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Role of precontoured clavicle plate in clavicular fractures

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Abstract
Plate prominence was noted in 2 patients at the end of 6 months though their functional outcome was on par with excellence according to the scoring scale. There was one case of non-union among the operated group at the end of 1 year. There were no catastrophic complications such as brachial plexus injury, vascular injury or pneumothorax. Common reason for re-intervention is implant failure. Patients were more satisfied with shoulder in terms of functional outcome. Early primary plate fixation results in improved patient outcome, return of function and decreased chances of nonunion and malunion.

Keywords: Clavicle Fracture, Clavicle Plate, Functional outcome

Introduction
Clavicular fracture was observed as early as 400 B.C by Hippocrates.
It is difficult to reduce fracture fragments and maintain its alignment by closed reduction.
Those who think that projecting medial fragment can be depressed and fracture reduction possible, its not correct because lateral fragment has to be brought up which is difficult by closed reduction.
Weight of the arm and pull of pectoralis major produces inferior pull of lateral fragment while sternocleidomastoid muscle pulls the medial fragment superiorly.
King William III of England had clavicle fracture sustained while riding a horse. He died after 3 days due to diffuse false aneurysm that was complicated by clavicle fracture.
Lucas Championnierre was the first to advocate FIGURE OF EIGHT BANDING in 1860 A.D.
Sagre, 1871 A.D advocated ambulatory treatment with rigid dressing to maintain reduction and support the extremity.
Neer type 2 fracture is an unstable fracture causing drooping of shoulder and also causing increased incidence of delayed and non-union. It is agreed by many that it is an indication for primary fixation. MULLER 1977, Nevesier 1984, Nevesier and Eskola *et al* 1987.
In INJURY 1992, Edwards *et al* published their stating that Neer type 2 fractures when treated conservatively gives more percentage of non-union, delayed union and local complications. If treated operatively, it has good functional results.
In INJURY 1992, PIOGENFURST *et al* published their results concluding that plating for acute mid-third fractures is a reliable procedure. They also advised to retain the plate for a minimum of six months. They also advocated not to remove interfragmentary screws while removing the plate.
In JBJS July 1993, (A) Leung *et al* stated that clavicular fractures associated with ipsilateral scapular neck fractures should be treated operatively because shoulder suspensory mechanism is affected and also normal lever arm, the rotator cuff is also lost. Their study noted that operative treatment is safe with good functional recovery.
In JBJS July 1997 (B), Hill *et al* published their study of conservatively treated displaced mid-third fractures and recommended surgical treatment for displaced mid-third fractures.
In Journal of Trauma 1999, Davids *et al* concluded that operative treatment of delayed and non-union with plating, bone grafting and early mobilization yields good results.
In Journal of Trauma 2000, Bostman *et al* concluded that the patient's non-compliance with post-operative regimen could be a major cause of treatment failure.

In Injury 2001, Jupiter *et al* stated in their study that plate and screw fixation is better than other modes of fixation as they excellent control over their rotations, restore normal length of the clavicle as it is fixed to the apex of the deformity. But he also stated that disadvantages of plate fixation like osteoporosis below the plate acting as stress raisers and wide periosteal stripping.

Methodology

- Prospective study June 2009- June 2011
- History of the patients was noted.

Details of history

- Name, Age, Sex
- Mode of injury
- Side
- Associated injuries

Clinical details

- Inspection: Side, swelling, features, external wounds.
- Palpation: Warmth, tenderness, swelling- features.
- Movements: Affected side shoulder movements are tested and range of movements noted.

Imaging

- X-ray of the affected clavicle, antero-posterior view in thoracic plane is taken.
- Fracture classified.

Inclusion criteria

- Middle one third clavicular fracture
- Bilateral clavicular fractures.
- Floating shoulder involving middle one third clavicular fractures
- Age more than 22 yrs

Exclusion criteria

- Open fractures involved in middle one third of clavicle
- Age more than 60 yrs.
- Lateral 1/3 fractures.
- Medial 1/3 fractures.

Treatment

Open Reduction and Internal Fixation with Pre-contoured clavicular plates.

