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Modification to Treatment Approach in an Active Individual After Partial Relief from Initial Physical Therapy for Hamstring Injury: A Case Report

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Abstract:

Background: Hamstring injuries are common among traditional and recreational athletes. Diagnosis and treatment of some of the newly described injuries remain difficult and lack supporting evidence. In addition, complete treatment of other components that may contribute to the injury is vastly lacking in research. The purpose of this case report is to highlight the challenges associated with diagnosing and comprehensively rehabilitating hamstring injuries. **Case Description:** A 72-year-old active female was referred to physical therapy for chronic proximal hamstring pain. This pain had progressed to limiting her ability to turn over in bed and participate in her exercise class. **Intervention:** Initial examination led to treatment via instrument assisted soft tissue mobilization and eccentric exercise training. After initial benefits, the patient's improvements plateaued and eventually her pain increased. The treatment plan was modified to address adductor magnus involvement and hamstrings via dry needling and continuation of eccentric exercises. **Outcome Measures:** The patient's pain initially decreased to 4/10 with bed mobility by the 4th visit with the initial treatment approach. However, the patient's improvement then plateaued for 3 weeks. By the 8th visit, the patient's pain had increased again. Over the course of treatment, the patient's Lower Extremity Functional Scale score improved from 66% to 89%; thus the treatment modification was put into place. The patient was able to fully return to her exercise class activities and perform rolling over in bed without discomfort. **Discussion:** This case suggests approaches to differentiate proximal hamstring tendinopathy from other hamstring injury in patients with complaints of hamstring and posterior thigh pain. This case also presents potential treatment approaches for and the regional interdependence of hamstring pain and surrounding musculature.

Keywords: physical therapy; rehabilitation; hamstring injury; proximal hamstring tendinopathy; adductor magnus; dry needling; instrument assisted soft tissue mobilization (IASTM)

Background

It is well known that hamstring injuries are common among highly competitive athletes, however they are also commonly seen among recreational athletes.[1,2] There are various forms of hamstring injuries, as well as multiple treatment approaches that can be applied, some of which are more specific to the injury sustained[1]

The most common hamstring injury is an acute hamstring strain.[3] These injuries often occur as a result of an inciting event in which the individual experiences a sudden onset of pain, and may hear a "pop".[3] Initial treatment of hamstring strains often involves controlling the body's reaction to injury through the RICE (Rest, Ice, Compression, Elevation) principles. Then treatment often aims to address any muscle imbalances, decreased flexibility, and poor coordination.[4] There is a great emphasis in the literature on the benefits of utilizing eccentric strength training before returning to sport.[4]

Proximal hamstring tendinopathy is a less commonly diagnosed cause of pain in this patient population.[3,5] Unlike hamstring strains, patients with hamstring tendinopathy do not typically report a specific event that caused their pain.[3] This injury, similar to other tendinopathies, is caused by chronic overuse, repetitive stretch, and overloading the musculotendinous unit.[3] Patients with hamstring tendinopathy often present with pain but do not demonstrate loss of hamstring strength or range of motion.[3,6] Due to its chronic nature, patients typically report a gradual increase in their pain.[3,6] This pain is often described as a deep gluteal ache or posterior hamstring pain near the ischial tuberosity that can spread inferiorly towards the posterior knee.[3,5,6]

The pathology can occur in any of the three hamstring muscles. Some studies have found proximal hamstring tendinopathy to always involve the semimembranosus, the most medial of the hamstrings, and other have found it to be involved 29% of the time. Other hamstring muscles were found to be involved at different rates; biceps femoris – 41%, semitendinosus – 6%, and common hamstring tendon – 23%.[7] Eccentric training has been shown to be beneficial in treating other tendinopathies, but has not been specifically studied in proximal hamstring tendinopathy.[5] While the treatment of hamstring strains is well documented in the literature, hamstring tendinopathy treatment is not as widely researched.[6,8]

Other musculoskeletal injuries can present similarly to or concurrently with hamstring injuries. This can make clear diagnosis a challenge, however, can also provide alternative treatment avenues if initial treatment proves ineffective or does not completely result in pain relief. One of these possible factors is an adductor injury, specifically the adductor magnus.[3,8,9] This muscle originates on the inferior pubic ramus and on the ischial tuberosity, just medially to the hamstrings, which allows a portion of it to assist the hamstrings in hip extension.[8,10] Thus, this portion of the adductor magnus is sometimes referred to as the "mini hamstring".[9]

