OUTPATIENT REHABILITATION FOLLOWING

TOTAL KNEE ARTHROPLASTY

A Doctoral Project
A Comprehensive Case Analysis

Presented to the Faculty of the Department of Physical Therapy

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DOCTOR OF PHYSICAL THERAPY

by

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Abstract

of

OUTPATIENT REHABILITATION FOLLOWING

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by

Ramona Lazar

A patient with total left knee arthroplasty was seen for physical therapy (PT) treatment for 16 sessions from May to July, 2016 at an outpatient PT clinic. Treatment was provided by a student physical therapist under the supervision of a licensed physical therapist.

The patient was evaluated at the initial encounter with manual muscle tests, range of motion (ROM) measurements, girth measurements, numeric pain rating scale, and gait evaluation. Based on the patient's test results, a plan of care was established. The main goals for the patient were to decrease pain and swelling, improve strength, ROM, gait during functional activities, functional independence and static and dynamic standing balance. The main interventions used were aquatic therapy, strength training, flexibility, and functional training.

The patient improved her strength, ROM, motor control, gait sequencing, speed, balance, and functional independence. The patient was discharged home with a home exercise program and a follow up with her physician.

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Chapter 1

General Background

Total Knee Arthroplasty (TKA) is one of the most common orthopedic procedures administered by an orthopedic surgeon. According to the American Academy of Orthopedic Surgeons, more than 360,000 TKAs are performed annually in the USA.[1] Osteoarthritis (OA) is the most common reason that patients need TKA[2]. The definition of OA is inflammation of the synovial joints. The most common joints affected are the hips, spine, wrists, and knees.[3] One of the major causes of disability in the world is OA, especially in the aging population.[3,4] Although no cure has been found for this disease, OA is a treatable condition through pain management, education, physical therapy and appropriate exercise. These conservative types of treatment are more useful in the early stages of OA.[3] The most common risk factors for developing knee OA are obesity, history of trauma, and being a female.[5]

There are two classifications for OA: idiopathic and secondary. Idiopathic OA can be localized or generalized. Secondary OA can be congenital, due to trauma, or of metabolic causes.[6] Although the primary cause of OA is unknown, it is known that OA leads to a loss of supporting hyaline cartilage in the synovial joints.[7] Cartilage is an avascular and aneural tissue; hence, when healthy joints incur damage, no pain is felt.[8] Bones, on the other hand, are highly innervated tissues, and, in most cases, without the supporting cartilage, a deep aching pain and stiffness is felt in the joints—even during normal daily activities.[4] In extreme cases, erosion and remodeling of the

bone that lies directly underneath the cartilage may occur. As a result, joints may lose their full ROM and experience edema, and the muscles surrounding the joints may become weak.[9] These factors change the biomechanical structure of the knee, altering the patient's gait pattern, which can in turn lead to a decrease in functional activities.[10]

After a TKA, outpatient rehabilitation begins when the patient receives clearance from their surgeon. The length of the treatment during outpatient rehabilitation is generally two sessions per week for a duration of 6-8 weeks.[11] The emphasis of outpatient rehabilitation, post TKA, is to decrease pain and swelling, increase ROM, and to strengthen the muscles surrounding the knee joint, with an emphasis on the quadriceps and hamstrings. One of the main complications that can occur post TKA is joint stiffness.[12] Knee stiffness is defined as flexion that is less than 75˚ and/or a 15˚ lack of extension.[13] According to the research, the presence of stiffness and lack of ROM prior to the TKA has a significant role in the amount of stiffness postoperatively.[13]

Another important concern after a TKA is the potential development of deep vein thrombosis (DVT).[14] To prevent DVT, the patient must receive anticoagulant medication. In the absence of this treatment, approximately 40-84% of the patients will develop DVT.[14] This relatively high percentage is a main concern since DVT may lead to venous thromboembolism (VTE), a life-threatening event that is the primary cause of readmission post major orthopedic surgery.[14] With an appropriate dose of anticoagulant, the incidence of DVT can be reduced to only 2-3% of the cases.[15] Patients who suffer from depression and anxiety may perceive pain to a higher degree

which may decrease the patient's quality of life. Both increased pain perception and decreased quality of life may delay the process of recovery from TKA when compared to individuals who do not suffer from depression.[16]

Chapter 2

Case Background Data

Examination – History

The patient was an 85-year-old female who had pain in both knees for an extended period of time. She was diagnosed with bilateral knee OA. Her surgeon decided to first perform a TKA on her left knee since it was in slightly worse condition than her right knee. A TKA on her right knee was planned after recovery from the TKA on her left knee. The surgery was performed four weeks prior to the initial outpatient visit and the patient participated in outpatient rehabilitation on a biweekly basis for a total of sixteen sessions in an eight-week period.

