UNIVERSIDADE NOVE DE JULHO

PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS DA REABILITAÇÃO

OTÁVIO HENRIQUE CARDOSO LEITE

AVALIAÇÃO DA RELAÇÃO ENTRE CINESIOFOBIA, AUTOEFICÁCIA E DESVIO DOS PADRÕES DE MOVIMENTO EM PESSOAS COM DOR FEMOROPATELAR

SÃO PAULO

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Orientador: Prof. Dr. Paulo Roberto Garcia Lucareli.

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Dedico esta conquista à minha mãe a ao meu pai.

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"Quem tem iniciativa própria estará sempre um passo à frente dos outros."

Valdeci Alves Nogueira

RESUMO

Introdução: A dor musculoesquelética é um problema de saúde pública global, com impactos significativos na qualidade de vida e na funcionalidade dos indivíduos. Dentre essas condições, a dor femoropatelar (DFP) é uma das queixas mais prevalentes em adultos jovens, especialmente mulheres, sendo caracterizada por dor anterior no joelho durante atividades que aumentam a carga na articulação. Embora historicamente considerada autolimitada, evidências recentes mostram que a DFP pode persistir e resultar em limitações funcionais prolongadas. A literatura atual reforça a importância de uma abordagem multifatorial da dor crônica, que contemple não apenas aspectos biomecânicos, mas também fatores cognitivos-comportamentais como a cinesiofobia, catastrofização da dor e autoeficácia, os quais influenciam diretamente a experiência dolorosa e o comportamento motor. A resposta ao movimento, por sua vez, pode refletir tanto estratégias adaptativas quanto comportamentos mal adaptativos aprendidos. Métodos de avaliação dinâmica, como o teste funcional *Lateral Step-Down* (LSD), possibilitam uma análise mais sensível da resposta do movimento ao estímulo nociceptivo, em comparação a medidas retrospectivas tradicionais. Diante disso, torna-se essencial investigar de forma integrada os fatores cognitivos-comportamentais, funcionais e motores em indivíduos com DFP, visando a elaboração de estratégias terapêuticas mais eficazes, individualizadas e centradas no paciente. **Objetivos:** Os objetivos principais desta tese são: 1) Avaliar as associações entre a cinesiofobia, os fatores cognitivo-comportamentais, a dor e os domínios funcionais em indivíduos com dor femoropatelar (DFP). 2) Determinar qual medida de dor autorreferida: (a) dor média nos últimos 15 dias, (b) dor na chegada do paciente para avaliação (baseline) ou (c) dor durante cada série de movimentos apresenta maior associação com o perfil de desvio do movimento (MDP) durante o *Lateral Step-Down* (LSD) em pessoas com dor femoropatelar. **Métodos:** 1) Trata-se de um estudo transversal envolvendo 66 indivíduos com DFP, submetidos à avaliação cinemática durante o *Lateral Step-Down* (LSD), concomitantemente à avaliação cognitivo-comportamental. Para examinar a cinemática angular durante a realização do SDL foi utilizado o *Movement Deviation Profile* (MDP). A avaliação cognitivo-comportamental foi conduzida por meio da aplicação de escalas destinadas a mensurar o medo relacionado ao movimento (Escala Tampa de Cinesiofobia), a confiança do indivíduo em realizar atividades mesmo diante da dor (*Pain Self-Efficacy Scale* (PSEQ-10) e *Chronic Pain Self-Efficacy* (CPSE) e o impacto emocional e comportamental negativo associado à forma de lidar com essa experiência dolorosa (Escala de Catastrofização da Dor). Posteriormente, antes das análises principais, verificou-se a normalidade e a homogeneidade

dos dados, garantindo a adequação e a consistência das etapas estatísticas subsequentes. Em seguida, foi construído um modelo estatístico para identificar os fatores mais associados à cinesiofobia, utilizando seleção automática de variáveis e critérios de qualidade do modelo. 2). Trata-se de um estudo transversal com 66 indivíduos com DFP foram submetidos à avaliação cinemática durante 12 ciclos do LSD concomitante com a aplicação da escala visual analógica da dor (*Numerical Pain Rating Scale*). Para examinar a cinemática angular durante a realização do LSD foi utilizado o MDP. Já para a avaliação do nível de dor, a escala numérica da dor foi aplicada em seis momentos distintos: inicialmente, considerando os 15 dias anteriores à coleta de dados; em seguida, antes do início da execução do agachamento unipodal; e posteriormente, a cada quatro repetições do agachamento unipodal. O estudo empregou um modelo linear generalizado para analisar a evolução das variáveis ao longo de múltiplas séries, considerando possíveis interações entre as variáveis analisadas, estimando coeficientes de regressão e associações existentes. **Resultados:** 1) A cinesiofobia diminuiu 0.31 pontos a cada aumento de um ponto no escore da *Pain Self-Efficacy Questionnaire* (PSEQ-10). Por outro lado, a variável MDPmean apresentou efeito diretamente proporcional, indicando aumento de 0.24 pontos na cinesiofobia para cada aumento de 1 grau no desvio do padrão de movimento. 2) A análise dos resultados mostrou que em todas as análises, nenhum dos índices de dor, seja retrospectivo, basal ou induzido pela tarefa, apresentou associação estatisticamente significativa com o desvio de movimento. A direção dos coeficientes indicou uma tendência fraca e positiva entre maior dor e valores mais altos de MDP, especialmente para a dor durante o movimento; entretanto, essas tendências não atingiram significância estatística convencional. **Conclusão:** 1) Os achados destacam que a autoeficácia, mensurada pelo PSEQ-10 e o MDP são variáveis importantes para explicar a cinesiofobia, evidenciando seu caráter multifatorial. 2) Os resultados deste estudo indicaram que o desvio do movimento ao longo de quatro séries de agachamento unipodal não se associou a nenhuma medida de dor, seja retrospectiva ou experimentada durante a execução do exercício.

Palavras-chave: Joelho; Fenômenos Biomecânicos; Síndrome da Dor Patelofemoral.

ABSTRACT

Introduction: Musculoskeletal pain is a global public health issue with significant impacts on individuals' quality of life and functionality. Among these conditions, patellofemoral pain (PFP) is one of the most prevalent complaints in young adults, especially women, and is characterized by anterior knee pain during activities that increase joint load. Although historically considered self-limiting, recent evidence shows that PFP can persist and result in long-term functional limitations. Current literature emphasizes the importance of a multifactorial approach to chronic pain, addressing not only biomechanical aspects but also cognitive-behavioral factors such as kinesiophobia, pain catastrophizing, and self-efficacy, which directly influence the pain experience and motor behavior. The motor response, in turn, may reflect both adaptive and maladaptive learned strategies. Dynamic assessment methods, such as the Lateral Step-Down (LSD) test, allow for a more sensitive analysis of movement responses to nociceptive stimuli compared with traditional retrospective measures. Therefore, it is essential to investigate cognitive-behavioral, functional, and motor factors in an integrated manner among individuals with PFP, aiming to develop more effective, individualized, and patient-centered therapeutic strategies. **Objectives:** The main objectives of this thesis are: 1) To evaluate the associations between kinesiophobia, cognitive-behavioral factors, pain, and functional domains in individuals with patellofemoral pain (PFP). 2) To determine which self-reported pain measure: (a) average pain over the past 15 days, (b) pain at baseline (upon arrival for assessment), or (c) pain during each movement set, shows the strongest association with the Movement Deviation Profile (MDP) during the Lateral Step-Down (LSD) test in people with PFP. **Methods: 1)**This is a cross-sectional study involving 66 individuals with PFP, who underwent kinematic assessment during the Lateral Step-Down (LSD) test, concomitantly with cognitive-behavioral evaluation. To examine angular kinematics during the LSD, the Movement Deviation Profile (MDP) was used. The cognitive-behavioral assessment was conducted using scales designed to measure fear of movement (Tampa Scale for Kinesiophobia), the individual's confidence in performing activities despite pain (Pain Self-Efficacy Scale – PSEQ-10 and Chronic Pain Self-Efficacy Scale – CPSE), and the negative emotional and behavioral impact associated with coping with pain (Pain Catastrophizing Scale). Before the main analyses, data normality and homogeneity were verified to ensure the adequacy and consistency of subsequent statistical procedures. A statistical model was then built to identify the factors most associated with kinesiophobia, using automatic variable selection and model quality criteria. 2) This is a cross-sectional study including 66 individuals with PFP who

underwent kinematic evaluation during 12 cycles of the LSD test, concomitant with pain assessment using the Numerical Pain Rating Scale. To analyze angular kinematics during the LSD, the MDP was used. For pain assessment, the numerical pain rating scale was applied at six different time points: initially, considering the 15 days prior to data collection; then, before starting the single-leg squat; and subsequently, after every four repetitions of the exercise. The study employed a generalized linear model to analyze the evolution of variables across multiple series, considering possible interactions between variables and estimating regression coefficients and existing associations. **Results:** 1) Kinesiophobia decreased by 0.31 points for every one-point increase in the Pain Self-Efficacy Questionnaire (PSEQ-10) score. Conversely, the MDPmean variable showed a directly proportional effect, with a 0.24-point increase in kinesiophobia for every one-degree increase in movement deviation. 2) The analysis showed that none of the pain indices, whether retrospective, baseline, or task-induced, presented a statistically significant association with movement deviation. The direction of the coefficients indicated a weak and positive trend between higher pain and higher MDP values, particularly for pain during movement; however, these trends did not reach conventional statistical significance. **Conclusion:** 1) The findings highlight that self-efficacy, measured by the PSEQ-10, and the MDP are important variables for explaining kinesiophobia, demonstrating its multifactorial nature. 2) The results of this study indicated that movement deviation over four sets of single-leg squats was not associated with any pain measure, whether retrospective or experienced during exercise.

Keywords: Knee; Biomechanical Phenomena; Patellofemoral Pain Syndrome.

SUMÁRIO

1 CONTEXTUALIZAÇÃO

De acordo com a *International Association for the Study of Pain* (IASP), dor é definida como uma experiência sensorial e emocional desagradável associada ou semelhante àquela causada por danos reais ou potenciais nos tecidos[1]. As dores musculoesqueléticas crônicas são consideradas um problema de saúde global[2], capazes de gerar inúmeros prejuízos econômicos e sociais[3], afetando cerca de 1,75 bilhão de pessoas em todo o mundo[4]. Nos Estados Unidos, aproximadamente 126 milhões de americanos sofrem com dores musculoesqueléticas, o que representa um alto custo para a economia local, com um gasto anual com saúde estimado em 213 bilhões de dólares[5].

A dor no joelho é uma das queixas musculoesqueléticas mais prevalentes em ambientes ambulatoriais, afetando especialmente a população jovem, com maior incidência entre mulheres na faixa etária de 18 a 35 anos[6,7]. Essa condição está frequentemente associada à redução da funcionalidade e ao comprometimento da qualidade de vida, provocando impactos duradouros tanto no bem-estar físico quanto no psicológico dos indivíduos acometidos[8].

Dentre as causas mais comuns de dor no joelho, destaca-se a dor femoropatelar (DFP), um distúrbio musculoesquelético crônico de natureza multifatorial, resultado da interação complexa entre fatores anatômicos, biomecânicos, emocionais e socioculturais[9,10]. Clinicamente, a DFP manifesta-se por dor na região anterior do joelho, que tende a se agravar durante atividades que aumentam a carga sobre a articulação femoropatelar, como subir ou descer escadas, agachar, correr ou permanecer sentado por períodos prolongados[6].

Historicamente considerada uma condição autolimitada, evidências recentes indicam que a DFP pode persistir por longos períodos, resultando em limitações funcionais contínuas, redução na participação em atividades físicas e prejuízos significativos na qualidade de vida[5]. Além disso, o prognóstico para esses pacientes é frequentemente desfavorável, com aproximadamente 57% relatando piora funcional entre cinco e oito anos após a reabilitação, mesmo diante do tratamento[11]. Nesse contexto, torna-se fundamental compreender como o desconforto experimentado influencia o comportamento motor e a percepção dos pacientes durante a reabilitação musculoesquelética.

Nos últimos anos, a abordagem multifatorial da dor musculoesquelética crônica tem ganhado destaque na literatura, ressaltando a necessidade de uma compreensão integrada do problema[12,13]. Entre os fatores investigados, os biomecânicos são amplamente considerados possíveis responsáveis pela dor e pela disfunção[7]. No entanto, fatores biomecânicos isolados

não conseguem explicar completamente a variabilidade dos sintomas musculoesqueléticos e as respostas divergentes ao tratamento observadas na prática clínica[12,13].

Além disso, a literatura tem enfatizado o papel crucial dos fatores psicológicos no desenvolvimento e na manutenção da dor crônica musculoesquelética[12,14]. O reconhecimento da importância das estratégias de autogestão no manejo da dor tem se mostrado promissor para melhorar os resultados terapêuticos[15].

Entre os principais fatores psicológicos associados à dor destacam-se a cinesiofobia, a catastrofização da dor e a baixa autoeficácia, os quais exercem influência direta sobre a experiência dolorosa e a resposta ao tratamento[13,16]. A cinesiofobia, em particular, tem sido amplamente associada aos piores desfechos clínicos em diversas condições musculoesqueléticas. Esse fator psicológico pode levar à evitação de movimento[11]. Embora seu papel já esteja bem documentado em populações com dor lombar e outras condições crônicas, ainda são escassos os estudos que investigam de forma sistemática a influência da cinesiofobia e de outros fatores psicológicos sobre a dor e a função em indivíduos com DFP[17].

