Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF

ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/16500
DOI URL: http://dx.doi.org/10.21474/IJAR01/16500

RESEARCH ARTICLE

A COMPARATIVE STUDY OF THE FUNCTIONAL AND RADIOLOGICAL OUTCOME OF DISPLACED MID SHAFT CLAVICLE FRACTURE MANAGED WITH INTRAMEDULLARY NAILING AND PLATING

Dr. R.K. Jain, Dr. Arjun Jain, Dr. Aayush Kumar Soni and Dr. Srajan Jain

Manuscript Info

Manuscript History
Received: 25 January 2023
Final Accepted: 27 February 2023
Published: March 2023

Key words:-
Clavicle Fracture, Trauma, Plate Osteosynthesis

Abstract

Introduction: Clavicle fractures are common injuries in young, energetic people, especially those who play sports involving frequent violent collisions or high-speed falls (e.g., football, hockey) ,but in children and the elderly they are associated with falls and makeup about 2.6% of all fractures (1-3). The most common site of fracture in the clavicle occurs at the middle third and which accounts for almost 80% of all clavicle fractures. With careful management, Neer reported an on-union rate of 0.1% (4), and Rowe confirmed these finding sin 1968 by demonstrating an on- union rate of 0.8% in patients.(6) Since then,though, other authors have been unable to show that conservative treatment can provide results as favourable. (7-8). This could be as a result of the early series including childrenand teenagers, whose extraordinary capacity for bone healing may have thrown off the results,as well as the fact that patient-based grading methods were not employed to record the out come in the initial series. Treating conservatively, Hilletal reported a non-union rate of 15% in correlation with initial shortening greater than 2 cm. 31% of patients who were reviewed in the study of Hillet al were not satisfied with treatment results.(10) Therefore, even if they mend without complications, displaced midshaft clavicle fracture scan result in significant, long-term morbidity. Thus, there is a trend towards surgical fixation of clavicle fractures based on the unsatisfactory data obtained from conservative treatment. For fixation of displaced clavicle fractures good results with high union rates and low complication rates have been reported from many techniques. Similar to other long bones, the clavicle is most effectively treated using intra medullary techniques. In order to reduce the number of delayed unions, non-union, symptomatic malunion andother complications, elastic stable intra medullary nailing (ESIN) is recommended for all simple displaced midshaft clavicle fractures

Result: Patients who had their displaced middle-third clavicle fractures surgically fixed had alow errate of non-union and symptomaticmal union.Given that functional ratings were identical in both groups, it is unclear whether this impact has any clinical importance. Overall, both PF and IMF demonstrated good recovery rates. Recovery was faster in the PF group, with a 55%

Corresponding Author:-Dr. Aayush Kumar Soni

DASH score. For early functional rehabilitation fixation constructis more rigid and both objective and subjective recovery is faster

Conclusion: Wecan there fore draw the conclusion from our study that, when used for surgical fixation of displaced mid-shaft clavicle fractures, pre-contoured plates offered better functional outcome and were associated with problems in fewer cases than titanium elastic nails. Upto 6 months, plating had better follow-up results than nailing, but after that, there were no appreciable differences in the prognosis of either operation. Accordingly, we advise using pre - contoured locking plates for internal fixation of displaced mid shaft clavicle fractures.Low prevalence complications were not found due to the short sample size. For knowing the prevalence of the more uncommon complications including wound dehiscence, symptomatic malunion, and refracture, a larger sample size will be necessary.Long term follows up are required for further research.

recovery rate at 6 weeks post procedure according to the

……

Introduction:-

Clavicle fractures are common injuries in young, energetic people, especially those who play sports involving frequent violent collisions or high-speed falls (e.g.,football,hockey),but in children and the elderly they are associated with falls and make up about 2.6% of all fractures [1-3].

The most common site of fracture in the clavicle occurs at the middle third and which accounts for almost 80% of all clavicle fractures. Older studies claimed that, even when severely displaced, afracture of the clavicle's shaft was generally had favourable prognosis when treated non-operatively.[4-5].