At the time of the initial evaluation, the patient presented with a moderate antalgic gait. She was ambulating with a front wheel walker and was accompanied by her caregiver, who was staying with her 24 hours a day during the weekdays. The patient was able to tolerate walking for 50 feet, sitting for one hour, and standing for five minutes. She was independent in her personal care, and her caregiver assisted her with her cooking, cleaning, and transportation. During weekends, the patient's daughter, who lived across the street from her, would stop by to help with her basic needs. The patient's chief complaint was pain and swelling in her left knee, and her goal was to gain independence in mobility and driving as soon as possible.

Systems Review

The patient's musculoskeletal system was impaired as measured by limitation in her left knee ROM, an impaired lower extremity manual muscle test (MMT), and the observation of antalgic gait. These tests were performed by the supervising physical therapist. The cardiovascular system was impaired as measured by a blood pressure of 140/96 and by the fact that the patient was on blood pressure medication. The pulmonary system was unimpaired based on patient report, the physical therapist's observation, and a respiratory rate of 13 breaths per minute. The neuromuscular system was impaired based on observation of deviation in gait, balance, and motor control. The patient's integumentary system was impaired due to the healing incision on the left knee. Based on the therapist's observation and the patient's report, the scar was healing appropriately, with no signs of infection. The patient's psychosocial system was impaired based on the fact that she was taking antidepressant medication to cope with the loss of her husband, who had died a year and a half prior to the surgery. The patient was fully oriented to time, person, and place. The patient's communication was unimpaired and was appropriate for her age. The patient's learning style was unimpaired based on fluency in reading and writing English.

Medications

Table 1

Medications[17,18]

MEDICATION	DOSAGE	REASON	SIDE EFFECTS
Omeprazole	**20 mg- 1 in the morning**	**Decrease stomach Acid**	Back, leg, or stomach pain, bleeding or crusting sores on the lips, blisters bloody or cloudy urine, chills, continuing ulcers or sores in the mouth. Difficult, burning, or painful urination, fever.
Eliquist	**5 mg-2 per day**	**Prevent DVT**	Blood in the eyes, blood in the urine, bloody or black, tarry stools, bruising or purple areas on the skin, confusion. Constipation, coughing up blood, decreased alertness, difficulty swallowing, dizziness, fainting, fast heartbeat, headache, hives, itching, skin rash.
Hydrocodone-Acetaminophen	**325 mg-As needed**	**Relieve moderate-severe pain**	Nausea, vomiting, constipation, lightheadedness, dizziness, or drowsiness.
Niacin	**1000 mg-one at night**	**Lower cholesterol**	Flushing, redness and warmth in the face and neck, liver problem, stomach ulcer, muscle damage, low blood pressure, arrhythmia.
Carvedilol	**12.5 mg-2 per day**	**reduce high blood pressure**	Hyperglycemia. angina pectoris, orthostatic hypotension, vomiting, rales, hypotension, visual disturbance, and nausea.
Atorvastatin Calcium	**40 mg-1 at night**	**Reduce LDL cholesterol**	Unexplained muscle pain, tenderness, or weakness; confusion, memory problems; fever, unusual tiredness, and dark colored urine; swelling, weight gain, urinating less than usual or not at all, nausea, dizziness.
Amlodipine Besylate	**5 mg-1 per day**	**reduce high blood pressure**	Dizziness, lightheadedness, swelling ankles/feet, or flushing
Escitalopram	**10 mg-2 per day**	**Anti depressant**	diarrhea, nausea, insomnia, headache, drowsiness.

