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Effect of Gua Sha therapy on patients with diabetic peripheral neuropathy: A randomized controlled trial

Xiaolan Xie[a], Liqiong Lu[a], Xiaoping Zhou[a], Caitang Zhong[b], Guo Ge[c], Huie Huang[d], Xiaoming Zhang[e], Yingchun Zeng[f,*]

[a] Department of Nursing, Guangdong Provincial Hospital of Integrated Traditional Chinese and Western Medicine, Nanhai, Guangdong Province, China
[b] Department of Nursing, The Third Affiliated Hospital of Guangdong Medical University, Shunde, Guangdong Province, China
[c] Department of Endocrinology, The First Affiliated Hospital of Jinan University, Guangzhou, China
[d] Department of Nephrology, The Affiliated Shenzhen Hospital of Beijing University, Shenzhen, China
[e] The Affiliated Baoan Hospital of Southern Medical University, The People's Hospital of Baoan Shenzhen, Shenzhen, China
[f] Research Institute of Gynecology and Obstetrics, The Third Affiliated Hospital of Guangzhou Medical University, Guangzhou, China

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ABSTRACT

Objective: To examine the effect of Gua Sha therapy in the treatment of diabetic peripheral neuropathy (DNP).
Design: An open-label randomized controlled study was conducted with usual care as the control (60 subjects in Gua Sha group and 59 subjects in usual care group). Outcome measures included Toronto Clinical Scoring System (TCSS), Vibration Perception Threshold (VPT), Ankle Brachial Index (ABI), and fasting plasma glucose (FPG). There were 12 consecutive sessions of Gua Sha, one session per week.
Results: After the first cycle of Gua Sha intervention, only performance of sensory function measured by the VPT, and peripheral artery disease symptoms by the ABI were statistically significant differences between the two groups (both P values < 0.01), and the total TCSS score and the FPG level were no group differences ($P = 0.14$, and 0.25, respectively). At the eight-week and 12-week post intervention assessment, Gua Sha therapy significantly reduced severity of neuropathy symptoms, improved performance of sensory function, reduced peripheral artery disease, and better controlled plasma glucose by comparing with the control group (all P values < 0.01). The changes of mean scores of TCSS, VPT, ABI and the plasma glucose levels in the Gua Sha group showed a significant change from baseline to week 12, indicating that Gua Sha therapy induced progressive improvement in the management of DPN symptoms, sensory function, peripheral artery disease and glucose levels. No serious adverse events were reported in either arm. Gua Sha therapy in this study was effective, safe and well tolerated by patients.
Conclusion: Gua Sha therapy appears to be effective at reducing the severity of DPN in a clinically relevant dimension, and at improving other health outcomes in patients with DPN. While this study found that Gua Sha therapy is a promising treatment in reducing the symptoms of patients with DPN, further, larger sample studies are required to confirm the effects of Gua Sha therapy in patients with DPN.

1. Introduction

Diabetic peripheral neuropathy (DPN), which represents a major global health problem, is a distressing and disabling complication of diabetes mellitus [1–3]. The estimated prevalence of diabetes in the Chinese population is 11.6% [4]. DPN is a chronic peripheral neuropathic syndrome estimated to occur in up to one-third of diabetic patients [1]. Typical symptoms include loss or reduction of somatosensory information from the legs and feet, leading to balance disturbances and nocturnal burning in the legs and feet. This indicates impairment or damage to small nerve fibers [1,5], which affects DPN patients' daily living and leads to impaired quality of life [2,3].

Given a lack of available treatment that can reverse the development or progression of DPN [1], patients often rely on the use of traditional Chinese medicine (TCM) and complementary therapies. While one of TCM therapies of acupuncture was applied to the management of patients with DPN, the results seems only to be effective in pain reduction of DPN [6]. Gua Sha therapy, also known as 'coining', is one of the most commonly used healing techniques in China [7] and in countries throughout Asia [8]. Gua Sha therapy is a therapeutic modality that involves press-stroking a lubricated

* Corresponding author. Tel.: +86 2081292216; fax: +86 2081292736.
E-mail address: chloezengyc@hotmail.co.uk (Y. Zeng).

