



**ORIGINAL RESEARCH PAPER**

**Orthopedic**

**FUNCTIONAL OUTCOME OF INTRAMEDULLARY NAILING AND PLATING IN BOTH-BONE FOREARM FRACTURES IN ADOLESCENT – A COMPARATIVE STUDY**

**KEY WORDS:** Titanium Elastic Nail System, TENS, forearm fracture, both-bone, adolescent, plating, GRACE AND EVERS-MANN

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**ABSTRACT**

**Background:** Forearm fractures is one of the commonest reasons to receive orthopaedic care in adolescent age group. They comprise 40% or more of all paediatric fractures. Forearm fractures in children show bimodal distribution. The first peak is at the age of 5-9 years and second between 10-14 years which coincide with growth spurt (19). The most common mechanism is a fall (83%) while direct trauma is a distant second (10%). In last few years, management of diaphyseal forearm fractures in children and adolescent has shifted from conservative to surgical (19). Surgical management includes either fixation with Elastic nails or plate fixation. The purpose of this study was to evaluate subjective and functional outcome in adolescent age group after osteosynthesis of the diaphyseal forearm fractures with plates and screws (ORIF) v/s Titanium Elastic nailing (TENS) (5). **Materials And Methods:** This is a prospective study for a period of 2 years from July 2017 to June 2019 done under the guidance of the ethical committee of the hospital. It includes 60 cases of diaphyseal fractures of both bones of forearm in adolescent age group i.e., 10-19 years. Thirty patients were treated with TENS and the other thirty with plate osteosynthesis. Modified GRACE AND EVERS-MANN RATING SYSTEM was used to analyse functional outcome. The functional and radiological parameters of the two groups were compared and evaluated. **Results:** According to Modified GRACE AND EVERS-MANN RATING SYSTEM, the plating group had 3 (10%) patients with excellent results, 4 (13.33) with good, 13 (43.33%) with fair and 10 (33.33%) with poor results. Whereas the nailing group had 19 (63.33%) patients having excellent results, 7 (23.33%) with Good, 3 (10%) with Fair and 1 (3%) with Poor result. Average time of fracture healing in plate osteosynthesis was 8.6 weeks whereas in nail fixation it was 6.6 week. Restoration of pronation & supination activities were possible by the end of 6th week using intramedullary nailing whereas they were possible by the end of 9th week using plate osteosynthesis. **Conclusion:** There is statistically significant difference in functional outcome between TENS group and plate osteosynthesis group. From this study it can be concluded that functional outcome, range of movement (ROM) and union time in cases of diaphyseal fractures of forearm in adolescent age group treated with TENS is better as compared with plate osteosynthesis.

**INTRODUCTION**

Forearm have a very important role in functioning of upper extremity. Hence it is essential to aggressively manage these fractures. Because of higher rate of incidence in adolescent, it is necessary to treat them adequately as there is also a psychosocial impact of the fracture on the child, possibly limiting physical activity and affecting their school performance (19). For effective postoperative function it is absolutely essential to reduce these types of fractures. Delayed hospitalization, use of indigenous bandages and associated vascular and nerve injuries contribute to increased incidence of morbidity.

There are numerous differences in treatment part and prognosis of diaphyseal fractures as compared to metaphyseal or physeal fractures of radius and ulna. Mechanism of injury and treatment part is different in children and adolescent compared to adults. With skilled close reduction techniques diaphyseal forearm fractures in Children and adolescent can be managed conservatively with slab/cast. Despite this, their failure and complications continue to occur (20). In these fractures, it is essential to maintain interosseous space for effective supination and pronation (13). This have to be kept in mind while managing forearm fractures. Postoperative morbidity is significantly affected by fracture pattern, presence of comminution, rotatory malalignment. Better understanding of the injury patterns, availability of better implants, the concept of early

surgical fixation and exact postoperative protocol altogether contribute better functional outcome of the patient (10).

Because of better implants and improved surgical techniques, complications in operative treatment of forearm diaphyseal fracture are relatively less. Thorough knowledge about local anatomy, mechanics of fracture fixation and patterns of fracture healing after internal fixation is essential to consistently have good operative results. State of the art implants and instruments alone never ensures favourable outcome.

44 Few known complications are Infection, Malunion, Non-union, Post traumatic Stiffness, refracture, Nail prominence, Compartment syndrome (20) In 2009, Forearm kinesiology was studied by Jesse, B. Jupiter and Diego L. Fernandez. Most important contribution for upper limb mobility is by forearm rotation. Both bones of the forearm together with proximal and distal radioulnar joint and rotational axis connecting two is considered as single bicondylar joint.

