

Retrospective study of medial Physeal stapling for primary and secondary genu valgum in late childhood and adolescents

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Abstract

Purpose: To study the outcome of staples (Temporary hemiepiphysiodesis) in the management of angular plane deformities of the knee in skeletally immature children.

Methods

Retrospective study: A Total of 20 patients with bilateral affected knee joints having minimum of 1 year of skeletal growth remaining were included in our study-out of 20, 16 being Primary genu valgum and 4 being secondary genu valgum due to renal rickets. Angular correction was measured by recording anatomical Tibio femoral angles.

The correction rate (degree per month) and complications were recorded.

Results: The most common was idiopathic genu valgum.

Rate of correction was 1.2 degree.

We had excellent and good outcomes according to modified Zueze *et al.* Criteria.

Conclusion: We recommend use of staples for primary and secondary genu valgum in late childhood and adolescence. However, the staples can carry a risk like extrusion, breakage and implant failure.

Keywords: Medial Physeal stapling, genu valgum, childhood, adolescents, tibio femoral angles

Introduction

Angular deformities of the knee joint are common in paediatric population. Physiological deformities contribute to the majority of the angular deformities ^[1].

Most of times physiological deformities correct with growth, pathological deformities may lead to functional impairment like gait abnormality, joint pain, and a high risk of developing osteoarthritis of knee. Temporary hemiepiphysiodesis, timed permanent hemiepiphysiodesis, corrective osteotomy and Ilizarov ring fixator are the common surgical methods for the correction of angular deformities around the knee joint ^[2-4].

Permanent hemiepiphysiodesis can lead to results which are unpredictable, as the timing of the procedure is never precise, most complications being over correction and under correction ^[5].

Temporary hemiepiphysiodesis can be achieved with Staples, percutaneous screws, or figure of eight plate and less invasive technique when compared to osteotomy. The process is

reversible and the results are predictable. The implants can be removed once desired correction is achieved [6-8].

In this study, we have shared our experience with the use of Staples for the correction of coronal plane deformities around the knee joint.

Review of Literature

Howorth (1971) states Moderate or severe genu valgum in late childhood will not correct spontaneously [9].

Salenius and Vankka (1975) for Moderate and severe genu valgum in late childhood operation is often required to improve appearance, gait and function [10].

Zuege, Kempken and Blount (1979) states the restoration of normal alignment may also reduce the later incidence of lateral compartment osteoarthritis [11].

Blount (1971), Howorth (1971), Pistevos and Duckworth (1977), Libri *et al.* (1990) A simple and effective form of treatment in pre-adolescents with primary genu valgum is temporary retardation of growth by stapling of the medial physis of the distal femur, the proximal tibia or both [12].

Corrective osteotomies are commonly done in adult patients while skeletally immature patients may require less surgical techniques such as permanent or temporary hemiepiphysiodesis. Permanent hemiepiphysiodesis relies on exact calculation of remaining growth and perfect timing of the surgical procedure [13].

Temporary epiphysiodesis can be achieved by using physeal staples. However, surgical complications like hardware breakage or migration have been reported [14].

Temporary epiphysiodesis is partially reversible and may be performed at an earlier age: once the hardware is removed there is a resumption of growth [15].

Objectives-The overall objectives/aims of the study

To evaluate outcome of medial physeal stapling for primary and secondary genu valgum in late childhood and adolescents.

Materials & Methods

Source of data

Patients who visit VIMS hospital with complaints of genu valgum, at the outpatient and inpatient department will be evaluated.

After thorough clinical and radiological examination, patients will be selected for surgical management of Genu Valgum.

Sufficient Clinical material/sample available.

(declaration based on last 3 years average in hospital/department)? Yes

Are the outcomes relevant to practice and patient benefits? Yes

Inclusion criteria

1. Patients age less than 18 years.
2. Primary or Secondary Genu Valgum.

Exclusion criteria

- Patients aged more than 18 years.
- Patient medically unfit for surgery.

Method of collection of data (Including sampling procedure, if any)

A. Design of study: Retrospective.

B. Sample size: 20.

C. Methodology

History by Verbal Communication with patient and attenders.

Clinical Examination: Both Local and Systemic.

Diagnosis: Clinical.

Investigations: Baseline Routine Investigations, Radiological evaluation

Procedure/Surgery: Temporary Hemiepiphyodesis with Stapling



Fig 1: Patient positioning

Operative technique

- Pre-operative radiography of knee was used to confirm that physis were open and showed maximum deformity.
- Image intensifier (c-arm) was used to locate the physis and to guide the insertion of 2 staples extra periosteally.
- Staples were inserted perpendicular to medial side of the plate with prongs placed equidistant above and below physis.



