Long term Clinical Outcomes for Salter-Harris type II Fractures of the Proximal Phalanx of the Small Finger (also Referred to as Extra-Octave Fractures)

Lily Kathleen Wood, Lynsey R Malin, Jennifer Lynn Robb, Deborah C Bohn

INTRODUCTION:

Fractures of the hand, and in particular the fingers, are common in the pediatric population. In the small finger (the most commonly fractured finger in children) a juxta-physeal fracture is often referred to as an "extra-octave" fracture due to the classic pattern of ulnar angulation. Guidelines on indications for surgical management, acceptable amount of coronal plane malangulation and long-term outcomes are not available. Recent studies have investigated nonoperative management in small groups of patients sustaining extra-octave fractures and report good functional as well as cosmetic results[1-3]. Our study aims to assess long-term, patient-reported outcomes regarding function, pain, and appearance after nonoperative management of extra-octave fractures in a pediatric population.

1. Verver et al., 2017
2. Boyer et al., 2015
3. Barton, 1979.

METHODS:

Our hospital PACS database was queried using the search term, "XR finger little" which generated a set of radiographs of pediatric small fingers obtained between 2011 and 2021. All radiographs and radiology reports were reviewed to identify eligible subjects. Inclusion criteria were defined as any skeletally immature patient between the ages of 8 and 16-years-old at time of injury with a peri-physeal fracture of the proximal phalanx of the small finger. Skeletally mature children, fractures managed operatively, and children with history of other hand fractures were excluded. Eligible subjects were contacted by phone and sent surveys electronically. Questions regarding subjective appearance and function were assessed with VAS scales based on previous surveys by other authors.[2] All responses were graded on a scale from 0-100. For pain, the Wong-Baker FACES scale was used with permission from the creator. Responses are graded from 0-10. We assessed patient-reported outcomes using the PROMIS v2.0 Pediatric Upper Extremity short form, patient and parent proxy versions. This survey is made up of seven (7) questions which are graded from 0-3 or 0-4.The displacement on initial injury radiographs was calculated using the diaphyseal-metacarpal head angle (DHA)[4]. T-tests were used to compare parent and child responses and ANOVA was run to examine the potential impact of demographic variables on patient-reported outcomes. A p-value < 0.05 was considered significant.

2. Boyer et al., 2015
4. Al-Qattan et al., 2013

RESULTS:

Our initial PACS query generated 1307 small finger radiographs. After review, 183 eligible subjects were identified and contacted. 80 patients agreed to participate and after extensive reminders and calls 41 parents and 38 patients completed the emailed surveys (Figure 1). The mean age at time of injury was 11.12 years old (SD 1.78) and the mean age at time of survey completion was 17.17 years old (SD 3.38) (Table 1). Injury characteristics are listed in Table 2. Most patients were right-hand dominant and injured their dominant hand. The mean coronal plane angulation (180 – DHA) at time of injury was 9.85^0 (SD 6.95, Range 1-26). Patient and parent-reported appearance and function scores are listed in Table 3. Patient and parent perceptions of appearance (83.95 +/- 22.87 vs. 83.84 +/- 25.08) and function (93.95 +/- 11.62 vs. 97.13 +/- 6.43) were not significantly different. Most patients reported 0 pain on the Wong-Baker FACES pain scale (Table 3). All patients reported full function scores on the PROMIS v2.0 Pediatric Upper Extremity short form (Table 4). No significant correlation was found between the initial angulation (180-DHA) and either appearance or function of the small finger at the time of survey administration (Figure 4).

DISCUSSION AND CONCLUSION:

Identifying surgical indications for fracture management is critical to optimal patient care. Currently available literature does not address maximum acceptable angulation for nonoperative management of extra-octave fractures nor expected remodeling. Long-term radiographic results are difficult to obtain in the pediatric population and patient reported outcomes may serve as a proxy for radiographic follow-up.

To our knowledge this is the largest study examining patient-reported function, appearance and pain at long term follow up after extra-octave fractures treated nonoperatively. At mean 6-year follow up 100% of children and parents reported excellent function and appearance of the previously injured small finger, including those with greater than 20^0 of angulation (12.5% of the study group). Our findings support nonoperative management of extra-octave fractures with up to 26^0 of coronal plane angulation.

Figure 1. Flow Chart of Patient Selection

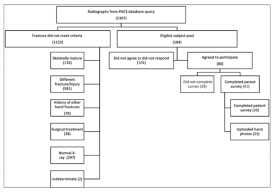

Figure 4. Relationship Between Initial Angulation (180-DHA) and Perceived Appearance and Function

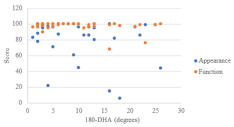

Table 1. Demographics (N = 41)

Variable	**Mean (SD)**
Age at Time of Survey	17.17 (3.38)
Age at X-Ray	11.12 (1.78)
Years from Injury to Survey	6.05 (2.60)

Table 2. Injury Characteristics

Gender	**N = 41 (%)**
Male	19 (46.3%)
Female	22 (53.6%)
Handedness	
Right-hand dominant	36 (87.8%)
Left-hand dominant	4 (9.75%)
Ambidextrous	1 (2.44%)
Injured Hand	
Dominant	22 (53.6%)
Non-Dominant	18 (43.9%)
Other	1 (2.44%)
Mean Coronal Plane Angulation (180-DHA)	
At Time of Injury (SD, Range)	9.85 (6.95, 1-26)

Table 3. Patient and Parent-Reported Outcomes

Perceived Appearance	**Mean Score (SD)**	**N**
Parent	83.95 (22.87)	41
Patient	83.84 (25.08)	38
Perceived Function*	**Mean Score (SD)**	
Parent	93.95 (11.62)	41
Patient	97.13 (6.43)	38
Perceived Pain$	**Median Score (Range)**	
Pain at rest	0 (0-2)	38
Pain with ADLs	0 (0-2)	38
Pain with sports	0 (0-2)	38

* Question out of 100. Not the PROMIS v2.0 Pediatric Upper Extremity short form score
$ Perceived pain based on patient responses, only

Table 4. PROMIS UE SF Survey Results (N = 38)

In the past 7 days I could…	**Median Response (Range)**
Button shirt / pants	3 (3)
Open a jar	4 (4)
Open the rings in school binder	4 (4)
Pour a drink from a full pitcher	4 (4)
Pull a shirt over my head	3 (3)
Pull open heavy doors	4 (4)
Put on shoes by myself	4 (4)
Use a key to unlock a door	4 (4)
Total Score	*30 (30)*