Chapter 3

Examination – Tests and Measures

The International Classification of Functioning (ICF) classifies the patient's impairments into three main categories.[1] In the body structure and function category, a goniometer was used to measure the ROM limitations, the manual muscle test (MMT) was used to measure the lower extremity strength, and circumferential girth was measured to determine the amount of edema around the patient's knee.[2] The numeric pain rating Scale (NPRS) was used to measure the patient's knee pain. In the activity limitation category, the Lower Extremity Functional Scale (LEFS) was used to measure lower extremity physical function.[3] In the participation restriction category, the patient's self report on community ambulation was utilized to measure the amount of the patient's participation in her community. Furthermore, to assess the patient's likelihood of having deep vein thrombosis (DVT), the Wells Clinical Prediction rule (CPR) was used.

A goniometer was used to measure the patient's knee ROM in degrees. Studies have shown that knee goniometric measurement, in patients with knee OA, is a reliable and valid tool for the assessment of ROM.[19,20] The Pearson Correlation Coefficient for ROM and disability was calculated to be most significant for knee extension. [21] In patients with knee OA, as ROM decreases, the significance of disability increases. The minimal detectable change (MDC_{90}) for the knee ROM has been reported to be 6.6˚ for active ROM and 10˚ for passive ROM.[22]

The circumference measurement of the knee has been shown to be a reliable outcome measure post TKA. In a study by Jakobsen et al. the measurement was taken 1 cm above the base of the patella. [20]

Muscular weakness following a TKA is a common phenomenon.[23] The MMT has been found to be a reliable and valid tool for quantification of muscle weakness in patients with TKA.[23,24] This test was found to have excellent test-retest reliability of 0.98 (ICC=0.98), a specificity of 0.90, [25,26] and a sensitivity of 0.39.[27] The specificity value signifies a true negative, so 90% of the time, the MMT test correctly identified patients who did not have a strength deficit. The sensitivity of MMT indicates a true positive, meaning 39% of the time this test correctly detected individuals who did have muscle weakness. The MDC for this test has been found to be a score change of one point. [28] The calculated positive likelihood ratio (LR+) is 3.9 (small shift). This implies that there is a small shift in post test probability that a patient who scores low on MMT has a true muscle weakness. The negative likelihood ratio (LR-) is 0.67 (negligible shift). This indicates that there is a negligible shift in post test probability that a patient who scores high on MMT has no muscle weakness. In the MMT muscle strength is measured based on a five-point scale, ranging from zero to five. A score of zero indicates no muscle contraction, while a score of five (normal) is given when a muscle exhibits full contraction against the examiner's maximal resistance.

The NPRS subjectively measured the patient's pain.[29] The NPRS is based on an eleven point scale from 0-10. The MDC for this scale, in patients with lower extremity pain, was found to be a change of three points in the patient's perspective of

the pain, and the MCID was equal to one point.[29,30] The MDC of three points means that the change is a true change and not due to random errors.

The LEFS was used to evaluate the patient's lower extremity function, as well as her ongoing progress and outcome. The LEFS is a self-reported questionnaire, containing 20 questions on the individual's everyday tasks. The scoring scale is 0-80, with a lower score indicating a higher amount of disability. The MDC for this test is 9 points. The (MCID) is 9.9 points. The LEFS has excellent test-retest reliability (ICC=0.88), inter-rater reliability (ICC=0.88), and internal consistency (0.96). The internal consistency means that most items on this test measure the same general construct and they produce similar scores. LEFS has been found to be a highly reliable and valid test in patients with knee OA.[29,31]

The Wells CPR was used as a diagnostic test to assess the risk for DVT in patients with specific risk factors.[32] The Wells CPR classifies the patient into low, moderate, or high risk for the presence of a DVT. This scale includes a set of nine questions, eight of which are worth 1 point, and one that is worth -2 points (score range was -2 to 9). If a patient receives a score of 3 or more they are categorized as high risk for the presence of a DVT (75% probability). A score of two points indicates moderate risk (17% probability), and a score of one point or less means that the patient is at low risk for having a DVT (3% probability). [33] The Wells CPR for DVT has a median positive likelihood ratio (LR+) of 6.62 for patients categorized as high risk, a LR+ of 1 for those categorized as moderate risk and a LR+ of 0.22 for those categorized as low risk.[34] The LR+ of 6.62 moderately shifts the post test probability

that a patient who scores ≥3 on the Wells CPR has DVT. These results showed that the Wells CPR was a useful diagnostic tool at identifying patients with DVT.

