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Original Article

Selective hemiepiphysodesis for patellar instability with associated genu valgum

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ABSTRACT

Background/Aims: Patellar instability limits activity and promotes arthritis. Correcting genu valgum with selective hemiepiphysodesis can treat patellar instability.

Methods: We retrospectively reviewed 26 knees with patellar instability and associated genu valgum that underwent hemiepiphysodesis.

Results: Average anatomic lateral distal femoral angle (aLDFA) significantly corrected. Symptoms improved in all patients. All competitive athletes returned to sports. One complication occurred.

Conclusions: In genu valgum, the patella seeks an abnormal mechanical axis, resulting in patellar instability. By correcting the mechanical axis with hemiepiphysodesis, patellar instability symptoms improve and patients return to sports. Complications are rare. Selective hemiepiphysodesis is recommended when treating patellar instability with associated genu valgum.

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1. Introduction

Patellar instability, including patellar subluxation and dislocation, is a condition often encountered in children and adolescents. Lateral patellar subluxation or dislocation is the most common instability pattern and is often associated with genu valgum.¹ Genu valgum can be defined both clinically and radiographically. Clinically, genu valgum is characterized by an intermalleolar distance greater than 8 cm and a tibiofemoral angle greater than 15°. ^{2,3} Radiographically, genu valgum is characterized by an anatomic lateral distal femoral angle (aLDFA) <79°, an anatomic medial proximal tibial angle

>90°, and a mechanical axis line that passes through the lateral half of the knee joint.⁴ As knee valgus increases, the stresses at the lateral patellofemoral joint increase⁵ and this can lead to patellofemoral pain and instability. Additionally, increased lateral patellofemoral joint contact pressures can lead to degenerative changes over time.¹

Historically, the mainstay of treating lateral patellar instability has been non-operative, including activity modification, physical therapy for quadriceps stretching and strengthening, and bracing.⁶ In the setting of genu valgum, this approach often fails, necessitating surgical management. Traditionally, surgical treatment of patellar instability has focused on realignment of the extensor mechanism. Several

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procedures have been described, but none has been uniformly successful in preventing recurrence of patellar instability. Reported unsatisfactory results range from 20% to 80%.⁷ Furthermore, these procedures are invasive, have high complication rates and require extensive rehabilitation.^{8–20}

Selective hemiepiphysodesis, where one or more physes are surgically closed at the medial distal femur or the proximal tibia, is a well described and accepted treatment for correcting primary and secondary genu valgum in pediatric patients.^{21–24} This technique can restore or improve the normal mechanical alignment of the knee and knee extensor mechanism.²⁵ Unlike some operations directed at realigning the extensor mechanism, selective hemiepiphysodesis is minimally-invasive and can be performed as an outpatient procedure. Both extremities can be addressed simultaneously. Patients are encouraged to begin range of motion exercises and bear weight as tolerated immediately after surgery. Release to full activities occurs once the surgical wounds have healed. Stevens et al²⁵ reviewed 152 knees in 76 patients who underwent hemiepiphysal stapling for idiopathic adolescent genu valgum and showed improved clinical and radiographic parameters as well as a high degree of patient satisfaction. The authors suggested that this technique be used in treating symptomatic genu valgum, including patellar instability, although it is unclear how many patients in their study had patellar subluxation or dislocation episodes. Additionally, 4 knees in their series underwent concomitant lateral retinacular release, but it is unclear if these patients had patellar instability.

We were unable to find any published studies that focus on treatment of patellar instability by correcting genu valgum with selective hemiepiphysodesis at the knee. The purpose of this study is to report the results of treating pediatric patients with patellar instability by correcting excessive genu valgum with selective hemiepiphysodesis. The intent is to make orthopaedic surgeons aware of the efficacy, simplicity and safety of this treatment strategy and its application in the armamentarium of treatment methods for pediatric patients with patellar instability.

2. Methods

We obtained institutional review board (IRB) approval for this retrospective review of patient records and radiographs. All patients with patellar instability symptoms with associated genu valgum who underwent selective hemiepiphysodesis at the knee from January 1999 through July 2009 at a university-based children's hospital were identified, resulting in a total of 22 patients. Seven patients were excluded. Of these, 4 patients did not have a documented episode of patellar instability, only patellofemoral joint pain. Two patients underwent concomitant soft tissue procedures about the knee and 1 patient was skeletally mature at the time of surgery. Fifteen patients were included in the study.

Data about the frequency of pre- and post-operative patellar subluxation and dislocation episodes as well as changes in activity level were obtained from the patient's history documented in the medical records. A subluxation episode was recorded when a patient described a painful and

excessive lateral movement of the patella that spontaneously reduced, while a dislocation required a patient description involving a manual patellar reduction. Although the exact numbers of pre- and post-operative patellar instability episodes were not specifically documented, the records did document whether there was a relative improvement in symptoms after surgery. Similarly, relative improvement in activity level was apparent in the patient records, particularly regarding ability to participate in competitive sports.

On exam, all patients were noted to have clinically apparent genu valgum. We could not include clinical measurements of genu valgum in this study (i.e. intermalleolar distance, tibiofemoral angle) as these were not consistently documented in the physical exam. Radiographically, we used the anatomic lateral distal femoral angle (aLDFA) to quantify pre-operative genu valgum and the amount of knee alignment correction obtained post-operatively. This was measured from the pre- and post-operative anterior-posterior (AP) knee radiographs by measuring the angle between the femoral shaft and the distal femoral articular surface. Normal aLDFA measurements can range between 79 and 83°. A value <79° indicates excessive genu valgum. Since all patients did not have pre- and post-operative full length lower extremity radiographs, tibiofemoral angle and mechanical axis alignment zone could not be accurately calculated.

Patients underwent a trial of conservative management prior to surgery, consisting of activity modification, physical therapy for quadriceps strengthening and, in some cases, bracing with a patellar cut-out orthotic. The indications for surgery included continued painful patellar subluxation or dislocation in the setting of clinical and radiographic genu valgum in a skeletally immature patient following at least 6 months of conservative management if remaining growth allowed.

The goal of surgery was to eliminate patellar instability by reestablishing normal patella tracking. Our approach used the principle of guided growth to restore the normal anatomic relationship of the knee joint and the extensor mechanism by correcting the mechanical axis to the center of the knee. The medial distal femoral physis was treated in all cases because it was the primary site of deformity. The medial proximal tibial physis was treated if the anatomic medial proximal tibial angle was >90°. Blount staples (Zimmer, Warsaw, IN) were implanted exclusively from 1999 to 2003 with a change to 8-plates (Orthofix, McKinney, TX) thereafter. If needed, both knees were treated simultaneously. Surgery was typically performed on an outpatient basis. Post-operatively, immediate knee motion and weight bearing as tolerated were encouraged. Once the surgical wounds were healed at 10–14 days, patients were released to full activities as tolerated.

Implant removal was routinely performed on an outpatient basis when the mechanical axis was slightly overcorrected. The previous surgical scar was often resected at the time of implant removal to create a thin, cosmetically-pleasing scar. Full activity was permitted after hardware removal once the wound healed in 10–14 days. All complications were reported.

Summary statistics were used to describe the research variables as means and percentages.

All statistical calculations were done using a Student's t-test with an alpha level set at 0.05.

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