No ambiente clínico, a dor pode desencadear uma variedade de respostas motoras, que vão desde ajustes sutis na execução das atividades até a evitação completa de movimentos que provocam incômodo[18]. Por isso, o monitoramento cuidadoso da dor durante o exercício é essencial, especialmente para indivíduos com dor crônica. Embora tradicionalmente a dor tenha sido vista como um sinal para interromper ou evitar a atividade, evidências recentes indicam que tolerar níveis moderados de desconforto durante exercícios terapêuticos supervisionados pode ser aceitável[19,20].

Outro ponto de destaque é que a avaliação da dor em pacientes com DFP frequentemente se baseia em medidas retrospectivas, como a intensidade média da dor nas últimas semanas. No entanto, esse tipo de avaliação pode não refletir com precisão a dor experimentada durante atividades funcionais específicas, nas quais os sintomas geralmente são exacerbados[21], como, por exemplo, durante a realização do *Step Down Lateral (LSD)*, teste funcional amplamente utilizado para avaliar o controle de movimento do membro inferior em indivíduos com DFP[22]. A dor provocada durante esse teste pode oferecer uma medida mais sensível e válida da resposta do movimento ao estímulo nociceptivo. Métodos de avaliação mais dinâmicos têm demonstrado que índices alternativos de dor, como dor máxima, variabilidade da dor e tempo em dor elevada, estão mais fortemente associados à limitação funcional do que apenas à média retrospectiva da dor[23].

O movimento é amplamente reconhecido como componente fundamental no tratamento da dor musculoesquelética; contudo, os mecanismos que levam às alterações nos padrões de

movimento em pacientes com dor ainda não são totalmente esclarecidos. Além disso, as adaptações motoras à dor apresentam ampla variabilidade entre os indivíduos, o que dificulta a compreensão dos processos que contribuem para o surgimento e a manutenção da dor crônica[24].

Diante dessas lacunas, torna-se imprescindível investigar, de forma integrada, os fatores psicológicos, como cinesiofobia e autoeficácia, as características funcionais do joelho e os possíveis desvios nos padrões de movimento em indivíduos com DFP. Essa abordagem permite compreender não apenas os mecanismos biomecânicos, mas também as respostas emocionais e comportamentais associadas à dor, que frequentemente passam despercebidas em avaliações tradicionais.

Do ponto de vista clínico, identificar o medo do movimento, a baixa confiança na capacidade de realizar tarefas físicas e padrões compensatórios sutis no movimento é fundamental, pois esses fatores podem influenciar tanto o desempenho motor quanto a evolução da dor, mesmo na ausência de alterações biomecânicas evidentes. Compreender essas interações possibilita o desenvolvimento de estratégias terapêuticas individualizadas e centradas no paciente, que integrem componentes físicos e cognitivo-comportamentais da dor, promovendo um movimento mais funcional e, consequentemente, potencializando a recuperação funcional e a adesão ao tratamento.

2 OBJETIVOS

2.1 Estudo 1

Avaliar as associações entre a cinesiofobia, os fatores cognitivo-comportamentais, a dor e os domínios funcionais em indivíduos com dor femoropatelar (DFP).

2.2 Estudo 2

Objetivo primário: Determinar qual medida de dor autorreferida: (a) dor média nos últimos 15 dias, (b) dor na chegada do paciente para avaliação (baseline) ou (c) dor durante a cada série de movimentos apresenta maior associação com o perfil de desvio do movimento (MDP) durante o *Lateral Step Down* em pessoas com dor femoropatelar.

Objetivos secundários: (1) Verificar se a intensidade da dor se altera entre as séries (efeito do número de tentativas); (2) testar se o MDP se altera entre as séries; e (3) explorar se a associação entre a dor e o MDP varia por série.

3. RESULTADOS

Os resultados da presente tese serão apresentados no formato de artigo. O estudo 1, intitulado "*Pain, Fear, and Movement: Cognitive-Behavioural Connections in Patellofemoral Pain*", em processo de revisão no periódico "*Clinical Biomechanics".* O estudo 2, intitulado "*Task-Evoked vs. Recalled Pain and Movement Deviation during the Lateral Step-Down in Patellofemoral Pain*" será submetido posteriormente.

3.1 Artigo 1 – Submetido à *Clinical Biomechanics*

Pain, Fear, and Movement:
Cognitive-Behavioural Connections in Patellofemoral Pain

ABSTRACT

Background: Kinesiophobia, or fear of movement, is common in individuals with musculoskeletal pain, especially in those with patellofemoral pain, and it can lead to increased functional limitations. Although pain self-efficacy is known to affect kinesiophobia, the link between psychological factors and physical aspects such as movement patterns and pain intensity remains uncertain. This study aimed to assess the relationships between kinesiophobia and cognitive-behavioural factors, pain, and functional domains in participants with patellofemoral pain.

Methods: This was an observational, cross-sectional study involving 66 participants with patellofemoral pain who underwent assessments of cognitive-behavioural factors, self-reported pain, knee-related function, and movement function. Generalized linear models were used to examine the relationship between kinesiophobia and self-efficacy, pain catastrophizing, self-reported pain, knee-related function, and movement function measured by the Movement Deviation Profile.

Findings: The general linear model demonstrated that self-efficacy and the Movement Deviation Profile were predictors of kinesiophobia. The final model confirmed a notable inverse association between self-efficacy and kinesiophobia, with a 0.31-point decrease in kinesiophobia for each one-point increase in the Pain Self-Efficacy Questionnaire score. Regarding the Movement Deviation Profile, each one-degree increase in the movement deviation pattern was associated with a 0.24-point increase in kinesiophobia scores.

Conclusion: Kinesiophobia can decrease self-efficacy and lead to movement avoidance, negatively impacting perceived ability and physical function. Our findings emphasise the complex nature of kinesiophobia. Improving self-efficacy might help lessen fear-related avoidance, while movement patterns should be interpreted carefully by distinguishing between adaptive and maladaptive behaviours.

Keywords: Fear, Knee, Movement, Patellofemoral Pain Syndrome

INTRODUCTION

Excessive and irrational fear of movement, known as kinesiophobia, often accompanies chronic musculoskeletal conditions such as patellofemoral pain (PFP)[1]. Pain is a complex experience shaped by anatomical, psychological, and social factors that make it difficult for patients to clearly describe their symptoms and pose challenges for managing chronic pain[2,3]. Biopsychosocial models of pain suggest that while moderate movement adjustments can help reduce discomfort, an exaggerated fear-avoidance response leading to unnecessary or excessive movement changes may sustain disability[3]. Therefore, kinesiophobia is recognised as a major factor contributing to ongoing disability in PFP.

Pain significantly affects patients' lives, and previous research has examined factors that contribute to its onset, worsening, and downstream effects[4-6]. In PFP, cognitive–behavioural constructs such as pain catastrophising, characterised by rumination, magnification, and helplessness, and pain self-efficacy, defined as confidence in one's ability to manage pain, serve as predictors of outcomes: higher catastrophising is linked to poorer treatment response, while greater self-efficacy is associated with better adherence and symptom relief[7-8]. PFP often appears insidiously with persistent symptoms and functional limitations, leading to compensatory movement strategies like reduced knee flexion during stair ascent[9-10]. While some compensatory strategies can be protective when used appropriately[10], as shown by a reduction in knee flexion during stair ascent and descent, which is a functional adaptation[11-13], they may become harmful if these adaptations are unnecessary or excessive, ultimately resulting in significant functional deficits[10].

Although increasing efforts have been made to understand how movement alterations and fear of movement contribute to pain-related disability, the combined associations of kinesiophobia with functional performance, cognitive–behavioural factors (pain self-efficacy,

catastrophising), pain intensity, knee-related function, and objective movement deviations in PFP remain underexplored. A clearer understanding of these interrelationships is vital to advance clinical management beyond purely biomechanical models and towards an integrated biopsychosocial framework that addresses the psychosocial drivers of persistent dysfunction. To our knowledge, no prior study has simultaneously examined these constructs as correlates of kinesiophobia in PFP. Identifying these relationships can guide personalised interventions to reduce avoidance behaviours, promote engagement in meaningful activities, and lessen fear-driven disability.

Building on these gaps, this cross-sectional study explores the relationships between kinesiophobia and core biopsychosocial variables, including pain self-efficacy, pain catastrophising, pain intensity, knee-related function, and objective movement deviations in participants with PFP. We hypothesise that reduced self-efficacy, increased catastrophising, higher pain intensity, poorer knee function, and more significant movement deviations are associated with greater kinesiophobia.

MATERIAL AND METHODS

Subjects

This cross-sectional study was conducted at the Human Movement Laboratory between February and December 2024. The local research ethics committee approved the study under protocol number (6.275.002), which followed the Declaration of Helsinki. All individuals read and signed the informed consent form. In addition, the study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist to ensure transparent and comprehensive reporting.

The study included individuals aged between 18 and 45 years old with patellofemoral pain. Participants were recruited through printed advertisements (i.e., flyers and posters) distributed at the university, active search, and social media announcements. Eligibility criteria included participants reporting diffuse knee pain with an insidious onset and non-traumatic origin, as well as a pain intensity of at least 3 out of 10 on the Numerical Pain Rating Scale (NPRS) during at least one of the following activities: prolonged sitting with the knee flexed, stair ascent or descent, running, or squatting. Pregnant women, participants with a history of lower limb surgery, recurrent patellar dislocation, meniscal or ligament injury, heart disorders, use of antidepressant medication, and neurological and/or orthopaedic disorders were not included. Standardised recruitment procedures were followed to minimise potential sources of bias, and all assessments were conducted using a consistent protocol by the same trained evaluator. After this initial screening to determine eligibility, participants completed questionnaires related to the cognitive-behavioural evaluation.

All assessments were carried out by a qualified physiotherapist with over five years of experience in PFP and 3D motion analysis. Before data collection, the evaluator completed two pilot sessions and standardised training on the study protocol.

Sample Size

The sample size calculation was performed according to Gatsonis and Sampson[14] using the G-Power® software, version 3.1.9.7 (Kiel University, Germany). To achieve a power of 99%, an alpha of 0.05, and an effect size of 0.48, a sample size of minimum 64 individuals with patellofemoral pain was required.

Procedures

Cognitive-behavioural factors of pain:

All the PFP participants completed four questionnaires about the three different cognitive-behavioural factors of pain: fear of movement, confidence, and catastrophising.

The Tampa Scale for Kinesiophobia (TSK) assessed fear of movement. This validated questionnaire measures excessive and irrational fear of movement related to pain during social activities, caused by a feeling of vulnerability to painful injuries. The scale includes 17 items that address the fear of movement. Each item is scored on a four-point Likert scale. The total score ranges from 17 to 68, with scores above 37 indicating kinesiophobia[8,15].

The Pain Self-Efficacy Questionnaire (PSEQ-10)[16], a validated 10-item instrument scored on a six-point Likert scale, was used. Higher scores indicate greater confidence in managing pain, regardless of its intensity[17]. Similarly, the Chronic Pain Self-Efficacy Scale (CPSE) was employed to assess patients' confidence in managing chronic pain across three domains: pain management, physical function, and symptom control. This scale consists of 22 items, each rated on a Likert scale from 10 to 100, with higher scores reflecting stronger self-efficacy in coping with pain[18].

The Pain Catastrophizing Scale (PCS), a validated instrument, was used to measure the level of pain catastrophising. Composed of 13 items, each question is scored on a Likert scale from 0 to 52 points, where higher scores indicate a maladaptive response to pain[19].

Pain and knee function assessment

The Numeric Pain Rating Scale (NPRS) is a validated tool that measures participants' pain levels over the past two weeks. This scale comprises 10 items, with higher scores indicating greater pain[18].

The Anterior Knee Pain Scale (AKPS) is a tool for assessing the functional limitations of patellofemoral disorders[20]. It is commonly used to evaluate symptoms and functional impairments associated with anterior knee pain.

Movement function: Lateral Step Down

To evaluate movement during a task capable of differentiating the kinematics of individuals with and without PFP, the Lateral Step Down test (LSD) was employed[19].

