Journal of Bodywork & Movement Therapies 24 (2020) 123–130

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Myofascial Pain and Treatment

Persian manual therapy method for chronic low-back pain with lumbar radiculopathy; a randomized controlled trial

Mohamad Sanei [a], Farzin Roozafzai [b], Shobeir Rostami Abousaidi [c], Mahmood Hamze [d], Amir-Masoud Negarestani [e], Roshanak Mokaberinejad [a, *]

[a] Department of Traditional Medicine, School of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[b] Digestive Disease Research Institute, Shariati Hopital, Tehran University of Medical Sciences, Tehran, Iran
[c] Department of Orthopedics, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[d] Department of Physical Medicine and Rehabilitation, Iran University of Medical Sciences, Tehran, Iran
[e] Department of Radiology, Shahid Beheshti University of Medical Sciences, Tehran, Iran

ARTICLE INFO

Article history:
Received 27 June 2019
Received in revised form
10 December 2019
Accepted 17 February 2020

Keywords:
Complementary therapies
Traditional medicine
Low-back pain
Radiculopathy
Radpa

ABSTRACT

Background: Manual therapy is a non-surgical approach for management of musculoskeletal symptoms. This study investigated safety and efficacy of a Persian manual therapy method (Fateh technique) for management of chronic low-back pain (LBP) and radiculopathy.

Methods: In this controlled trial, 52 eligible patients with chronic LBP and lumbar radiculopathy were randomly assigned into two intervention groups; one received a 16-min soft tissue manipulation for four weekly sessions and did two daily home active exercises. The other group only did the two daily exercises for four weeks. Roland-Morris disability score, Visual Analogue Scale scores of LBP, radiculopathy and paresthesia, and finger-to-floor test result were assessed at the baseline, and in fourth and eighth weeks of trial.

Results: Data of 48 participants was analyzed. Distributions of age, sex, and duration of symptoms in two groups were the same. Fateh technique respectively decreased pain, radiculopathy, paresthesia, and disability, by 4.28 [95% confidence interval: 3.36–5.19], 3.85 [2.67–5.03], 1.32 [0.37–2.27], and 4.58 [3.23–5.93] units, and increased body flexibility by 35.42 [6.91–63.92] millimeters. Compared with home exercise, Fateh technique was associated with greater changes in all outcomes. No adverse event has occurred.

Conclusions: Fateh technique is safe and effective for management of LBP and radiculopathy in patients without severe progressive symptoms.

1. Introduction

Low-back pain (LBP) is known to be the leading worldwide cause of disability and its burden increases by aging of population (Buchbinder et al., 2018). About 60–80% of active individuals in developed countries experience acute LBP at least once a year (Balthazard et al., 2012). Most of them recover within six to eight weeks, but 7–10% suffer from chronic LBP for more than three months (Balthazard et al., 2012). Among patients with LBP, those with radicular pain might experience more severe pain, more disability, and poorer prognosis; and at least a third of them are expected to have proceeding symptoms for more than a year after onset (Ryan and Roberts, 2019). Lumbar radiculopathy is 3–5% prevalent and is predisposed by risk factors such as aging, ethnicity, hereditary factors, spinal abnormalities, body posture, and occupational factors (Zhang et al., 2018). Common non-surgical treatments for lumbar radiculopathy are neither effective nor safe (Nascimento et al., 2019; Ryan and Roberts, 2019; Xiao et al., 2017).

Manual therapy is a non-surgical conservative approach for assessment, diagnosis, and treatment of a variety of musculoskeletal symptoms and conditions, such as chronic LBP (Bernet et al., 2019; Clar et al., 2014; Lin et al., 2019; Nascimento et al., 2019). The use of manual therapies, such as chiropractic and osteopathy, has been increasing in the western countries. Different types of manual therapies, e.g. Chinese Tuina and Korean Chuna, are also

* Corresponding author. Department of Traditional Medicine, School of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Valiasr Street, 1516745811, Tehran, Iran.
E-mail address: rmokaberi@gmail.com (R. Mokaberinejad).

https://doi.org/10.1016/j.jbmt.2020.02.015
1360-8592/

used in eastern countries (Clar et al., 2014; Shin et al., 2017; Yang et al., 2014).

Manual therapies are also advised for treatment of LBP and sciatica in Iranian traditional medicine literature. Ghamz (strong transverse pressure and movements), and Dalk (longitudinal massage) with oils like *C. colocynthis* oil are therapies recommended in Avicenna's Canon of Medicine and Rhazes' Liber Continens, two major references of Iranian traditional medicine (Hakimi et al., 2015; Hashemi et al., 2016; Ibn-e-Sina, 2005; Jaladat et al., 2008; Razi, 2016). Kermanshahi massage is an example of folklore Dalk (Iranian traditional massage) used for management of lumbar radiculopathy (Hashemi et al., 2016). Moreover, many other folklore manipulations are widely used for decades to manage LBP and lumbar radiculopathy, but there are scarce evidence for efficacy, safety, and cost-effectiveness of such therapies. For example, to the knowledge of the authors, there was a folklore Achilles tendon manipulation technique for LBP management whose inventor died before teaching or documenting it.

Here, we introduce Persian manual therapy method -Rahkarhaye Darman-e Dasti-ye Parsi (Radpa)-, i.e., the collection of evidence-based Persian manual therapy methods, as a new category of Persian traditional medicine. This study aimed to investigate the safety and efficacy of a folklore Persian manual therapy method, so-called Fateh technique for lower limb, for management of chronic LBP and radiculopathy. Based on Iranian traditional medicine, Mohamad Fateh invented and utilized a manipulation technique for management of LBP and lumbar radiculopathy about four decades ago. Fifteen years ago, his son, Ahmad Fateh, modified the technique and combined it with two active home exercises (Afrasiabian et al., 2015). Being fast and easy to learn and execute, patients' satisfaction, tangible signs of immediate efficacy, and very few side effects encouraged us to evaluate this manual therapy technique in a clinical trial.

