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Accelerated Increased Flexibility in the Treatment of a Sedentary Adult Female's Lower Back Pain with Frequency-Specific Microcurrent: A Case Report

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Abstract

Importance: Lower back pain (LBP) contributes to a prevalent disease burden that is clinically and financially taxing to patients. Alternative non-pharmacological analgesic treatment methods can help alleviate symptoms while helping to fight the global opioid overdose crisis.

Objective: This case report presents clinical findings of the successful use of frequency-specific microcurrent (FSM) therapy with brief stretching for treating LBP and reviews the secondary outcomes of accelerated increased flexibility.

Design: Medical case report

Setting: Outpatient setting

Participant: 32-year-old female with chronic LBP

Interventions: The patient received 10 FSM treatments over 3 weeks and performed the stand-and-reach stretch in the first 20 min of each FSM session.

Measures: The primary outcome was numerical rating pain scale (NRPS) reduction or elimination of pain symptoms. The secondary outcome was the reduction in the fingertip-to-floor (FTF) distance when performing the toe touch test (TTT).

Outcomes: After the second FSM treatment, the patient stopped having episodes of stiff restricted back pain following prolonged sitting. The patient's measured FTF distance decreased by 27 cm from an initial baseline of 21 cm at the index fingertip landmark to a final FTF measurement of 2 cm at the flexed index finger metacarpophalangeal (MCP) joint tip landmark. Within each FSM session, the patient's FTF distance decreased by a mean of 9.4 ± 1.2 cm between the pre- and post-session time points.

Conclusions: FSM is clinically effective and efficient for treating unspecific chronic LBP. FSM can lead to accelerated increases in trunk flexibility levels, comparable to those found in athletes, with minimal effort by the patient, despite a sedentary lifestyle.

Relevance: This case highlights the potential of off-label FSM therapy to improve range of motion and support flexibility goals in patients with medical conditions or injuries, as well as in athletes seeking to enhance physical performance.

Keywords

Lower Back Pain, Frequency-Specific Microcurrent, Flexibility, Stretching, Nonpharmacological, Range of Motion

Introduction

Globally, over 500 million cases of lower back pain (LBP) were recorded in 2020, and this prevalence is expected to increase to 800 million by 2050 [1]. With approximately 100 million Americans experiencing chronic pain conditions, the annual cost of this disease burden is estimated to be $600 billion in the United States [2]. Although improving myofascial and connective tissue flexibility enhances functional movement [3], treatment plans that heavily rely on analgesic medications do not improve activity levels or function in patients with chronic pain [4]. Nonpharmacological analgesic techniques are important alternatives for treating pain, and they can help fight the global opioid overdose epidemic, through which 224 individuals died each day in the United States in 2022 [5].

The United States Food and Drug Administration (FDA) has approved microcurrent therapy (MCT) for musculoskeletal pain applications; MCT uses lower current levels than transcutaneous electrical nerve stimulation [6]. Frequency-specific microcurrent (FSM) is an electrical stimulation technique that uses paired frequencies delivered via a micro amperage-level current to the body using electrodes placed on the skin. FSM has been successfully applied in clinical practice to significantly improve pain and disability in patients with mechanical LBP [7] and fibromyalgia [8]. Clinical studies in the public domain lack information about the exact effects of specific frequencies on biological tissue and function; however, it is known that bioelectric signaling changes cellular function as well as chemical and tissue properties [9]. FSM is hypothesized to affect tissues through the biophysical properties of resonance [10] and often produces palpable tissue texture changes [11].

Patient Information

A 32-year-old Caucasian female patient presented with a chief complaint of chronic "seizing back pain when getting out of the car." The patient's medical and surgical history was unremarkable for any relevant invasive/interventional procedures that could have contributed to symptom onset. The patient did not take any prescribed or over-the-counter (OTC) medications or supplements. The patient described her lifestyle as "sedentary but balanced," reporting an average of 8 hours of restful sleep per night and regular engagement in stress management techniques such as meditation and breathing exercises. The patient did not participate in any physical exercise, except for walking a self-estimated <2,000 steps per day that were incorporated into activities of daily living by necessity. The patient weighed 61.4 kg and had a well-nourished, slim physique with symmetrically proportional distribution of body mass.

