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CLINICAL SUGGESTION

FUNCTIONAL JOINT MOBILIZATIONS FOR PATELLOFEMORAL PAIN SYNDROME: A CLINICAL SUGGESTION

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ABSTRACT

Patellofemoral pain syndrome (PFPS) is often effectively managed with appropriate exercise prescription, yet in many cases PFPS related symptoms can become persistent and result in reduced daily, functional and sport-related activity levels. Patellofemoral mobilizations may be incorporated to minimize the impact of mobility deficits, and are frequently performed in the patellofemoral joint's open-packed position of knee extension. However, many individuals with PFPS have pain during weight-bearing activities requiring knee flexion such as stairs, squatting, or running. Therefore, it seems reasonable that utilizing joint mobilizations in more symptomatic functional positions may enhance treatment plans. The purpose of this clinical suggestion is to present patellofemoral joint mobilization options in positions more closely replicating positions of symptom provocation, in an effort to offer clinicians different intervention strategies for the challenging condition of PFPS.

Level of Evidence: 5

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PROBLEM

Patellofemoral pain syndrome (PFPS) is a common health condition treated by orthopedic and sports practitioners. The condition negatively affects an individual's ability to perform activities of daily living and recreation including activities such as walking, squatting, stair navigation, running and participation in sports. An annual PFPS prevalence of 23% in adults and 29% in adolescents has been reported within the general population.[1] Patellofemoral pain can be challenging to successfully manage, and has been reported to persist in approximately 50% of individuals,[2-4] lasting decades in some cases.[5] Chronic patellofemoral pain may also contribute to early onset of osteoarthritis and chronic pain, highlighting the importance of identifying optimal management options for the condition.[6]

The patella is the largest sesamoid bone in the body and acts as a fulcrum to improve the mechanical advantage of the quadriceps. In full knee extension the patella does not articulate with the femoral condyles, and related to the lack of articular congruency, is able to glide more freely. The inferior patellar facet first contacts the femoral condyle around 20-30^{o} of knee flexion.[7] As flexion continues, the congruency between the patella and femoral condyles increases, with the greatest contact area at approximately 60-90^{o} of knee flexion.[7] While contact between the patella and femur increases with knee flexion, weight-bearing tasks substantially increase the compressive load on the patellofemoral joint (PFJ). Previous studies have shown PFJ loads upwards of 1.3x body weight (BW) during normal ambulation, 3.3x BW during stair ambulation, 5.6x BW during running and up to 7.8x during deep squatting.[8] It is not surprising then, that the majority of individuals with PFPS have symptoms with loaded activities involving knee flexion.

The etiology of PFPS is multifactorial with numerous risk factors, some of which are modifiable while others are not. Altered load and stress to the PFJ through impairments of local, proximal and distal factors is commonly accepted as a factor in the development of PFPS. Related to this, targeted exercise and load management is the first line of intervention for PFPS.[9] However, as noted previously, a large portion of individuals with PFPS have ongoing symptoms and lack long-term improvement, which may be related to additional impairments that are not resolved with exercise. Impairments of joint and soft tissue mobility may play a role in the persistence or development of pain.[10] For example, hypomobility of medial PFJ gliding or reduced extensibility of the tensor fascia lata, iliotibial tract or lateral retinaculum may increase lateral joint loading during knee flexion. Without addressing mobility restrictions, improper joint loading may persist. Interestingly, patients with PFPS may also demonstrate altered psychological function,[11] increased temporal summation of pain,[12] impaired conditioned pain modulation,[13] widespread hyperalgesia,[14] somatosensory alterations,[15] higher levels of mental distress,[16] and bilateral tactile sensitivity deficits.[17] These findings suggest individuals with PFPS may have dysfunctional central pain processing mechanisms, despite the local anterior knee pain complaint, which may benefit from additional intervention beyond exercise alone.

Among other effects, joint mobilization has been shown to improve mobility,[18] decrease nociceptive excitability[19] and enhance pain modulation[20] in patients with longstanding knee pain, as well as reduce widespread hyperalgesia[21] and enhance psychological outcomes.[22] Given the mobility and central pain processing deficits potentially associated with PFPS and the purported effects of joint mobilization, joint mobilization seems like a logical intervention in managing individuals with the condition. Mobilization of the PFJ is typically performed in non-weight bearing positions, where the amount of mobility is most easily detected, but where the individual's symptoms are rarely provoked. This may contribute to the limited success of patellofemoral joint mobilizations in isolation for PFPS compared to other multimodal interventions.[23] Along these lines, if a movement is painful, an individual will frequently develop compensatory movement strategies to avoid the pain or will avoid the task completely. To this end, if painful positions and movements can be less symptom provoking, movement could theoretically become more functional.