2. Materials and methods

2.1. Study design and participants

In compliance with the CONSORT statement (Pandis et al., 2019), this two-arm single-centered single-blinded (analyst) randomized controlled trial was conducted in Imam Hossein Hospital of Shahid Beheshti University of Medical Sciences, Tehran, Iran, from July to October 2018. One hundred and five patients with LBP and lumbar radiculopathy who referred to orthopedics, neurosurgery, or traditional medicine clinics, were recruited in this trial. Fig. 1 demonstrates study design and population.

2.2. Inclusion and exclusion criteria

Patients who agreed to participate, aged 20–55 years, and had LBP with radiculopathy symptoms for more than three months, were included. Patients with any of the following conditions were excluded from the trial: unwillingness to participate; pregnancy; any history or indication of lumbar surgery (e.g. cauda equine syndrome, severe or progressive incontinency or lower limb weakness, or clinical neurogenic claudication); spinal infection; history of rheumatoid diseases, auto-immune disorders, malignancies, and genetic disorders; LBP of visceral origin; skeletal deformities; edematous limbs; Waddell score higher than 3/5 (Waddell et al., 1980); receiving manual therapy within past three months; corticosteroids, non-steroidal anti-inflammatory drugs, or opioid use during two months prior to inclusion.

2.3. Randomization and blinding

Following an initial evaluation by an orthopedist and using a random number generator, 52 eligible participants were randomly assigned to either “Fateh manipulation and active home exercise” (Radpa + Exercise) group or “active home exercise only” (Exercise) group in a 1:1 ratio. As blinding of participants and physician was impossible due to dissimilarity of interventions in two study groups, only data analyst was blinded.

2.4. Interventions

In “Radpa + Exercise” group, 26 participants received Fateh manual therapy for about 16 min during four weekly sessions and were asked to do daily home exercises between the sessions. In “Exercise” group, 26 participants were asked to do daily exercises for 4 weeks at home.

2.4.1. Fateh manual therapy

During each treatment session, the physician administered a Radpa three-step protocol as described below.

Gluteal region is manipulated in first step (Fig. 2). The patient lies in prone position, opens the legs as wide as the shoulders. A thin pillow is put below the knee of the manipulation side in order to keep the hip joint slightly extended and abducted to reach the maximum relaxation of gluteal muscles. The patient should take his/her clothes off, since thick cloth might reduce the pressure of manipulator's hand and the effectiveness of manipulation. This step consists of three maneuvers done by hands with deep tissue pressure from lateral edge of medial upper quadrant of gluteal region, i.e., insertion of Gluteus Maximus, to the lateral edge of lateral upper quadrant below the iliac crest, i.e., insertion of Gluteus Medius. Spine or sciatic nerve manipulation is not applied in this step.

First maneuver is deep tissue friction, perpendicular to the tissue, with tip of the thumb or the proximal interphalangeal joint of the middle finger while the manipulator's hand is fisted (Fig. 2A_1 and 2.A_2). It is fast, repetitive, and rhythmic, and is applied mediolaterally on the whole above-mentioned area, with focus on the insertion of muscles. The amplitude should be gradually intensified. Some participants with severe muscle spasm, contracted muscle tissue (knots), or trigger points may feel pain at first, which is relieved by relaxation of muscles during the maneuver. Second maneuver is rotary pressure with thenar eminence of manipulator's palm, which is applied with the first maneuver one after another to reduce the pain from deep tissue pressure (Fig. 2B). Third maneuver of step one is deep petrissage, such as kneading and skin rolling, of above-mentioned area, with both hands, from medial to lateral side to resolve fascial adhesions and affect the connective tissue (Fig. 2C). After finishing one side, the other side will be done as well. These three maneuvers take approximately 4 min for each limb in total.

Sub-popliteal area is manipulated in second step (Fig. 3A). The patient lies in supine position with knees flexed at 90°. The area of this manipulation is below the popliteal fossa, where gastrocnemius tendons and tibial nerve are felt by deep palpation. The physician stabilizes patient's knee by putting his hand on it and uses the other hand for manipulation. The right hand is used for left leg manipulation and vice versa. Using the third and fourth fingers of opposite hand, repetitive deep petrissage are applied mediolaterally. At first, the patient may feel a pain that gradually decreases as the procedure goes on. It takes about 2 min for each limb.

The physician manipulates patient's calf in third step (Fig. 3B). The patient's posture is the same as step two. The medial and lateral heads of gastrocnemius are kneaded and squeezed with firm

