# OUTPATIENT REHABILITATION FOLLOWING RECONSTRUCTION OF THE MEDIAL PATELLOFEMORAL LIGAMENT

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A Comprehensive Case Analysis

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Abstract

of

OUTPATIENT REHABILITATION FOLLOWING RECONSTRUCTION OF THE MEDIAL PATELLOFEMORAL LIGAMENT

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A 53-year-old patient seen 13 days post medial patellofemoral ligament reconstruction was seen for student physical therapy treatment for 11 sessions over 6 weeks at an outpatient orthopedic clinic under the supervision of a licensed physical therapist.

The patient was evaluated at the initial encounter with Numeric Pain Rating Scale, Knee Injury and Osteoarthritis Outcome Score-12, Kujala Anterior Knee Pain Scale, Manual Muscle testing of the right knee and hip, Goniometry of the right knee, Fear Avoidance Beliefs Questionnaire Physical Activity Scale, Patient Specific Functional Scale, and Global Rate of Change. A plan of care was established to address right knee pain, range of motion, and strength impairments of the right knee and hip which led to activity limitations of walking, negotiating stairs, squatting to the floor during activities of daily living, and participation restrictions of driving and hiking. The main goals for the patient were return to ambulation and stair navigation without an assistive device, return to driving, decrease pain, improve range of motion and strength, and return to hiking. The main interventions used were manual therapy, task-specific training, therapeutic exercise including functional exercises, and patient education. The patient achieved the following goals: decreased pain, increased range of motion, ability to walk > 10 minutes without an assistive device, independent in-home stair navigation without an assistive

device, perform activities of daily living with few limitations from symptoms, and return to driving. The patient was discharged to continue skilled outpatient physical therapy with another therapist.

_____, Committee Chair
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Date

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I acknowledge my clinical instructor for allowing me to learn about the treatment of patients post operatively with previous patellar instability as well as allowing me to access information for my case study.

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# Chapter 1

## General Background

Patellar dislocation (PD) can result from sporting activities, a common mechanism of injury is a twisting motion with femoral internal rotation on a planted foot.[1,2] Patellar dislocation is the second most common diagnosis under arthroscopy in knee injuries with acute hemiarthrosis.[3] Gage et al reported that PD comprised 3% of all knee injuries presenting to the emergency department (ED).[4] Typically, PD involves a lateral dislocation, defined as when the patella has become laterally displaced relative to the femoral trochlear groove, while medial dislocations are uncommon.[5,6] Incidence of primary PD has been reported as 2.29-5.8/100,000 with a peak incidence in the 15-19 year old range at 11.19/100,000.[1,7] In patients with previous PD, recurrent PD has a reported incidence of 3.8/100,000 and these patients are 7 times more likely to have subsequent dislocations odds ratio (OR), 6.6.[1]

During the first 20 degrees of knee flexion, the medial patellofemoral ligament (MPFL) is the primary restraint to lateral displacement of the patella.[8] The MPFL is a thin band of tissue that connects the medial patella to the femoral adductor tubercle and medial epicondyle, and has been found to provide approximately 53% of the medial restraint forces to lateral displacement of the patella.[9,10] Lateral shifting and tilting of the patella, from 25 degrees of active knee flexion to full extension has been noted as significantly different between healthy controls and patients with recurrent dislocation.[11] With knee flexion angles greater than 20-25 degrees patella stability

increases as the patella engages within the trochlear groove; moreover, and increased quadriceps muscle tension enhances patellofemoral joint stability even further.[12]

In patients with known risk factors for PD the presence of increased patellar tilt OR=1.07 and patellar deviation OR=1.12 increased the odds of potential PD, or patellar instability, becoming objective PD.[13] Non-modifiable risk factors that are associated with recurrent dislocation are trochlear dysplasia OR=18.1[14], 4.25[15], hazard ratio (HR), 3.27[16], and female sex OR=1.5[14]. Younger age based on a specific cut off OR=11.2[15], 2.4[14], HR= 1.09[16] or immature physes based on radiographic evidence OR=4.05[17], HR=2.2[16], have been found to be a risk factor. Patella alta described by various imaging measures, OR=10.4[14], 3.0[17], 1.364[15], HR= 1.61[16], tibial tuberosity-trochlear groove distance OR=2.1[14], 1.47[15], and patellar tilt angle more than 20 degrees OR=1.93[15], measured on imaging, are risk factors for recurrent dislocation.

The diagnosis of PD, or patellar instability is often clinical and based on subjective history, observation, palpation, special tests, and various imaging techniques including magnetic resonance imaging (MRI).[18,19] Special tests in the clinical examination of patellar instability include the patellar apprehension test and the j-sign.[20] The gold standard for PD diagnosis is MRI due to detailed assessment of the underlying bony pathology, identification of osteochondral damage, MPFL tears, and joint effusion.[19,21] Advance imaging such as MRI can also direct treatment and surgical interventions based on the extent of soft tissue and osseous injuries.[19] Conservative treatment including physical therapy is recommended before surgery for this patient population, an individualized surgical approach should then be considered

if there is recurrent PD that addresses the underlying pathology of the soft tissue and osseous structures.[22] This individualized approach accounts for the wide variety of surgical approaches that are performed for this patient population.[23] Patients who seek surgical management after PD tend to have better outcomes than patients treated with conservative measures.[24,25] Patients that undergo surgical intervention tend to have significantly decreased rates of recurrent dislocation and improve their function as measured by validated outcome measures.[20,25,26] Patella alta OR=4.9, and preoperative positive j-sign OR=3.9 were found to be preoperative risk factors for surgical failure.[20]

In the current research surrounding PD and patellar instability there is a lack of good quality evidence for interventions, diagnostics, and prognostics compared to other pathologies of the knee.[27-30] Patients with PD share similar characteristics such as risk factors, underlying anatomy, and demographics as described previously when compared to patients with patellofemoral pain syndrome (PFPS).[31] Due to the lack of quality evidence for PD, the best available evidence for diagnostics and prognostics will be presented for the PFPS population.[28,29,32]