With careful management, Neer reported a non-union rate of 0.1%[4], and Rowe confirmed these finding sin 1968 by demonstrating an on-union rate of 0.8% in patients.[6] Sincethen, though, other authors have been unable to show that conservative treatment can provideresults as favourable. [7-8]. This could be as a result of the early series including children and teenagers, whose extraordinary capacity for bone healing may have thrown off the results, as well as the fact that patient- based grading methods were notemployed to record the outcome in the initial series.

From 1975 to 2005 in ameta – analysis of the literature, Zlowodzkietal found15.1%, higher non-union incidence than previously described for non- operatively treated displaced midshaft clavicle fractures. [9]

Treating conservatively, Hill et al reported a non-union rate of 15% in correlation with initial shortening greater than 2 cm. 31% of patients who were reviewed in the study ofHillet al werenot satisfied with treatment results.[10]

Therefore, even if they mend without complications, displaced midshaft clavicle fracturescan result in significant, long-term morbidity. Thus, there is a trend towards surgicalfixation of clavicle fractures based on the unsatisfactory data obtained from conservative treatment.

For fixation of displaced clavicle fractures good results with high union rates and low complication rates have been reported from many techniques. Similar to other long bones, the clavicle is most effectively treated using intra medullary techniques.

In order to reduce the number of delayed unions., non-union, symptomatic malunion andother complications, elastic stable intra medullary nailing (ESIN) is recommended for all simple displaced midshaft claviclefractures.

Material & Methods:-

This was an analytical cross-sectional study where in operative cases of displaced mid shaft clavicle fractures, which presented to Sri Aurobindo Medical College & PG Institute Indore M.P India between the period of April 2021 to September 2022 were included.

A total of 40 Cases were Included, 20 each for intramedullary nailing and plating for displaced fracture mid shaft clavicle were taken up for the study at Sri Aurobindo Medical College & PG Institute Indore M.P India

Patients meeting our inclusion criteria were those who were above the age of 18 years, who sustained displaced mid shaft clavicle fracture, presented within the 14 days day of injury. Exclusion criteria include Concomitant fracture in Ipsilateral upper extremity, fracture of clavicle other than mid shaft clavicle fracture, open injuries, pathological fractures & Patient not giving consent for study.

Patients with anaverage follow-up time of 6 months were evaluated with the DASH questionnaire. DASH questionnaire was composed by 30 questions rated 1 to 5 regarding the upper limb ROM.

Patients participating in this study were called for regular follow up for every 3 weeks, 6 week, 3 months and 6 months and dash score was obtained for our study of functional outcome of mid shaft clavicular fractures.

Radiological outcome was analysed to check the union by checking the xrays at regular intervals.

Statistical analysis was executed with an unpaired t-test in order to assess the significant differences between the 2 groups.All the data was feed in excel sheet and significants results were obtained .

Result:-

Table No. …

Distribution of patients according to groups

Group	Frequency (N)	Percentage (%)
Group 1: (ORIF with plating)	20	50.0
Group 2: (ORIF with TENS)	20	50.0
Total	40	100.0

The above table shows the distribution of patients according to groups.
There were 20 (50%) patients in Group 1 (ORIF with plating) and 20 (50%) patients in Group 2 (ORIF with TENS).

