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Quad Strengthening and Hamstring Stretching as a Treatment of Pes Anserine Bursitis

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QUAD STRENGTHENING AND HAMSTRING STRETCHING AS A TREATMENT OF PES ANSERINE BURSITIS

by

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This Scholarly Project, submitted by Jennifer Bernardy in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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ABSTRACT

Background/Purpose: This case study describes a 28-year-old woman's six physical therapy visits over a period of four weeks for treatment of right pes anserine bursitis. The purpose of this case study is to describe the treatment of an individual with pes anserine bursitis using hamstring stretching, quadriceps strengthening, and iontophoresis and to describe the outcomes.

Case Description: Following a fall down eight steps in her home with her right knee underneath her. The patient presented with increased pain, swelling, loss of range of motion, and tenderness at the pes anserine. Treatment consisted of iontophoresis, hamstring stretches, and quadriceps strengthening.

Outcomes: The patient improved by 85% to 90% since initial visit as indicated by patient visual analog scale ranking and was able to return to all work activities and exercise on the elliptical at home. She had increased range of motion and no swelling at the bursa. The patient responded well to treatment and was able to return to all activities.

Discussion: Current literature provides protocols, case studies, and individual doctor's papers about pes anserine bursitis but no evidence based practice for interventions. This case study is an initiative that randomized controlled trials need to be performed to determine what the best treatment of pes anserine bursitis.

Key Words: pes anserine, bursitis, iontophoresis, hamstring and quadriceps strengthening

CHAPTER 1

BACKGROUND AND PURPOSE

Pes anserine bursitis is an inflammation of the bursa that sits between medial knee tendons and the proximal anteromedial tibia. The gracilis, sartorius, and semitendinosus tendons insert onto the proximal anteromedial tibia and together form what is known as the pes anserine. Pes anserine receives its name from the appearance of the three tendons as they attach to the tibia because it looks like a goose foot, which in Latin is "pes" for foot and "anserine" for goose. The gracilis, sartorius, and semitendinosus muscles function to flex the knee, provide medial support to the knee to prevent excessive valgus, and provide counterrotary torque to the knee.[1]

A bursa is a fluid-filled sac that helps to reduce friction between different tissues. The pes anserine bursa can become inflamed due to overuse, trauma, tight hamstring muscles, degenerative joint disease, osteoarthritis, obesity, and pes planus. Pes anserine bursitis tends to affect middle-aged women who are obese, young active athletes, and those who are aged 50 to 80 years old with osteoarthritis of the knees or rheumatoid arthritis.[2,3] One study reported that 0.4% of all visits to primary care clinics are due to bursitis, not necessarily at the pes anserine.[4] Pes anserine bursitis is commonly misdiagnosised as a medial meniscus injury or collateral ligament injury.[5] According to a study conducted by Rennie and Saifuddin[6], the prevalence in symptomatic adults is 2.5% as found on MRI. The results from this study suggest that 2.5% of adults with knee pain

have pes anserine bursitis. MRI is a common diagnostic tool used to identify pes anserine bursitis, although conclusions made with the MRI are tentative findings that are confirmed by the physician with corresponding signs and symptoms.[3] Brigham and Women's Hospital developed a treatment protocol for pes anserine bursitis that included: NSAIDS, corticosteroid injection, and therapeutic exercises. They also suggest modalities such as ice, ultrasound, high voltage electrical stimulation, gait training, orthotic consultation, and instruction in home exercise program.[1] LaPrade[7] concluded that some common treatments for pes anserine bursitis are hamstring stretching and closed chain quadriceps strengthening, NSAIDS, ice, rest, and surgery. He put emphasis on having positive results with patients who are treated with hamstring stretching and closed chain quadriceps strengthening. Glencross[2] concluded that some common treatments for pes anserine bursitis are NSAIDS, rest, ice massage, ultrasound, electrical stimulation, stretching programs of the adductors, quadriceps and hamstrings, and surgery. All of these articles are opinions of the authors who wrote them and have no research to support them, although all 3 articles suggest NSAIDs, ice, rest, and stretching as options for pes anserine treatment.[1,2,7] Two of the three articles suggested strengthening, ultrasound, electrical stimulation, and rest as viable options for the treatment of pes anserine bursitis. The patient in this case study was diagnosed with pes anserine bursitis and was treated with iontophoresis, hamstring stretching, and quadriceps strengthening. The hamstring stretching and quadriceps strengthening program was based on the article by LaPrade[7] and was the focus of this patient's treatment.

