

Randomized Controlled Pilot Study: Pain Intensity and Pressure Pain Thresholds in Patients with Neck and Low Back Pain Before and After Traditional East Asian “Gua Sha” Therapy

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Abstract: Gua Sha is a traditional East Asian healing technique where the body surface is “press-stroked” with a smooth-edged instrument to raise therapeutic petechiae that last 2–5 days. The technique is traditionally used in the treatment of both acute and chronic neck and back pain. This study aimed to measure the effects of Gua Sha therapy on the pain ratings and pressure pain thresholds of patients with chronic neck pain (CNP) and chronic low back pain (CLBP). A total of 40 patients with either CNP or CLBP (mean age 49.23 ± 10.96 years) were randomized to either a treatment group (TG) or a waiting list control group (WLC). At baseline assessment (T1), all patients rated their pain on a 10 cm visual analog scale (VAS). Patients’ pressure pain thresholds (PPT) at a site of maximal pain (pain-maximum) and an adjacent (pain-adjacent) site were also established. The treatment group then received a single Gua Sha treatment. Post-intervention measurements were taken for both groups at T2, seven days after baseline assessment (T1), using the same VAS and PPT measurements in precisely the same locations as at T1. Final analysis were conducted with 21 patients with CNP and 18 patients with CLBP. The study groups were equally distributed with regard to randomization. Patients in both the CNP and the CLBP treatment groups reported pain reduction ($p < 0.05$) and improved health status from their one Gua Sha treatment, as

compared to the waiting list group. Pain sensitivity improved in the TG in CNP, but not in CLBP patients, possibly due to higher pressure sensitivity in the neck area. No adverse events were reported. These results suggest that Gua Sha may be an effective treatment for patients with chronic neck and low back pain. Further study of Gua Sha is warranted.

Keywords: Gua Sha; Traditional East Asian Medicine; Neck Pain; Low Back Pain; Chronic Pain; Pressure Pain Threshold.

Introduction

Gua Sha is an instrument-assisted unidirectional “press-stroking” of a lubricated area of the body surface that intentionally creates transitory therapeutic petechiae. These petechiae, which fade within 2–5 days, result from the extravasation of blood into the subcutis (Nielsen *et al.*, 2007; Braun *et al.*, 2011). While they and their accompanying ecchymosis appear remarkable (Fig. 1), Gua Sha therapy is generally well tolerated, with little or no discomfort. Gua Sha is widely used in Asia (So, 1987; Tsai *et al.*, 2008), as well as in communities of Asian immigrants worldwide (Craig, 2002; van Nguyen and Pivar, 2004).



Figure 1. Gua Sha treatment for chronic neck pain. The picture shows the beginning of the treatment in the upper back and demonstrates how the formation of the petechiae and ecchymosis are induced by means of repeated unidirectional “press-stroking” with a smooth-edged instrument. When treatment for neck pain is finished, the upper back, neck and shoulders are covered with petechiae, which will fade over several days.

It remains an important treatment technique for many acupuncturists and traditional East Asian medicine practitioners (Nielsen, 1995; Kaptchuk, 2002) for regional pain and for functional problems with impaired movement including neck and back pain (Nielsen, 1995). However, a 2010 systematic review of controlled trials of Gua Sha for musculoskeletal pain conducted in China found the quality of trials was lacking (Lee *et al.*, 2010). Since that review there have been positive randomized controlled trials for Gua Sha in the Western literature for neck pain (Braun *et al.*, 2011) and for pain and inflammation associated with mastitis/breast engorgement (Chiu *et al.*, 2010) in addition to case reports suggesting Gua Sha is valuable for migraine headache (Schwickert *et al.*, 2007), post-herpetic neuralgia (Nielsen, 2005) and chronic active hepatitis B where Gua Sha demonstrated a hepato-protectant effect (Chan *et al.*, 2011).