It is the proximal, tendinous portion of the adductor magnus that contributes to hip extension. Tendon injuries often result from chronic overuse and with increased age, tendons undergo changes in their collagen and matrix structure.[10] Thus, adductor tendinous injuries are more commonly seen in older adults over 35 years than in the younger population.[10]

As a result of its close proximity, adductor magnus tendon damage can occur in conjunction with proximal hamstring injury. Some studies showing a prevalence of 23.5% adductor magnus injury alongside hamstring avulsions.[9] While hamstring injuries have copious research describing their presentation and treatment approaches, injury of the tendinous "mini-hamstring" continues to be largely ignored. [9] It is necessary to understand the complexities of the proximal hamstring anatomy to adequately diagnose and approach various hamstring injuries.[9]

While it is not always pertinent to determine a definitive diagnosis, as some of the treatments will be similar across the continuum of hamstring injuries, doing so may be beneficial to select treatments that are more specific for a particular injury. It is also important to be able to recognize when other joints and muscles may be contributing to the pain and dysfunction. In addition, it has been shown that incidence of recurrence of hamstring injuries is high.[2] It has been proposed that this could be due to lack of assessment and treatment of adjacent musculature.[4] Despite the copious evidence behind hamstring strains, there continues to be relatively few studies guiding the diagnosis and treatment of idiopathic,

chronic hamstring pain. Therefore, this case study will highlight the challenges associated with diagnosing and comprehensively rehabilitating hamstring injuries.

Case Description

History of Current Injury

A 72-year-old female was referred to an outpatient physical therapy clinic with a chief complaint of left hip pain that began three months prior due to unknown reasons. She initially saw an orthopedist for an x-ray and received an injection to her left hip. She reported relief from the injection that lasted for four days. She noted that prior to this injection, her pain would be present when walking at the beginning of long-distance walks and would increase after the walk ended. She reported having current pain with hip movement, twisting and turning in positions such as turning in bed, and along the hamstring muscles and origin during sit-ups, V-ups, and inclined walking. She noted that other than the initial hip injection, she had not found any specific things that reduced her pain. She had ceased her long-distance walking. She acknowledged that she had limitations with balance. At worst, the pain was 6/10, and at best it was 0/10. She denied any history of back pain.

Medical and Social History

The patient had a history of breast cancer, arthritis, and rotator cuff repair. She rated her overall health as good and denied any history of tobacco use. This was a retired, active patient, who attended organized group exercise classes 4-5 times per week. The patient's career was as a nurse in obstetrics and gynecology.

Initial Examination

The patient was initially screened by the physical therapist for any spine impairments. While she had full range of motion of lumbar flexion, extension, and bilateral side bending, she reported left hip pain and stiffness with extension and left side bending.

The patient demonstrated full active range of motion (ROM) for bilateral hips and had no pain during this testing. The straight leg raise test was negative ruling out disc involvement. She had 5/5 strength of the right hip in all directions, and only demonstrated weakness at 4/5 for hip flexion on the left. She had bilateral knee flexion and extension strength of 5/5. Bilateral lower extremity manual muscle testing was performed as follows. Hip flexion, internal rotation, and external rotation were tested in seated, extension in prone, abduction in sidelying, and adduction in hooklying. Knee flexion and extension were tested in seated. As the patient had suspected, she had impaired balance. As compared to the normative, functional value of 30 seconds, she was able to perform a single leg stance balance test for 15 seconds on the right and 12 seconds on the left.

During palpation of the left hip, the patient reported tenderness along the medial origin of the hamstrings on the ischial tuberosity. She noted that her pain started there and went laterally towards the greater trochanter and inferior into the hamstrings. When assessing functional and activity movements, the patient reported pain with bridges, initial walking, and single leg V-ups. A V-up is an abdominal contraction in supine, in which extended upper extremities are reached toward extended lower extremities that have been raised about 45 degrees off the ground. She had a Lower Extremity Functional Scale (LEFS) score of 66%. Indicating that she was at 66% of her maximal function, or her injury impaired her function 34%.