Clinical Findings

Subjective:

A subjective review of systems yielded the patient endorsing chronic LBP rated 4 of 10 on the Numerical Rating Pain Scale (NRPS), [12] which occurred after vehicle travel of ≥30–40 min and after prolonged sitting of >60 min on living room sofas or armchairs. The stiff, aching pain subsides within 2–4 hours after a triggering event. The passing of time was the only alleviating factor mentioned by the patient who did not attempt the use of OTC medications, stretching, hot compresses, or mild physical movement. The patient recalled that this episodic pain started approximately 2 years ago and has persisted intermittently when aggravating factors are present. Around the time of initial symptom onset, the patient was participating in personal and professional activities that required prolonged standing (>8 hours per day up to 5 days per week). The patient did not recall any physical incident that initiated the onset of symptoms and endorsed wearing compression stockings and comfortable shoes during standing activities. The patient wanted to pursue FSM treatment because of its noninvasive, nonpharmacological treatment benefits. The patient denied having a pacemaker, implanted pump, or current or prior history of seizures and denied being pregnant.

Objective:

Physical examination revealed that active forward trunk flexion, posterior extension, right lateral flexion, left lateral flexion, and return to the upright posture in between movements did not elicit a pain response; each movement was performed within a comfortable range of motion (ROM) of <90°. The patient's upright stance was symmetrical, and no postural deviations were noted. When the patient attempted to touch her toes via active trunk flexion, no pain response was observed; however, decreased flexibility of the posterior chain was observed as the patient was unable to reach past 21 cm above the floor.

Methods

Design:

This medical case report presents a retrospective analysis of a patient's medical record to highlight a unique outcome obtained during the course of clinical treatment. The structure and content of this report follow the CARE guidelines for case reporting developed by Gagnier et al. (2013) [13] and further elaborated by Riley et al. (2017) [14]. The Template for Intervention Description and Replication (TIDieR) guide was used to inform the presentation of the interventional procedures [15].

Timeline:

See **Fig-1**.

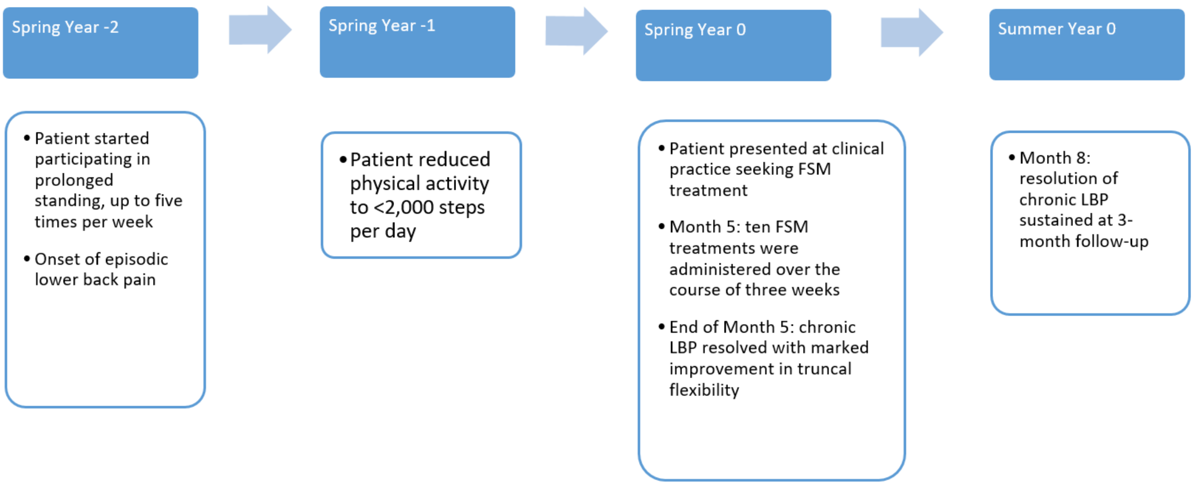

Fig-1: Brief Timeline of the Symptoms and Clinical Presentation

Diagnostic Assessment:

