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Original article

Reconstruction of the anterior cruciate ligament in skeletally immature patients: an individualized approach☆,☆☆

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ABSTRACT

Objective: to evaluate a series of skeletally immature patients who underwent three surgical techniques for anterior cruciate ligament (ACL) reconstruction according to each patient's growth potential.

Methods: a series of 23 skeletally immature patients who underwent ACL reconstruction surgery at ages ranging from 7 to 15 years was evaluated prospectively. The surgical technique was individualized according to the Tanner sexual maturity score. The surgical techniques used were transphyseal reconstruction, partial transphyseal reconstruction and extraphyseal reconstruction. Four patients underwent the extraphyseal technique, seven the partial transphyseal technique and twelve the full transphyseal technique, on the ACL. The postoperative evaluation was based on the Lysholm score, clinical analysis on the knee and the presence of angular deformity or dysmetria of the lower limb.

Results: the mean Lysholm score was 96.34 (±2.53). None of the patients presented differences in length and/or clinical or radiographic misalignment abnormality of the lower limbs.

Conclusion: ACL reconstruction using flexor tendon grafts in skeletally immature patients provided satisfactory functional results. Use of individualized surgical techniques according to growth potential did not give rise to physeal lesions capable of causing length discrepancies or misalignments of the lower limbs, even in patients with high growth potential.

Reconstrução do ligamento cruzado anterior em pacientes esqueleticamente imaturos: uma abordagem individualizada

Palavras-chave:
Reconstrução
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RESUMO

Objetivo: avaliar uma série de pacientes esqueleticamente imaturos submetidos a três técnicas cirúrgicas de reconstrução do ligamento cruzado anterior (LCA) de acordo com o potencial de crescimento de cada paciente.

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Métodos: foram avaliados prospectivamente 23 pacientes com idade de sete a 15 anos esqueleticamente imaturos submetidos à cirurgia de reconstrução do LCA. A técnica cirúrgica foi individualizada de acordo com o escore de maturação sexual de Tanner. As técnicas cirúrgicas usadas foram a reconstrução transfisária (TF), a transfisária parcial (TFP) e a extrafisária (EF). Quatro pacientes foram submetidos à EF, sete à TFP e 12 à TF. Avaliação pós-operatória foi baseada no escore de Lysholm, na análise clínica do joelho e na presença de deformidade angular ou dismetria do membro inferior.

Resultados: a média do escore de Lysholm foi de 96,34 (± 2,53). Nenhum paciente apresentou diferença de comprimento e/ou alteração clínica ou radiográfica de mau alinhamento dos membros inferiores.

Conclusão: a reconstrução do LCA com o uso de enxerto de tendões flexores em pacientes esqueleticamente imaturos proporcionou resultados funcionais satisfatórios. O uso de técnicas cirúrgicas individualizadas de acordo com o potencial de crescimento não ocasionou lesão fisária capaz de determinar discrepância de comprimento ou mau alinhamento dos membros inferiores, mesmo em pacientes com alto potencial de crescimento.

Introduction

Anterior cruciate ligament (ACL) injuries in skeletally immature patients are still considered to be infrequent. Although some studies prior to the 1980s stated that ACL injuries in patients with open growth plates were rare findings, some authors of recent studies have reported greater incidence of complete ACL tears in skeletally immature patients, accounting for 0.4% to 3.4% of the lesions.[1–4] This increase in the incidence of ACL injuries observed in skeletally immature patients probably results from greater clinical suspicion, improved diagnostic methods and increased participation and demands on children in sports presenting risks of such injuries.

The ideal treatment for ACL tears in skeletally immature patients still remains controversial. Some series that have considered that conservative treatment should be used until the growth plates close have reported unsatisfactory results because the instability continues and secondary lesions develop on the menisci and joint cartilage.[5–8] Other authors have also highlighted that this group of patients presents low adherence to the care that is inherent to conservative treatment, particularly with regard to changes in physical activity, the need to use a brace or the frequency of attendance of muscle strengthening programs.[9–11]

Today, surgical treatment for anterior instability resulting from ACL injury is a promising reality based on evolution of the diagnostic methods and development of new operative techniques.[12–18] However, the time and the type of ACL reconstruction surgery to be performed on skeletally immature patients with a high potential for growth remains controversial matters. The presence of growth phases in the distal femur and the proximal tibia is a challenge for ACL reconstruction techniques in immature patients.

The growth cartilage of the distal femur and proximal tibia accounts for most of the lower-limb growth, and for the injuries. In such cases, injuries caused by constructing bone tunnels in ACL reconstruction surgery may result in premature closure of the phase and in consequent unequal lengths and/or angular deformity around the knee.[11]

The present study had the aim of clinically evaluating a series of skeletally immature patients at different phases of growth who underwent three different ACL reconstruction techniques using autologous grafts from the flexor tendons. The techniques were chosen according to each patient's growth potential.

Materials and methods

Twenty-three skeletally immature patients who underwent ACL reconstruction surgery to treat complete tears of the ligament were evaluated prospectively. The patients were operated between March 2005 and August 2010. Among the patients included, 19 were male and four were female. The inclusion criterion was the presence of extensively open growth phases at the time of the surgery. The exclusion criteria were a history of previous surgery on the knee involved, failure of the patient to return for clinical evaluations; and refusal to participate, expressed through the patient's legal representative. This study had previously been approved by the Research Ethics Committee of the University of Passo Fundo.

The patients' mean age at the time of the surgery was 12.3 years (range: 7–15). Fourteen individuals had been injured on the right knee and nine on the left knee. The mean length of time between the ACL injury and the surgery was 4.8 ± 2.9 months. Twenty individuals (86.9%) suffered ACL injuries by twisting their knee during sports activities: 15 in soccer, three in volleyball, one in handball and one in tennis. Two individuals (8.6%) suffered injuries through falls from bicycles and one (4.3%; the youngest patient) tore the ACL in a fall down the stairs.

The preoperative evaluation was based on the clinical history, preoperative Lysholm score, physical examination, simple X-ray examination and magnetic resonance imaging (MRI) on the knee. In addition to investigation of the trauma mechanism, the clinical history included participation in sports activities before the injury. Anterior instability was evaluated clinically by using the Lachman and pivot shift tests. Each patient's growth potential was defined at the time of the surgery by using Tanner's sexual maturity score.[19]