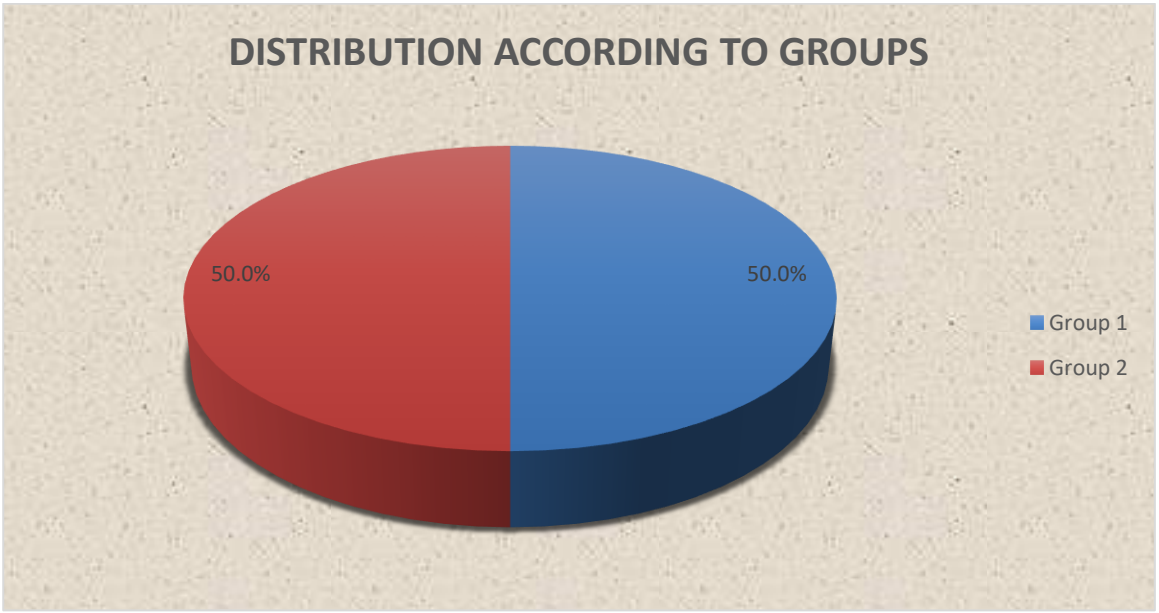

Figure:- Pie diagram shows the distribution of patients according to groups.

TableNo.2:- Distribution of patients according to age.

Age	Group1		Group2	
	No.	%	No.	%
18-20years	1	5.0	2	10.0
21-30years	11	55.0	3	15.0

31-40years	6	30.0	4	20.0
41-50years	2	10.0	8	40.0
>50years	0	0.0	3	15.0
Total	20	100.0	20	100.0
Mean±SD	30.60 ± 7.81		39.25 ± 11.04	
't'value, df		-2.861,df=38		
Pvalue		0.007*		

Unpaired 't' test applied.P value = 0.007,Significant

The above table shows the distribution of patients according to age.

In **Group1**,1(5%) patient was in the age group 18-20years, 11(55%) were in the age group 21-30years ,6 (30%) were in the age group 31-40 years and 2 (10%) were in the age group 41- 50years.

In**Group2**, 2(10%) patients were in the age group 18-20 years, 3(15%) were in the age group 21-30 years, 4 (20%) were in the age group 31-40 years, 8 (40%) were in the age group 41-50 years and 3 (15%) patients were in the age group > 50years.

The mean age in Group 1 was 30.60± 7.81 years and in Group 2 was 39.25± 11.04 years.The difference was found to be statistically significant (P=0.007). The mean age in Group 2 was significantly higher than Group 1.

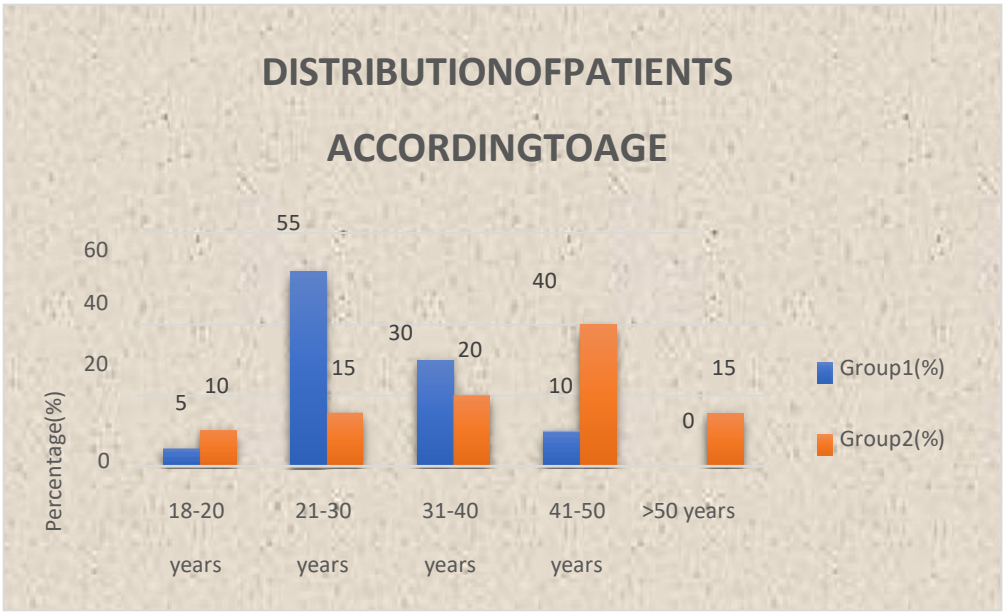

Figure:- Bar diagram shows the distribution of patients according to age.

