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RESEARCH ARTICLE

COMPARATIVE FUNCTIONAL AND RADIOLOGICAL OUTCOMES OF PLATING VERSUS INTRAMEDULLARY NAILING IN ADULT DIAPHYSEAL FRACTURES OF BOTH BONES OF THE FOREARM: A PROSPECTIVE OBSERVATIONAL STUDY

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Diaphyseal forearm fracture, radius, ulna, plating, intramedullary nailing, DASH score, Grace-Eversmann grading

Abstract

Background: Adult diaphyseal fractures of both radius and ulna present unique anatomical and biomechanical challenges. While plating is considered the gold standard, intramedullary nailing is less invasive and used in selected cases. This study evaluates and compares the functional and radiological outcomes of both surgical methods.

Aim: To assess clinical union,radiographic consolidation,complications, and functional outcomes of adult forearm diaphyseal fractures treated by plating and/or intramedullary nailing.

Methods: A prospective comparative study of 48 patients with adult both-bone forearm fractures was conducted between October 2017 and September 2019. Patients were divided into four groups (n=12 each): A (both plating), B (both nailing), C (radius plating + ulna nailing), D (radius nailing + ulna plating). Outcomes were assessed using DASH and Grace-Eversmann scores, time to union, ROM, and complications over a 9-month follow-up.

Results: Plating groups (A & C) showed faster union (avg. 10.4 weeks) and higher functional recovery(mean DASH: 12.6) compared to nailing groups (B & D; union time: 13.1 weeks, DASH: 21.4). Group B had the highest complication rate (25%). ROM was best preserved in Group A. Hybrid fixation (Group C) yielded favorable results with minimal soft tissue compromise.

Conclusion: Plating ensures faster healing, better functional outcome, and fewer complications. Hybrid fixation may be optimal for patients with segmental injury or compromised soft tissue. Intramedullary nailing is suitable in specific indications but with increased risk of malunion and delayed union.

Introduction:-

Forearm diaphyseal fractures are among the most functionally significant injuries in orthopaedic trauma. In adults, they often result from high-velocity trauma, sports injuries, or falls, and require precise anatomical reduction and fixation to restore pronation-supination arc and prevent complications like malunion or nonunion. Conservative management, though successful in children, is associated with poor outcomes in adults due to muscular and mechanical influences that deform the fracture fragments[1]. Plating offers the advantage of rigid fixation and

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anatomical restoration of radial bow, while intramedullary nailing is minimally invasive, preserves soft tissue and periosteum, and may offer advantages in polytrauma or open fractures[2]. However, controversy persists regarding their comparative outcomes. This study aims to evaluate and compare plating, nailing, and hybrid combinations in adult both-bone forearm fractures using objective functional and radiographic metrics.

Aims and Objectives:-

Aim:

To evaluate and compare the clinical and radiological outcomes of adult diaphyseal fractures of the forearm treated with plating or nailing.

Objectives:-

1. Compare functional outcomes using DASH and Grace-Eversmann scoring systems.
2. Compare union time and radiographic healing between techniques.
3. Identify and assess complication rates (infection, malunion, nonunion).
4. Evaluate range of motion restoration in wrist, elbow, and forearm.
5. Determine if hybrid fixation offers comparable outcomes.

Materials and Methods:-

Study Design and Setting:-

Prospective interventional comparative study conducted at MIMER Medical College & Hospital, Talegaon (Oct 2017–Sep 2019).