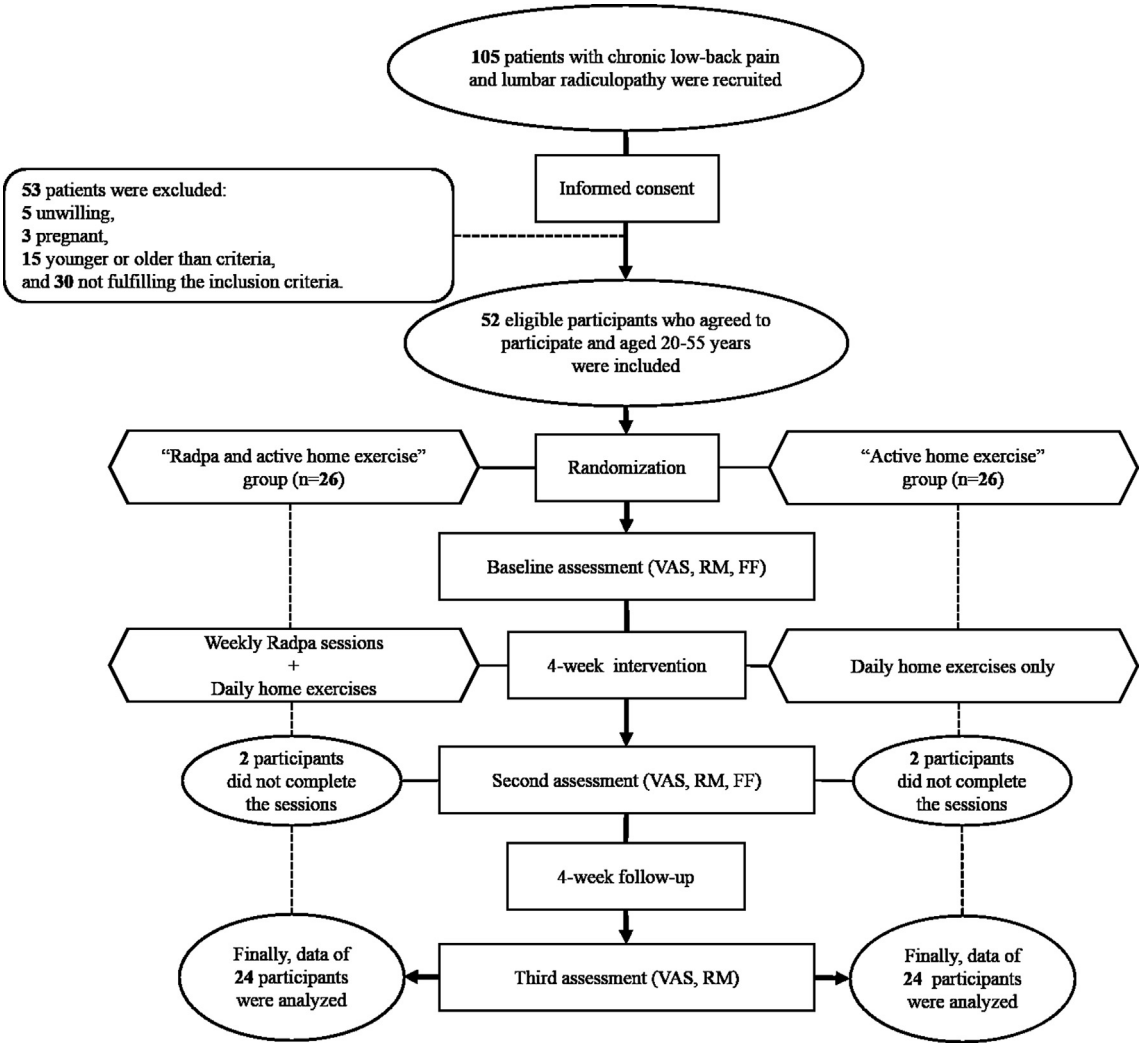

Fig. 1. Schematic study flowchart. (FF: finger-to-floor test, Radpa: Persian manual therapy method, RM: Roland-Morris disability questionnaire, VAS: low-back pain, radiculopathy, and paresthesia visual analogue scale).

pressure from proximal to distal to the Achilles tendon. This maneuver also takes about 2 min and should be applied to both limbs.

2.4.2. Active home exercises

All participants in both groups were asked to do the same daily exercises in home. The participants were given educative pamphlets describing the exercises and were asked to record the quantity of each daily exercise done. After four weeks (Exercise group) or in the last treatment session (Radpa + Exercise group), the pamphlets were collected to make sure at least 80% of the exercises have been done. The exercises are described below. Each exercise should be done 10 times for each limb, thrice daily.

One exercise is "standing leg lift" (Fig. 4A). The patient stands up tall, holding onto a firm object like wall or a table. Then patient raises one leg by flexion of hip and knee at 90° and holds the position for 3 s and returns to the starting position, rests for 3 s, and repeats the exercise 10 times. The exercise is repeated for the other limb.

The other exercise is "knee-to-chest stretch" (Fig. 4B). The patient lies flat on his/her back and slowly pulls his/her leg up to full flexion of hip, while the knee and ankle are flexed. Wrapping arms around the thigh, the position is kept for about 10 s and then the leg extends to the starting position slowly. After 3 s of rest, the exercise is repeated 10 times for each limb.

2.5. Data collection

LBP, radiculopathy, and paresthesia Visual Analogue Scale (VAS) scores (0–10), Roland-Morris disability questionnaire score (0–24), and finger-to-floor test result (millimeter) have been assessed before the interventions (baseline assessment), at the end of interventions (second assessment), and four weeks after the second assessment (third assessment). Adverse events, such as persistent pain at the site of manipulation, muscle stiffness, ecchymosis, soft tissue trauma, fractures, and neurovascular compromise, were assessed through self-reports or direct observation during and at the end of interventions. Following a training session, the participants were asked to enter the data in online questionnaires themselves. All participants' medical documents such as previous imaging, laboratory tests, and electromyography/nerve conduction studies, as well as VAS scores, disability score, and flexibility test result were recorded in Followapp© online application (Sanei, 2018). Table 1 demonstrates the timeline of data collection.

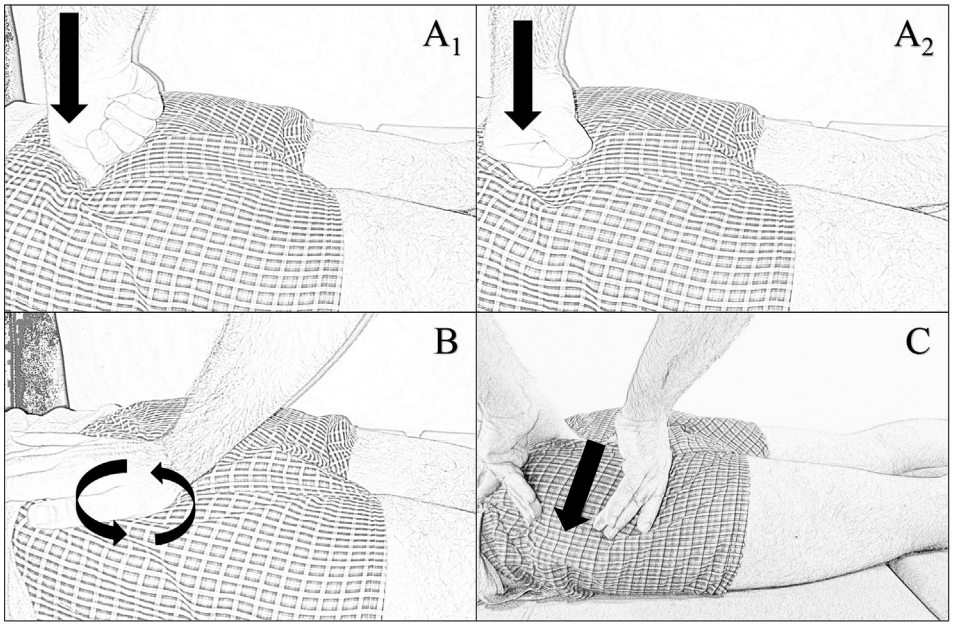

Fig. 2. Three maneuvers of gluteal region manipulation in the first step of Fateh technique. (A_1) Deep tissue friction with tip of the thumb; (A_2) Deep tissue friction with the proximal interphalangeal joint of the middle finger; (B) Rotary pressure with palm; (C) Deep petrissage with both hands.