TableNo.3:- Distribution of patients according to sex.

Sex	**Group1**		**Group2**	
	No.	**%**	**No.**	**%**
Female	2	10.0	7	35.0
Male	18	90.0	13	65.0
Total	20	100.0	20	100.0

Pearson Chi – square test applied.

Chi-square value= 3.584, df=1, P value=0.058,Not Significant

The above table shows the distribution of patients according to sex.

In **Group1**,2(10%) patients were females and 18 (90%) patients weremales.

In **Group2**,7(35%) patients were females and 13 (65%) patients were males.

In both the groups, males out numbered the females.

There was no statistically significant association between groups and the sex of the patients (P=0.058),which shows that the groups are independent of the sex of the patients.

TableNo.4:- Distribution of patients according to side involved.

Side involved	**Group1**		**Group2**	
	No.	**%**	**No.**	**%**
Left	9	45.0	8	40.0
Right	11	55.0	12	60.0
Total	20	100.0	20	100.0

PearsonChi-squaretestapplied.

Chi-squarevalue= 0.102, df=1, Pvalue=0.749, NotSignificant
The above table shows the distribution of patients according to side in volved.
In **Group1**, in 9 (45%) patients, leftside was in volved and in 11(55%) patients, right side was involved.
In **Group2**, in 8 (40%)patients, leftside was in volved and in 12(60%) patients, right side was involved.
In both the groups, right side involvement was more predominant.

There was no statistically significant association between groups and the side involved of the patients (P=0.749), which shows that the groups are independent of the side involved of thepatients

TableNo.5:- Distribution of patients according to mode of injury.

Mode of injury	**Group1**		**Group2**	
	No.	**%**	**No.**	**%**
Fall from bike	7	35.0	6	30.0
Fallon ground	1	5.0	0	0.0
Road traffic accident	12	60.0	14	70.0
Total	20	100.0	20	100.0

Pearson Chi- squarete stapplied.

Chi-square value=1.231,df=2, P value=0.540,Not Significant
The above table shows the distribution of patients according to mode of injury.

In **Group 1**, 7 (35%) patients sustained injury due to fall from bike, 1 (5%) patients sustained injury due to fall on ground and 12(60%) patients sustained injury due to road traffic accident. In **Group 2**, 6 (30%) patients sustained injury due to fall from bike, and 14 (70%) patients sustained injury due to road traffic accident.

In both the groups, majority of the patient sustained injury due to road traffic accident.

There was no statistically significant association between groups and the mode of injury of the patients (P=0.540), which shows that the groups are independent of the mode of injury of thepatients.

Table No. 7:- Comparison of fracture union between the two groups at different time intervals.

Time Interval	racture Union	Group 1		Group 2		alue, df	P value
		No.	%	No.	%		
Immediate postoperative	No	20	100.0	20	100.0	-	-
	Yes	-	-	-	-		
	NA	-	-	-	-		
3 weeks	No	18	90.0	18	90.0	0.000, df=1	000, NS
	Yes	2	10.0	2	10.0		
	NA	-	-	-	-		
6 weeks	No	8	40.0	3	15.0	3.844, df=2	146, NS
	Yes	12	60.0	16	80.0		
	NA	0	0.0	1	5.0		

3 months	No	2	10.0	0	0.0	3.243, df=2	198, NS
	Yes	17	85.0	20	100.0		
	NA	1	5.0	0	0.0		
6 months	No	-	-	-	-	-	-
	Yes	20	100.0	20	100.0		
	NA	-	-	-	-		

Pearson Chi-square test applied. P value <0.05 was taken as statistically significant.

The above table shows the comparison off racture union between the two groups at different time intervals.
Immediate post operative : In Group 1 as well as Group 2, none of the patients achieved any fracture union.