Participants:-

- Sample size: 48 patients with closed, displaced diaphyseal fractures of both bones of forearm.
- Randomized into four groups (12 each):
  - Group A: Radius + Ulna Plating
  - Group B: Radius + Ulna Nailing
  - Group C: Radius Plating + Ulna Nailing
  - Group D: Radius Nailing + Ulna Plating

Inclusion Criteria:-

- Adults aged ≥12 years
- Closed fractures of both radius and ulna
- Consent for surgical treatment and follow-up

Exclusion Criteria:-

- Periarticular fractures
- Pathological fractures
- Cases needing bone grafting
- Additional implants beyond plating/nailing

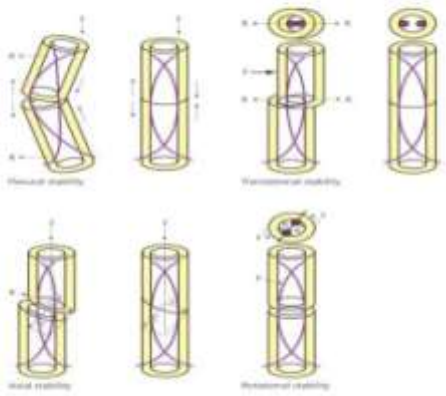
Surgical Technique:-

- Group A: Standard ORIF with LC-DCP or DCP
- Group B: Intramedullary TENS or square nail (closed technique)
- Group C & D: Hybrid fixation as per fracture geometry
- Intraoperative fluoroscopy for reduction control
- Post-op immobilization in cast for B, C, D; early ROM in A

Dynamic compression plate(DCP)

Limited Contact Dynamic Compression Plate(LCDCP)