Iontophoresis has been found to have short-term effectiveness in decreasing pain and tenderness for lateral epicondylitis. A study found that on a visual analog scale

patients treated with dexamaethsone had an improved rating of 23 mm on a 100 mm scale compared to 14 mm for those who received the placebo.[8] Also patients treated with dexaethasone were rated at an average of 54% on a global improvement scale compared to the placebo at 33%. Lateral epicondylitis has similar pathophysiology as pes anserine bursitis in that they are both inflammatory conditions and can both be caused by overuse. Bertolucci[9] supports the use of iontophoresis using anti-inflammatory drugs to help reduce swelling. Therefore iontophoresis has supporting evidence to be an effective treatment for inflammatory conditions. Previous literature lacked evidence based support for iontophoresis in the treatment of pes anserine bursitis.

This case study is unique as it provides evidence on the effectiveness of iontophoresis and a hamstring stretching and quadriceps strengthening program in treating pes anserine bursitis. The patient returned to all previous activities without restrictions. Since the case study was only conducted on one individual, it provides an initiative to perform further evidence-based studies on the hamstring stretching and quadriceps strengthening program for pes anserine bursitis. I was unable to find research based articles concerning hamstring stretching and quadriceps strengthening program, and furthermore was unable to find evidence to support any treatments for pes anserine bursitis. Several other case studies have been performed but nothing can be found that has been a wide scale study. The purpose of this case study is to describe the treatment of an individual with pes anserine bursitis using the hamstring stretching and quadriceps strengthening program and describe the positive outcomes.

CHAPTER II

CASE DESCRIPTION

The patient was a 28-year-old Caucasian female who was a teacher at a local middle school. She was recently married, and lived in a house with 1 flight of stairs. The patient complained of right knee pain at the medial joint line and also at the pes anserine. The pain began when the patient fell and slid down 8 stairs with her right knee beneath her. The trauma of the incident caused inflammation in the pes anserine bursa. Since the incident, the patient's chief complaint was recurring episodes of her knee buckling while ascending stairs. In addition she was unable to stand for prolonged periods, squat, or continue exercising on her home elliptical. She reported having pain at a 3 to 4 out of 10 at rest that could increase to a 8 out of 10 with activity on a pain scale where zero is no pain and 10 is the worst pain imaginable. The patient presented to physical therapy with a diagnosis of right knee pain/bursitis. The prognosis for this case was good due to the patient's youthful age and her high level of motivation. The patient's past medical history was relatively brief, although she was diagnosed with relapsing/ remitting multiple sclerosis in 2002. At the time of the evaluation she had not experienced an exacerbation since 2003. She had a history of allergic rhinitis, optic neuritis, and galacturia. She reported that at 16 years of age she fell off a swing and developed a cyst in her right knee. She was required to wear an immobilizer and have physical therapy, which improved her symptoms. She had no previous therapy for the current complaint

but had been icing and taking ibuprofen and prescription of meloxicam, which had helped to reduce the pain. Meloxicam was prescribed by her family physician, although side effects of this drug can include difficulty breathing or swallowing, tachycardia, excessive tiredness, lack of energy, flu-like symptoms, and back pain.[10] The patient did not complain of or express any of these side effects during her therapy treatments. This patient was a good candidate for treatment because she is a young active individual who was motivated to get back to her previous level of function. It was important to rule out knee instability with special tests in this patient care.

Examination, Evaluation, and Diagnosis

During the initial physical therapy visit her right knee was examined and the results are listed as follows. Through observation there was minimal swelling observable at both the medial aspect of the right knee and also at the pes anserine. Range of motion is listed in Table 1.

