling and stiffness. These microinjuries may trigger an inflammatory response, leading to tissue swelling and stiffness. This is similar to a study that found that self-massage using a foam roller increased muscle hardness in the gastrocnemius muscle[39]. Another study also found that ultrasound elastography showed significant muscle hardness in 6 healthy male volunteers after eccentric contraction of the elbow flexors ($P < 0.01$)[40].

Third, temporary effect. The rise in tissue hardness may be temporary, and it may gradually decrease over time when the hyperemia of the skin and subcutaneous tissues resulting from Gua Sha gradually subsides within a few days after the treatment. This finding appears counterintuitive, as Gua Sha is traditionally associated with tension relief; however, it underscores the complexity of fascial responses to mechanical stimuli. Notably, no adverse reactions were observed, suggesting the tissue hardness increase may represent a benign, transient physiological adaptation. Further investigation is warranted to elucidate the mechanisms and time course of these effects.

This study found that Gua Sha significantly improved lumbar flexibility in healthy young adults ($p < 0.001$). This result is consistent with the theory that Gua Sha is an effective myofascial induction tool, which states that Gua Sha improves posterior chain muscle mobility and flexibility in a short period[41]. The potential mechanisms by which Gua Sha improves lumbar flexibility include promoting fascial gliding, reducing muscle tension and stiffness, enhancing muscle activity, and improving neuromuscular control. The results of this study are consistent with previous studies that show that Gua Sha has a positive effect on improving lower back pain and functional activities[16,17,35]. This is clinically significant as improved flexibility directly relates to enhanced functional activities and quality of life for patients. This result is consistent with previous studies that show that Gua Sha has a positive effect on improving lower back pain and functional activities.

We acknowledge the following limitations in the conclusion. First, the study involved a small sample size of only 24 healthy young adults. This restricts the generalizability of our results to a broader population, particularly individuals afflicted with CLBP. Second, the inherent nature of Gua Sha, which produces visible marks, precluded effective assessor blinding, potentially introducing detection bias. Furthermore, the absence of a true placebo control group represents an additional methodological limitation. Third, this investigation focused solely on the immediate effects of a single 15-minute Gua Sha session, thus limiting our understanding of its sustained impact.

Based on these limitations, several avenues for future research are strongly recommended. First, multi-session and longitudinal trials are crucial to elucidate the sustained impact of Gua Sha on TLF properties and functional parameters. Second, future research should prioritize clinical trials involving individuals with CLBP to comprehensively assess the therapeutic potential of Gua Sha in a pathologically relevant population. Third, combining ultrasound with elastography or MRI to quantify structural and functional fascial changes. Fourth,larger studies are warranted to further clarify the observed right-side dominance in TLF thickness reduction, which may be influenced by factors such as operator hand preference, anatomical differences, or measurement errors.

CONCLUSIONS

This is the first study to utilize ultrasound imaging to assess the effects of Gua Sha on TLF thickness. The results indicate that a single 15-minute Gua Sha session can significantly reduce TLF thickness and improve skin temperature, PPT, and lumbar flexibility in healthy adults. Based on these preliminary findings, and acknowledging the limitations of this pilot study, including its small sample size, the lack of effective assessor blinding, and its focus on a healthy population, we recommend further studies. Future research should utilize larger sample sizes and clinical populations to evaluate the long-term, multi-session effects of Gua Sha in individuals with LBP.

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