

Ilizarov external fixation – A novel method for treatment of T-condylar elbow fractures in children and adolescents

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Background

- T-condylar fractures rare in skeletally immature children
- Occur in older children and adolescents
- Surgery challenging
- Complications common

Background

- Treatment surgical
- Goals
 - Restore articular surface
 - Rigid fixation for early ROM
- Options
 - Closed reduction with pinning
 - Pinning combined with titanium nails
 - ***ORIF***

ORIF

- Current standard of care
- Technically challenging
- Large exposure
- Extensive soft-tissue stripping
- Occasional olecranon osteotomy

Ilizarov

- Minimally invasive
- No soft-tissue stripping
- Rigid construct allows early motion
- No study in literature

Purpose

- To assess the clinical and functional outcomes of patients with t-condylar fractures of the humerus treated with small wire external fixation.

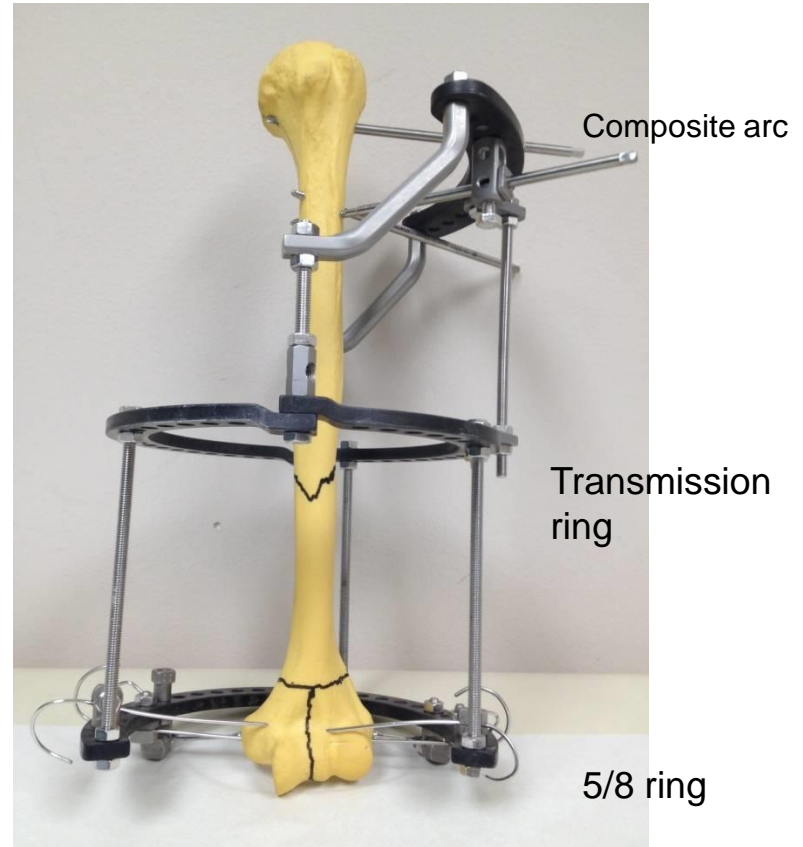
Ilizarov Technique

- Pre-op films of uninjured arm for sizing



Ilizarov Technique

- Preconstruct frame
 - composite arc proximal
 - Full or 5/8 ring distal
 - Mid shaft transmission ring



Ilizarov Technique

- 4 mm proximal half-pin
- Traction
- 1.8 mm smooth wire at med epicondyle
- Frame centered and fixed



Ilizarov Technique

- 2 more proximal half-pins
- 1.8 mm olive wires in opposite directions
- Olive wires tensioned simultaneously to restore joint
- Final reduction with connecting rods



Methods

- Retrospective case series
- Two surgeons
- Minimum 1 year follow-up

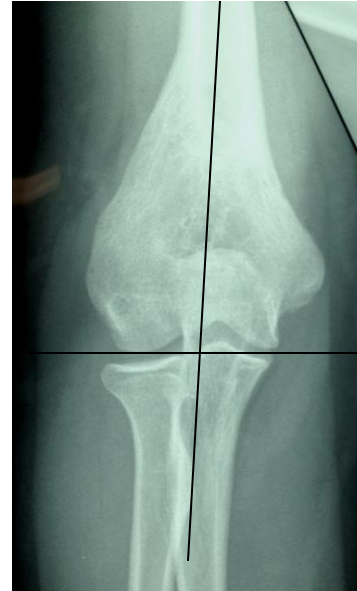
Methods

- Chart review
 - Demographics
 - Mechanism of injury
 - Operative time
 - Duration of time in frame
 - Complications
- Radiograph review
 - OTA fracture classification

Methods

Late clinical review

- Carrying angle
- ROM
- X-rays
 - Anterior humeral line
 - Lateral distal humeral or Baumann's angle
- PODCI <18yrs
- Upper Limb DASH >18yrs



Results

- 15 patients (11 males and 4 females)
- Mean age at injury: 11.5 years (range 8-15 years).
- OTA Fracture Classification:
 - 85% C1.1 fractures
 - 7% C2.1 fractures
 - 7% C2.2 fractures

Results

- Mechanism of Injury
 - 27% sports
 - 13% playground
 - 13% motorized vehicle
 - 13%skates
 - 13% fall
 - 20% other

Results

- 1 Grade I open fracture.
- 3 patients ipsilateral upper extremity fractures

Results

- Mean OR time: 113 minutes (range 60-150 minutes).
- One intraoperative arthrogram to assess the reduction.
- Mean time in frame: 57 days (range 35-115 days).

