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Effect of neuromeningeal mobilization and postural re-education exercises for persistent hamstring strain: a case report

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Abstract

Introduction Despite appropriate interventions, healing following hamstring strain tends to be slow. Prediction for return to play is inconsistent, and recurrence of injuries is high, which poses a challenge and burden to athletes, sports physiotherapists, and trainers. The exact mechanism of hamstring strain injury or re-injury still remains unclear. The primary focus of this case report was to discuss a patient's course of treatment with relentless symptoms of hamstring strain and how he responded to neuromeningeal mobilization and postural re-education.

Case description A 20-year-old male Arabic martial artist had a history of left hamstring strain for the past 5 weeks. He had undergone pharmacological and physiotherapeutic interventions for his clinical conditions but had not responded favorably. Further clinical assessment had ruled out hamstring syndrome. The patient refrained from all sports activities.

Intervention The patient was treated using a modified slump mobilization technique with four repetitions for 3 consecutive days, together with postural retraining. Results of the numeric pain rating scale and Knee Society score before and after the interventions were obtained.

Results and discussion Pre-intervention score of the numeric pain rating scale was 5/10 and 7/10 at rest and with activity, respectively. Assessment on the 3rd consecutive day of intervention, the numeric pain rating scale decreased to 2/10 and 4/10 at rest and with activity, respectively. Similarly, the pre- and post-intervention Knee Society score improved from 22 to 61 in pain and from 30 to 80 in function. At the 2-month follow-up, the patient reported a complete recovery from symptoms and resumed his sports activities without any disruption.

Conclusion Neuromeningel mobilization and postural re-education exercises are suggested as mainstream of treatment for hamstring strains, even when the slump test is negative. This report calls for a need of advancement in diagnostic procedure dealing with all hamstring strain injury conditions. More prospective studies are recommended to confirm the current findings.

Keywords Hamstring injury, Neural mobility, Neural glide, Hamstring strain, Hamstring flexibility

Introduction

Hamstring strain injuries (HSI) are common among sprint-based sports [1]. Approximately half of all muscle injuries in athletes participating in hurdling sports are anticipated to be hamstring strains, and these injuries carry a substantial risk of re-injury ranging from 12 to 31% [1–3], despite receiving appropriate treatment.

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Current clinical practice guidelines for recurrent HSI are limited in treating myofascial or musculotendinous structures.

The practice of nerve mobility glides (NMG) is limited in minimizing pain and swelling in the early healing phase of strained muscle and hamstring syndrome or deep gluteal syndrome [4], though there was convincing evidence in the past that proposed neural gliding improved the clinical outcomes in patients with hamstring strains [5–8]. Yet the practice of managing hamstring injury with neuromenigeal mobilization is not in practice where the term "neuromenigeal" relates to nervous tissue and the meninges.

Originally, the pain or limited mobility in HSI or lower limbs was often associated with reduced movement of the pain-sensitive structures in the spinal canal [8–11], instead of blaming only shortened hamstring muscles. Hence, authors resort to mobilizing only the neuromeningeal structures rather than treating the muscle or tendon for a patient diagnosed with HSI.

The slump test is popular for ruling out the involvement of a neural component in lower limb disorder. However, the specificity of this clinical test is 83% [11], which means that 17% of the interpretations may be falsely positive [12]. Hence, it is possible that slump may not precisely rule out involvement of nerve or muscle for structural differentiation of pathologies.

Unfortunately, there is less evidence regarding the prognostic value of magnetic resonance imaging (MRI) in predicting re-injury [13] and a higher prevalence of pathology in the asymptomatic population [14], rendering a message to clinical practitioners to move a step ahead to solve the growing challenges of dealing with HSI.

The mobility of neuromeningeal structure may be influenced by postural causes [15, 16] on the basis of its functional anatomy, leading to flexibility issues or pain in the hamstring muscle, tendon, or fascia. Hence, this study aimed to describe how a patient with hamstring strain with negative slump test responded well to neural mobilization and postural re-education exercise.

Patient information

A 20-year-old male Arabic martial artist (weight 91.5 kg, height 180 cm, and body mas index (BMI) 28.24) presented with pain in the back of the left thigh for the past 5 weeks and underwent pharmacological and physiotherapeutic intervention; however, he did not responded well to symptomatic treatment. He reported that the symptoms first appeared during a short sprint while playing soccer and heard a pop in the back of his thigh. The pain was so bad that he withdrew from the game soon after his injury and noted no bruising on the back of his thigh or significant swelling in that area. However, he reported progressive loss of flexibility in the left knee and inability to flex and extend the knee joint while the knee remained flexed at a 15° angle, whether standing or having the leg in the air. He denied any previous history of lower back pain but could barely support the weight of the affected limb. There was no history of alcohol, smoking, diabetes, high blood pressure, or other serious genetic diseases.