Chronic neck and low back pain are very common in Germany, with a 12-month prevalence of 44.8% (Wolff *et al.*, 2011) and 76.0% (Schwickert *et al.*, 2007) respectively. Potential connective tissue changes have been hypothesized in the development and chronicity of low back pain (Langevin and Sherman, 2007; Langevin *et al.*, 2009). The same may also be true of chronic neck pain. Muscle and connective tissue disturbances have previously been linked to poor microcirculation and pressure pain hyperalgesia (Jänig, 2005) in both the back (Langevin and Sherman, 2007; Farasyn and Meeusen, 2005; Giesbrecht and Battie, 2005) and the neck (Larsson *et al.*, 1999; Scott *et al.*, 2005; Strom *et al.*, 2009; Javanshir *et al.*, 2010; La Touche *et al.*, 2010), although the extent to which such hyperalgesia is localized is unclear (Giesbrecht and Battie, 2005; Javanshir *et al.*, 2010).

While manual therapies such as joint manipulation (Mansilla-Ferragut *et al.*, 2009), acupuncture (Irnich *et al.*, 2001) and cupping therapy (Cramer *et al.*, 2011; Lauche *et al.*, 2011, 2012) are known to influence patients' pressure pain sensitivity, Gua Sha's potential in this respect has not been established. This pilot study aims to investigate the effects of Gua Sha on the pain ratings (VAS) and pressure pain thresholds (PPT) of patients with chronic neck or chronic low back pain.

Methods

The study protocol was approved by the University Duisburg-Essen Medical Institutions' review board (No. 08-3594).

Patients

Forty patients were recruited to this study between January 2008 and August 2009. The inclusion criteria specified that they be aged 18–75 years, with non-specific neck or low back pain on at least five days a week for at least three consecutive months. Their mean pain intensity score was required to be at least 4 cm on a 10 cm VAS. In addition, an orthopedic practitioner or neurologist must have previously excluded specific causes for patients' pain. Study exclusion criteria included vertebral disc prolapse, trauma, inflammatory or malignant disease and congenital malformation of the spine, as well as radicular

symptoms such as radiating pain, paresis, pricking or tingling. Patients were also excluded if they had invasive treatments within the previous month, spinal surgery within the last year or previous treatment with corticosteroids or opiates. Further exclusion criteria were serious acute or chronic organic disease, such as diabetes or cancer, mental health disorders, pregnancy, anticoagulation treatment or a tendency to hemorrhage. Non-steroidal pain medication and physiotherapy were allowed if the treatment regimen had not been altered for at least a month before recruitment and continued unaltered during the trial. This ensured that the evaluation of Gua Sha's effects was uninfluenced by changes in these areas.

Recruitment

All patients were recruited via notices placed in local newspapers. Following a brief screening telephone interview, potential participants were invited to the clinic for physical and brief neurological assessment. All eligible patients gave written informed consent to participate.

Randomization

Patients were randomized into either a treatment group (TG) or a waiting list control group (WLC). Randomization was conducted using sequentially numbered, sealed opaque envelopes, prepared in advance by the study coordinator. The latter was not involved in either patients' treatment or measurement. Randomization took place directly after patients' baseline assessments.

Timing of Measures

Baseline assessment measures were taken before patients were randomized and patients in the treatment group received Gua Sha treatment (T1). These measures were repeated post-intervention, seven days after T1 (T2), at which point waiting list patients were also offered treatment.

Intervention

Gua Sha therapy. The Gua Sha treatments were administered to sitting patients by the study physician. Patients' backs were first covered with Tumarol N Balsam (made by ROBUGEN GmbH; main ingredients: camphor, eucalyptus oil, menthol; dose: approx. 5 g per subject). The physician then applied a round-edged instrument (the inside smooth edged lip of a metal cap) to patients' skin in downward strokes. The treatment usually started in the centerline, going on to the non-painful and finally to the painful side. For patients with CNP, paravertebral strokes were applied from C7 to T12, followed by horizontal strokes from C7 to the shoulder. Further horizontal strokes were then applied between C7 and T12, following the contours of the ribs. Final paravertebral strokes were applied from C1/2 to C7. For patients with CLBP, paravertebral strokes were applied from

C7 to L5, followed by horizontal strokes between C7 and L5 and further strokes along the dorsal part of the gluteus maximus muscle.

The strokes were repeated in one location until “Sha” (petechiae) became visible. At this point, the physician moved on to other body areas. Individual treatments lasted 10–15 minutes. The pressure applied was adjusted to patients’ comfort. Post-treatment, patients rested briefly and then left.

