

A Comparative Study Between Plating And Titanium Elastic Nailing In Fracture Midshaft Clavicle

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Abstract- Introduction- Clavicle is the subcutaneous bone and is a part of shoulder girdle. It articulates with sternum medially and acromion of scapula laterally. The clavicle will fracture (closed, open) and affects the movement at affected shoulder joint. Fracture of clavicle will be treated by various mode of treatment (conservative, operative). This study was conducted to evaluate the outcome of plating and intra-medullary titanium elastic nailing in treatment of displaced midshaft clavicle fracture and compare between them on the basis of various modalities.

MATERIAL AND METHOD- In this retrospective study, 30 patients of displaced mid shaft clavicle fracture were treated by TENS(15) and PLATING(15) during november 2018 to june 2020 at SRMS IMS BAREILLY. Allocation into plate fixation group or TENS group was done alternatively. The assessment was done on the basis of, using disabilities of arm, shoulder, and hand (DASH)score and shoulder pain CONSTANT score, radiological outcome ,complication and functional status in all these patients at 2/6/12/24 weeks post operatively.

Results- As per radiological and clinical evaluation union time was faster in TENS group (93%) but clavicular shortening (43%) was found more in TENS group as compared to plate group. CONSTANT score and DASH score was improved better in TENS group with more radiation exposure during fixation. In TENS group there was 20% cases of non union as compared to plate group(13%).

Conclusion- TENS nailing is a minimal invasive procedure for displaced mid shaft clavicle fractures with faster union rate, lesser morbidity, easier implant removal, but associated with non union, hardware prominence as few complications. But for comminuted, segmental, abnormally displaced and neglected cases plating remains the procedure of choice.

I. INTRODUCTION

Anatomy- The clavicle is located between the ribcage (sternum) and the shoulder blade (scapula). It is the bone that connects the arm to the body. The growth plates of the medial and lateral clavicular epiphyses do not fuse until the age of 25 years. Peculiar among long bones is the clavicle's S-shaped double curve, which is convex medially and concave laterally. The deltoid, trapezius, and pectoralis major muscles have important attachments to the clavicle. The deltoid muscle inserts onto the

anterior surface of the lateral third of the clavicle, and the trapezius muscle onto the posterior aspect. The pectoralis major muscle inserts onto the anterior surface of the medial

(B) Incidence- The frequency with which the 3 groups of fractures occur is as follows:

- Group I (middle third) - Approximately 80%
- Group II (distal third) - 12-15%
- Group III (medial third) - Less than 5%
- Clavicular injuries occur 2.5 times more commonly in males than in females, reflecting a greater involvement of males in contact and violent sports and motor vehicle accidents (MVs).

(C) Mechanism- Clavicle fractures may be caused by direct or indirect trauma. The most common mechanism is an indirect one, involving a fall directly onto the lateral shoulder. A less common mechanism for clavicle fractures is a fall onto an outstretched hand (i.e., a FOOSH injury). 87% clavicle injuries resulted from a fall onto the shoulder, 7% resulted from a direct blow, and 6% resulted from a fall onto an outstretched hand.

(D) Symptoms- Clavicle fracture can be very painful and may make it hard to move your arm. Other signs and symptoms of a fracture may include:

- Sagging of the shoulder downward and forward
- Inability to lift the arm because of pain
- A grinding sensation when you try to raise the arm
- A deformity or "bump" over the break
- Bruising, swelling, and/or tenderness over the collarbone

(E) Treatment-

- I. Conservative treatment-** Conservative or non-surgical treatment is the norm for middle-third clavicle fractures, and is recommended for not displaced fractures given the generally low incidence of non-union after conservative treatment of these fractures with rates ranging from 0.03% to 5.9% . There are numerous conservative treatment options available, the most common being the use of a sling or 'figure-of-eight' bandage (also known as figure-of-eight splint, or back-pack bandage), or a combination of these two methods

II. Surgical Treatment- If the broken ends of the bones have significantly shifted out of place, it may recommend surgery. Surgery typically involves putting the broken pieces of bone back into position and preventing them from moving out of place until they are healed. This can improve shoulder strength when you have recovered. It includes-

1. Plates and screws
2. Titanium elastic nailing (TENS)

(F) Complications- Complication of clavicle fracture include radiographic and symptomatic malunion and shoulder deformity, non-union and infections.

1. Malunion secondary to angulations and shortening
2. Infection
3. Wound dehiscence
4. Hardware problem
5. Protudation of implant

II. MATERIAL AND METHOD

The present study will be conducted in the department of Orthopaedics of SRMS-IMS, Bareilly from November 2018 to June 2020 in all the patients having mid-clavicle fracture shaft after obtaining approval from Hospital Ethics Committee.

Inclusion criteria

- 1) Age >16 and <65 year of age
- 2) Duration <2 weeks.
- 3) Unilateral displaced mid shaft clavicle fractures with a displacement of more than a shaft width
- 4) Shortening of over 2 cm or threat of skin perforation

Exclusion criteria- Patient having following entities will not be included in the study:

1. Patients with pre-existing morbidity concerning arm, shoulder, or hand.
2. Moderate to severe head injury (GCS <12)
3. Multi trauma patients
4. Open fractures
5. Pathological fractures
6. Fractures of > 2 weeks duration
7. Bilateral clavicle fractures
8. Segmental fractures
9. Fractures with associated neurovascular injuries

PRE-OP DESCRIPTION- Patient comes in OPD/EMERGENCY with complain of:

- 1- Sharp pain felt at the time of injury
- 2- Stiffness in the shoulder
- 3- The affected shoulder sags, forward or downward.
- 4- Swelling, tenderness, and bruising occurs over the collarbone.
- 5- The desire to hold the affected arm close to the body—supporting it with the hand of the healthy arm.

[A] On examination-

- 1- Swelling, ecchymosis and tenderness.
- 2- Crepitus from fracture ends rubbing against each other.

3- Difficulty in breathing or diminished breathing sounds on affected side if there is pneumothorax.

4- Tenting and blanching of skin at the fracture site.

5- Associated neurovascular injury if any.

[B] INVESTIGATION:

1- X-RAY both shoulder AP view

2- X-RAY affected shoulder in 30 degree Cephalic Tilt view.

3- Blood investigations

- Complete blood count
- Erythrocyte sedimentation rate
- Bleeding time, clotting time
- Blood grouping
- Blood urea
- Serum creatinine
- Serum electrolytes
- Other lab investigations (if needed)

Allocation into plate fixation group or titanium elastic nailing group will be done alternatively.

OPERATIVE-

a) Plate fixation- After anaesthesia, patients will be positioned in a supine position. Involved shoulders prepared and draped free. Incision will be made transversely just under the fracture site. Supraclavicular nerves to be identified and spared wherever possible. Soft tissue dissection to be kept to a minimum injury. After reduction of fractures, a pre contoured locking plate will be fixed on the anterosuperior surface of the bone, starting medially using bi-cortical screws. In oblique or comminute fractures, inter fragmentary lag screws may be used to achieve compression. The fascia and skin to be closed in layers. We can also put percutaneous plate by MIPO technique.

(b) TENS fixation- After anaesthesia, the patients will be placed in supine position and the sternoclavicular joint was palpated and marked on the affected side. We will use image intensification in 45° cephalad and 45° caudal directions. This can provide us with images in two planes, 90° apart. A small incision will be made approximately 1 cm lateral to the sternoclavicular joint. The anterior cortex will be opened using a sharp, pointed awl. A TEN will be inserted (the diameter varied from 2 to 3 mm depending on the width of the bone). Before introduction, the original curvature of the small and flattened nail tip straightened slightly to allow better gliding in the small medullary canal.

Closed reduction will be performed under fluoroscopic control using two percutaneous introduced pointed reduction clamps. If closed reduction failed, an additional incision (mini-open) may be made above the fracture site for direct manipulation of the main fragments. The nail then advanced manually until it is just medial to the acromio-clavicular joint. Accurate manoeuvring of the nail tip is necessary under fluoroscopic control to avoid penetration of the thin dorsal cortex. After reaching the end point, the fracture will be compressed and the nail cut close to the entry point to minimize soft tissue irritation, at the same time leaving sufficient length behind for easy extraction later on. The fascia and skin will be closed in layers.

We will include peri-operative data like operative time, amount of blood loss and size of the surgical wound; complications such as radiation exposure, neurovascular injury, wound infection, non-union, mal-union, implant migration, implant failure, soft tissue irritation, re-fractures after implant

removal and cosmetic outcome with regards to visible deformity, hypertrophic scars and hardware prominence under the skin. Implant removal will not be done routinely in our study. It will be done as per need and will of the patient after fracture union. The number of days to return to normal activities after implant removal will be noted.