Initial Physical Therapy Interventions

On the day of the initial evaluation, instrument assisted soft tissue mobilization (IASTM) was performed to the left proximal hamstrings along the medial ischial tuberosity down into the first 2/3rds of the hamstring muscle. The patient was provided a sheet to cover up with and asked to lie in a prone position. The patient was then draped so that the area to be treated was exposed. The patient was provided with an initial home exercise program (HEP) that consisted of supine IT band stretch with belt,

supine piriformis stretch, supine hamstring stretch with belt, child's pose, and prone hip extension. The patient was educated to ice the painful area on her left hip after completing the exercises.

At the second visit the patient noted no change in her symptoms, but she was sore after completing her HEP. She noted that most activities that aggravated her pain were exercises that she performed at her group workout classes. The patient was educated to hold off on attending these classes until her pain was more under control. During this visit, IASTM was again performed to the proximal hamstrings along the medial ischial tuberosity. This treatment was again performed in prone but was also performed in a quadruped position so that the hamstrings and gluteals were more taut, allowing for easier contact with the area of pain. Therapeutic exercises performed this visit were prone hamstring curls with green theraband, bridges with adductor ball squeeze, bridging with Swiss ball under feet, and standing hip extension and abduction with red theraband, as well as review of HEP. Throughout the exercises, the patient noted pain with single leg bridging after it was attempted and patient was educated to only stretch within a pain free range. Ice was also applied to the left proximal hamstrings in a seated position at the conclusion of the visit for 10 minutes.

The patient reported improvements at the start of the third visit. She had noticed increased pain free range with stretches and slightly lower pain levels when turning over in bed. However, her greatest complaint was continued 4/10 pain with turning over in bed via a single leg bridge on the left. The patient reported continued attendance to her workout classes but performed modified exercises that did not elicit pain. IASTM was again performed to the proximal hamstrings along the medial ischial tuberosity. However, during this visit's treatment, she noted that the pain was much more medial to her initial area of pain and medial hamstring tightness was apparent. IASTM was focused more distally into the muscle belly of the medial hamstrings. Therapeutic exercises remained the same at this appointment, since the patient had responded well. However, some exercise progression was initiated. Progression of exercises included walking backwards on treadmill at .7 mph for 6 minutes, gastrocnemius stretch on slant board, leg press machine at 80 lbs, single-leg leg press machine at 60 lbs, TRX squats, and a dynamic hamstring stretch. The patient tolerated the exercise progression well and reported no pain throughout this session.

Physical Therapy Intervention Modifications

Assessment of the Pelvic Floor

Although the patient demonstrated initial improvements in pain with some activities, after 2 weeks (4 visits) she continued to report no continued change in her pain with rolling over in bed via a single leg bridge and group workout exercises specifically V-ups and sitting up from supine to long sit. The therapist consulted with a certified pelvic floor physical therapist within the same company. However, she was at a distant clinic, so the consultation regarded what assessments the outpatient therapist could complete in order to assess pelvic floor involvement. After this consultation, a very basic assessment of the pelvic floor muscles was performed due to their proximity to and similar attachment sites with the hamstring muscles. Under the suggestion of this therapist, Kegels in supine, Kegels during transitional movements such as supine to sit, and reverse Kegels in supine, or bearing down, were assessed. This therapist also provided verbal cues, which the pelvic floor therapist had suggested, to encourage proper performance. For the Kegels, the patient was educated to pull the pelvic floor muscles up and in, for the reverse Kegels she was cued to bear down as though she were having a bowel movement. Due to the patient's career as an obstetrics and gynecology nurse, she frequently educated patients on proper performance of Kegels. Therefore, the physical therapist felt comfortable with her ability to perform Kegels correctly for general assessment. Neither Kegels with or without transitional movements nor reverse Kegels reproduced any pain. The pelvic floor therapist also provided subjective questions to assess potential pelvic floor involvement. These questions addressed dysfunction of and changes in the patient's bladder and bowel function. The patient denied any changes in or dysfunction of her bowel and bladder, including denial of incontinence. It was determined to not follow-up with pelvic floor physical therapy. However, this possibility remained as a next step should other treatments not prove effective.

