The Clavicle Question: To Plate or Not to Plate

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Clavicle Fractures to Plate or Not to Plate—Objectives

- What fractures benefit from fixation
- Non operative outcomes
- Operative outcomes
Clavicle Fractures (FxS)

- Very common (2-4% of all adult fxs)
- Most frequent in young active individuals
- Midshaft fxs account for about 80% of all clavicle fxs
- Midshaft fractures traditionally treated non operatively

  - Canadian OTA, JBJS 2007
Clavicle Fractures

What we really know...

- Skeletally immature patients universally heal, remodel, & do well
- Non/Minimally displaced clavicle fractures generally heal & do well
Early reports of displaced midshaft clavicle fxs

- Nonunion rare (<1%)
- Malunion “radiographic interest only with no clinical importance”

- McKee, R et al J BJ S 2012
Recent prospective studies of adults with displaced midshaft clavicle fxs

- Nonunion not so rare (15-20%)
- Malunion was symptomatic
  - Shoulder muscle strength loss (18-33%) with poor early functioning of the shoulder
  - Residual sequelae in up to 42% six months after the injury

McKee, R et al J BJ S 2012
Displaced Midshaft Clavicle Fractures...Controversial
Displaced Midshaft Clavicle Fxs-Treatment Options

- **Closed-Non Operative**
  - Sling
  - Early ROM

- **Operative**
  - Open reduction internal fixation (ORIF)
    - Plate and Screw
    - Intramedullary fixation (percutaneous or ORIF)
Displaced Midshaft Clavicle Fxs-Closed Treatment
Displaced Midshaft Clavicle Fxs-Operative Treatment
Displaced Midshaft Clavicle Fractures

- Why not fix them all…?
- Bad “stuff” in proximity
  - Lung, brachial plexus, subclavian vessels
  - Mediastinal contents (potential catastrophic outcome with hardware migration)
- Potential problems with fixation
  - Subcutaneous bone with thin soft tissue envelope
    - Symptomatic hardware
    - Numbness/neuroma supraclavicular nerves
    - Difficult “bail out” if infection, wound problems, malunion, or nonunion
Displaced Midshaft Clavicle Fractures

- Generally accepted fixation indications
  - Open fracture or impending open fracture
  - Ipsilateral floating shoulder/shoulder girdle injury
  - Scapulo-thoracic dissociation
  - Fx with progressive neurovascular compromise
  - Multi trauma with need to use/bear weight through the extremity
Displaced Midshaft Clavicle Fractures-Fix this one!
Displaced Midshaft Clavicle Fxs-
What Does the Literature Say

- Old literature-no role for operative treatment, they all do well
- New literature-some role for operative treatment
  - Nonunions can be symptomatic
  - Malunions can cause pain & muscle weakness
    - McKee, M et al J BJS 2004
Nonoperative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures (DMCFx)

- Multicenter, randomized, Level 1 evidence by the Canadian Orthopedic Trauma Association (JBJS 2007)
- Acute closed completely displaced mid 1/3 clavicle fxs in patients between 16-60yo
- 132 adult patients with DMCFx
  - 67 operative with plate ORIF (superior clavicle)
  - 65 non operative with sling
Nonoperative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures (DMCFx)

- **Time to radiographic union***
  - Operative 16.4 weeks
  - Non operative 28.4 weeks

- **Nonunion***
  - Operative-2
  - Nonoperative-7

- **DASH & Constant Shoulder Scores*** significantly improved at all time periods in the 1 year f/u
  - * statistically significant
Nonoperative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures (DMCFx)

- Symptomatic malunion*
  - Operative-ZERO
  - Non operative-9

- Operative complications
  - Mostly hardware related
  - Symptomatic/prominent hardware-5
  - Wound infection-3
  - Mechanical failure-1
Nonoperative Treatment Compared with Plate Fixation of DMCFx

Conclusions at 1 year follow up

- **Satisfaction** in general with the shoulder & its appearance was **greater** in the **operative group vs non operative group**

- ORIF of DMSCFx results in **improved functional outcome & a lower rate of malunion/ nonunion** compared with non operative treatment.
Why Not Fix Them All...

18yo high school football player referred in with infected nonunion...did he need fixation?
Why Not Fix Them All...