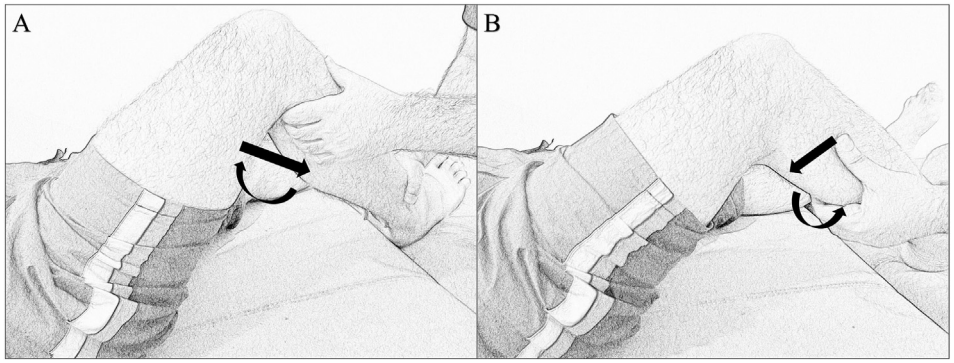

Fig. 3. Second and third steps of Fateh technique. (A) Sub-popliteal deep petrissage; (B) Calf manipulation.

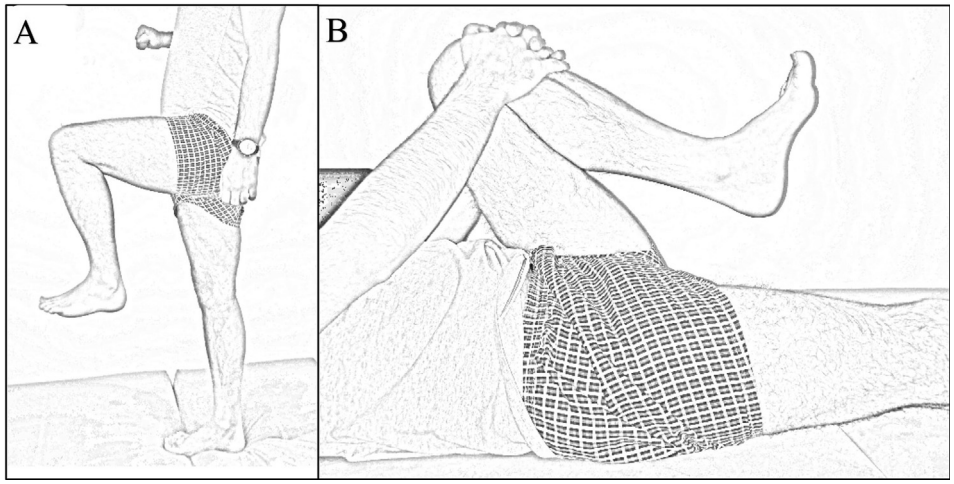

Fig. 4. Daily active home exercises. (A) Standing leg lift; (B) Knee-to-chest stretch.

Table 1
Timeline for study data collection.

Assessment	Point of measurement		
	Baseline (Week 0)	End of intervention (Week 4)	Follow-up (Week 8)
Informed consent	✓		
Past medical history	✓		
Drug history	✓		
Physical examination	✓	✓	
Comorbidity	✓	✓	✓
Current treatment	✓	✓	✓
LBP VAS score	✓	✓	✓
Radiculopathy VAS score	✓	✓	✓
Paresthesia VAS score	✓	✓	✓
Roland-Morris disability score	✓	✓	✓
Finger-to-Floor test	✓	✓	✓
Side effects		✓	

LBP: low-back pain, VAS: visual analogue scale.

2.6. Statistical analysis

Descriptive statistics (frequency, mean, and standard deviation [SD]) were used to report the baseline findings. Fisher's exact test, and independent and related samples t tests were used to compare two study groups and to assess the changes in patients' sign and symptoms. Level of significance was 0.05. All analyses were conducted using IBM SPSS Statistics v.25 (IBM Corp., Armonk, USA).

2.7. Ethical considerations

According to the Declaration of Helsinki, protocol of this study has been reviewed and approved by Ethics Committee in Biomedical Researches of Shahid Beheshti University of Medical Sciences (reference number: IR.SBMU.RETECH.REC.1396.853). The protocol is registered in Iranian Registry of Clinical Trials (reference number: IRCT20161225031563N1). All participants gave written informed consents prior to participation. The study procedures and participant's unconditional right to withdraw from the study were fully described to each participant. All identity-revealing and personal data are kept secure.

3. Results

3.1. Demographic findings

Data of 48 participants was analyzed. Data of four participants (two in each group) was not appropriate for analysis; those participants either did less than 80% of daily exercises or failed to complete treatment sessions (Fig. 1). There were 10 men (41.7%) and 14 women (58.3%) in each group. Mean (±SD) ages of "Radpa + Exercise" group and "Exercise" group were 39.58 (±9.20) and 37.25 (±9.47) years, respectively. Age (p-value = 0.391) and sex (p-value = 1.000) distribution in two study groups was statistically the same. Most of patients, nine (37.5%) in "Radpa + Exercise" group and 10 (41.7%) in "Exercise" group, suffered LBP and radiculopathy for one to five years. Regarding duration of symptoms, the two groups were statistically the same (p-value = 0.950) (Table 2).

3.2. Low-back pain

At the baseline, mean (±SD) LBP VAS score was 7.63 (±1.96) and 7.45 (±1.74) in "Radpa + Exercise" and "Exercise" groups, respectively (Table 3). The difference between two groups' scores was not statistically significant (p-value = 0.735). Second assessment showed that LBP VAS score decreased by 5.05 [4.12–5.98] and 0.75 [0.26–1.25] units in "Radpa + Exercise" (p-value <0.001) and "Exercise" (p-value = 0.004) groups, respectively (Table 3). In comparison with the baseline, LBP VAS score in third assessment decreased by 4.28 [3.36–5.19] and 0.58 [0.01–1.15] units in "Radpa + Exercise" (p-value <0.001) and "Exercise" (p-value = 0.045) groups, respectively (Table 3). The mean decrease of LBP VAS score in "Radpa + Exercise" group was 3.69 [2.64–4.75] units greater than the mean decrease in "Exercise" group (p-value <0.001).