Following this assessment, IASTM was performed to the medial and proximal hamstrings, to which the patient tolerated increased pressure without increased pain. Again, the patient noted that the pain felt “more towards the middle”. Therapeutic exercises included backwards walking on treadmill, dynamic hamstring stretch, TRX squats, leg press (80 lbs), single-leg leg press (60 lbs), and gastrocnemius stretch on slant board. TRX pushups were also included to address core weakness that could contribute to pain during transitional movements. The patient was educated to increase awareness of core activation and perform a transversus abdominis (TA) brace during transitional movements such as supine to long sit. The patient was educated to properly perform a TA contraction.

At the following session, the patient reported being “almost 100% better” but still having difficulty with turning over in bed and V-ups. IASTM was not performed at this session to assess the patient’s response to not having this treatment. The patient’s therapeutic exercises were progressed to include lateral walks and step ups onto a 4-inch step. This progression was tolerated well with no increases in pain, and the patient was able to tolerate progression to a green theraband with standing hip extension and abduction. The patient reported no change in her pain when IASTM was not performed; it was therefore not utilized again throughout her plan of care. For three more sessions, there is a continued focus on core strengthening and eccentric hamstring strengthening. Yet, the plateau in improvement remains.

At the patient’s progress report visit, session number 8, her symptoms had begun to worsen. The pain had started to increase, was now apparent during walking, and occurred with more exercises at her workout classes. There were no significant improvements in any of her initial objective measures from the first session, other than minor improvements in left hip flexion strength and no pain with lumbar spine motion. Other hip motions seemed to decrease in their strength, and balance of both lower extremities diminished. LEFS improved by only 1%, which does not meet the Minimal Detectable Change (MDC) or the Minimal Clinically Important Difference (MCID) required for significant change. The patient continued to be tender to palpation at the left ischial tuberosity and proximal hamstrings.

While the patient was initially demonstrating improvements, she verbalized a plateau in her progress and demonstrated increased impairment when her progress note was completed. Some of this lack of progress, and even regression, seen with re-evaluation could be due to inter-rater reliability, as different therapists completed the initial evaluation and progress notes. However, in alignment with the patient’s subjective concern of a plateau and worsening pain, there is also the possibility that there could be other components playing into her pain that had not yet been addressed.

Dry Needling to the Adductor Magnus

With the plateau in improvement, no subjective or objective data supporting pelvic floor involvement, and a return of the patient’s symptoms, it was believed that another component not yet addressed was involved. Due to the adductor magnus’ and the hamstrings’ shared function of hip extension, this was assessed at the patient’s ninth session. Prior assessment of the hip adductors had shown no impairment in ROM or strength. Therefore, the bent knee fall-out test was utilized to further assess hip ROM. The patient had decreased ROM of the left hip when compared to the right and reported that her muscles (the adductors) felt tighter on the left. A physical therapist with a dry needling certification educated the patient about the risks of dry needling and received written consent for the treatment to be performed. The hamstrings and adductor magnus were then palpated resulting in a subjective report of tenderness from the patient and identification of trigger points by the therapist along the proximal 1/3 of the adductor muscle belly.

With the patient positioned in prone, this portion of the adductor magnus was dry needled at three trigger points with a pistoning technique. Dry needling was completed utilizing a .30 x40 mm needle. The pistoning technique is the insertion of the needle into the trigger point, removing it partially, and then directing it back into the trigger point. The treatment triggered multiple local twitch responses at each point. Initially after the treatment, the patient had increased motion of the left hip in bent knee fall-out and no pain with walking or backwards walking. The patient was educated to apply ice to this area once she returned home.

At the following session, the patient reported her function was slowly improving again, as she no longer had pain with turning over in bed. She continued to report some pain with abdominal exercises at her workout class. The adductor magnus was dry needled again by the same therapist. This was performed in areas with determined trigger points via a pistoning technique. The patient's exercises were progressed to include 4-way single leg stance steamboats with a green theraband, bent knee fall-outs, and happy baby stretch. The patient had no increase in pain as a result of this exercise progression.