Outcome Measures

Pain. Each subject’s pain was recorded at rest at baseline (T1) and at 7 days post-intervention (T2), using a 10-cm visual analog scale (VAS) (Duncan *et al.*, 1989). This scale ran from 0 (no pain) to 10 cm (worst imaginable pain).

General Health Outcome. Patients reported their general health outcome on a 5-point Likert-type scale, which ranged from “My health is much better than before treatment” to “My health is much worse than before treatment”. This scale was adapted from the SF-36 Quality of Life measure (Bullinger *et al.*, 1995).

Pressure Pain Threshold. Patients’ pressure pain thresholds (PPT) were measured at a site of maximal pain (pain-maximum) and an adjacent site (pain-adjacent). These areas were determined individually for each patient. To do this, patients were given body diagrams on which to mark painful areas of their necks or lower backs, highlighting the most painful area. This area was defined as “pain-maximum” and confirmed by palpation. For the “pain-adjacent” area, the boundary of the painful area was identified. A location 2 cm superior or inferior to the painful area was defined as “pain adjacent”. This location was chosen to take account of both primary and secondary hyperalgesia (Woolf and Salter, 2000). Both locations were marked on patients’ pain diagrams at T1, so that measurements could be replicated precisely at T2. PPTs were determined and calculated according to the Quantitative Sensory Testing (QST) standardized protocol developed by Rolke *et al.* (2006b,a) to ensure inter-study comparability. Retest- and inter-observer reliability, with standardized QST protocols, have proven satisfactory (Geber *et al.*, 2011). Patients’ PPT was measured using a pressure algometer (Algometer, SOMEDIC, Sweden). This device exerts forces of up to 2000 kPa when used with a probe area of 1 cm². In this study, patients’ thresholds were measured in three series of trials (at T1), increasing the pressure intensities by 50 kPa/s, until patients reported pain in addition to pressure sensations. The log-transformed arithmetic mean of these three series was taken as individual patient’s PPT (Rolke *et al.*, 2006a). The test-retest reliability of this process was determined by applying the same series of trials to the thenar eminence of control group patients’ right hands (WLC, $n = 19$). The resulting correlation coefficient of $r = 0.84$ ($p < 0.001$) indicated good test-retest reliability.

Safety

Gua Sha was applied by trained professionals experienced in the use of Gua Sha. All patients were asked to report any adverse events during the treatment period.

Statistical Analyses

Patients' demographic details, pain history and pre-treatment variables were compared using chi-squared tests for discrete data and independent *t*-tests for continuous data, to ensure the treatment and control groups' comparability at baseline. The researchers' original intention to use Student's *t*-tests to analyze the study difference scores was revised on the advice of an external biometrician. An ANCOVA model was used instead, to minimize the influence of any baseline differences. Sub-group analyses were not specified in the study protocol but conducted with regards to the pain location, i.e. neck or low back.

Patients' VAS and PPT scores were analyzed, using the ANCOVA model, with the post-intervention measurement (T2) as the dependent variable and patients' group as the between-subject factor. Patients' respective baseline values (T1) served as covariates. Their General Health Outcome scores were analyzed using Mann-Whitney U tests. The intention-to-treat principle was applied. All statistical calculations were performed using SPSS software (version 17, Chicago, Illinois, USA), with the level of statistical significance set at $p \leq 0.05$.

Results

Consort Flowchart

Following the initial screening telephone interviews, 40 of 44 patients were invited to the clinic for further evaluation. All fulfilled the study criteria and all agreed to take part in the study, although one person withdrew following randomization to the WLC group. There was no further withdrawal, leaving 20 patients in the TG (10 CNP, 10 CLBP) and 19 in the WLC group (11 CNP, 8 CLBP). Figure 2 shows the flow chart for patient recruitment.

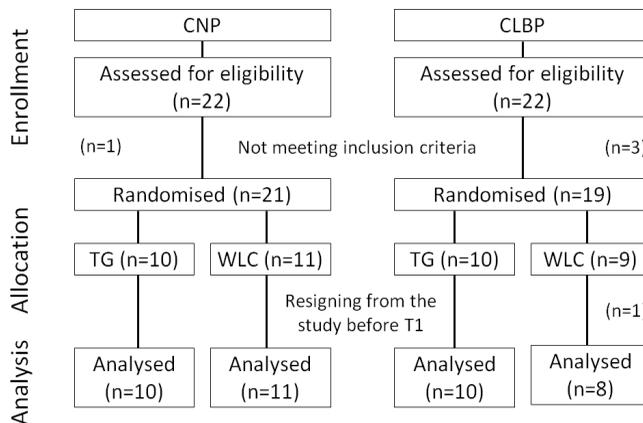


Figure 2. Consort flow chart of recruitment and trial conditions.