3.3. Radiculopathy

At the baseline, mean (±SD) radiculopathy VAS score was 6.36 (±3.12) and 5.84 (±2.97) in "Radpa + Exercise" and "Exercise" groups, respectively (Table 3). The difference between two groups' scores was not statistically significant (p-value = 0.558). Radiculopathy VAS score decreased by 4.04 [2.97–5.10] and 0.12 [-0.17–0.42] units in "Radpa + Exercise" (p-value <0.001) and "Exercise" (p-value = 0.389) groups, respectively, in second assessment (Table 3). Compared with the baseline, radiculopathy VAS score decreased by 3.85 [2.67–5.03] and 0.20 [-0.29–0.69] units in "Radpa + Exercise" (p-value <0.001) and "Exercise" (p-value = 0.403) groups, respectively, in third assessment (Table 3). The mean decrease of radiculopathy VAS score in "Radpa + Exercise" group was 3.65 [2.39–4.91] units greater than the mean decrease in "Exercise" group (p-value <0.001).

3.4. Paresthesia

At the baseline assessment, mean (±SD) paresthesia VAS score was 1.84 (±3.03) and 0.67 (±1.51) in "Radpa + Exercise" and "Exercise" groups, respectively (Table 3). The difference between two groups' scores was not statistically significant (p-value = 0.100). Second assessment showed that paresthesia VAS score decreased by 1.46 [0.40–2.51] and 0.05 [-0.08–0.19] units in "Radpa + Exercise" (p-value = 0.009) and "Exercise" (p-value = 0.409) groups, respectively (Table 3). Compared with the baseline, paresthesia VAS score decreased by 1.32 [0.37–2.27] and 0.12 [-0.23–0.48] units in "Radpa + Exercise" (p-value = 0.009) and "Exercise" (p-value = 0.476) groups, respectively, in third assessment (Table 3). The mean decrease of paresthesia VAS score in "Radpa + Exercise" group was 1.19 [0.19–2.20] units greater than the mean decrease in "Exercise" group (p-value = 0.021).

3.5. Roland-Morris disability questionnaire

At the baseline, mean (±SD) Roland-Morris disability score was 12.00 (±3.61) and 11.67 (±4.03) in "Radpa + Exercise" and "Exercise" groups, respectively (Table 3). These scores were statistically the same (p-value = 0.764). Second assessment showed that disability score decreased by 4.96 [95% confidence interval: 3.93–5.98] and 0.58 [0.06–1.11] units in "Radpa + Exercise" (p-value <0.001) and "Exercise" (p-value = 0.032) groups, respectively (Table 3). Compared with the findings of baseline assessment, disability score decreased by 4.58 [3.23–5.93] and 0.79 [0.31–1.27] units in "Radpa + Exercise" (p-value <0.001) and "Exercise" (p-value = 0.002) groups, respectively, in third assessment (Table 3). The mean decrease of Roland-Morris disability score in "Radpa + Exercise" group was 3.79 [2.38–5.21] units greater than the mean decrease in "Exercise" group (p-value <0.001).

Table 2
Sex and age distribution, and duration of symptoms (low-back pain and radiculopathy) in two study groups.

Characteristic		Study group		p-value
		Exercise only (N = 24)	Radpa and Exercise (N = 24)	
		Mean (±SD)		
Age (years)		37.25 (±9.47)	39.58 (±9.20)	0.391 [b]
		Count (Percent)		
Sex	Male	10 (41.7)	10 (41.7)	1.000 [c]
	Female	14 (58.3)	14 (58.3)	
Duration of symptoms [a]	3–6 months	3 (12.5)	3 (12.5)	0.950 [c]
	6–12 months	6 (25.0)	8 (33.3)	
	1–5 years	10 (41.7)	9 (37.5)	
	>5 years	5 (20.8)	4 (16.7)	

N: count, Radpa: rahkar-e darman-e dasti-e parsi (persian manual therapy method), SD: standard deviation.
[a] Symptoms include low-back pain and radiculopathy.
[b] Independent samples *t*-test; level of significance is 0.05.
[c] Fisher's exact test; level of significance is 0.05.

Table 3
Changes in VAS scores, Roland-Morris disability score, and body flexibility in two study groups; before interventions (baseline), at the end of interventions, and four weeks later.

Study group	Variable	Assessments [c]			p-value [d]
		Baseline	Second	Third	
Exercise only (N = 24)	Low-back pain VAS score [a]	7.45 (±1.74)	6.70 (±1.56)	6.87 (±1.42)	0.045
	Radiculopathy VAS score [a]	5.84 (±2.97)	5.72 (±2.87)	5.64 (±3.04)	0.403
	Paresthesia VAS score [a]	0.67 (±1.51)	0.62 (±1.51)	0.55 (±1.20)	0.476
	Roland-Morris score [b]	11.67 (±4.03)	11.08 (±3.87)	10.87 (±3.76)	0.002
	Finger-to-Floor test (mm)	70.62 (±42.31)	71.25 (±43.79)	-	0.832
Radpa and Exercise (N = 24)	Low-back pain VAS score [a]	7.63 (±1.96)	2.58 (±1.59)	3.36 (±1.79)	<0.001
	Radiculopathy VAS score [a]	6.36 (±3.12)	2.33 (±1.75)	2.51 (±1.91)	<0.001
	Paresthesia VAS score [a]	1.84 (±3.03)	0.39 (±0.72)	0.52 (±1.24)	0.009
	Roland-Morris score [b]	12.00 (±3.61)	7.04 (±2.87)	7.42 (±3.22)	<0.001
	Finger-to-Floor test (mm)	126.25 (±88.42)	90.83 (±66.77)	-	0.017

mm: millimeters, N: count, Radpa: rahkar-e darman-e dasti-e parsi (persian manual therapy method), VAS: visual analogue scale.
[a] From 0 to 10.
[b] From 0 to 24.
[c] Numbers represent "mean (±standard deviation)".
[d] Related samples *t*-test, comparison between the baseline and last assessment; level of significance is 0.05.