# Chapter 2

## Case Background Data

### Examination – History

A 53-year-old female social media consultant presented to outpatient physical therapy 13 days s/p right (R) MFPL reconstruction, abrasion arthroplasty, partial lateral meniscectomy, multicompartment synovectomy and debridement, and lateral retinacular release. Approximately 3.5 years ago the patient was dancing at a family gathering and dislocated her R patella. She visited the ED the following day and received an x-ray that was negative for fracture. A subsequent MRI was taken that revealed right mild lateral patellar subluxation, a torn MFPL, and a lateral femoral condyle bone marrow contusion. The patient was treated for 16 sessions of skilled physical therapy with improvements in R knee strength, range of motion, ability to navigate stairs, and return to work. Approximately 4.5 months ago the patient was descending stairs in her home planted her R foot, turned to the right, and dislocated her R patella. A subsequent x-ray showed small joint effusion and was negative for fracture. The patient received 9 sessions of skilled physical therapy with improvements in subjective R knee function. Due to the COVID-19 pandemic the patient was transitioned to telehealth therapy for the last 3 visits and could not be contacted for further visits.

The initial encounter took place in a private outpatient physical therapy clinic 13 days after surgery with a referral for treatment 2 to 3 times weekly for 6 weeks. The patient had a medical history of hypertension, asthma, allergies, arthritis,

fibromyalgia, rheumatoid arthritis, systemic lupus, and low back pain (LBP) with sciatica. There were 2 treatment episodes, one 2 years ago and one 7 months ago, for LBP with sciatica at the current facility with resolution of symptoms. The patient's surgical history included: sinus surgery 2001, R shoulder surgery 2004, and appendectomy 2014. The patient lived with her significant other in a single-story home with 3 steps to enter and 2 steps to a sunken living room. A home evaluation was not conducted during the plan of care.

At the time of the initial encounter, the patient ambulated independently with bilateral axillary crutches with a tripod simultaneous swing through gait pattern and a hinged knee brace locked in extension. She had a non-weight bearing precaution on the R lower extremity (LE) from her surgeon. In addition, the patient could remove her knee brace during physical therapy, for hygiene purposes. Due to the COVID-19 pandemic the patient completed her work duties remotely from her home.

The patient's chief complaints were inability to walk on level surfaces without an assistive device (AD), inability to navigate stairs without an AD, inability to squat or kneel to retrieve items from the floor during activities of daily living (ADL), inability to drive, inability to hike or walk without fear of her knee giving out.

**Systems Review**

The patient's cardiopulmonary system was unimpaired based on objective measurements: resting blood pressure was 118/80 millimeters mercury (mmHg), resting heart rate was 64 beats per minute, and resting respiratory rate was 16 breaths per minute. The integumentary system was impaired based on observation and patient

report of right knee edema and 3 incisions for portal sites. The neuromuscular and musculoskeletal systems were impaired based on medical diagnosis, observation, and examination data listed in Table 2. Her language communication, affect, cognition, and learning were unimpaired based on observation and patient report.

**Examination – Medications**

Table 1

Medications

| MEDICATION | DOSAGE | REASON | SIDE EFFECTS |
|---|---|---|---|
| Prednisone | 5mg 1 time per day | Anti-inflammatory | Headache, dizziness, extreme tiredness, muscle weakness, sweating |
| Amlodipine Besylate (Norvasc) | 5mg 2 times per day | Anti-hypertensive | Swelling of the hands, feet, ankles, or lower legs, headache, upset stomach, nausea, stomach pain, dizziness, drowsiness, excessive tiredness |
| Tizanidine (Zanaflex) | 4mg 1 time per day | Muscle relaxant | Dizziness, drowsiness, weakness, vomiting, tingling sensation in arms, legs, hands, and feet, dry mouth, increased muscles spasms, back pain, sweating, extreme tiredness |
| Duloxetine HCL (Cymbalta) | 90mg 1 time per day | Fibromyalgia | Nausea, vomiting, constipation, stomach pain, dizziness, headache, tiredness, weakness, drowsiness, muscle pain or cramps, extreme tiredness |
| Metoprolol Succinate ER (Toprol XL] | 25mg 1 time per day | Anti-hypertensive | Dizziness, tiredness, nausea, stomach pain, vomiting, constipation, shortness of breath, fainting |
| Benadryl | 50 mg 1 time per day | Antihistamine | Drowsiness, dizziness, nausea, committing, constipation, headache, muscle weakness |
| Docusate Sodium (Stool Softener) | 100mg 1 time per day | Constipation | Nausea difficulty breathing, fever, vomiting, stomach pain |
| mg=milligrams, HCL=hydrochloride, ER=extended release, XL=extended release | | | |

# Chapter 3

## Examination – Tests and Measures

The patient's deficits were categorized according to the International Classification of Functioning, Disability, and Health Model.[33] Tests and measures that were used to assess the patient's body structure and function impairments were the Numeric Pain Rating Scale (NPRS), Manual Muscle Tests (MMT), Goniometry, Patellar Apprehension test, and Fear Avoidance Beliefs Questionnaire-Physical Activity Scale (FABQ-PA). The patient's activity limitations were measured with the Knee Injury and Osteoarthritis Outcome Score-12 (KOOS-12), the Kujala Anterior Knee Pain Scale (AKPS), and two activity level items within the Patient Specific Functional Scale (PSFS). The patient's participation restrictions were assessed with one participation item on the PSFS, and the Global Rate of Change Scale (GROC). The Patellar Apprehension test was used to inform the physical therapy diagnosis, and the FABQ-PA was used as a prognostic predictor of ADL function. The NPRS, MMT, Goniometry, FABQ-PA, KOOS-12, AKPS, PSFS, and GROC were used as outcome measures.