POST-OP PERIOD- Postoperatively, patients were given a sling, but were encouraged for early shoulder mobilization (as tolerated), starting with pendulum exercises from the second day. After 7 days, passive and active assisted range of movement exercises will be started, however, overhead shoulder abduction will be allowed only after 2 weeks. Activities of daily living were started thereafter, but those requiring lifting heavy objects were delayed until union was achieved. All patients will be reviewed in the outpatient department at 2, 6 weeks, 12, and 24 weeks after surgery. At each visit, patients will be assessed clinically and radiologically for any complication and union of bone. Functional outcome will be assessed by the Constant score. Radiographic union will be defined as evidence of bridging callus or obliteration of fracture lines. After union, shortening of clavicle length will be measured clinically as the linear difference of clavicle lengths from sternal end to acromial end between operated and normal side.

Radiographic Evaluation in Plate Fixation (case-1)



Pre-op X-Ray



Post-op X-Ray



12 Weeks

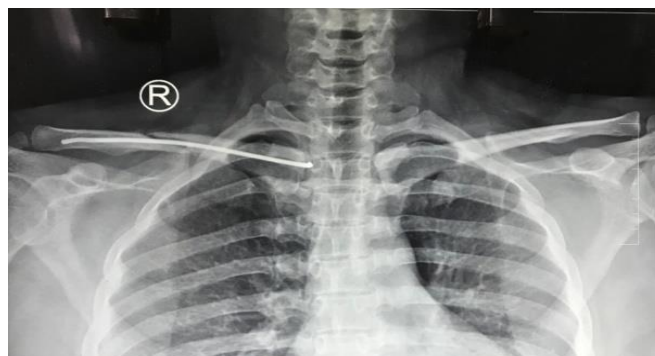


24 Weeks

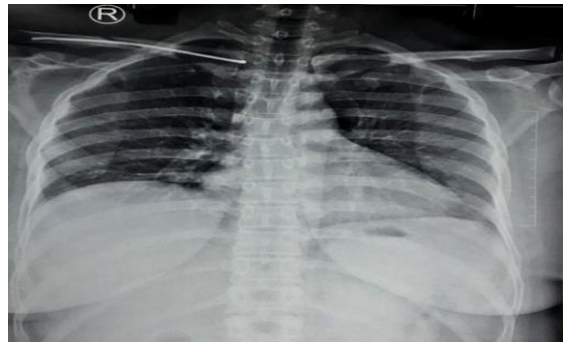
Radiographic photograph of TENS fixation (Case-1)



Pre op X-ray



Post-op X-ray



12 Weeks



24 Weeks

Clinical Photographs Figure (Plate Fixation case-1)



Flexion



Extension



Abduction



Internal Rotation

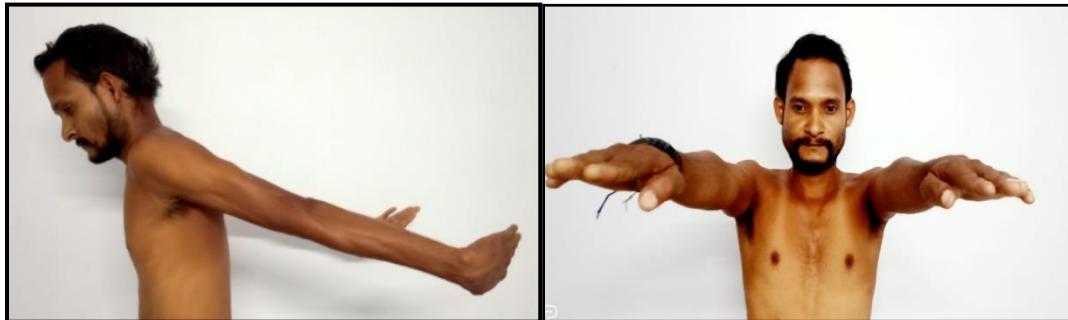
Pt. No. 41876054

Diagnosis – Fracture clavicle Right

Treatment – ORIF with Plate fixation

Movement- At Right Shoulder Joint

Clinical photographs figure (TENS Fixation Case-1)



Extension

Flexion



Abduction



Internal Rotation

Pt. No. 41794568

Diagnosis – Fracture Clavicle Right

Treatment – CRIF with TENS fixation

Movement- At Left Shoulder Joint

COMPLICATIONS

1- Implant Prominence



Pt. No. – 41619369

Diagnosis – Fracture clavicle Right (Simple)

Treatment – CRIF with TENS fixation

2- Joint stiffness at left shoulder



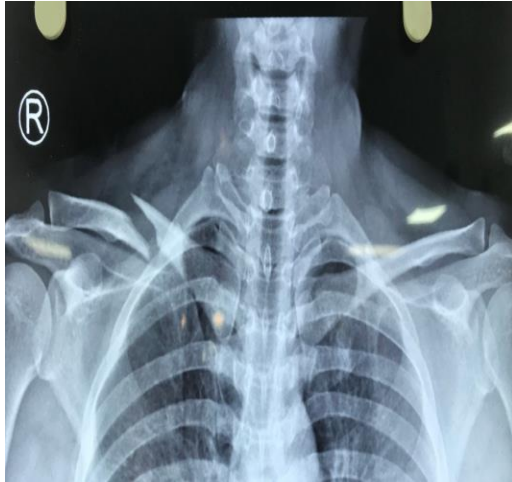
Pt. No. – 41968825

Diagnosis – Fracture clavicle Left (Comminuted)