A focused assessment of the patient's prior health history was performed in conjunction with a subjective review of the systems and an objective physical examination. Musculoskeletal strain was evaluated using active trunk flexion movements in multiple directions. The Stand and Reach Test (SRT) (also known as the Toe Touch Test (TTT)) was performed with straight knees; the patient failed the TTT with a measured fingertip-to-floor (FTF) distance of 21 cm. For reference, studies have found a mean FTF distance of 12.3 ± 16.0 cm among women whose average age was 52 years who had experienced LBP for >5 years [16]. The TTT and FTF findings suggested limited spinal and hamstring flexibility with possible compromise of hip flexion. Diagnostic challenges included the absence of a formal physical therapy evaluation and spine, hip, or torso clinical imaging.

Differential diagnoses of intervertebral disk pain, disk herniation with nerve root involvement, and radicular pain were of low suspicion because of the negative SLR and Crossed SLR findings with an absence of dermatomal pain distribution [17]. Neuropathic pain cannot be diagnosed via clinical examination; however, clinical findings can support impaired nervous system function [18]. A possible differential diagnosis of facet joint syndrome was considered due to stiffness of pain characterization and exacerbation after attempting to stand following prolonged sitting; however, suspicion was low because of lack of pain with lumbar extension, rotation, and lateral bending [19]. Centralized pain sensitization was ruled out because of the absence of hypersensitivity and disproportionate pain experience

[17]. The primary diagnosis was determined as myofascial pain with possible episodic nerve entrapment; clinical evaluation alone may not fully confirm the diagnosis.

Data Collection and Instruments:

The fingertip-to-floor (FTF) test can appropriately evaluate the responsiveness of trunk flexibility after the implementation of an interventional functional restoration program [16]. It is often used to evaluate total body flexibility [20]. The FTF distance was measured before and after treatment using a standard 30-cm ruler placed perpendicular to the floor with the 0-cm edge of the ruler touching the floor. The FTF test has a Spearman's correlation coefficient of −0.96 and an intraclass correlation coefficient (ICC) of 0.99, indicating great validity and reliability [16].

The FTF test was performed by placing the patient in an orthostatic posture with shoes removed and feet together on a hard floor surface. While maintaining fully extended knees, the patient was instructed to bend forward at the waist and reach for her toes with straight arms and extended fingers in adduction while holding her palms in parallel with only the medial sides of the index fingers in contact; the vertical distance was measured in centimeters between the floor and the tips of the index fingers. No warm-up exercises were performed before the FTF measurements were taken. Throughout the treatment course, once the patient's fingertips touched the floor, a new anatomical landmark was used; the vertical distance was measured between the floor and the flexed edge of the metacarpophalangeal (MCP) joint (first knuckle) of the index fingers. The distance between the patient's index fingertips (IFT) and the flexed edge of the MCP joints was 8 and 8.25 cm on the right and left hands, respectively; thus, for simplicity and consistency of calculations, the designated IFT–MCP distance of 8 cm was used. This distance was subtracted from subsequent FTF measurements taken using the MCP tip as the new anatomical landmark to obtain the true measured gains in the FTF test.

Data Analysis Plan:

IBM SPSS (Statistical Package for the Social Sciences) software was used for descriptive and inferential analyses. Pre- and posttreatment FTF interval data measurements of 10 paired observations were compared using the Wilcoxon signed-rank test, appropriate for small, nonnormally distributed paired samples. The p-value was reported to determine statistical significance, and the median and interquartile range (IQR) were determined to interpret the direction of the relationship. Cohen's d_z for paired samples was calculated to quantify the magnitude of the effect between pre- and post-treatment FTF measurements [21], which is correlated data. Effect sizes were interpreted using standard thresholds: d = 0.2 (small), d = 0.5 (medium), and d = 0.8 (large) [22].

