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Original Article

Proprioceptive deficit in individuals with unilateral tearing of the anterior cruciate ligament after active evaluation of the sense of joint position☆,☆☆

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ABSTRACT

Objective: To ascertain whether the proprioceptive deficit in the sense of joint position continues to be present when patients with a limb presenting a deficient anterior cruciate ligament (ACL) are assessed by testing their active reproduction of joint position, in comparison with the contralateral limb.

Methods: Twenty patients with unilateral ACL tearing participated in the study. Their active reproduction of joint position in the limb with the deficient ACL and in the healthy contralateral limb was tested. Meta-positions of 20% and 50% of the maximum joint range of motion were used. Proprioceptive performance was determined through the values of the absolute error, variable error and constant error.

Results: Significant differences in absolute error were found at both of the positions evaluated, and in constant error at 50% of the maximum joint range of motion.

Conclusion: When evaluated in terms of absolute error, the proprioceptive deficit continues to be present even when an active evaluation of the sense of joint position is made. Consequently, this sense involves activity of both intramuscular and tendon receptors.

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Déficit proprioceptivo em indivíduos com ruptura unilateral do ligamento cruzado anterior após a avaliação ativa do senso de posição articular

Palavras-chave:
LCA
Sistema somatossensorial
Joelho

RESUMO

Objetivo: Verificar se o déficit proprioceptivo no SPA permanece quando pacientes com um membro LCA deficiente são avaliados por meio do teste de reprodução ativa da posição articular, em comparação com o membro contralateral.

Métodos: Participaram do estudo 20 pacientes com ruptura unilateral do LCA. Foi feito o teste de reprodução ativa da posição articular no membro LCA deficiente e contralateral saudável. Foram usadas as posições meta de 20% e 50% da amplitude articular máxima. O desempenho proprioceptivo foi determinado por meio dos valores de erro absoluto (EA), erro variável (EV) e erro constante (EC).

Resultados: Diferenças significativas foram encontradas para o EA em ambas as posições avaliadas e para o EC em 50% AAM.

Conclusão: O déficit proprioceptivo quando avaliado pelo EA permanece mesmo quando a avaliação do senso de posição articular é ativa e, consequentemente, envolve a atividade de receptores intramusculares e tendíneos.

Introduction

Appropriate kinematics for the knee depend on the mechanical stability of the joint that is provided by its static and dynamic components.[1,2] The ligaments furnish static stabilization and their main function is to enable normal joint kinematics and prevent abnormal and rotational movements that could damage the joint surfaces,[2] while dynamic stabilization is given by coordinated muscle contraction activity modulated by the neuromuscular system.[3,4] This system requires proprioceptive information from the joint kinesthesia and position[5–7] and from the force developed by the muscles.[8–10]

This information is obtained through acquiring afferent signals from the peripheral mechanical receptors that are found in the muscles, tendons, ligaments, joint capsules and skin.[11] Mechanical receptors have also been identified in the anterior cruciate ligament (ACL)[12] and it is believed that these contribute toward proprioception of the joint.[13,14] Thus, tearing of the ACL would lead to joint instability not only because of the impairment due to the mechanical restriction but also because proprioception is disturbed[14,15] and the capacity of the muscles acting on the knee to respond adequately to the loads applied is diminished.[15,16]

Proprioceptive deficits have been observed in patients with ACL tearing and have been correlated with reduced functional capacity.[7,17] These deficits have been identified in relation to the passive movement detection threshold (PMDT) and joint position sense (JPS), in comparison with normal individuals[18,19] and with the healthy contralateral limb.[19,20] Assessments of PMDT and passive JPS have been adopted preferentially for use in studies.[18,21,22] This practice is based on the assumption that the low angular velocities used would specifically stimulate the receptors of the capsule and ligament structures without stimulating the intramuscular and tendon receptors. In these procedures, the individuals' voluntary muscle activity is not involved. However, under normal conditions of human movement, voluntary muscle activity is always present.

There is little evidence to demonstrate that proprioceptive deficits, in the way in which they are assessed, would adversely affect patients with insufficiency of the ACL or a surgically reconstructed ACL.[22] Thus, procedures that involve voluntary muscle action and consequently stimulation of the muscle-tendon receptors should receive greater attention in evaluations on proprioception. JPS assessment with active positioning and reproduction may be an option for investigating proprioceptive capacity in a more functional manner. Thus, the present study had the aim of ascertaining whether the proprioceptive deficit regarding JPS continues when patients with a deficient ACL are evaluated by means of a test on active reproduction of joint position, in comparison with the healthy contralateral limb.

Materials and methods

Subjects

Twenty patients participated in this study: 12 men and 8 women of mean age 30.6 ± 4.5 years, mean weight 72.3 ± 14.2 kg and mean height 169.2 ± 8.9 cm. All of these patients presented unilateral tearing of the ACL. They were selected randomly from the waiting list for ACL reconstruction surgery. The inclusion criteria were: (1) age between 20 and 40 years; (2) absence of injuries to the ACL or any other structure of the contralateral knee; (3) not having undergone any surgery on the limb with the ACL tearing; and (4) not having any signs of joint degeneration (characterized by joint crepitation in any of the compartments of the knee). The exclusion criteria were: (1) chondral lesions diagnosed through magnetic resonance imaging; and (2) signs of osteoarthrosis on knee radiographs. All the patients were evaluated clinically by the