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area of the body with a smooth-edged instrument to intentionally create transient red or purple petechiae and ecchymosis, which normally fades in a few days [9]. Gua Sha therapy is generally well tolerated, with little or no discomfort [7], and research evidence reported the use of Gua Sha in the management of chronic low back pain and perimenopausal syndrome [7,8]. To the best of our knowledge, there are no studies that have investigated the effects of Gua Sha therapy on DNP. Therefore, this study was conducted to examine the effect of Gua Sha therapy on patients with DPN as compared with usual care.

2. Methods

2.1. Study design

This study used an open-label randomized controlled design. Before participant enrollment, a computer-generated randomized list of numbers was placed inside sequentially ordered opaque sealed envelopes, which were used to allocate participants to receive either Gua Sha therapy or usual care. The study started with 119 participants and was completed with 113 participants. A detailed study procedure is summarized in Fig. 1, showing details of the screening, randomization, participant flow and participant disposition for each group.

2.2. Ethics, consent and permissions

This study obtained ethical approval from the ethics committee of Guangdong Provincial Hospital of Integrated Traditional Chinese and Western Medicine, in accordance with the ethical standards of the Helsinki Declaration. All participants signed informed consent forms before enrollment.

2.3. Sample

The inclusion criteria were: patients with Type 1 or Type 2 diabetes, with a primary clinical diagnosis of DPN (defined as impaired light touch by 10 g monofilament; a vibration perception threshold on either foot > 16 V; or with clinical neuropathy scores by the Toronto Clinical Scoring System ≥6), aged between 18 and 80 years, and no foot ulcers or active signs of skin disease. The exclusion criteria were: patients with a diagnosed cardiovascular or mental illness, nondiabetic peripheral nephropathy, as well as ketoacidosis or hyperosmolar coma.

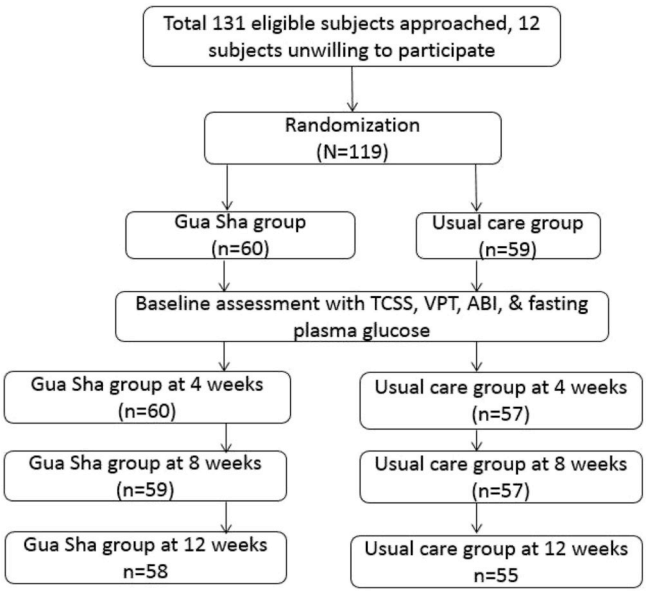

Fig. 1. Study CONSORT schematic. (TCSS, Toronto Clinical Scoring System; VPT, Vibration Perception Threshold; ABI, Ankle Brachial Index).