Clinical findings and diagnostic assessment

The patient reported having received icing and elevation of the affected leg while lying down following the injury as therapeutic interventions. He had a crepe bandage applied to his affected thigh to support him while standing and walking. He used crutches for ambulation and to go for a little longer distance. To climb the stairs, he had to use one step at a time, relying on his right lower extremity. He also reported adopting a sitting position at the edge of the chair as direct pressure on the thigh from the chair caused him discomfort. He denied ever hurting his legs or back in sports. As a result, the patient withdrew from all activities, such as playing sports, owing to the pain, and his knee was mildly bent most of the time. Despite taking medication (nonsteroidal antiinflammatory drugs (NSAIDs)), the pain worsened over time. Since the patient did not respond well to cryotherapy, compression bandages, and medications, he decided to see a doctor for further diagnosis and treatment before meeting with us.

On further evaluation, he presented with limited knee extension and flexion and exhibited an analgesic gait with a reduced heel strike phase. Active range of motion (AROM) of the left knee was 10–15° compared with 0–130°degrees in the right knee. Palpation revealed tenderness and firmness in the middle third of the semimembranosus and semitendinosus muscles.

Manual muscle testing and isometrics could not be performed owing to persistent discomfort. The patient reported pain at rest, rated 5/10, and during activity it was rated 7/10. Further, clinical evaluation rule out lumbar disc involvement or gluteal and ischial tunnel syndrome [4, 6].

The best way to screen nerve tension for peripheral pain in the lower extremities is with a slump test [17]. However, the result of the slump test in this patient was negative.

Therapeutic interventions

Despite the patient's current clinical presentation, which was suggestive of HSI, the authors decided to treat him with neural glide technique on the basis of the structural and functional proximity of nerve to the lower limb flexibility through a novel neurodynamic tension technique

[18, 19]. The scientific rationale for this neural approach was detailed to the patient and consent was obtained.

The patient was directed to sit with arms folded behind his back and knees and ankles held in extension and dorsiflexion, respectively, while a therapist guided the patient to flex his thoracic and cervical spine and extend his knee joint to the maximum tolerable limit. Next, the patient was instructed to move his neck forward and backward as much as possible while also moving his ankle up and down 15 times to help with nerve glide.

This was done in three sets each day. The therapist then helped the patient bend their middle and upper back as much as possible until the patient felt pain in the knee area. Then, the process was repeated. By the 3rd day, the patient's active knee extension improved from 5° to 10° and then to a 15° degree bent position. In addition, the standing posture also got better.

Subsequently, the patient was instructed in executing a set of posture re-education workouts [20], which involved doing active chin flexion, engaging in passive stretching of the cervical extensors while lying down in prone, and building up the shoulder retractors, arm from positions T to Y, then from Y to W with the limb's weight while lying down.

To address the kyphotic posture, active chest stretches were taught at wall corners. The patient was instructed to increase the duration of the exercises from 5 to 10 seconds, doing 10 reps and 3 sets daily.

Outcomes and follow-up

The results were assessed using a numeric pain rating scale (NPRS) [21] and Knee Society score (KSS) [22]. Substantial enhancement in clinical outcome measures such as pain and function were achieved within 3 successive days of therapy. The use of pain medication was discontinued.

The patient continued his self-neural glides and postural reduction exercises at home and was advised for a follow-up after 4 weeks or to contact us if symptoms worsened. On the 3rd follow-up day, the patient's NPRS from 5 at rest and 7 with activity to 2 at rest and 4 with activity. The KSS increased from 22 to 61 and from 30 to 80 in the functional domain. At the end of the 2-week home program, the patient reported to have full active straight leg raise (SLR). The patient had fully recovered from his knee dysfunction and pain at the 2-month follow-up (Table 1).

Following 2 and 4 months of follow-up, the patient reported no pain in the knee joint during normal activities or at rest. Furthermore, the patient resumed his regular sports activities, such as soccer and sprinting, without experiencing any problems to date. No adverse events were reported following the intervention. The patient quoted "I have done this exercise for 2 months and I saw a good improvement". The patient also reported that he started slowly working out at the gym and did not feel any pain; therefore, he started increasing the weight for dead lifts to 80 kg without experiencing any pain.

Table 1 Describes the progress of the patient at regular intervals

Patient progress track	NPRS Scale		KSS	
	Rest	Activity	Pain score	Function score
1st day	5	7	22	30
3rd day	2	4	61	80
2nd month	Full recovery in pain and functional status			

Discussion

The current case report found that neural mobilization with postural re-education helped a patient with hamstring strain to recover quickly from his pain and disability. The patient was then able to resume his regular sports activities, which involve sprinting, without any recurrence of hamstring injury.

The proposed treatment approach is entirely different and novel to the contemporary practice of treating a patient with a hamstring strain keeping in line with the functional anatomy and biomechanical aspect of neuromeningeal structure to leg pain and flexibility. The case responded well to neuromeningeal mobilization therapy and postural re-education without any symptomatic treatment.

