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ORIGINAL ARTICLE

Arthroscopic Technique for Reduction and Fixation of Adolescent Tibial Eminence Fracture using a Cannulated Screw

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Abstract. This study describes an arthroscopic technique for reduction and fixation of tibial eminence fracture using cannulated screw in six patients aged 12-18 years, with a follow-up after 6-48 months. We used subjective, clinical and radiological outcome measures during the follow-up. On last follow-up, all patients demonstrated full range of motion in the affected knee comparable with the contralateral knee. Our conclusion is that arthroscopic reduction and fixation of adolescent tibial eminence fracture is an acceptable, and safe method of fixation with larger fragments with no concern to growth in this age group of patients.

Keywords: Arthroscopy, Reduction and fixation, Cannulated screw, Tibial-eminence fracture.

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Introduction

The arthroscopic reduction and fixation of the avulsed tibial eminence in children and adolescents have been gaining popularity and allowing more understanding of the morphology, amount of the displacement of the fragment, the mechanical block to knee extension by the displaced tibial eminence, and the role played by a meniscus to block the reduction of the displaced fragment,[1] as well as concomitant treatment of meniscal tears.

The treatment of tibial eminence injuries is guided by classification type[2]. Zariczyj has modified the classification made by Meyers and McKeefer[3]. He divided Type III fractures into classes A and B: type IIIA describes the pathology when the fragment with complete separation is displaced minimally; type IIIB when the fragment is twisted or fragmented resulting in rotational malalignment[4]. These types of fractures may be impossible to reduce because of soft tissue, or the meniscus preventing proper reduction.

Arthroscopic reduction and fixation can usually be achieved, and the fracture is reduced and fixed using either pins, screws[5], or sutures[1] if the fragment is small or fragmented

In our previous studies, we described arthroscopic reduction and fixation of these fractures using sutures. The present study is a description of an alternative method of fixation using the cannulated screws.

Materials and Methods

The study was carried out at the Department of Orthopedics at McMaster University, Hamilton, Ontario, Canada. We identified patients with tibial eminence fracture between the years 2005 to 2007 who were treated arthroscopically using the cannulated screw; all patients had displaced fracture that required surgical treatment. Diagnosis was confirmed by clinical and radiological assessment.

All patients were followed clinically and radiologically. Healing of the fragment was assessed in all cases by comparative digital

radiographic means using pre- and post-operative X-rays (Figs. 1 and 2).

Fig. 1. Lateral view showing displaced fragment of tibial eminence.

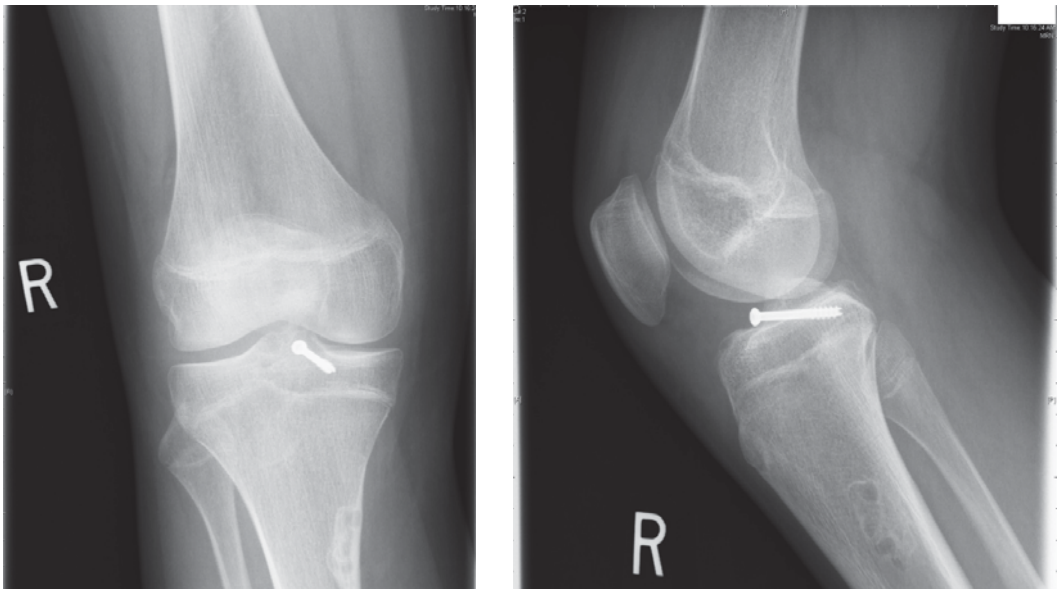

Fig. 2. Postoperative X-ray post screw insertion.

Surgical Technique

Under general anesthesia, a tourniquet was applied to the affected leg. Clinical examination performed under anesthesia included: Lachman's; pivot shift tests; and range of motion evaluation, with comparison exam of the unaffected extremity.

The tourniquet was then inflated and the extremity placed in a leg holder.

The arthroscope was introduced into the knee through the anterolateral portal. The hematoma was evacuated to clear the blood from the knee. This was followed by standard arthroscopic evaluation of knee compartments, including meniscal probing to rule out concurrent pathology. The tibial eminence was reduced back in its anatomical bed through an anteromedial portal using a probe; the motor shaver was used if necessary to remove debris and soft tissue impingement. Through a superior medial portal, a smooth k-wire was passed to fix the fragment and a 4.0 mm cannulated screw was inserted over the wire without passing the growth plate. Intra-operative imaging was used to confirm reduction and screw position (Fig. 3). At the end of the procedure the lower extremity was placed in long leg cast in extension for a period of 4 weeks, followed by a gradual rehabilitation program (Fig. 3).