2.4. Gua Sha therapy

The study physician administered the Gua Sha therapy on patients, who were seated. Their backs were first covered with Gua Sha oil (key ingredients: camphor, eucalyptus oil and menthol) (Fig. 2a). Unidirectional press-stroke was applied along the midline (left or right) of the back using a special Gua Sha tool made out of copper (Fig. 2b). The treatment usually started at the midline of the back. Paravertebral strokes were applied from C7 to L5, followed by horizontal strokes between C7 and L5 with additional strokes along the dorsal surface of the gluteus maximus muscle. Final paravertebral strokes were applied to the neck from C1/2 to C7. The strokes were repeated in one area until “Sha” (petechiae) became visible (Fig. 2c). The Gua Sha oil was not shared among the participants, and the Gua Sha tool was disposed of after a single use. All subjects in the Gua Sha group received the same standard procedure of Gua Sha involving strict sterilization for instrument, and Gua sha plate was sterilized in an autoclave.

There were 12 consecutive sessions of Gua Sha: A single session of Gua Sha therapy lasted 60 min. The duration of the Gua Sha therapy was four weeks, once per week. This study repeated three cycles of interventions, so that the total number of Gua Sha intervention sessions was 12. Patients in both groups received usual care: standard medical care including medication to control blood sugar, improvement of microcirculation and nutrition of vascular nerves, education for foot care, and diet.

2.5. Outcome measures

An information sheet included patient demographic and clinical characteristics. Toronto Clinical Scoring System (TCSS) was used to assess clinical neuropathy. The scores of TCSS range from a minimum of 0 (no neuropathy) to a maximum of 19 points. “Six points are derived from symptoms, eight fro lower-limb reflexes, and five from sensory examination distally at the toes” [10]. Chinese version of TCSS is well validated and acceptable scale for measuring DNP symptoms and higher scores mean more clinical DPN symptoms [11]. While there are many screening instruments used to evaluate neuropathy in clinical practice [12], the TCSS is widely used among Chinese diabetes patients with DPN, as the Chinese version of TCSS is best suited for disease diagnosis or severity evaluation [11,13,14]. Vibration Perception Threshold (VPT) was used to measure performance sensory function. The VPT was assessed using the MediCare Sensiometer A VPT System (MediCare Instruments, Beijing, China). The device produces vibration amplitudes from 0 to 57 volts (V), with a higher vibration unit value indicating worse performance of sensory function or greater sensory dysfunction. VPT less than or equal to 15 V indicates no signs of DPN, VPT with 16 V–20 V indicates DPN, and VPT higher than 20 V indicates severe DPN [15]. Ankle Brachial Index (ABI) was used to measure the ratio of blood pressure at the ankle to blood pressure in the upper arm (brachium). Compared to the arm, lower blood pressure in the leg suggests blocked arteries due to peripheral artery disease. The normal value of ABI was equal to or higher than 0.97 [16]. Fasting plasma glucose (FPG) was used to assess participants’ glucose values, which were measured taking blood before breakfast using routine biochemical tests. The normal value of FPG was 3.9–6.1 mmol/L.

Adverse events: At the beginning of each study visit, patients were provided with a telephone number to report any concerns to a research nurse. If any adverse event were to result from the Gua Sha therapy, the nurse would refer patients to the study physician to assess their concern and initiate any necessary treatment.

2.6. Data collection

Data were collected from January to October 2018. After informed consent, patients were asked to complete the patient information sheet. Research nurses, blinded to the allocation concealment, performed all