Table 1. Baseline Demographic and Clinical Characteristics of Trial Groups

	CNP			CLBP		
	TG (<i>n</i> = 10)	WLC (<i>n</i> = 11)	<i>p</i>	TG (<i>n</i> = 10)	WLC (<i>n</i> = 8)	<i>p</i>
Age (years)	47.7 ± 12.4	45.5 ± 8.3	0.81	52.8 ± 12.4	51.8 ± 10.4	0.86
Sex (F/M)	8/2	9/2	0.92	8/2	5/3	0.41
Pain at rest (VAS)	4.3 ± 1.7	5.2 ± 1.6	0.28	3.4 ± 2.4	3.3 ± 2.1	0.97
Duration of back/neck pain (months)	42.1 ± 46.2	60.8 ± 84.4	0.54	71.5 ± 145.6	37.1 ± 37.5	0.53

Sample Characteristics

Table 1 shows patients' demographic and baseline characteristics. Patients with neck and low back pain, in both the treatment and the control group, proved comparable in terms of their ages, gender distributions and baseline pain scores.

Patients' pre- and post-intervention scores and estimated differences are shown in Table 2 and described below.

Pain Outcome

Significant group differences between TG and WLC were found with regard to patients' levels of pain at rest (VAS) at T2, both for patients with CNP ($\Delta - 1.6$; 95%CI -3.0 to -0.1 , $p = 0.05$) and CLBP ($\Delta - 1.1$; 95%CI -2.0 to -0.2 , $p = 0.03$).

General Health Outcome

The Mann-Whitney U test showed significant between group differences for patients with CNP (mean ranks TG 7.7; WLC 14.0; $U = 22.0$; $p = 0.02$) and CNBP (mean ranks TG 6.9; WLC 12.75; $U = 14.0$; $p = 0.02$). Subjects in the Gua Sha treatment group rated their health as "much" or "somewhat" better than before, while most control group patients rated their health as unchanged.

Pressure Pain Thresholds

Significant group differences for PPT were found only for patients with CNP at pain-maximum ($\Delta 0.13$; 95%CI 0.04 to 0.22, $p = 0.01$) and pain-adjacent ($\Delta 0.15$; 95%CI 0.06 to 0.24, $p = 0.01$), with significant higher thresholds in the treatment than the control group. No group difference for pressure pain threshold was found for patients with CLBP.

Safety

No adverse events were observed in the patients.

Table 2. Outcome Measures and Estimated Group Differences from ANCOVA at T2 for Each Group

	CNP						CLBP							
	TG		WLC		T2		TG		T1		T2		Group Difference* at T2 (95%CI)	p
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2				
Pain at Rest (VAS)	4.3 ± 1.7	3.0 ± 2.2	5.2 ± 1.6	5.1 ± 1.4	-1.6 (-3.0 to -0.1)	0.045	3.4 ± 2.4	2.1 ± 1.9	3.3 ± 2.1	3.1 ± 2.4	-1.1 (-2.0 to -0.2)	0.03		
PPT at Pain-Maximum	2.38 ± 0.26	2.46 ± 0.13	2.40 ± 0.19	2.34 ± 0.16	0.13 (0.04 to 0.22)	0.01	2.56 ± 0.16	2.56 ± 0.15	2.52 ± 0.26	2.50 ± 0.28	0.02 (-0.08 to 0.12)	0.64		
PPT at Pain-Adjacent	2.41 ± 0.23	2.50 ± 0.09	2.43 ± 0.17	2.36 ± 0.17	0.15 (0.06 to 0.24)	0.01	2.52 ± 0.17	2.52 ± 0.17	2.55 ± 0.19	2.48 ± 0.22	0.07 (-0.01 to 0.15)	0.11		

Note: *Group differences and p values from an ANCOVA model with two groups and baseline values as covariate.

