

Evidence Based Management of Adolescent Clavicle Fractures

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No Disclosures

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Clavicle Fractures

- The Clavicle
 - "...a relatively agreeable and cooperative bone....requiring little more than symptomatic treatment [when fractured]..."
 - David Ring, Jesse Jupiter, 2002
- "If you want to get into trouble, then fix a clavicle fracture...."
 - JC, Professor of Orthopaedic Surgery, NJMS, ~2004
- "Primary operative intervention is meddlesome and only makes things worse.... UOA
 - Skeletal Trauma, 3rd Ed, 2003

Clavicle Fractures

"They all do fine....."



13M football, right clavicle fx





13M football, right clavicle fx





Serial X-rays of a midshaft clavicle fracture in a 13 year-old boy treated nonoperatively. Day 1: displaced fracture. 4 Weeks: fracture position maintained with early callus. 3 Months: healed (calcified callus). 8 Months: significant remodeling has already begun

Clavicle Fractures: Non-operative Treatment?

McKee, J Bone Joint Surg, 2006

- "Deficits following non-operative treatment of displaced mid-shaft clavicle fractures"
 - 30 patients with displaced fractures
 - 4.5 year clinical f/u
- Results:
 - Residual deficits in strength and endurance persist with nonoperative treatment
 - Fracture shortening >2cm may be predictive of worse outcome
 - Level III study
 - Should we be fixing more of these?



Displaced Mid-shaft Clavicle Fractures: The Evidence

- Canadian Orthopaedic Society, 2007
- Multicenter, prospective, randomized trial
- ORIF vs Non-Op treatment
- Level I
- 111 patients with 1 year f/u
- Results:
 - Constant and DASH scores significantly improved in ORIF group
 - Faster union (16 weeks vs 28 weeks)
 - Lower non-union in ORIF group, fewer symptomatic malunions
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Canadian Orthopaedic Trauma Society, 2007

- Non-union rate
 - Non Op: 14%, Op: 1.6%
- Malunion rate*
 - Non Op: 18%, Op: 0%
- Complications
 - Infection/Wound--Op: 3/62, Non-op 0/62
 - Hardware removal—Op: 5/62
 - CRPS--Non-op: 1pt





Operative Treatment of Clavicle Fractures

- Lower nonunion rate
- Lower malunion rate
- Possible earlier return to play
- Possible better function
- Wound complications
- Need for hardware removal





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Huttunen, Trends in the Incidence of Clavicle Fractures and Surgical Repair in Sweden: 2001-2012. *J Bone Joint Surg*, 2016

• 705% increase in rate of surgically treated clavicle fractures!



What about clavicle fractures in children and adolescents?



Epidemiology of Clavicle Fxs in HS Athletes

- 2008-2017
- Nat'l HS Sports-Related Injury Surveillance Study
- Rates
 - Boys: Ice Hockey > Lacrosse > Football > Wrestling....
 - Girls: Soccer > Lacrosse > Basketball

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- Boys clavicle fx rates much higher than Girls
- Games > practice
- RTP
 - Players treated with surgery LESS likely to RTP that season*
- Op vs Non Op
 - 567 Fxs, 83% treated Non-Op, 17% Operative





McCarthy, Orthopaedic Journal of Sports Medicine, 2019

What about clavicle fractures in children and adolescents?

• Traditionally nonoperative management, excellent results





ORIF reserved for open fractures, fractures with adjacent NV injury and "floating shoulders"





"ORIF of clavicle fractures in children appears to be safe and effective...."

Mehlman, J Pedatric Orthopaedics, 2009

24 children, avg age 12 (7-16) No nonunions 2 had scar sensitivity

All had hardware removed

Level IV study





Adolescent Clavicle Fractures 2007-2011 Operative Management by Age Group



Clavicle Fractures in Adolescents: ORIF?





Should we be treating adolescent clavicle fractures the same as adults?