The following visit, the patient reported having no pain in the area, but increased pain along the substance of the medial hamstring belly. Thus, dry needling was performed to trigger points along this area, resulting in immediate relief in her pain. The patient reported being able to perform all of her exercise at her workout class and no recurrence of her pain at the beginning of her next session. The patient was seen for three more visits addressing piriformis and IT band discomfort.

Outcomes

The outcomes for the patient can be seen in Table 1. Three different therapists performed the initial, progress note, and final evaluations. However, the therapist that performed the final examination had supervised a physical therapy student perform the initial evaluation. In addition to these three therapists, a physical therapist assistant also contributed to the care of this patient. Following a treatment program that incorporated eccentric hamstring training, dry needling of the adductor magnus and hamstrings, and IASTM of the proximal hamstrings, the patient's function improved and she was able to fully return to her group exercise class. The patient was seen by physical therapy for a total of 15 visits.

Four sessions of IASTM to the proximal hamstrings were performed. The patient had no change in her symptoms after the first IASTM treatment. However, the patient had continued to participate in aggravating activities in her community-based exercise class. After the second session, the patient reported improvements via decreased pain levels to 4/10 with turning over in bed, previously 6/10. This improvement remained after the third session of IASTM. The patient noted continued maintenance in her pain levels, however her improvements had plateaued after the fourth session. IASTM was not performed as a result, and the patient's symptoms did not return, so IASTM treatments were stopped.

Dry needling was performed at three visits. The first dry needling session was performed to three trigger points in the adductor magnus and resulted in immediate improvement in function (no pain with walking and backwards walking) and ROM with the bent knee fall-out test. The patient continued to report improved function at the following visit, as she no longer had pain with turning over in bed, and only had pain with abdominal exercises performed in her workout class. The second dry needling session was also performed to three trigger points in the adductor magnus, and this resulted in the patient reporting complete resolution of the deep, medial pain. Another dry needling session was performed to three trigger points in the medial hamstring belly due to the patient's subjective complaint of increased pain in this area. The patient reported complete resolution of pain in the area at the next visit.

Eccentric hamstring strengthening was performed at all sessions, with the exception of the final three. Exercises were progressed when the new exercise introduced resulted in 0/10 pain. Other than subjective pain ratings, this component had less specific outcomes to assess its effectiveness.

After resolution of the patient's initial pain, the patient was seen for three additional visits to address infrequent piriformis and IT band discomfort. At discharge, the patient's LEFS score was at 89% (71 points). With the patient's initial LEFS score being 66%, or 53 points, the patient successfully achieved the MDC and the MCID, both of which were an increase in 9 points.[11] Therefore, with this multifactorial approach, the patient achieved significant improvements in her functional levels.

Table 1. Initial and final evaluation outcome measures

Outcome Measures	Initial Evaluation	Final Evaluation
Lumbar ROM	WFL; left hip pain and stiffness with extension and left side bending	WFL; no pain
Active hip ROM	WFL	WFL
Hip Strength (all motions)	Right: 5/5; Left: flexion: 4+/5, 5/5 all others	Right: 5/5; Left: flexion: 4+/5, abduction: 4+/5, 5/5 all others
Knee Strength	Flexion and extension: 5/5	Flexion and extension: 5/5
Balance	Right: 15 sec; Left: 12 sec	Right: 30 sec; Left: 30 sec
Pain/Tenderness to Palpation	Left medial ischial tuberosity, out laterally and inferiorly towards the knee	None
LEFS	66% (53 points)	89% (71 points)
Painful activities	Bridges; initial walking; single leg V-ups	None

Range of motion (ROM); within functional limits (WFL); seconds (sec); lower extremity functional scale (LEFS)

Discussion

Hamstring Involvement

With proximal hamstring tendinopathy being a fairly new diagnosis, it is unclear if hamstring strain protocols are sufficient in treating these more chronic conditions.[5,6] Therefore, it is currently of benefit to determine if a patient presents with an acute or chronic condition, and if the pain occurred from a specific inciting event or gradually worsened over time.[3] This will allow clinicians and researchers to determine what treatments work best for various diagnoses.