3.6. Finger-to-floor test

At the baseline assessment, mean (±SD) result of finger-to-floor test, i.e., mean distance between the tip of middle finger and floor, was 126.25 (±88.42) and 70.62 (±42.31) millimeters in "Radpa + Exercise" and "Exercise" groups, respectively (Table 3). The result was 55.62 [15.35–95.90] millimeters higher in "Radpa + Exercise" group; and this observation was statistically significant (p-value = 0.009). In second assessment, finger-to-floor test result decreased by 35.42 [6.91–63.92] and 0.62 [-6.64–5.39] millimeters in "Radpa + Exercise" (p-value = 0.017) and "Exercise" (p-value = 0.832) groups, respectively (Table 3). The mean decrease of finger-to-floor test result in "Radpa + Exercise" group was 36.04 [7.04–65.04] millimeters greater than the mean decrease in "Exercise" group (p-value = 0.017).

3.7. Adverse events

The participants might feel a pain gradually decreasing during the manipulation. Yet, no adverse event, such as persistent pain at the site of manipulation, muscle stiffness, ecchymosis, soft tissue trauma, fractures, and neurovascular compromise, has occurred during interventions.

4. Discussion

Fateh technique is almost a deep soft tissue manipulation applied on the lower limbs, with no spinal or para-spinal manipulations. It is intended to relax muscles, improve circulation, stimulate tendons and nerves, and modulate pain. What makes this technique unique is the site of manipulation, particularly subpopliteal area, where is not a target for common manual therapies; common techniques are mostly applied on the whole body or the whole lower limb. An advantage of this technique is being fast and easy. Massage therapies usually take more than half an hour, while Fateh protocol takes about 16 min (Tanwir et al., 2013).

Ghamz is strong pressure and transverse movement of the fingertips on the painful area (Jaladat et al., 2008). First maneuver of first step of Fateh protocol is a technique of Ghamz, similar to deep transverse friction massage on Gluteus Medius that is previously studied by Doley et al., (2013) Deep transverse friction massage affects ligaments, tendons, and muscles of a small area. Like Fateh technique, it is applied with the thumb perpendicular to the tissue fibers; and the pressure is applied as much as tolerable (Doley et al., 2013).

According to present study, Fateh technique effectively alleviated sign and symptoms of patients suffering from chronic LBP and radiculopathy. This technique decreased pain, disability, and radiculopathy symptoms, and increased body flexibility of our patients;

and the effects lasted for at least four weeks after Fateh manipulation. On the other hand, home exercise, alone, improved only pain and disability of patients, which were subjectively assessed. Fateh technique and home exercise together improved all signs and symptoms of our patients better than home exercise alone. Therefore, the manipulation itself plays a major role in Fateh protocol for LBP and radiculopathy management.

In a previous study, Hashemi et al. compared a Radpa method, i.e., Kermanshahi massage, with routine medical treatments for management of lumbar radiculopathy in a non-randomized controlled trial. Like Fateh manual therapy, their technique decreased pain and disability of patients (Hashemi et al., 2016). Manual therapy stimulates release of endogenous opioids and increases the pain threshold in peripheral receptors (Bialosky et al., 2009). It is suggested that manual therapy might affect brain processing of anticipated painful movements and reduce pain expectancy and fear of physical exercise (Ellingsen et al., 2018). There are also cognitive and psychological factors, such as patient's satisfaction following an immediate relief of pain and disability or a tangible improvement of body flexibility, which might affect the patient's perception of pain, and consequently, the study outcomes (Hajihasani et al., 2019; Vier et al., 2018).

Unlike home exercise, Fateh manual therapy improved radiculopathy and paresthesia in our patients. This observation might emanate from nerve stimulation during manipulation. Radiculopathy suggests nerve root compression, leading to neuropathic conditions, such as radicular pain, numbness, tingling, and muscle weakness (Zhang et al., 2018). Manual therapy changes plasma levels of cytokines, modulates neuroinflammatory pathways, and modifies inflammatory responses, and consequently decreases the symptoms (Chakravarthy et al., 2019; Ellingsen et al., 2018).

Previous studies mostly assessed subjective measures, such as pain and disability (Bernet et al., 2019; Bond et al., 2019; Goertz et al., 2018; Hashemi et al., 2016; Kamali et al., 2019; Satpute et al., 2019). Present study included an objective assessment of body flexibility. In our trial, Fateh technique improved finger-to-floor test result. A plausible description for increased body flexibility is that, in this technique, petrissage and pressure are applied to muscle insertions and tendons, where Golgi tendon organs (GTOs) exist. GTO, a proprioceptive sensory receptor, responds to tension caused by an active muscular contraction (Proske, 1981). It takes part in Golgi tendon reflex, which is a protective feedback mechanism to control an active muscle's tension by inhibiting alpha motor neurons and causing relaxation before the tendon reaches its tension threshold (Proske, 1981). Deep pressure and petrissage applied in Fateh technique might stimulate GTO, ignite the reflex arc, and relax the muscle, and consequently, can increase body flexibility and relieve the pain.

Fateh manual therapy was also safe and caused no adverse events in our trial. Mild adverse events, such as muscle stiffness and pain at the site of manipulation, occur in about half of adults undergoing manipulative therapies (Smith et al., 2019). Although serious adverse events, such as fractures, and neurovascular compromise, are rare, they can be debilitating or lethal (Rubinstein et al., 2019; Smith et al., 2019). Of course, due to low incidence, one should note that randomized controlled trials are not the design of choice to assess serious adverse events. Fateh technique also does not have the potential harms of osteopathic or spinal manipulations, such as intervertebral disc herniation, and cauda equina syndrome (Jonas, 2018; Rubinstein et al., 2019).

To provide high-quality patient-centered care in this trial, we screened for red flags, reviewed imaging, did physical examinations, and provided educative information to the participants before intervention (Lin et al., 2019). Persian manual therapy is not covered by health insurances in Iran yet.