The NPRS is a patient reported outcome measure used to assess perceived musculoskeletal pain.[34] Patients report their pain severity on a scale of 0-10. This subjective rating of pain is a simple way to assess the patient's pain level over time. The Minimal Clinically Important Difference (MCID) on a 95% Confidence Interval (95% CI) in patients with chronic pain was reported as a raw point difference of -1 point, or a percentage change of -15.0%. These changes were associated with a

descriptor of "slightly better". A more meaningful change associated with the descriptor of "much better" was a difference in raw score of -2 points, and a percentage change of -33.0%.[34]

Goniometry is a commonly utilized tool to measure limitations in joint range of motion in physical therapy practice.[35] This measure can objectively assess the status of a patient's limitation in range of motion and can be used to track change over time. Measurements at various joints of the body are recorded with a specific placement associated with anatomical landmarks, with agreed upon ranges of motion, and body position. In the assessment of knee range of motion, standard plastic goniometers have shown to have good intertester reliability analyzed with the Pearson product-moment correlation coefficient (r) of .98, and an Intraclass Correlation Coefficient (ICC) of .99. Validity for this measure was also good with r=.97-.98 and ICC=.98-.99.[35] The Minimal Detectable Change on a 95% CI ($MDC_{95}$) was calculated with the ICC from this study and was found to be a change of 5 degrees.[36]

Manual muscle testing is a common method used to assess the impairment of muscle strength in patients with neuromusculoskeletal dysfunction.[37] Standardized testing positions and hand placement for specific muscle groups are utilized to ensure consistency of results. In physical therapy practice this is typically performed as "break test" where the examiner grades the force required to overcome the patient's resistance..[37] The common scale used grade patient strength is 0-5/5, with corresponding descriptors for each grade.[38] The descriptive qualifiers and the corresponding strength definitions are 0= No activity, 1= Trace activity, 2= Poor,

3=Fair, 4=Good, and 5=Normal. A grade of 3/5 must be cleared for patients to receive a grade of 4/5 or 5/5.[38] According to the review by Cuthbert et al in order for a true strength change to have occurred a difference in +/- one grade must be achieved (MDC > 1).[37] In a comparison with the gold standard of dynamometry, MMT of knee extensors had a correlation of (r=0.768; P<0.001).[39] Wadsworth found that MMT had a test retest reliability coefficient that ranged from .63 to .98.[40]

The KOOS-12 is a shortened version of the 42 question Knee Injury and Osteoarthritis Outcome Score (KOOS).[41] The KOOS is a frequently used outcome measure to track progress over time for individuals with knee osteoarthritis and other knee injuries.[41] The KOOS-12 was adapted from the 42 item KOOS in order to increase the clinical utility for routine use using a computerized adaptive test.[42] The scoring for the KOOS-12 and KOOS uses a Likert scale from 0 (no problems) to 4 (extreme problems) and are summed for each subscale then converted to a 0-100 scale with 0 indicating extreme problems and 100 indicating no problems.[43] The 3 subscales of the KOOS-12, pain, function, and quality of life (QOL), can be reported separately, can be averaged and reported as a summary measure.[41] Internal consistency using Cronbach's alpha was >.70 for all subscales and ≥ .90 for summary scores of the KOOS-12. The $MDC_{95}$ was calculated from the standard error of the measure (SEM) and found to be an increase of 23, 24, and 22 percentage points on the KOOS-12 Pain, Function, and QOL subscales respectively.[41]

The AKPS is a 13-item knee specific patient reported outcome measure that assesses pain levels and level of difficulty with daily activities.[44] The 13 items are

scored on a numeric scale with a minimum score of 0, and a maximum score of 5 or 10 for each question. Depending on the number of options for the question scores for each answer are also 2, 3, 4, 5, 6, 7, and 8. Scores are summed and reported as a raw score out of 100. The full outcome measure and corresponding scoring can be found in the Kujala et al reference.[44] Paxton et al found that the test-retest reliability for the AKPS was 0.86, an internal consistency of 0.82, a ceiling effect of 19% and no floor effect.[45] The $MDC_{95}$ was calculated from the SEM and was found to be an increase of 18 raw points.[45]

The PSFS is a self-reported outcome measure of function based on specific activities that are important to the patient.[46] Patients identify up to 5 different tasks and rate them on an 11 point scale with 0="unable to perform activity" and 10="able to perform activity at same level before injury or problem". This outcome measure can be a clinically useful tool due to the specificity for patients, and the ability to track change over time. In patients with knee dysfunction it was found that the PSFS had a test-retest coefficient of r=.84 for individual activities and an r=.87 for the average score. The MDC at the 90% CI ($MDC_{90}$) was found to be an increase of 2.5 raw points for individual activities.[46]

The GROC scale is a patient reported outcome measure used to assess perceived improvement in various health conditions.[47] Patients are asked to rate the magnitude of improvement over a specific time period. This scale is a 15-point Likert-type scale from that ranges from -7 to +7, with 0 representing no change, negative scores represent getting worse, and positive getting better. In patients with knee

impairments, the GROC Minimal Clinically Important Improvement (MCII) threshold was defined as a cut-score of +3 points and was determined with a receiver operating characteristic curve analysis.[47] In this study the MCII was in smallest amount of change that was important to patients and is dependent on patient's baseline functional status.[47]