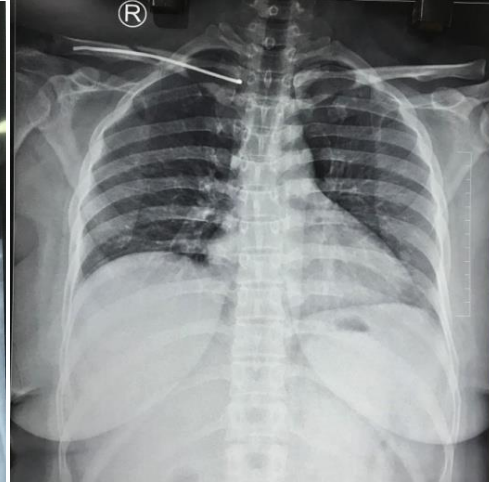
Treatment – ORIF with Plate fixation

3- Non Union

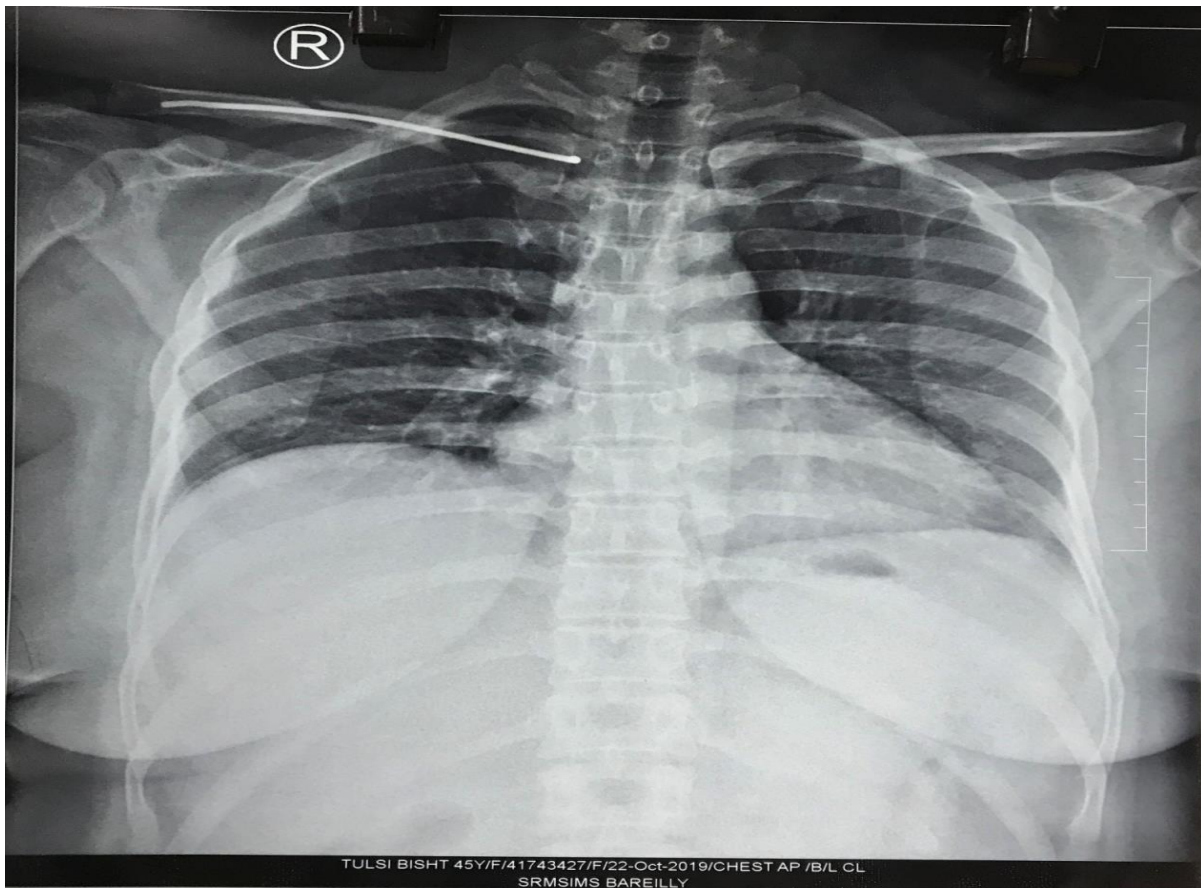
Pre-op X-Ray



Pre-op X-ray



Immediate post-op X-ray



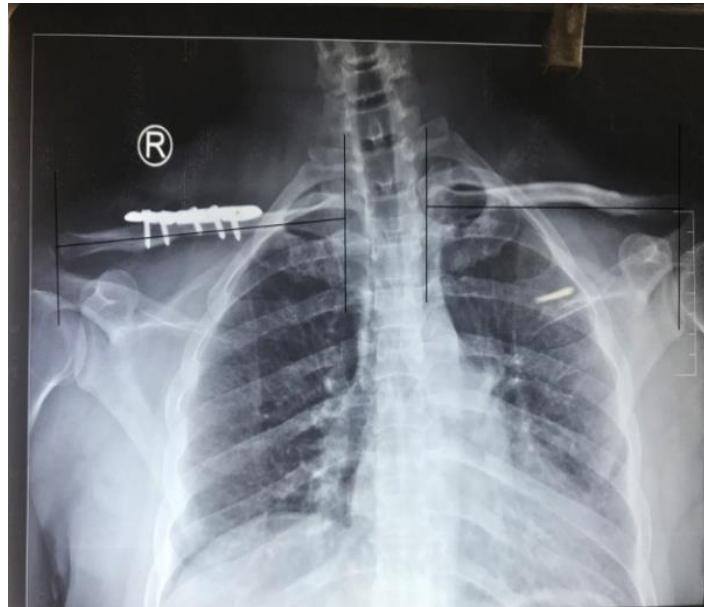
Radiographic Evaluation at 6 month post-operatively

Pt. No. – 41743427

Diagnosis – Fracture clavicle Right

Treatment – CRIF with TENS fixation

POST-OP CLAVICLE SHORTENING MEASUREMENT



Pt. No.- 20415126
Clavicle shortening = 2.5 MM



Pt. No.- 41478348
Clavicle shortening = 3 MM

III. RESULTS

Table 1: Age distribution among the study groups

Age (yrs)	Plating Group	TENS Group
15-25	03	08
26-35	03	05
36-45	04	01
46-55	03	01
56-65	02	00
Mean	38.67	27.8
SD	12.11	10.48

Mean age among the plating and TENS group was 38.67 ± 12.11 and 27.80 ± 10.48 years respectively as shown in table 1, Figure1.

Figure1: Age distribution among the study groups

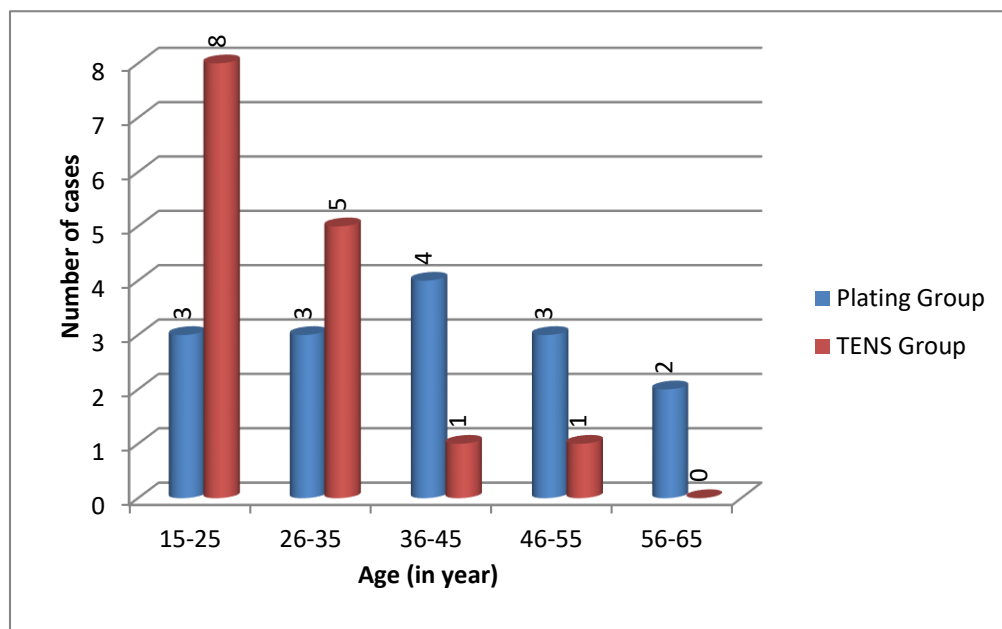
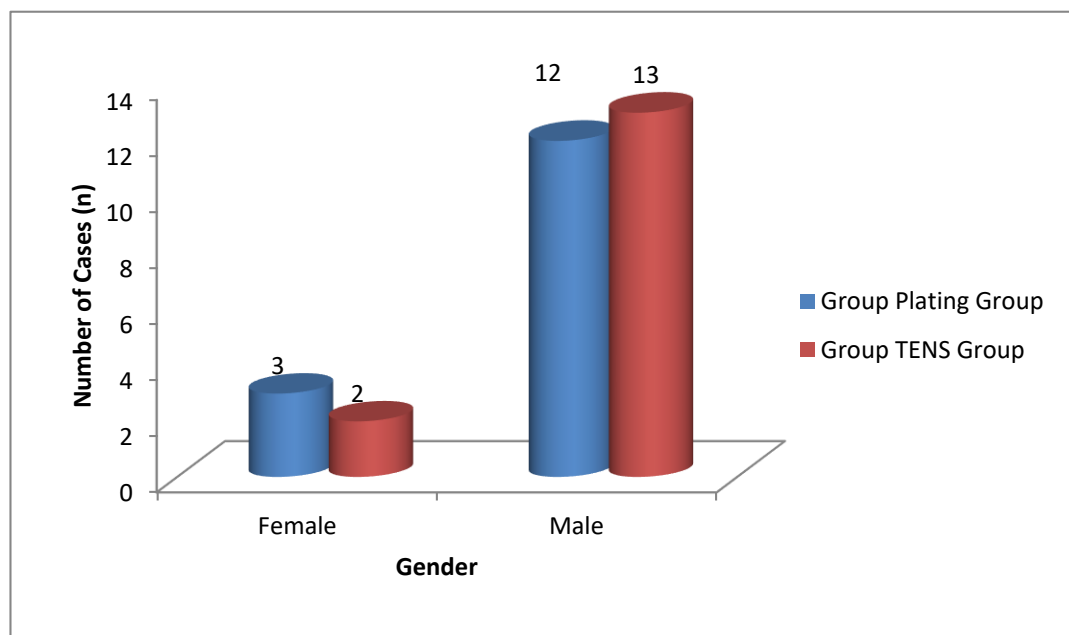


Table 2: Gender distribution among the study groups

Gender		Group	
		Plating Group	TENS Group
Female	N	3	2
	%	20.0%	13.3%
Male	N	12	13
	%	80.0%	86.7%

Figure2: Gender distribution among the study groups



The present study was conducted in the Department of Orthopaedics of SRMS-IMS, Bareilly from November 2018 to June 2020 among 30 patients having mid-clavicle fracture shaft. Equal number of patients underwent surgery either by plate fixation group or titanium elastic nailing group. Allocation into plate fixation group or titanium elastic nailing group was done alternatively. In both the groups, there was dominance of males (83.33%) as compared to females (16.7%) with ratio of 5:1 (table 2, Figure2).