Clavicle Fractures in Adolescents: Outcomes

- Schulz, et al. Functional and Radiographic Outcomes of Nonoperative Treatment of Displaced Adolescent Clavicle Fractures, *JBJS*, 2013
 - Injured vs Uninjured side comparison
 - Strength, endurance testing, ROM
 - QDASH and Constant scores
 - Radiographic union and length

CONCLUSIONS: NO DIFFERENCE

- 100% Union
- Mild objective decrease in maximal ER strength and abduction endurance
- Level IV Study, small N (16)



Adolescent Clavicle Fractures: Nonunion

- Pennock et al. Adolescent clavicle nonunions: potential risk factors and surgical management. *J Shoulder Elbow Surgery*, 2018
 - Level III Study, retrospective case series of 25 non unions
- Risk for nonunion after a displaced clavicle fracture is exceedingly rare, <1% (vs ~15% in adults)
- Risk Factors for nonunion:
 - Previous ipsilateral clavicle fx
 - Displacement, comminution, shortening and demographics NOT found to be RFs



The FACTS study group

- Function after Adolescent Clavicle Trauma and Surgery
- Heyworth, et al. Two-year functional outcomes of operative vs nonoperative treatment of completely displaced midshaft clavicle fractures in adolescents. *American Journal of Sports Medicine*, 2022
 - Level II prospective multicenter cohort
 - 10-18yr olds
 - 416N
- Pts followed with radiographs, DASH scores, ASES scores, Marx score...



The FACTS study group

- Results:
 - NO DIFFERENCE in patient reported outcomes between operative and non operative groups
 - NO DIFFERENCE in nonunion (0.4%), malunion and refracture
 - Higher complication rate in operative group (43%) vs non op (5.5%)
 <u>5% removal</u> of symptomatic hardware, 22% sensory disturbance
 - Refracture: 6 (2%) in non op group, 5 (4%) in the op group
- Conclusion: Surgery provides no benefit for completely displaced clavicle fractures in adolescents.
- Nonunion exceedingly rare in adolescent clavicle fractures



Why?







Why?





Late closure of clavicular physes likely improves union and remodeling rates after displaced clavicle fractures in teenagers

Adolescent Clavicle Fracture Remodeling

- The clavicle is the last bone to finish growing, with physes open as late as 25 years old
- Growing bones have better healing and remodeling potential
- FACTS study group
 - "Bony remodeling of adolescent displaced clavicle fractures", AJSM, 2023
 - Retrospective, Level IV, radiographic review of 98 pts, avg 3.4yr f/u
 - Initial displacement (14.5mm), shortening (17.7mm) and angulation (10.2*) all improved to 5.8mm, 6.7mm and 5.5*, respectively
 - Severely shortened and displaced fractures all improved significantly
 - The longer the f/u, the more remodeling occurred, even in older adolescents

What about Return to Play?

- "~6-10 weeks" for nonoperative treatment
- Vander Have, J Pediatric Orthopaedics, 2010
 - Level III study
 - NonOp 16 weeks
 - ORIF 12 weeks
- Kamaci, J Pediatric Orthopaedics, 2020
 - Level IV

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- ORIF 7 weeks *[19% ROH, 6 weeks RTP]
- Nawar, Current Reviews In Musculoskeletal Medicine, 2020

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- Level IV Systematic Review
 - No difference in RTP ORIF vs NonOp*

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Nawar, Current Reviews In Musculoskeletal Medicine, 2020

- Level IV Systematic Review
 - No difference in RTP ORIF vs NonOp*
- ORIF may allow earlier RTP by a few weeks...



Adolescent Clavicle Fractures: Summary

- Clavicle fractures are a very common injury in youth and high school sports
- Male, collision sports most common
- Majority of these fractures should be treated nonoperatively, with expected excellent results
- Nonunion is exceedingly rare in young people
- The clavicle remodels later than other bones, including in older teens
- RTP is 6-10 weeks; ORIF may accelerate this and be indicated in certain circumstances
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THANK YOU!!!