For the LSD test, four sets of movements, each consisting of three consecutive repetitions, totaling 12 cycles, were performed, with the squat standardized to 60º of knee flexion[19]. A step measuring 18 cm high, 30 cm wide and 30 cm deep was used to perform the task. For the LSD the medial border of the foot was aligned with the lateral edge of the step and the contralateral limb was held in the air immediately to the side. The initial position of the limb tested was maximal extension of the knee on the support side, while the contralateral limb had to remain with the knee completely extended and the ankle in maximum dorsiflexion, arms crossed and close to the trunk throughout the execution of the tasks. The volunteer was asked to perform the squats slowly, over two seconds, and immediately return to the initial position, also over two seconds, in each repetition requested. Kinematic data were collected using the Vicon® motion analysis system, which consist of 10 cameras with a sampling frequency of 120 frames per second. Thirty-five spherical markers were placed at specific anatomical landmarks as references for the motion system based on the Vicon Plug-in-Gait® biomechanical model, which estimates the position and calculates the three-dimensional kinematics of body

segments[20,21]. The raw kinematic data were processed in Vicon Nexus (version 2.15) using the Plug-in Gait model to compute joint centres and segment orientations. Marker trajectories were then smoothed with a Woltring filter, applying two mean square errors (2MSE) to the marker trajectories to attenuate noise arising from soft-tissue artefacts. Each LSD cycle was marked starting from the initial position of maximum knee extension of the more painful leg until this same leg returned to the initial position after the squat. Kinematic data from the 12 LSD cycles were saved in C3D format, exported, and tabulated in an Excel database for subsequent analysis through the Movement Deviation Profile. A pilot study with the first 10 participants observed an Intraclass Correlation Coefficient (ICC2, K) ranging from 0.73 to 0.97 and a Standard Error of Measurement (SEM) ranging from 0.38 to 2.50°. Checklist items are presented in the Supplementary Material, following Bazett-Jones et al.[24].

Movement Deviation Profile

The Movement Deviation Profile (MDP) uses artificial neural networks, specifically self-organizing maps (SOM), for time series analysis. This method calculates the deviation of an individual's movement pattern relative to a reference group with similar characteristics[22]. The self-organized map calculates the multidimensional distance between each subject and the distribution of normality derived from the reference group. It also serves as a metric capable of synthesizing and simplifying kinematic data, facilitating interpretation and comparison[23]. The LSD kinematic data from the 66 individuals with kinesiophobia were compared to the asymptomatic reference group composed of 87 asymptomatic individuals, ensuring an appropriate baseline for comparison. The MDP is the series of Euclidean distances between the kinematics of the kinesiophobic group from the distribution of normality defined by the control

group. The MDP_{mean} is the single number summary of the MDP calculated as the mean of the MDP time series.

Statistical Analysis

Normality and homogeneity of the variables were evaluated using visual inspection of their distributions and the Shapiro-Wilk test.

We fitted an initial generalised linear model (GLM) including all candidate predictors grouped by domain: function (AKPS), movement (MDPmean), cognitive-behavioural (PSEQ-10, CPSE, PCS), and pain (NPRS). Multicollinearity was assessed using variance inflation factors (VIF) and tolerance, with thresholds of VIF > 5 and tolerance < 0.2. A bidirectional stepwise selection guided by Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) produced the final parsimonious model. Final model performance is reported as adjusted R^2, overall F test, root mean squared error (RMSE), AIC, and BIC. Residual diagnostics (normality, homoscedasticity, autocorrelation, and visual inspections) were performed, and HC3 robust standard errors were applied when residual autocorrelation was detected. All statistical analyses were conducted on macOS in R (version 4.3.1; R Core Team, Vienna, Austria).

RESULTS

Sixty-six patellofemoral individuals, 14 men and 52 women, participated in this study. The personal, cognitive-behavioural factors, functional domains, and pain data obtained were summarized in Table 1.

Table 1. Personal, cognitive-behavioural factors, functional domains and pain values.

Variables	Overall mean (95% CI) n=66	Men mean (95% CI) n=14	Women mean (95% CI) n=52
Age (years)	25.56 (24.10 to 27.01)	25.92 (22.43 to 29.42)	25.46 (23.80 to 27.11)
Body mass (kg)	64.39 (61.58 to 67.21)	75.50 (70.03 to 80.96)	61.40 (58.60 to 64.21)
Height (m)	1.66 (1.63 to 1.68)	1.76 (1.72 to 1.79)	1.63 (1.61 to 1.65)
TSK	38.81 (37.45 to 40.18)	37.35 (34.51 to 40.20)	39.21 (37.63 to 40.79)
PSEQ-10	52.87 (51.29 to 54.46)	55.07 (51.19 to 58.94)	52.28 (50.53 to 54.04)
CPSE	93.83 (91.13 to 96.53)	94.42 (86.92 to 101.93)	93.67 (90.74 to 96.59)
PCS	28.71 (26.43 to 30.98)	24.00 (18.72 to 29.27)	29.98 (27.48 to 32.47)
NPRS	5.53 (5.14 to 5.91)	5.14 (4.06 to 6.23)	5.63 (5.22 to 6.04)
AKPS	23.93 (22.83 to 25.04)	22.64 (20.62 to 24.66)	24.28 (22.97 to 25.59)
MDP_{mean} (º)	15.83 (14.61 to 17.10)	16.63 (12.79 to 20.53)	15.64 (14.37 to 16.91)

Legend: "CI": confidence interval; ''TSK'': tampa scale for kinesiophobia; "PSEQ-10'': pain self-efficacy questionnaire; "CPSE'': chronic pain self-efficacy scale; ''PCS'': pain catastrophizing scale; "NPRS'': numerical pain rating scale; ''AKPS'': anterior knee pain scale; "MDP_{mean}": mean movement deviation profile.

Predictors of Kinesiophobia

Table 2 displays the GLM results with kinesiophobia as the dependent variable, including the regression coefficients and associated p-values for each variable analysed. Among

the predictors, only the PSEQ-10 showed a statistically significant link with kinesiophobia. The regression coefficients reveal an inverse relationship between these variables, indicating that self-efficacy, as measured by the PSEQ-10, tends to decrease as kinesiophobia increases.

Table 2. Results from the general linear model with kinesiophobia as the dependent variable (R^2: 24%, RMSE: 4.78).

Dependent Variable: Kinesiophobia			
Parameter	**β**	**95% CI**	**p**
Intercept	49.15	30.03 to 68.27	< .001
PSEQ-10	-0.39	-0.66 to -0.11	0.006
CPSE	0.05	-0.12 to 0.22	0.579
PCS	-0.00553	-0.18 to 0.17	0.950
NPRS	-1.02	-2.96 to 0.92	0.302
AKPS	0.16	-0.15 to 0.46	0.322
MDP_{mean}	0.48	-0.11 to 1.07	0.112

Legend: "R^2": coefficient of determination; "RMSE": root mean squared error; "β": regression coefficient; "CI": confidence interval; "PSEQ-10'': pain self-efficacy questionnaire; "CPSE'': chronic pain self-efficacy scale; ''PCS'': pain catastrophizing scale; "NPRS'': numerical pain rating scale; ''AKPS'': anterior knee pain scale; "MDP_{mean}": mean movement deviation profile.

Multicollinearity Between Independent Variables

Table 3: Initial Regression Model Including All Explanatory Variables: Model Fit and Collinearity Indicators (R^2 = 24%, RMSE = 4.78)

Parameter	VIF	95% CI	Tolerance
PSEQ-10	2.07	1.58 to 2.96	0.48
CPSE	2.39	1.79 to 3.45	0.42
PCS	1.70	1.34 to 2.42	0.59
NPRS	**6.04**	4.20 to 8.96	0.17
AKPS	1.27	1.08 to 1.88	0.79
MDP_{mean}	**5.83**	4.05 to 8.63	0.17

Legend: "R^2": coefficient of determination; "RMSE": root mean squared error; VIF: ''variance inflation factor''; "CI": confidence interval; "PSEQ-10'': pain self-efficacy questionnaire; "CPSE'': chronic pain self-efficacy scale; ''PCS'': pain catastrophizing scale; "NPRS'': numerical pain rating scale; ''AKPS'': anterior knee pain scale; "MDP_{mean}": mean movement deviation profile.

Table 3 suggests that VIF values greater than 5 indicate substantial multicollinearity, while tolerance values below 0.2 further support this concern. MDP_{mean} and NPRS showed considerable overlap with other predictor variables in this model, suggesting significant multicollinearity. This redundancy likely increased the standard errors of their coefficients. It reduced the precision of the estimates, which may help explain the non-significant p-values despite seemingly meaningful effect sizes.

Final Model After Stepwise Regression

Table 4 presents the results of the stepwise regression, showing the variables that best explain the dependent variable, kinesiophobia.

Table 4. Results from model after stepwise method (R^2: 21%, RMSE: 4.88).

Dependent Variable: **Kinesiophobia**				
Parameter	**β**	**95% CI**	**Cohen's f²**	**p**
Intercept	51.36	39.61 to 63.12	-----	< .001
PSEQ-10	-0.31	-0.50 to -0.12	0.16	0.008
MDP	0.24	-0.00570 to 0.49	0.06	0.011

Legend: "R^2": coefficient of determination; "RMSE": root mean squared error; "β": regression coefficient; "CI": confidence interval "PSEQ-10'': pain self-efficacy questionnaire; "MDP_{mean}": mean movement deviation profile.

The final model was developed using stepwise regression with kinesiophobia as the dependent variable. The table presents the regression coefficients and their respective p-values for the variables included in the model. The results demonstrate that kinesiophobia decreased by 0.31 points for each one-point increase in the PSEQ-10 score, indicating a statistically significant inverse relationship between self-efficacy and kinesiophobia. The variable MDP_{mean} showed a statistically significant positive correlation with kinesiophobia. Specifically, each 1-degree rise in the movement deviation pattern was associated with a 0.24 unit increase in kinesiophobia scores. This finding suggests that changes in movement patterns are

meaningfully connected to kinesiophobia, with MDPmean included in the final model, which enhanced the model fit and reduced multicollinearity. Furthermore, it added clinical relevance by indicating that biomechanical factors should be considered alongside psychological constructs when assessing and addressing kinesiophobia.

DISCUSSION

Summary and Interpretation of Main Findings

This study aimed to examine the relationship between kinesiophobia, functional domains, cognitive-behavioural factors, and pain intensity in patients with PFP. The main findings were: (1) greater pain self-efficacy, as measured by the PSEQ-10, was associated with a decrease in kinesiophobia, and (2) higher levels of kinesiophobia correlated with larger deviations in movement. These findings emphasise the complex interaction between cognitive-emotional and functional factors.

The standardised effect sizes support the central role of pain self-efficacy in explaining kinesiophobia. The standardised coefficient of -0.31 for the PSEQ-10 indicates that increased beliefs about functional capability are associated with clinically relevant reductions in kinesiophobia. The MDP_{mean}, although with a smaller effect, demonstrates an independent contribution, suggesting that biomechanical aspects of movement may play a complementary role alongside cognitive factors in the maintenance of kinesiophobia. This indicates that self-efficacy may encompass or be influenced by pain intensity, functional ability, and movement confidence, supporting the notion of an interconnected cycle in which cognitive beliefs and physical experiences mutually shape fear-avoidant behaviours in participants with PFP. The MDPmean measure also reached conventional significance; therefore, we interpret MDPmean

as a potential indicator of association and recommend that future studies confirm its relevance. Although it is theoretically plausible that this measure captures aspects of movement deviation patterns related to kinesiophobia, it is not yet possible to determine the causal direction or the underlying mechanisms of the relationship between movement pattern deviations and kinesiophobia.

The Role of Self-Efficacy in Kinesiophobia

Pain is a complex phenomenon that includes sensory, cognitive, and emotional-motivational aspects[3]. Cognitive-behavioural responses to pain usually involve three main parts: interpreting a threatening stimulus, activating the sympathetic nervous system, and starting defensive behaviours[1]. Kinesiophobia has been linked to higher pain intensity and poorer knee function[27]. However, no significant links were found between kinesiophobia and other cognitive-behavioural factors, such as pain catastrophising, CPSE, or self-reported pain levels. Our data suggest that patients are likely to perform the task even if they feel fear in situations where the functional demand is apparent and immediate. This implies that the need to complete the task can reduce the usual fear-based avoidance response, highlighting the ongoing interaction between cognitive-behavioural mechanisms and situational requirements.

It is essential to emphasise that self-efficacy plays a key role in the relationship between kinesiophobia and disability[3]. General self-efficacy in the context of chronic pain has been explored to determine whether it reflects domain-specific coping strategies or broader coping capacities and how it relates to functional outcomes[5,22]. Our findings show that self-efficacy, measured by the Pain Self-Efficacy Questionnaire (PSEQ-10), is the main factor linked to kinesiophobia in participants with a history of knee pain.

A relevant question arises: what cognitive-emotional mechanisms are associated with this observation? Notably, solid evidence[28] supports that the relationship between self-efficacy

and kinesiophobia can be explained through multiple mechanisms. Participants with high self-efficacy perceive greater control over pain and movement, which boosts their confidence in moving without increasing their pain. These participants tend to adopt more effective coping strategies that help reduce fear. Self-efficacy also regulates physiological stress by modulating the autonomic nervous system, leading to better pain and anxiety management. Believing in one's abilities can decrease anxiety, which in turn reduces the fear of movement and promotes a more relaxed response to pain[29].

Pain, Fear, and Movement: A Bidirectional Relationship

Kinesiophobia can be lessened through gradual exposure to movement[30]. Biomechanical deviations, such as reduced peak knee flexion and abnormal movement during stair descent or running, are associated with kinesiophobia in participants with PFP. However, it remains unclear whether these altered movements cause kinesiophobia or merely function as protective mechanisms linked to the condition[29]. Although gradual exposure to movement has been shown to decrease kinesiophobia, changes in movement during dynamic tasks may not directly trigger increased fear[30]. Instead, these altered movements could serve as adaptive or protective strategies developed to manage pain. This uncertainty underscores the bidirectional relationship between pain, movement adaptation, and fear, highlighting the need for future research to determine causal relationships.