Table 3: Side of Injury among the study groups

Side of Injury		Group	
		Plating Group	TENS Group
Left	n	6	9
	%	40.0%	60.0%
Right	n	9	6
	%	60.0%	40.0%

In our study, right and left side midshaft clavicle fracture was reported among 6 (40%), 9 (60%) and 9 (60%), 6 (40%) subjects among plating and TENS group respectively (table 3, Figure 3).

Figure 3: Side of Injury among the study groups

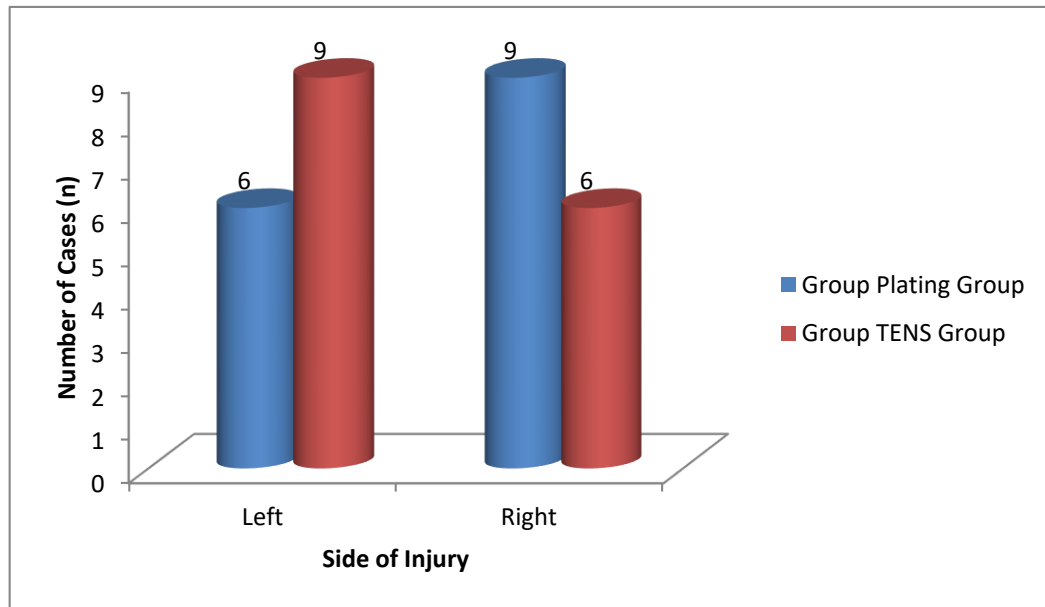


Table 4: Mode of injury among the study groups

Mode of injury		Group	
		Plating Group	TENS Group
Fall from Height	n	4	4
	%	26.7%	26.7%
Fall on outstretched hand	n	2	2
	%	13.3%	13.3%
RTA	n	7	7
	%	46.7%	46.7%
Sports	n	2	2
	%	13.3%	13.3%

In the present study, most common mode of injury was road traffic accident (RTA) reported among 46.7% of the subjects in plating as well as TENS group. Least common mode of injury was sports related and fall on outstretched hand (table 4, Figure 4).
 Figure 4: Mode of injury among the study groups

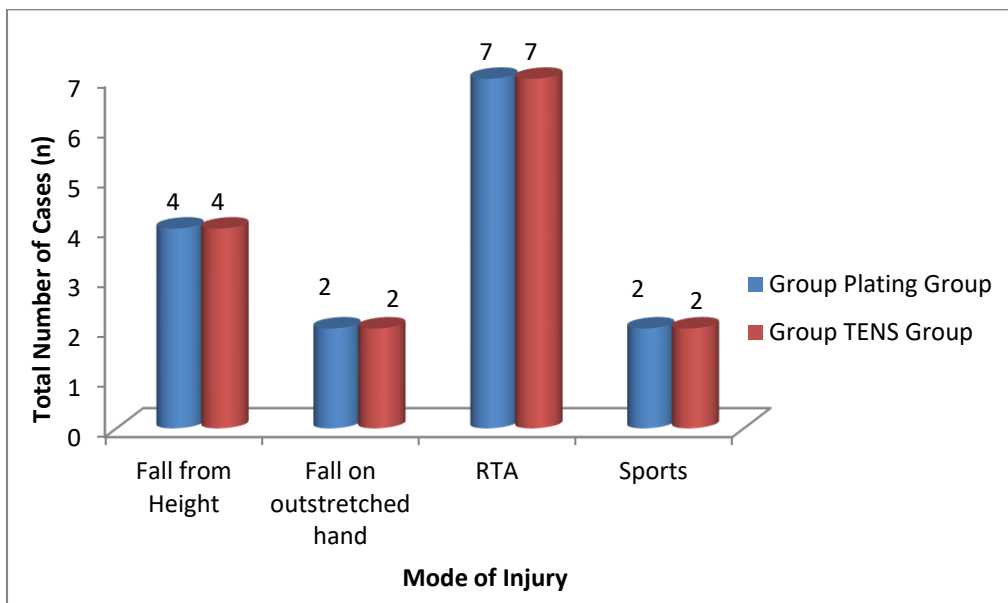


Table 5: Type of fracture as per OTA among the study groups

Type of fracture		Group	
		Plating Group	TENS Group
B1	n	7	7
	%	46.7%	46.7%
B2	n	8	8
	%	53.3%	53.3%

B1 and B2 fracture as per OTA classification was revealed among 46.7% and 53.3% of the subjects plating as well as TENS group (table 5, Figure 5).

Figure 5: Type of fracture as per OTA among the study groups

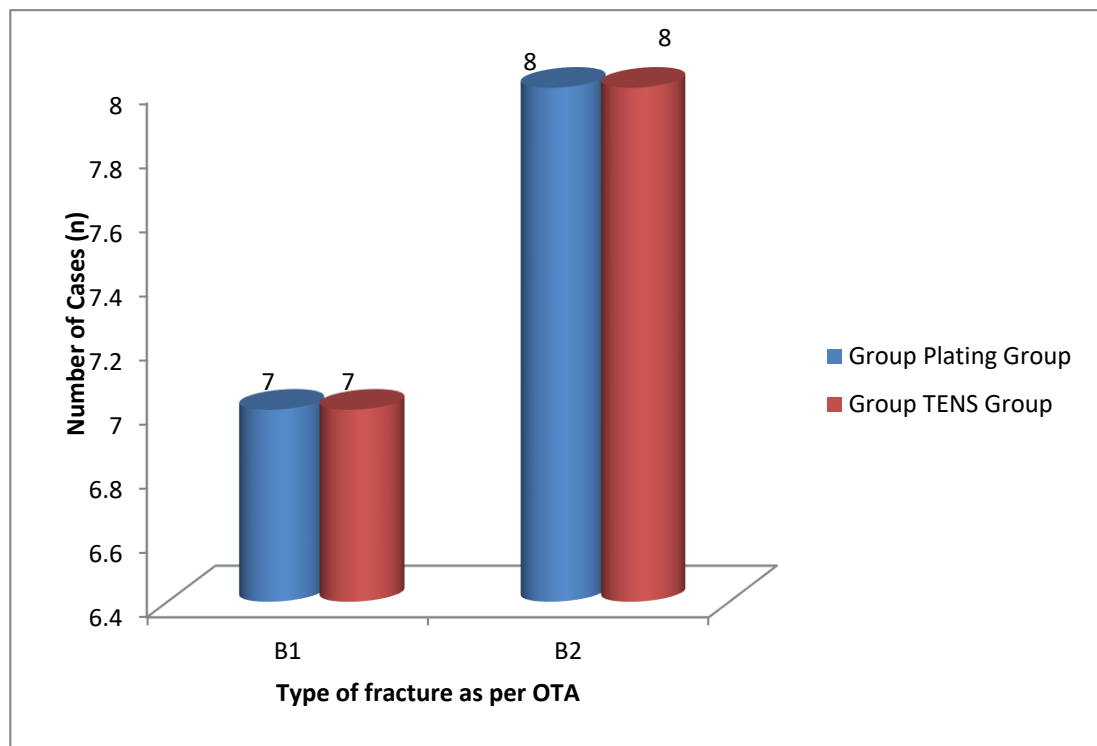


Table 6: Fracture Pattern among the study groups

Fracture Pattern		Group		Total
		Plating Group	TENS Group	
Comminuted	n	6	2	8
	%	40.0%	13.3%	26.7%
Simple	n	7	7	14
	%	46.7%	46.7%	46.7%
Simple Butterfly	n	2	6	8
	%	13.4%	40%	26.7% %

Comminuted, simple and simple butterfly was found among 40%, 46.7%, 13.4% and 13.3%, 46.7%, 40% of the subjects in Plating and TENS group respectively (table 6, Figure 6).

