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MASTERCLASS

Do hip muscle weakness and dynamic knee valgus matter for the clinical evaluation and decision-making process in patients with patellofemoral pain?



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Abstract

Background: Patellofemoral pain is a very common musculoskeletal condition. In the last years, evidence regarding this disease increased exponentially. Although widely investigated, this problem still frustrates patients and clinicians for having an unfavorable prognosis. Some gaps still exist in the understanding and managing of patellofemoral pain. Numerous cross-sectional association studies show an association between gluteus muscular strength and dynamic knee valgus in patients with patellofemoral pain. In spite of this biological plausibility, many evidences challenge the direct relationship between these factors. Recent studies have concluded that women with patellofemoral pain show muscular weakness of the hip based on the cross-sectional studies, however prospective studies indicate that hip weakness cannot be considered a risk for development of patellofemoral pain. In addition, some clinical trials have demonstrated that strength training of the gluteal muscles promotes significant improvement in symptoms but not alter the kinematics of the patients with patellofemoral pain. These findings cast doubt on whether the cause of this condition is really being treated, whether all individuals suffering from patellofemoral pain present dynamic knee valgus or if this is a disturbance present in only a subgroup of patients and whether the strengthening of the hip musculature is an option to consider for prevention of patellofemoral pain.

Conclusion: Certainly, more studies should be conducted to clarify the influence of mechanical patterns on this condition, but with the existing evidence so far, the importance given to these issues in the evaluation and clinical decision on treatment of these patients seems questionable. Therefore, this masterclass explores the understanding about patellofemoral pain, highlighting mainly the importance of muscular strength and dynamic knee valgus, as well as other possible factors that must be consider during the evaluation and the decision making in these patients. © 2017 Associação Brasileira de Pesquisa e Pós-Graduação em Fisioterapia. Published by Elsevier Editora Ltda. All rights reserved.

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Introduction

Patellofemoral pain (PFP) is a common musculoskeletal condition in both adolescents^{1,2} and young women.^{3,4} Although PFP has been widely investigated, this problem still frustrates patients and clinicians. About 40% of treated individuals experience a recurrence in symptoms in one year⁵ and more than 50% of patients did not fully recover between five and eight years.⁶ This unfavorable prognosis reveals that many gaps still exist in the understanding and managing of this condition.

The etiology of PFP is considered to be multifactorial.^{7,8} Historically, local factors such as weakness of the quadriceps muscle were established as a potential risk factor for the development of this condition.^{9,10} However, the focus has shifted to proximal factors, such as the function of the hip muscles and disturbances in the movement of the trunk, pelvis and hips.^{7,8} Therefore, clinicians and researchers have been focusing their attention on the weakness of the gluteal muscles and dynamic misalignment of the lower limbs on the assessment, treatment and prevention of PFP.

Cross-sectional studies have demonstrated that the weakness of the gluteal muscles^{11,12} and excessive adduction and internal rotation of the hip as well as contralateral pelvic drop were associated with the presence of PFP.^{13–16} Therefore, it has been hypothesized that weakness of the hip muscles, more specifically the abductor and lateral rotator muscles, contributes to increase the movements of the hip in the frontal and transverse planes.^{17–19}

Furthermore, there are assumptions that dynamic knee valgus can be closely associated with PFP, since these condition would result in reduction of the contact area between the patella and trochlea and increase the pressure on the patellofemoral joint, causing overload on the subchondral bone and adjacent soft tissues, and hence anterior knee pain.^{17–20} These data are based solely on cross-sectional association studies and therefore this type of association, to date, cannot be considered as causative.

This novel concept has become the basis for treatment strategies based upon a possible causal relationship between hip muscle weakness and movement disturbance in patients with PFP. This has become even more likely because few clinical trials have demonstrated that treatment protocols involving proximal muscles strengthening alone^{21,22} or associated with strengthening of the quadriceps,^{23,24} resulted in significant improvement of pain and disability of patients compared to patients who received other interventions, such as knee braces,²⁵ patellar taping²⁶ and electro-physical agents.²⁷ Nevertheless, there are no studies that directly comprised interventions mentioned above.

In this context, it seems reasonable to speculate that the strengthening of the gluteal muscles would reduce the adduction and internal rotation of the hip, and these changes on these surrogate outcomes would be associated with positive changes with clinical outcomes of these patients. Therefore, at first glance it might appear that doubts about this condition have been resolved. Interestingly, however, recent prospective studies have demonstrated that although strength training of the gluteal muscles promotes a gain in force and significant improve-

ment in symptoms, it is unable to generate movement changes in women with PFP.^{24,28,29} In addition, strength training associated with movement control training did not alter the kinematics^{28,30} and did not promote additional benefits to the clinical outcomes obtained from strength training alone.²⁴

This evidence challenges the hypothesis of causality of muscular strength and movement disturbance in patients with PFP. The reason is that if there is a direct causal relationship between dynamic knee valgus and PFP, what is the explanation for the improvement of symptoms in patients who do not change their movement pattern after treatment? Therefore, if the positive response to therapeutic exercise cannot be explained by the kinematic change, then perhaps the importance of dynamic knee valgus as a causal factor of the PFP could be questionable and new discussions about the interpretation of mechanical changes and tissue damage as source of pain are strongly needed.

Although plausible, so far there is limited evidence that dysfunction of movement is a risk factor for this condition.³¹ It is possible to observe association between PFP and movement disturbance in cross-sectional studies,^{11,13–16} but it is important to note that existing studies also have found no differences in the adduction^{11,12,16,32} and internal hip rotation^{12,16,32} in women with PFP, in several activities. This casts doubt on whether all individuals suffering from PFP present dynamic knee valgus or if this is a disturbance present in only a subgroup of patients.