Movement Deviation and Neural Contributions

Regarding movement function, this is the first study to analyse the complete angular kinematics of the trunk, pelvis, and lower limbs during a unipodal squat assessment concerning kinesiophobia. The MDP employs an artificial neural network with a self-organising map (SOM)[25]. The SOM uses unsupervised learning to measure the multidimensional deviation of

movement compared to a reference distribution. Our findings indicate that movement affects kinesiophobia. Neural circuits that process pain and fear influence movement, potentially increasing the perception of threat during motor tasks. This neurophysiological aspect suggests that kinesiophobia is not solely a behavioural response but also involves changes in pain modulation and motor control, emphasising the importance of a multidimensional approach to management[31].

The observed link between kinesiophobia, self-efficacy, function, and movement deviation is significant, as these factors are seldom studied. Kinesiophobia can lower self-efficacy and lead to movement avoidance, which negatively impacts perceived ability and physical function[32]. Although no significant links were found with variables like catastrophising or CPSE-assessed self-efficacy, these factors still hold clinical importance within a multidimensional pain framework because of their effect on movement behaviour and rehabilitation outcomes.

Limitations and Future Directions

This study has several limitations that should be acknowledged. First, the sample exhibited a sex imbalance, with more women than men; however, the population average aligns with reference values reported in the literature[33]. Sex differences in pain perception[33], coping strategies, and cognitive-emotional responses could restrict the generalisability of the findings to a more balanced population. Second, most participants had a high level of education. Previous research[35] indicates that education and social functioning can influence the relationship between pain intensity and cognitive-behavioural factors. Finally, the results obtained are specific to the assessment of participants with PFP evaluated using the LSD, which limits the ability to track changes across other pain conditions and different movement functions.

We acknowledge that bidirectional stepwise selection can yield sample-dependent models and may introduce bias or overfitting, particularly with a moderate sample size. Our final model was chosen to mitigate multicollinearity and enhance parsimony, but its generalizability requires confirmation in independent cohorts. Although HC3 robust standard errors addressed residual autocorrelation, future studies should validate these findings using pre-registered models and larger samples. Despite these limitations, our analysis offers exploratory insights into how pain self-efficacy and movement deviation patterns independently contribute to kinesiophobia in PFP.

Main Contributions and Implications

By integrating domain-specific self-efficacy assessments with multidimensional movement-deviation metrics, this study advances our understanding of kinesiophobia in PFP. Our results emphasise pain self-efficacy as a key target alongside biomechanical retraining, suggesting that combined interventions may more effectively interrupt the cycle of fear-avoidance. Future research should confirm these findings in larger cohorts and explore neural-based kinematic markers as predictors of treatment outcomes.

CONCLUSION

The findings of this study underscore that self-efficacy, as measured by the PSEQ-10, and movement function, analyzed through the MDP, are critical variables in explaining kinesiophobia within a multivariate analysis model. In conclusion, our findings underscore the multifaceted nature of kinesiophobia. While enhancing self-efficacy appears to offer a promising route to reducing fear-related avoidance, the role of movement deviations is more complex. Rather than viewing all deviations as detrimental, it is crucial to distinguish between

adaptive compensatory movements and maladaptive patterns that may exacerbate kinesiophobia. Future research should further unravel these relationships to inform more targeted clinical interventions.

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3.2 ARTIGO 2 – A ser submetido ao *Journal of Biomechanics*

Task-Evoked versus Recalled Pain and Movement Deviation during the Lateral Step-Down in Patellofemoral Pain

ABSTRACT

Background: Pain influences motor behaviour and performance in musculoskeletal rehabilitation, with chronic conditions like patellofemoral pain showing associations between pain intensity and movement deviations. Functional tests, such as the Lateral Step-Down, allow observation of this interplay; however, it is unclear whether task-evoked pain better reflects movement impairments than retrospective pain reports. This study aimed to determine which self-reported pain measure, retrospective 15-day, baseline, or during movement, is most associated with the Movement Deviation Profile.

Methods: This cross-sectional study included 66 individuals. Participants performed 12 repetitions of the Lateral Step-Down test. Movement deviation was quantified using the Movement Deviation Profile, and pain was assessed via the Numerical Pain Rating Scale at six time points: 15-day retrospective, baseline, and during each set. Linear mixed-effects models were used to test associations between pain and movement, with participant identification as a random effect.

Findings: None of the pain measures, recalled, baseline, or task-evoked, showed significant associations with movement deviation. Although pain during movement showed a weak positive trend with the Movement Deviation Profile, it was not statistically significant. High between-subject variability (ICC $\approx$ 0.85) suggests that individual differences, such as anatomical, behavioral, or cognitive factors, have a greater influence on movement deviation than pain intensity.

Conclusion: Movement deviation during four sets of single-leg squats was not associated with any measure of pain, whether retrospective or experienced during the exercise.

Keywords: Knee, Movement, Pain, Patellofemoral Pain Syndrome

INTRODUCTION

Pain and movement are fundamental factors in musculoskeletal rehabilitation, influencing patient behaviour and perception in both measurable and observable ways. In a clinical setting, pain triggers a range of motor responses, from slight adjustments in activity execution to complete avoidance of movements that cause discomfort[1]. Monitoring pain during exercise is critical, especially for individuals with chronic pain conditions. While pain has traditionally been seen as a signal to stop or avoid activity, emerging evidence suggests that under proper supervision, a certain level of exercise-induced discomfort is acceptable[2]. Real-time pain assessment can help distinguish between acceptable exercise-related discomfort and pain that signals tissue overload or maladaptive movement patterns[3].

In fact, evidence demonstrates that in chronic musculoskeletal disorders like patellofemoral pain (PFP), individuals with greater pain intensity often exhibit more pronounced movement deviations[4]. This finding highlights the interconnection between pain perception and biomechanical alterations. It also emphasises the importance of evaluating movement quality and pain intensity when understanding and managing PFP[5].

By contrast, pain that arises during exercise (i.e., exercise-induced pain) results from a combination of nociceptive input and an individual's tolerance for discomfort. Historically, such exercise-related pain was viewed as a barrier to physical activity. However, recent evidence suggests that controlled exposure to pain during therapeutic exercise can be beneficial, potentially facilitating neural adaptations and promoting functional recovery[3]. Understanding the interplay between pre-existing pain and task-induced pain is therefore essential for devising effective rehabilitation strategies for individuals with chronic musculoskeletal conditions[6]

Given the complexity of PFP, it is essential to assess pain behaviour across different functional tasks and contexts[7]. One commonly used functional assessment for PFP is the Lateral Step-Down (LSD) test, which requires balance and motor control. The LSD test provides a valuable framework for observing how biomechanical factors and pain perception interact during dynamic movement[8,9].

However, it remains unknown whether the pain intensity experienced during a dynamic task like the LSD is more indicative of movement impairments than patients' self-reported pain levels over a more extended period (e.g. the past two weeks). Notably, no study has directly compared task-evoked pain and recalled pain measures concerning movement deviation, highlighting a significant knowledge gap. Clarifying this relationship will help determine whether real-time, task-specific pain responses better reflect underlying movement

dysfunction. Such insight could guide clinicians on whether to prioritise immediate pain monitoring during functional assessments over retrospective pain reports when managing PFP.

Therefore, the primary purpose of this study was to determine which self-reported pain measure is most strongly associated with the Movement Deviation Profile (MDP), a 3D kinematic measure of movement deviation, during the LSD test in individuals with PFP. Specifically, we compared three pain ratings: (a) the average pain intensity over the past 15 days, (b) pain at baseline upon arrival for assessment, and (c) pain reported during each set of movements.

Secondary objectives were: (1) to examine whether pain intensity changes across sets (effect of trial number); (2) to test whether the MDP changes across sets; and (3) to explore whether the association between pain and MDP varies across sets.

METHODS

Study design

A cross-sectional study was designed, approved by the local research ethics committee under protocol number (6.275.002) and conducted at the Human Movement Laboratory between February and December 2024. The study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist to ensure clear and comprehensive reporting.

Participants

The study included 66 individuals aged 18 to 45 years diagnosed with patellofemoral pain. Participants were recruited via flyers and posters distributed at the university, active search strategies, and social media announcements. Eligibility criteria required participants to report a pain intensity of at least 3 out of 10 on the Numerical Pain Rating Scale (NPRS) during at least one of the following activities: prolonged sitting with the knee flexed, stair climbing or descending, running, or squatting. An experienced evaluator evaluated pain presence and intensity.

Exclusion criteria included pregnancy, lower limb surgery, patellar dislocation, meniscal or ligament injuries, heart conditions, use of antidepressant medication, and neurological and/or orthopaedic disorders. Standardised recruitment procedures were rigorously implemented to minimise potential biases, and all assessments were conducted by

consistent protocols by a single trained evaluator. Next, they were simultaneously invited to perform the kinematic assessment.

Procedures

Kinematic Assessment: Lateral Step Down

The LSD test was chosen to analyse movement patterns capable of distinguishing individuals with and without patellofemoral pain. In this test, four sets of movements were performed, each consisting of three consecutive repetitions, resulting in 12 cycles. The squat was standardised to a knee flexion of 60º [8]. A step measuring 18 cm in height, 30 cm in width, and 30 cm in depth was used to perform the task. For the LSD, the medial border of the foot was aligned with the lateral edge of the step, and the contralateral limb was held in the air immediately to the side. The initial position of the limb tested was maximal extension of the knee on the support side.

In contrast, the contralateral limb had to remain with the knee completely extended. The ankle is in maximum dorsiflexion, arms crossed and close to the trunk throughout the execution of the tasks. The volunteer was asked to perform the squats slowly, over two seconds, and immediately return to the initial position over two seconds in each repetition requested. Kinematic data were recorded using the Vicon® motion capture system, which employs 10 cameras operating at 120 Hz. Thirty-five reflective markers were placed on predefined anatomical landmarks based on the Vicon Plug-in-Gait biomechanical model to capture three-dimensional segmental motion. Each movement cycle was defined from the initial full knee extension of the more painful leg until it returned to the same position after completing the squat.

Data from all 12 LSD repetitions were systematically organised in a spreadsheet for further evaluation through the Movement Deviation Profile analysis.

Movement Deviation Profile

The Movement Deviation Profile (MDP) is an artificial intelligence technique that employs self-organising maps, a type of artificial neural network, to analyse time-series data. This method evaluates deviations in an individual's movement patterns by comparing them to a reference group with similar characteristics[11]. Self-organising maps classify input data based

on the spatial distance between individuals and the reference group. This provides a comprehensive metric that condenses and simplifies kinematic data for more straightforward interpretation and analysis[12].

Kinematic data from the LSD test of 66 individuals with PFP were compared to a reference group of 87 asymptomatic participants. This comparison established a strong baseline, where a larger Euclidean distance indicated greater movement deviation in the PFP group compared to the asymptomatic group. The MDPmean is the single number summary of the MDP calculated as the mean of the MDP time series.

Pain Assessment

The Numeric Pain Rating Scale was used to measure individuals' pain levels. This scale ranges from 0 to 10, with higher scores indicating greater pain intensity, and has been recognised as the most sensitive and stable tool for assessing self-reported pain13. The NPRS was utilised at six distinct time points:

- NPRS_15days: to evaluate pain reported for the two weeks prior to the kinematic assessment;
- NPRS_baseline: to evaluate pain reported immediately before the start of the kinematic assessment;
- NPRS_series: to evaluate pain reported immediately after each of the four sets of three unipodal squats.

Statistical Analysis

All statistical analyses were performed in R (version 4.3.2) using the lme4, lmerTest, and performance packages. Linear mixed-effects models were employed to examine the association between pain intensity and MDP during the LSD task. The MDP was entered as the dependent variable, while pain measures were considered as fixed effects, and participant ID was modelled as a random intercept to account for repeated measures across sessions.

Four analytical approaches were implemented. First, a model assessed the association between task-evoked pain (NPRS_series) and MDP across four LSD sessions (MDP ~ NPRS_series + session + (1|ID)). Second, a model evaluated whether baseline pain before each session (NPRS_baseline) predicted MDP (MDP ~ NPRS_baseline + session + (1|ID)). Third, a model tested the relationship between recalled pain over the past 15 days (NPRS_15days) and MDP (MDP ~ NPRS_15days + session + (1|ID)). Finally, a joint model including all

standardized pain variables (z-scores) was used to compare their relative influence on movement deviation (MDP ~ zNPRS_15days + zNPRS_baseline + zNPRS_series+ session + (1|ID)).

Model assumptions were checked through visual inspection of residuals, normality, and homoscedasticity tests using the DHARMa package. Effect sizes were expressed as standardized coefficients (β) with 95% confidence intervals. Marginal and conditional R^2 values were used to estimate the variance explained by fixed effects and the full model, respectively. The intraclass correlation coefficient (ICC) quantified the variance proportion attributed to individual differences. A two-tailed α of 0.05 was adopted as the threshold for statistical significance.