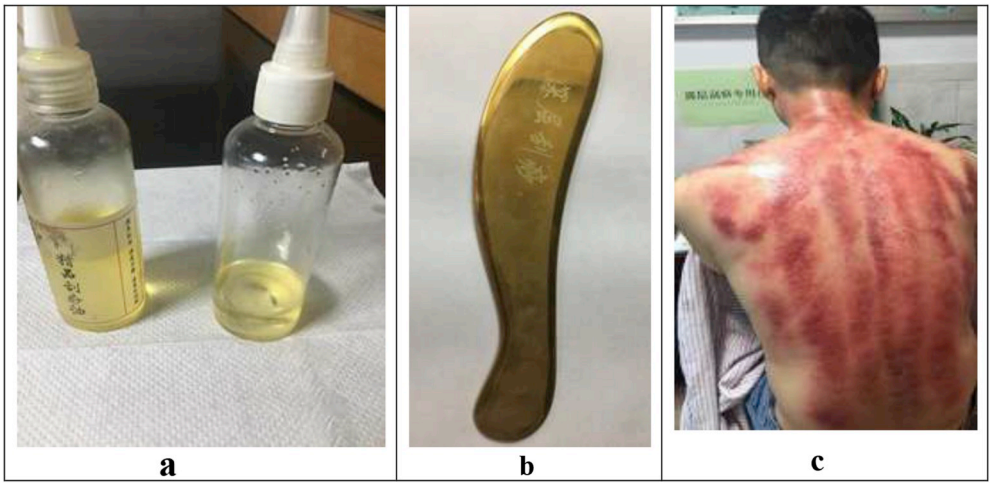

Fig. 2. a. Gua Sha oil, b. Gua Sha tool, c. Sample of petechiae after Gua Sha therapy.

assessments using the above data measurement tools at the beginning of the study, and at the fourth, eighth and twelfth weeks.

2.7. Data analysis

All analyses were performed using SPSS for Windows (version 21; IBM SPSS Statistics, Armonk, NY, U.S.). The chi-squared test and independent t-tests were used to perform an analysis of categorical and continuous variables, respectively. TCSS, VPT, ABI, and FPG outcomes were analyzed using analysis of covariance (ANOVA). The threshold for statistical significance was set at $P < 0.05$. The sample size calculation was based on our feasibility test of Gua Sha therapy for DPN in six Chinese patients. The study was powered to detect a group difference in TCSS score with a standard deviation of 1.0, based on 90% power and an alpha value of 0.05. Based on this calculation, a sample of 108 patients was required, and in order to account for possible dropouts, this study needed to recruit a sample of 120 patients.

3. Results

3.1. Participant characteristics

Of the 119 patients, 60 were randomized to Gua Sha therapy and 59 to the control group. Two patients in the Gua Sha group and four patients in the control group were lost to follow-up. In the Gua Sha group, the dropouts were due to the time commitment required for the study (n = 2). In the control group, the dropouts were a result of scheduling problems (n = 3), and the requirement for admission to a hospital outside of the town where the study took place (n = 1). Baseline demographic and clinical characteristics were similar in both groups and had no statistically significant differences (Table 1).

Table 1
Baseline characteristics for the study sample (N = 119).

	Mean (SD)/n (%)		T-test or χ^2 test	*p* value
	Gua Sha group n = 60	Control group n = 59		
Age (years)	58.86 (11.75)	59.22 (9.13)	t = 0.18	0.85
Gender			χ^2 = 2.54	0.08
Female	33 (56.9)	23 (41.8)		
Male	25 (43.1)	32 (58.2)		
Education			χ^2 = 2.51	0.11
Middle school or below	23 (39.7)	30 (54.5)		
High school or above	35 (60.3)	25 (45.5)		
Smoking			χ^2 = 0.71	0.41
Yes	26 (44.8)	29 (52.7)		
No	32 (55.2)	26 (47.3)		
BMI (kg/m^2)	20.97 (4.11)	20.82 (3.78)	t = −0.21	0.84
Disease duration (years)	10.10 (5.56)	9.36 (3.19)	t = −0.87	0.36

Table 2
Comparison of mean scores of key study outcomes at baseline (N = 119).

	Baseline Mean (SD)		t	*p*
	Gua Sha group n = 60	Control group n = 59		
TCSS	8.72 (1.68)	8.69 (1.57)	0.32	0.75
VPT	17.24 (2.54)	18.24 (2.89)	−1.94	0.06
ABI	0.59 (0.11)	0.56 (0.08)	1.63	0.11
FPG	8.81 (1.63)	8.91 (1.65)	−0.06	0.95

Abbreviations: ABI, Ankle Brachial Index; FPG, fasting plasma glucose; TCSS, Toronto Clinical Scoring System; VPT, Vibration Perception Threshold.

