



# **Operative Treatment of midshaft clavicular fracture**

M.N. Naderi, MD

- Recent observations emphasize that nonunion of the clavicle is more common than previously recognized, and that malunion with shortening can be associated with shoulder dysfunction



*primary operative treatment is becoming more commonplace*



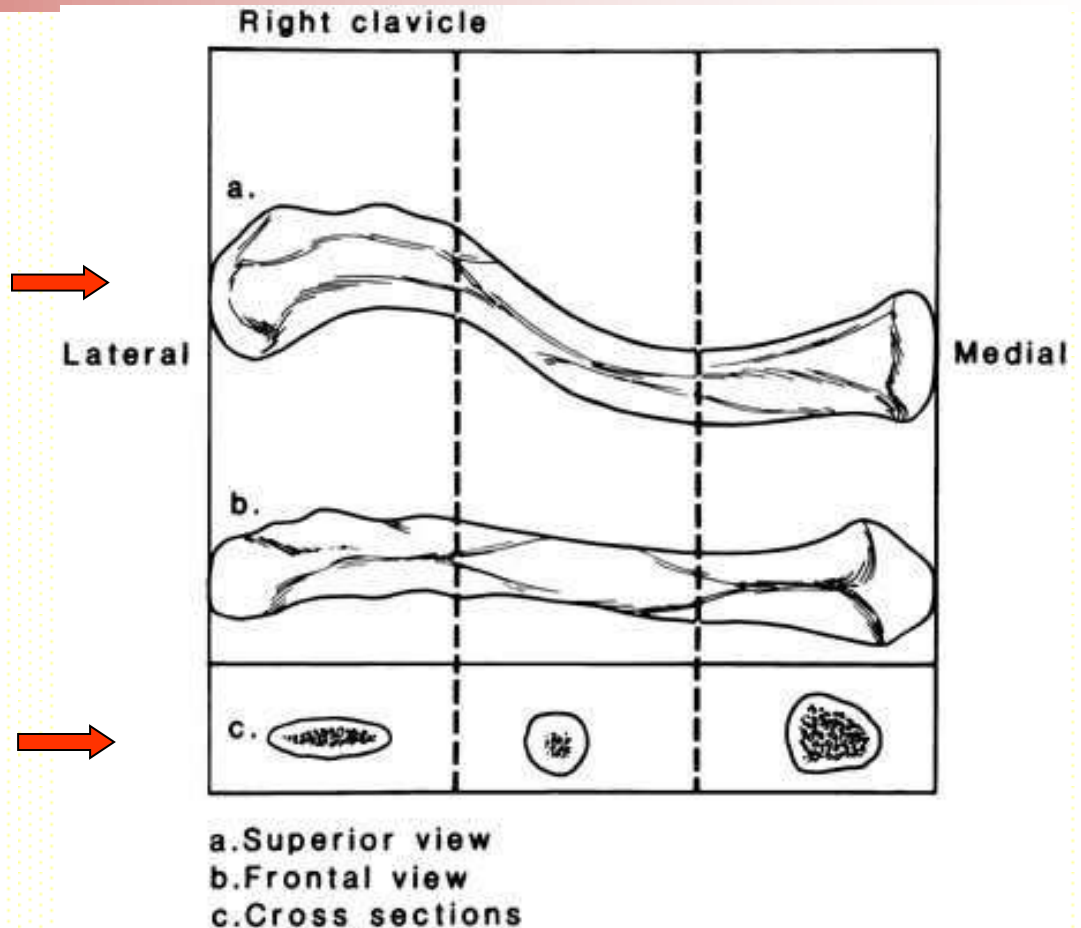
indications and techniques of operative treatment are evolving

White et al. Orthop Trans 1989;13:514–515.

Hill et al. JBJS(Br) 1997;79:537.

Wick et al. Arch Orthop Trauma Surg 2001;121(4):207-211

# Anatomy

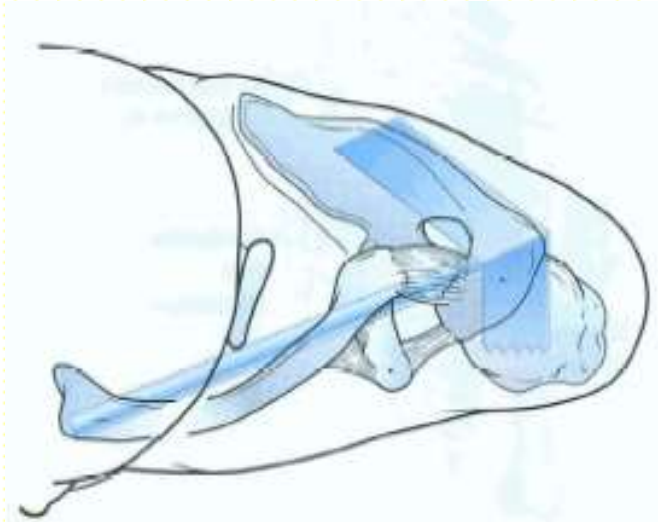


- S-shaped bone
- base for muscular attachments
- Strongly held with ligaments at both ends
- protects vital neurovascular structures
- cross-sectional anatomy changes along its course

# Normal Clavicular Functions

## ■ **Strut Function**

- bracing the shoulder girdle optimal muscle-tendon unit length cosmesis and posture to the shoulder