Table 2

Examination Data

BODY FUNCTION OR STRUCTURE			
Measurement Category	Test/Measure Used	Test/Measure Results	
Passive ROM	**Goniometry**	Left knee 9-110˚	Right knee 0-130˚
Strength	MMT Hip flexion Hip extension Hip Abduction Hip Adduction Knee flexion Knee extension Ankle dorsiflexion Ankle Plantarflexion	 4-/5 3+/5 3+/5 4/5 3/5 4/5 3+/5 4/5	 4/5 4/5 3+/5 4/5 4/5 4/5 3/5 4/5
Edema	Girth	At base of patella: Right knee 50 cm (At rest) Left knee 55 cm (At rest)	
Pain	Numeric Pain Rating Scale	Right knee: 8/10 (Worst pain) Left Knee: 8-10/10 (Worst pain)	
Gait Deviations	Observation	Antalgic gait (extreme lateral shifts) Decreased knee flexion on swing through (The patient was using a front wheel walker for ambulation)	
Body Composition	BMI (kg/m^2)	38 (Obesity II)	
FUNCTIONAL ACTIVITY			
Measurement Category	Test/Measure Used	Test/Measure Results	
Physical function	LEFS	Score:25/80	
Gait on stairs	Patient's report	The patient was not able to climb stairs.	

PARTICIPATION RESTRICTIONS		
Measurement Category	Test/Measure Used	Test/Measure Results
Unable to walk to her daughter's house (300ft)	Patient report	Able to walk only to her mailbox and back with use of her front wheel walker (50ft).
Unable to drive	Patient report	Unable to drive. Patient's caregiver currently drove her.
ROM=Range of Motion, LEFS=Lower Extremity Functional Score, BMI=Body Mass Index		

Chapter 4

Evaluation

Evaluation Summary

The patient was an 85-year-old obese female with a 10-year history of knee OA, and bilateral knee pain prior to left TKA surgery. She was four weeks post TKA status when she was first evaluated in the outpatient PT clinic. The patient presented with an antalgic gait, decreased ROM, decreased strength in her lower extremities, and increased pain and swelling of the left knee joint. The patient was independent in personal care, but relied on her caregiver for major tasks such as cooking and driving.

Diagnostic Impression

The patient had participation restrictions, activity limitations, and impairments that were consistent with those associated with unilateral TKA. The patient's impairments of decreased lower extremity strength and ROM and increased pain and edema led to limitations of functional activities, as shown in LEFS, which restricted the patient's ability to walk to her daughter's house and spend time with her family. The Wells CPR was utilized in order to clear the patient of the possibility of having a DVT. Based on this test the patient was in low risk category for having a DVT.

Prognostic Statement

Some of the most influential factors in determining the prognosis of this patient, in the order of influence, were as follows. The negative prognostic factors included the patient's obesity, female gender, and older age. In addition, since the patient's non-surgical knee was severely affected by OA she was restricted from

following up with her home exercise program (HEP) in the way that it was prescribed to her. The factors that positively influenced the patient's prognosis were a short length of stay in the hospital (2 days), successful surgery without complications, limited edema, fast healing scar tissue, and the patient's satisfaction with her surgeon and the procedure. In addition, the patient's positive attitude and desire to become independent contributed to her good prognosis. Furthermore, based on the patient's report at the time of her initial evaluation, she was already independent with most of her ADLs, and the caregiver was helping mainly with driving and shopping tasks.

Based on the factors mentioned above, the overall prognosis for this patient to achieve her goals was good.

G-Codes

Current with modifier: G8978CK
Goal with modifier: G8979CJ

Discharge Plan

Based on the patient's initial presentation, she was expected to be discharged to live at home, independently, with an appropriate HEP.