Figure 6: Fracture Pattern among the study groups

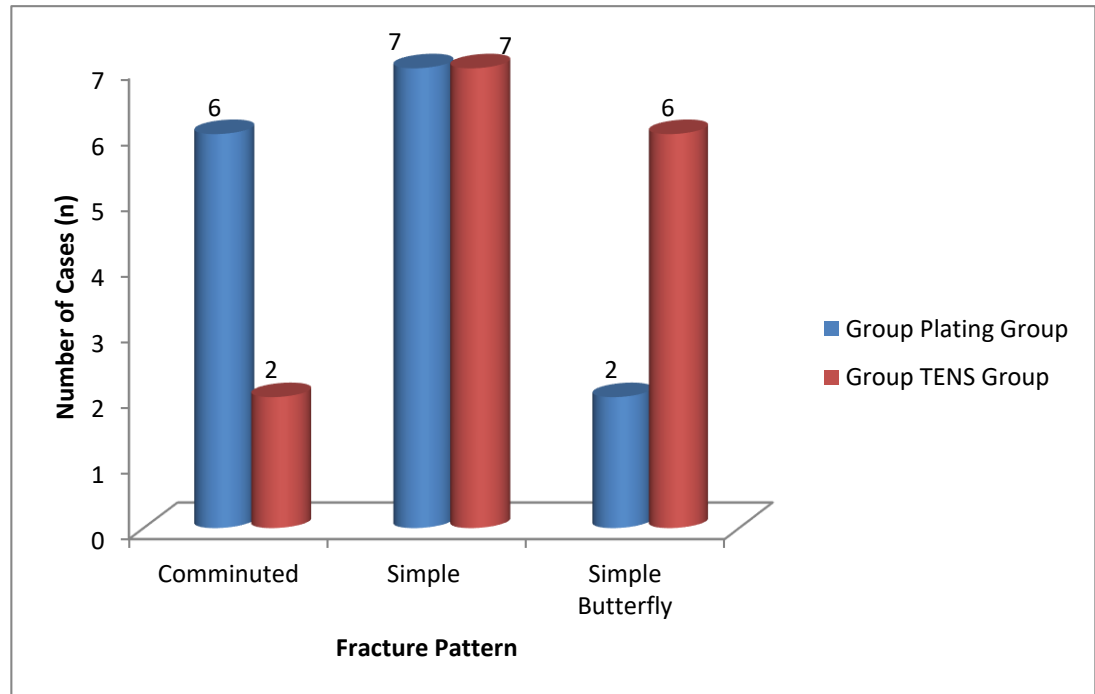


Table 7: Time period between injury and surgery (Days) among the study groups

Time Period		Group		Total
		Plating Group	TENS Group	
3-5	N	6	6	12
	%	40%	40%	40%
6-10	N	6	8	14
	%	6.7%	53.3%	46.67%
>10	N	3	1	4
	%	13.3%	6.7%	13.33%

3-5, 6-10 and >10 days of time period between injury and surgery was reported among 40%, 6.7%, 13.3% and 40%, 53.3%, 6.7% of the subjects in plating and TENS group respectively (table 7, Figure 7).

Figure 7: Time period between injury and surgery(Days) among the study groups

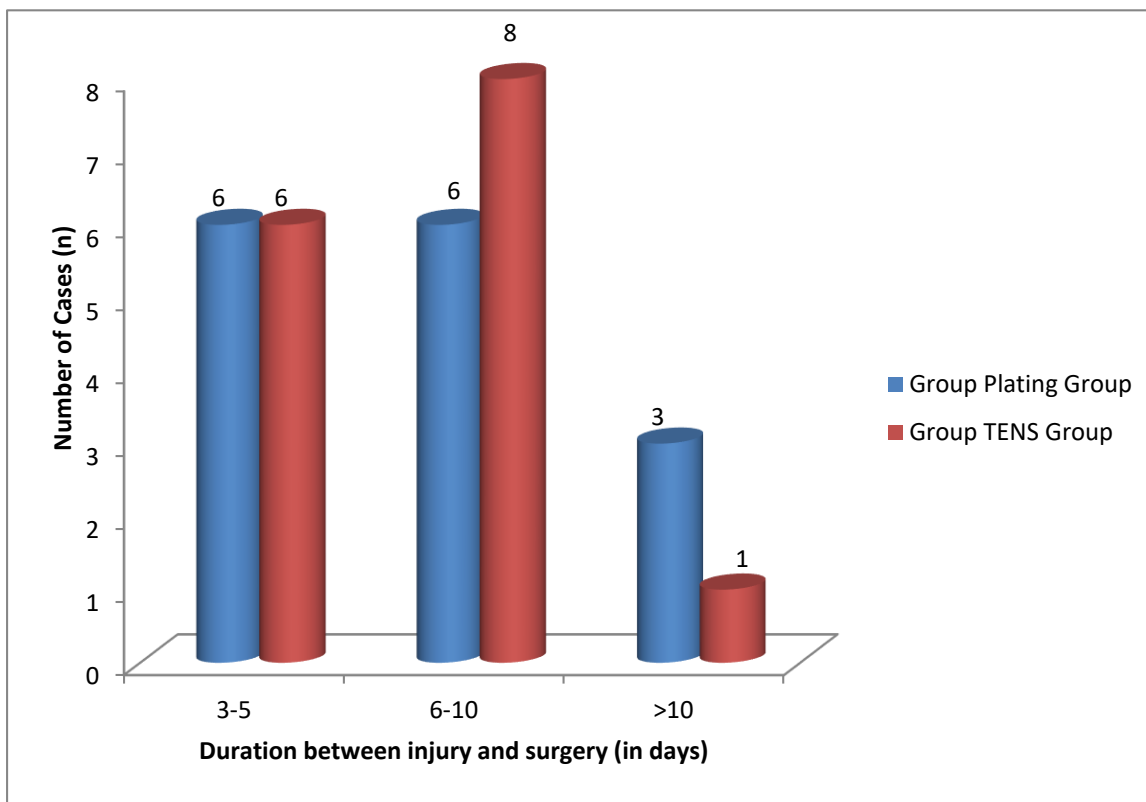


Table 8: Radiation Exposure(number of shoots) among the study groups

Radiation Exposure (Total No. of Shoots)	Plating Group	TENS Group
0-10	08	00
11-20	07	11
21-30	00	04
Mean	10	18.67
SD	2.67	6.31
t-test	12.91	
p-value	< 0.01*	

*: statistically significant

Mean radiation exposure (number of shoots) among the plating and TENS group was 10 ± 2.61 and 18.67 ± 6.31 respectively with statistically significant difference (table 8, Figure 8).

Figure 8: Radiation Exposure (number of shoots) among the study groups

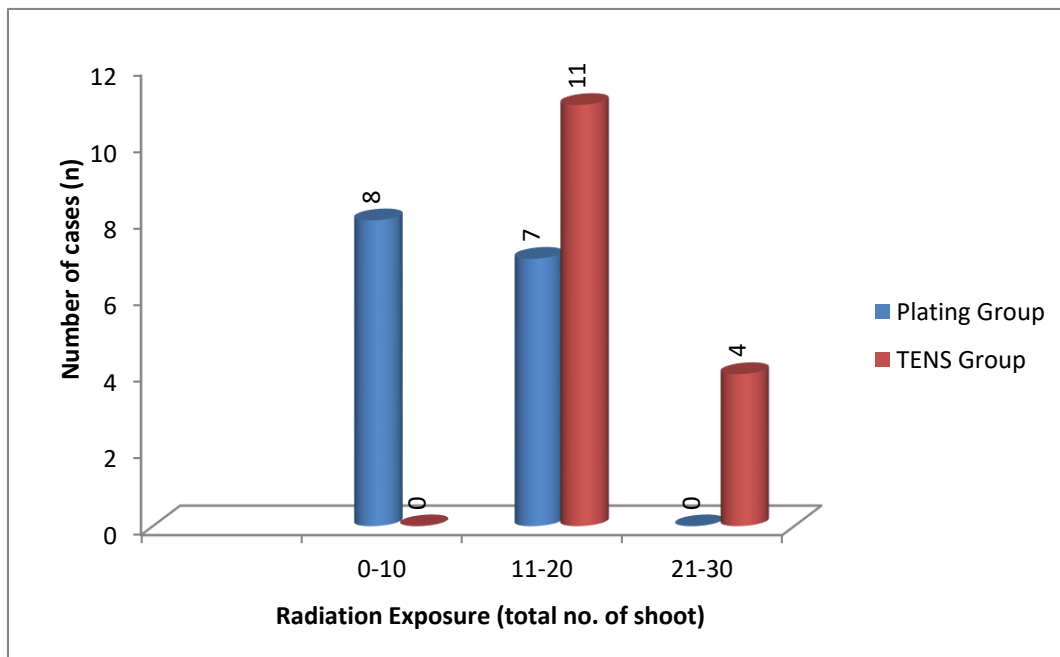


Table 9: Operation Time (Minutes) among the study groups

Operation Time (Min)	Plating Group	TENS Group
≤ 60	00	14
61-90	12	01
91-120	03	00
Mean	81.93	48.73
SD	16.808	6.563
t-test	50.79	
p-value	< 0.01*	