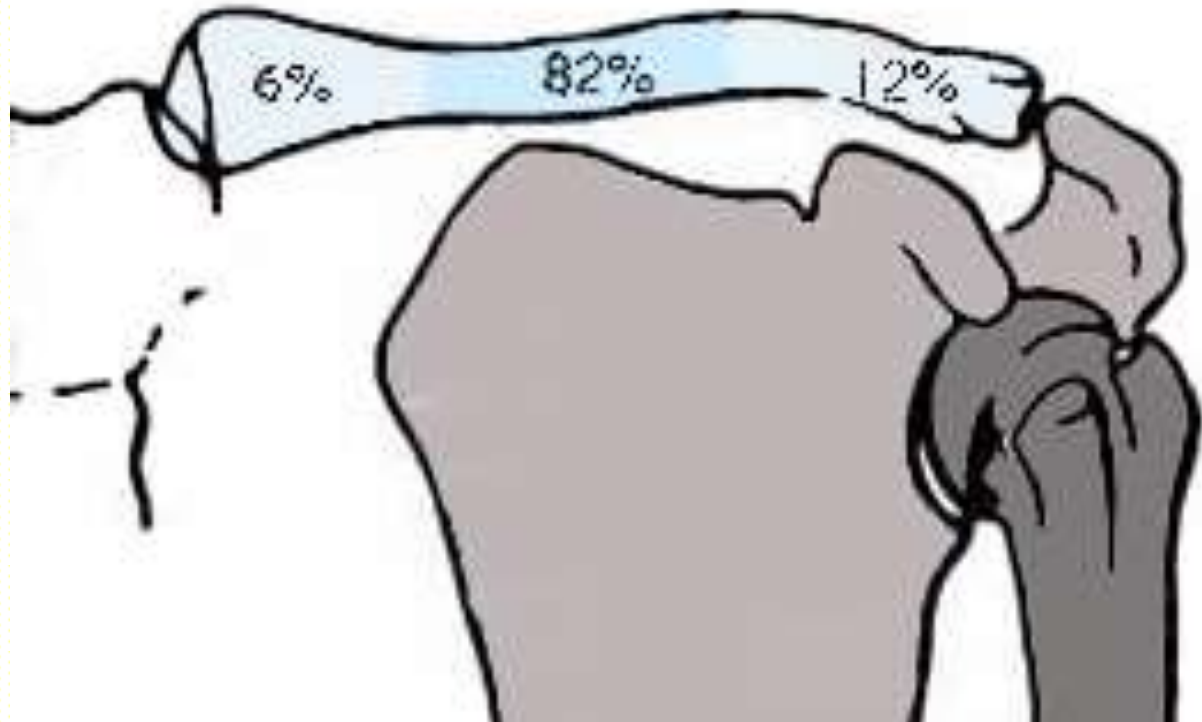
## ■ **Suspensory Function**

- stabilization against inferior displacement as static mechanisms (trapezius acts as a dynamic scapular elevator)



# Incidence

- 4% of all fractures and 35% to 43% of shoulder girdle injuries



# classification of clavicular fractures

**Allman**

**Group 1: middle third fractures**

**Robinson**

**Group 2: lateral third fractures**

**Group 3: medial third fractures**

**Neer**

**Craig**

# classification of clavicular fractures

Allman

Robinson

Neer

Craig

Type 1—medial

A—nondisplaced

A1—extraarticular

A2—intraarticular

B—displaced

B1—extraarticular

B2—intraarticular

Type 2—middle

A—cortical alignment

A1—nondisplaced

A2—angulated

B—displaced

B1—simple or single butterfly fragment

B2—comminuted or segmental

Type 3—distal

A—nondisplaced

A1—extraarticular

A2—intraarticular

B—displaced

B1—extraarticular

B2—intraarticular

# classification of clavicular fractures

Allman

Robinson

Neer

Craig

## Distal clavicle fractures

**Type 1:** coracoclavicular ligaments intact

**Type 2:** coracoclavicular ligaments detached from the medial segment but trapezoid intact to distal segment

**Type 3:** intra-articular extension into the acromioclavicular joint



# classification of clavicular fractures

Allman

Robinson

Neer

Craig

TABLE 32-1

## Craig Classification of Clavicular Fractures

Group I—fracture of the middle third

Group II—fracture of the distal third

Type I—minimal displacement (interligamentous)

Type II—displaced secondary to fracture line medial to the coracoclavicular ligaments

(A) conoid and trapezoid attached

(B) conoid torn, trapezoid attached

Type III—fractures of the articular surface

Type IV—periosteal sleeve fracture (children)

Type V—comminuted with ligaments attached neither proximally nor distally, but to an inferior comminuted fragment

Group III—fractures of the proximal third

Type I—minimal displacement

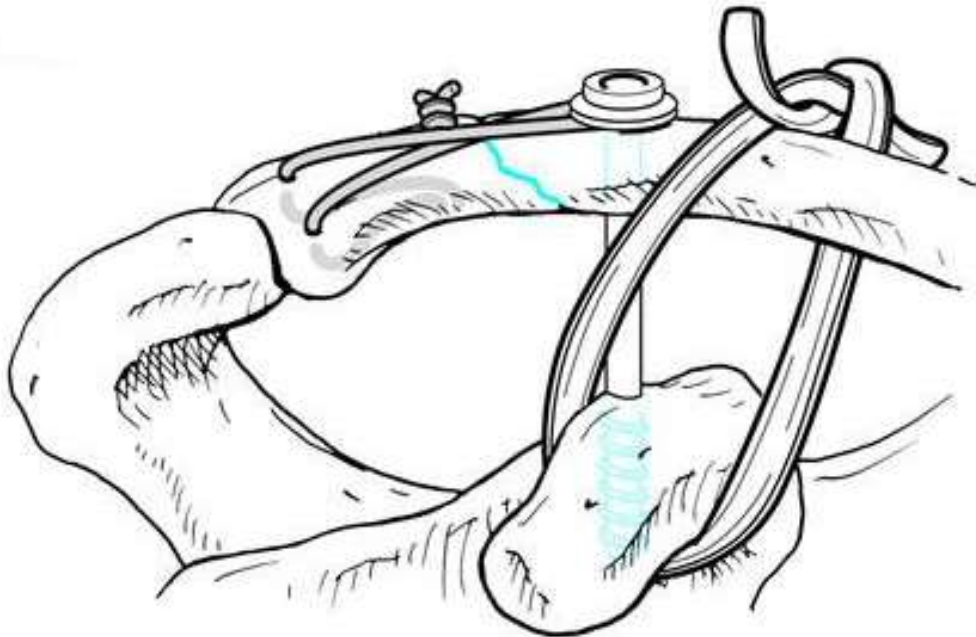
Type II—displaced (ligaments ruptured)