RESULTS

Overview

A total of 66 individuals with patellofemoral pain (52 women and 14 men) completed all four sessions of the LSD assessment, yielding 264 valid observations for analysis. Table 1 summarises the participants' demographic and clinical characteristics. The mean age of the sample was 25.56 years (95% CI: 24.10 to 27.01), with women and men presenting similar age distributions. As expected, men exhibited higher body mass (75.50 kg [70.03–80.96]) and height (1.76 m [1.72–1.79]) than women (61.40 kg [58.60–64.21]; 1.63 m [1.61–1.65]).

Regarding pain intensity, the average recalled pain over the previous 15 days (NPRS_15days) was 5.55 (95% CI: 5.17–5.92), reflecting a moderate level of perceived discomfort. Baseline pain measured immediately before testing was low (1.53 [1.04–2.02]), whereas task-evoked pain increased progressively across sessions—from 2.32 (1.77–2.87) in the first set to 3.59 (3.00–4.18) in the fourth. This gradual increase confirmed the expected pain provocation pattern during repeated unipodal squats, although the absolute values remained within a tolerable range.

The MDPmean demonstrated remarkable consistency across the four sessions, with values ranging from 11.29° to 11.89°. This stability suggests that participants maintained similar movement deviation across repetitions despite the incremental rise in pain intensity throughout the task. No visible trends indicated progressive deterioration or improvement in kinematic performance, aligning with the absence of session effects in subsequent mixed-model analyses.

Linear mixed-effects modeling was employed to examine the association between pain and movement deviation across conditions. All models included session as a fixed effect and participant as a random intercept to account for within-subject correlations. Model assumptions were satisfied across all analyses, with residuals showing normal distribution, homoscedasticity, and absence of influential outliers. The conditional R^2 values (≈ 0.85) indicated excellent overall model fit, while marginal R^2 values (0.6–1.8%) revealed that fixed effects explained only a small proportion of the total variance. Intraclass correlation coefficients (ICC $\approx$ 0.84–0.85) confirmed that most variability in MDPmean was attributable to interindividual differences rather than within-subject fluctuations.

Table 1. Demographic, NPRS and MDPmean values.

Variables	Overall mean (95% CI) n=66	Men mean (95% CI) n=14	Women mean (95% CI) n=52
Age (years)	25.56 (24.10 to 27.01)	25.92 (22.43 to 29.42)	25.46 (23.80 to 27.11)
Body mass (kg)	64.39 (61.58 to 67.21)	75.50 (70.03 to 80.96)	61.40 (58.60 to 64.21)
Height (m)	1.66 (1.63 to 1.68)	1.76 (1.72 to 1.79)	1.63 (1.61 to 1.65)
NPRS_15days	5.55 (5.17 to 5.92)	5.14 (4.06 to 6.23)	5.65 (5.26 to 6.05)
NPRS_baseline	1.53 (1.04 to 2.02)	1.79 (0.65 to 2.92)	1.45 (0.90 to 2.020
NPRS_serie1	2.32 (1.77 to 2.87)	2.29 (0.94 to 3.63)	2.33 (1.70 to 2.95)
NPRS_serie2	2.80 (2.23 to 3.37)	2.93 (1.52 to 4.33)	2.77 (2.13 to 3.41)
NPRS_serie3	3.29 (2.72 to 3.86)	3.29 (1.85 to 4.73)	3.29 (2.65 to 3.29)
NPRS_Serie 4	3.59 (3.00 to 4.18)	3.36 (1.84 to 4.87)	3.65 (2.99 to 4.31)
MDP_{mean} Serie 1 (º)	11.89 (11.30 to 12.48)	12.42 (11.02 to 13.81)	11.74 (11.07 to 12.41)
MDP_{mean} Serie 2 (º)	11.49 (11.09 to 12.26)	11.90 (11.87 to 12.10)	11.62 (10.92 to 12.31)
MDP_{mean} Serie 3 (º)	11.29 (11.18 to 12.44)	12.22 (10.67 to 13.76)	11.70 (11.00 to 12.41)
MDP_{mean} Serie 4 (º)	11.52 (11.41 to 12.60)	12.83 (11.53 to 14.13)	11.78 (11.10 to 12.46)

Legend: NPRS: Numerical Pain Rating Scale; MDPmean: Mean of Movement Deviation Profile.

Task-Evoked Pain and Movement Deviation

The primary model investigated whether pain intensity reported immediately after each set (NPRS_series) was associated with MDPmean. Results revealed a non-significant positive association between task-evoked pain and MDPmean (β = +0.13; 95% CI: −0.02 to 0.29; p = 0.098), suggesting a weak tendency for higher pain to accompany greater movement deviation, though without statistical support. The fixed effect of session was also non-significant (F(3, 208.8) = 1.18; p = 0.319), indicating stability in MDP values across the four sets. The model demonstrated strong overall fit (R^2_conditional = 0.847) but a low fixed effect contribution (R^2_marginal = 0.018). Decomposition of variance showed substantial heterogeneity between participants (ICC = 0.844), underscoring that individual differences were the predominant

source of MDP variability. Diagnostic plots confirmed homogeneity of variance (p = 0.369), absence of influential cases, and acceptable residual uniformity (Kolmogorov–Smirnov p = 0.042).

Further decomposition into within- and between-subject effects supported these findings. Neither within-person deviations (β = +0.10; 95% CI: −0.11 to 0.30; p = 0.349) nor between-person averages (β = +0.18; 95% CI: −0.06 to 0.43; p = 0.145) were significantly related to MDP, indicating that both acute fluctuations in pain and general pain levels among participants failed to predict movement deviation. The explained variance remained small (R^2_marginal = 0.031; R^2_conditional = 0.849), reinforcing the predominance of individual factors unrelated to pain intensity.

Table 2. Association between task-evoked pain (NPRS_series) and MDPmean

Model / Predictor	β (95% CI)	t(df)	p-value	R^2marginal	R^2conditional	ICC
Model 1 – Concurrent association				0.018	0.847	0.844
NPRS_series	+0.13 (−0.02 to 0.29)	1.66 (257)	0.098			
Session (1–4)	-	F(3, 209), 1.18	0.319			
Model 2 – Within/Between decomposition				0.031	0.849	0.844
NPRS_series(within-subject)	+0.10 (−0.11 to 0.30)	0.94 (194)	0.349			
NPRS_series(between-subject)	+0.18 (−0.06 to 0.43)	1.46 (64)	0.145			
Session (1–4)	-	F(3, 194), 1.16	0.328			

Note. Model 1 tested the concurrent association between pain intensity during movement and MDP; Model 2 separated within- and between-subject variance components. β = standardized coefficient. ICC = intraclass correlation coefficient.

Legend: β = coefficient. ICC = intraclass correlation coefficient.

Baseline Pain and Movement Deviation

In the model examining baseline pain before the task (NPRS_baseline), no significant association emerged between pre-movement pain intensity and MDPmean (β = +0.11; 95% CI: −0.17 to 0.39; p = 0.451). Likewise, the effect of the session was not significant (F(3, 195) = 1.37; p = 0.255). The fixed effects explained approximately 1% of MDPmean variance (R^2_marginal = 0.010), whereas the total model, including random effects, accounted for 85% (R^2_conditional = 0.849). The ICC of 0.848 highlighted that differences in MDP were driven mainly by interindividual variation rather than by fluctuations in baseline pain. Model diagnostics confirmed adequate fit, with residuals showing normal distribution and homoscedasticity (p = 0.361) and no meaningful deviations or outliers (Kolmogorov–Smirnov p = 0.051).

Table 3. Association between baseline pain (NPRS_baseline) and MDPmean

Model / Predictor	β (95% CI)	t(df)	p-value	R^2marginal	R^2conditional	ICC
Model – Baseline pain				0.010	0.849	0.848
NPRS_baseline (baseline pain)	+0.11 (−0.17 to 0.39)	0.76 (257)	0.451			
Session (1–4)	-	F(3, 195), 1.37	0.255			

Note. The model tested the association between pain intensity reported immediately before each session (baseline pain) and MDP.

Legend: β = coefficient. ICC = intraclass correlation coefficient.

Recalled Pain and Movement Deviation

When recalled pain intensity over the previous 15 days (NPRS_15days) was used as a predictor, no significant effect on MDP was observed (β = +0.10; 95% CI: −0.27 to 0.47; p = 0.585). As in prior models, the session effect was not significant (F(3, 195) = 1.37; p = 0.255), suggesting consistent performance across trials. The explained variance by fixed effects remained minimal (R^2_marginal = 0.006), while the overall model fit was strong (R^2_conditional = 0.849). The ICC of 0.848 again confirmed the dominance of between-subject differences.

Model validation tests indicated normal residual distribution (Kolmogorov–Smirnov p = 0.085), homoscedasticity (p = 0.363), and absence of outlier influence.

Table 4. Association between recalled pain over 15 days (NPRS_15days) and Movement Deviation Profile (MDP)

Model / Predictor	β (95% CI)	t(df)	p-value	R²marginal	R²conditional	ICC
Model – Recalled pain (15 days)				0.006	0.849	0.848
NPRS_15days (recalled pain)	+0.10 (−0.27 to 0.47)	0.55 (257)	0.585			
Session (1–4)	-	F(3, 195), 1.37	0.255			

Note. The model tested the association between pain intensity recalled over the previous 15 days and MDP.
Legend: β = coefficient. ICC = intraclass correlation coefficient.

Comparative Model Including All Pain Predictors

To directly compare the relative contribution of each pain measure, a joint model was constructed with all pain variables standardised (z-scores). None of the predictors reached statistical significance after mutual adjustment: z-NPRS_15days (β = +0.04; p = 0.902), z-NPRS_baseline (β = −0.02; p = 0.956), and z-NPRS_series (β = +0.31; p = 0.162). Despite the lack of significance, the standardized coefficient for pain during the movement (z-NPRS_series) was the largest in magnitude, suggesting a trend toward stronger association with movement deviation compared to the recalled or baseline measures. The session effect remained non-significant (F(3, 202.4) = 1.17; p = 0.321).

The model exhibited R^2_marginal = 0.018 and R^2_conditional = 0.850, with an ICC of 0.847, indicating that approximately 85% of the total variance in MDP stemmed from interindividual factors. Variance Inflation Factors (VIF < 2) confirmed the absence of problematic multicollinearity, ensuring the stability of coefficient estimates. Diagnostic analyses demonstrated appropriate convergence, normal residual distribution (Kolmogorov–Smirnov p = 0.064), and homoscedasticity (p = 0.369).

Table 5. Comparative model including all standardized pain predictors (z-NPRS15_days, z-NPRSbaseline, z-NPRSseries) on Movement Deviation Profile (MDP)

Model / Predictor	β (95% CI)	t(df)	p-value	R^2marginal	R^2conditional	ICC
Model – Combined pain predictors				0.018	0.850	0.847
z-NPRS_15days (recalled pain)	+0.04 (−0.54 to 0.62)	0.12 (255)	0.902			
z-NPRS_baseline (baseline pain)	−0.02 (−0.66 to 0.62)	−0.05 (255)	0.956			
z-NPRS_series (task-evoked pain)	+0.31 (−0.12 to 0.74)	1.40 (255)	0.162			
Session (1–4)	-	F(3, 202), 1.17	0.321			

Note. The model tested the simultaneous influence of the three standardized pain indices on MDP.

β = standardized coefficient. ICC = intraclass correlation coefficient.

No evidence of multicollinearity was detected (all VIF < 2).

Summary of Findings

Across all analyses, none of the pain measures, whether recalled, baseline, or task-evoked, showed statistically significant associations with movement deviation. The direction of coefficients consistently suggested a weak positive relationship between greater pain and higher MDP values, particularly for pain experienced during movement; however, these trends did not reach conventional significance thresholds. The dominance of between-subject variability, reflected by ICC values around 0.85.

Overall, these findings suggest that while pain and movement are conceptually intertwined, real-time biomechanical deviations in individuals with patellofemoral pain are not directly explained by self-reported pain magnitude, whether measured acutely or retrospectively.

DISCUSSION

The present study examined whether different pain measures, including retrospective (NPRS_15days), baseline (NPRS_baseline), and task-evoked pain (NPRS_series), are associated with movement deviation profile during the LSD task in individuals with patellofemoral pain. According to the results, none of the pain indices showed a statistically

significant association with the MDP. Although pain experienced during movement presented the highest standardised coefficient, indicating a trend toward a stronger association, this relationship was inconclusive. These findings underscore the complex relationship between pain and movement deviation, emphasising that pain alone does not explain variations in movement performance. Other underlying factors, such as specific motor learning demands, may play a more significant role by influencing movement adaptation and compensation during task execution[1].

Pain is often considered a limiting factor in motor performance, as it can affect both movement execution and the ability to adapt to motor practice[14]. This finding may be partly explained by adaptive mechanisms that occur in response to motor activity[15], which can enhance the performance of the practised skill depending on factors such as task complexity and motivational conditions[16,17]. Although pain may influence motor performance, either through redistribution of muscle activity or avoidance of painful movements, its effects may be subtle and may not substantially affect task execution[18,19].

