

## Surgical and functional outcomes of results of titanium elastic nailing system in paediatric diaphyseal fractures

Abhishek Vaish<sup>1</sup>, Sandeep Patwardhan<sup>1</sup>, Ashok Shyam<sup>1</sup>, Parag Sancheti<sup>1</sup>

<sup>1</sup> Sancheti Institute for Orthopedics and Rehabilitation, Shivajinagar, Pune.  
Institute Where Research Was Conducted: Sancheti Institute for Orthopedics and Rehabilitation, Shivajinagar, Pune 411005.  
University Affiliation: MUHS(Maharashtra university of health sciences),Nashik.  
Year Of Acceptance Of Thesis: 2015.

### Address of Correspondence

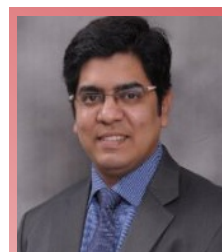
Dr. Abhishek Vaish  
Healing Touch Clinic, 94 Sukhdev Vihar  
New delhi 110025.  
Email: drabhishekvaish@gmail.com



Dr. Abhishek Vaish



Dr. Sandeep Patwardhan



Dr. Ashok Shyam



Dr. Parag Sancheti

**Abstract: Background:** Titanium elastic nail (TEN) fixation was originally meant as an ideal treatment method for femoral fractures, but was gradually applied to other long bone fractures in children. We assessed outcomes in 50 Indian patients.

**Material and Methods:** Children with long bones fractures between 3-16 years were included and patients pathological fractures excluded. Functional outcome was assessed by using LEFS and DASH scoring and clinical by Flynn and Daruwala scoring. Radiological union was assessed by Anthony score. All patients were assessed upto 1 year or till implant removal.

**Results:** Excellent in 73%, satisfactory in 27% cases based on Flynn score. Based on Daruwala forearm score Excellent in 53%, Good in 27% and Fair in 20% cases. Percentage of functionality based on LEFS Score was 89.15% and Percentage of disability according to Quick DASH was 6.6 for both bones and 7.4 for humerus. Grade 3 callus formation according to Anthony et al scale was seen at 6 weeks in 70% and 28% cases at 12 weeks.

**Conclusion:** Based on our results, we conclude that flexible intramedullary nailing is an effective way of fixation with excellent functional results and minimal complications in diaphyseal fractures in skeletally immature patients.

**Keywords:** ESIN, TEN, Diaphyseal Fracture, Flynn.

**Thesis Question:** Is flexible elastic nailing an effective treatment modality in skeletally immature children?

**Thesis Answer:** Based on our results, we conclude that flexible intramedullary nailing is an effective way of fixation with excellent functional results and minimal complications in diaphyseal fractures in skeletally immature patients.

## THESIS SUMMARY

### Introduction

Treatment of paediatric fractures dramatically changed in 1982, when Métaizeau and the team from Nancy (France), developed the technique of flexible stable intramedullary pinning (FSIMP) using titanium pins [1,2]. Since then there have been tremendous advances in the surgical options available to treat paediatric fractures. Pediatric orthopedists have increasingly recognized the advantages of fixation and rapid mobilization.

Between 6 to 16 years, there are several available treatment options like traction followed by hip spica, external fixation, flexible stable intramedullary nails (ender or titanium), plate fixation, and locked intramedullary nailing [3,4,5,6,7]. Systematic review of literature

provides little evidence to support one method of treatment over the other [8].

The treatment of long bone fractures in children less than 6 years and adolescents older than 16 years is straight forward.

Titanium elastic nail (TEN) fixation was originally meant as a gold standard treatment method for femoral fractures [9], but was gradually applied to other long bone fractures in children, as it represents a midpath between conservative and surgical modality with satisfactory results and minimal

complications. [10,11,12,13].

Much of the indexed publications and literature available on titanium elastic nailing is based on studies conducted outside the Indian

subcontinent where the demographics like body weight on an average is different.

The aim of this study is to evaluate the results of operative treatment of paediatric diaphyseal fractures in the age group between 6 to 16 years using titanium elastic nailing system (TENS).

### Aims and Objectives

1. To study the surgical and functional outcomes of titanium elastic nailing in diaphyseal fractures in children between the age of 6-16 years.
2. To study the complications associated with titanium elastic nailing.

### Material and Methods

**Type of Study:** Prospective study.

**Duration of Study:** May 2012 to November 2014

**Case Selection Criteria:** During this period all patients posted for titanium elastic nailing were screened using the inclusion and exclusion criteria. Informed consent was taken from all patients that fit the inclusion criteria and all patients willing to undergo the study were included after approval from the ethics committee.

#### Inclusion Criteria:

- Children with diaphyseal fractures of long bones.
- Age between 6-16 years.

#### Exclusion criteria:

- Congenital disorders.
- Patients with pathological fractures.

### Study Method

All patients diagnosed with fractures of long bones were assessed clinically and radiographs were taken. Patients who fell into the eligibility criteria were included in the study and followed up at 2 weeks, 6 weeks, 12 weeks and till maximum 1 year or till implant removal whichever was earlier. They were assessed clinically, radiographically and functionally using Flynn outcome scoring<sup>65</sup> (Table 1- Annexure), Daruwala scoring<sup>66</sup> (Table 2-Annexure) for forearm fractures.

Radiographs were analysed in which the Limb alignment, delayed or non union (using Anthony scoring<sup>67</sup>-Table 5 annexure) were seen.

Functional outcome was assessed by using quick Disability Arm, Shoulder, Hand scoring (Table 3-Annexure) for upper limbs and Lower Extremity Functional Score (Table 4-Annexure) for lower limbs at final follow up. Protocol was approved by Institutional review board. All patients were consented prior to inclusion in the study.

Displaced fractures were immobilized using skin traction with Thomas splint (femur / tibia) or slab support till the day of surgery.

Various demographic, clinical, investigative and operative findings were recorded from the hospital case file. Postoperative data collected was number of nails, postoperative immobilization, period of hospital stay, period of radiological union, return to normal work/daily activities,

any complication, time to nail removal.

Radiographs were evaluated for alignment, callus formation, nail position, and measurement of fracture location.

Final outcome was graded excellent, satisfactory or poor based on criteria described by Flynn et al.

### Results

Excellent in 73%, satisfactory in 27% cases based on Flynn score. Based on Daruwala forearm score Excellent in 53%, Good in 27% and Fair in 20% cases. Percentage of functionality based on LEFS Score was 89.15% and Percentage of disability according to Quick DASH was 6.6 for both bones and 7.4 for humerus. Grade 3 callus formation according to Anthony et al scale was seen at 6 weeks in 70% and 28% cases at 12 weeks.

### Conclusion

Based on our results, we conclude that flexible intramedullary nailing is an effective way of fixation with excellent functional results and minimal complications in diaphyseal fractures in skeletally immature patients.

### Clinical message

Titanium elastic nailing is a good modality of treatment with excellent results in the hands of experience surgeons with good surgical skills. Hence this should be undertaken after proper training as the learning curve is high.

Keywords: ESIN, TEN, diaphyseal fracture, Flynn

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Conflict of Interest: Nil  
Source of Support: None

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**How to Cite this Article:**

Vaish A, Patwardhan S, Shyam A, Sancheti P. Surgical and functional outcomes of results of titanium elastic nailing system in paediatric diaphyseal fractures. *Journal Medical Thesis* 2016 Jan-Apr; 4(1):26-30.