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RESEARCH ARTICLE OPEN ACCESS

A SIMPLE TECHNIQUE FOR HEMI EPIPHYSIODESIS IN CHILDREN USING MOSAICPLASTY SYSTEM

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ABSTRACT

Guided growth is helpful in correcting angular misalignments in children. Temporary and permanent hemiepiphysiodesis is a surgical procedure that can correct angular misalignments and provide effective correction. 12.5year old male with bilateral knee valgus deformity was included in this case study. Permanent hemiepiphysiodesis was performed using the Mosiaplasty system.Permanent hemiepiphysiodesis using the Arthex OATS System with a modification of the green approach is a safe and effective method for correcting knee valgus in adolescents.

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INTRODUCTION

Knee valgus is part of a normal physiological process in children. During development, the femotibial (FT) angle changes from varus to valgus. Before the age of 1 year a child can reach varus up to 15 degree. By age 2 children are approaching neutrality. By age 3, children can develop maximum valgus before spontaneously improving to about 6º by age seven [1]. Persistent knee valgus can be unilateral or bilateral, with persistent knee valgus most commonly being bilateral. Etiologies such as cartilage growth disorders, skeletal dysplasia and idiopathic dysplasia are usually bilateral. Knee trauma or infection can lead to unlateral knee valgus. The indications for the procedure were: 1) unacceptable cosmetics; 2) Knee valgus> 15º after age 7; 3) asymmetry; 4) intermalleolar distance (MI) greater than 7.5 cm; 5) walking disorder; 6) pain and 7) decreased participation in physical activity [2,3]. Various surgical approaches have been described in theliterature as effective treatments for patients with lower extremity angular deformities [4-9]. Physeal manipulation has the advantage of reducing morbidity compared to more invasive methods such as osteotomy [10,11]. In 1933, Phemister described growth arrest by epiphyseal manipulation by rotating the epiphyseal plate 90° to create a bony bridge [12]. In 1949, Blount and Clarke described epiphyseal growth control by stapling the epiphyses [13]. Temporary hemi-epiphysiodesis can be performed with tension band plate plates, percutaneous pedicle screws, and staples [14-16].

The method described by Green, in which the growth plate is curetted anterior, posterior, and distal directions to the bone graft is made removed from the proximal holder and placed back in the original holder with the ends rotated 180 degrees. Timing of hemiepiphysiodesis for optimal cuff removal and deformity correction is key to success and is based on bone age radiographs [19-21]. In this study, we modified Green's technique by harvesting two 10mm bone blocks from the Arthex OATS system instead of using an osteotome for a single growth plate wedge in children with idiopathic valgus knee.

METHODS

In order to determine the degree of deformity, IM distance measurements were made with the patient supine, legs flat and touching of the medial femoral condyles. An IM distance greater than 7.5cm was considered abnormal [2,3]. The FT angle was measured clinically preoperatively with AP radiographs and a goniometer to help guide the surgical procedure. Indications for surgery included pre-operative IM distance greater than 7.5cm and FT angles greater than 12º in addition to patient symptomatology. In our case the patient was having bilateral genu valgum deformity withtibiofemoral angle of right side was 14 degree and for left side it was 9.7 degree.Intermalleolar distance was more than 10 cm. Patient was given supine position on OT table. Both lower limbs were scrubbed,

painted and draped. Under all aseptic conditions, incision was taken over the medial distal femoral site of size 4 cm which was 1 cm proximal to the joint line and in the center of the anterior and posterior aspect of femur. After dissection of subcutaneous tissues, periosteum was dissected and physis region of femurexposed. The physeal region was identified with the help of a C-arm. Two bone blocks of 10 mm diameter with the depth of 15 mm were taken out keeping the physis in the center and reinserted with inner surface facing outwards as shown figure 5

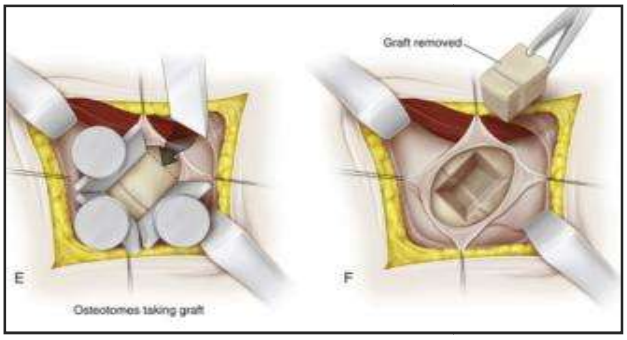

Figure 1 Green method

Arthex Oats System: Commonly used in Mosaicplasty for taking and transferring autologous osteochondral grafts from one site to another. 5 mm to 25 mm diameter sizes are available through which up to 25 mm cylindrical grafts can be taken out.