Table 1. Initial Knee Range of Motion

	Right	Left
Flexion	135 degrees	141 degrees
Extension	2-3 degrees hyperextension	2-3 degrees hyperextension

Bilateral lower extremity strength was tested using manual muscle testing for hip flexion, knee flexion, knee extension, and ankle dorsiflexion and all were found to be 5 out of 5. Lachman test for integrity of the anterior cruciate ligament (ACL), varus and valgus stress test for integrity of the medial collateral ligament (MCL) and lateral collateral ligament (LCL), and anterior drawer test also for the integrity of the ACL were

performed and all were found to be negative bilaterally. A negative finding signifies that the integrity of the ACL, MCL, and LCL is intact. The Lachman test is performed with the knee in 30 degrees of flexion while the tibia is anteriorly translated with respect to the femur.[11] The Lachman test has been found to have a sensitivity of 86% and specificity of 91%,[12] making it the most sensitive test for an ACL tear.[13] The valgus stress test is performed with the patient in supine and the involved knee in extension. A strong valgus force is applied with a counterforce applied at the lateral femoral condyle. Harilainen[14] found sensitivity to be 86% for the valgus stress test and found the sensitivity to be 25% for the varus stress test. There was no specificity reports about the valgus and varus stress tests. The varus stress test is performed in supine with the involved knee in full extension while a strong varus force is applied thru the knee with a counterforce applied at the medial femoral condyle. The anterior drawer test is performed with the knee in 80 degrees of flexion and the lower leg is grasped just distal to the joint space. The clinician then sits on the foot and the lower leg is quickly moved forward.[11] Hardaker[15] found that the anterior drawer sign has a sensitivity of 18% and no report for specificity. Tonino[16] found sensitivity to be 27% and specificity to be 98% for the anterior drawer test, and also found the Lachman test to be 89% sensitivity and having 98% specificity. These tests were performed to rule out any ligament or meniscal injuries due to the trauma of falling down the stairs. Palpation revealed tenderness underneath the patella, at the medial joint line, and over the pes anserine bursa on the right knee. The pes anserine bursa was significantly more tender and provoked a greater patient response of pain then the aforementioned areas.

The diagnosis of pes anserine bursitis was confirmed through the evaluation process by the negative results of the tests for ligament integrity, full strength, tenderness and swelling at the pes anserine, and a X-ray that was negative for acute bony abnormality or fractures. Forbes et al[3] report that classic symptoms are tenderness and swelling along the proximal medial tibia or a patient complaint of medial knee pain. Also ascending or descending stairs may exacerbate the symptoms. An article written by Calmbach and Hutchens[5] states that patients with pes anserine bursitis report pain at the medial aspect of the knee, which is worsened by repetitive flexion and extension. A physical examination should reveal tenderness at the medial aspect of the knee, just posterior and distal to the medial joint line. No knee joint swelling is present, but there may be slight swelling at the insertion of the medial hamstring muscles. Valgus stress testing in supine or resisted knee flexion in the prone position may reproduce pain. Palpable for tenderness, location of pain, swelling at the pes anserine, and flexion and extension movements which eliciting pain were symptoms detected during the evaluation of this patient and found to concur with the findings above.

The problem list for this patient included: pain, swelling, decreased range of motion, limp during ambulation, inability to squat, and right knee buckling. The systems review was in the areas of cardiopulmonary, integumentary, musculoskeletal, neuromuscular, and cognitive orientation. The patient displayed no problems in the cardiopulmonary or integument area. The musculoskeletal system was compromised due to the swelling and a loss of range of motion. The neuromuscular system was compromised due to multiple sclerosis. The patient was able to communicate effectively and expressed during her initial treatment that she is a visual and kinesthetic learner. The

practice pattern in the Guide to Physical Therapist's Practice is 4E impaired joint mobility, motor function, muscle performance, and range of motion associated with localized inflammation. The ICD-9 code for pes anserine bursitis is 726.61.[17]

Prognosis and Plan of Care

The plan of care consisted of iontophoresis, strengthening, stretching, ultrasound, heat/ cold modalities, range of motion, and a home exercise program, although not all of the above interventions were used during treatment of this patient. Treatment specifically focused on iontophoresis, strengthening, stretching, and a home exercise program. She was seen 2 times a week for 4 weeks. The patient's prognosis according to the Guide to Physical Therapist Practice is over the course of two to four months, patient will demonstrate optimal function and the highest level of functioning in all activites.[17]

The patient's short term goals were: Following physical therapy intervention the patient would be independent in her home exercise program (1 week). Following physical therapy intervention the patient would have reduced swelling around the pes anserine bursa in order to decrease pain level from a 4 out of 10 to a 2 out of 10 (2 weeks). The patient's long term goals were: Following physical therapy intervention the patient will have reduced pain to a zero to 1 out of 10 in order to allow the patient to squat while at work. Following physical therapy intervention the patient would be able to ambulate without a limp. Following physical therapy intervention the patient would have no episodes of her knee buckling in order to go up the stairs safely. All long term goals were expected to be met in 4 weeks. The patient was expected to meet all of the

short term and long term goals. She was re-evaluated at every appointment by pain level assessment, the number of times her knee buckled, and knee flexion measurements.