Chapter 5

Plan of Care-Goals and Interventions

Table 3

Evaluation and Plan of Care

PROBLEM	PLAN OF CARE		
	Short Term Goals (2 weeks)	Long Term Goals (8 weeks)	Planned Interventions Interventions are Direct or Procedural unless they are marked: (C) = Coordination of care intervention (E) = Educational intervention
BODY FUNCTION OR STRUCTURE IMPAIRMENTS			
Decreased left knee ROM	Increase left knee flexion PROM from 9-110˚ to 5-115˚	Increase left knee flexion PROM from 9-110˚ to 0-120˚	(E) The patient was educated regarding the importance of gaining her normal knee ROM. In addition, the importance of HEP was explained. Supine heel slides on a table with a pillow case under the heel, to a comfortable ROM. 3 sets, 8 reps for weeks 1-2, progress to 3 sets of 15 reps in weeks 3-4, and progressed to 3 sets of 15 with half a pound ankle weight. Heel slides on an exercise ball to promote elevation and decrease edema. 3 sets, 8 reps for weeks 1-2, progressed to 3 sets of 15 reps in weeks 3-4, and progressed to 3 sets of 15 with physical therapist applying resistance to the ball. PROM was progressed to passive physiologic knee flexion and extension. Initially grades II, progressed to grades III and IV. 3 bouts of 30s mobilization.

			Calf and hamstring stretch. Holding for 30sec. repeat 3 times. Patella mobilization in cephalad, caudad, medial, lateral, and rotational directions. Initially grades I/II in weeks 1-2 and progressed to III/IV in weeks 3-8, in all directions, 3 bouts of 30 sec . Grades II-III physiological knee flexion and extension mobilization, 3 bouts of 30 sec in each direction. Self knee flexion stretch: the patient was asked to sit on an elevated seat and hook the left leg with the right leg and take the left knee in to knee flexion, 3 sets of 5-12. Aquatic therapy: 1. Walking for 5 min, forward and side stepping for 8-10min. Cycling for 5-10 min. 2. Hamstring stretch on a step, 3 times, holding for 30s. 3. Calf stretch, 3 times, holding for 30s.
Edema of the left knee	Decrease edema from 55 cm to 53 cm	Decrease edema from 53 cm in to 50 cm	Heel slides on an exercise ball to promote elevation and decreases edema Soft tissue mobilization around the knee joint Elevation and cryotherapy post treatment for 15min and as part of the HEP, 2-3x/day for 15-20min, every day if possible. (E) The importance of reducing the inflammation was explained to the patient.

Decreased strength in the left hip, knee, and ankle.	Increase knee extensor strength from 4/5 to 4+/5 (No measurable change expected.)	Increase knee extensor strength from 4+/5 to 5/5	Quad sets: The patient started with 30 repetitions, holding each for 5s with 50% intensity. Gradually the number of sets was increased to 60-80 with 70% intensity and up to 80% intensity. Short arc knee extension. 3 sets, 8 reps and progressed to 3 sets of 15 reps. Gradually a light weight was added to the patient's ankle (1-3lb).
	Increase Knee flexor strength from 3/5 to 4/5 Increase hip extension from 3/5 to 4/5 Increase hip adduction strength from 4/5 to 4+/5	Increase Knee flexor strength from 4/5 to 5/5 Increase hip extension from 4/5 to 5/5 Increase hip adduction strength from 4+/5 to 5/5	Bridges with hip abductors and adductors activation: The patient was instructed in performing bridges to a comfortable zone and abduction was performed against a theraband wrapped around the distal thighs. Adduction was performed by placing a soft ball between the patient's knees and asking her to squeeze the ball while performing the bridges. 3 sets, 8 reps with yellow band for weeks 1-2, progressed to 3 sets of 15 reps with yellow band in weeks 3-4, and progressed to 3 sets of 15 reps with red band.
	Increase hip flexor strength from 4-/5 to 4/5 (no measurable change was expected) Increase hip abduction strength from 3+/5 to 4/5 (no measurable change was expected)	Increase hip flexor strength from 4/5 to 5/5 Increase hip abduction strength from 4/5 to 5/5	Straight leg raises: Started with 2 sets of 10 and progressed to 3 sets of 10 with added weight (1 lb) to the ankles. Clam shells: 3sets of 10, progressed to applying resistance with a yellow theraband.