At 3 weeks: In Group 1, 2 (10%) patients and in Group 2, 2 (10%) patients achieved union,while rest 18 (90%) patients inboth thegroups did not achieve fracture union.

At 6 weeks : InGroup1, 12 (60%) patients achieved union and 8 (40%) patients did not achieve union. In Group 2, 16 (80%) patients achieved union, 3 (15%) patients did not achieve union and in 1 (5%) patient fracture union could not be assessed, as X-ray could not bed one.

At 3 months: In Group 1, 17 (85%) patients achieved union, 2 (10%) patients did not achieve union and in 1 (5%) patient fracture union could not be assessed, as X-ray could not be done.InGroup 2, all 20 (100%)patients achieved fracture union.

At 6 months : In both the groups, all 20 (100%) patients achieve fracture union.

Table No .8:- Comparison of mean DASH score between the two groups at different time intervals.

TimeInterval	**Group**	**No.**	**Mean±SD**	**ılue,df**	**Pvalue**
Immediate post operative	Group1	20	89.75 ± 4.14	-0.647, df=38	0.521,NS
	Group2	20	90.55 ± 3.66		
3Weeks	Group1	20	78.40 ± 3.03	-1.455, df=38	0.154,NS
	Group2	20	80.10 ± 4.25		
6Weeks	Group1	20	58.05 ± 3.41	-2.526, df=38	0.016*
	Group2	20	61.30 ± 4.64		
3Months	Group1	20	22.60 ± 5.48		0.042*
	Group2	20	25.85 ± 4.21	-2.103, df=38	
6Months	Group1	20	13.80 ± 3.14	-1.941, df=38	0.060,NS
	Group2	20	15.95 ± 3.83		

Unpaired 't' test applied. P value < 0.05 wastaken asstatistically significant

The above table shows the comparison of mean DASH score between the two groups at different time intervals.

Immediate post operative:
The mean DASH score in Group 1 was 89.75 ± 4.14 and in Group 2 was 90.55 ± 3.66. The difference was found to be statistically not significant (P=0.521).

At 3 weeks:
The mean DASH score in Group1 was 78.40 ± 3.03 and in Group 2 was 80.10 ±4.25. The difference was found to be statistically not significant (P=0.154).

At 6 weeks:
The mean DASH score in Group 1 was 58.05 ± 3.4 1 and in Group 2 was 22.60 ± 5.48. The difference was found to best atistically significant (P=0.016). The mean DASH score was significantly lower in Group 1 in comparison to Group 2.

At 3 months:
The mean DASH score in Group 1 was 22.60 ± 5 . 48 and in Group 2 was 25.85 ± 4.21. The difference was found to be statistically significant (P=0.042). The mean DASH score was significantly lower in Group1 in comparison to Group 2.

At 6 months:
The mean DASH score in Group 1 was 13.80 ± 3.14 and in Group 2 was 15.95 ± 3.83. The difference was found to be statistically not significant (P=0.060) . The mean DASH score was significantly lower in Group 1 incomparison to Group 2 at 6 weeks and at 3 months, while at 6 months, the mean DASH score between the two groups became comparable.