Results

- Complications
 - persistent serous drainage from pin sites while in the frame (3),
 - transient ulnar neuropraxia (1),
 - loss of flexion (2),
 - loss of extension (1),
 - malunion causing cubitus varus (1)
 - No pin tract infections

Results

- Late review
 - 4 patients
 - All males
 - Average age at follow-up 17.5 (11-24 yrs)
 - Average length of follow-up 95 months (39 to 141 months)

Results

- Late review
 - Range of motion:
 - Mean flexion: 127° (range $110 - 150^\circ$),
 - Mean extension: 3° (range $0 - 8^\circ$),
 - Mean pronation: 85° (range $70 - 90^\circ$),
 - Mean supination: 90°
- Mean carrying angle $+3^\circ$ ($-10^\circ - +8^\circ$)



Results

- Late radiographic review
- Mean lateral distal humeral angle 89°
- Anterior humeral line: intersected the capitellum in all cases except the one malunion.

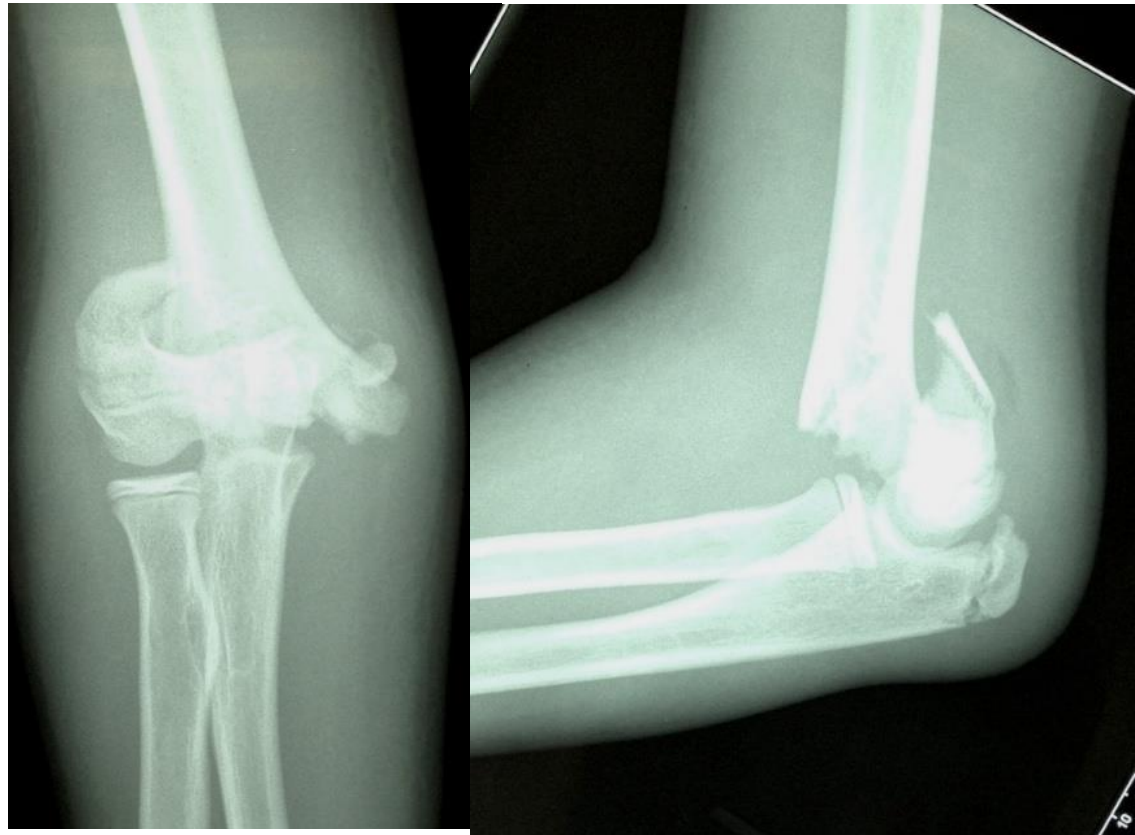


Results: Outcome Scores

- PODCI
 - Pediatric global function 92 (1)
 - Adolescent global function 92.5 (2)
- Upper Limb-DASH 0 (1)

Case 1

- 15 year old boy
- Dirt bike accident
- Type C1.1 fx



Case 1

- 10 year follow-up
- No complaints
- Upper-Limb DASH: 0



Case 2

- 13y/o R hand dominant boy
- Fell playing tennis
- Left C2.1 T-condylar fracture



Case 2

- 5.9 year follow-up
- Adolescent PODCI: 93
- Mild asymmetry noted by him but not parents
- College tennis scholarship



Discussion

- Challenging Fracture
- Current Literature
 - Rx options: ORIF, CR pinning + TEN
 - Rockwood and Wilkins' Fractures in Children
 - Lovell and Winter's Pediatric Orthopaedics
 - Injury not mentioned
 - Skeletal Trauma in Children
 - Tachdjian's Pediatric Orthopaedics

Discussion

- Safe and effective technique
- Minimally invasive
- No soft-tissue stripping or disruption of fracture hematoma
- Rigid fixation allows early motion

Limitations

- Small series
- 4/15 long term follow-up
- No control group

Conclusion

- Results should **broaden** the conversation about management of this difficult fracture
- Stimulate comparative prospective series

Thank You