Indeed, the process of motor adaptation can promote the automatization of movements, reducing the need for conscious attention to factors such as pain and thereby allowing greater fluidity during execution[20]. In our study, this adaptive process over the course of the sessions may have diminished the perception of discomfort associated with movement, enabling participants to maintain their motor patterns even in the presence of a potentially limiting factor, such as pain. However, the movement analyzed, characterized as a closed kinetic chain exercise, imposes additional constraints on the ability to modify motor patterns. Closed kinetic chain movements involve interdependence among the body segments, such that any alteration in one joint or segment may be compensated for or restricted by other segments acting synergistically and in coordination[21,22]. In this context, although neural adaptation may have contributed to increased pain tolerance, the structural characteristics of closed kinetic chain movements restrict the degree of motor modification possible, as movement execution is largely determined by the complex interaction of multiple joints moving simultaneously. This suggests that while adaptation facilitates task execution and pain management, it does not necessarily lead to substantial or lasting alterations in the motor pattern[1,22].

The absence of significant changes in movement deviation in the context of mild pain (until 3.4 points at NPRS)[23] is consistent with current evidence indicating that low pain intensity may not be sufficient to elicit overt compensatory motor strategies or detectable alterations in movement execution. Mild pain intensity in individuals with patellofemoral pain typically does not result in substantial or overt alterations in movement patterns. The literature

demonstrates that when pain is mild, as observed in this study across almost all unipodal squat series, individuals with patellofemoral pain are generally able to maintain their habitual movement strategies during functional activities such as walking, running, stair ascent, and squatting, with only minor or undetectable kinematic changes[24-26]. Studies specifically investigating the effect of mild pain on biomechanics and quadriceps function show that while there may be a reduction in quadriceps muscle activation and increased arthrogenic muscle inhibition, gross lower limb biomechanics and movement patterns remain largely unchanged during dynamic tasks[24].

Furthermore, studies[26,27] indicate that the magnitude of kinematic differences between those with patellofemoral pain and pain-free controls is small to moderate, and these differences are more pronounced with higher pain levels[26,27]. There is a strong positive correlation between pain intensity and the number of altered kinematic patterns, suggesting that mild pain is less likely to elicit compensatory movement strategies or detectable changes in overall movement execution[27]. In summary, mild pain intensity in patellofemoral pain is associated with preserved movement patterns and only subtle neuromuscular adaptations, with significant biomechanical changes typically emerging only as pain severity increases[24-27]. Therefore, the stability of movement observed in the presence of mild pain likely reflects both the limited intensity of pain and the ability of the neuromuscular system to compensate without necessitating significant changes in movement execution[25]. This aligns with the pain adaptation theory, which posits that protective motor strategies are more pronounced as pain intensity increases, but may be negligible or undetectable when pain is mild[27].

An important point when interpreting the present findings is the lack of association between pain and movement deviation during the lateral step-down task, which contrasts with previous studies[28,29] demonstrating a strong correlation between pain intensity and gait deviations in women with patellofemoral pain. Task-specific factors may explain this apparent discrepancy. Walking is a cyclical, everyday activity that allows for distributed compensatory adjustments across multiple joints and planes of movement, making it more sensitive to the influence of pain. In contrast, the lateral step-down is a constrained, closed-chain exercise that places greater demands on postural control and has limited degrees of freedom, where pain may be perceived but does not necessarily translate into measurable kinematic deviations[30]. Moreover, the nature of patellofemoral pain itself, often exacerbated by dynamic, repetitive loading during gait, may contribute to stronger associations in walking compared to isolated functional tests. Taken together, these findings suggest that the relationship between pain and

motor deviation is context-dependent, highlighting the importance of evaluating multiple tasks to understand how pain shapes motor behavior in patellofemoral pain fully.

On the other hand, individuals' ability to cope with pain through various coping strategies may also have contributed to the consistency of the relationship between pain and movement. Strategies such as cognitive reappraisal of pain or focusing attention on task execution, for example, can reduce the perception of discomfort and minimise its impact on motor performance[31,14]. Repeated exposure to exercise enables individuals to maintain their performance over time, with pain being perceived as less of an obstacle. Furthermore, the literature suggests that cognitive-behavioural resilience, associated with emotional detachment from pain, facilitates adaptation and enables efficient movement execution even in the presence of discomfort[14,32].

From a general perspective, pain is recognised as a complex and multifactorial phenomenon, leading to considerable variability in its manifestation[33]. While the biomedical model tends to focus primarily on the physical and biomechanical causes of pain, the biopsychosocial model broadens understanding by including psychological and social factors that may play a significant role in the pain experience[34]. In this context, cognitive-behavioral factors, such as self-efficacy[35] and kinesiophobia, may help explain the lack of association between movement and retrospective pain, as fear of movement can intensify pain perception and limit functionality[36]. Although movement may not necessarily be the primary factor associated with retrospective pain, it remains a key element to be assessed, since inactivity and fear of movement can contribute to pain chronicity and deterioration of quality of life[37].

This study has some limitations related to potential confounding factors, such as participants' physical activity level and pain characteristics, including duration and laterality, which may have influenced the results results. However, standardised protocols to evaluate pain and movement, and minimum pain criteria were applied to reduce bias. The cross-sectional design also limits causal interpretation. Despite these constraints, the measures adopted ensured consistent and reliable associations between pain and movement deviation patterns, providing a basis for future studies.

CONCLUSION

The results of this study did not demonstrate that pain, as measured by the NPRS, has a significant impact on movement deviation patterns across four sets of unipodal squats. These findings are consistent with recent evidence suggesting that, in functional tasks such as the unipodal squat, pain alone may not be the primary determinant of kinematic alterations or motor

control, highlighting the need to consider other factors, such as perceived disability, compensatory motor strategies, and cognitive-behavioural variables.

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4. CONSIDERAÇÕES FINAIS

Os resultados deste estudo evidenciam a complexidade das interações entre dor, padrão do movimento e fatores cognitivos-comportamentais em indivíduos com dor femoropatelar. Embora a dor autorreferida não tenha apresentado associação significativa com o desvio do padrão de movimento durante o agachamento unipodal, a análise multivariada destacou a autoeficácia, mensurada pelo *Pain Self-Efficacy Questionnaire*, e a função do movimento, representada pelo *Movement Deviation Profile*, como variáveis relevantes na explicação da cinesiofobia. Esses achados reforçam o caráter multifatorial da dor femoropatelar e sugerem que a dor, isoladamente, pode não ser o principal determinante na modulação do padrão de movimento, uma vez que essa associação se mostrou restrita. A autoeficácia emerge, portanto, como um mediador cognitivo-comportamental fundamental, influenciando a forma como o indivíduo interpreta e responde às experiências dolorosas, bem como sua disposição para se engajar em atividades físicas. Nesse contexto, é crucial que a interpretação dos desvios de movimento durante a tarefa analisada vá além de uma perspectiva puramente mecânica. Deve-se distinguir entre padrões adaptativos e compensatórios, que podem representar respostas funcionais ao desconforto.

Dessa forma, intervenções clínicas mais eficazes devem integrar não apenas o controle da dor, mas estratégias voltadas ao fortalecimento da autoeficácia, promovendo a confiança do paciente em sua capacidade de se mover com segurança, aliadas à reeducação motora individualizada, quando necessária. Essa abordagem integrada pode favorecer não apenas a redução da cinesiofobia, mas também a restauração da função e da autonomia no manejo da dor.

Um ponto importante a se destacar é que as variáveis cognitivos-comportamentais, embora frequentemente apresentem correlações aparentes, devem ser examinadas com rigor metodológico, uma vez que sua coexistência não implica, por si só, uma relação causal. Cada uma dessas variáveis pode ser modulada por fatores individuais, contextuais e ambientais distintos, o que exige cautela na interpretação de suas interações.

Por fim, considerando seu papel central na modulação do comportamento diante da dor e na recuperação funcional, a autoeficácia deve ser reconhecida e incorporada como um desfecho principal em futuros estudos que investiguem os fatores determinantes no desenvolvimento e na persistência da dor femoropatelar.

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6. APÊNDICES

APÊNDICE A – PROCESSO DE SUBMISSÃO DE ARTIGO CIENTÍFICO 1

De: em.clbi.0.964b08.624d81cd@editorialmanager.com <em.clbi.0.964b08.624d81cd@editorialmanager.com> em nome de Clinical Biomechanics <em@editorialmanager.com>
Enviado: terça-feira, 23 de setembro de 2025 10:38
Para: Paulo Roberto Garcia Lucareli <plucareli@outlook.com>
Assunto: Decision on submission to Clinical Biomechanics

Manuscript Number: **CLBI-D-25-00580**

Pain, Fear, and Movement: Cognitive-Behavioural Connections in Patellofemoral Pain

Dear Professor Lucareli,

Thank you for submitting your manuscript to Clinical Biomechanics.

I have completed my evaluation of your manuscript. The reviewers recommend reconsideration of your manuscript following minor revision and modification. I invite you to resubmit your manuscript after addressing the comments below. Please resubmit your revised manuscript by **Oct 14, 2025**.

APÊNDICE B – TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

TCLE - Termo de Consentimento livre e esclarecido para Participação em Pesquisa Clínica:

Nome do participante: _____

Endereço: _____

Telefone para contato: _____ Cidade: _____ CEP: _____

E-mail: _____

1. **Título do Trabalho Experimental: ‘’**Perfil biomecânico (descrição dos movimentos realizados pelo corpo) e psicométrico (condição que associa características psicológicas ao movimento) de participantes com dor femoropatelar (condição dolorosa na região anterior do joelho)’’: estudo transversal (estudo observacional onde será realizado apenas uma avaliação da condição atual do participante de pesquisa).

2. **Objetivo:** Relacionar as características cinesiofóbicas (condição que associa dor ao movimento) e de confiança com possíveis alterações biomecânicas (como se movimentam as juntas do corpo) que podem influenciar no desempenho durante o Step Down Lateral (agachamento realizado com apenas uma perna).

3. **Justificativa:** Devido aos poucos estudos existentes na literatura, os atuais achados referentes a avaliação da dor femoropatelar (dor anterior no joelho) enfatizam (destacam) a necessidade de se avaliar o quadro clínico da dor e sua associação com as características psicológicas em pacientes com dor femoropatelar durante a realização de diferentes atividades (testes físicos que simulam atividades de impacto e/ou movimentos do dia a dia). Logo, é importante compreender se a dor na articulação femoropatelar durante a execução de um agachamento unipodal pode estar associado às escalas psicológicas (características de dor e confiança). Deste modo, correlacionar (associar) aspectos psicológicos e biomecânicos (características relacionadas aos movimentos do corpo humano) pode auxiliar clínicos (profissionais da área da saúde) a compreender ajustes necessários importantes na avaliação de pacientes com dor femoropatelar.

4. **Procedimentos da Fase Experimental:** Você está sendo convidado(a) a participar deste estudo no qual será realizada uma avaliação que durará cerca de 2 horas. Na sua participação, inicialmente você responderá a um questionário de identificação (nome, idade, peso, altura, histórico de lesões, volume de treino semanal). Logo após, você responderá três escalas (questionários) à respeito da sua percepção (forma como você lida com a situação) de medo e confiança com relação ao seu quadro de dor. Em seguida, você será submetido a uma análise cinemática (analisar como se movimentam suas pernas e braços e as juntas do seu corpo) em diferentes testes (testes físicos que simulam atividades de impacto e/ou movimentos do cotidiano). Para captura dos seus movimentos durante a avaliação biomecânica será colado em você, com fita antialérgica, 35 marcadores retroreflexivos (esferas revestidas com material que reflete a luz) em diversos pontos do seu corpo. O teste funcional a que você será submetido será: agachar com uma perna só durante dezesseis vezes. Durante a repetição de cada teste haverá um momento de descanso baseado na individualidade de cada participante de pesquisa, onde você será questionado ao fim de cada bloco de quatro repetições sobre seu nível de dor. Você será monitorado durante todo o teste.

5. Desconforto ou Riscos Esperados: Durante o preenchimento do questionário você pode se sentir desconfortável para responder determinada(s) pergunta(s). Durante a realização dos testes físicos você estará sem camisa e usando shorts no caso dos homens e top e shorts no caso das mulheres, isso pode te trazer algum constrangimento. No decorrer dos agachamentos você corre o risco, mesmo que improvável de queda, dor, desconforto muscular, sensação de tontura, mal-estar. Pela utilização de uma fita adesiva dupla face, mesmo que hipoalérgica, corre-se o risco de alguma reação alérgica ao material que será colado em sua pele. Para melhor adesão da fita adesiva ao seu corpo, seus pêlos serão raspados.