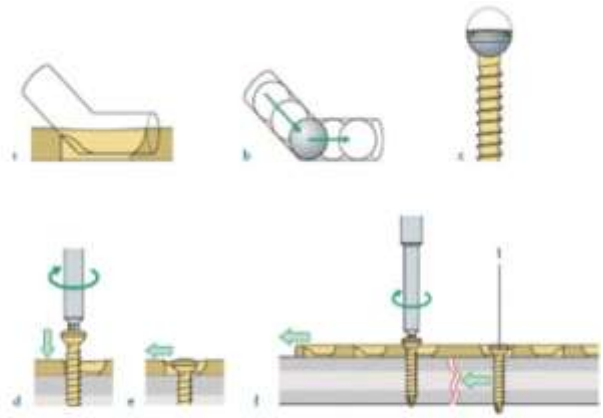
. TENS nail



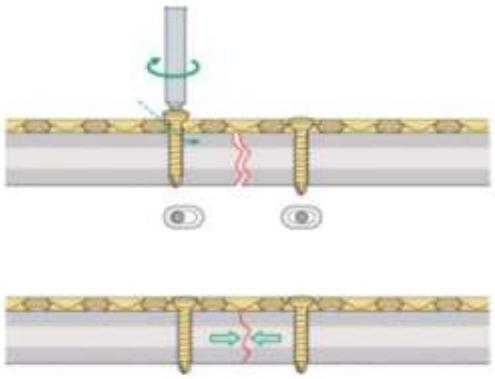
. TENS nail principle

Radius Square nail

Ulna Square nail



Dynamic Compression Principle



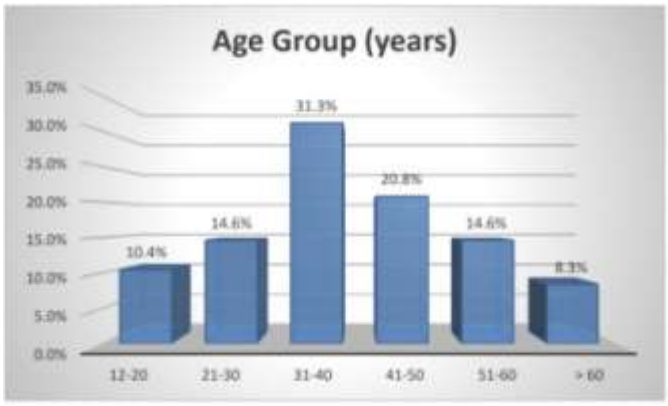
Dynamic compression principle

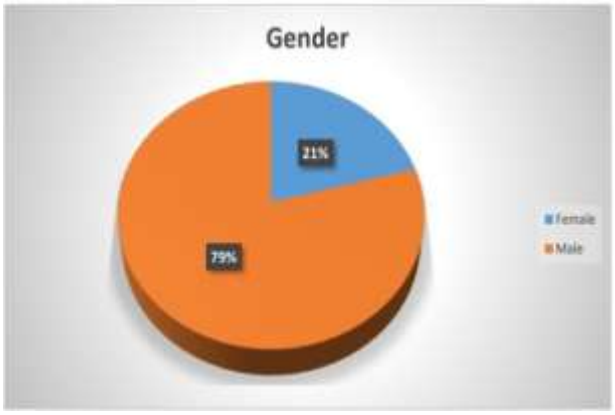
Follow-Up and Assessment:-

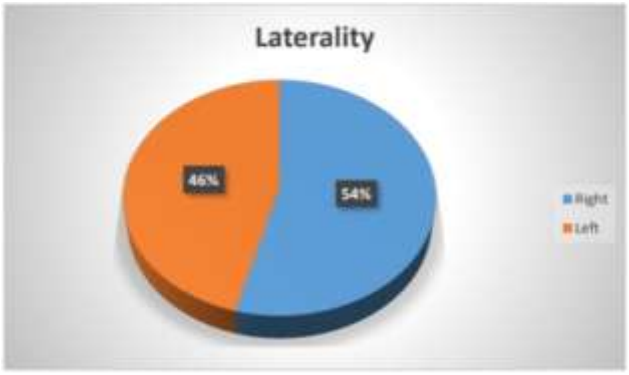
Patients were followed up at 3, 6, 12, 24, and 36 weeks post-op:-

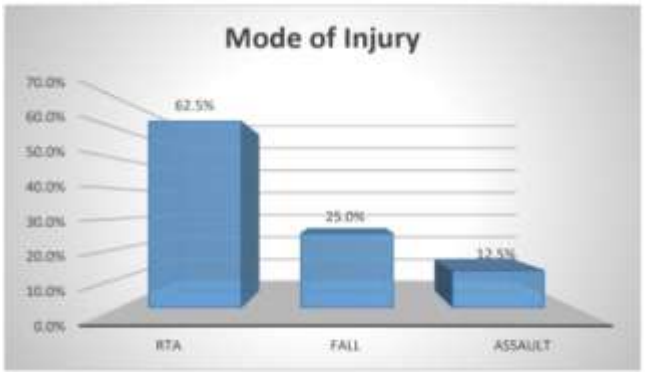
- Radiological union assessed by cortical continuity on AP/lateral views
- Functional outcome via:
  - DASH (Disabilities of Arm, Shoulder, and Hand)
  - Grace-Eversmann grading
- Complications noted: infection, malunion, nonunion, neurovascular issues.

