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ORIGINAL RESEARCH

Different pain responses to distinct levels of physical activity in women with patellofemoral pain

Q1 **Ronaldo V. Briani, Marcella F. Pazzinatto, Danilo O. Silva, Fábio M. Azevedo***

Departamento de Fisioterapia, Faculdade de Ciências e Tecnologia (FCT), Universidade Estadual Paulista ''Júlio de Mesquita Filho'' (UNESP), Presidente Prudente, SP, Brazil

KEYWORDS
Knee pain;
Overuse;
Physical activity level;
Physical therapy;
Rehabilitation;
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Abstract
Background: Physical activity levels seem to play a role in patellofemoral pain (PFP); however, few studies have been conducted to confirm this hypothesis.
Objectives: To determine the reported pain levels of women with and without PFP who maintain different levels of physical activity; to determine the capability of these levels to predict pain; and to test the capability of two stair-negotiation protocols, with and without external load, to equalize pain between groups.
Method: Four groups were divided based on the women's physical activity levels: moderate activity PFP group (28), moderate activity control group (23), intense activity PFP group (22), and intense activity control group (22). All participants were asked to perform 15 repetitions of stair negotiation with and without external load on a seven-step staircase on two separate days. Pain levels were reported using a visual analog scale at five distinct moments: previous month, before stair negotiation, after stair negotiation, before patellofemoral joint (PFJ) loading protocol, and after PFJ loading protocol.
Results: The intense activity PFP group showed higher levels of pain than the moderate activity PFP group ($F_{(8,158)} = 11.714$, $p = 0.000$, $\eta^2 = 0.30$). The PFJ loading protocol was able to equalize and exacerbate pain in the PFP groups.
Conclusion: Intense physical activity seems to have a higher association with knee pain than moderate physical activity. A PFJ loading protocol may be an alternative to equalize pain in women with PFP during clinical assessments.

Introduction

Patellofemoral pain (PFP) is a common and costly musculoskeletal disorder that affects men, women, and adolescents, albeit women are 2.23 times more likely to

* Corresponding author at: Rua Roberto Simonsen 305, Presidente Prudente - SP - Brazil CEP 19060-900.
E-mail: micolis@fct.unesp.br (F.M. Azevedo).

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develop PFP than men.[1] PFP is characterized by pain around and behind the patella and is aggravated by activities causing repetitive and high patellofemoral compressive forces such as squatting and running.[2] Although this disorder accounts for 25–40% of all knee complaints in sports medicine,[3] its underlying mechanisms remain unclear.[4]

The importance of physical activity levels and the overuse of activity have been discussed in some studies and it appears that the stimulus for developing and/or exacerbating PFP may be related to increased physical activity and mechanical overloading.[5] Thomeé et al.[6] found that individuals with PFP tend to report an insidious onset of symptoms associated with temporary overuse or a period of increased physical activity. Furthermore, Fairbank et al.[7] reported that individuals with PFP stated that both their maximal level of pain and average highest level of daily pain were associated with increased physical activity.

Nevertheless, a large number of PFP studies have been performed without taking into account the level of physical activity of the sample.[7–9] Likewise, clinicians tend to assess individuals with PFP without considering their physical activity levels.[6] However, when all of these subjects are placed in one PFP group, potential misunderstandings might arise. Changes in the type, frequency, duration, and intensity of physical activities may cause a variation in the level of reported pain.[5] As musculoskeletal pain has the potential to influence biomechanical characteristics,[11] it is possible that different levels of pain may produce distinct mechanical strategies in women with PFP during biomechanical analyses and clinical assessments.[12,13] For instance, some studies[14,15] have verified a difference in onset timing between the vastus medialis and lateralis among women with and without PFP, while other studies have not.[16,17] Recently, Briani et al.[11] found that these controversial results may be related to the different levels of physical activity of the women in the samples. Therefore, there seems to be different reports of pain in women with PFP who maintain distinct levels of physical activity. Yet, to date, no study has been conducted to confirm this hypothesis.

Therefore, the first objective of this study was to determine the pain levels reported by women with and without PFP who maintain different levels of physical activity during 5 distinct moments: previous month, before stair negotiation, after stair negotiation, before PFJ loading protocol, and after PFJ loading protocol. The second objective was to determine the capability of different activity levels to predict pain. We hypothesized that: (1) women with PFP who maintained higher levels of physical activity would present higher levels of pain and; (2) higher levels of physical activity would better predict the pain. Given such hypotheses, we proposed a stair negotiation and a PFJ loading protocol in an attempt to equalize the pain between women with PFP who maintain different levels of physical activity. Our hypothesis was that (3) the PFJ loading protocol would equalize the pain in the women with PFP, while the stair negotiation would not.

Method

Subjects

Fifty women with PFP and forty-five asymptomatic women were recruited via advertisements placed at the university, parks, and gyms. Based on calculations made in Sample-power using Statistical Software for Social Sciences (SPSS) version 18.0 (SPSS Inc. Chicago, IL, USA) with preliminary data (pilot study), a minimum sample size of 22 women would be needed to evaluate the Visual Analogue Scale (VAS) values with a statistical power of 80%, observing a minimum difference of 1.2 cm between means and a standard deviation of 1.6 cm and assuming a significance level of 5% and $\beta = 0.20$. Prior to the data collection, all participants provided written informed consent and the experimental protocol was approved by the Human Research Ethics Committee of the Estadual Paulista ''Júlio de Mesquita Filho'' (UNESP), Presidente Prudente, SP, Brazil (approval no. 306.729).

Diagnosis of PFP was completed following consensus from two experienced clinicians (>5 years' experience) and based on definitions used in previous studies.[18,19] The inclusion criteria were (1) anterior knee pain during at least two of the following activities: prolonged sitting, squatting, kneeling, running, climbing stairs, and jumping; (2) pain during patellar palpation; (3) symptoms of insidious onset and duration of at least 1 month; (4) worst pain level in the previous month of at least 3 cm on a 10-cm VAS; and (5) three or more positive clinical signs in the following tests: Clarke's sign, McConnell test, Noble compression, Waldron test, and patellar pain on palpation. The participants were required to fulfill all five requirements to be included in the study as women with PFP. The presence of the following conditions were carefully screened as exclusion criteria: events of patellar subluxation or dislocation, lower limb inflammatory process, patellar tendon or meniscus tears, bursitis, ligament tears, or the presence of neurological diseases. Those who had undergone knee surgery or received oral steroids, opiate treatment, acupuncture, or physical therapy during the preceding six months were excluded from this study. On the other hand, the participants could not present any signs or symptoms of PFP or other diseases to be admitted in the study as asymptomatic women.

After the screening process, the women with and without PFP were divided into groups according to physical activity level. This division was done using the self-administered International Physical Activity Questionnaire – long form (IPAQ), a valid and reliable form for classifying physical activity levels.[20] The levels were determined by the total amount of physical activity in the previous week involving the lower limbs that generate high PFJ stress and classified according to Craig et al.[20] With respect to our sample, four groups were formed: moderate activity patellofemoral pain group (MAPFPG = 28), moderate activity control group (MACG = 23), intense activity patellofemoral pain group (IAPFPG = 22) and intense activity control group (IACG = 22).

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