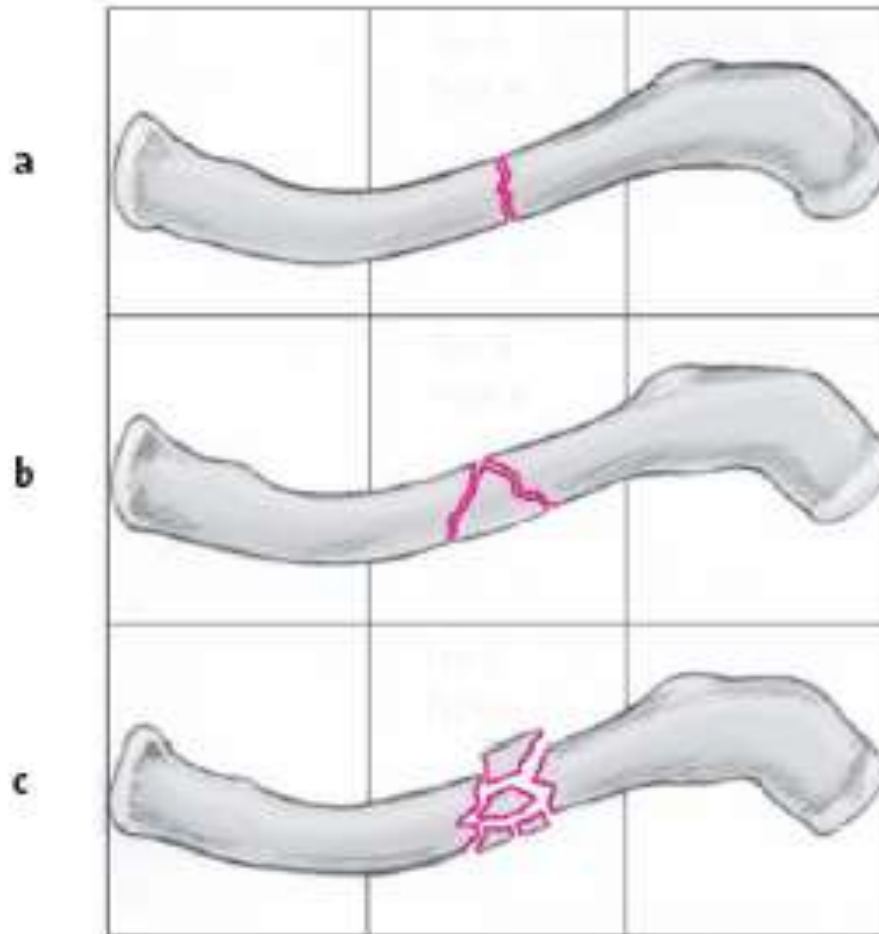
Type III—intraarticular

Type IV—epiphyseal separation (children and young adults)

Type V—comminuted

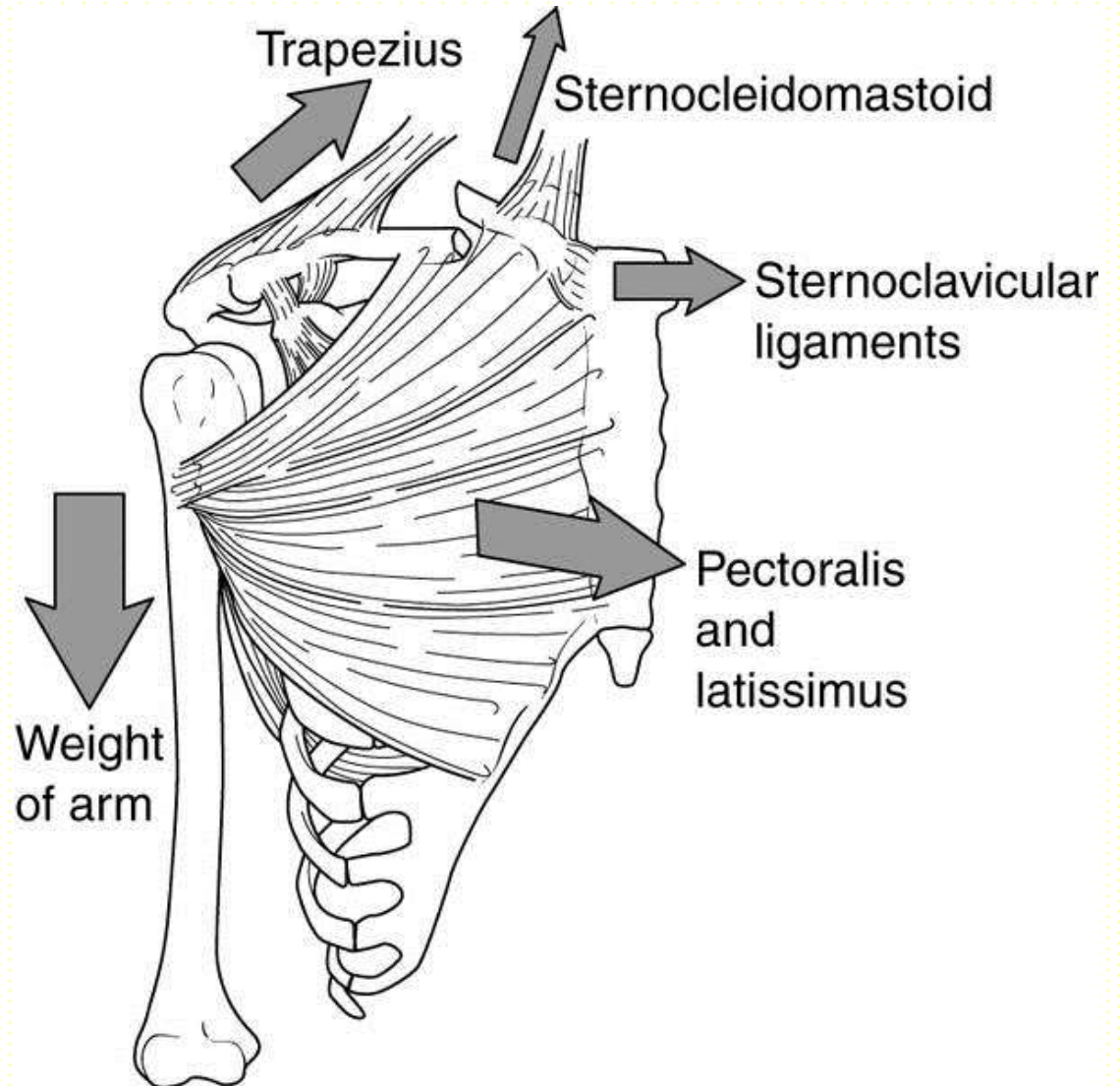
- Lateral one-third more prone to nonunion if it is displaced and treated closed (50%)
- Most authors recommend operative treatment for displaced distal clavicle fx