Forearm malunion and its clinical correlation with forearm rotation was studied by them. Distal third of forearm deformities causes decrease pronation. Angulation up to 10 degrees in middle third of forearm do not restricts rotation. But angulation 20 degree causes restriction of forearm by 30% (11). Further increase in angulation causes more restriction of rotation. Rotational deformities also affect

prono-supination.

In 2010 Shah AS studied Stabilization of adolescent both-bone forearm fractures, a comparison of intramedullary nailing versus open reduction and internal fixation (15). He concluded that, Flexible IM nailing of both-bone forearm fractures in adolescents was safe and effective in small series; he had less complications when compared with conventional ORIF. Although flexible IM nailing results in distal translation of the radial bow, forearm rotation is not compromised.

**MATERIALS AND METHODS**

Sixty adolescent patients who were willing for surgical management were admitted during the study period between July 2017 to June 2019. Informed and written consent were taken for all the patients. Thirty patients were treated with TENS and thirty with plate osteosynthesis.

**Inclusion Criteria:**

- Diaphyseal fractures of both bones of forearm in adolescent i.e., 10-19 years.
- Comminuted and segmental fractures of forearm.
- Patients fit for surgery.
- Patient willing to take part in study.

**Exclusion Criteria:**

- Less than 10 years age and more than 19 years of age.
- Compound fractures.
- Fracture associated with neurovascular injury.
- Malunited Fractures.
- Pathological Fractures.

**Surgical Technique**

All surgeries were done with standard protocols in supine position under General anaesthesia. Surgeries were performed by a single surgeon.

**Plate Osteosynthesis:**

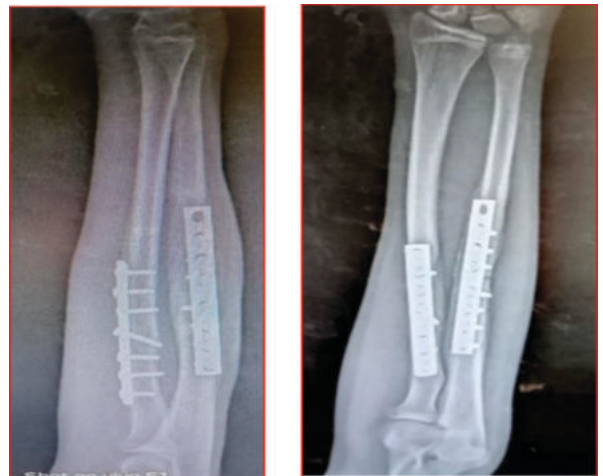
3.5mm Dynamic Compression Plate (DCP) was applies using Henry's approach for radius and subcutaneous approaches for ulna (18). Routinely, tourniquet was used. Radius was opened first. Minimal periosteal stripping was practiced.



**Fig 1: Pre-operative X-rays**



**Fig 2: Immediate Post-operative X-rays (plating)**



**Fig 3: Six Weeks Follow Up X-rays**



**Fig 4: Range Of Movements**

**Titanium Elastic Intramedullary Nailing:**

Patient's forearm kept in supine position placed on hand table compatible with C-arm. Tourniquet not used. Appropriately sized nail selected so that it will occupy 60% of the medullary space. First radius is operated. Entry just medial to Lister tubercle 5mm proximal to wrist joint or from the radial styloid. Olecranon entry point is used to insert nail in ulna. Both the nails buried up to the bone and cut flush to it. Reduction of the



fracture site, entry points of the nail and tips confirmed under c arm.

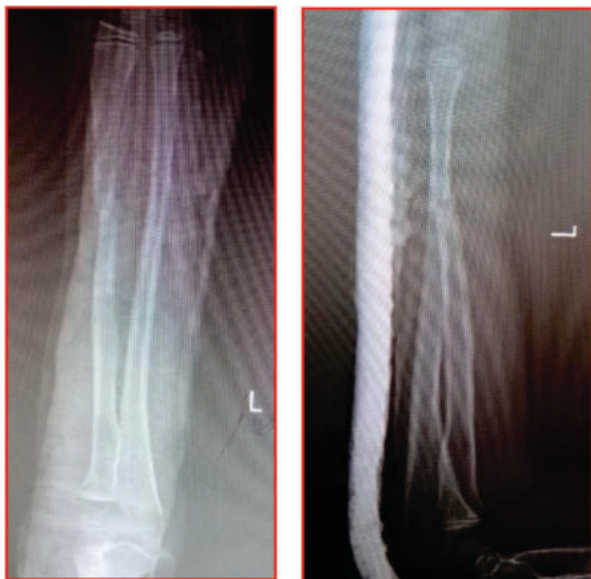


Fig 5: Pre-operative X-rays



Fig 6: Immediate Post-operative X-rays (nailing)