CHAPTER III

INTERVENTION

Due to the findings in the examination and evaluation the patient was treated for pes anserine bursitis. The treatments that were utilized were iontophoresis, a home exercise program, strengthening, and stretching. Iontophoresis was done to decrease the inflammation and a quadriceps strengthening and hamstring stretching program to decrease friction on the bursa. Laparade and Flinn[7] state that patients with pes anserine bursitis need to work on both a hamstring stretching program and a concurrent closed-chain quadriceps strengthening program. This approach was used during the treatment of this patient.

Iontophoresis is a method using an low voltage direct electrical current to drive an anti-inflammatory medication, usually dexamethasone, through the skin to the inflamed area. The current theory is the electrical current increases the permeability of the stratum corneum which allows the medication through more effectively.[18] The medicated active electrode was applied to the medial proximal tibia over the pes anserine bursa while the dispersive electrode was applied superiorly and medially to the patella, approximately 2 inches superior to the active electrode. Iontophoresis was performed with 4.0 cc of dexamethasone at 60 mA per min, 4.0 mA for 15 minutes. A white spot developed under the active electrode after the third visit. The patient had no increased pain or sensation over this spot. When she returned for a subsequent visit, the area where the electrode was

previously placed was speckled with red spots. She continued to report that there was no pain or increased sensitivity. Iontophoresis was continued but observed closely. She did not experience any problems during the rest of her treatments.

Her warm up consisted of bicycling on a recumbent bike for 4 to 5 minutes. During the third visit the patient experienced a burning sensation on her right medial knee while on the recumbent bike, and also an audible snapping when the right knee would fully extend during the cycling movement. The patient was advised to quit that activity for the day. The patient never experienced the burning or snapping during subsequent physical therapy treatments. Strengthening also included right leg step ups on a 4 and 5 in step for 2 sets of 10 repetitions on a step against a wall with hand rails to provide balance. Next, standing hamstring curls with a 3lb weight for 3 sets of 10 repetitions were performed against a wall with handles for balance. Finally straight leg raises were performed in supine with a 3lb weight for 2 sets of 10 repetitions. During the second to last visit, stool scoots were attempted but discontinued due to popping and pain in the right knee. Stool scoots were performed by having the patient sit on a wheeled stool and having her pull herself forward by digging her heels into the floor and flexing her knee. This exercise was not attempted again during her treatment.

The home exercise program consisted of 3 stretches, straight leg raises, and partial squats. Stretching consisted of 2 adductor stretches and a hamstring stretch. The first adductor stretch was a sitting butterfly stretch while the patient applied a force toward the floor through their knees with their hands. The second adductor stretch taught to the patient required the patient to assume a half squat position and to lean her weight onto the left leg leaving the right leg out to the side. The last stretch taught to the patient was a

standing hamstring stretch. This stretch is performed by placing the right leg on a stool then dorsiflexing the right ankle and pushing the heel toward the footstool keeping the knee straight. To increase the stretch the patient could lean forward at the hips while keeping the back straight. The patient was taught to hold all stretches for 30 seconds and repeat 3 times, 1 to 2 times per day. Two articles suggested the use of stretching, which helps by reducing friction over the bursa.[7,19] The partial squats were performed by the patient while holding onto the back of a chair for support and balance while bending at the knees, making sure to keep the knees behind the toes, and slightly sticking the buttocks out behind herself, then standing back up. The partial squats were performed for 10 repetitions 1 to 2 times per day. The final home exercise program the patient was to continue at home consisted of the hamstring stretch, straight leg raises, and partial squats. Please see Appendix A for images of these exercises. This treatment plan required no coordination with another health care discipline other than the physician who wrote the referral for physical therapy.