Therapeutic Interventions:

The patient was treated with frequency-specific microcurrent (FSM) therapy while performing the stand-and-reach stretch in the first 20 min of FSM administration. The treatment goal was to mobilize the patient's previously limited anatomical movements while using microcurrent therapy to enhance the tissue response for improved pain resolution. A combination of FSM and static stretching was chosen as the treatment protocol for this patient to wholistically address the multiple suspected and alternative possible contributing factors to her recurrent LBP, such as muscle tension, muscle spasm, hamstring tightness, and limited lumbar flexion. Microcurrent treatment of chronic persistent back pain has been shown to reduce pain in the short term, with significant (75%) decreases in pain observed at the 2-month follow-up [23]. McMakin (2004) [24] found a 3.8-fold reduction in chronic LBP using FSM for an average of one treatment per week for 5.6 weeks. In a systematic review of randomized controlled trials, Gou et al. (2024) [25] reported that hamstring stretching improves function while reducing multiple types of LBP.

Materials and Procedures:

A two-channel FDA-approved prescription microcurrent machine was used to deliver a series of frequency combinations (see **Fig-2**) to the patient; each FSM treatment session lasted 92 min and used a polarized positive direct current (DC) delivery of 120 microamperes (uA) with a sharp waveslope. Four 2-by-2-inch gel electrodes were placed on the skin after each electrode location was briefly cleaned with an alcohol wipe. The channel A positive electrode was placed on the posterior left lower back approximately 6–8 cm lateral to the L4–L5 vertebra location. The channel A negative electrode was placed on the central dorsal aspect of the right foot. The channel B positive electrode was placed on the posterior right lower back approximately 6–8 cm lateral to the L4–L5 vertebra location. The channel B negative electrode was placed on the central dorsal aspect of the left foot.

Sequence and Timing:

The patient received 10 FSM treatments over a 22-day period (see **Table-1**). The treatments were administered in-person at the patient's home. The FSM session sequence and timing of administration were not evenly spaced due to the patient's variable schedule. Before each FSM session, the patient was instructed to drink one tall glass of water (approximately 24 fluid ounces).

Channel A frequencies (hz)	Channel B Frequencies (hz)	Setting Parameters
40	77	Polarization
294	142	Positive
321	100	Current Level
9	191	120 microamperes
124	46	Lead Placement
13	396	Posterior lower back and dorsal aspects of the feet
51	10	Duration
49		92 min

Fig-2: Summary of the *FlexEnhance* Frequency-Specific Microcurrent (FSM) Treatment

Table-1: Frequency-Specific Microcurrent (FSM) Treatment Program Data

Treatment session	Calendar day	FTF-1		FTF-2		FTF-3 (cm)	Difference (cm)
		cm	Landmark	cm	Landmark		
1	9	21	IFT	11	IFT	11	−10
2	10	23	IFT	13	IFT	13	−10
3	11	17	IFT	9	IFT	9	−8
4	13	18	IFT	7	IFT	7	−11
5	14	16	IFT	9	IFT	9	−7
6	16	15	IFT	6	IFT	6	−9
7	18	12	IFT	3	IFT	3	−9
8	23	9	IFT	7	MCP	−1	−10
9	28	7	IFT	5	MCP	−3	−10
10	31	4	IFT	2	MCP	−6	−10

Note: FTF-1, fingertip-to-floor distance before the FSM session; FTF-2, fingertip-to-floor distance 20 min into the FSM session; FTF-3, true fingertip-to-floor distance measurement when FTF-2 is adjusted for the anatomical landmark; Difference, decrease in fingertip-to-floor distance between FTF-1 and FTF-3; IFT, index fingertip; MCP, flexed index finger metacarpophalangeal joint tip. Fingertip-to-floor (FTF) distance above the horizontal standing surface (considered 0 cm) is shown as a positive value, and FTF distance below the horizontal standing surface is shown as a negative value.