3.2. Effects of Gua Sha therapy on DPN

As seen in Table 2, there were no significant differences in the total TCSS, VPT and ABI scores, or in the plasma glucose levels between the two groups at baseline (all P values > 0.05). After the first cycle of Gua Sha intervention, only performance of sensory function measured by the VPT, and peripheral artery disease symptoms by the ABI were statistically significant differences between the two groups (both P values < 0.01), and the total TCSS score and the FPG level were no group differences (P = 0.14, and 0.25, respectively) (Table 3). At the eight-week and 12-week post intervention assessment, Gua Sha therapy significantly reduced severity of neuropathy symptoms, improved performance of sensory function, reduced peripheral artery disease, and better controlled plasma glucose by comparing with the control group (all P values < 0.01) (Table 3). As presented in Table 4, the changes of mean scores of TCSS, VPT, ABI and the plasma glucose levels in the Gua Sha group showed a significant change from baseline to week 12, indicating that Gua Sha therapy induced progressive improvement in the management of DPN symptoms, sensory function, peripheral artery disease and glucose levels.

3.3. Patient safety using Gua Sha therapy

One patient in the control group had diabetic neuropathy aggravation. There were no serious adverse events reported in the Gua Sha group. Only one patient reported leg numbness, but it was not considered to be serious.

Table 3
Comparison of mean scores of key study outcomes at three time-point.

	Mean (SD) at 4 weeks		t	p	Mean (SD) at 8 weeks		t	p	Mean (SD) at 12 weeks		t	p
	Gua Sha group n = 60	Control group n = 57			Gua Sha group n = 59	Control group n = 57			Gua Sha group n = 58	Control group n = 55		
TCSS	6.42 (1.20)	6.69 (1.27)	−1.50	0.14	5.47 (0.66)	6.23 (0.97)	−5.53	< 0.01	5.24 (0.56)	6.95 (1.36)	−8.14	< 0.01
VPT	14.97 (2.93)	17.80 (2.52)	−5.49	< 0.01	13.36 (1.78)	14.82 (1.68)	−4.46	< 0.01	12.57 (2.27)	15.62 (1.51)	−8.44	< 0.01
ABI	0.64 (0.10)	0.59 (0.08)	3.27	< 0.01	0.81 (0.10)	0.67 (0.09)	7.44	< 0.01	0.98 (0.17)	0.76 (0.13)	7.77	< 0.01
FPG	7.50 (1.43)	7.91 (1.47)	−1.16	0.25	5.24 (1.22)	6.58 (1.36)	−4.87	< 0.01	4.24 (1.16)	6.15 (1.33)	−8.67	< 0.01

Abbreviations: ABI, Ankle Brachial Index; FPG, fasting plasma glucose; TCSS, Toronto Clinical Scoring System; VPT, Vibration Perception Threshold.

Table 4
Changes of mean scores of key study outcomes in the Gua Sha group (n = 58).

	Gua Sha group Mean (SD)				Time effect		Estimated mean difference with 95% confidence interval (CI)			F	p
	Baseline	4-week	8-week	12-week	F	p	△0–4 weeks	△0–8 weeks	△0–12 weeks		
TCSS	8.72 (1.68)	6.42 (1.20)	5.47 (0.66)	5.24 (0.56)	371.40	< 0.01	1.31 (0.81–1.81)	3.57 (3.07–4.07)	4.57 (4.07–5.07)	133.81	< 0.01
VPT	17.24 (2.54)	14.97 (2.93)	13.36 (1.78)	12.57 (2.27)	156.74	< 0.01	2.28 (1.39–3.16)	3.88 (2.99–4.76)	4.67 (3.79–5.56)	42.13	< 0.01
ABI	0.59 (0.11)	0.64 (0.10)	0.81 (0.10)	0.98 (0.17)	418.85	< 0.01	−0.05 (−0.09–0.01)	−0.22 (−0.26–0.18)	−0.39 (−0.44–0.35)	120.85	< 0.01
FPG	8.81 (1.63)	7.50 (1.43)	5.24 (1.22)	4.24 (1.16)	238.56	< 0.01	2.29 (1.88–2.70)	3.25 (2.84–3.66)	3.47 (3.06–3.88)	116.31	< 0.01