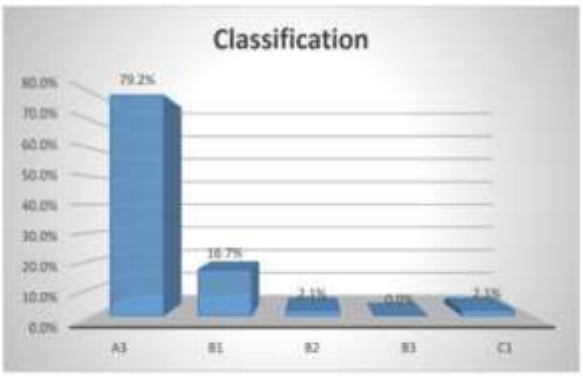
Results:-



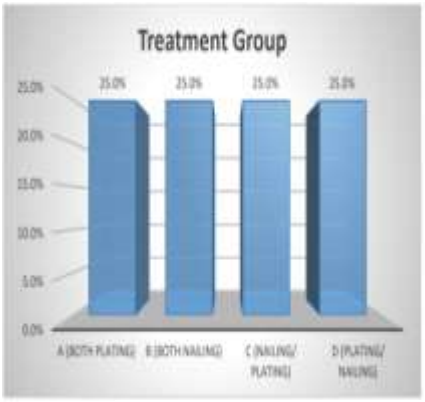




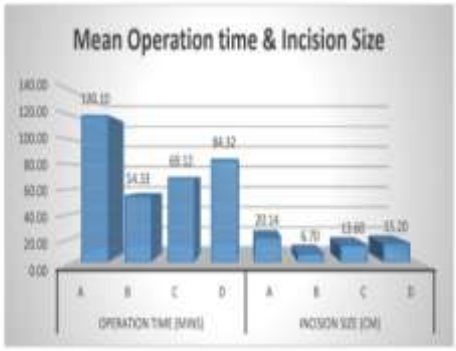


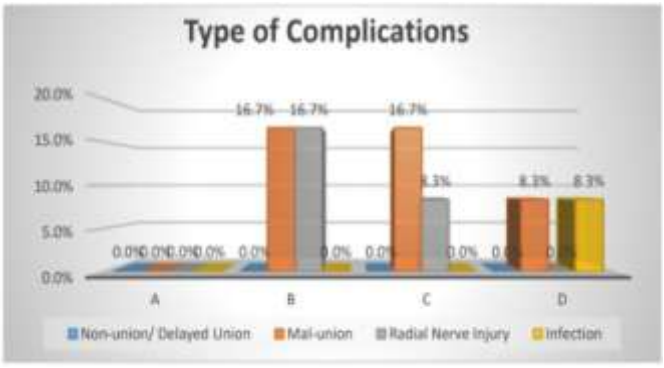

Classification
79.2%
16.7%
A3
B1
B2
B3
C1

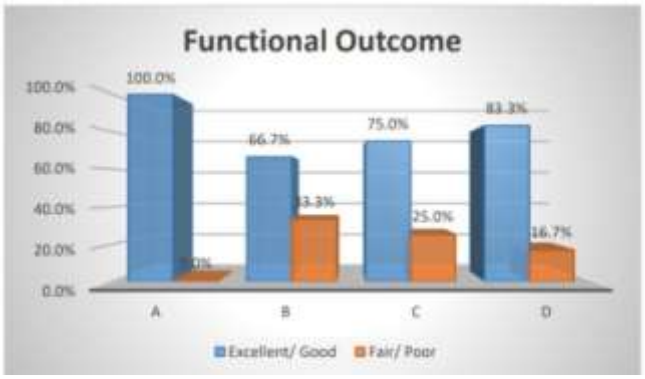

Associated Injuries
6.3%
4.2%
2.1%
2.1%
FRACTURE BOTH LEG
BRAIN INJURY
FRACTURE FEMUR
FRACTURE META-CARPAL

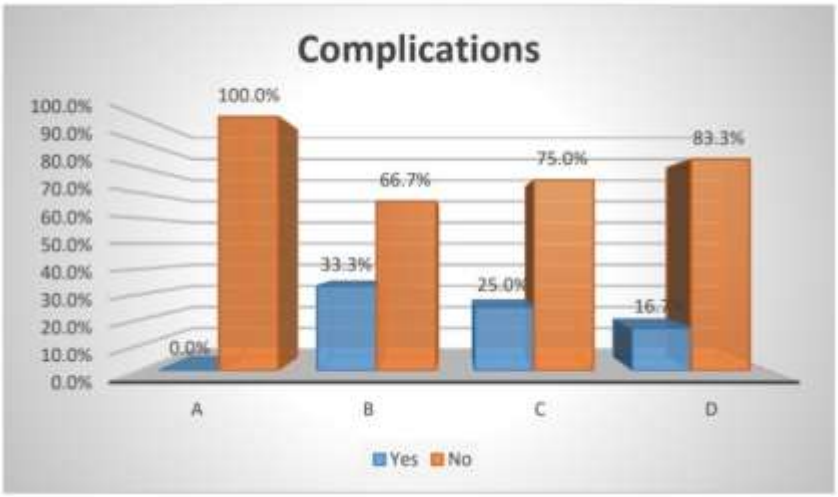

Treatment Group
25.0%
25.0%
25.0%
25.0%


Injury to Surgery Duration (days)
62.5%
16.7%
20.8%
< 2 DAYS
2-5 DAYS
5-7 DAYS


Mean Operation time & Incision Size
180.10
54.33
69.12
84.12
20.14
5.70
13.60
15.20
OPERATION TIME (MINS)
INCISION SIZE (CM)