6. Medidas protetivas aos riscos: Para diminuir o risco de qualquer incidente durante a aplicação do teste, os participantes de pesquisa receberão orientações e esclarecimentos antes da realização de cada procedimento. Para minimizar os riscos de constrangimentos por parte dos participantes de pesquisa ao responderem os questionários, os mesmos foram elaborados com perguntas simples, objetivas e diretas, e, que dizem respeito apenas aos hábitos cotidianos e/ou a percepção individual do participante de pesquisa em relação a sua própria condição. Para evitar qualquer constrangimento por parte dos participantes de pesquisa, devido as vestimentas que serão utilizadas, todo o procedimento de avaliação será realizado em um local reservado onde só ficarão presentes os avaliadores pertencentes ao estudo. Para evitar o risco o risco de alguma reação alérgica ao material dos marcadores corporais, será utilizado material hipoalérgico, isto é, material que não cause alergias ou qualquer outro tipo de evento adverso. Para evitar o risco de corte ou de alergia durante o processo de retirada de pêlos, será utilizada uma máquina de barbear hipoalérgica apropriada que não agrida a sua pele. Para evitar o risco de quedas, dor ou desconforto muscular, a aplicação dos testes será baseada na individualidade física e funcional de cada participante de pesquisa. Caso ocorra qualquer tipo de mal estar durante os procedimentos, ou, qualquer uma das intercorrências citadas no tópico acima, a pesquisa será interrompida e o participante será encaminhado para avaliação ou tratamento no ambulatório médico da UNINOVE campus Vergueiro, que se encontra no mesmo local onde o estudo será realizado, para que sejam tomados os devidos cuidados. Durante as avaliações os participantes estarão sendo acompanhados pelo fisioterapeuta responsável pelo projeto, que intervirá se houver necessidade. Além disso, todos os membros da equipe que realizarão a aplicação dos testes serão treinados para que os riscos sejam minimizados.

7. Benefícios da Pesquisa: Os benefícios do estudo serão diretos. O participante de pesquisa receberá de forma gratuita e verbal orientações para possível melhora do quadro de dor.

8. Métodos Alternativos Existentes: Não se aplica.

9. Retirada do Consentimento: O participante de pesquisa tem a liberdade de retirar seu consentimento e deixar de participar da pesquisa a qualquer momento, sem nenhum lucro ou prejuízo.

10. Garantia do Sigilo: Os pesquisadores asseguram a privacidade dos participantes referente aos dados sigilosos envolvidos na pesquisa.

11. Formas de Ressarcimento das Despesas decorrentes da Participação na Pesquisa: Não há nenhum tipo de custos para o(a) senhor(a) relacionado aos exames, consultas deste projeto. A equipe dessa pesquisa garante o ressarcimento de possíveis despesas pessoais, como transporte e lanche, seu e de seu acompanhante, decorrentes da participação nesse estudo. Também não há compensação financeira relacionada à sua participação, ou seja, você não irá

receber uma verba para participar do estudo. Se existir qualquer despesa adicional relacionada aos procedimentos experimentais, ela será absorvida pelo orçamento da pesquisa.

12. Local da Pesquisa: Laboratório de Análise do Movimento NAPAM da UNINOVE, localizado na Rua Vergueiro, n° 235/249. Liberdade. São Paulo – SP / CEP 01525-000. Tel.: (11) 33859241.

13. Comitê de Ética em Pesquisa (CEP) é um colegiado interdisciplinar e independente, que deve existir nas instituições que realizam pesquisas envolvendo seres humanos no Brasil, criado para defender os interesses dos participantes de pesquisas em sua integridade e dignidade e para contribuir no desenvolvimento das pesquisas dentro dos padrões éticos (Normas e Diretrizes Regulamentadoras da Pesquisa envolvendo Seres Humanos – Res. CNS nº 466/12 e Res. CNS 510/2016). O Comitê de Ética é responsável pela avaliação e acompanhamento dos protocolos de pesquisa no que corresponde aos aspectos éticos. **Endereço do Comitê de Ética da Uninove: Rua. Vergueiro nº 235/249 – 12º andar – Liberdade – São Paulo – SP CEP. 01504-001. Telefone: 3385-9010. E-mail:** comitedeetica@uninove.br
Horários de atendimento do Comitê de Ética: segunda-feira a sexta-feira – Das 11h30 às 13h00 e Das 15h30 às 19h00
14. Nome Completo e telefones dos Pesquisadores para Contato: Prof. Dr. Paulo Roberto Garcia Lucareli - (011) 9 4157-9003, Otávio Henrique Cardoso Leite - (034) 9 9956-9939.

15. Informações: O participante de pesquisa tem garantia que receberá respostas a qualquer pergunta ou esclarecimento de qualquer dúvida quanto aos procedimentos, riscos, benefícios e outros assuntos relacionados com a pesquisa. Também os pesquisadores supracitados assumem o compromisso de proporcionar informação atualizada obtida durante o estudo, ainda que esta possa afetar a vontade do participante de pesquisa em continuar participando.

São Paulo, de de 2024.
16. Consentimento Pós-Informação:

Eu, _____, após leitura e compreensão deste termo de informação e consentimento, entendo que minha participação é voluntária, e que posso sair a qualquer momento do estudo, sem prejuízo algum. Confirmo que recebi uma via deste termo de consentimento, e autorizo a realização do trabalho de pesquisa e a divulgação dos dados obtidos somente neste estudo no meio científico.

_____
Assinatura do Participante
(Todas as folhas devem ser rubricadas pelo participante da pesquisa)

17. Eu, Otávio Henrique Cardoso Leite, certifico que:
a) Esta pesquisa só terá início após a aprovação do(s) referido(s) Comitê(s) de Ética em Pesquisa o qual o projeto foi submetido.
b) Considerando que a ética em pesquisa implica o respeito pela dignidade humana e a proteção devida aos participantes das pesquisas científicas envolvendo seres humanos;
c) Este estudo tem mérito científico e a equipe de profissionais devidamente citados neste termo é treinada, capacitada e competente para executar os procedimentos descritos neste termo;

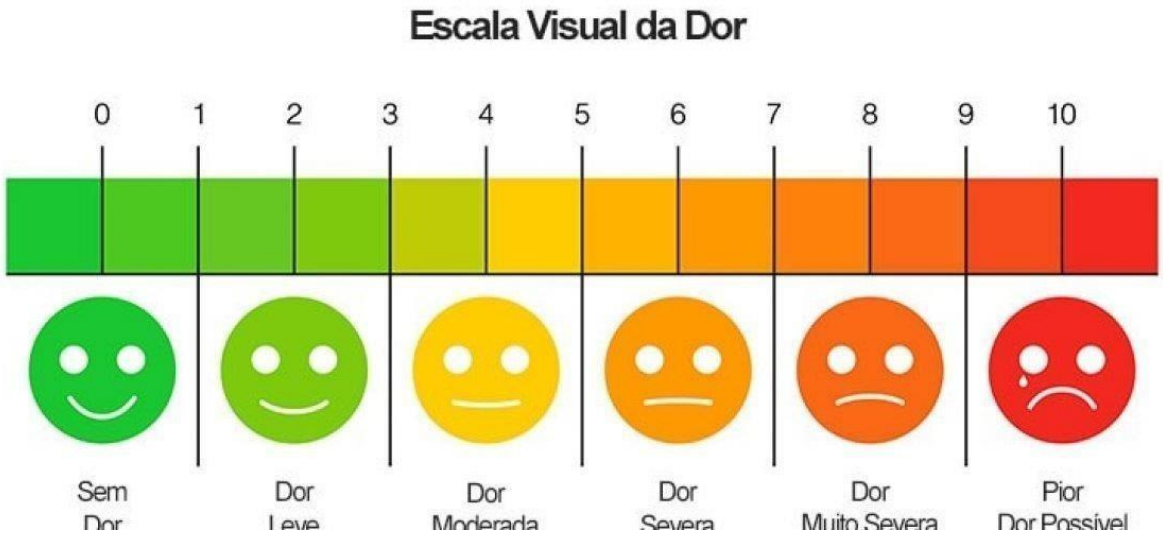
_____
Otávio Henrique Cardoso Leite
Pesquisador Responsável

APÊNDICE C – QUESTIONÁRIO DE IDENTIFICAÇÃO DO PARTICIPANTE

Questionário de Identificação do Paciente	NAPAM HUMAN MOVEMENT LABORATORY 
1) Dados Pessoais	
Nome Completo:	
Data de Nascimento:	Idade:
Peso:	Altura:
Celular:	
E-mail:	
2) Lesões Prévias em Membros Inferiores? ( ) SIM ( ) NÃO Se sim, qual?	
3) Medicamentos: ( ) SIM ( ) NÃO Se sim, qual?	
4) Já teve luxação patelar?	( ) SIM ( ) NÃO
5) Sente dor em qual joelho?	( ) D ( ) E
6) Se sua dor é bilateral, qual joelho doi mais?	( ) D ( ) E

7. ANEXOS

ANEXO A – ESCALA VISUAL ANALÓGICA DE DOR (NPRS)



Fonte: https://soniatakara.com.br/wp-content/uploads/elementor/thumbs/escala-visual-da-dor-bruna-pz3v0mc926804sqhbxx01dnun1px5wo4jt6pymk8zs.jpg

ANEXO B - QUESTIONÁRIO INTERNACIONAL DE ATIVIDADE FÍSICA (IPAQ)

ANEXO
Questionário Internacional de Atividade Física – IPAQ
Forma longa, semana usual /normal, adaptado por Benedetti *et al.*[12]

As perguntas estão relacionadas ao tempo que você gasta fazendo atividade física em uma semana **normal/habitual**

Para responder às questões lembre que:

- atividades físicas **vigorosas** são aquelas que precisam de um grande esforço físico e que fazem respirar **muito** mais forte que o normal.
- atividades físicas **moderadas** são aquelas que precisam de algum esforço físico e que fazem respirar **um pouco** mais forte que o normal.
- atividades físicas **leves** são aquelas em que o esforço físico é normal, fazendo com que a respiração seja normal.

DAS QUESTÕES 1B a 4C O QUADRO ABAIXO DEVERÁ ESTAR DISPONÍVEL PARA PREENCHIMENTO

Dia da semana	Tempo horas/Min.			Dia da semana	Tempo horas/Min.		
	manhã	tarde	noite		manhã	tarde	noite
2ª-feira				6ª-feira			
3ª-feira				Sábado			
4ª-feira				Domingo			
5ª-feira				XXXXXX			

DOMÍNIO 1 – ATIVIDADE FÍSICA NO TRABALHO: Este domínio inclui as atividades que você faz no seu trabalho remunerado ou voluntário, e as atividades na universidade, faculdade ou escola (trabalho intelectual). Não incluir as tarefas domésticas, cuidar do jardim e da casa ou tomar conta da sua família. Estas serão incluídas no Domínio 3.

1a. Atualmente você tem ocupação remunerada ou faz trabalho voluntário fora de sua casa?

( ) Sim ( ) Não – **Caso você responda não, Vá para o Domínio 2: Transporte**

As próximas questões relacionam-se com toda a atividade física que você faz em uma semana **normal / habitual,** como parte do seu trabalho remunerado ou voluntário. **Não inclua** o transporte para o trabalho. Pense apenas naquelas atividades que durem **pelo menos 10 minutos contínuos** dentro de seu trabalho:

1b. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal você realiza atividades **VIGOROSAS** como: trabalho de construção pesada, levantar e transportar objetos pesados, cortar lenha, serrar madeira, cortar grama, pintar casa, cavar valas ou buracos, subir escadas **como parte do seu trabalho remunerado ou voluntário**, por **pelo menos 10 MINUTOS CONTÍNUOS**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para a questão 1c.**

1c. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal você realiza atividades **MODERADAS,** como: levantar e transportar pequenos objetos, lavar roupas com as mãos, limpar vidros, varrer ou limpar o chão, carregar crianças no colo, **como parte do seu trabalho remunerado ou voluntário,** por **pelo menos 10 MINUTOS CONTÍNUOS**?

1d. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal você **CAMINHA, NO SEU TRABALHO remunerado ou voluntário** por **pelo menos 10 MINUTOS CONTÍNUOS**? Por favor, **não inclua** o caminhar como forma de transporte para ir ou voltar do trabalho ou do local que você é voluntário.

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para a Domínio 2 - Transporte**.

DOMÍNIO 2 – ATIVIDADE FÍSICA COMO MEIO DE TRANSPORTE

Estas questões se referem à forma normal como você se desloca de um lugar para outro, incluindo seu grupo de convivência para idosos, igreja, supermercado, trabalho, cinema, lojas e outros.

2a. Quantos dias e qual o tempo (horas e minutos) durante **uma semana normal** você **ANDA DE ÔNIBUS E CARRO/MOTO**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para questão 2b.**

Agora pense somente em relação a caminhar ou pedalar para ir de um lugar a outro em uma semana normal.

2b. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal você **ANDA DE BICICLETA** para ir de um lugar para outro por **pelo menos 10 minutos contínuos**? (**Não inclua o pedalar por lazer ou exercício**)

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para a questão 2d**.

2c. Quantos dias e qual o tempo (horas e minutos) durante uma semana **normal** você **CAMINHA** para ir de um lugar para outro, como: ir ao grupo de convivência para idosos, igreja, supermercado, médico, banco, visita a amigo, vizinho e parentes por **pelo menos 10 minutos contínuos**?

(**NÃO INCLUA as Caminhadas por Lazer ou Exercício Físico**)

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para o Domínio 3**.

DOMÍNIO 3 – ATIVIDADE FÍSICA EM CASA OU APARTAMENTO: TRABALHO, TAREFAS DOMÉSTICAS E CUIDAR DA FAMÍLIA

Esta parte inclui as atividades físicas que você faz em uma semana **normal/habitual** dentro e ao redor da sua casa ou apartamento. Por exemplo: trabalho doméstico, cuidar do jardim, cuidar do quintal, trabalho de manutenção da casa e para cuidar da sua família. Novamente pense **somente** naquelas atividades físicas com duração **por pelo menos 10 minutos contínuos**.