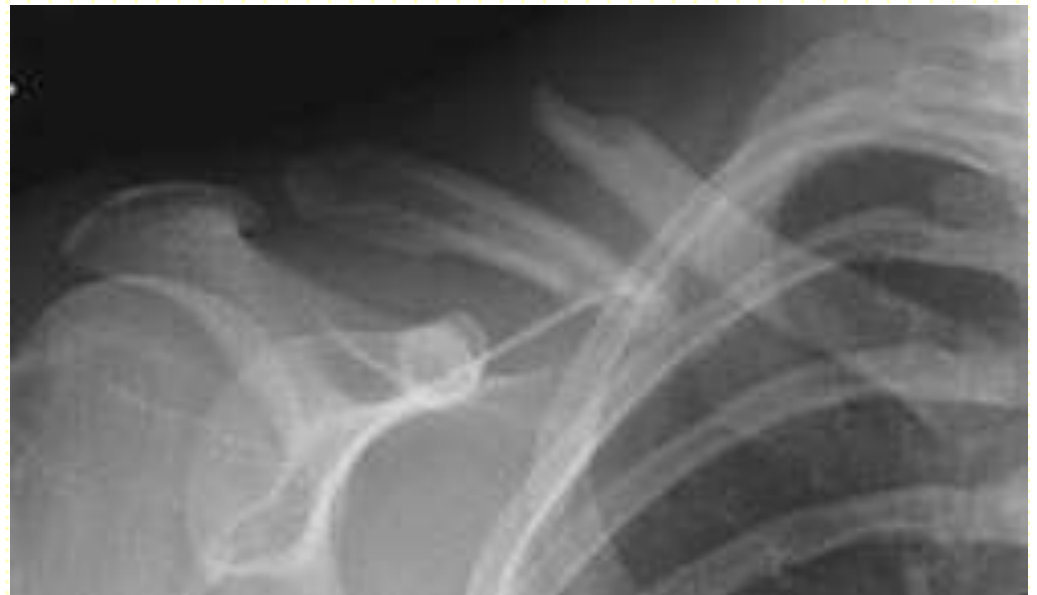
**OTA classification of midshaft clavicle fractures**

# Deforming forces

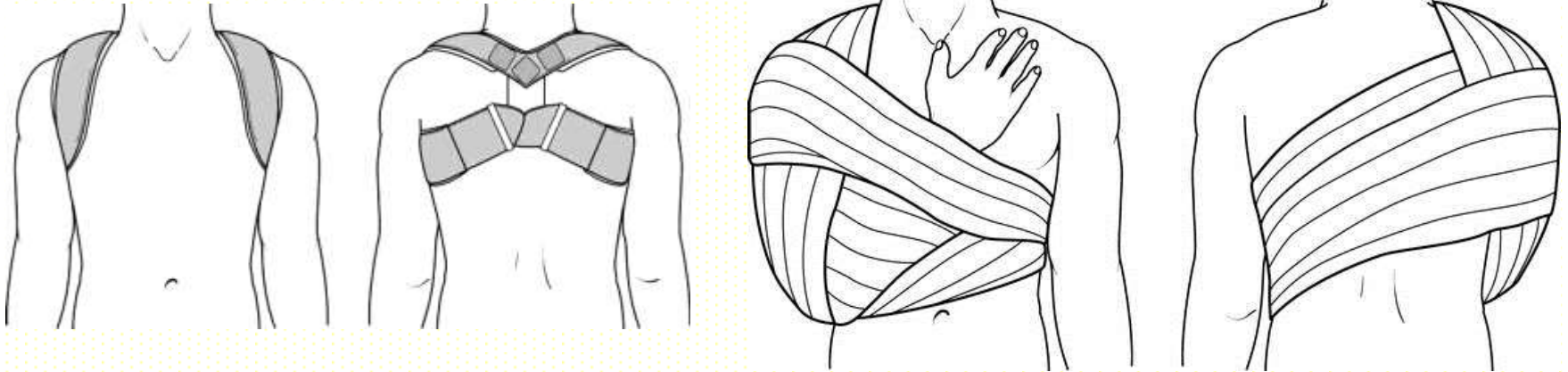


# Evaluation

- Physical exam
- X-Ray → frontal view - 45 cephalad tilt - Chest X-Ray
- CT Scan 3D



# Nonoperative Treatment



## Disadvantages

- difficulty to keeping the brace adjusted properly
- potential skin problems
- Impairment of patients' agility, personal hygiene needs, and comfort while sleeping

# Disadvantages



**Most midshaft clavicle fractures will go on to heal with any method of immobilization**



**Which clavicular fractures require surgical intervention?**





# Factors associated with development of nonunion

Fracture shortening of  $\geq 20$  mm

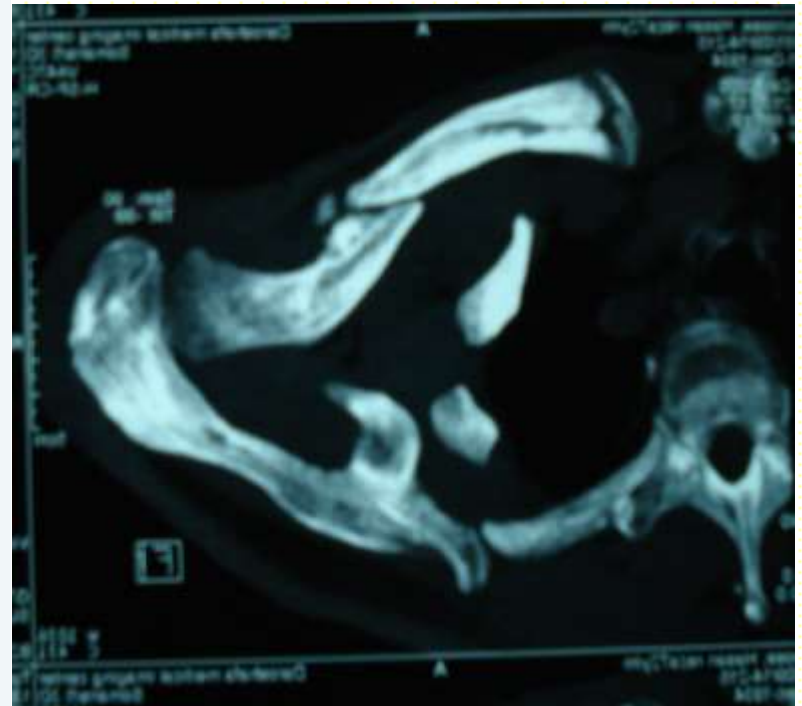
Fracture displacement of  $>20$  mm

Increasing patient age

Increasing severity of trauma

Refracture

Primary open reduction?