The test that was used to inform the physical therapy diagnosis was the Patellar Apprehension test and is used in patients with Patellofemoral disorders.[48] This test is common in the diagnosis of PD and often referred to as the Fairbank's Apprehension Test. The patient is positioned supine with the test knee in 30 degrees of flexion and the quadriceps relaxed. The test limb is supported on the table at the thigh with the leg off the table to allow passive knee flexion. A lateral glide is then applied to the patella, and the patient may become apprehensive with this movement.[48] The test is considered positive if it reproduces pain, or the patient is apprehensive.[29] It was found that in the population of patients with PFPS the patellar apprehension test had a positive likelihood ratio (+LR) of 2.26, and a negative likelihood ratio (-LR) of 0.79 with 95% CI.[29] For this test +LR represents a small shift in post-test probability if the test is positive, and the -LR represents a negligible shift in post-test probability if the test is negative.[49]

The Fear Avoidance Belief Questionnaire (FABQ) is used to assess fear avoidant beliefs in patients with LBP.[50] On the FABQ there are 16 questions that are related to the patient's pain, physical activity, and work and rated on a 7 point scale of 0=Completely disagree and 6=Completely agree. The scores for the individual

questions are added and reported out of 96, higher scores are associated with increased fear-avoidant beliefs. The questionnaire has two subscales; fear avoidance beliefs associated with work, and with physical activity.[50] In patients with LBP it was found that a decrease in the FABQ subscale score of 13 points was show to be clinically meaningful change ($MDC_{95}$=13) in decreasing pain intensity.[51] This outcome measure has been used in other populations, such as patellofemoral pain syndrome, to assess fear avoidant behaviors.[32] In the PFPS population it was found that the FABQ-PA was predictive of functional outcome following rehabilitation.[32] In a forward regression model predictive of functional outcome age, sex, height, and weight accounted for 10% of the variation, the addition of the change in FABQ-PA accounted for 27% of the variation.[32] The overall model for this forward regression predicting functional outcomes had a $R^2$=0.37, p=0.000.[32]

Table 2
Examination Data

| BODY FUNCTION OR STRUCTURE | | | | |
|---|---|---|---|---|
| Measurement Category | Test/Measure Used | Test/Measure Results | | |
| Pain | NPRS | Worst pain in last 2 weeks 7/10 | | |
| AROM | Goniometry | | R | L |
| | | Knee flexion AROM | 5-65° | 0-135° |
| | | Knee extension AROM | -5° | 0-5° |
| Strength | MMT | Knee flexion | 4-/5 | 4+/5 |
| | | Knee extension | 4-/5 | 5/5 |
| | | Hip abduction | 4-/5 | 4-/5 |
| | | Hip extension | 3+/5 | 4-/5 |
| | | Ankle plantarflexion | 4/5 | 5/5 |
| Fear avoidance behavior | FABQ-PA | 14/24 | | |
| FUNCTIONAL ACTIVITY | | | | |
| Measurement Category | Test/Measure Used | Test/Measure Results | | |
| Pain during activity | KOOS-12 Pain | 25/100 | | |
| Physical function | KOOS-12 Function | 25/100 | | |

| | | |
|---|---|---|
| Quality of life | KOOS-12 QOL | 0/100 |
| Physical pain and function | AKPS | 41/100 |
| Walking > 10 minutes | PSFS | 1/10 |
| Stair navigation in home | PSFS | 2/10 |
| Walking > 10 minutes on even surface | Patient report | Patient is unable to walk on even surfaces > 10 minutes independently without an AD |
| Stair navigation in home | Patient report | Patient is unable to independently ascend/descend stairs in home without AD |
| Ability to squat during ADL's | Patient report | Patient is unable to squat during ADLs to retrieve items off the floor independently |
| PARTICIPATION RESTRICTIONS | | |
| Measurement Category | Test/Measure Used | Test/Measure Results |
| Hiking | PSFS | 0/10 |
| Overall R knee change | GROC | N/A |
| Driving | Patient report | Unable to drive |
| Abbreviations: (NPRS) Numeric Pain Rating Scale, , (AROM) Active range of motion, (R) Right, (L) Left, (MMT) Manual Muscle Tests, (FABQ-PA) Fear Avoidance Beliefs Questionnaire Physical Activity Scale, (KOOS-12 Pain) Knee Injury and Osteoarthritis Outcome Score-12 Pain Subscale, (KOOS-12 Function) Knee Injury and Osteoarthritis Outcome Score-12 Function Subscale, (KOOS-12 QOL) Knee Injury and Osteoarthritis Outcome Score-12 Quality of Life Subscale, (AKPS) Kujala Anterior Knee Pain Scale, (PSFS) Patient Specific Functional Scale, (AD) Assistive Device, (GROC) Global Rate of Change Scale, (N/A) Not Applicable. | | |

# Chapter 4

# Evaluation

## Evaluation Summary

The patient was a 53-year-old female that presented with impairments consistent with patients who are 13 days status post MPFL reconstruction. Upon examination the patient was found to have limited mobility, decreased strength, severe pain in the right knee, and fear avoidant behaviors related to physical activity. These impairments contributed to activity limitations as noted by low scores the KOOS-12, the AKPS, and the PSFS and participation restrictions of hiking and independent driving. Most notable, the patient was severely limited in the quality of life subsection of the KOOS-12 and hiking question on the PSFS, scoring a 0 in both areas. For this patient, impairments of limited R knee flexion ROM along with knee extension and hip extension strength contributed to the activity limitation of in-home stair navigation. Together these impairments and the activity limitation led to the participation restriction of hiking. The patient was able to ambulate and transfer independently but required assistance from her husband in the task of driving. The patient's symptoms were musculoskeletal in nature, with moderate severity and irritability.