Type of Complications
16.7%
16.7%
16.7%
8.3%
8.3%
Non-union/ Delayed Union
Mal-union
Radial Nerve Injury
Infection


Functional Outcome
100.0%
66.7%
33.3%
75.0%
25.0%
83.3%
16.7%
Excellent/ Good
Fair/ Poor



33yr old male with left both bone forearm fracture operated with radius and ulna plating.

Functional outcome at 9 months

39yr old female case of right both bone forearm fracture operated with ulna ting and radius nailing

Functional outcome at 9 months

13 yr old male with left both bone fracture operated with radius and ulna TENS nailing

Functional outcome at 9 months

57 yr old male with left both bone fracture operated with radius plating and ulna nailing

Functional outcome at 9 months

Demographics and Fracture Characteristics:-

Parameter	Group A	Group B	Group C	Group D
Mean Age (years)	36.7	38.1	35.3	37.8
Male : Female	7:5	8:4	6:6	9:3
Dominant hand involved (%)	58.3%	66.7%	75%	50%
Mode of injury: RTA/Fall	8/4	9/3	7/5	6/6

Union Time (weeks):-

Group	Union Time (Mean ± SD)
A	10.4 ± 1.8
B	13.1 ± 2.3
C	11.2 ± 1.9
D	12.4 ± 2.0

Plating (Group A) showed statistically faster union ($p<0.05$).

DASH Scores:-

Time Point	Group A	Group B	Group C	Group D
Pre-op	63.8	64.1	61.7	62.9

6 weeks	38.2	46.4	40.1	44.3
12 weeks	22.5	34.6	26.8	29.9
36 weeks (final)	12.6	21.4	14.7	17.1

Grace and Eversmann Grading at 9 Months:-

Grade	A (%)	B (%)	C (%)	D (%)
Excellent	75%	33.3%	66.6%	50%
Good	25%	41.6%	33.3%	41.6%
Acceptable	0	25%	0	8.4%
Unacceptable	0	0	0	0

Complications by Group:-

Complication	A	B	C	D
Superficial Infection	1	2	0	1
Nonunion	0	1	0	1
Malunion	0	2	1	1
PIN Neuropraxia	0	1	0	0

Discussion:-

Our results confirm that plating is superior in terms of earlier union, better functional recovery, and fewer complications. This aligns with findings by Zhang et al. who demonstrated better ROM and satisfaction with plate fixation in diaphyseal forearm fractures[10]. IM nailing remains useful in open or segmental fractures but carries risk of rotational malalignment[11]. Hybrid techniques (Group C) performed well, supporting literature on radius plating + ulna nailing offering strong construct and preserving soft tissues[12]. Complication rates were lower in plating groups, especially regarding infection, malunion, and nonunion, consistent with findings from Milao et al.[13].

Recent Advances:-

- Precontoured locking plates for radius and ulna
- Computer-assisted navigation for rotational alignment
- Biologic bone graft substitutes
- Titanium IM nails with locking options
- Minimally invasive plate osteosynthesis (MIPO) techniques

Future Directions:-

- Comparative RCTs in hybrid vs. full plating/nailing
- Development of 3D-printed preoperative models for bow restoration
- Role of AI in predicting complications and union timelines
- Patient-reported outcome measures beyond DASH, like

Promis Demerits:-

- Small sample size (n=12 per group)
- Short follow-up (9 months)
- No randomization in technique selection
- Radiographic union was not confirmed by CT

Conclusion:-

Plating remains the gold standard for adult diaphyseal fractures of the forearm, offering better functional and radiological outcomes than intramedullary nailing. Hybrid fixation strategies provide a valuable alternative in special fracture configurations. Surgical technique, soft tissue handling, and fracture alignment are pivotal in outcome determination.

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