## Indications for Open Reduction and Internal Fixation of Displaced Midshaft Fractures

### Absolute

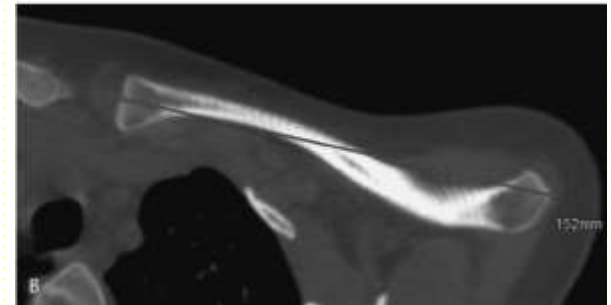
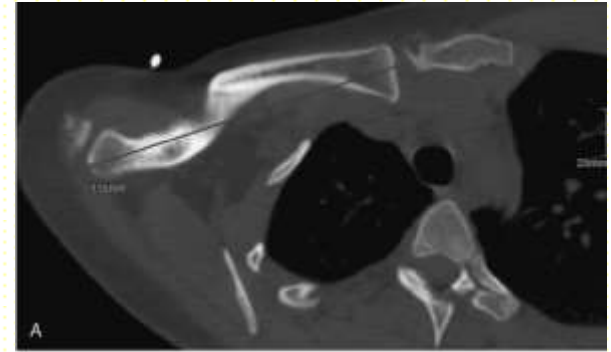
- Shortening of  $\geq 20$  mm
- Open injury
- Impending skin disruption and irreducible fracture
- Vascular compromise
- Progressive neurologic loss
- Displaced pathologic fracture with associated trapezial paralysis
- Scapulothoracic dissociation

### Relative

- Displacement of  $> 20$  mm
- Neurologic disorder
  - Parkinson's
  - Seizures
  - Head injury
- Multitrauma
- Expected prolonged recumbency
- Floating shoulder
- Intolerance to immobilization
- Bilateral fractures
- Ipsilateral upper extremity fracture
- Cosmesis

Smekal et al: Length Determination in Midshaft Clavicle Fractures: Validation of Measurement. J Orthop Trauma Vol 22, Aug 2008

- **Determining proportional length differences by taking a posteroanterior thorax radiograph**





# Methods of operative fixation

- **Plate fixation**
- **Intramedullary devices**

# ORIF with plate

Fixation with three screws (six cortices) on each side

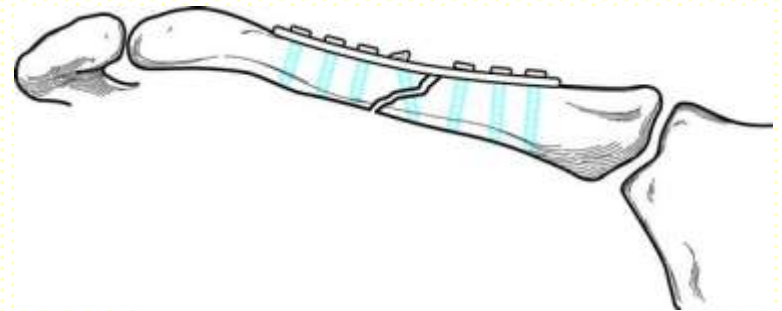
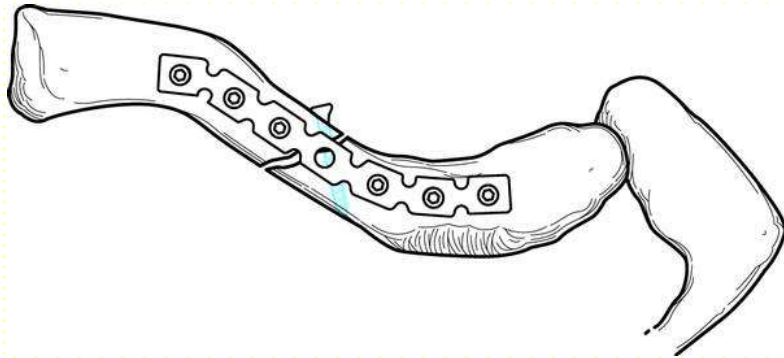


Fig. 2-B

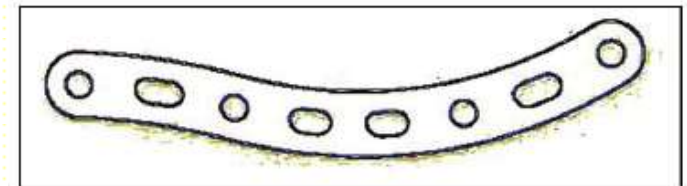
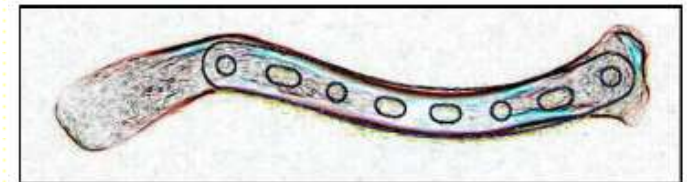
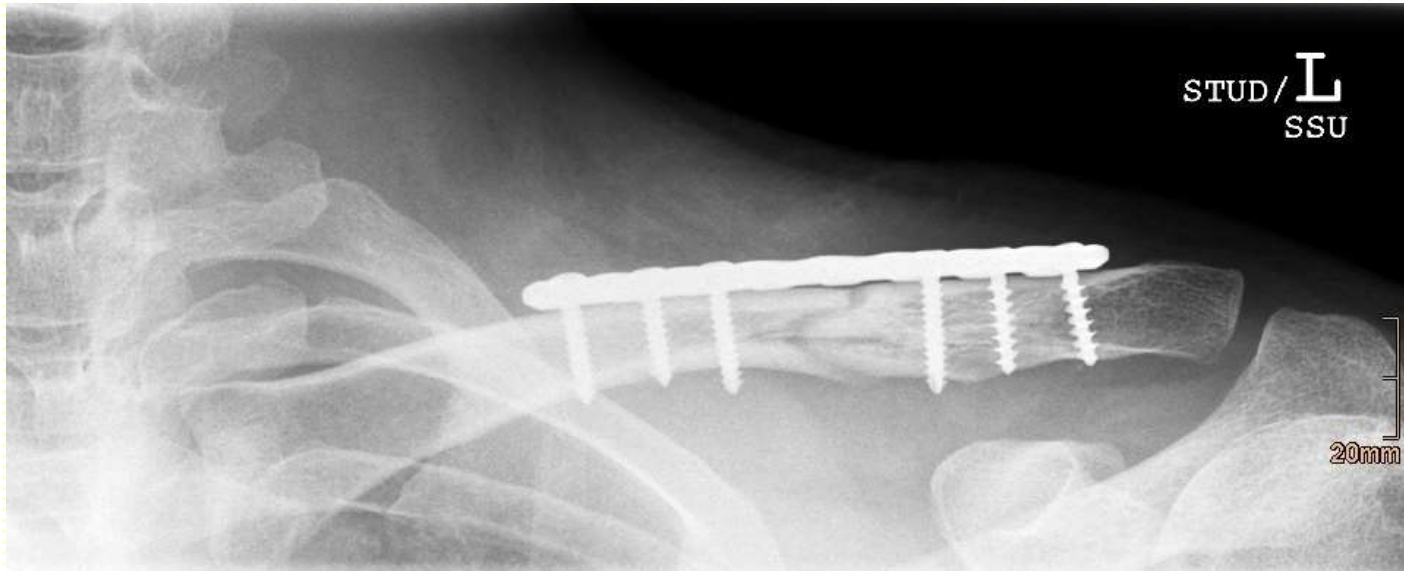