Figure 2. Pre op Radiograph

Intra Operative Pictures: Harvesting two bone block cylinders of 10 mm diameter with 15 mm length.

Figure 3.

Intra op pictures: Both cylinders are rotated 180 degree and reinserted at same site.

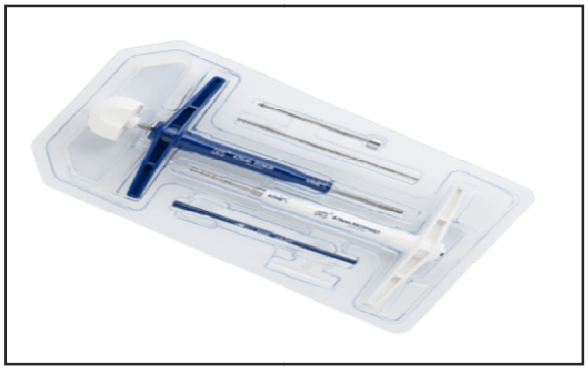

Figure 4. Arhex OATS system

Figure 5.

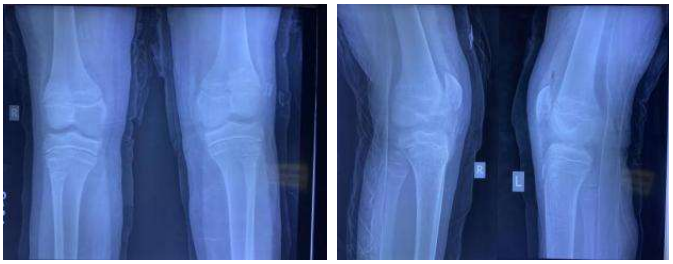

Figure 6. Post op radiograph

Patient was mobilised the next day of operation

DISCUSSION

Medial hemiepiphysiodesis with a tubular bone block under fluoroscopy imaging is an effective treatment for adolescents with

idiopathic knee valgus. Inan [19] successfully corrected valgus by percutaneous hemi-epiphysiodesis in patients with a preoperative deformity of 12° and postoperative valgus measurements of 4°. Ferrick [22] showed an average mechanical axis correction of 10º with a FT manipulation correction factor of 1.1º per month over a one year period, Bowen [18] showed an average net correction of 1 angle FT of 4.4º for the physis, and another study [17] showed a sharp correction of the valgus angle of 11.8º FT by percutaneous hemi-epiphysiodesis. genu valgus has been shown to cause lateralization of the patella, making patients more prone to instability [23]. Patients who do not receive valgus correction may be at risk of failure due to persistent knee valgus and its significant association with patellar instability [24]. One of the keys to hemi-epiphysiodesis is the timing of the surgery. Lower limb growth has been shown to stop around 2 years and 6 months after distal phalangeal fusion in children [25, 26]. This may be the optimal time for patients to undergo permanent hemi-epiphysiodesis as their remaining growth phase begins to decrease and therefore relying on guided growth techniques may not be sufficient. Other studies analyzing the timing of onset of permanent hemi-epiphysiodesis have suggested surgery within 1-2 years after growth with careful follow-up [22].

Troyetal.investigated percutaneous epiphysiodesis with drill /curettage versus transphyseal screws [27] in 115 adolescents with leg length discrepancy (LLD). Both procedures showed equal efficacy in removing LLD with similar operative times and length of stay (LOS). However, the advantage of thedrill curettage is that it does not usually need to return to the operating room for subsequent hardware removal [28,29]. Permanent hemi-epiphysiodesis using cylindrical bone blocks has several advantages over other methods of permanent epiphysiodesis. Extraction of the bone block with osteotomes sometimes causes bone deformities and sometimes late collapse of the medial condyle.This is a clean technique that allows clean bony cylinders to be removed without creating stress in themedialcondyle. In addition, cylinders with a diameter of 5 mm to 20 mm and a depth of up to 25 mmcan be removed and reversed without using force. Because there are no sharp corners , patient can be confidently told to bear full weight the day after surgery. This method requires no hardware removal and is less likely to cause postoperative infections. There is no rebound phenomena with this method. Cosmetically, the procedure is performed with minimal incision and minimal scarring and hardware is not needed [5,15,30]. We can use a horizontal incision to dissect the skin and a vertical incision to dissect the periosteum. The horizontal incision promotes better healing and the vertical incision helps provide more surface area for growth plate exposure and avoiding contact with deeper tissue with minimal incision.

CONCLUSION

Permanent hemi epiphysiodesis using Arthex OATS system with cylindrical blocks from physis is a safe and effective method to correct genu valgum in adolescents. This procedure using using Arthex OATS system is easy to use, without much damage to physis and minimally invasive compare to the Green's procedure. Due to minimal invasive approach, there is less chances of post operative infections and less chances of adjoining tissue damage. Patient can confidently be asked to bear full weight after surgery.

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