	Increase PF strength strength from 4/5 to 4+/5 Increase DF strength strength from 3+/5 to 4/5	Increase PF strength strength from 4+/5 to 5/5 Increase DF strength strength from 4/5 to 5/5	Supine PF, progress to standing. 3 sets of 10-20. Seated DF 3 sets, 8 reps (weeks 1-2) Progressed to applying resistance with yellow band (weeks 3-4) Progressed to red band (weeks 6-7). Progressed to standing DF (week 8) Squats: Started with sit to stand from elevated therapy table, 3 sets of 5 repetitions. Progressed to mini wall squats and a squat to 90˚ hip flexion, 3 sets of 8-12. Progressed to squats with abductors and adductors activation using a red band and a ball, 3 sets of 12. Stepping up/down a stair. 1-10 steps on each side. This exercise was progressed by gradually increasing the height of the stair (from 5 in to 7in) and by decreasing the magnitude of the assistance. PNF D1/D2 for the lower extremities. 3 sets, 10 reps weeks 2-4 and progress to 3 sets, 15 reps weeks 5-8. Aquatic therapy: 1. hip flexion/abduction/extension in standing with straight knees, 3 sets of 8 weeks 1-2, 3 sets of 10 weeks 3-4, 3 sets of 15 weeks 5-6, and 3 sets of 15 with 2lb ankle weight weeks 7-8. 2. Back kicks same progress as above. 3. Heel raises, 3 sets of 8 weeks 1-2, 3 sets of 10 weeks 3-4, 3 sets of 12

			weeks 5-6, and 3 sets of 15 weeks 7-8 4. Squats, 3 sets of 8 weeks 1-2, 3 sets of 10 weeks 3-4, 3 sets of 12 weeks 5-6, and 3 sets of 15 weeks 7-8. 5. Straight leg hip flexion, extension, abduction 8-10 rep each.
Pain in the left knee (Based on the patient's report)	Decrease left knee pain (worst pain) from 8/10 to 5/10	Decrease left knee pain (worst pain) from 5/10 to 0/10	At the end of each session, electrical stimulation (on the highest tolerable setting) and ice were applied for 15 min to reduce pain and edema and to improve ROM. Please refer to the POC above.
		ACTIVITY LIMITATIONS	
Limited functional abilities	Increase number of stairs from 0 to 2. Improve antalgic gait pattern and decrease use of assistive devise. Improve LEFS score from 25/80 to 30/80	Increase number of stairs from 2 to 6. No antalgic gait pattern and eliminate use of an assistive devise. Improve LEFS score from 30/80 to 35/80	Please refer to the POC above. Walking on a level surface with a front wheel walker. Gradually increased the distance from 25ft to 300ft. Gait training was incorporated to correct gait pattern. Progressed by decreasing the amount of walker usage at home and in the clinic, starting with the use of a cane and gradually progressing to use of no assistive devise. Please refer to the POC above.

PARTICIPATION RESTRICTIONS			
Unable to walk to her daughter's house (300ft)	Able to walk half way to her daughter's house using the front wheel walker (150ft).	Able to walk to her daughter's house with out the use of the front wheel walker (300ft).	See POC above for activity and impairment limitations.

- *All exercises were performed bilaterally*
- *All exercises were recommended 4-6 times per week.*
- *Min=minutes*
- *Rep=Repetition*
- *QOL=Quality of Life*
- *ROM=Range of Motion, PROM=Passive Range of Motion*
- *Ft=Feet*
- *Sec=Second*
- *POC=Plan of Care*
- *MDC=Minimal Detectable Change*
- *PF=Plantar Flexion*
- *DF=Dorsiflexion*
- *LEFS=Lower Extremities Functional Scale*

Plan of Care – Interventions

Please refer to table 3.

Overall Approach

The overall approach was a patient-centered and evidence-based methodology. The plan of care was designed based on the patient's goals, and was written upon accumulation of subjective and objective examination data. Treatment was focused on manual therapy, mobilization (active and passive), stretching and strengthening exercises. The overload principle was used to progress strength in this patient. To improve the activity limitations, a combination of land based therapy and aquatic therapy was incorporated into the patient's POC. The patient began each session with 30-40 minutes of aquatic therapy, supervised by the student physical therapist, followed by 30-40 minutes of land based therapy.

The patient education was an important aspect of this approach. The patient was informed about the structures of the knee that were involved in her surgery and the

importance of adhering to her HEP in order to achieve her goals. The aim was to cover all three aspects of the ICF model, in a task-oriented approach. This type of approach, with thoughtful problem solving and critical thinking, allows the physical therapist to avoid targeting unnecessary areas, and to focus only on the patient's problems and needs. In addition to having access to the pool in the clinic, the patient had a pool available to her at home; thus she was able to incorporate her aqua therapy exercises, as part of her HEP.