Fig. 2-C



Huang et al: Clavicular Anatomy and the Applicability of Precontoured Plates. J Bone Joint Surg Am. 2007;89:2260-5







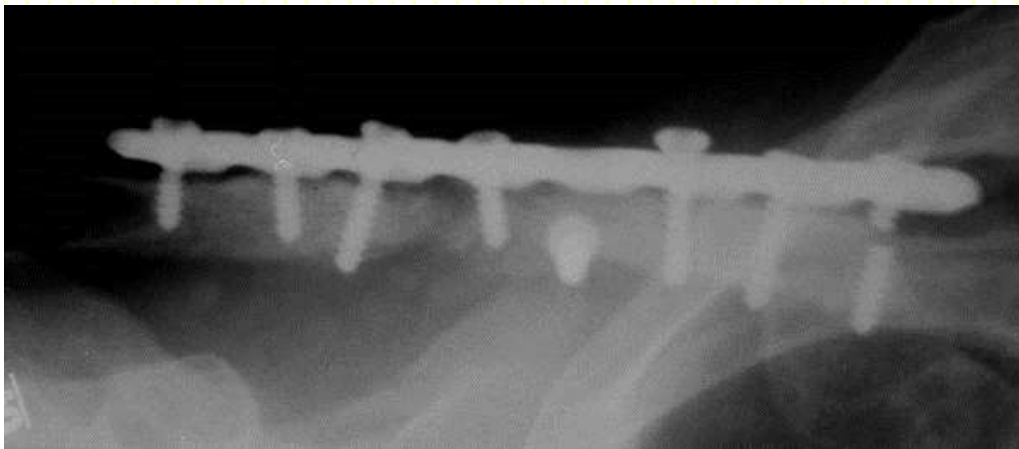




**Advocates for open reduction and plate fixation argue that rigid fixation, cortical compression, and rotational control are worth the cost of increased soft-tissue stripping**