## Diagnostic Impression

The patient's presentation was typical of status post 13 days MPFL reconstruction. The patient's body structure and function impairments included decreased strength, reduced range of motion, and increased pain in the right knee that

contributed to activity limitations of decreased LE function during ADL's resulting in participation restrictions of ability to hike and drive her car independently. For this patient, the physical therapy diagnosis was informed with the patellar apprehension test. The pre-test probability of patellar dysfunction for this patient was 80% based on the prevalence and subjective history of the condition. Given a +LR of 2.26, the positive test finding resulted in a small shift of the posttest probability to 90% for patellar dysfunction.[49]

**Prognostic Statement**

There were negative and positive prognostic factors affecting a successful outcome for the patient. A positive prognostic factor was the absence of a grade 3 j-sign preoperatively, defined as repeated subluxation of the patella with passive knee flexion under anesthesia.[52] The negative prognostic factors associated with surgical failure included patella alta, and a positive j-sign preoperatively.[20] During the 6-week plan of care the patient was expected to have decreased pain levels and improved function with in-home, community, and recreational activities. Statistically significant changes, using the MDC, in fear avoidant behaviors as described by the FABQ-PA would result in improvements of ADL function including walking > 10 minutes, squatting during ADLs, independent stair navigation without an AD could be reported. The participation goal of independent driving was expected to be met in this time frame; however, the goal of hiking was not expected to be met in a 6-week plan of care.

**Discharge Plan**

At the end of the 6-week plan of care, the patient was expected to continue skilled therapy with another therapist due to impairments and limitations that were still present at the end of this plan of care. The continuation of care would focus of normalizing strength with functional progressive resistance exercises, with the addition of balance and proprioceptive activities to increase function in the R LE.

# Chapter 5

## Plan of Care-Goals and Interventions

Table 3
Evaluation and Plan of Care

| PROBLEM | PLAN OF CARE<br>Short Term Goals<br>3 weeks | Long Term Goals<br>6 weeks | Planned Interventions<br>Interventions are Direct or Procedural unless they are marked:<br>© = Coordination of care intervention<br>© = Educational intervention |
|---|---|---|---|
| BODY FUNCTION OR STRUCTURE IMPAIRMENTS | | | |
| **Pain in R knee as measured by NPRS**<br>$MCID_{95}$= -1 pt[34] | 5/10 pain at worst | 3/10 pain at worst | **Pain:**<br>(E) The patient was instructed to apply ice at home as needed and elevate the R leg to reduce swelling.<br>Week 3 visit 6 Pt education on normal pain associated with fluid drainage site<br><br>At the end of each session, ice and tens were applied for 15 minutes to reduce pain.<br><br>Weeks 2,3,5-7<br>Soft tissue massage to R distal quad<br>Weeks 3, 5-7<br>Soft tissue massage to R gastroc/soleus complex |
| **Decreased AROM as measured by Goniometry**<br>$MDC_{95}$=5 degrees[36] | R knee flexion AROM 0 - 110°<br><br>R knee extension AROM to 0° | R knee flexion AROM 0 - 130°<br><br>R knee extension AROM 0 - 5° | **R Knee AROM flexion and extension:**<br>(E) Educated patient on importance of completing heel slides in a pain free range of motion<br><br>Week 1<br>Effleurage for R knee swelling<br>Heel slides with strap 1 min, 3" H<br><br>Weeks 1-3, 5-7<br>R knee PROM flexion and extension limited by pain<br>patellar glides superior, inferior, and medial (GI-II) lateral glides were a surgical precaution<br><br>Weeks 1-3, 5-7<br>HEP<br>Heel slides with strap 1 min, 3" H |

| | | | |
|---|---|---|---|
| **Decreased Strength as measured by MMT**<br>MDC ≥ 1[37] | STG for strength not appropriate | R knee flexion MMT 4+/5 | **R Knee flexion strength**<br>Weeks 2 and 3<br>Heel digs with SB 2x12, 3”H<br>Weeks 5-7<br>Heel digs with SB 2x12, 5”H<br><br>Weeks 3, 5-7<br>HEP<br>Heel digs with SB 2x12, 3”H |
| | | R knee extension MMT 5/5 | **R Knee extension strength**<br>Week 1:<br>Quad sets 2x12, 3” H (visit 1)<br>Visit 2 and 3: Progressed with NMES 3”H, 3 min during<br>SLR 2x10, 3” H<br><br>Weeks 2 and 3<br>Quad set with NMES 3”H 3 min<br><br>Week 2<br>Sit to stands to 22” surface 1x10 2x stand by guard, with brace<br><br>Week 3<br>Visit 6 Sit to stands to 22” surface 2x12<br>Visit 7 Sit to stands to 20” surface 2x12<br><br>Weeks 5-7<br>Sit to stands to 18” surface 2x12<br>Step ups to 6” surface 2x12<br><br>Weeks 6 and 7<br>Leg press DL 50 lbs. 2x12<br><br>HEP<br>Weeks 1-3<br>Quad sets 2x12, 3” H<br>SLR 2x10, 3” H |
| | | R hip abduction MMT 4+/5 | **R Hip Abduction Strength**<br>Week 1<br>Visit 2 and 3: Side lying hip abduction 2x10 with brace<br><br>Weeks 2, 3, 5-7<br>Side lying clams R 2x1 min H, OTL<br>Side lying hip abduction R 1x1 min H, OTL |
| | | R hip extension MMT 4+/5 | **R Hip Extension Strength**<br>Week 1<br>Visit 1 Glue sets 2x10 3” H |