PICO question

Following a TKA, in a patient with persistent knee pain (P), is aquatic therapy (I) more effective than the land based therapy (C) in improving function, quality of life, and decreasing the knee pain (O)?

A systematic review of randomized controlled trials (RCT) by Goehring et al. (2013), level of evidence 1a, investigated the effectiveness of aquatic therapy intervention in patients with TKA.[35] A total of six studies were reviewed, from a pool of 1,508 articles. The inclusion criteria for review were: (1) patients must have had a TKA procedure, (2) a presence of an aquatic group in the study, (3) a presence of control group (land based therapy), (4) specific outcome measures (OM) that included pain, functional status, and quality of life, (5) these studies must have been RCT's. Based on the results of these studies it was found that aquatic therapy, at the very least, has an equivalent effect on the outcome of a patient, post TKA, when compared to land-based therapy alone.

In all studies for patients who could not tolerate land based PT, aquatic therapy was a superior substitute that prevented exacerbation and promoted healing post TKA. In addition, the unique properties of water, such as the buoyancy force, density, hydrostatic pressure, viscosity, and thermodynamics positively affected other systems that were greatly impacted in this population, such as the cardiovascular and pulmonary systems. Some benefits of aquatic therapy included reduction of edema in the lower extremities and the decrease of compressive forces on the joint. Based on

this systematic review, patients who had edema and were in the aquatic therapy group improved their joint mobility and ROM more when compared to land based therapy group. Aquatic therapy was found more beneficial when the patient could not tolerate land based activities. This study concluded that aquatic therapy has a significant impact on pain, wound healing, disability, quality of life, and functional activities in patients with TKA.

In this case, the patient was having difficulty bearing weight through her knees, especially because she was suffering from OA in her right knee. Based on this systematic review, this patient was an appropriate candidate for a combination of aqua and land based PT throughout her outpatient PT rehabilitation program. Furthermore, the patient met the inclusion and exclusion criteria that were implemented in the systematic review and she matched the sample demographics of these studies.

In this review of articles none of the studies compared the land based therapy and aquatic therapy with land based therapy alone. Although only six studies were included in this literature review, all of the studies were RCTs with a methodological rigor of at least 7 or 8 on the PEDro scale. The risk of bias was limited by a rigorous article selection process. These factors gave reasonable support for the physical therapist to incorporate aquatic therapy into her POC for this patient.

Chapter 6

Outcomes

Table 4

Outcomes

OUTCOMES				
BODY FUNCTION OR STRUCTURE IMPAIRMENTS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
Goniometry	Left knee flexion PROM: 9-110˚ (101˚ total ROM)	Left knee flexion PROM: 2-125˚ (123˚ total ROM)	Left knee flexion PROM: +22˚	Y
MMT	Left knee: Extension 4/5 Flexion 3/5 Left hip: Flexion 4-/5 Abduction 3+/5 Extension (Gluteus Maximus) 3+/5 Left ankle: Plantar flexion 4-/5 Dorsiflexion 3+/5	Left knee: Extension 4+/5 Flexion 5/5 Left hip: Flexion 5/5 Abduction 4+/5 Extension (Gluteus Maximus) 4+/5 Left ankle: Plantar flexion 5/5 Dorsiflexion 5/5	Left knee: Extension +.5 Flexion +2 Left hip: Flexion +1.25 Abduction +1 Extension +1 Left ankle Plantar flexion +1.25 Dorsiflexion +1.5	 N Y Y Y Y Y Y
NPRS	Left knee worst pain 8/10	Left knee worst pain 2/10	Left knee worst pain 6 points MDC=3 points MCID=1pont	Y
Girth measurement	1cm above base of patella: Left knee: 55 cm	1cm above base of patella: Left knee: 48cm	1cm above base of patella: Left knee -8cm	 Y

