Journal of Maharashtra Orthopaedic Association 2012;7(2):26-29

Hemiepiphysiodesis using 8-plate: a promising tool for correction of angular deformities around knee in paediatric population.

Viraj Uttamrao Shingade[1]

Abstract

Management of angular deformities around knee with sick physis, in growing children, is always a difficult task. Corrective osteotomies are associated with pain, stiffness, risk of non union and prolonged period of immobilization. Stapling is associated with high rate of breakage and migration, while epiphysiodesis using transphyseal screw carry the risk of breakage of screws or formation of physeal bar. To overcome these problems the concept of guided growth (hemiepiphysiodesis) using a flexible construct of a nonlocking plate of 8 shaped and two screws came forward in the year 2006-2007. This plate acts as a tension band without any risk of direct damage to growth plate. Once the deformity is corrected, plate is removed and the growth is reversible. The procedure is easy, safe and it offers the effective solution for angular deformities around knee.

Key words: hemiepiphysiodesis, 8 plate, guided growth

Introduction

Management of angular deformities around knee in growing children is always a difficult task. Particularly those deformities which are due to dysplasias, post traumatic, or due to metabolic causes are known to progress and cause recurrences [1]. Corrective osteotomies offer the gold standard treatment for these deformities, but are associated with pain, stiffness, risk of non union and prolonged period of immobilization [2]. Furthermore with above underlying aetiologies chances of recurrences are very high and may require multiple repeated procedures.

Stapling at one time was considered as an effective treatment modality for correction of these deformities; but went into disrepute due to high rate of breakage and migration [3, 4.] Epiphysiodesis using transphyseal screws carried the risk of breakage of screws or formation of physeal bar [5]. Considering all above issues, Peter Stevens [6, 7, 8] in the year 2006-7 described the concept of guided growth (hemiepiphysiodesis) using a flexible construct of a nonlocking plate of 8 shaped and two screws (Fig. 1). This plate which is placed extraperiosteally act as a tension band [9] without any risk of direct damage to growth plate. Once the deformity is corrected, plate is removed and the growth is reversible.

Children Orthopaedic Care Institute, Pravira Hospital Campus, Wardha Road, Nagpur, Maharashtra, India

Address for correspondence:

Dr Viraj Uttamrao Shingade

Children Orthopaedic Care Institute, Pravira Hospital Campus, Daya Chambers, Beside Haldiram Building, Ajni square, Wardha Road, Nagpur, Maharashtra, India

Phone: 0712-3221760, 2252327.

Email : virajshingade@rediffmail.com

Indications

Mostly it is used for angular deformities at knee [10, 11, 12, 13]. The physiological genu varum and genu valgum should be excluded, as they only need reassurance. It can be also used around ankle [13], hip or any other physis wherever correction is needed and there is adequate space for 8-plate and to pass two screws around the physis. The procedure can be used around many physis at the same time if deformity is severe and can be used at both lower limbs simultaneously. The commonest example is severe valgus or varus at both knees where plates are applied at both distal femur and both proximal tibia (Figure 2).

It can be used at any age; the only consideration is that, there should be at least one year of growth remaining. Secondly before planning the surgery one should check the availability of smaller size plates when using for too small kids (eg. at 2 or 3 yrs of age).

Contraindications

The procedure will not be effective if physis has been closed due to previous damage. The second contraindication is preexisting physeal bar. The procedure will not be effective if maturity has already been achieved [10, 11, 12].

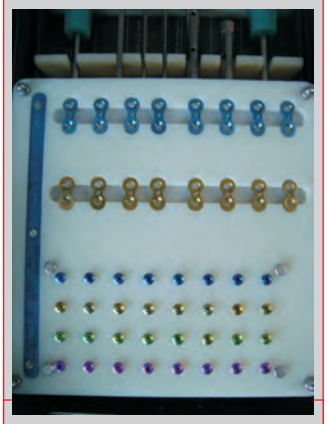

Figure 1: An instrument set consisting of 8-plates of various sizes, and cannulated screws of 3.5 mm diameter. The plate and screws are made from titanium. Plates are available in various sizes, and screws are available in 3.5 mm and 4.5 mm diameter and different lengths.

Figure 2: If deformity is severe, then distal femoral as well as proximal tibial physis are used for 8 plate construct.

Figure 4: a- Illustrative example: a 8 year child with severe post rickets genu varum treated with 8-plate. Preoperative photograph. b- Post surgery 2 year follow-up. The deformity is well corrected the plates are removed.

The Procedure

The presurgical planning remains the same as for any deformity correction. The full length standing X-rays need to be taken. The magnitude and direction of deformity should be noted. Various metaphyseal, diaphyseal angles need to be measured and mechanical axis deviation should be determined [14]. If there is associated excessive ligament laxity then it should be documented and should be informed to the parents.