| | | | |
|---|---|---|---|
| | | | Visits 2 and 3 Standing hip extension 2x10 with brace<br>Progressed to sit to stands see "knee extension strength"<br><br>Week 3<br>Visit 6 Bridges 1x12<br>Visit 7 Bridges 2x12<br>Weeks 5-7<br>Bridges 2x12<br>Step ups see "knee extension strength"<br><br>Weeks 6, 7<br>Leg press DL see "knee extension strength"<br><br>HEP<br>Weeks 1 and 2<br>Glue sets 2x10 3" H<br><br>Weeks 2 and 3<br>R Standing hip extension 2x12<br><br>Weeks 5-7<br>Bridges 2x12 |
| | | R ankle plantarflexion MMT 5/5 | **R ankle plantarflexion strength**<br>Week 2<br>Heel raises 2x12 with brace<br>Week 3, 5-7<br>Heel raises 2x12<br><br>HEP<br>Week 2, 3, 5-7<br>Heel raises 2x12 |
| **Fear avoidant beliefs as measured by the FABQ-PA**<br>$MDC_{95}$=13[51] | 7/24 on FABQ-PA | 1/24 on FABQ-PA | The therapeutic exercises listed in the body structure and function impairments and task specific training in activity limitations helped the patient decrease their fear avoidant beliefs about physical activity in a controlled setting along with patient education about their condition. |
| ACTIVITY LIMITATIONS | | | |
| **Pain during activity as measured by KOOS-12 Pain**<br>$MDC_{95}$=23 pts[41] | 37/100 on the KOOS-12 Pain | 48/100 on the KOOS-12 Pain | (E) Pt education on normal pain levels with various activities during PT and around the house.<br><br>See interventions in "Pain" and functional exercises interventions in "knee extension strength", these interventions will aide in the patient's recovery and help decrease pain levels |

| | | | |
|---|---|---|---|
| **Physical function as measured by KOOS-12 Function** $MDC_{95}$=24 pts[41] | 37/100 on the KOOS-12 Function | 49/100 on the KOOS-12 Function | (E) Week 1 Visit 2: Pt educated on proper mechanics on sit to stand transfer with bilateral axillary crutches.<br>Week 2 Visit 4: Described new weight bearing protocol of WBAT to patient and normal pain in response to this progression.<br>Week 3 visit 6 Pt educated on WBAT with D/C of crutches and brace from MD and normal muscle soreness associated with progression<br><br>AP and ML weight shift with brace locked in extension 10x each. 2x stand by guard<br><br>See "knee extension strength" functional exercise step ups and sit to stands |
| **Quality of life as measured by KOOS-12 QOL** $MDC_{95}$=22 pts[41] | 11/100 on the KOOS-12 QOL | 22/100 on the KOOS-12 QOL | The therapeutic exercises and modalities listed in the body structure and function impairments and task specific training in activity limitations helped the patient increase their quality of life through functional exercises and patient education about their condition. |
| **Physical pain and function as measured by AKPS** $MDC_{95}$=18 pts[45] | 50/100 on the AKPS | 59/100 on the AKPS | The therapeutic exercises and modalities listed in the body structure and function impairments and task specific training in activity limitations helped the patient increase their functional capacity during ADL's. |
| **In home stair navigation as measured by PSFS** $MDC_{90}$=2.5 pts[46] | 3/10 on the in-home stair navigation subsection of the PSFS | 6/10 on the in-home stair navigation subsections of the PSFS | See "knee extension strength" functional exercise step ups |
| **Walking >10 minutes as measured by PSFS** $MDC_{90}$=2.5 pts[46] | 3/10 on the walking > 10 minutes subsection of the PSFS | 6/10 on the walking >10 minutes subsection of the PSFS | Week 2<br>Visit 4 Gait training with bilateral axillary crutches brace locked in extension 2x stand by guard 3-point gait step to pattern for 50% WB, 144 ft, unlocked for 20 ft<br>Visit 5<br>Gait training with 1 crutch for 75% WB, x1 stand by guard, 2-point step to pattern, 144 ft |
| Patient report-Walking > 10 minutes on even surface | Walk on even surfaces > 20 minutes independently with AD | Walk on even surfaces >30 minutes independently | Interventions in PSFS walking >10 minutes will help this patient reported item |

| | | | |
|---|---|---|---|
| | | without an AD | |
| Patient report- Stair navigation in home | Ascend and descend stairs reciprocally independently without the use of an AD | Ascend and descend stairs reciprocally independently without the use of an AD | Interventions in PSFS in-home stair navigation will help this patient reported item |
| Patient report- Ability to squat during ADL's | Perform mini squat during ADL's to retrieve items from low surfaces independently with support from AD | Squat during ADL's to retrieve items off the floor independently | See "knee extension strength" exercise repeated sit to stands |
| PARTICIPATION RESTRICTIONS | | | |
| **Overall R knee change as measured by GROC** MCII=+3 [47] | +3 on the GROC | +6 on the GROC | The therapeutic exercises and modalities listed in the body structure and function impairments and task specific training in activity limitations helped the patient increase their change in overall knee function through functional exercises and patient education about their condition. |
| **Ability to hike as measure by PSFS** $MDC_{90}$=2.5 pts[46] | STG not appropriate for hiking | 3/10 on the PSFS hiking | See "knee extension strength" functional exercise step ups and sit to stands |
| Patient report- Ability to drive | STG not appropriate for driving | Patient will drive independently | See interventions listed in Pain, KOOS-12 function, and PSFS walking >10 minutes. These interventions will help the patient receive MD approval with the criteria of walking, weight bearing, and active knee extension with <3/10 pain to return to driving independently. |

Abbreviations: (R) Right, (NPRS) Numeric Pain Rating Scale, ($MCID_{95}$) Minimal Clinically Important Difference 95% Confidence Interval, (Pt) Patient, (Tens) transdermal electrical neuromuscular stimulation, (AROM) Active range of motion, (min) minutes, (H) hold, (PROM) Passive Range of Motion, (GI-II) Grade I and II mobilizations, ($MDC_{95}$) Minimal Detectable Change 95% Confidence Interval, (NMES) Neuromuscular electrical stimulation, (HEP) Home Exercise Program, (MMT) Manual Muscle Tests, (MDC) Minimal Detectable Change, (STG) short term goal, (SB) Swiss Ball, (SLR) Straight Leg Raise, (DL) Double Leg, (lbs.) Pounds (OTL) Orange Theraloop, (FABQ-PA) Fear Avoidance Beliefs Questionnaire-Physical Activity Scale, (KOOS-12 Pain) Knee Injury and Osteoarthritis Outcome Score-12 Pain Subscale, (PT) Physical Therapy, (KOOS-12 Function) Knee Injury and Osteoarthritis Outcome Score-12 Function Subscale, (WBAT) Weight Bearing as Tolerated, (D/C) Discharge, (MD) Medical Doctor, (AP) Anterior to Posterior, (ML) Medial to Lateral (KOOS-12 QOL) Knee Injury and Osteoarthritis Outcome Score-12 Quality of Life Subscale, (AKPS) Kujala Anterior Knee Pain Scale, (ADL)

Activities of Daily Living, (PSFS) Patient Specific Functional Scale, ($MDC_{90}$ ) Minimal Detectable Change 90% Confidence Interval, (WB) Weight Bearing, (AD) Assistive Device, (GROC) Global Rate of Change Scale, (MCII) Minimal Clinically Important Improvement.