37yo fitness/weightlifting fanatic
Early results were good...
If at first you don’t succeed...
...try, try again
Finally, success (I think) …after 4 operations over 2 years
If bad things can happen with ORIF, which fractures should we fix?

- **Prevent nonunion**
- **Risk factors for nonunion**
  - Female
  - Advanced age
  - Comminution
  - Displacement greater than 100%

Robinson et al J BJ S 2004
If bad things can happen with ORIF, which fractures should we fix to prevent symptomatic malunion?

- Risk factors for symptomatic malunion
  - Shortening
    - 18mm in males
    - 14mm in females
    - Lazarides, S J Shoulder Elbow Surg 2006
  - Comminution, increasing age, initial displacement (not shortening)
    - Nowak, J et al J Shoulder Elbow Surg 2004
To plate or not to plate...?

44yo female
Referred to me 8 weeks post fracture
not happy with her results
Perhaps it should have been fixed...
Treat a patient, not an X-ray
Osteotomy & Repair
Healed but Hardware was Symptomatic
Final Result after Hardware Removal
Would you fix this fracture...?
19yo semi-pro football player
I recommended yes, he said no. He was right...painless full ROM 6 weeks post fx
Would you fix this fracture...?
54yo diabetic smoking male
How about if you were losing your insurance in 6 weeks...?
6 week results are good.
DMCFxs-What Does the most recent Literature Say

- Operative Versus Nonoperative Care of Displaced Midshaft Clavicular Fractures: A Meta Analysis of Randomized Clinical Trials
- Systemic review of the literature found six level 1 randomized clinical trials
- ORIF/IM fixation vs non operative
  - McKee, R et al J BsJ 2012
Operative Versus Nonoperative Care of DMCFxs: A Meta Analysis of Randomized Clinical Trials

- Nonunion & symptomatic malunion rate was higher in non operative vs operative
- Earlier functional return in operative vs non operative
- Marginally superior long term functional outcome scores in operative vs non operative
Operative Versus Nonoperative Care of DMCFxs: A Meta Analysis of Randomized Clinical Trials

- Completely displaced midshaft clavicle fxs have a higher rate of nonunion & symptomatic malunion if treated nonoperatively
- No clear evidence that operative treatment will improve their long term function in general
Operative Versus Nonoperative Care of DMCFxs: A Meta Analysis of Randomized Clinical Trials

- A subset of pts with completely displaced midshaft clavicle fx will benefit from fixation (which ones...?)
- About 75% of non operatively treated completely displaced clavicle fx will heal with few if any long term complications
Operative Versus Nonoperative Care of DMCFxs: A Meta Analysis of Randomized Clinical Trials

CONCLUSION

“There is little evidence at present to show that long-term functional outcome of operative intervention is significantly superior to nonoperative care”
To plate or not to plate...?
36yo active male
2 weeks post op
Healed, but...
...delayed (>1 year) wound infection requiring hardware removal
Isolated Displaced Midshaft clavicle fractures—Zussman’s thoughts...

- Some DMCFxs benefit from fixation
  - Significant displacement (vertical butterfly fragments)
  - Significant shortening
  - Significant tenting of the skin
  - Skeletally mature active patients
- I prefer plate fixation when I fix them
Isolated Displaced Midshaft clavicle fractures-Zussman’s thoughts…

- Most operatively treated fxs heal & do well
- There will be anterior chest numbness
- The hardware may be symptomatic enough to require removal
- Complications can occur…“No problem is so bad that you can’t make it worse with surgery”
To plate or not to plate...?
21yo male
Immediate post op
Final follow up, healed uneventfully
The Clavicle Question: To Plate or Not to Plate—Summary

- More studies are needed...
- Some DMCFxs benefit from fixation
- Plate fixation decreases nonunion & symptomatic malunion rates & gets earlier return to function
- Long term results of operative treatment are not necessarily superior to non-op treatment
- Treat a patient, not an X-ray
References

Thank You

THAT CONCLUDES MY TWO-HOUR PRESENTATION. ANY QUESTIONS?

DID YOU INTEND THE PRESENTATION TO BE INCOMPREHENSIBLE, OR DO YOU HAVE SOME SORT OF RARE “POWER-POINT” DISABILITY?

ARE THERE ANY QUESTIONS ABOUT THE CONTENT?

THERE WAS CONTENT?