Although the technique was safe and effective based on the described measures, this study has an important drawback; Fateh manual therapy was not compared with a standard massage procedure or other manual therapies, so the results might be contextual. Studies with larger sample size should be conducted and might robust our observation. This trial was controlled by age, sex, and duration of symptoms. In addition, VAS and Roland-Morris disability scores were randomly distributed in two study groups before the intervention. Being single-blinded (analyst) affects the study psychometrics. Since the participants were not blinded, subjective assessments, i.e., VAS and Roland-Morris disability scores might be confounded. To reduce the potential subjective bias, an objective measure (finger-to-floor test) was included in the study. Patients under medical treatments for LBP were excluded from our trial. Further studies are needed to compare Fateh protocol with LBP medical managements, such as corticosteroids. Investigation of associations between Radpa's success and pathophysiology of LBP and radiculopathy is also priceless. To facilitate data collection and minimize the chance of missing data, all data was recorded in Followapp© online application (Sanei, 2018).

In conclusion, Fateh manual therapy is safe and effective for management of chronic LBP and lumbar radiculopathy in patients without severe or progressive symptoms. Authors suggest Fateh technique, an evidence-based Radpa method, as a complementary therapeutic approach and a possible alternative to medical managements.

5. Clinical relevance

- Burden of LBP and lumbar radiculopathy is increasing worldwide.
- Radpa is the collection of Persian manual therapy methods.
- Fateh technique for lower limb is a folklore Radpa manipulation method.
- Fateh technique appears to be safe and effective for LBP and radiculopathy management.

Authors' contributions

MS and RM designed the concept. All authors collaborated in data acquisition. SRA and MH visited and selected the participants. AMN interpreted radiologic images. MS did the interventions. FR provided the statistical advice. MS and FR analyzed and interpreted the data. MS and FR drafted the manuscript. All authors critically revised and approved the final manuscript. RM is the guarantor and takes the responsibility for the paper as a whole.

Funding

This study was based on Ph.D. thesis of Traditional Medicine (Mohamad Sanei), granted by School of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran (grant no: 190).

Declaration of competing interest

None.

Acknowledgements

Authors acknowledge Fateh family for their substantial role in development of Fateh technique. Authors must thank hospital personnel and study participants for their kind collaboration.

References

Afrasiabian, H., Fateh Garrous, A., Shams Ardakani, M.R., 2015. Essentials of Ghamz in Iranian Traditional Medicine (Mabani-Ye Ghamz Dar Tebb-E Sonnati-Ye Iran). Nameh Hasti, Tehran.

Balthazard, P., de Goumoens, P., Rivier, G., Demeulenaere, P., Ballabeni, P., Dériaz, O., 2012. Manual therapy followed by specific active exercises versus a placebo followed by specific active exercises on the improvement of functional disability in patients with chronic non specific low back pain: a randomized controlled trial. BMC Muscoskel. Disord. 13 https://doi.org/10.1186/1471-2474-13-162, 162-162.

Bernet, B.A., Peskura, E.T., Meyer, S.T., Bauch, P.C., Donaldson, M.B., 2019. The effects of hip-targeted physical therapy interventions on low back pain: a systematic review and meta-analysis. Muscoskel. Sci. Pract. 39, 91–100. https://doi.org/10.1016/j.msksp.2018.11.016.

Bialosky, J.E., Bishop, M.D., Price, D.D., Robinson, M.E., George, S.Z., 2009. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. Man. Ther. 14, 531–538. https://doi.org/10.1016/j.math.2008.09.001.

Bond, B.M., Kinslow, C.D., Yoder, A.W., Liu, W., 2019. Effect of spinal manipulative therapy on mechanical pain sensitivity in patients with chronic nonspecific low back pain: a pilot randomized, controlled trial. J. Man. Manip. Ther. 1–13 https://doi.org/10.1080/10669817.2019.1572986.

Buchbinder, R., van Tulder, M., Oberg, B., Costa, L.M., Woolf, A., Schoene, M., Croft, P., 2018. Low back pain: a call for action. Lancet 391, 2384–2388. https://doi.org/10.1016/s0140-6736(18)30488-4.

Chakravarthy, K.V., Xing, F., Bruno, K., Kent, A.R., Raza, A., Hurlemann, R., Kinfe, T.M., 2019. A review of spinal and peripheral neuromodulation and neuro-inflammation: lessons learned thus far and future prospects of biotype development. Neuromodulation 22, 235–243. https://doi.org/10.1111/ner.12859.

Clar, C., Tsertsvadze, A., Court, R., Hundt, G.L., Clarke, A., Sutcliffe, P., 2014. Clinical effectiveness of manual therapy for the management of musculoskeletal and non-musculoskeletal conditions: systematic review and update of UK evidence report. Chiropr. Man. Ther. 22 https://doi.org/10.1186/2045-709X-22-12, 12-12.

Doley, M., Warikoo, D., Arunmozhi, R., 2013. Effect of positional release therapy and deep transverse friction massage on Gluteus Medius trigger point - a comparative study. J. Exerc. Sci. Physiother. 9, 40–45. https://doi.org/10.18376//2013/v9i1/67579.

Ellingsen, D.M., Napadow, V., Protsenko, E., Mawla, I., Kowalski, M.H., Swensen, D., O'Dwyer-Swensen, D., Edwards, R.R., Kettner, N., Loggia, M.L., 2018. Brain mechanisms of anticipated painful movements and their modulation by manual therapy in chronic low back pain. J. Pain 19, 1352–1365. https://doi.org/10.1016/j.jpain.2018.05.012.

Goertz, C.M., Long, C.R., Vining, R.D., Pohlman, K.A., Walter, J., Coulter, I., 2018. Effect of usual medical care plus chiropractic care vs usual medical care alone on pain and disability Among US service members with low back pain: a comparative effectiveness clinical trial. JAMA Netw. Open 1, e180105. https://doi.org/10.1001/jamanetworkopen.2018.0105.

Hajihasani, A., Rouhani, M., Salavati, M., Hedayati, R., Kahlaee, A.H., 2019. The influence of cognitive behavioral therapy on pain, quality of life, and depression in patients receiving physical therapy for chronic low back pain: a systematic review. PM & R :J. Inj. Funct. Rehabil. 11, 167–176. https://doi.org/10.1016/j.pmrj.2018.09.029.