During the first 20 min of each FSM session, the patient concurrently performed intermittent static stretching. While maintaining fully extended knees, the patient bent forward at the waist and reached for her toes with straight arms and extended fingers until a stretch was felt in the backs of the legs to a discomfort level of 3 of 10. No pain was elicited by the stretching maneuvers during the FSM treatment. After the first 20 min of stretching at the beginning of each session, the rest of the FSM treatment administration continued as the patient sat on her sofa or in a chair and proceeded to read a book or work on her computer.

Static stretching and FTF measurements were performed without shoes on, with the feet together on a hard floor surface. FTF measurements were performed immediately before each FSM treatment (pre-session) and immediately after the first 20 min of stretching (post-session). Each treatment session was administered and supervised by a nurse practitioner to ensure proper FSM equipment functionality while monitoring the patient for changes in state and observing the patient's stretching technique for appropriate positioning. The patient did not participate in any other treatments, exercises, or movement therapies between the FSM sessions.

Informed Consent

Written informed consent was obtained from the patient for the publication of this case report and the accompanying images (if any). A copy of the written consent form is available for review by the Editor-in-Chief of this journal. All patient information in this case report was fully de-identified according to the guidelines set forth by the Health Insurance Portability and Accountability Act; no protected health information was included for privacy and confidentiality.

Outcomes

The FSM treatment course resulted in clinically meaningful primary outcomes and objectively measurable secondary outcomes. After the second FSM session, the patient noted that she no longer had episodes of stiff restricted back pain after prolonged sitting that she had previously reported to be 4 of 10 on the NRPS. This improvement was sustained throughout the rest of the treatment timeframe.

The patient's measured FTF distance decreased by a total of 27 cm from an initial baseline of 21 cm at the IFT landmark to the final FTF measurement taken after the 10^{th} FSM session of 2 cm at the flexed MCP joint tip landmark. Within each FSM treatment session, the patient's FTF distance decreased by a mean of 9.4 ± 1.2 cm between the pre- and post-session time points. The Shapiro–Wilk test indicated no significant departure from normality for pre-session ($W = 0.969$, $p = 0.884$) and post-session ($W = 0.939$, $p = 0.542$) FTF measurements. Due to the small sample size of 10 paired measurements from two time points, the data were analyzed using the Wilcoxon signed-rank test with a 0.05 significance level to compare the median FTF distance before and after the FSM treatment sessions. Post-session FTF distances (*median* = 6.5, IQR = −1.5 to 9.5) were lower than pre-session FTF distances (*median* = 15.5, IQR = 8.5–18.8) ($Z = -2.842$, $p = 0.004$), indicating a statistically significant improvement in trunk flexibility following each FSM treatment. Cohen's d_z for paired samples indicated a very large effect of the FSM treatments on trunk flexibility ($d_z = -8.0$), with a significant decrease in FTF distances from pre-session (mean = 14.2 ± 6.1) to post-session measurements (mean = 4.8 ± 6.3).

Intervention Adherence and Tolerability

The patient demonstrated full adherence to the treatment protocol, completing all 10 FSM sessions. Tolerability was assessed via informal patient feedback during and after each FSM session, as well as the clinician's observations of the patient throughout the treatment course. The patient did not exhibit signs of distress or pain, performed stretching maneuvers at the beginning of each FSM session with ease, and then continued to receive the rest of the treatment while multitasking with administrative work or reading. The FSM sessions required minimal physical effort from the patient.

Discussion

Considering the outcome measures, the FSM treatment program not only benefited the patient's targeted resolution of chronic LBP but also positioned her for a lower likelihood of LBP and injury in the future due to the increased truncal ROM. Decreased hamstring flexibility can lead to lumbar lordosis, which can lead to

LBP [3]. Hamstring muscle tightness predisposes the body to subsequent musculoskeletal injury [26]. Thus, trunk flexion improvements can contribute to the remediation and prevention of chronic LBP [27].