*: statistically significant

Mean operating time required was comparatively less in TENS group (48.73 minute) as compared to plating group (81.93 minute) with statistically significant difference (table 9, Figure 9).

Figure 9: Operation Time (Minutes) among the study groups

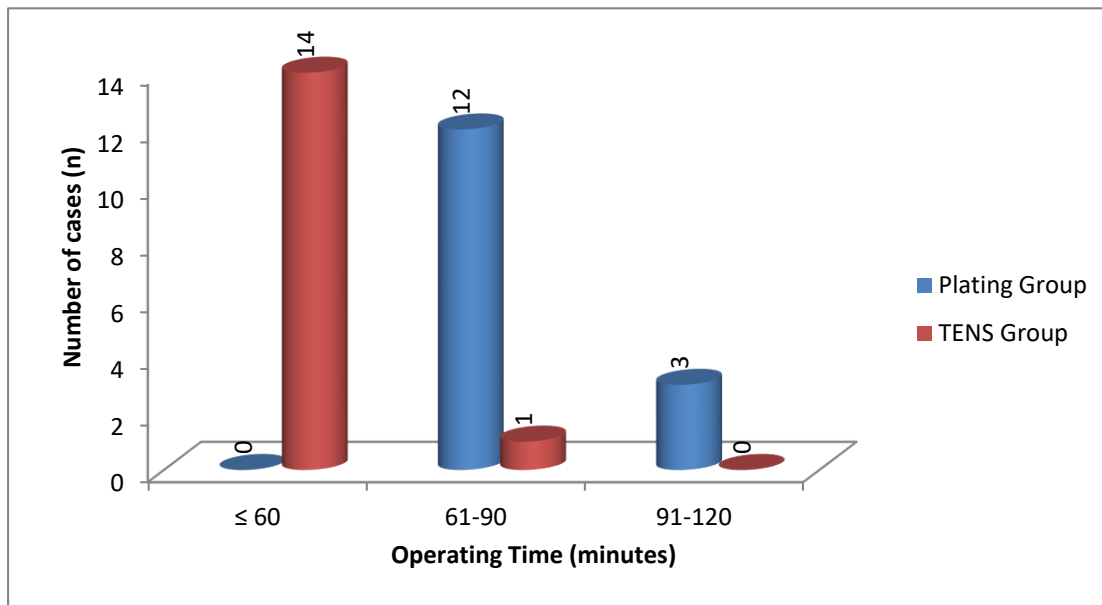


Table 10: Comparison of union time (Weeks) among the study groups

Union Time (Weeks)		Group		Total	Chi Square	p value
		Plating Group	TENS Group			
12	n	13	12	25	2.81	0.38
	%	86.67%	80%	83.33%		
18	n	0	2	2	2.81	0.38
	%	0%	13.33%	6.7%		
24	n	2	1	3	2.81	0.38
	%	13.33%	6.7%	10%		

Union time required by most of the subjects (>80%) was 12 weeks in both the groups. When union time (Weeks) was compared statistically among plating and TENS group, it was found to be statistically not significant as $p > 0.05$ (table 10, Figure 10).

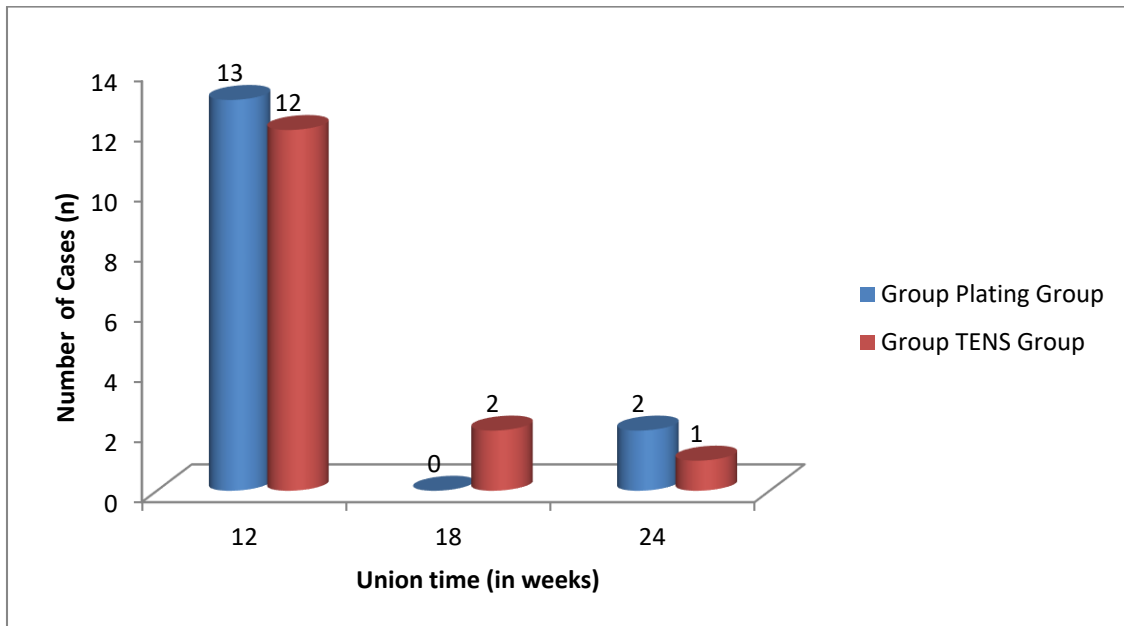


Figure 10: Comparison of union time (Weeks) among the study groups

Table 11: Clavicular Shortening (in mm) among the groups

Clavicular Shortening (in mm)		Group			
		Plating Group		TENS Group	
		B1 type	B2 type	B1 type	B2 type
1-2	n	00	00	00	00
	%				
2-3	n	00	02	00	03
	%		13.33%		20%
3-4	n	00	01	00	02
	%		6.67%		13.33%
Chi Square		2.83			
p value		0.42			

In our study, clavicular shortening i.e. 2.5, 3 and 3.5mm was reported among 13.33%, 6.67%, 0% and 13.33%, 6.67%, 13.33% of the subjects in plating and TENS group respectively. Clavicular shortening was found more in TENS group as compared to plating group, though statistically not significant (table 11, Figure 11).