Fig 2: Staples



Fig 3: Staples placed under c arm guidance

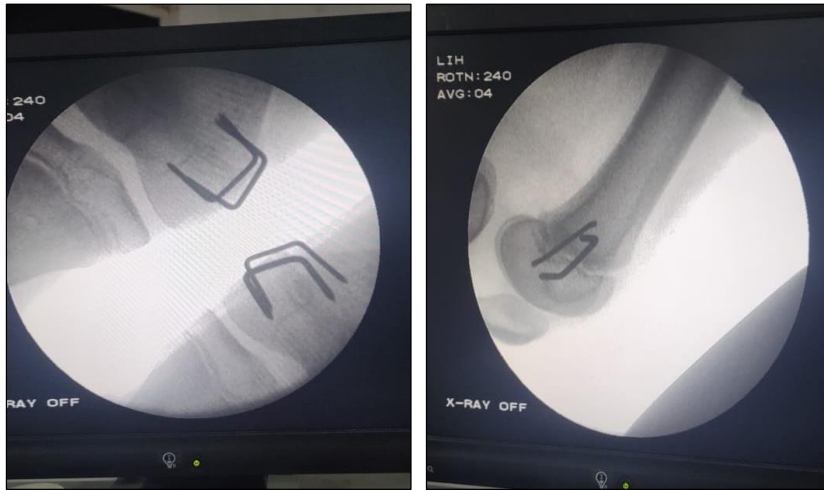


Fig 4 & 5: Staples placed under C arm guidance



Fig 6 & 7: Case of renal rickets

Pre-Operative scanogram and clinical picture (fig 6 and 7)

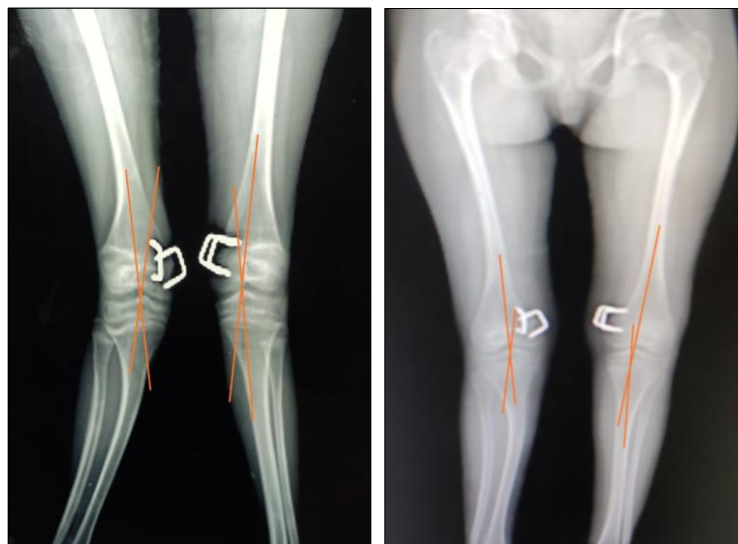


Fig 8: Post-operative

Fig 9: 1 year fallow up



Fig 10: After staple removal



Fig 11 & 12



Fig 13

Clinical images after correction (fig 11 12 and 13)

Case-2 after 1 & ½ year, staples removal



Fig 14 & 15: After correction clinical picture and scanogram

Case after one & half year follow up



Fig 16 & 17



Fig 18

Clinical picture and scanogram (fig 16 17 and 18)

Assessments of results

- We recorded all operative and early postoperative complications and assessed the results after one and half a year follow up by clinical and radiological measurement.
- We modified the criteria of Zuege *et al.* to classify radiographic results.

Result	Tibiofemoral angle
Excellent	5-9 degrees females
	4-7 degrees males
Good	Within 4 degrees of the above range
Poor	Outside 4 degrees of the above range

Results

	Primary	Secondary
No. of patients	16	04
Male: female ratio	10:6	0:4
Laterality		
Bilateral	16	04
Age at surgery (mean)		
Male	13	-
Female	12	12
Physis stapled		
Femur	32	08
Staple extrusion	04	02
Alignment		
Excellent	28	04
good	04	04
Poor	-	-

Post-operative Evaluation was done by Clinical and Radiological examination.

Post operatively wound healing, complications, Range of Movements, Ambulation will be assessed in each follow up visit.

Patient followed up for 1 and half years.

Discussion

- Blount (1948) introduced staples as to achieve temporary hemi epiphysiodesis although widely used and considered safe, several reports have documented the occurrence of complications with use of staples ^[16].
- Hemi epiphysiodesis is based on the Hueter-Volkman principle which states that, compression and tension forces at the physis can cause physal growth inhibition and acceleration ^[17].
- Temporary hemi epiphysiodesis is applicable to skeletally immature children with open physis and having at least of 1 year growth remaining ^[18].
- Tibiofemoral angle is simple and reproducible measurable parameter on standing Roentgenogram ^[19].
- We achieved satisfactory correction of persistent primary genu valgum in all cases by medial physal stapling in late childhood or in early adolescence ^[20].
- In young patients some rebound growth can be expected after the removal of staples. Zueg *et al.* (1979) suggested an allowance of 5 degree for this of which 1-2 degree will be made up by premature closure of physis, they therefore recommended that staples should be removed in a boy when tibiofemoral angle reaches 0 and in girl it reaches 3 degree. Overcorrection should be avoided, however, in children close to skeletal maturity, since rebound growth is minimal at this stage ^[21].

Conclusion

We recommend use of staples for primary and secondary genu valgum in late childhood and adolescence. However, complications of staples like extrusion, breakage and implant failure should be taken care.

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