Discussion

Principal Findings

Treatment group patients reported significant symptomatic improvements after Gua Sha therapy in terms of their pain at rest (VAS) and General Health Outcome. Treatment group patients' pressure pain thresholds were also significantly higher, i.e. less sensitive after treatment for those with CNP but not CLBP.

Interpretation of the Study Findings

The above changes to study patients' pain ratings and perceived health suggest that Gua Sha therapy may be an effective treatment for chronic non-specific neck and low back pain, with the changes to patients' VAS score supporting potential clinical significance (Dworkin *et al.*, 2008). Pressure hyperalgesia is a common finding in chronic neck (Scott *et al.*, 2005; La Touche *et al.*, 2010) and chronic low back pain (Farasyn and Meeusen, 2005; Giesbrecht and Battie, 2005). While the precise mechanisms operating in these areas remain unclear, recent studies show hyperalgesia to be a consequence of chronic pain, rather than a cause (Javanshir *et al.*, 2010; O'Neill *et al.*, 2011). Pressure pain thresholds have been found to be significantly higher in the lower back than in the neck (Binderup *et al.*, 2010), suggesting greater pressure sensitivity in the neck despite similar mechanisms at work. In the current study, changes only occurred in the pressure pain thresholds of patients with CNP, following Gua Sha therapy, and not those with CLBP. Similar results were reported in studies of other manual therapies, with effects only for patients with CNP (De Camargo *et al.*, 2011) and not CLBP (Cote *et al.*, 1994). This difference may be due to higher levels of pressure sensitivity in the neck area or possible variations, currently unknown, in pain processing mechanisms.

Several modes of action for Gua Sha are described in the literature. Gua Sha therapy increases surface microperfusion in treated areas by 400% following treatment (Nielsen *et al.*, 2007) and the resulting extravasated blood in the capillary bed is associated with an up-regulation of the heme oxygenase-1 (HO-1) gene expression (Kwong *et al.*, 2009; Chan *et al.*, 2011). This effect, which can be measured directly after treatment, is sustained for a minimum of five days in mouse models (Kwong *et al.*, 2009). Up-regulation of HO-1 has both cytoprotective (Soares *et al.*, 2009) and anti-nociceptive effects (Nascimento and Branco, 2007, 2009), as well as anti-inflammatory and immunoregulatory properties (Xia *et al.*, 2008). These findings suggest that Gua Sha's immediate and sustained benefits for CNP and CLBP may be due to an anti-nociceptive and anti-inflammatory effect via HO-1 gene up-regulation.

Therapeutic stimulation of the skin's mechanoreceptors and nociceptors has been previously discussed as a mechanism that inhibits pain signal conduction in the spinal cord (Rosenzweig *et al.*, 1999; Meyer *et al.*, 2006; Musial *et al.*, 2008). It is also conceivable that Gua Sha therapy's ability to stretch underlying muscles and connective tissue may correct connective tissue changes hypothetically involved the development and chronicity of chronic back pain (Langevin and Sherman, 2007; Langevin *et al.*, 2009; 2010).

Limitations of the Study

The results of this study are potentially limited by its small sample size and choice of a waiting list control group. However, a systematic review of 20 studies of therapeutic treatment for non-whiplash neck disorders showed that the placebo effect did not differ significantly from the effect seen in studies with unblinded non-treatment controls (Vernon *et al.*, 2006). Although the current study's pilot character made a waiting list control group appropriate, future studies should include an active control group. An additional challenge for future studies is offered by the fact that experimental blinding of the assessor is impracticable when using Gua Sha, due to the occurrence and persistence of the resulting petechiae. Lastly, the medicated balm used in the current study, may have influenced the results and its specific effects should therefore be further investigated.

Conclusions

Both patients with chronic neck and chronic low back pain reported pain reduction and improved health status from one Gua Sha treatment compared to a waiting list control group. Adjacent area pain sensitivity improved in patients with neck pain, but not those with low back pain, possibly due to higher pressure sensitivity that is characteristic of the neck area. Gua Sha therapy may be effective in treating patients with chronic neck and chronic low back pain. Further study of Gua Sha is warranted. No adverse events were reported.

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Competing Interests

The authors declare no commercial associations that might create a conflict of interest in connection with this study and no competing financial interests.

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