The purpose of this clinical suggestion is to present PFJ mobilization options in positions more closely replicating positions of symptom provocation, in an effort to offer clinicians different intervention strategies for the challenging condition of PFPS.

SOLUTION

While appropriate exercise prescriptions can frequently improve outcomes with PFPS, some individuals with PFPS have numerous impairments of both peripheral and central pain mechanisms. Joint mobilization has been associated with dampening of aberrant pain mechanisms and combined with its biomechanical effects could serve as a potent adjunctive intervention in the management of PFPS.[24]

As the PFJ joint congruency increases with knee flexion, and mobility subsequently decreases, mobilizing the individual's PFJ in the angle or position of symptom provocation or joint restriction may allow for enhanced PFJ load dispersion and decreased pain. Studies have demonstrated that early identification and improvement in an individual's primary symptomatic movement (ie their comparable sign) is associated with an improved outcome at discharge.[25,26] To this end, the authors present patellar mobilizations targeting the painful movement pattern itself. The rationale is to take the proposed benefits from joint mobilizations (which are commonly done in open-packed, non-provocative positions) and apply them to functional positions where individuals with PFPS most commonly have pain or limitation. Making a movement less painful or restricted (through mobilizations) could enhance the capacity to perform the activity.

Below is a proposed progression of patellar mobilization options from unloaded and typically less functional, to loaded and more functional (and usually more provocative) for persons with PFPS. Figure 1 is a patellofemoral glide starting in mid-range knee flexion in supine. This position replicates the knee angle associated with symptoms (ie during squats, ascending or descending stairs), but removes the weight bearing component thereby reducing some compressive load. Figure 2 demonstrates a partial weight-bearing patellofemoral glide in a static lunge position. This could be an ideal position to mobilize the PFJ if the patient is having symptoms in a specific point in a range of motion in weight-bearing. Figure 3 demonstrates mobilization with movement (MWM), utilizing a patellofemoral glide in a loaded

Figure 1. *Medial patellofemoral joint glide in non-weight bearing knee flexion.*

Figure 2. *Medial patellofemoral joint glide in static weight bearing knee flexion.*

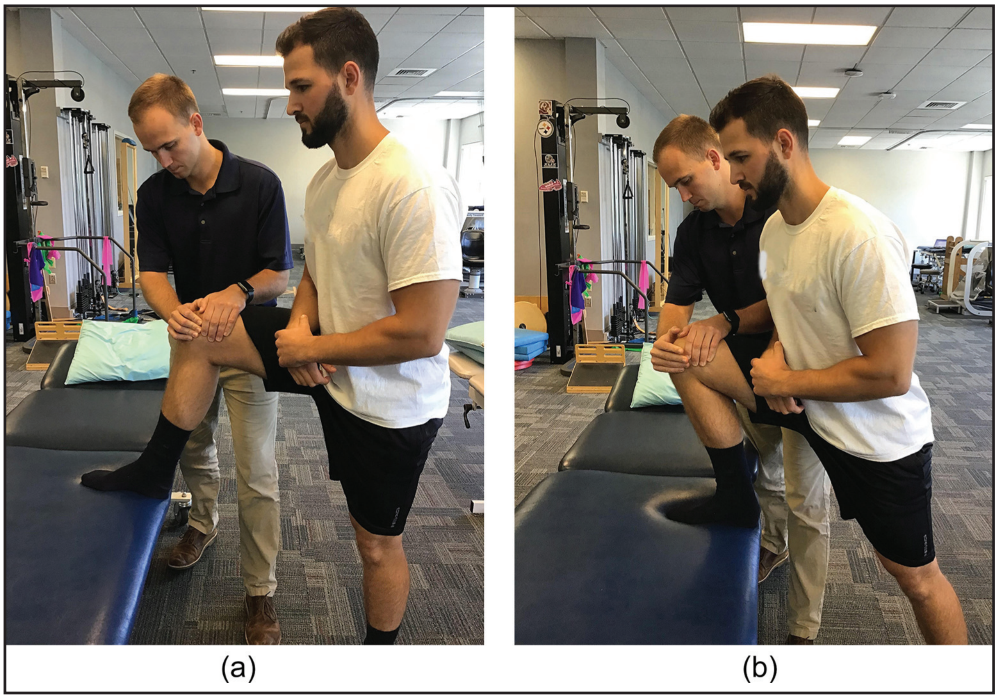

Figure 3. *Medial patellofemoral joint mobilization with movement during a unilateral lunge. a) starting position; b) ending position.*