Gait Deviations	Antalgic gait with lateral shift and Decreased knee flexion on swing through	No antalgic gait was observed Increases in knee knee flexion on swing through.	Improvement in gait deviations and flexion on swing through	Y
ACTIVITY LIMITATIONS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
LEFS	Score:25/80	Score:30/80	5 points MCID 9 MDC 9	N
Stair climbing	Not able to climb one stair	Able to climb 6 stairs	Increased ability to climb stairs from 0 to 6	Y
PARTICIPATION RESTRICTIONS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
Unable to walk to daughter's house	Patient reported not being able to walk to her daughters' house with her walker. Patient reported not being able to drive.	1) Patient reported being able to walk to her daughters' house with a single point cane. 2) Patient was driving independently.	1) Meaningful to the patient 2) Meaningful to the patient	Y Y

MMT=Manual Muscle Test
PROM=Passive Range of Motion
ROM= Range of Motion
LEFS=Lower Extremity Functional Scale
NPRS=Numeric Pain Rating Scale
DC=Discharge
MCID=Minimal Clinically Important Difference
MDC=Minimum Detectable Change

Discharge Statement:

Four weeks post left TKA, the patient attended eight weeks of outpatient physical therapy. She was evaluated and treated biweekly for two hours per week. The patient's plan of care included active and passive ROM, manual therapy, strengthening, flexibility, gait training, patient education, HEP, and aquatic therapy. At the time of initial evaluation, due to her limited knee ROM and pain, she was unable to walk more than 50 feet or drive. Her goal was to gain independence in walking 300 feet to her daughter's house and driving. With the help of the physical therapy program and the patient's effort and motivation, she was able to achieve her goals. The patient gained the necessary functional strength and ROM to become completely independent in self-care and ADLs. At discharge the patient was able to ambulate 300 ft. with a single point cane. The patient was discharged to continue her HEP and aquatic therapy independently.

DC G-Code with modifier: G8980CJ

Chapter 7

Discussion

After eight weeks of biweekly appointments in an outpatient physical therapy clinic, post left TKA, the patient was able to achieve most of the goals in the body structure and function category. Goals that were not met included knee extension ROM to zero degrees, and the knee extensor's strength to 5/5. The possible explanation is that, throughout the therapy sessions, the patient complained of a deep and focused pain (8/10) in the anterior knee region that was exacerbated by vigorous active knee flexion and extension. To solve this problem in the future, the physical therapist might incorporate more manual therapy interventions, such as anterior-posterior glide and posterior-anterior glide of the knee joint to improve flexion and extension ROM, respectively. One possible reason the patient did not achieve the full knee extension strength is that the grade 5/5 goal for this muscle group was too high. Functionally, the amount of strength that this patient gained was an adequate to reach activity and participation goals.

Since the patient was suffering from right knee OA, with pain (8/10) and swelling, she continued to have an antalgic gait after her left TKA, especially when she was not using her front wheel walker. The weight shift away from her painful right (non-surgical) knee demanded an extra load on the operated knee. A potential solution to this problem would have been to treat the right knee for pain and inflammation. The physical therapist could have requested permission from the insurance company to

treat the non-operated joint in order to speed up the rehabilitation for a patient with bilateral knee OA. Furthermore, the fact that the patient was obese made it more difficult for her tissues to heal, due to excess load on the joint. The physical therapist could work with the patient and a nutritionist to design an appropriate weight loss program to help gain a healthy weight range while going through her physical therapy program.

In the activity limitation category, the MCID on the LEFS outcome measure was not achieved. This was potentially due to questions 16-19 which are athletic in nature, and thus were not appropriate for this patient's age and physical abilities. For example, challenging activities such as being able to walk for a mile, stand for an hour, and do heavy activities were among questions that received a score of zero. This factor might encourage the physical therapist to consider using a more specific outcome measure, such as Knee Injury and Osteoarthritis Outcome Score (KOOS) or Western Ontario and McMaster Osteoarthritis Index (WOMAC), in patients with TKA.

When planning an intervention for patients with similar conditions, the physical therapist should include assessment and treatment of the strength, level of pain, and swelling of the non-operated knee. When the non-operated knee has pain (8/10) and discomfort, it presents an additional challenge to the patient's ability to walk with a normal gait. This factor may make it difficult for the patient to gain independence from the assistive device; i.e., the patient may remain dependent on the assistive device due to the impact of the non-operated lower extremity.

Since this patient responded well to the planned intervention, if an outpatient facility has the advantage of providing an indoor heated pool, I recommend applying a combination of aquatic therapy, manual intervention, rehabilitation exercises, and HEP for patients with a similar presentation post TKA.

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