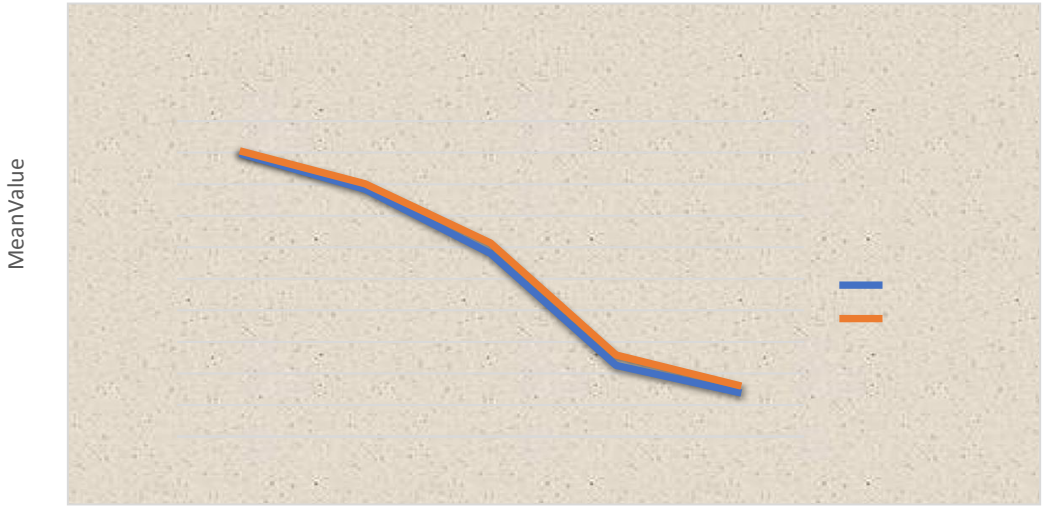

Figure:- Line diagram shows the comparison of mean DASH score between the twogroupsat different time intervals.

TableNo.9:- Comparison of early and late complications between the two groups.

Early / Late Complications	Comp-lications	Group1		Group2		χ2value,df	Pvalue
		No.	%	No.	%		
Early complications	Yes	0	0.0	1	5.0	1.026, df=1	0.311,NS
	No	20	100.0	19	95.0		
Late complications	Yes	0	0.0	0	0.0	-	-
	No	20	100.0	20	100.0		

Pearson Chi- square test applied. P value <0.05 was taken ass tatistically significant.

The above table shows the comparison of early and late complications between the two groups.

Early complications:
In Group 1, there were no complications, while in Group 2, 1 (5%) patient had superficial infection. There was no statistically significant association between groups and the early complications (P=0.311), which shows that early complications were comparable between thetwo groups

Late complications:
In both the groups, there were no complications.
Superficial infection was seen in only 1 patient of Group 2, while none of the patients in Group1 had any complications

Radiological Union

UNION	PLATE		NAIL	
	YES	NO	YES	NO
Immediate posttrauma	00	20	00	20
3weeks	00	20	00	20
6weeks	12	8	16	4
3months	17	3	20	00
6months	20	00	20	00

Discussion:-

In this study an attempt to find answer to the following questions was made;
1. The surgical management and to assess its functional out come indisplaced clavicular fracture
2. To determine duration of union and its complications
3. Conclusions and how it may influence treatment of midshaft clavicle fractures?

In our study out of 40 patient of mid shaft clavicular 22 percent were due to fall on groundand 28 were due to RTA. severe complication occurs in 2.5 percent of patients and includes uperficial infection, implant failure, non-union.

Plate fixation have been described for surgical treatment. The advantage of plate fixation is good reduction with compression and rigid fixation.

No matter the level of evidence offered, the majority of issues appear to be implant-related,with discomfort or plate failure routinely occurring.

An alternate fixation technique is intra medullary fixation. From a bio mechanical perspective ,intra medullary implant 2 is ideal since it adapt stov ariations in arm rotation and loading direction on the tension side of the clavicle. Additionally, there is less periosteal stripping and a smaller incision.

Frequent complication encountere dissk inirritation from prominentme dial end of the nail and frequently leads to premature implant removal.

Duan et al. [12] Comparing plating vs intra medullary fixation in a meta - analysis of randomized controlled studies showed equal functional outcomes. (1) They did, however, exhibit more symptomatic plating-related hard ware issues. However, plating was found in our study to beless complicated than IM nailing.

In obese individuals achieving closed reduction was a difficult task especially in AO B2 fractures. We attempted various aids like use of percutaneous reduction clamps and drillingak-wire in to the fragment to manipulate. Where as in plating reduction can be achieved in obese. The advantage of plate fixation is good reduction with compression and rigid fixation.

Park et al. [13] reported higher satisfaction with IM nailing, early post operative pain and fracture migration were higher with IM nailing, especially in the multi - fragmentary fracture type, suggesting plate fixation was better option.

Meijden et al. [14] found that patients with plate fixation had less disability six months from surgery and more patients needed implant removal due to implant irritation in patients treated with IM nailing however in our study upto 3 month post-surgery plating proved to show better result than IM nailing but after 6 months results were not differentiable.