Complication

- Pain
- Non union
- Delayed union
- Shoulder restriction
- Implant failure
- Infection

Follow up

- X-ray taken immediate post-op.
- Follow up at 6 weeks, 3 months, 6 months & 1 year.
- Clinical status recorded using Constant & Murley scoring system.

Results

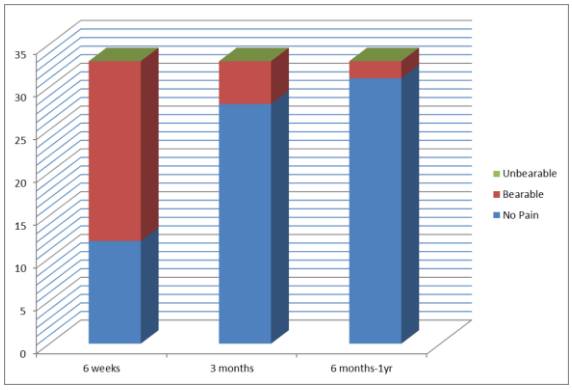


Fig 1: Comparison of Pain

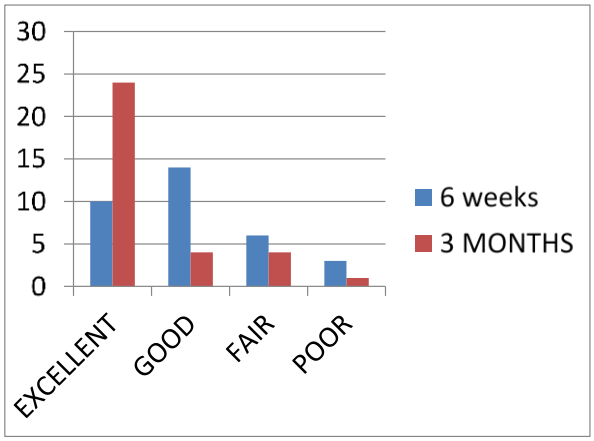


Fig 2: Results after 6 weeks & 3 months

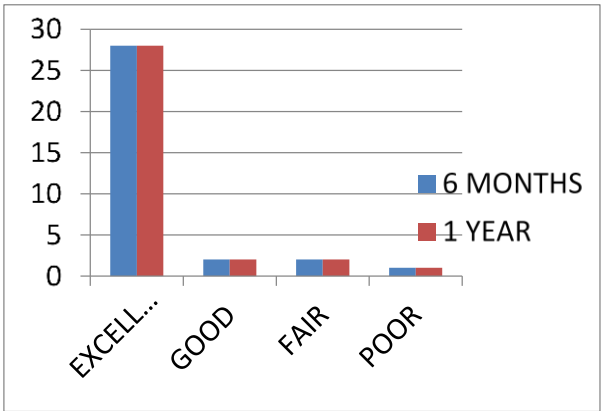


Fig 3: Results after 6 months & 1 year

Table 1: Grading after 1 year

	PATIENTS
POOR	1
FAIR	2
GOOD	2
EXCELLENT	28

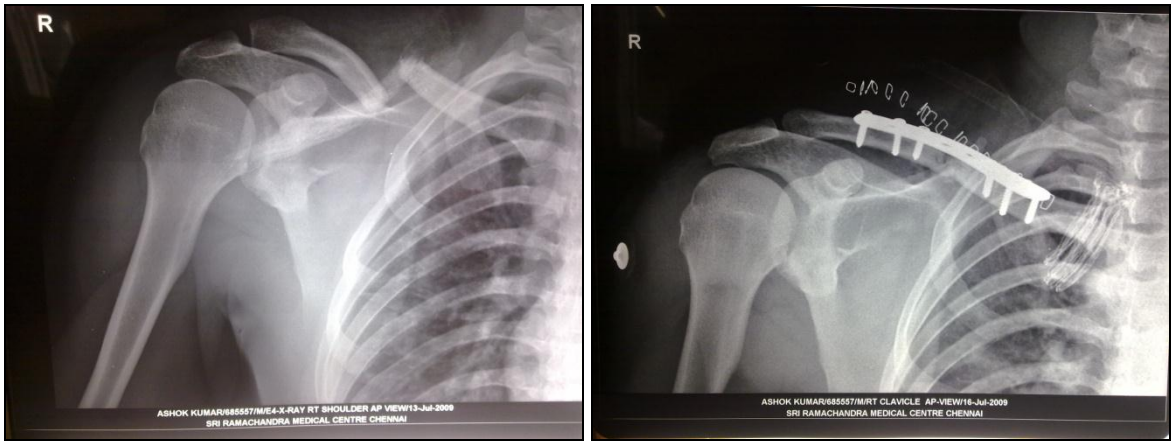
Table 2: Comparison of Grading

TYPE 2B1	PATIENTS
POOR	0
FAIR	2
GOOD	2
EXCELLENT	24

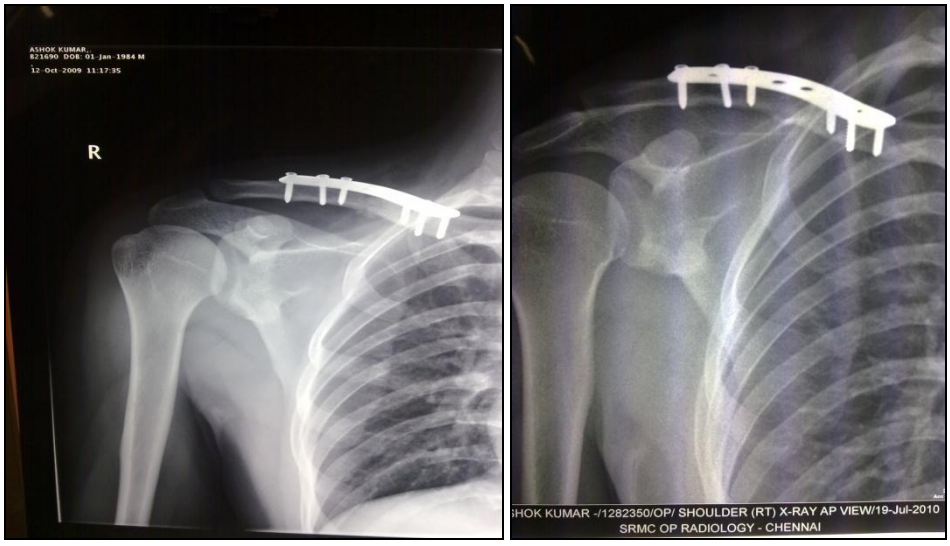
TYPE 2B2	PATIENTS
EXCELLENT	4
GOOD	0
FAIR	0
POOR	1

Table 3: Complications

	PATIENTS
Non union	1
Mal union	0
Shoulder restriction	1
Implant failure	2
Infection	0



Pre OP **Post OP**



Follow UP

Discussion

Plate prominence was noted in 2 patients at the end of 6 months though their functional outcome was on par with excellence according to the scoring scale.

There was one case of non-union among the operated group at the end of 1 year.

There were no catastrophic complications such as brachial plexus injury, vascular injury or pneumothorax.

Common reason for re-intervention is implant failure.

Patients were more satisfied with shoulder in terms of functional outcome.

33.33% had full range of movements according to the scoring system at the end of 6 weeks.

81.81% had full range of movements by the end of 3 months.

27.27% were able to do their normal activities like driving a 2-wheeler, typing etc, by the end of 6 weeks.

90.9% were able to do their daily routine by the end of 3 months.

45.45% and 54.54% of the patients were able to perform sport activities and strenuous work by the end of 3 and 6 months respectively.

90.90% of the patients had no pain due to fracture and post-operatively by the end of 3 months.

Complete union of the fractures was noted in 81.81% by the end of 3 months.

Our data supports primary plate fixation of displaced mid-shaft clavicular fractures with locked pre-contoured clavicular plate.

Conclusion

- Pre-contoured locked clavicular plate is adequately shaped for midshaft clavicular fractures.
- Pre-contoured locked clavicular plate significantly reduces intraoperative time and hardware prominence.

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