lunge position. The direction of mobilization can be based on which motion provides symptom reduction, and/or whichever direction the therapist feels to be restricted. In this demonstration, the medial glide is sustained during closed-kinetic chain knee flexion. Figure 4 continues the weight-bearing progression of functional patellofemoral glides during a weighted leg-press. With the leg press, load can be added to progress from partial weight-bearing to full body weight (or more). The medial glide demonstrated is sustained throughout the leg-press motion to theoretically reduce excessive compressive load on the lateral knee joint. The final progression demonstrated in this paper is a body-weight squat (Figure 5). During this task, a sustained glide or graded oscillation is applied while the patient performs a single or double leg squat. Although the presented progression has worked well in challenging cases of PFPS for the authors, the decision on how, when or why joint mobilization should be applied should be patient-specific. Additional positions and tasks could also be considered depending on the symptomatic and functionally-limited tasks. If joint mobilization within the clinic is found to be effective, activities to replicate the intervention should be considered as part of a home exercise program.[27]

Providing the reader with specific prescriptions of joint mobilization is inappropriate, as manual therapy should be applied in a patient-centric fashion. Guiding principles are presented to assist in clinical decision making, however additional resources may be helpful for further direction.[28] If a patient is primarily painful and their pain is limiting their performance of other therapeutic tasks, lower grade mobilizations without engaging the barrier of tissue resistance could assist in dampening the pain response and desensitizing the nervous system through neurophysiological effects. If stiffness is the primary problem, then higher grade mobilizations should be incorporated to mechanically facilitate improved motion and decreased tissue resistance. The duration of application will typically depend on the purpose. When attempting to reduce pain, shorter durations should be incorporated to avoid aggravating symptoms, giving the patient rest breaks between mobilizations. If improving mobility is the goal, then the technique should be performed until a change in tissue resistance is felt, which generally will take longer than achieving neurophysiological results. However, given the increased PFJ congruency in knee flexion, available mobility of the PFJ will be reduced in some of the positions presented in

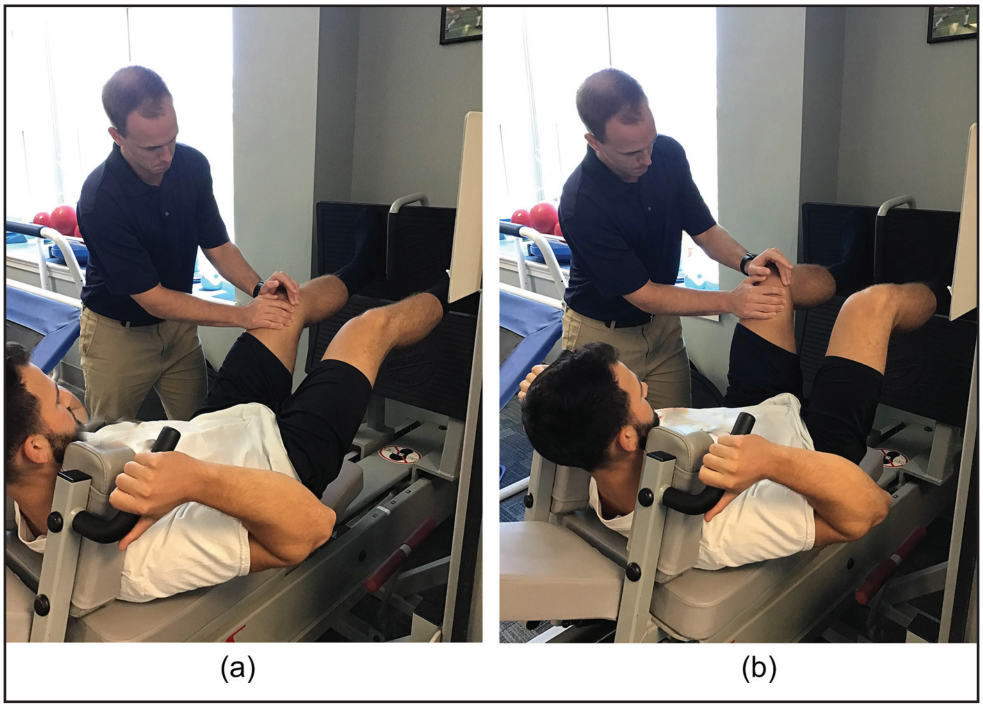

Figure 4. *Medial patellofemoral joint mobilization with movement while on the leg press. a) starting position; b) ending position.*