Table 2. Timeline of Visits and Progression of Interventions

Date	**10-22-07**	**10-26-07**	**10-30-07**	**11-2-07**	**11-9-07**	**11-14-07**
Visit	Initial visit	2	3	4	5	6
Pain	3-4/10	Some better	Pain is better	No report	85%-90% better	No report
Treat-ment	Ionto-phoresis HEP: SLR, Partial squats, adductor stretch	Ionto-phoresis and reviewed HEP	Ionto-phoresis R. Bike 4 minutes, 4 inch step ups 2 sets of 10	Ionto-phoresis R. Bike 5 minutes, 4 inch step ups 2 sets of 10	Ionto-phoresis R. Bike 5 minutes, 4 inch step ups 2 sets of 10, hamstring curls 3 sets of 10 with a 3 lb weight, hamstring stretch	Ionto-phoresis R. Bike 5 minutes, 5 inch step ups 2 sets of 10, hamstring curls 3 sets of 10 with a 3 lb weight, SLR 2 sets of 10 with 3 lb weight

CHAPTER IV

OUTCOMES

At the initial visit the patient reported that her pain level was a 3 to 4 out of 10, her range of motion on the right knee was 135 degrees of flexion and the left was 141 degrees, and there was observable swelling at the pes anserine bursa. On the third visit the patient was able to squat at work and felt she was improving although she still had observable swelling at the bursa. On the fifth visit the patient reported her pain had improved by 85% to 90% since her initial visit, right knee flexion was 145 degrees and left knee flexion was 145 degrees, but was still tender over the bursa. On the last visit the patient was able to exercise on her elliptical machine again, and was no longer tender over the bursa. At discharge the patient had no remaining impairments. The limp had resolved, swelling was resolved, and the patient had increased confidence that her knee would not give out. See Table 2 for reevaluation of pain levels at each visit.

The patient felt that she was greatly improved and she was able to meet all of the short term goals and long terms goals. The patient reported that the iontophoresis really helped and that she was beginning to progress her home exercise program on her own. She was encouraged to continue with her home exercise program and increase weight and repetitions as needed. Patient had no evident compliance issues.

No clinometric was used during the treatment of this patient. Although an appropriate one that could have been used is the Lower Extremity Functional Scale (Appendix B). It is a 20-question survey that requires patients to rate activities on a five-

point scale. The 5 different choices are 0 for extreme difficulty, 1 quite of bit of difficulty, 2 moderate difficulty, 3 a little bit of difficulty, and 4 no difficulty. This scale has been found to be reliable and to have construct validity.[20]

CHAPTER V

DISCUSSION

The patient improved with the treatment of iontophoresis, hamstring stretches and quadriceps strengthening. She met all the short term and long term goals set out at the initial visit. This improvement could have been due to the interventions provided or due to a decrease in inflammation of the bursa or be either spontaneous. Also it could have been due to the patient allowing the knee to rest which reduced the inflammation. An article by Butcher et al[19] suggests that an acronym be applied to the treatment of pes anserine bursitis. The acronym "PRICEMM" stands for protection, rest, ice, compression, elevation, medication, and modalities. They suggest interventions such as padding or bracing, suggesting alternative forms of exercise that eliminates the aggravating factors to the bursa, ice massages, compression with a elastic bandage, elevation, ultrasound, high-voltage electrical stimulation, and medications such as: no steroidal anti-inflammatory drugs, and corticosteroids injections. In addition to the interventions listed above Butcher et al[19] call rehabilitative exercise the cornerstone of the treatment for bursitis. They include stretching and symmetrically strengthening the muscles involved in adjacent joint motion as rehabilitative exercise. LaPrade and Flinn[7] and Glencross[2] suggest similar plans for treatment as was listed in the introduction.

It was found during this study that many of the evaluation techniques used by Calmbach and Hutchens[5] for pes anserine bursitis were applicable to this patient. Her only characteristic that did not fit his criteria was pain with a valgus stress test. The

patient also responded well to the stretching and strengthening program once the swelling was reduced by iontophoresis. Laparade and Flinn[5] did not list iontophoresis as a possible treatment of pes anserine bursitis, but this patient found the iontophoresis to be effective in pain reduction and swelling reduction.