In this case, the patient had pain that developed over the course of three months with no specific event initiating the pain. The pain was described as being deep, at the left ischial tuberosity, and descending towards the knee. This chronic presentation, gradual onset, and location and description of pain lead to the diagnosis of proximal hamstring tendinopathy.[3,5,6] The patient also had no loss of hip ROM or hamstring strength at the initial evaluation, which is also consistent with this diagnosis.[3,6] In addition, the patient's description of pain only at the beginning of long distance walks, that would increase after the activity as well, is consistent with tendon pain behavior. This behavior typically presents as localized pain that decreases after a period of activity and worsens after the activity is ceased.[7] The semimembranosus origin is the deepest and most medial of the three hamstring muscles.[7] Based on subjective description of the pain being more towards the middle and deep, as well as palpation to this area being tender, it was suspected that the semimembranosus was the main driver in the patient's pain.

While there are some diagnostic tests in the literature that are believed to assist in the diagnosis of proximal hamstring tendinopathy, these are not yet backed up with sufficient evidence.[7] However, one of these tests is strikingly similar to a functional motion that was a chief cause of pain for the patient in this case. The special test is a single-leg bent-knee bridge and is intended to provoke the patient's pain.[7] When performed, the test is quite similar to the way the patient performed rolling over in bed. There are also three passive stretch tests that have moderate to high evidence to support them in the use of diagnosing proximal hamstring tendinopathy. These are the bent-knee stretch, modified bent-knee stretch, and Puranen-Orava test. However, some clinicians have found that these tests are often negative in patients with a less severe presentation.[7] It is believed that the patient in this case would not have been positive in these measures, as she had no loss of flexibility or ROM in single plane motion assessment and had no symptoms during the straight leg raise test at initial examination. Thus,

future research in specifying diagnostic tests would further benefit clinicians in best treating patients similar to that in this case.

With such little research in the treatment of hamstring tendinopathy, various treatment approaches typically used for hamstring strains and other tendinopathies were utilized in the initial treatment of this patient. Many of these treatment approaches align with expert opinion and case reports for proximal hamstring tendinopathy treatment.[5,6] While the initial treatment approach of IASTM and eccentric hamstring strengthening resulted in decreased pain and improved function, these improvements plateaued at 2 weeks. At 6 weeks the patient's pain increased and function declined. Therefore, additional sources of pain were investigated.

Adductor Magnus Involvement

In chronic conditions, it is common that other musculoskeletal pathologies may also be present alongside the hamstring component.[7] Therefore, with a return of the patient's pain and a decline in her function, the adductor magnus was assessed as a potential source of injury. This muscle was more specifically assessed due to its origin neighboring that of the hamstrings, and it's fibers contributing to hip extension.[8-10] It has also been shown that adductor injury occurs in almost a fourth of more serious hamstring injuries.[9]

In addition, during treatments of IASTM, the patient frequently reported that she felt the pain occurred more towards the middle when compared to where the IASTM was being used. However, the treatment was already being applied as medially as possible. Research has found that the adductor magnus tendon's most lateral portion is consistently just medial to the origin of the hamstrings.[12] Therefore, it was believed that the pain could be deeper or more towards the true medial thigh, *i.e.,* the location of the adductors. When the adductor magnus was palpated, the patient reported tenderness and the therapist noted muscle tightness, or trigger points, which are often associated with dysfunction.[5]

Studies have shown tendon overuse injuries to account for 30-50% of sports and general musculoskeletal injuries.[13] Hip adductor overuse injury typically occurs along their proximal tendons. These injuries also present gradually, resulting in decreased hip ROM and function.[14] With the adductor magnus' origin being directly medial to that of the hamstrings, it is possible that adductor tendinopathy of the specific fibers that aid in hip extension may have contributed to this patient's pain.

During assessment of adductor magnus involvement, additional hip ROM assessment was performed via the bent knee fall-out test.[15] This special test combines hip flexion, abduction, and external rotation by requiring a patient positioned in hooklying to bend the knees to 90º of flexion, and allow both knees to fall out to the side will keeping feet together and on the table.[16] This test was used due to the strong evidence that supports it's correlation with hip and groin pain in athletes.[17]

Along with the patient's subjective feeling of tightness in the adductors on the left, there was decreased motion of the left hip during the bent knee fall-out. Therefore, it was believed that the adductors were impacted this patient's pain, and the bent knee fall-out was chosen to be used to assess effectiveness of adductor treatment.