The acute trunk flexibility improvements in this case report, reflected by a mean FTF distance reduction of 9.4 cm within one FSM session, are notable. A systematic review with meta-analysis by Ingram et al. (2024) [28] found that static stretching is associated with higher flexibility improvements in individuals with ROM impairments at baseline. Multiple studies with impressive findings have reported FTF distance improvements after a single stretching session; however, these values were still lower than those observed in this case report. Oh & Kang (2021) [29] reported mean FTF improvements of 5.9 and 7.2 cm after one session of proprioceptive neuromuscular facilitation and jack-knife stretching, respectively, in participants with tight hamstrings and a baseline FTF distance of approximately 6 cm. Rodrigues et al. (2024) [30] found a mean reduction in the FTF distance of 8.4 cm from a baseline of approximately 2.5 cm after one session of Global Active Stretching (SGA) in participants with increased knee flexion angles suggestive of tight hamstrings. It is unclear whether the improvements in FTF distances found by Oh & Kang (2021) [29] and Rodrigues et al. (2024) [30] would have continued beyond the initial single session under study.

Table-2: Summary of Flexibility Improvements in the Fingertip-To-Floor Distance Before (Pre) and After (Post) the Treatment Program

Publication	Pre-FTF (cm)		Post-FTF (cm)		Improvement in FTF (cm)	Sample Size (n)	Participant Type	Treatment or intervention	Intervention duration
	M	*SD*	*M*	*SD*					
Hasebe et al., (2016)[37]	5.8	5.5	-2.5	3.8	8.3	12	19–21 YO healthy males	Dynamic stretching using machines	7 min per session; 3 sessions per week; for 6 weeks
Sairyo et al., (2012)[32]	8.1	8	−9.6	6.8	17.7	17	8–18 YO active sports players with LBP	Dynamic-static stretching	A few minutes per session; 14 sessions per week; for 4 weeks
Shinde et al. (2021)[36]	16.9	N/A	9.8	N/A	7.1	15	15–25 YO college students with tight hamstrings	Static stretching	A few minutes per session; 3 sessions per week; for 2 weeks
Seif et al. (2015)[31]	43.5	7.6	19.4	2.1	24.1	20	25–40 YO males & females with CLBP	PT with static stretching, gastrocnemius muscle	60 min per session; 3 sessions per week; for 6 weeks
Seif et al. (2015)[31]	44.9	7.6	30.2	5.8	14.7	20	25–40 YO males & females with CLBP	PT with static stretching	60 min per session; 3 sessions per week; for 6 weeks
This Case Report	21	N/A	−6.0	N/A	27	1	32 YO female with CLBP & tight hamstrings	FSM with static stretching	20 min per FSM session;; 3.2 sessions per week (10 total); for 3 weeks

Note: Fingertip-to-floor (FTF) distance above the horizontal standing surface (considered 0 cm) is shown as a positive value, and FTF distance below the horizontal standing surface is shown as a negative value. Pre-FTF, baseline fingertip-to-floor distance; Post-FTF, fingertip-to-floor distance after completion of the treatment/intervention program; N/A, not available; LBP, lower back pain; CLBP, chronic lower back pain; YO, year-old; PT, physical therapy; FSM, frequency-specific microcurrent.

Considering the cumulative effects of repeated and ongoing trunk flexibility improvements, the absolute FTF distance reduction obtained by the patient in this case report by the end of the FSM treatment program is significant, particularly compared with reference studies from the existing literature (see **Table-2**). In this case report, the patient's minimal stretching frequency of approximately 3.2 sessions per week, coupled with FSM, yielded a larger FTF distance reduction in half the timeframe than that achieved by Seif et al. (2015) [31] through a combined 60-min physical therapy and stretching program administered three times per week. The participants of the study by Seif et al. (2015) [31] also had the advantage of significantly reduced flexibility at baseline, which would have made them more responsive to static stretching [28] compared to this case report's patient.