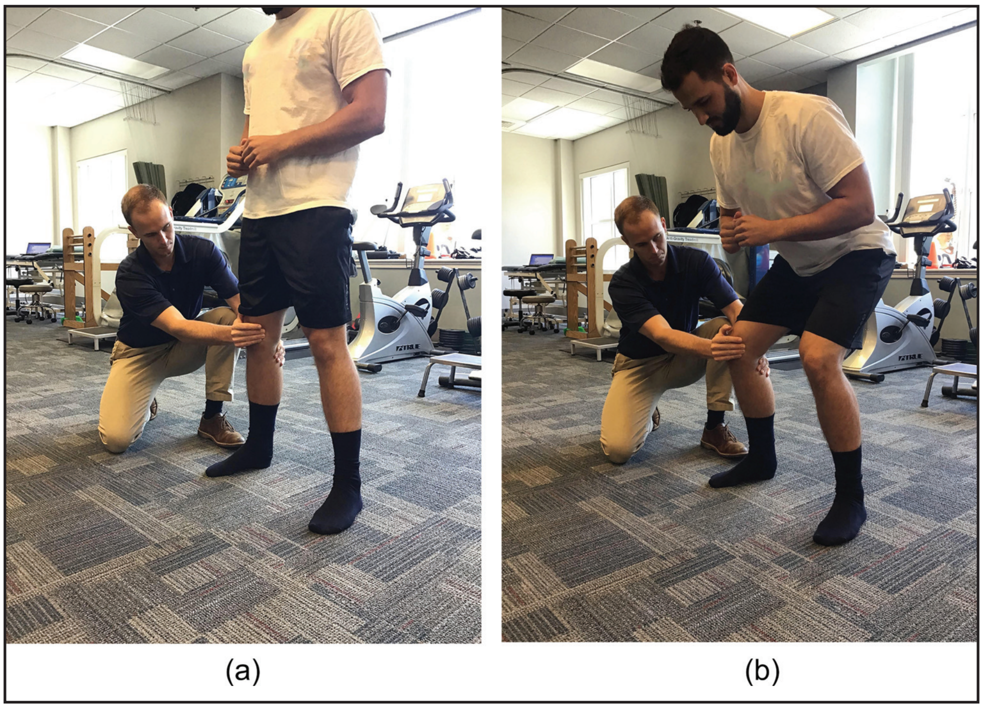

Figure 5. *Medial patellofemoral joint mobilization with movement during a bilateral squat. a) starting position; b) ending position.*

this clinical suggestion, possibly making the assessment of existing joint motion difficult. In the case of MWM a pain reducing glide is typically sustained as the patient actively moves through the movement that was previously painful. If the initially considered glide direction does not reduce symptoms, a different direction glide is applied, until a pain reducing glide is found (if possible). During each mobilization, the therapist may consider directing their glide on the patella at different angles to accommodate the anatomical position of the femoral condyles.

Importantly, while arthrokinematics can guide a clinician's thought process, arthokinematic principles are based on cadaveric studies and theory involving normal joint surfaces, and the presence of pathology, pain, or mobility deficits may make typical arthrokinematics less relevant to the patient/athlete. In fact, a glide performed in the opposite direction of typical arthrokinematic conventions was found to be substantially more useful in improving range of motion for individuals with adhesive capsulitis,[29] reinforcing the need to perform hands-on techniques coupled with a dynamic clinical reasoning process which responds in-action to the patient's demands while incorporating clinician experience and best available evidence.

DISCUSSION

Patellofemoral pain is a common but challenging condition to manage. This is partly due to the various physical impairments along the entire lower extremity biomechanical chain, variables such as training errors, improper shoe wear or type of running surface, and possible central pain processing dysfunction. As high quality research and clinical practice guidelines assist in optimizing outcomes, the recurrence rate and functional impact of PFPS remains high. When coupled with other interventions, joint mobilization has been shown to help reduce pain and improve functional outcomes for patients with PFPS, with moderate to large effect sizes.[23,30] However, available research frequently emphasizes mobilizations performed in a supine position which would allow for greater PFJ excursion, but may inherently lack carryover to the functionally limited task. Performing mobilizations in positions where the individual with PFPS is having pain (i.e. knee flexion to mimic the position required for stairs) may lead to improved patient reported outcomes and have more carry over into functional tasks. While anecdotal evidence from the authors suggests these techniques can be beneficial, additional research needs to be performed to identify the true efficacy. Nevertheless, in the absence of high quality clinical trials investigating weight-bearing mobilizations for PFPS, and in the presence of high prevalence rates of PFPS coupled with longstanding cases of limited function, additional approaches to current practice should be considered.

It also needs to be highlighted that the authors do not suggest that joint mobilization, functional or not, should be performed on all individuals with PFPS. Many individuals with PFPS do *not* have mobility restrictions, rather, have a reduced capacity to control available movement, in which case specific exercises and load management would be more beneficial. Joint mobilization would be primarily indicated when pain or mobility deficits are present, and even then, should not be used in isolation.[10,23] It is the authors' hope that this clinical suggestion provides readers with additional options for treating the challenging condition of PFPS, or at a minimum challenges traditional thought processes of joint mobilization for peripheral conditions.

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