Pelvic Floor Involvement

The pelvic floor muscles are also in close proximity to the hamstrings, and share an origin with the adductor magnus at the inferior pubic rami.[8,10,18] A case study reported the presence of pelvic floor dysfunction in a patient with a hamstring injury. In this case, initial treatment of the hamstring injury via hamstring strengthening and iontophoresis resulted in decreased pain. The pain, while initially present at the ischial tuberosity, then presented at the inferior pubic ramus, which was described as a deep pain, and could not be palpated.[19]

These aspects described in a previous case, resulted in the belief that pelvic floor muscles could be implicated in the pain of the patient in the present case study. Therefore, the therapist consulted a pelvic floor therapist to determine subjective questions and simple tests that could be performed to decide if a formal pelvic floor physical therapy examination was necessary. The pelvic floor therapist

suggested assessing Kegels, reverse Kegels, and provided the cueing to encourage proper performance. Due to the patient's denial of any bowel or bladder impairments, and no pain with both forms of Kegels, a formal evaluation was not performed and pelvic floor involvement was considered less likely. However, pelvic floor dysfunction was still considered a potential component, should other treatment avenues not lead to relief. Although this patient did not have any signs, symptoms, or pain associated with potential pelvic floor dysfunction, this is an important aspect to consider in the regional interdependence of the hamstrings and their surrounding musculature.

Eccentric Hamstring Strengthening

When treating proximal hamstring tendinopathy, case reports and some clinicians have suggested utilizing similar treatment approaches as used for hamstring strains and other tendinopathies, which often emphasize inclusion of eccentric training.[4,7] This is due to a current lack in the literature regarding the most appropriate treatment approach for proximal hamstring tendinopathy. However, it has shown that appropriate progressive loading of the injured tendon in an eccentric manner, can lead to normalization of the tendons structure. Decreasing abnormal tendon structure has been described to decrease pain and improve function.[5] Therefore, eccentric hamstring strengthening was utilized in this case report.

Evidence based eccentric exercises utilized in this case report were prone hamstring curls, bridges, bridges on a Swiss ball, single leg bridges, bridge progressions, forward step ups with gradual increase in height of step, and steamboats with theraband (also called 4-way hip exercise in the literature).[5,7] Progression of these exercises is typically based on the activity causing minimal, or 0-3/10, pain.[7] In this case, the patient was only progressed if the new activity caused 0/10 pain. The patient was educated to hold off on group workout exercises due to supporting research that painful activities should be stopped until symptoms settle and become unchanging.[7] It is possible that these exercises were too advanced for her healing tendons.

Although eccentric exercise has been supported in the literature in the treatment of tendinopathies, it is important to note that it has not been specifically researched in proximal hamstring tendinopathy other than in case studies.[7]

IASTM

In chronic cases such as in this report, scar tissue can develop around the proximal hamstring and adductor magnus, leading to sciatic neuropathy.[9] The patient's initial pain description presented as potential sciatic involvement, as it went from the medial, proximal hamstring, very close to the sacrum, out laterally towards the greater trochanter and distally into the hamstring muscle belly. It has been shown that IASTM can be beneficial in breaking up scar tissue and in promoting recovery by encouraging new formation of collagen.[20] IASTM is the use of a metal instrument directly over the injured area to stimulate realignment of collagen.[20] Some studies have shown that the use of IASTM can lead to decreases in pain, improvements in range of motion and function, and shorten the rehabilitation length.[20]

Initially, the patient in this case saw the benefit of decreased pain and improved function with use of IASTM treatment. The treatment was focused on the proximal tendons and muscle belly of the medial hamstrings along their origin of the ischial tuberosity. However, other tissues were involved in this patient's overall injury, thus the IASTM to the hamstrings was not sufficient in alleviating her pain and returning her to her prior level of function. It should be considered that IASTM to the adductor magnus might have provided some benefits as well, since this was later found to be the suspected driving force in her lingering and exacerbated pain. It is possible that had the adductor magnus involvement been identified and treated sooner, the patient may not have had this exacerbation of pain and decreased function.