Compared with flexibility gains obtained by teenagers with LBP, this case report achieved a 53% larger reduction in FTF distance in one-fifth the number of sessions in a patient that was twice the age of the adolescent participants in a study conducted by Sairyo et al. (2012) [32]. This is notable because trunk flexibility reduces with age [33,34], and it is unexpected for a sedentary young adult to have significantly better flexibility improvements in a fraction of the number of treatments than the improvements obtained by a group of sports-active teenagers. Sairyo et al. (2012) also had eight healthy volunteers (without LBP) in their 20s complete the 14 sessions per week of jack-knife active-static stretching for 4 weeks, and their overall mean improvement in FTF distance was 22.2 cm from a baseline of approximately 14 cm [32]; the absolute flexibility gains were significant but (1) still less than the FTF reduction achieved by this case report in 22 days with one-fifth the number of sessions, and (2) the feasibility of applying a twice daily stretching program for 28 days consecutively is not pragmatically achievable in clinical practice for adults because they are unlikely to adhere to such a rigid program in the pursuit of flexibility and back pain alleviation.

The FSM treatment program of this case report delivered a level of functional flexibility typically reserved for active athletes. A study measured FTF distance via the administration of the TTT in 24 tennis players, 30 canoeists, 43 kayakers, and 44 cyclists; the athletes' mean FTF distances were −8.63, −4.53, 0.81, and −3.98 cm, respectively [35]. The FTF distance above the horizontal standing surface (considered 0 cm) is shown as a positive value, while the FTF distance below the horizontal standing surface is shown as a negative value. The athletes in the study by Muyor et al. (2014) [35] were injury-free and trained between 3 and 6 days per week, with daily training of 2–4 hours. The patient in this case report achieved a final FTF distance of −6.0 cm after the last FSM treatment, putting her TTT and FTF distance flexibility within the range of FTF measurements collected by Muyor et al. (2014) [35]. This is notable considering that the patient maintained a sedentary lifestyle and did not participate in any exercise training or physical activities before or during the FSM treatment process. For reference, the athletes in the study by Muyor et al. (2014) [35] conducted their multi-hour regular training on a weekly basis for at least 4 years [35].

Limitations

The focus of this case report was a single female individual; treatment applications are not generalizable and may not be applicable to other patients with similar symptoms or conditions. The effect of FSM alone cannot be determined as it was used in combination with static stretching; future research should separate interventions to clarify outcomes. This report is meant to generate hypotheses and not establish treatment efficacy. This case report was written from a clinician's perspective with the possibility of observer or confirmation bias, as the treatment was delivered and observed by the same clinician at the patient's home. As with any treatment, there is a possibility of a confounding placebo effect. The lack of before-and-after clinical imaging could be a potential limitation of this case report if using the assumption that physical pathology was present and could have been detected via radiography, ultrasound, or computed tomography; it is unlikely that magnetic resonance imaging would have been clinically relevant.

Conclusion

FSM is a clinically effective and efficient treatment for chronic LBP. Through treatment of chronic LBP with FSM, secondary outcomes of accelerated increased flexibility were achieved in trunk functional mobility gains, as measured by a reduction of 27 cm in FTF distance when performing the TTT. An enhanced level of flexibility was obtained with minimal effort by the patient during treatment, with no pain or discomfort and no additional home treatment exercises. Despite a sedentary lifestyle before and during the session administration, the patient's flexibility gains were maintained throughout the FSM treatment program. The significant positive changes in flexibility achieved in the course of FSM treatment were likely due to a combination of neural, physical, and mechanical effects of enhanced tissue remodeling. Future research should investigate the effects of FSM on ROM, flexibility, and tissue composition changes in patients with LBP as well as healthy and athletic individuals seeking to improve physical fitness.

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Declaration of Interests

The author reports a relationship with Frequency Specific Seminars Inc., that includes: speaking and lecture fees.

Data Availability Statement

The author confirms that the data supporting the findings of this article are available within the article and/or its supplementary material.

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