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Arthroscopic anterior cruciate ligament repair for proximal anterior cruciate ligament tears in skeletally immature patients: Surgical technique and preliminary results

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ABSTRACT

Background: Anterior cruciate ligament (ACL) tears in children are increasingly common and present difficult treatment decisions due to the risk of growth disturbance. Although open primary ACL repair was abandoned in the historical literature, recent studies have suggested that there is a role for arthroscopic primary repair in patients with proximal tears.
Methods: This is a retrospective review of five consecutive patients aged 9.2 years (range 8 to 10) who underwent suture anchor ACL reinsertion. Patients were included if they were Tanner stages 1–2 and proximal ACL tears with adequate tissue quality confirmed arthroscopically. The time frame was 81 days. Arthroscopic ACL reinsertion was performed with bioabsorbable suture anchor. Clinical evaluation, KT-1000™, and MRI were re-evaluated. Clinical outcomes were measured using International Knee Documentation Committee (IKDC), Lysholm and Tegner activity score.
Results: At a mean follow-up of 43.4 months (range 25 to 56), no re-injury and leg length discrepancies were observed. Four patients had negative Lachman tests. The remainder had a grade 1 Lachman test. The mean side-to-side difference was 3 (2–4 mm). In MRI obtained at the last follow-up, no articular lesions or growth arrest were observed and the reinserted ACL was recognized in every exam. All patients returned to previous level of activity and presented normal and nearly normal IKDC score. The mean Lysholm score was 93.6.
Conclusion: Arthroscopic ACL repair can achieve good short-term results with joint stability and recovery of sport activity in skeletally immature patients, with proximal ACL avulsion tear.

1. Introduction

Anterior cruciate ligament (ACL) tears are increasingly more common among children and adolescents [1]. To illustrate, ACL tears comprise 6.7% of all injuries and 30.8% of all knee injuries in pediatric and adolescent soccer players aged five to 18 [2].

The history of ACL rupture treatment in skeletally immature individuals is controversial. Non-surgical (conservative) management is associated with increased occurrence of new meniscal or cartilage injuries, reduced stability, and lower physical activity levels in comparison with surgical treatment [3–6]. Surgical management, on the other hand, restores knee stability and offers the

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possibility of maintaining comparable activity levels. This intervention is advantageous in younger patients who are non-compliant with bracing, and are intolerant of reduced physical activity [3,7,8]. However, a historical analysis of ACL open repair revealed an unacceptable failure rate [9–11]; thus, enthusiasm for this procedure waned. In order to parse-out factors contributing to this failure rate, Sherman et al. conducted an extensive subgroup analysis which included ACL tear type and tissue quality. They revealed better results in patients with proximal ACL avulsion tear and good tissue quality [12]. Genelin et al. subsequently employed this technique principally in proximal avulsion injury of ACL, and observed good mid-term results [13]. Nonetheless, both groups conducted open repairs and implemented long post-operative immobilization (six to eight weeks of long leg cast). In this context, a recent review of the literature showed that in a selected subset of patients, considering only proximal ACL tears, primary ACL repair could be reconsidered as an effective treatment [14].

However, it is the specific nature of surgical treatment in the skeletally immature, which can lead to growth disturbances with serious consequences such as angular deviation or leg shortening in up to 11% of cases [15,16]. These risks are especially apparent in patients in Tanner stages 1 and 2, who have higher growth potential and consequently have a higher risk of major limb growth disturbance compared with patients with closed physes [17]. In response to this confounding problem, novel surgical interventions have been attempted in order to mitigate physeal growth disruption. First, a novel minimally invasive arthroscopic ACL repair with suture anchor achieved short-term clinical success in a carefully selected adult population with proximal ACL avulsion and excellent tissue quality of the stump [18]. Secondly, Steadman et al. performed arthroscopic holes in the femoral ACL footprint to induce a "healing response" in selected skeletally immature patients. Although "healing response" should not be considered a repair technique, the good clinical outcomes in these pediatric patients with a proximal ACL tear lead us to consider children as the ideal candidates for arthroscopic suture anchor ACL repair [19].

The aim of this study is to describe a variation in the previously described suture anchor repair [24] to treat proximal ACL tears in the skeletally immature patients, and to evaluate the clinical and subjective results in the short-term follow-up.

2. Materials and methods

This is a retrospective review and early follow-up of five consecutive skeletally immature patients (four boys and one girl) with proximal ACL tears that underwent arthroscopic ACL femoral reinsertion with a bioabsorbable anchor by the senior surgeon (M.B.) in our center between 2007 and 2010 (Figure 1). Children with a clinical ACL deficiency underwent knee radiographs and magnetic resonance imaging (MRI) to exclude spine avulsion and fracture and to recognize a proximal ACL avulsion (Figure 2). Indications for primary repair of the ACL included: (i) a primary proximal ACL lesion confirmed clinically and identified on MRI, (ii) any patient with open growth plates with a Tanner stage 1 or stage 2, (iii) informed consent signed by both parents, and (iv) an arthroscopic intraoperative confirmation of the adequate tissue quality and quantity of the ACL stump to perform the ACL reinsertion. In the presence of inadequate tissue, ACL reinsertion was converted to ACL reconstruction or conservative treatment according to parental consent. Exclusion criteria included any indications of: (i) ACL mid-substance or distal ruptures, (ii) spine avulsion, (iii) intra-epiphyseal growth disturbances, (iv) multi-ligament injury patterns (≥3 ligaments involved), and (v) any previous surgical interventions on the limb under consideration for treatment.

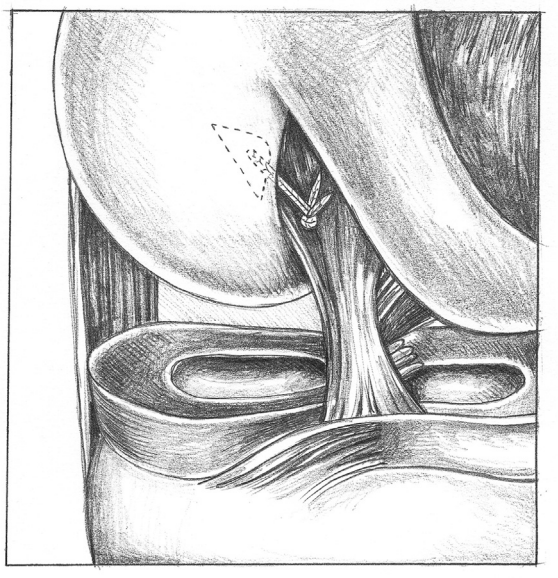

Figure 1. Principle of the ACL femoral reinsertion with a bioabsorbable anchor.

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