Post operative rehabilitation was similar for both operative techniques in the Plate or Pinstudy, stimulating early functional recovery, which allowed for easy and direct comparison. It might be advisable, however, to instruct patients after IMF, not to abduct the arm over 90 degrees for the first few weeks inorder toprevent secondary shortening and thus possible implant related soft tissue irritation.

Patients who had their displaced middle-third clavicle fractures surgically fixed had alower rate of non - union and symptomaticmal union. Given that functional ratings were identical in both groups, it is unclear whether this impact has any clinical importance.

Over all , both PF and IMF demonstrated good recovery rates. Recovery was faster in the PF group, with a 55% recovery rate at 6 weeks post procedure according to the DASH score.

For early functional rehabilitation fixation construct is more rigid and both objective and subjective recovery is faster.

Conclusion:-

We can there fore draw the conclusion from our study that,when used for surgical fixation of displaced mid-shaft clavicle fractures, pre-contoured plates offered better functional out come and were associated with problems in fewer cases than titanium elastic nails. Upto 6 months, plating had better follow-up results than nailing, but after that, there were no appreciable differences in the prognosis of either operation. Accordingly, we advise using pre-contoured locking plates for internal fixation of displaced mid shaft clavicle fractures.Low prevalence complications were not found due to the short sample size. For knowing the prevalence of the more uncommon complications including wound dehiscence, symptomatic malunion, and refracture, a larger sample size will be necessary . Long term follows up are required for further research.

References:-

1. Campbell's Operative Orthopaedics, 12thedition
2. Rock wood and Green's Fractures in Adults,8th edition
3. Craig EV. Fractures of the clavicle. In: Rockwood CA ,Matsen FA ,eds. The Shoulder. 3 rded.Philadelphia, PA:WB Saunders; 1998:428-482.
4. Neer CS., 2 nd Nonunion of theclavicle. J Am Med Assoc.1960;172:1006–11.
5. NeviaserJS.The treatment offractures of the clavicle .Surg Clin North Am.1963;43:1555-1563
6. RoweCR.4 An Atlasof Anatomy and Treatment of Mid clavicular Fractures. Clinical Orthopaedics and Related Research (1976-2007).1968May1;58:29-42.
7. HillJM, Mc Guire MH, Crosby LA. Closed treatment of displaced middle- third fractures of the clavicle gives poor results. The Journal of bone and joint surgery. British volume.1997 Jul;79(4):537-8.
8. McKee MD, Pedersen EM, JonesC, Stephen DJ, Kreder HJ, Schemitsch EH, Wild LM, Potter J. Deficits following non operative treatment of displaced mid shaft clavicular fractures.JBJS. 2006Jan1;88(1):35-40.
9. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD. Treatment of acute midshaftclavicle fractures: systematic review of 2144 fractures: on behalf of the Evidence-Based Orthopaedic Trauma Working Group. Journal of orthopaedic trauma.2005Aug1;19(7):504-7.
10. SmekalV, Irenberger A, StruveP ,Wambacher M, Krappinger D, Kralinger FS. Elastic stable intramedullary nailing versus non operative treatment of displaced mid shaft clavicular fractures- arandomized, controlled , clinicaltrial. Journal oforthopaedictrauma.2009 Feb 1;23(2):106-12.
11. Anton HC.Width of clavicul arc or texinoste oporosis .BrMedJ.1969Feb15;1(5641):409-11.
12. Duan X, Zhong G, Cen S, Huang F, Xiang Z. Plating versus intra medullary pin orconservative treatment for midshaft fracture of clavicle: a meta-analysis of randomized controlledtrials. Journal of Shoulder and ElbowSurgery. 2011 Sep 1;20(6):1008-15.
13. Jeong HS, ParkKJ ,KilKM, ChongS, EunHJ, LeeTS ,LeeJP .Minimally invasive plate osteosynthesisusing 3D printing for shaft fractures of clavicles. Archives of orthopaedic and trauma surgery. 2014 Nov;134(11):1551-5.
14. WijdicksFJ,Vander MeijdenOA, MillettPJ , VerleisdonkEJ , HouwertRM . Systematicre view of the complications of plate fixation of clavicle fractures. Archives of orthopaedic and trauma surgery. 2012May;132(5):617-25.