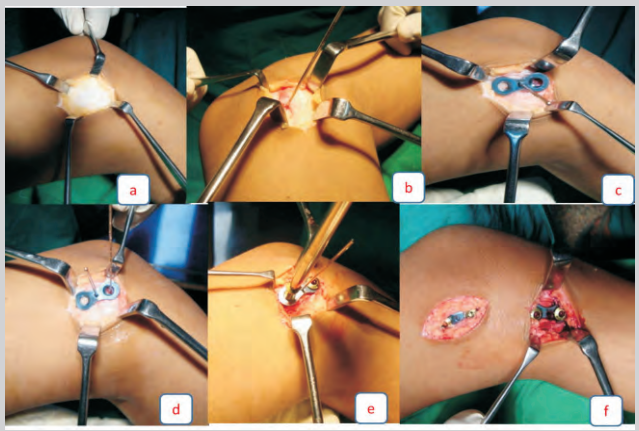

Figure 3: a- A small 2 to 3 cm incision is taken around the physis. The fascia is divided but care is taken not to disturb the periosteum. b- A fine guide pin is inserted in to the physis under image intensifier control. The placement of guide pin should be in midsagittal plane (centre of AP diameter) or slightly posterior. c- The plate is passed over the guide pin through its central hole, and placed in such a way that there is scope to put one screw in epiphysis and other one in metaphysis. d- guide wire for epiphysis is passed with due care that it does not cross the joint. e- The self tapping screws of either 3.5 mm or 4.5 mm diameter (depending upon size of the bone) are passed over the guide wires and are tightened. f- as deformity is severe, distal femoral as well as proximal tibial physis are applied with 8-plate construct in the same sitting.

The plate is applied at the apex of the deformity which usually coincides with distal femur or proximal tibia. If deformity is severe then femur as well as tibia both should be considered for plating.

Patient is under anaesthesia, in supine position; image intensifier is centered over the knee. The tourniquet is inflated. A small 2 to 3 cm incision is taken around the physis. The fascia is divided but care is taken not to disturb the periosteum (Figure 3a). If periosteum is damaged then there are chances of permanent physeal closure.

A fine hypodermic needle or guide pin is inserted in to the physis under image intensifier control (Figure 3b). The placement of needle or guide pin should be in midsagittal

Figure 5: a- 4 year child with bilateral fibular hemimelia with severe genu valgum: front view. b- back view of the deformity. c- 14 months after application of 8-plate. Deformity correction is in progress: front view. d-back view: deformity is getting corrected. e-AP radiograph showing 8-plates at femoral as well as tibial physis. f- Lateral radiograph showing 8-plates.

plane (centre of AP diameter) or slightly posterior, to prevent the recurvatum.

The plate is passed over the needle or guide pin through its central hole, and placed in such a way that there is scope to

put one screw in epiphysis and other one in metaphysis (Figure 3c). Now the guide wire for epiphysis is passed with due care that it do not cross the joint (Figure 3d). This is followed by insertion of metaphyseal guide wire. The utmost care need to be taken at this stage; so that guide wire should not cross the physis.

The two guide wires are not necessarily parallel to each other. A cannulated drill bit is used to make the initial few mm (3 to 5 mm) of whole over the guide wire. The self tapping cannulated screws of either 3.5 mm or 4.5 mm diameter (depending upon size of the bone) are passed over the guide wires and are tightened (Figure 3e).

Only one plate is required for correction of deformity at one physis. The only indication of using two plates at one physis is fixed flexion deformity at knee; where two plates are applied at distal femur, each plate placed on either side of patellofemoral sulcus [15, 16].

If deformity is severe then distal femoral as well as proximal tibial physis are applied with 8-plate construct in the same sitting (Figure 3f).

The wound is closed in a routine fashion. Tourniquet is deflated and padded dressing is given. The weight bearing is allowed on the same day or as soon as operative pain is over. The child is kept under observation and follow-up at 3 monthly intervals. X-rays are taken at each follow-up. Once the deformity is corrected the implants are removed (Figure 4 and 5). Long term follow up is kept till skeletal maturity [14].

Advantages

There are many advantages of this procedure when you compare with other techniques

Over stapling the advantages are less chances of implant breakage as construct is flexible. The speed of deformity correction is also fast [3, 4, 17].

Over the osteotomy the advantages are [1,2,18] negligible blood loss, no chances of non-union or malunion. There are no plaster related problems and no risk of compartment syndrome. Child can resume all the activities as soon as pain is over and hence prolonged immobilization is avoided.

Disadvantages and problems encountered

As earlier mentioned the procedure is not useful if maturity has been already achieved or there is physeal closure before the surgical procedure.

In Peter Stevens own series of more than 100 children, he has found migration of 3.5 mm screws in few cases. This problem was solved once he used 4.5 mm screws [6,7,8,19] instead of 3.5 mm screws. There are chances of permanent physeal closure if care is not taken and periosteum is traumatized during surgery. Although Peter Stevens has observed most of the deformities getting corrected within 12-18 months period [6, 7], in Indian patients we have observed that little more time is taken for correction of deformities. In our observation the average time taken for correction of deformity in Indian patients is around 18 to 24 months. Similar finding is also noted by other centres in India (unpublished data –personnel communication).