Hakimi, F., Saeedi, A., Mokaberinejhad, R., 2015. A comparison between ghamz therapy in traditional Iranian medicine and shiatsu in traditional Chinese medicine. Avicenna J. Phytomed. 5, 49–50.

Hashemi, M., Jafarian, A.A., Tofighi, S., Mahluji, K., Halabchi, F., 2016. Studying the effectiveness of one type of Iranian traditional massage on lumbar radiculopathy. Iran. J. Med. Sci. 41, S11.

Ibn-e-Sina, 2005. Canon of Medicine (Al-Qanun Fet-Teb). Syndicate of Publishers Union in Lebanon, Beirut.

Jaladat, A.M., Nimrouzi, M., Karimi, M., Hashemi, M., Falah, M., Attarzadeh, F., 2008. Massage therapy in Iranian traditional medicine. Rehabil. Med. 1, 51–62. https://doi.org/10.22037/r.m.v1i3.4644.

Jonas, C., 2018. Musculoskeletal therapies: osteopathic manipulative treatment. FP Essentials 470, 11–15.

Kamali, F., Zamanlou, M., Ghanbari, A., Alipour, A., Bervis, S., 2019. Comparison of manipulation and stabilization exercises in patients with sacroiliac joint dysfunction patients: a randomized clinical trial. J. Bodyw. Mov. Ther. 23, 177–182. https://doi.org/10.1016/j.jbmt.2018.01.014.

Lin, I., Wiles, L., Waller, R., Goucke, R., Nagree, Y., Gibberd, M., Straker, L., Maher, C.G., O'Sullivan, P.P.B., 2019. What does best practice care for musculoskeletal pain look like? Eleven consistent recommendations from high-quality clinical practice guidelines: systematic review. Br. J. Sports Med. bjsports. https://doi.org/10.1136/bjsports-2018-099878, 2018-099878.

Nascimento, P., Costa, L.O.P., Araujo, A.C., Poitras, S., Bilodeau, M., 2019. Effectiveness of interventions for non-specific low back pain in older adults. A systematic review and meta-analysis. Physiotherapy 105, 147–162. https://doi.org/10.1016/j.physio.2018.11.004.

Pandis, N., Chung, B., Scherer, R.W., Elbourne, D., Altman, D.G., 2019. CONSORT 2010 statement: extension checklist for reporting within person randomised trials. Br. J. Dermatol. 180, 534–552. https://doi.org/10.1111/bjd.17239.

Proske, U., 1981. The Golgi tendon organ. Properties of the receptor and reflex action of impulses arising from tendon organs. Int. Rev. Physiol. 25, 127–171.

Razi, 2016. Liber Continens (Alhavi Fet-Teb). Shahid Beheshti Medical University, Traditional Medicine Research Center, Tehran.

Rubinstein, S.M., de Zoete, A., van Middelkoop, M., Assendelft, W.J.J., de Boer, M.R., van Tulder, M.W., 2019. Benefits and harms of spinal manipulative therapy for the treatment of chronic low back pain: systematic review and meta-analysis of randomised controlled trials. BMJ 364, l689. https://doi.org/10.1136/bmj.l689.

Ryan, C., Roberts, L., 2019. 'Life on hold': the lived experience of radicular symptoms. A qualitative, interpretative inquiry. Muscoskel. Sci. Pract. 39, 51–57. https://doi.org/10.1016/j.msksp.2018.11.005.

Sanei, M., 2018. Followapp research management system: lotus integrative med [updated October 2018. Available from: https://followapp.clinic/.

Satpute, K., Hall, T., Bisen, R., Lokhande, P., 2019. The effect of spinal mobilization with leg movement in patients with lumbar radiculopathy-A double-blind randomized controlled trial. Arch. Phys. Med. Rehabil. 100, 828–836. https://doi.org/10.1016/j.apmr.2018.11.004.

Shin, B.-C., Kim, M-r, Cho, J.-H., Jung, J.-Y., Kim, K.-W., Lee, J.-H., Nam, K., Lee, Mh, Hwang, E.-H., Heo, K.-H., Kim, N., Ha, I.-H., 2017. Comparative effectiveness and cost-effectiveness of Chuna manual therapy versus conventional usual care for nonacute low back pain: study protocol for a pilot multicenter, pragmatic randomized controlled trial (pCRN study). Trials 18, 26. https://doi.org/10.1186/s13063-016-1756-8.

Smith, M.S., Olivas, J., Smith, K., 2019. Manipulative therapies: what works. Am. Fam. Physician 99, 248–252.

Tanwir, M.A., Ansari, A.H., Aisha, P., Anzar, M.A., 2013. Dalk (therapeutic massage) & their indication for musculoskeletal disorder in Unani medicine. Int. J. Adv. Ayurveda, Yoga, Unani, Siddha Homeopathy 2, 59–70.

Vier, C., Bracht, M.A., Neves, M.L., Junkes-Cunha, M., Santos, A.R.S., 2018. Effects of spinal manipulation and pain education on pain in patients with chronic low back pain: a protocol of randomized sham-controlled trial. Integr. Med. Res. 7, 271–278. https://doi.org/10.1016/j.imr.2018.04.003.

Waddell, G., McCulloch, J.A., Kummel, E., Venner, R.M., 1980. Nonorganic physical signs in low-back pain. Spine 5, 117–125.

Xiao, L., Ding, M., Fernandez, A., Zhao, P., Jin, L., Li, X., 2017. Curcumin alleviates lumbar radiculopathy by reducing neuroinflammation, oxidative stress and nociceptive factors. Eur. Cell. Mater. 33, 279–293. https://doi.org/10.22203/eCM.v033a21.

Yang, M., Feng, Y., Pei, H., Deng, S., Wang, M., Xiao, X., Zheng, H., Lai, Z., Chen, J., Li, X., 2014. Effectiveness of Chinese massage therapy (Tui Na) for chronic low back pain: study protocol for a randomized controlled trial. Trials 15, 418.

Zhang, X., Zhang, Z., Wen, J., Lu, J., Sun, Y., Sang, D., 2018. The effectiveness of therapeutic strategies for patients with radiculopathy: a network meta-analysis. Mol. Pain 14. https://doi.org/10.1177/1744806918768972, 1744806918768972.