**Plan of Care – Interventions**

See Table 3.

**Overall Approach**

The patient was treated with skilled physical therapy that included manual therapy, therapeutic exercises, task specific training, and patient education for 11 sessions that spanned 6 weeks. The rehabilitation approach was focused on restoring right knee range of motion with manual therapy, including PROM and soft tissue massage, to improve mobility and tissue extensibility. Task specific training was utilized to reintroduce normal weight bearing status during functional activities. Therapeutic exercises that utilized the overload principle helped the patient improve their functional LE strength to improve tolerance to ADLs.[53] The combination of these interventions helped the patient progress toward normal mobility, strength, and return to functional activities with decreased pain. Patient education focused on informing the patient of the normal progression through the rehabilitation process.

**PICOT intervention question**

For a 53-year-old female with MPFL reconstruction (P) is a physical therapy led progressive resistance exercise program (I) better than an unsupervised home-based exercise program (C) in improving function in daily life and return to hiking (O) in 6 weeks (T)?

A retrospective case series (Oxford level: IV) was appraised for the present PICOT question.[54] In this retrospective case series, the objective was to analyze the plan of care for patients that underwent MPFL reconstruction to describe their management including progressive therapeutic exercise interventions, and propose a stage rehabilitation treatment protocol. The participants in the study (n=7) underwent MPFL reconstruction with a semitendinosus autograph due to recurrent PD with failed conservative management of physical therapy. The patient population in the study included individuals aged 14-35 years with a confirmed tear of the MPFL according to MRI. Patients were excluded if they had previous MPFL or patellar realignment surgeries. The treating physical therapists were given protocols pertaining to weight bearing status, bracing timelines, and general rehabilitation from the patient's surgeon.

In this study, the authors described a staged approach to rehabilitation that included phases with specific therapeutic exercises and criteria for progression to the next stage. Progression through the rehabilitation program was documented objectively in reference to weeks after surgery and included knee flexion and extension range of motion, progression of weight bearing status, exercise phase advancement, and return to sport or activity that was meaningful to the patient. In addition to tracking progress with objective measures listed in Table 3, the Modified Cincinnati Knee Outcome Measure (MCKOM) was given to all the participants at discharge of physical therapy services and follow up to assess the effectiveness of the interventions the patients received. This test measures a similar construct to the outcome measures administered to this patient throughout the plan of care.

During the intervention, patients received in person physical therapy treatment and a prescribed a home exercise program. In this staged rehabilitation approach, the 6 patients that were available for follow up scored between 82-100/100 on the MCKOM during the follow up assessment, indicating an excellent outcome with an average score of 92.8%. These patients returned to the sport that was meaningful for them with an average time of 19-36 weeks after surgery. The study concluded that this staged physical therapy rehabilitation program resulted in excellent outcomes for return to sport for patients who underwent MPFL reconstruction.[54]

The patient fit the inclusion criteria for this study, apart from the surgical approach utilized for the patients in the study. There are numerous surgical options available for this patient population, therefore it is not surprising the surgical approach in the study did not match the patient's surgical interventions.[23] The age demographics in this study were representative of the peak incidence population rather than the age of this patient. Although this retrospective case series did not directly answer the PICOT question, as there was no comparison between treatment with a physical therapist and an unsupervised rehabilitation program, this case series specified phases of rehabilitation and guidelines for progression that were described in detail. Items that were important to track included progression of ROM, WB status, progression in the phases of rehabilitation, and return to sport. This was clinically useful for treating this patient due to the reproducibility of the protocol, in addition to timelines regarding important progressions in rehabilitation including WB status and ROM improvements. While the dosing protocol was not given in the study, dosing for this patient was based

on knowledge of muscular endurance dosing and the presentation of the patient at each treatment session.[53] In the treatment of this patient, beginning the intervention of repeated sit to stands at post-surgical week 4, was used as a reference in this case series study. This case series was chosen due to the specific nature of exercise recommendations and the progression of 7 different patients through the protocol, and the reproducibility of the protocol for treating physical therapists.