Dry Needling

Dry needling is a treatment that utilizes the insertion of a fine needle into a skeletal muscle trigger point. A trigger point is a band of tight skeletal muscle that is tender to palpation, can radiate pain, and can result in muscle and tendon dysfunction.[5] Using dry needling to treat these points can result in decreased pain, improve relaxation of the trigger point muscle fibers, and improve flexibility of the muscle as whole.[5] Case studies have shown that dry needling of the hamstrings and adductor magnus, in conjunction with lumbopelvic stability and eccentric training, resulted in decreased pain and return to pain free running in patients with proximal hamstring tendinopathy.[5] Both patients in this case study only required 2-3 sessions of dry needling, similar to the patient in this case requiring three sessions. Dry needling was ceased in all cases once the initial improvements seen after the treatment remained steady. Each patient in the previous cases, as well as this case, received dry needling to both hamstrings and adductor magnus due to their shared origin, function, and presence of trigger points.[5]

Dry needling has been more extensively studied in other, more common, tendinopathies. In lateral epicondylitis, or tendinopathy of the lateral elbow, this treatment has been shown to be more effective than anti-inflammatory drug, brace, and ice use in the long term.[21] However, it is important to note that the muscles involved in this diagnosis are non-weight bearing, whereas the adductor magnus and the hamstrings have this additional load during their closed-chain functions. In patellar tendinopathy, long and short term benefits of pain reduction and improved function have been shown with dry needling.[22] Case studies have also found that dry needling, in conjunction with eccentric-concentric exercises and stretching, may be a beneficial treatment for patients with biceps tendinopathy.[23] Research suggests that dry needling be used as an adjunct alongside specific exercises for the muscles involved.[22] Dry needling is still a new approach to treating tendinopathies.[21] Thus, continued research is necessary to determine the true effectiveness of this approach.

As described previously, the bent knee fall out, patient pain, and subjective description of adductor tightness were used to assess the effectiveness of the dry needling treatment when it was initially performed. One of the benefits of dry needling is the ability to cause a localized twitch response, or a quick contraction and consequent relaxation as a result of the needle stimulus.[5] With each trigger point, multiple localized twitch responses were elicited in this case. Dry needling has been shown improve the flexibility of the musculotendinous unit, as well as impact the muscles function.[5] After dry needling to the adductor magnus was performed, the patient demonstrated improved motion with the bent knee fall-out, reported no pain with walking, and reported less tightness in the left adductors in during the bent knee fall-out. After dry needling to the adductor magnus once more, and the hamstrings in a subsequent visit, the patient reported complete resolution of her pain that brought her to physical therapy. Therefore, dry needling may be an effective treatment in proximal hamstring and adductor injuries and tendinopathies.

It may be difficult to apply the results from this case to other patients with similar presentations, as a specific protocol was not used. A limitation of this case report is that involvement of the adductor and potential proximal hamstring tendinopathy were based on patient report and clinical presentation, rather than utilizing imaging to confirm.[24] In addition to the previously mentioned causes of pain along the ischial tuberosity region, there are various other causes of this pain that should be recognized as a potential diagnosis.[1] Another limitation, was that different therapists performed initial, progress, and discharge evaluations. In future research, using a single blinded evaluator would lead to less bias and influence via inter-rater reliability. Due to the lack of current literature describing treatment of proximal hamstring tendinopathy along with adductor magnus involvement, future systematic research is needed to determine the optimal dosage and treatment protocol. However, this case can provide a foundation for other clinicians and researchers to build on.

Conclusion

When treating a patient with a hamstring injury, it can be difficult to correctly determine a diagnosis and, therefore, treatment, due to a lack of evidence supporting newly described injuries. However, this case study supports previously described presentations of proximal hamstring tendinopathy. It is

possible that a similar approach to assessment, in addition to assessments described in other case studies, would be beneficial in appropriately differentiating hamstring injuries. When assessing hamstring injuries, it seems to be pertinent to also assess the surrounding tissues, especially the adductor magnus. As these tissues may also require treatment in order to fully treat the patient's injury.

A multifactorial approach to treatment in patients with similar posterior hamstring and gluteal presentations may lead to relief of symptoms. The various factors that can be considered are IASTM, eccentric exercise, and dry needling. Although the literature in comprehensive treatment of proximal hamstring tendinopathy is currently lacking, this case report presents potential treatments that may benefit clinicians and may spark future research.

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