3a. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal você faz Atividades Físicas **VIGOROSAS AO REDOR DE SUA CASA OU APARTAMENTO (QUINTAL OU JARDIM)** como: carpir, cortar lenha, serrar madeira, pintar casa, levantar e transportar objetos pesados, cortar grama, por **pelo menos 10 MINUTOS CONTÍNUOS**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para a questão 3b.**

3b. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal você faz atividades **MODERADAS AO REDOR de sua casa ou apartamento** (jardim ou quintal) como: levantar e carregar pequenos objetos, limpar a garagem, serviço de jardinagem em geral, por **pelo menos 10 minutos contínuos**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para questão 3c**.

3c. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal você faz atividades **MODERADAS DENTRO da sua casa ou apartamento** como: carregar pesos leves, limpar vidros e/ou janelas, lavar roupas a mão, limpar banheiro e o chão, por **pelo menos 10 minutos contínuos**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para o Domínio 4.**

DOMÍNIO 4 – ATIVIDADES FÍSICAS DE RECREAÇÃO, ESPORTE, EXERCÍCIO E DE LAZER

Este domínio se refere às atividades físicas que você faz em uma semana **normal/ habitual** unicamente por recreação, esporte, exercício ou lazer. Novamente pense somente nas atividades físicas que você faz **por pelo menos 10 minutos contínuos**. Por favor **não inclua atividades que você já tenha citado.**

4a. **Sem contar qualquer caminhada que você tenha citado anteriormente**, quantos dias e qual o tempo (horas e minutos) durante uma semana normal, você **CAMINHA (exercício físico) no seu tempo livre** por **PELO MENOS 10 MINUTOS CONTÍNUOS**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para questão 4c.**

4b. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal, você faz atividades **VIGOROSAS no seu tempo livre** como: correr, nadar rápido, musculação, canoagem, remo, enfim, esportes em geral por **pelo menos 10 minutos contínuos**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para questão 4d.**

4c. Quantos dias e qual o tempo (horas e minutos) durante uma semana normal, você faz atividades **MODERADAS no seu tempo livre** como: pedalar em ritmo moderado, jogar voleibol recreativo, fazer hidroginástica, ginástica para a terceira idade, dançar... **pelo menos 10 minutos contínuos**?

_____ horas _____min. _____dias por **semana** ( ) Nenhum. **Vá para o Domínio 5.**

DOMÍNIO 5 – TEMPO GASTO SENTADO

Estas últimas questões são sobre o tempo que você permanece sentado em diferentes locais como exemplo: em casa, no grupo de convivência para idosos, no consultório médico e outros. Isso inclui o tempo sentado, enquanto descansa, assiste a televisão, faz trabalhos manuais, visita amigos e parentes, faz leituras, telefonemas e realiza as refeições. **Não inclua o tempo gasto sentando durante o transporte em ônibus, carro, trem e metrô**.

5a. Quanto tempo, no total, você gasta sentado durante **UM DIA de semana normal**?

UM DIA _____horas ____minutos

Dia da semana Um dia	Tempo horas/Min.		
	manhã	tarde	noite

5b. Quanto tempo, no total, você gasta sentado durante **UM DIA de final de semana normal**?

UM DIA _____horas ____minutos

Final da semana Um dia	Tempo horas/Min.		
	manhã	tarde	noite

ANEXO C - ESCALA DE DOR ANTERIOR NO JOELHO (AKPS)

Anexo 1. *Versão final em português*

1. Ao andar, você manca?
(a) Não (5)
(b) Ás vezes (3)
(c) Sempre (0)

2. Você sustenta o peso do corpo?
(a) Sim, totalmente sem dor (5)
(b) Sim, mas com dor (3)
(c) Não, é impossível (0)

3. Você caminha:
(a) Sem limite de distância (5)
(b) Mais de 2 km (3)
(c) Entre 1 a 2 km (2)
(d) Sou incapaz de caminhar (0)

4. Para subir e descer escadas você:
(a) Não tem dificuldade (10)
(b) Tem leve dor apenas ao descer (8)
(c) Tem dor ao descer e ao subir (5)
(d) Não consegue subir nem descer escadas (0)

5. Para agachar você:
(a) Não tem dificuldade (5)
(b) Sente dor após vários agachamentos (4)
(c) Sente dor em um/cada agachamento (3)
(d) Só é possível descarregando parcialmente o peso do corpo na perna afetada (2)
(e) Não consegue (0)

6. Para correr você:
(a) Não tem dificuldade (10)
(b) Sente dor após 2 km (8)
(c) Sente dor leve desde o início (6)
(d) Sente dor forte (3)
(e) Não consegue (0)

7. Para pular você:
(a) Não tem dificuldade (10)
(b) Tem leve dificuldade (7)
(c) Tem dor constante (2)
(d) Não consegue (0)

8. Em relação à sentar-se prolongadamente com os joelhos flexionados:
(a) Não sente dor (10)
(b) Sente dor ao sentar somente após realização de exercício (8)
(c) Sente dor constante (6)
(d) Sente dor que faz com que tenha que estender os joelhos por um tempo (4)
(e) Não consegue (0)

9. Você sente dor no joelho afetado?
(a) Não (10)
(b) Leve e às vezes (8)
(c) Tenho dor que prejudica o sono (6)
(d) Forte e às vezes (3)
(e) Forte e Constante (0)

10. Quanto ao inchaço:
(a) Não apresento (10)
(b) Tenho apenas após muito esforço (8)
(c) Tenho após atividades diárias (6)
(d) Tenho toda noite (4)
(e) Tenho constantemente (0)

11. Em relação a sua **DOR** aos deslocamentos patelares anormais (subluxações):
(a) Está ausente (10)
(b) Às vezes em atividades esportivas (6)
(c) Às vezes em atividades diárias (4)
(d) Pelo menos um deslocamento comprovado (2)
(e) Mais de dois deslocamentos (0)

12. Você perdeu massa muscular (Atrofia) da coxa?
(a) Nenhuma (5)
(b) Pouca (3)
(c) Muita (0)

13. Você tem dificuldade para dobrar o joelho afetado?
(a) Nenhuma (5)
(b) Pouca (3)
(c) Muita (0)

ANEXO D - ESCALA TAMPA DE CINSESIOFOBIA

Aqui estão algumas das coisas que outros pacientes nos contaram sobre sua dor. Para cada afirmativa, por favor, indique um numero de 1 a 4, caso você concorde ou discorde da afirmativa. Primeiro você vai pensar se concorda ou discorda e depois, se totalmente ou parcialmente.

	Discordo totalmente	Discordo parcialmente	Concordo parcialmente	Concordo totalmente
1. Eu tenho medo que eu possa me machucar se eu fizer exercícios.	1	2	3	4
2. Se eu tentasse superar esse medo, minha dor aumentaria.	1	2	3	4
3. Meu corpo está me dizendo que algo muito errado esta acontecendo comigo.	1	2	3	4
4. Minha dor provavelmente seria aliviada se eu fizesse exercício.	1	2	3	4
5. As pessoas não estão levando minha condição médica a serio.	1	2	3	4
6. Minha lesão colocou o meu corpo em risco para o resto da minha vida.	1	2	3	4
7. A dor sempre significa que eu machuquei meu corpo.	1	2	3	4
8. Só porque alguma coisa piora minha dor, não significa que é perigoso.	1	2	3	4
9. Eu tenho medo que eu possa me machucar acidentalmente.	1	2	3	4
10. Simplesmente sendo cuidadoso para não fazer nenhum movimento desnecessário e a atitude mais segura que eu posso tomar para prevenir a piora da minha dor.	1	2	3	4
11. Eu não teria tanta dor se algo potencialmente perigoso não estivesse acontecendo no meu corpo.	1	2	3	4
12. Embora minha condição seja dolorosa, eu estaria melhor se estivesse ativo fisicamente.	1	2	3	4
13. A dor me avisa quando parar o exercício para que eu não me machuque.	1	2	3	4
14. Não é realmente seguro para uma pessoa com minha condição ser ativo fisicamente.	1	2	3	4
15. Eu não posso fazer todas as coisas que as pessoas normais fazem, porque para mim e muito fácil me machucar.	1	2	3	4
16. Embora algo esteja me causando muita dor, eu não acho que seja, de fato, perigoso.	1	2	3	4
17. Ninguém deveria fazer exercícios, quando está com dor.	1	2	3	4

ANEXO E - QUESTIONÁRIO DE AUTOEFICÁCIA SOBRE DOR (PSEQ-10)

Por favor, indique o quanto confiante você está neste momento em poder fazer as seguintes coisas apesar da sua dor. Para indicar sua resposta, circule um número em cada questão, considerando que (0) indica nem um pouco confiante e (6) completamente confiante.
Por exemplo:

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

Lembre-se, este questionário não está perguntando se você tem feito estas coisas ou não. Mas sim o quanto confiante você se sente em poder fazê-las neste momento, apesar da sua dor.

1. Posso aproveitar as coisas apesar da dor.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

2. Posso fazer a maior parte das minhas tarefas domésticas (ex: Lavar a louça, arrumar a casa, lavar o carro...) apesar da dor.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

3. Continuo encontrando meus amigos e familiares com a mesma frequência que antes apesar da dor.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

4. Posso lidar com a dor na maior parte das situações.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

5. Posso fazer alguns trabalhos apesar da minha dor (ex: trabalhos de casa e emprego remunerado ou não).

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

6. Posso fazer muitas coisas que aprecio apesar da dor (ex: lazer, artesanato, esporte ....).

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

7. Posso lidar com a dor sem usar remédios.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

8. Posso alcançar a maior parte dos meus objetivos na vida apesar da dor.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

9. Apesar da dor posso viver uma vida normal.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

10. Posso aos poucos me tornar mais ativo apesar da dor.

0	1	2	3	4	5	6
Nem um pouco confiante						Completamente confiante

ANEXO F - ESCALA DE AUTOEFICÁCIA PARA DOR CRÔNICA (CPSE)

Gostaríamos de saber de que maneira sua dor afeta você. Para cada pergunta circule o número que corresponde a quanta certeza você tem de poder realizar as tarefas mencionadas.

( )10 ( )20 ( )30 ( )40 ( )50 ( )60 ( )70 ( )80 ( )90 ( )100

Nenhuma certeza	**Muita certeza**
1. Quanta certeza você tem de que pode diminuir um pouco sua dor?	
2. Quanta certeza você tem de que pode continuar a realizar a maioria das suas atividades diárias?	
3. Quanta certeza você tem de que consegue impedir que a dor interfira com seu sono?	
4. Quanta certeza você tem de que consegue promover uma redução pequena ou moderada na sua dor?	
5. Quanta certeza você tem de que pode promover uma grande redução na sua dor?	

Autoeficácia para funcionalidade

Gostaríamos de conhecer sua autoconfiança para realizar algumas atividades diárias. Para cada pergunta, circule o número que corresponde a quanta certeza você tem de poder realizar as tarefas, sem ajuda de outras pessoas. Por favor, considere aquilo que pode fazer no dia-a-dia, não atividades isoladas que exijam um esforço extraordinário.
Atualmente quanta certeza você tem de que pode:

( )10 ( )20 ( )30 ( )40 ( )50 ( )60 ( )70 ( )80 ( )90 ( )100

Nenhuma certeza	**Muita certeza**
1. Caminhar 800 metros em terreno plano?	
2. Levantar uma caixa pesando 5 quilos?	
3. Realizar um programa diário de exercícios a serem feitos em casa?	
4. Realizar os trabalhos de cuidados da casa?	
5. Fazer compras de supermercado ou de roupas?	
6. Participar de atividades sociais?	
7. Dedicar-se a passatempos ou atividades recreativas?	
8. Participar de atividades familiares?	

9. Realizar as tarefas de trabalho que você tinha antes do início da dor crônica? (Para donas de casa, favor considerar as tarefas da casa como as tarefas de trabalho).	

Autoeficácia para lidar com outros sintomas

Gostaríamos de saber como você se sente em relação a sua capacidade de controlar sintomas físicos como a fadiga e a dor. Para cada pergunta, circule o número que corresponde a quanta certeza você tem de que <u>atualmente</u> pode realizar as atividades ou tarefas mencionadas.

( )10 ( )20 ( )30 ( )40 ( )50 ( )60 ( )70 ( )80 ( )90 ( )100

Nenhuma certeza **Muita certeza**

1. Quanta certeza você tem de que pode controlar sua fadiga?	
2. Quanta certeza você tem de que pode regular sua atividade de forma a ficar sem piorar os sintomas físicos. (por exemplo, fadiga, dor)?	
3. Quanta certeza você tem de que pode fazer alguma coisa para se sentir melhor quando está triste?	
4. Comparando-se com outras pessoas com problemas de saúde crônicos como o seu, quanta certeza você tem de que pode controlar sua dor durante suas atividades diárias?	
5. Quanta certeza você tem de que pode controlar seus sintomas físicos de forma a poder fazer as coisas que gosta?	
6. Quanta certeza você tem de que pode lidar com a frustração provocada por problemas de saúde crônicos?	
7. Quanta certeza você tem de que pode lidar com dor leve ou moderada?	
8. Quanta certeza você tem de que pode lidar com dor forte?	