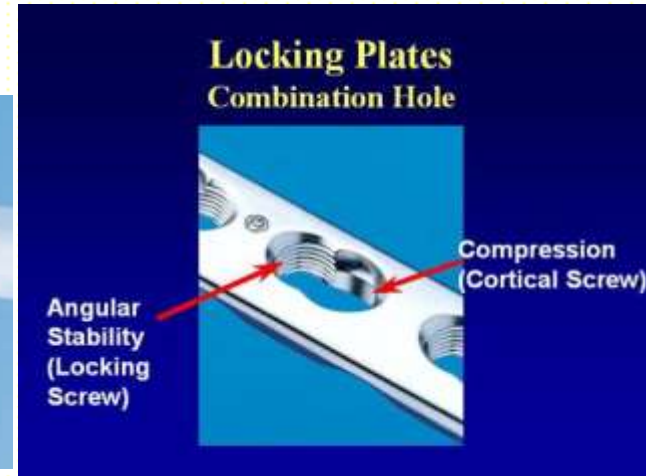
# Disadvantages

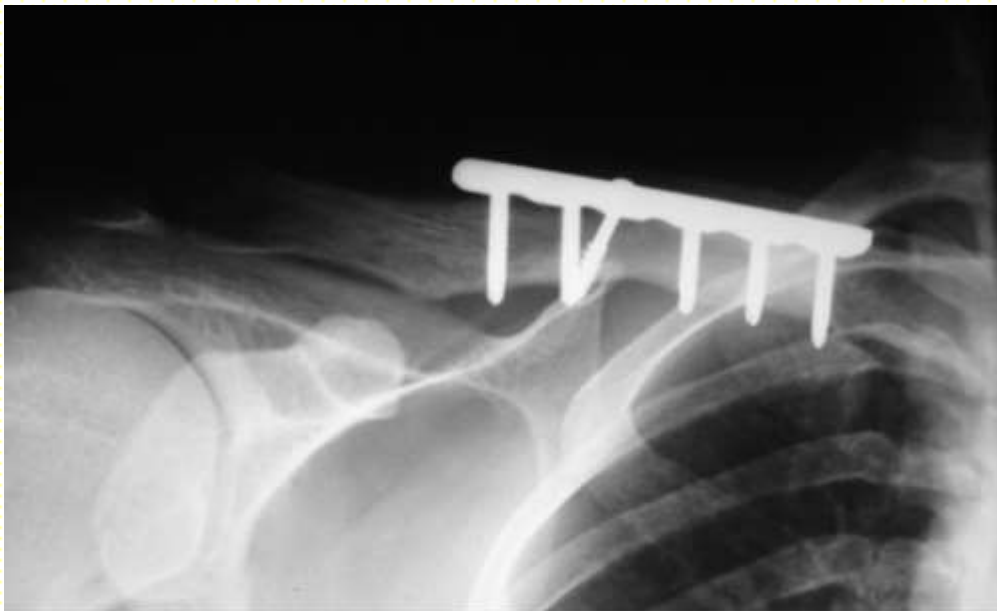
- Skin scar
- Plate failure



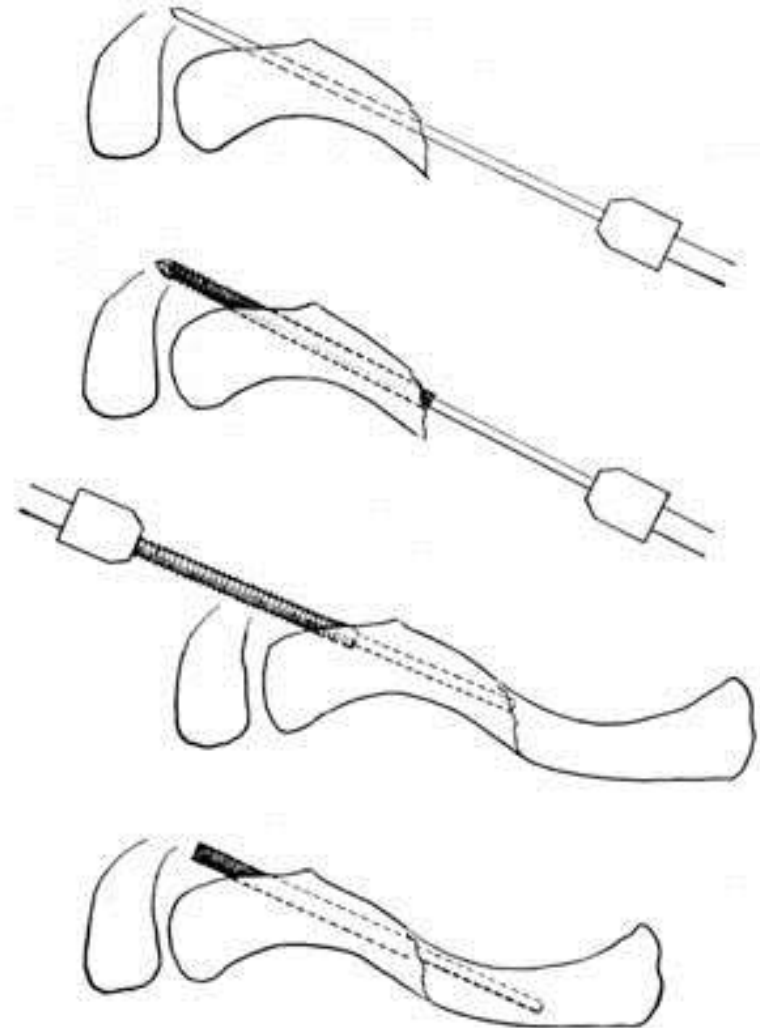


# Advances in plate technology and development of locking plate technology provided advantages for clavicular fixation





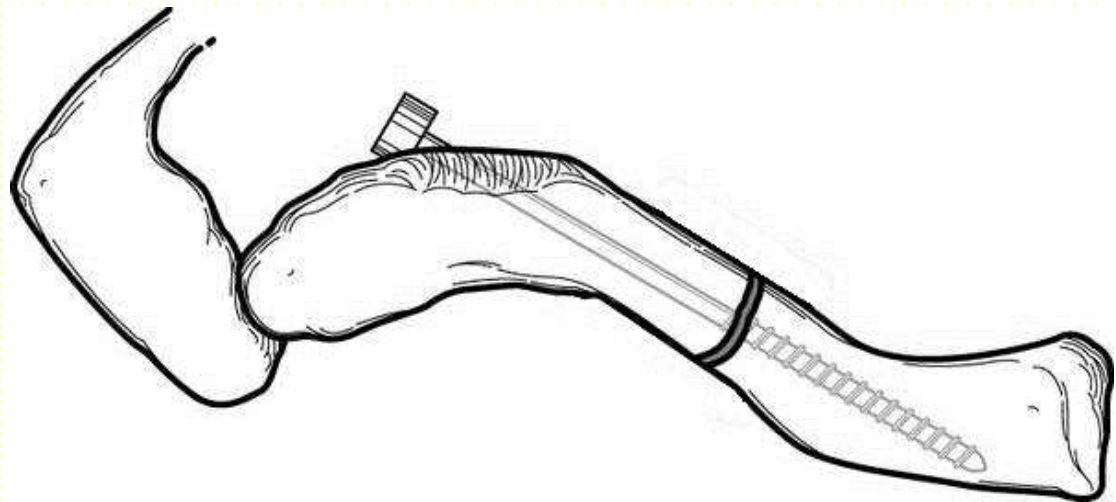
## Intramedullary Nail



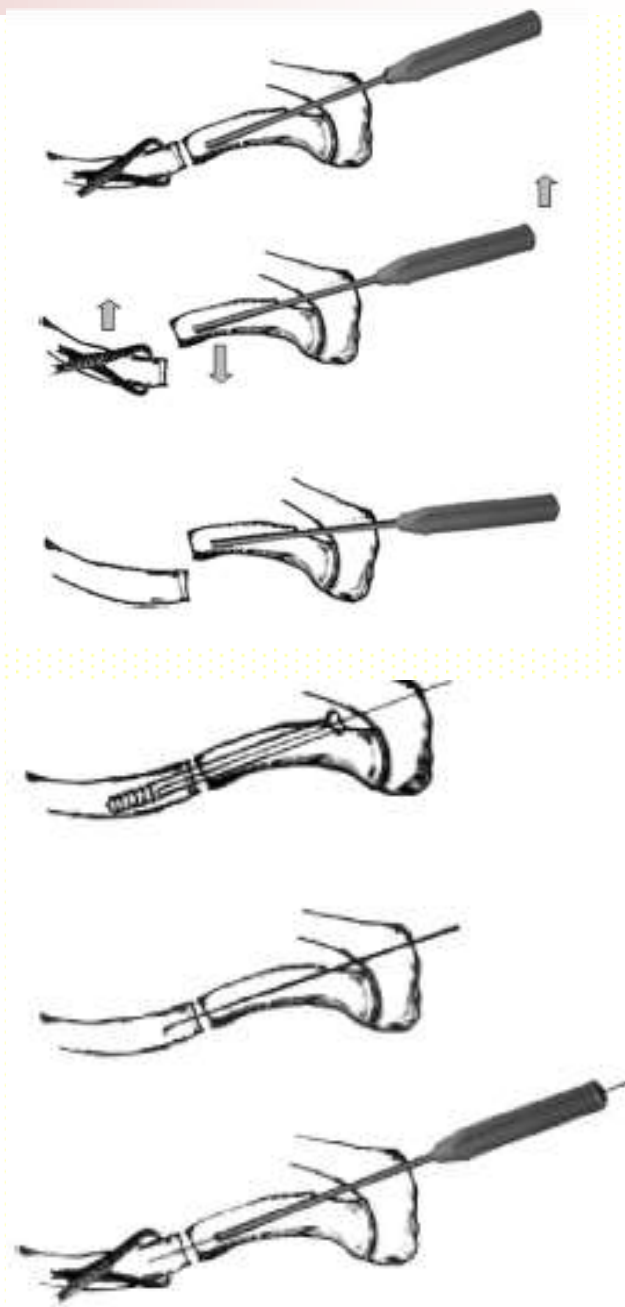
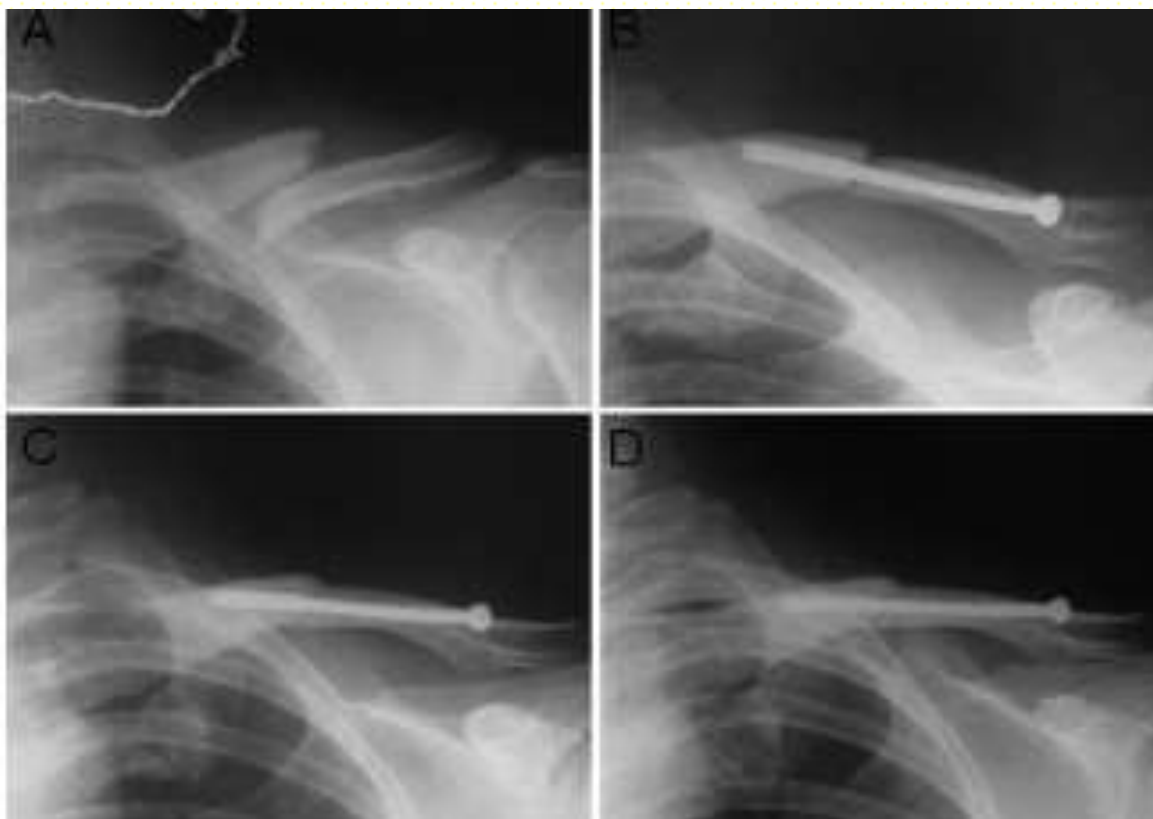
- ❑ **Less** surgical dissection & soft tissue stripping
- ❑ **less** prominent hardware