The authors diagnosed hamstring syndrome in this case using the slump test and other common clinical symptoms to associate it with the presence of neural tension, such as prolonged siting causing provocation signs. This is the first study ever conducted to treat HSI with neuromeningeal mobilization and postural exercise alone, contrary to treatment focused on the hamstring muscle.

A common method in treating HSI is to impart muscle or tendon lengthening exercises [23] in addition to the application of therapeutic electrotherapy modalities. However, a recent Cochrane review [24] did not find proof for the efficacy of stretching muscle or tendon in the prognostic value of hamstring strains.

Negative neural tension or stiffness had already been pointed out by Sharon E. *et al.* as a possible hidden cause of all recurrent hamstring strain conditions [5]. This is supported by another study that reported the prevalence of abnormal neural tension among most of the participants diagnosed with grade I hamstring injury [6]. Similarly, another study reported that even grade III hamstring injury responded well to nerve mobilization without surgery [8].

Furthermore, it was proposed that the protective contraction or spasm of the hamstring muscles may be a result of neuronal mechanical sensitivity [25], which may mislead a clinician to consider pathology within the hamstring muscle. This hypothesis is partly supported by recent muscle strain classification, where grade 0 category is associated with nerve involvement [26], which can be a promising first sign.

According to earlier reports, noncontractile tissues, such as deep fascia, the soft tissues around joints, and neurological tissues, can restrict the range of motion of soft tissues in addition to contractile tissues [26, 27]. Thus, it can be postulated about the involvement of meningeal mobility for lower limb flexibility issues and pain or other possible signs of HSI.

Evidence shows that increased passive resistance to stretching of the hamstring muscles during neck and chest flexion (slump test position) without significant elecromyography (EMG) activity suggests that the extensibility of neural structures may contribute to musculoskeletal flexibility of upper and lower limbs [11].

Another study reported an impairment of sciatic nerve conductivity among athletes with a history of hamstring strain injuries, which is quite convincing that nerve involvement is confirmed in HSI yet can be often misdiagnosed as muscle strain. Further, it is believed that neuromechanical sensitivity may contribute to differences in strength deficits observed in HSI [28].

Moreover, the evidence from a radiological perspective found 15% of the asymptomatic population to have bilateral partial hamstring lesions and 2% to have complete bilateral lesions in hamstring muscle [14], probably due to age and other factors [29, 30]. The slump test was found to be negative for this case, yet the patient responded favorably to neural therapy and postural correction exercise. This implies that further enhancement in the slump test procedure is highly recommended to sensitize the meningeal involvement in HSI.

Besides this, evidence supports that neural sliding and tensioners combined with static stretching have been shown to have a superior effect compared with intervention alone with static muscle stretching in increasing the knee flexibility [31, 32]; however, these findings were subject to passive and active forms of interventional approaches used in the studies.

Another recent study recommended incorporating sciatic nerve gliding into an athletic training program as part of the pre-competition warm-up [32]. Evidence confirms a reduction in cross-sectional area and an increase in nerve pressure, causing the sciatic nerve to move freely in response to neural therapy, resulting in increased compliance in muscle flexibility [33, 34].

Surprisingly, yet another study reported that spinal manual therapy can immediately relieve the symptoms associated with hamstring strain and flexibility [35]. Evidence supports that posture can impact the neurodynamics [12]; therefore, this study added postural re-education as part of mainstream treatment for the hamstring strain condition.

This current case report proposes that a hamstring muscle injury may respond favorably to meningeal mobilization and postural re-education despite the absence of hamstring syndrome [36, 37]. The proposed concept is yet to be proven in light of high-quality prospective studies to address the rate of HSI recurrence associated with HSI and can additionally help predict the time to return to sports.

Conclusion

This case report described how a patient with a hamstring strain responded well to neuromeningeal mobilization exercises combined with postural re-education while he remained unresponsive to conventional interventions in the past. This study insists on the need of more prospective randomized controlled trials to prove that recurrent hamstring injuries are preventable.

Take-home message and the lessons learned

- Neuromeningeal mobilization is suggested to be a mainstay of treatment in treating hamstring conditions rather than treating the symptoms alone.
- Postural correction can influence neuromeningeal mobility, which is suggested to be a mainstay of treatment in hamstring conditions on the basis of this case report.
- A novel solution to address the recurrence rate of HSI.
- Interpretation of slump test is cautioned in structural differentiation of nerve from muscle in HSI.

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PKK—conceptualization, data collection, data analysis, supervision, and administrative support. RM—conceptualization, data collection, data analysis, supervision, manuscript review, and administrative support. WA—conceptualization, data collection, data analysis, supervision, and manuscript writing and revision. AH—conceptualization, data collection, data analysis, supervision, and manuscript writing and revision.

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Declarations

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Not applicable (case report).

Consent for publication
Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
Authors declare no competing interests.

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