The search for existing studies on pes anserine bursitis treatments was extensive. Pubmed, CINAHL, and Cochrane Library were searched using the following key words: PES ANERINE BURSITIS, LOWER EXTREMITY BURSITIS, BURSITIS TREATMENT, KNEE BURSITIS, and BURSITIS. Also the search engine google was used with the above key words. Most of the articles that were found dealt with the diagnosis of pes anserine. There were 3 case studies that dealt with radiographs to aid in diagnosis of pes anserine bursitis.[21,22,23] Several other case reports found that magnetic resonance imaging (MRI) is a useful diagnostic tool to identify pes anserine bursitis and differentiate between other diagnose.[23,24,25] Although due to their cost and clinical findings MRI are usually unnecessary. One article reported that MRI findings are only tentative and need to have symptoms the patient is experiencing to diagnosis pes anserine bursitis.[3] Only a few other studies were found that did not have to do with differential diagnosis or diagnostic tools. One of these articles reported that in their study those with suspected bursitis were found to have the highest prevalence of rheumatoid osteoarthritis at 71%. They report that their findings suggest that bursitides are more likely to occur in further advanced stages of knee osteoarthritis (OA).[26] This article supports that older adults with OA are commonly afflicted with pes anserine bursitis as was discussed earlier.[2,3]

There are 3 limitations to this report. First the case report was performed on only 1 subject. There is no way to be certain that if this 1 patient did well with something that everybody else in the general population would. This patient does not fit the general demographics that display this type of injury. Commonly pes anserine bursitis patients are middle-aged women with knee osteoarthritis.[1] There needs to be a randomized controlled trial done on a large scale with several participants selected from the general population randomly. Secondly gathered information about pain level is subjective. The patients may feel the need to answer that they are improving to please the therapist or also the patient may be using their pain for attention and therefore report their pain as worse. With a larger sample size malingering patients and those with inflated pain ratings would become a minority and the true effectiveness of treatments would be displayed by the majority. Finally the report was done by the therapist who was treating the patient and may have had a biased opinion. To prevent any bias the results should have been turned over to a third party to present the information.

This case report is important because it shows that treatments done commonly in the clinic setting for pes anserine bursitis are effective. Also it shows that there is a gap in evidence based practice for the treatment. Many articles and protocols offer suggestions for treatment without research support. There is a need for studies performed on the effectiveness of suggested treatments so the most effective treatments can be performed for the patient with pes anserine bursitis.

Reflective Practice

After conducting this case report there are things I would change while taking the history and performing the examination. In the future I would add the following

questions while taking a history: Do you have problems going up and down the stairs? Have you increased the amount of exercise you normally perform? To the examination portion Brigham and Women's hospital suggest performing the Thomas test, hamstring flexibility, leg length measurements, McMurray's, Faber and Scouring tests in addition to the tests that were performed.[1] Another aspect that was not performed that would have been very helpful would have been to have the patient complete the Lower Extremity Functional Scale at the initial visit, during treatment and also at discharge. This scale would have given evidence of improvement on a subjective scale. Due to the lack of research, the plan of care was based off of suggested treatments without evidence based treatments. In the future when more studies have been performed and the best treatment is supported I would change accordingly so patients would receive the best care possible. Until then I would leave my plan of care as is and adjust only for specific patient's tolerance and other factors.

The cost of treatment for this patient per visit was $48.88. The total cost for her 6 visits was $293.28. These numbers were formed by using the Medicare fee schedule for North Dakota in 2005.[27] The patient had insurance although it is unknown as to the value of her coverage so we are unable to know her exact out of pocket expenses. The initial evaluation was $71.35 and the treatments were $26.41 for therapeutic exercise and $14.98 for iontophoresis. The patient achieved all of her short term and long term goals and returned to her previous functional level. The cost was reasonable for the outcomes the patient received. The patient received 1 unit of iontophoresis and 1 unit of therapeutic exercise per visit. This is the minimal amount of cost to the patient. The therapeutic exercises were kept between the time frame of 1 unit to help reduce costs.

This 1 unit was necessary though to allow the continued progression of her home exercise program.

This case study has taught me a lot about my examination and re-evaluation process. I need to re-evaluate more often and with consistent comparable findings. For example with this patient I usually recorded her pain rating on a scale of zero to 10 but on her second to last visit I instead recorded the amount of improvement she feels she has gained as a percentage and never asked her pain level. Also I now understand how the use of a clinometric or functional scale helps to demonstrate that the patient has had a measurable improvement.

APPENDICES

Appendix A

Appendix B

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