



Original article

Femoropatellar radiographic alterations in cases of anterior cruciate ligament failure[☆]



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ABSTRACT

Objective: To make a comparative analysis on three femoropatellar radiographic parameters, between knees with chronic failure of the anterior cruciate ligament (ACL) and normal knees.

Methods: Thirty volunteer patients with a diagnosis of unilateral isolated chronic ACL injury for more than one year and a normal contralateral knee were selected. Digital radiographs were produced for all the patients, on both knees in absolute lateral view at 30° of flexion, with and without load-bearing on one leg, and in axial view of the patella at 30°. The Caton–Deschamps patellar height index, Merchant patellar congruence angle and Laurin lateral patellar tilt angle were measured on the radiographs obtained from the normal knees and knees with ACL injuries, and comparative analysis was performed between these two groups.

Results: The patellar height was statistically significantly lower ($p < 0.001$) in the knees with ACL failure than in the normal knees, both on radiographs without loading and on those with single-foot loading. The Merchant patellar congruence angle was significantly smaller ($p < 0.001$) in the normal knees and the lateral patellar tilt angle was smaller ($p < 0.001$) in the knees with ACL failure.

Conclusion: Chronic ACL failure gave rise to a statistically significant change in the femoropatellar radiographic values studied ($p < 0.001$). Knees with injuries to this ligament presented lower patellar height values, greater tilt and lateral displacement of the patella, in relation to the femoral trochlea, in comparison with the normal contralateral knees.

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Alterações radiográficas femoropatellares na insuficiência do ligamento cruzado anterior

R E S U M O

Palavras-chave:

Instabilidade articular
Ligamento cruzado anterior
Articulação patelofemoral

Objetivo: Análise comparativa de três parâmetros radiográficos femoropatellares entre joelhos com insuficiência crônica do ligamento cruzado anterior (LCA) e joelhos normais.

Métodos: Foram selecionados 30 pacientes voluntários com diagnóstico de lesão crônica isolada unilateral do LCA havia mais de um ano e joelho contralateral normal. Todos os pacientes foram submetidos a radiografias digitais de ambos os joelhos nas incidências em perfil absoluto a 30° de flexão, com e sem carga monopodal, e axial de patela a 30°. Foram mensurados, nas radiografias obtidas, o índice de altura patelar de Caton-Deschamps, o ângulo de congruência patelar de Merchant e o ângulo de inclinação lateral da patela, descrito por Laurin, nos joelhos normais e nos joelhos com lesão do LCA e foi feita análise comparativa entre esses dois grupos.

Resultados: A altura patelar foi inferior, de forma estatisticamente significativa ($p < 0,001$), nos joelhos com insuficiência do LCA em comparação com os joelhos normais, tanto nas radiografias sem carga quanto nas com carga monopodal. O ângulo de congruência patelar de Merchant foi significativamente menor ($p < 0,001$) nos joelhos normais e o ângulo de inclinação lateral da patela foi inferior ($p < 0,001$) nos joelhos com insuficiência do LCA.

Conclusão: A insuficiência crônica do LCA alterou de forma estatisticamente significativa ($p < 0,001$) os valores dos parâmetros radiográficos femoropatellares estudados. Joelhos com lesão desse ligamento apresentaram menores valores de altura patelar, maior inclinação e deslocamento laterais da patela em relação à tróclea femoral comparados com os joelhos contralaterais normais.

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Introduction

Anterior cruciate ligament (ACL) injuries are among the commonest knee injuries, with growing incidence due to the increasingly large number of individuals involved in sports activities.¹ Failure of this ligament causes anterior and rotational instability of the knee, characterized by recurrent episodes of anterior and rotational (i.e. internal rotational) subluxation of the tibia over the femur.² These episodes may cause functional losses and limit sports practices and certain activities of daily living.³

Significant biomechanical and kinematic alterations have been recognized over recent decades, in knees with ACL failure. Laboratory studies on gait analysis have shown that knees with ACL injuries present greater internal rotation,⁴ less external rotation⁵ and increased medial translation of the tibia over the femur,⁶ in comparison with normal knees, during the stance and swing phases of gait. Several authors⁷⁻¹⁰ have stated that ACL failure gives rise to loss of tibiofemoral kinematic balance and causes abnormal biomechanical behavior, which puts the knee at risk of secondary injuries.

Despite the large number of studies that have examined the effects of ACL injuries on tibiofemoral kinematics, few have analyzed femoropatellar alterations in patients with failure of this ligament.⁹ Baugher et al.¹¹ demonstrated that patients with ACL failure presented irreversible atrophy of the quadriceps muscle and warned of the possible consequences of this for the patellofemoral joint.

According to Hsieh et al.,^{12,13} alterations to tibiofemoral kinematics that result from ACL injuries affect the kinematics of the patellofemoral joint and cause imbalance of the extensor mechanism and abnormal distribution of forces between the patella and the femoral trochlea. These authors^{12,13} showed that there were increases in lateral translation and lateral inclination of the patella in relation to the femur, after resection of the ACL in the knees of cadavers. *In vivo*, Van de Velde et al.¹⁴ demonstrated that ACL failure alters the contact area and femoropatellar tracking.

Femoropatellar radiographic parameters may aid in diagnosing alterations of the patellofemoral joint. In the present study, we made a comparative analysis on three femoropatellar radiographic parameters that are commonly used in clinical practice, with the aim of detecting differences in these parameters between knees with chronic ACL failure and normal knees.

Methods

After approval for this study had been obtained from our institution's Research Ethics Committee, 30 volunteer patients (17 males and 13 females) who were attended at the Knee Surgery Center of this institution were selected. All of them presented a diagnosis of ACL injury alone, which had occurred in one knee (while the contralateral knee remained normal) more than 12 months earlier, and they fulfilled the inclusion and exclusion criteria of the sample (Table 1). The subjects' mean age was 28 years, with a range from 17 to 46, and the mean

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