# Disadvantages

- No rotational stability
- Nail breakage
- Nail migration



**Chuang et al : Closed Reduction and Internal Fixation  
for Acute Midshaft Clavicular Fractures Using  
Cannulated Screws. *J Trauma*. 2006;60:1315–1321.**



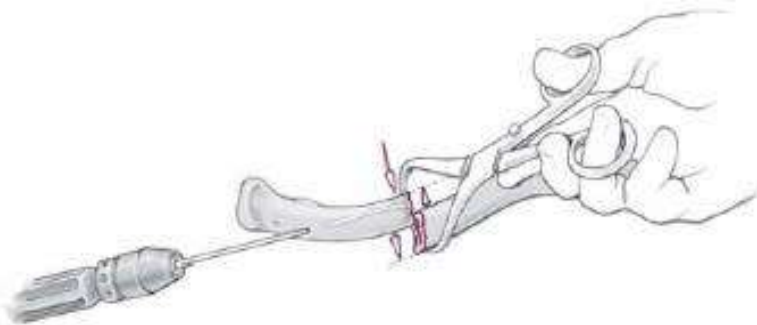


## IMN with TEN



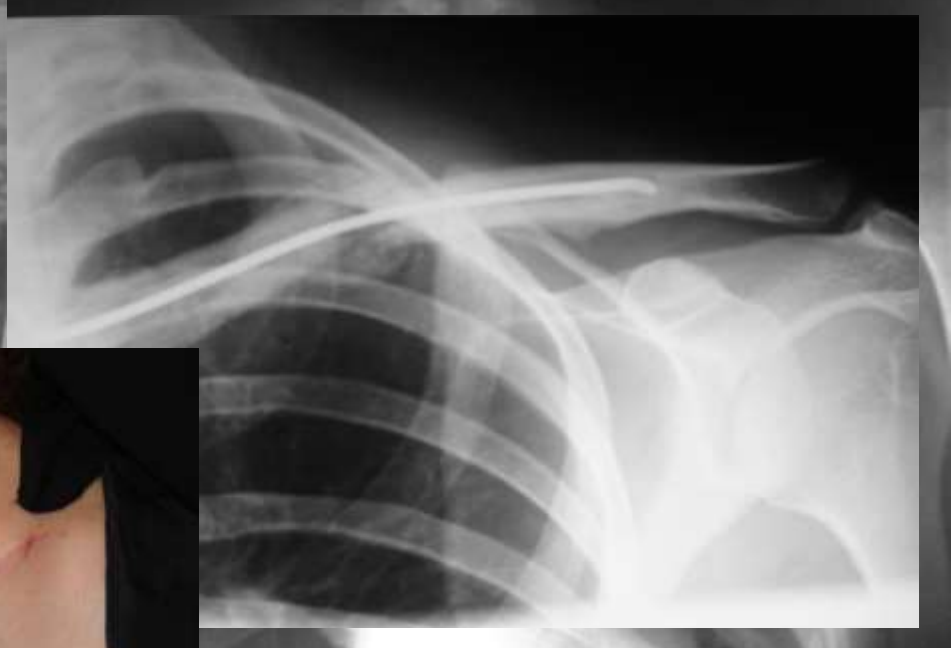
**the nail diameter should be two thirds of the narrowest diameter of the medullary canal**

# Technique



Klaus E. Rehm, Jonas Andermahr, Axel Jubel. Intramedullary Nailing of Midclavicular Fractures with an Elastic Titanium Nail. Operat Orthop Traumatol 2004 · Nr. 4













**Not suitable for comminuted fx and old fx**





# Summary

- Most clavicular fx can be treated conservatively
- Conservative treatment → not good result in all
- Completely displaced fx → nonunion ↑
- Think about fixing more clavicle fx

**Thank you for attention**