Fig 7: Six Weeks Follow-up X-rays



Fig 9: Various Sizes Of Titanium Elastic Nails With Colour Coding And Instruments Used

**Post-operative Protocol:** Patients operated with intramedullary nailing was given above elbow slab while the ones operated with plate osteosynthesis were not given any slab. Post-operative full length anteroposterior and lateral view x-rays of the operated forearm were taken. Post-operative Hemogram was done immediately. Finger and wrist movements started next day. Range of Movement (ROM) exercises were started actively. Intravenous antibiotics were given for 3 days and patients discharged on the third day. Dressings were done on 2<sup>nd</sup> and 7<sup>th</sup> day. Suture removal was done on or after 14 days. Follow up was done every 2 weeks till 6 weeks and then on 3<sup>rd</sup> month, 6<sup>th</sup> month, and 1 year after the surgery.

**RESULTS**

- The mean age of the study population was 14.2 years.
- Among 60 cases selected for the study, 36 patients were males and 24 females.
- Right sided forearm fractures were predominant accounting to 65% while rest 35% were left side fractures. No bilaterally injured patients were included in the study.
- Commonest mode of injury is fall while playing (55%) followed by direct blow to forearm (45%)
- CLASSIFICATION: According to AO classification, 22A3 was the most common type (28) while 22C3 was least common (3).

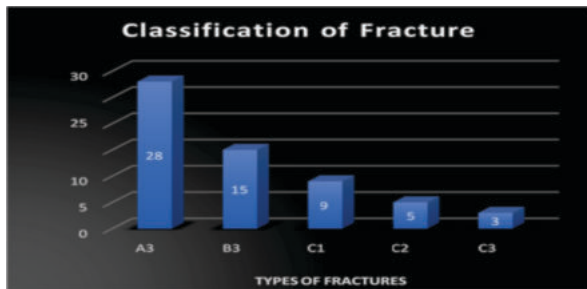


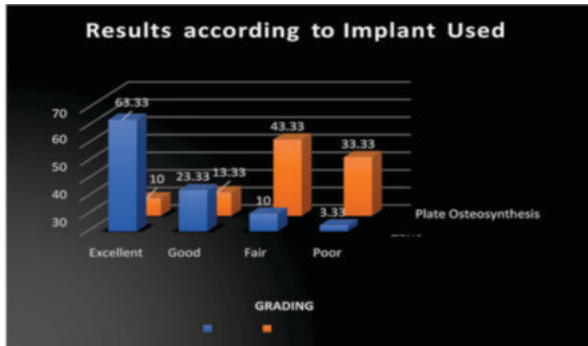
Chart 1: Frequency Of Ao Fracture Types In Study Population

**Complications:**

We had 3 complications – 1 tourniquet palsy (plating), 1

superficial stitch site infection (Plating) and 1 radial styloid fracture during far lateral nail entry (Nailing).

Modified GRACE AND EVERSMANN RATING SYSTEM was used to analyse functional outcome, which considers parameters like Supination-Pronation, Radiological union and ROM at elbow joint. The plating group had 3 (10%) patients with excellent results, 4 (13.33) with good, 13 (43.33%) with fair and 10 (33.33%) with poor results. Whereas the nailing group had 19 (63.33%) patients having excellent results, 7 (23.33%) with Good, 3 (10%) with Fair and 1 (3%) with Poor result.



**Chart 2: Functional Outcome Of Plating And Nailing Compared**

**CONCLUSION**

- Diaphyseal fractures of the forearm is one of the commonest fractures in adolescent age group.
- Early fixation of the fracture followed by intense physiotherapy produce excellent results.
- Titanium elastic nail fixation is particularly useful in fractures involving middle third of radius and ulna as it provides 3-point fixation which leads to stable fixation and proper alignment of fracture fragments.
- There is statistically significant difference in functional outcome between titanium elastic nail group and plate osteosynthesis group.
- Also, there is statistically significant difference in range of movement, union time between the two groups.

Following are the advantages of the TENS:

- Preservation of fracture hematoma
- Less operative time
- Can be done as a day care procedure
- Early union and mobilisation
- Less postoperative morbidity
- Smaller incision – better cosmetically.
- Less refracture chances after implant removal
- Because there is no axial loading after nailing, chances of implant failure are very less.

So, from this study it can be concluded that functional outcome in cases of diaphyseal fractures of forearm in adolescent age group treated with TENS is better as compared with plate osteosynthesis.

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