Conclusion

Multiple and repeated osteotomies are required for managing angular deformities around knee in growing children. These osteotomies are associated with pain, stiffness, risk of non union, malunion and prolonged period of immobilization. Guided growth using a flexible construct of 8 plate and two screws applied around the physis offers the easy, safe and effective solution for these angular deformities around knee. The published results are promising and our experience goes in favour of using this effective tool for management of deformities around knee, and ankle

.

References

1. Chotigavanichaya C, Salinas G, Green T, Moseley CF, Otsuka NY .Recurrence of varus deformity after proximal tibial osteotomy in Blount disease: long-term follow-up. J Pediatr Orthop. 2002 Sep-Oct; 22(5):638-41.

2. Payman KR, Patenall V, Borden P, Green T, Otsuka NY .Complications of tibial osteotomies in children with comorbidities. J Pediatr Orthop. 2002 Sep-Oct; 22(5):642-4.

3. Wiemann JM 4th, Tryon C, Szalay EA. Physeal stapling versus 8-plate hemiepiphysiodesis for guided correction of angular deformity about the knee. J Pediatr Orthop. 2009 Jul-Aug; 29(5):481-5.

4. Goyeneche RA, Primomo CE, Lambert N, Miscione H. Correction of bone angular deformities: experimental analysis of staples versus 8-plate. J Pediatr Orthop. 2009 Oct-Nov; 29(7):736-40.

5. Métaizeau JP, Wong-Chung J, Bertrand H, Pasquier P .Percutaneous epiphysiodesis using transphyseal screws (PETS).J Pediatr Orthop. 1998 May-Jun; 18(3):363-9.

6. Stevens PM. Guided growth for Angular correction: A preliminary series using a tension band plate. J Pediatr Orthop.2007; April-May 27:253-259.

7. Stevens PM. Guided growth: 1933 to the Present. Strat Traum Limb Recon.2006; 1:29-35.

8. Stevens PM, Pease F. Hemiepiphysiodesis for posttraumatic tibial valgus.J Pediatr Orthop. 2006 May-Jun; 26(3):385-92.

9. Ballal MS, Bruce CE, Nayagam S. Correcting genu varum and valgum in children by guided growth: temporary hemiepiphysiodesis using tension band plates .J Bone Joint Surg Br. 2010 Feb;92(2):273-6.

10. Ghanem I, Karam JA, Widmann RF. Surgical epiphysiodesis indications and techniques:update. Curr Opin Pediatr. 2011 Feb; 23(1):53-59.

11. Burghardt RD, Herzenberg JE. Temporary hemiepiphysiodesis with the eight-plate for angular deformities: mid-term results.J Orthop Sci. 2010 Sep; 15(5):699-704.

12. Niethard M , Deja M, Rogalski M . Correction of angular deformity of the knee in growing children by temporary hemiepiphysiodesis using the eight plate. Z Orthop Unfall. 2010 Mar; 148(2):215-21.

13. Burghardt RD, Herzenberg JE, Standard SC, Paley D. Temporary hemiepiphyseal arrest using a screw and plate device to treat knee and ankle deformities in children: a preliminary report.J Child Orthop. 2008 Jun; 2(3):187-97.

14. Stevens PM, Klatt JB. Guided growth for pathological physes:radiographic improvement during realignment. J Pediatr Orthop. 2008 Sep; 28(6):632-9.

15. Saran N, Rathjen KE. Guided growth for the correction of pediatric lower limb angular deformity.J Am Acad Orthop Surg. 2010 Sep; 18(9):528-36.

16. Eastwood DM, Sanghrajka AP. Guided growth:recent advances in a deep-rooted cocept. J Bone Joint Surg Br. 2011 Jan; 93(1):12-8.

17. Kanellopoulos AD, Mavrogenis AF, Dovris D, Vlasis K, Burghart R, Soucacos PN, Papagelopoulos PJ , Herzenberg JE. Temporary hemiepiphysiodesis with blount staples and eight-plates in pigs. Orthopaedics.2011 Apr 11; 34(4): 228-35.

18. Martin SD, Moran MC, Martin TL, Burke SW. Proximal tibial osteotomy with compression plate fixation for tibia vara. J Pediatr Orthop. 1994 Sep-Oct; 14(5):619-22.

19. Burghardt RD, Specht SC, Herzenberg JE. Mechanical failures of eight-plate guided growth system for temporary hemiepiphysiodesis. J Pediatr Orthop. 2010 Sep; 30(6):594-7.

Conflict of Interest: Nil

Source of Support: None

How to cite the article:

Shingade VU. Hemiepiphysiodesis using 8-plate: a promising tool for correction of angular deformities around knee, in paediatric population. J Maha Orth Assoc 2012;7(2):26-29