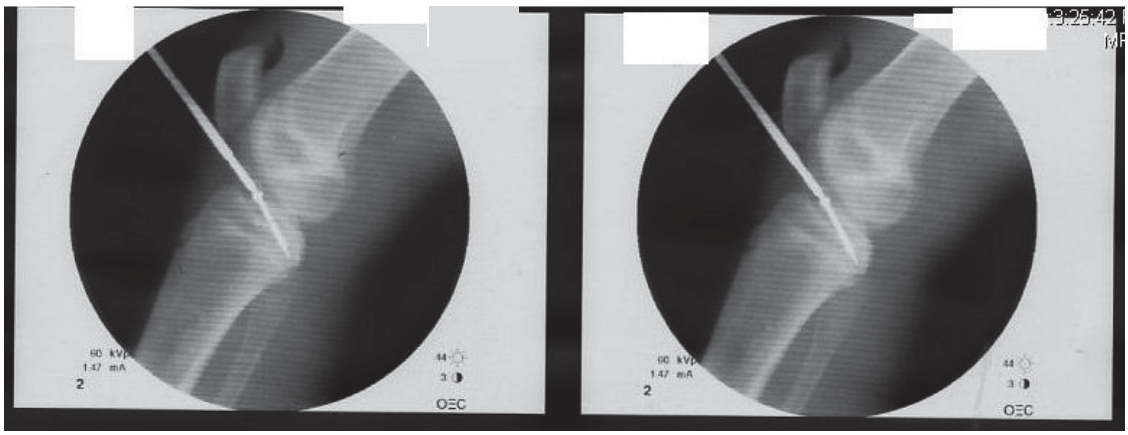

Fig. 3. Intraoperative X-ray (note the direction of the screw insertion).

Results

The study included six patients, four females and two males. The average age was 14 years (range of 12 - 18), and all patients had hemarthrosis.

The average follow up time was 19.7 months (6 - 48 months). In all patients, the tibial eminence fracture healed and all had regained full range of motion. One patient had an extension lag of 10 degrees and he was treated arthroscopically. Fibrous tissue anterior to the eminence was found and it was excised using the motor shaver and the screw was removed. No postoperative complications were noted. In one patient the screw fixation did not feel stable intraoperatively and therefore we augmented our screw fixation with suture technique as described by Mah *et al.*[1]. We think that in this particular patient the fragment was not large enough for adequate screw purchase.

There were no signs of instability on postoperative examination of this patient and the Lachman test had a firm end point. One patient had a lateral meniscus tear, which was repaired at this time.

Follow up radiographs confirmed complete union of the fractures in the correct anatomical position in all patients.

Discussion

The goal of treatment of displaced intercondylar eminence fractures is anatomic reduction and fixation. The method of fixation of the tibial-eminence fracture varies: the use of sutures, pins and screws have been reported[1,5]. Binnet *et al.*[6] reported the use of screw fixation in 13 adult patients. The use of arthroscopy in the treatment of tibial eminence fractures has been widely used and reported[1,5-7]. Arthroscopic evaluations of these fractures allow the surgeon to reduce the fracture anatomically and use the proper fixation method needed for the type of fracture.

With arthroscopy the fragment can be reduced anatomically under direct vision and interposing tissues, or menisci can be identified and removed. We have reported nine patients who demonstrated lateral meniscus interposition in our previous study[7].

Associated soft tissue and cartilage pathological conditions may be a significant prognostic indicator for the development of knee pain at follow up; in this review we had one patient who had a meniscus tear that was repaired simultaneously.

Anatomic reduction and stable fixation of these fractures contribute to the stability of the knee joint as reported by Willis *et al.*[2]. All of our patients had a stable knee in follow up examination.

There were no concerns regarding growth affection as the screw position was sparing the physis. There was no radiographic evidence of displacement of the healed tibial eminence at follow up.

The authors believe that this method of fixation is an easy, safe, and acceptable one that can be used to treat large size tibial eminence fractures in adolescents with no concern to growth problems in this age group.

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أسلوب جراحة المناظير لإرجاع و تثبيت العظام البارزة بين اللقمتين في عظام الظنبوب باستخدام مسمار مقنّى

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المستخلص. تم في هذا البحث وصف أسلوب جراحة المناظير لإرجاع وتثبيت كسر العظم البارز بين اللقمتين بالظنبوب باستخدام المسمار المقنى في ستة مرضى تتراوح أعمارهم بين ١٢–١٨ سنة، مع متابعة لفترة ٦–٤٨ شهراً باستخدام الفحص السريري والإشعاعي. تبين في المتابعة النهائية أن جميع المرضى كان لديهم الحركة الكاملة في الركبة المتضررة مقارنة مع الركبة المقابلة. إستنتاجنا هو أن العلاج بالمنظار وتثبيت كسر عظام الساق البارز بين اللقمتين للمراهقين يعتبر علاج مقبول وآمن بدون أي مضاعفات في نمو العظام في هذه الفئة العمرية من المرضى.