In this respect, recent studies appear to challenge the direct relationship between the dynamic alignment of the lower limbs and PFP.^{33,34} Rabin et al.³³ demonstrated that individuals with good quality of movement did not show difference in the knee pain intensity when compared to those with worse movement quality during the lateral step-down test. Besides this, Baldon et al.³⁴ showed that even though there was a reduction of the pelvic drop and hip adduction movement after strengthening and functional stabilization training in a group of women with PFP, no statistical difference was observed in the knee pain intensity and disability immediately after the training between this group and the other group that had not present kinematic change. Certainly, more studies should be conducted to clarify the influence of mechanical patterns on PFP, but with the existing evidence so far, the importance given to these issues in the evaluation and clinical decision on treatment of these patients seems questionable.

With respect to weakness of the abductor and lateral rotator muscles, although this is present in women with PFP,^{31,35} its causal relation with dynamic knee valgus and consequently PFP is not clear. To the best of our knowledge, there is no consensus among studies that have correlated the strength of the gluteal muscles and dysfunctions of hip movement.^{12,19,33,36,37} The studies of Souza and Powers¹¹ and Bolgla et al.¹² indicated a strength deficit of the hip abductor muscles of 14% and 26%, respectively, but without difference in adduction movement of the hip between women with and without pain. Sigward et al.³⁶ observed that the strength of the hip muscles did not predict dynamic knee valgus among women, and Rabin et al.³³ and Hollman et al.³⁷ comparing women with different levels of movement quality during lateral-step down and single-leg squat, respectively, did not identify differences in the strength of

the adductor and lateral rotator muscles between the two groups.

Prospective studies have been published suggesting that individuals who develop PFP tend to have stronger hip abductor and lateral rotator muscles than those who do not develop this condition.^{38,39} In addition, Plataras et al.⁴⁰ analyzed runners in the initial stages of PFP and did not identify deficits in the strength of the hip abductor muscles of the limb with pain when compared with the weaker limb of asymptomatic runners. Based on these results, the authors suggested that the weakness of gluteal muscles identified in individuals with PFP could not be the cause of the pain, and instead is a consequence of the reduced demand placed on the painful knee due to an antalgic response of the individual over time. Finally, recent meta-analysis^{31,35} have concluded that women with PFP show muscular weakness of the hip based on the cross-sectional studies, but contrary to these prospective studies indicate that the hip weakness cannot be considered a risk for development of PFP. These divergent findings cast doubt on whether the cause of this condition is really being treated and whether the strengthening of the hip musculature is an option to consider for prevention of PFP.

It is possible that specific strengthening may improve the patients' muscle tissue's envelope of function, increasing their tolerance to the loads on the patellofemoral joint.⁴¹ However, a recent narrative review contested traditional methods based on a biomedical model of treatment for patients with PFP, and discussed the pain mechanisms after exercise therapy.⁴² In general, loaded therapeutic exercises have been shown to be beneficial for chronic tendon pain,⁴³ low back pain⁴⁴ and shoulder pain.⁴⁵ It is believed that the positive response to exercise can be attributed to its impact on central nervous system (CNS) desensitization and not simply to its mechanical effects.^{46,47}

Traditional models of understanding pain based on tissue pathology as the source of pain response have been insufficient to explain chronic and persistent pain in patients with PFP.⁴² Therefore, there is a large number of studies that consider psychosocial models that encompass the concept of central sensitization, which considers that nociceptive inputs are modulated in the CNS and can lead to long term pain experience, even in the absence of tissue damage.⁴⁸ There is a possibility that nonphysical features are also related with PFP and a change in central pain modulation may be present in these patients,⁴⁹ generating negative impact on the levels of pain experienced by them.⁵⁰ The consideration of these aspects may play a fundamental role in the understanding and handling of long term PFP.

It has been recently identified that subjects with PFP present altered unfavorable psychological and social factors and this may help to understand the recurrence of the symptoms.⁵¹ These patients have demonstrated signs of catastrophization,⁵² anxiety, depression⁵³ and fear-avoidance beliefs.⁵⁴ These characteristics have a strong and consistent relationship with pain and disability.⁵⁵ In addition, Piva et al.⁵⁴ detected that decrease in fear-avoidance beliefs was a strong predictor of functional improvement and pain reduction, highlighting the necessity of address psychosocial factors in the treatment of PFP.

Conclusion

In conclusion, the current evidence indicates based on few prospective and clinical trials that much more research is needed to clarify, more robustly, the possible causal factors of PFP. For this reason, other variables, such as structural factors of the knee,⁵⁶ weakness of the quadriceps,¹⁰ dysfunction of distal segment,⁵⁷ task dependency,⁵⁸ neurophysiological factors, such as cognitive and behavioral factors⁵¹ and patient education⁵⁹ should be considered both at the moment of evaluation and when recommending preventive and therapeutic approaches to patients.

Certainly, it is impossible to ignore the existence of relationship among lower limb joints during weight-bearing activities, so the evidence presented above does not exclude consideration of these relationships, but it does suggest that other possible factors can contribute to PFP and dynamic knee valgus and should receive more attention and critical analysis of clinicians and researchers. Perhaps the key to PFP management is to understand that the treatment should include a contribution of patient education to self-management, strategies to correct biomechanical factors, as well as to reduce psychosocial components.

Conflicts of interest

The authors declare no conflicts of interest.

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