Figure 11: Clavicular Shortening (in mm) among the groups

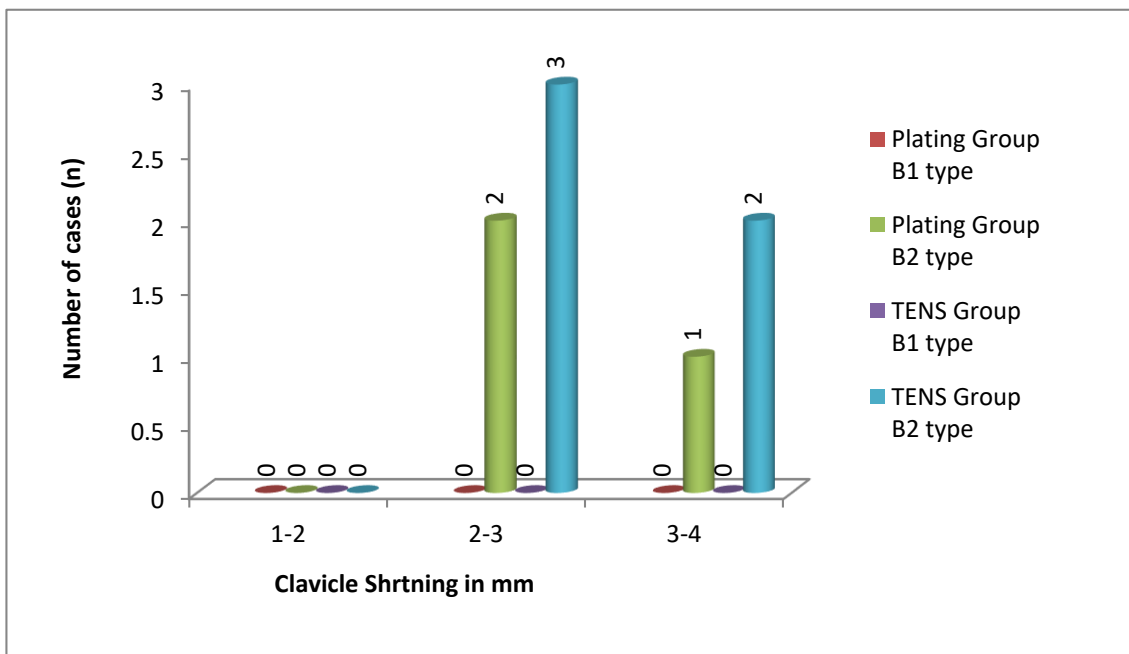


Table 12:- Constant Score among the study groups at different interval

Group		Constant Score (2 Weeks)	Constant Score (6 Weeks)	Constant Score (12 Weeks)	Constant Score (24 Weeks)
Plating Group	Mean	65.6	70.4	77	82.67
	SD	4.55	3.94	4.34	4.12
TENS Group	Mean	62.8	69.27	76.47	82.87
	SD	5.24	4.22	3.85	5.58
t test		3.81	0.65	0.91	0.51
p value		0.03*	0.43	0.62	0.72

*: statistically significant

Figure 12: Constant Score among the study groups at different interval

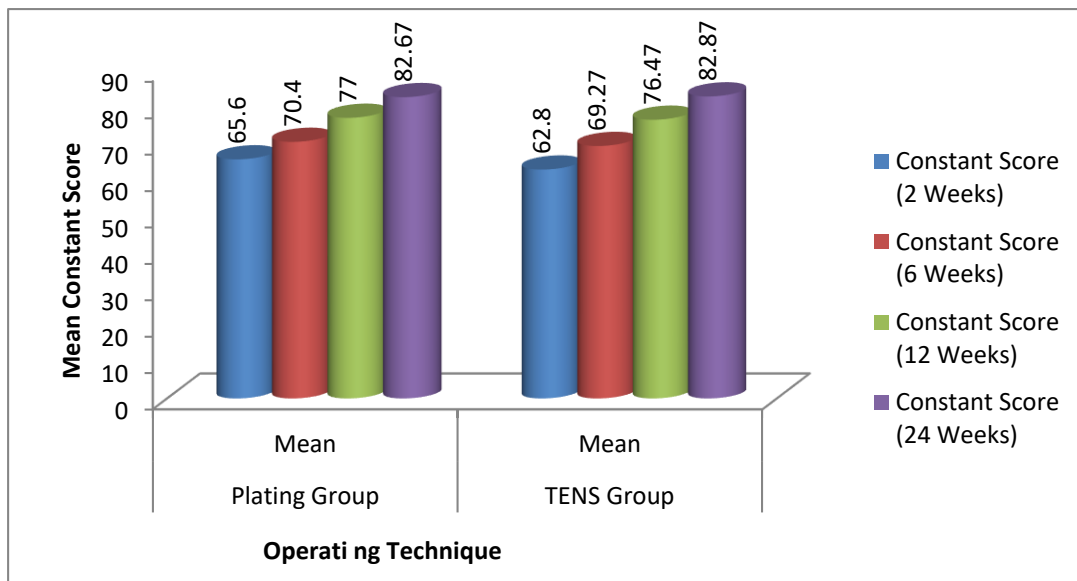


Table 12-, Figure 12- shows the comparison of constant score among the study groups at different intervals in TENS and plating group.

In our study, mean constant score was continuously improving among both the group at all the intervals, with slightly better improvement in plating group at 2 and 6 weeks post-operatively. At 24 weeks of follow-up the mean constant score was approximately equal in both the study group with no statistical significant difference.

Table 13: Dash Score among the study groups at different interval

Group		Dash Score (2 Weeks)	Dash Score (6 Weeks)	Dash Score (12 Weeks)	Dash Score (24 Weeks)
Plating Group	Mean	66.20	57.53	28.73	6.33
	SD	4.36	4.63	4.43	1.68
TENS Group	Mean	74.40	62.47	26.47	6.47

	SD	7.16	6.664	4.688	2.066
t test		8.93	4.44	2.37	0.04
p value		0.003*	0.04*	0.14	0.85

*: statistically significant

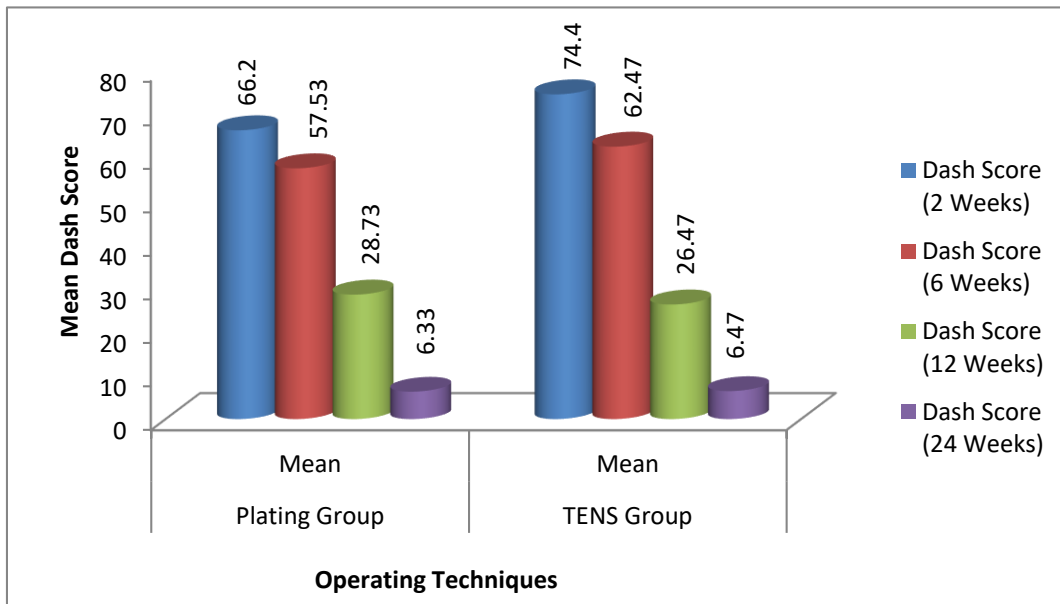


Table 13, Figure 13 shows the comparison of Dash score among the study groups at different intervals.