# Chapter 6

## Outcomes

Table 4

Outcomes

| OUTCOMES | | | | |
|---|---|---|---|---|
| BODY FUNCTION OR STRUCTURE IMPAIRMENTS | | | | |
| Outcome Measure | Initial | Follow-up (DC) | Change | Goal Met? (Y/N) |
| **NPRS pain at worst** | **7/10** | **2/10** | **5** | **Y** |
| **Goniometry R knee flexion AROM** | **5-65°** | **0-131°** | **0-66°** | **Y** |
| **Goniometry R knee extension AROM** | **-5°** | **0-2°** | **0-7°** | **N** |
| **MMT R knee flexion** | **4-/5** | **4/5** | **0.33** | **N** |
| **MMT R knee extension** | **4-/5** | **4-/5** | **0** | **N** |
| **MMT R hip abduction** | **4-/5** | **4-/5** | **0** | **N** |
| **MMT R hip extension** | **3+/5** | **4-/5** | **0.33** | **N** |
| **MMT R ankle plantarflexion** | **4/5 (7 reps)** | **4/5 (13 reps)** | **0** | **N** |
| **FABQ-PA** | **14/24** | **12/24** | **2** | **N** |
| ACTIVITY LIMITATIONS | | | | |
| Outcome Measure | Initial | Follow-up (DC) | Change | Goal Met? (Y/N) |
| **KOOS-12 Pain** | **25/100** | **56/100** | **31** | **Y** |
| **KOOS-12 Function** | **25/100** | **63/100** | **38** | **Y** |
| **KOOS-12 QOL** | **0/100** | **38/100** | **38** | **Y** |
| **AKPS** | **41/100** | **63/100** | **22** | **Y** |
| **PSFS-Stairs** | **2/10** | **4/10** | **2** | **N** |
| **PSFS-Walking > 10 minutes** | **1/10** | **3/10** | **2** | **N** |
| **Patient report-Walking > 10 minutes on even surface** | **unable to walk on even surfaces > 10 minutes independently with AD** | **able to walk on even surfaces 30-45 minutes independently without AD** | **walking tolerance 20-35 minutes independently without AD** | **Y** |
| **Patient report-Stair navigation in home** | **unable to independently ascend/descend stairs in home without AD** | **able to independently ascend stairs reciprocally and descend stairs with** | **Able to ascend stairs reciprocally and descend stairs with step** | **N** |

| | | | | |
|---|---|---|---|---|
| | | **step to pattern independently without AD** | **to pattern independently without AD** | |
| **Patient report-Ability to squat during ADL's** | **unable to squat during ADL's to retrieve items off the floor independently** | **able to squat from low surfaces during ADL's to retrieve items off the floor independently** | **able to squat from low surfaces during ADL's to retrieve items off the floor independently** | **N** |
| PARTICIPATION RESTRICTIONS | | | | |
| Outcome Measure | Initial | Follow-up (DC) | Change | Goal Met? (Y/N) |
| **GROC** | **N/A** | **+5** | **+5** | **Y** |
| **PSFS-Hiking** | **0/10** | **0/10** | **0** | **N** |
| **Patient report-Ability to drive** | **Unable to drive** | **able to drive independently** | **Able to drive independently** | **Y** |
| Abbreviations: (NPRS) Numeric Pain Rating Scale, (FABQ-PA) Fear Avoidance Beliefs Questionnaire-Physical Activity, (AROM) Active range of motion, (min) minute, (MMT) Manual Muscle Tests, (KOOS-12) Knee Injury and Osteoarthritis Outcome Score-12, (AKPS) Kujala Anterior Knee Pain Scale, (PSFS) Patient Specific Functional Scale, (AD) Assistive device, (ADL) Activities of Daily Living, (GROC) Global Rate of Change Scale. | | | | |

**Discharge Statement:**

The patient received 11 skilled physical therapy sessions over a 6-week period that included manual therapy, progressive resistance exercises, ROM exercises, patient education, and a home exercise program to complement physical therapy sessions. Goals for knee flexion range of motion, pain, all subscales of the KOOS-12, the AKPS, self-reported walking tolerance, the GROC, and ability to drive were met. The patient did not meet goals related to strength, the FABQ-PA, the PSFS, and self-reported ability to navigate stairs and squat during ADL's. Further skilled therapy including manual therapy, progression of functional exercises, and the addition of proprioceptive interventions is recommended for this patient. These continued interventions will help the patient return to her prior level of function before the episodes of patellar instability approximately 3.5 years ago.

# Chapter 7

## Discussion

This patient was treated for 11 sessions during a 6-week period in a private outpatient clinic 13 days status post MPFL reconstruction. The patient ambulated with a tripod simultaneous swing through gait pattern and had a non-weight bearing precaution for the R LE. In the third week of treatment the patient was able to ambulate independently for approximately 10 minutes on level surfaces and performed repeated sit to stands with minimal pain. This change in weightbearing status improved the patient's condition substantially and her ability to perform self-care and ADLs. The patient was expected to achieve her functional limitation goals pertaining to ambulation, stair navigation, and return to driving.

The patient made significant improvements in the first few weeks of treatment given her multiple co-morbidities. These included fibromyalgia and systemic lupus, which hindered the progression of functional exercises due to the extent of muscle soreness the patient experienced. In addition, she missed week 4 of therapy due to complications with her multiple medications.

In the plan of care the patient's goals were to return to driving, hiking, and walking and stair navigation without an AD. All goals except return to hiking were achieved with 11 visits in a 6-week period. The primary impairments included limited knee ROM, impaired strength, pain, and fear avoidant behaviors. Her functional limitations included inability to drive, navigate stairs, walk for > 10 minutes, and squat during ADLs. The main participation restrictions were inability to drive independently

and go hiking with her family. The plan of care addressed impairments with therapeutic exercises and manual therapy, functional limitations were also addressed with therapeutic exercise and task specific activities. The level of muscle soreness and pain the patient experienced were the limiting factors in progressing exercises during the plan of care. In treating this patient part of the plan of care was based on evidence of a case series that implemented phase specific exercises and guidelines on time progression. This was a very low level of evidence however it matched the impairments that the patient presented with. Evidence-based intervention with this patient population would benefit from much better evidence.

In the treatment of this patient, there are certain things I would have done differently. The communication between the surgeon's office and the clinic was lacking which delayed the use of the surgeon's rehabilitation protocol and lengthened the amount of time the patient had a non-WB precaution. During week three of treatment we discovered the patient should have been WBAT with her brace locked in extension at the initiation of treatment. In the initial examination I could have done more tests and measures with the unaffected side, which I did not complete until later. The HEP that I prescribed the patient was thorough and perhaps too much to expect of the patient. It would have been better to prescribe a few exercises that she could tolerate on the days she did not have therapy. In the progression of the patient's exercises, there could have been smaller progressions made throughout the plan of care.

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