Abbreviations: ABI, Ankle Brachial Index; FPG, fasting plasma glucose; TCSS, Toronto Clinical Scoring System; VPT, Vibration Perception Threshold.

4. Discussion

Gua Sha therapy in this study was effective, safe and well tolerated by patients. After three cycles of Gua Sha treatments, the severity of DPN by TCSS was significantly reduced and the patients' other health outcomes, such as VPT, ABI and FPG, also improved. To the best of our knowledge, this is the first study to use Gua Sha therapy to treat diabetic patients with peripheral neuropathy, although Gua Sha therapy has widely been applied to manage other disease conditions, such as perimenopausal syndrome [7] and chronic low back pain [8].

Gua Sha therapy is widely used to treat different disease conditions in a diversity of geographic locations, including Asia, as well as among the Asian diaspora [7,8]. However, the possible mechanisms of how Gua Sha therapy exerts positive effects on different disease conditions are under ongoing investigations. According to pre-clinical studies, Gua Sha is shown to increase microperfusion [17], produce an anti-inflammatory and an immune protective effect due to up-regulating the heme oxygenase-1 (HO-1) [18,19], which has both cytoprotective and anti-nociceptive effects [20,21], as well as anti-inflammatory and immunoregulatory properties [20–22]. Based on these animal study findings, it could be inferred that Gua Sha can reduce DPN symptoms, which is attributable to an antinociceptive and anti-inflammatory effect via HO-1 gene up-regulation. Another proposed mechanism of Gua Sha therapy may be that therapeutic stimulation of the skin's mechanoreceptors and nociceptors as a mechanism could possibly mediate the effects of Gua Sha therapy [23].

5. Strengths and limitations

While this study's main strength is that it is the first to apply Gua Sha therapy in DPN patients, it has several limitations. The first, is that it only assessed study outcomes at 12 weeks and lacked long-term follow-up; the second limitation is that this study only blinded the outcome assessor, without blinding patients and therapists to patient treatment allocations. While there were no adverse events of Gua Sha therapy reported throughout the study period, it was not absolutely safe or without complications as there is one case study reported that Gua Sha caused acute epiglottitis [24]. Possibly, acute epiglottis may belong to medical negligence or error as Gua Sha is not indicated to be applied to the front of the throat. Hence, future research needs continuously to monitor the adverse effects of Gua Sha therapy. The final limitation is that it was difficult to exclude possible placebo effects, due to the lack of sham Gua Sha therapy acting as a control condition. Finally, use of Gua Sha oil is another study limitation and one of potential confounding factors. Future Gua Sha research should have a comparison group that uses application of medicated oil alone, or applying plain oil or balm that is without camphor, eucalyptus or any other herbal additive so that there is no need for another arm of application of medicated oil to serve as control.

6. Implications and suggestions

Gua Sha therapy appears to be effective at reducing the severity of DPN in a clinically relevant dimension, and at improving other health outcomes in patients with DPN. While this study found that Gua Sha therapy is a promising treatment for reducing symptoms in DPN patients, further studies with larger sample sizes are required to confirm the effect of Gua Sha therapy in DPN.

Data availability

The data are available from Ms. Xiaolan Xie upon request.

Conflicts of interest

The authors declare they have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ctcp.2019.03.018.

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