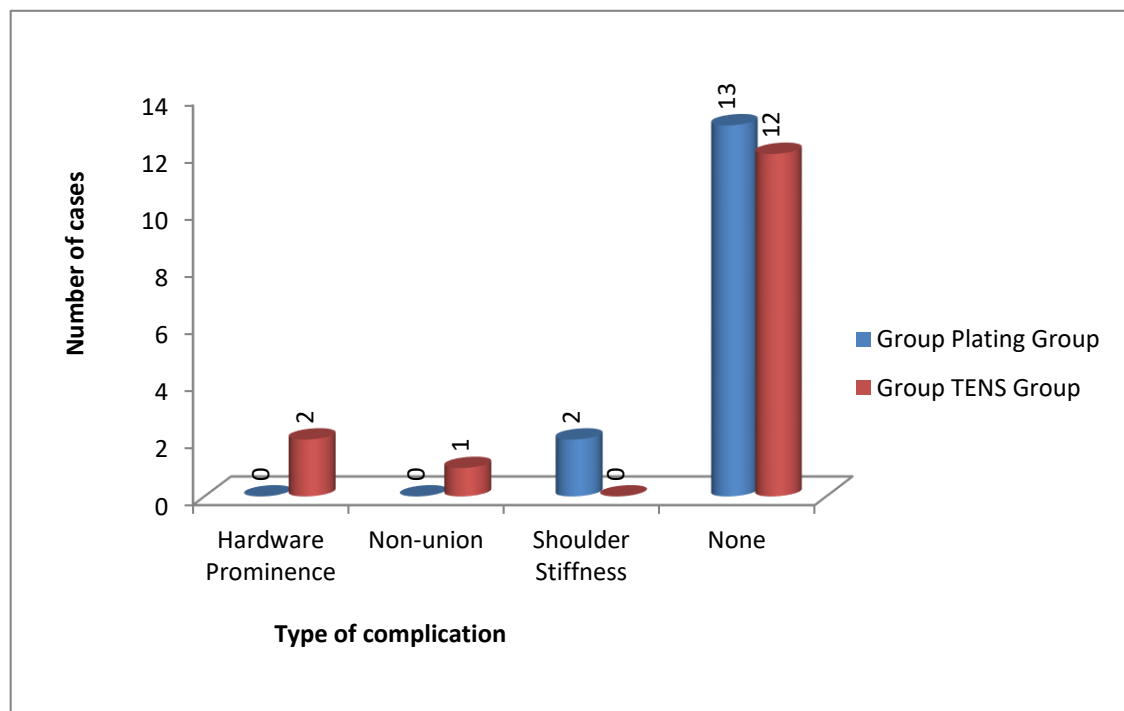
Mean Dash score was continuously reducing among both the group at all the intervals, with better reduction in plating group but the difference was statistically not significant. At 24 weeks the DASH score was approximately equal in TENS and plating group.

Table 14: Complications among the study groups

Complications		Group		Total
		Plating Group	TENS Group	
Hardware Prominence	n	0	2	2
	%	0.0%	13.33%	
Non-union	n	0	1	1
	%	0.0%	6.7%	
Shoulder Stiffness	n	2	0	2
	%	13.3%	0%	
None	n	13	12	25
	%	86.7%	80%	
Chi Square		4.17		
p value		0.53		

Complications was found among 3 subjects (20%) in TENS group and 2 (13.3%) in plating group. Both the subjects in plating group reported shoulder stiffness while 2 (13.3%) and 1 subject (6.7%) in TENS group revealed hardware prominence and non-union respectively (table 14, Figure 14).

Figure 14: Complications among the study groups



The results of the study are as follows:

- In both the groups, there was dominancy of males (83.33%) as compared to females (16.7%) with ratio of 5:1 in the present study.
- Mean age among the plating and TENS group was 38.67±12.11 and 27.80±10.48 years respectively.
- Right and left side midshaft clavicle fracture was reported among 6 (40%), 9 (60%) and 9 (60%), 6 (40%) subjects among plating and TENS group respectively.
- Most common mode if injury was road traffic accident (RTA), reported among 46.7% of the subjects in plating as well as TENS group. Least common mode of injury was sports related and fall on outstretched hand.
- BI and B2 fracture as per OTA classification was revealed among 46.7% and 53.3% of the subjects plating as well as TENS group in the present study.
- Comminuted, simple and simple butterfly was found among 40%, 46.7%, 13.4% and 13.3%, 46.7%, 40% of the subjects in Plating and TENS group respectively.
- 3-5, 6-10 and >10 days of time period between injury and surgery was reported among 40%, 6.7%, 13.3% and

40%, 53.3%, 6.7% of the subjects in plating and TENS group respectively.

- h. Mean radiation exposure (number of shoots) among the plating and TENS group was 10 ± 2.61 and 18.67 ± 6.31 respectively with statistically significant difference.
- i. Mean operating time required was comparatively less in TENS group (48.73 minute) as compared to plating group (81.93 minute) with statistically significant difference.
- j. Union time required by most of the subjects (>80%) was 12 weeks in both the groups. When union time (Weeks) was compared statistically among plating and TENS group, it was found to be statistically not significant as $p > 0.05$.
- k. Clavicular shortening i.e. 2.5, 3 and 3.5mm was reported among 13.33%, 6.67%, 0% and 13.33%, 6.67%, 13.33% of the subjects in plating and TENS group respectively. Clavicular shortening was found more in TENS group as compared to plating group, though it was statistically insignificant.
- l. In this study, constant score was continuously improving among both the group at all the intervals, with slightly better improvement in TENS group. But there was no statistical significant difference between the plating and TENS group w.r.t mean constant score at all the intervals except at 2 weeks.
- m. Dash score was continuously reducing among both the group at all the intervals, with better reduction in plating group. There was statistical significant difference between the plating and TENS group w.r.t mean Dash score at 2 and 6 weeks in the present study. But at 24 weeks, it was approximately equal in both the groups.
- n. Both the subjects in plating group reported shoulder stiffness while 2 (13.3%) and 1 subject (6.7%) in TENS group revealed hardware prominence and non-union respectively.

IV. DISCUSSION

Among bony injuries, clavicle fracture is reported to be the most common injury. Approximately 2% to 5% of all fractures in adults and 10% to 15% in children involve the clavicle. Studies indicate that 29 to 64 per 1, 00000 suffer from a clavicle fracture each year.^{1,2} Study conducted by **Bostman et al**⁵⁸ showed that the average age was 33.4 years³. In our study, the results are approximately similar to the above-mentioned studies. **Saha P et al**⁷ in their study revealed similar male dominance i.e. in the Plate group (M:F:: 30:7), and in the TEN group (M/F, 30/7). **Govindasamy R et. al**³ in their study, they included 28 left sided and 26 right sided fractures out of 54 patients. **Elango M**⁴⁴ includes 12 right sided and 16 left sided clavicle in their study. **Govindasamy R et. al**³ in their study found that the mode of injury in 35 patient was road traffic accidents and in 19 cases it was due to fall from height. **Borthakur B. et al**³⁶ in their study includes 28 B1 and 3 B2 cases. **Sahu A K. et al**⁵³ revealed that 50% cases were simple (B1) type and 50% cases were wedge (B2) type. **Hussain N et al**²³ reported 55% simple, 38% comminuted and 7% simple butterfly type of fracture pattern in their study. **Borthakur B. et al**³⁶ in their study reported the duration of injury was 5.91 ± 1.96

days. **Balachandar S et al**⁴⁶ noted that the duration between injury and surgery was 3-5 days. **Simek J et al**⁶⁰ in their study reported that the total radiation exposure was less in plating group as compared to TENS group. **Pramod B Itagi**⁴² found the mean operating time was 36.2 minutes in TENS group while in case of plating it was 59 minutes. **Elango Met al**²⁵ noted that the union time was 18.62 ± 3.4 weeks in TENS group and 22.4 ± 4.85 weeks in plating group. **Lazarides S et al**²⁹, noticed that, shortening of final clavicular >18 mm in males and >14 mm among females were significantly associated with unsatisfactory findings. **Sahu A K et al**⁵³ in their study revealed that mean Constant shoulder score in TENS group was 9.36 ± 7.04 and 15.08 ± 9.4 in plate group respectively. **Mckee MD et al**¹⁷ found that average constant score among TENS group was 91.6 ± 14.1 and in plate group, it was 97 ± 4.5 and mean Dash score 4.1 ± 7.0 and 11.49 ± 7 respectively.³ **Sahu A K et al**⁵³ in their study revealed that mean DASH score in TENS group was 1.87 ± 3.4 and 4.8 ± 9.0 in plate group respectively. **Balachandar S et al**⁴⁶ noticed that 73.4% patient in plating group and 80% cases in TENS group had delayed union and shoulder stiffness. Nail migration noticed in 13.3 % cases in TENS fixation and in 1 % case there was infection in plating group. Re-fracture secondary to additional trauma either medial and lateral to original occurs and reported at a rate between 1% to 2% by **Mckee et al**¹⁷. **Poigenfurst et al**⁵⁹ reported re-fracture in 4 patients out of 122 patients.

V. CONCLUSION

With the present day advancement in surgical method and technique and a better understanding of patho-anatomy and biomechanics of clavicle, the management of clavicle fractures by surgical fixation has evolved. However it is essential to stringently adhere to the basic principles of management, having an understanding of the various fracture configuration and their idiosyncrasies.

In our study on fracture mid-shaft clavicle, patient were randomly divided into plating and TENS group; following conclusions are made. Fracture mid-shaft clavicle is more common in male as compared to females. The mode of injury was usually road traffic injury followed by sports and fall on out stretched hand. The operating time required was less in TENS group as compared to plating group. Radiation exposure time was more in TENS group as compared to plating group. Constant score was better in TENS group; but not statistically significant as compared to plating group. Dash score was better in plating group; but not statistically significant as compared to TENS group.

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