**Table 1.** The relationship between family's education level and outcome criteria.

| | TAM | | | | | AS | | | | | Strength | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Excellent | Good | Fair | Poor | *p*-value[a] | Excellent | Good | Fair | Poor | *p*-value[a] | (kg[c]) | *p*-value[b] |
| Mother's educational background | | | | | | | | | | | | |
| Elementary School | 18 | 24 | 6 | 10 | 0.121 | 28 | 8 | 12 | 10 | 0.072[a] | 0.71 | 0.342 |
| Secondary School | – | – | – | – | | – | – | – | – | | – | |
| High School | 4 | 4 | 4 | 2 | | 8 | – | 6 | – | | 0.83 | |
| University | 16 | 4 | – | – | | 20 | – | – | – | | 0.76 | |
| Father's educational background | | | | | | | | | | | | |
| Elementary School | 2 | 8 | 6 | 12 | <**0.001** | 6 | 4 | 8 | 10 | <**0.001** | 0.65 | 0.116 |
| Secondary School | 2 | 12 | – | – | | 8 | 4 | 2 | – | | 0.87 | |
| High School | 16 | 8 | 4 | – | | 20 | – | 8 | – | | 0.76 | |
| University | 18 | 4 | – | – | | 22 | – | – | – | | 0.76 | |

[a]Fisher exact test.
[b]Kruskal–Wallis test.
[c]Tip-pinch grip strength of the injured side versus contralateral normal side.
TAM: total active motion; AS: adjusted Strickland criteria.

maternal education and the treatment outcomes with increasing sample size, but our results have not shown this.

The limitations of this study include its retrospective nature with limited numbers, and the grouping of different tendon injuries for analysis, for example, injuries in different zones. Also, as mentioned, the complex social-economic factors associated with educational level has not been examined in detail. Future studies can explore these associations, but at present, our study would suggest the need to offer more support and counselling when treating children with lower parental educational levels.

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**Informed consent** Written informed consent was obtained from all subjects before the study.

**ORCID iD** Galip Gencay Üstün https://orcid.org/0000-0002-3538-1152

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**Galip Gencay Üstün*, Fethiye Damla Menkü Özdemir and Ali Emre Aksu**
Department of Plastic Reconstructive and Aesthetic Surgery, Hacettepe University Faculty of Medicine, Ankara, Turkey
*Corresponding author: ggustun@hacettepe.edu.tr


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## Isolated Salter-Harris Type IV distal ulna fracture: a case report

Dear Editor,

While distal forearm fractures are among the most common injuries in children, isolated physeal injury to distal ulna is rare.

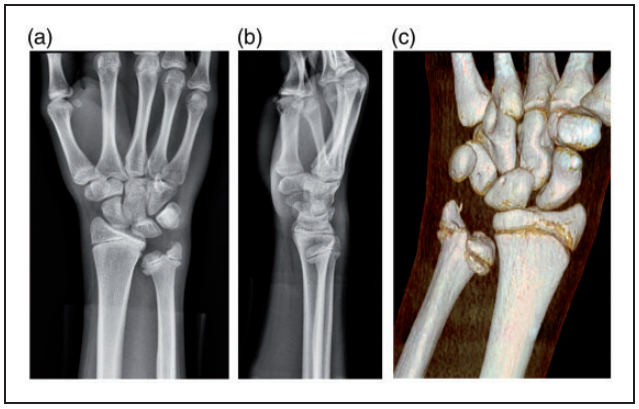


**Figure 1.** Admission X-rays (a and b), CT-scan 3-D reconstruction (c) showing isolated fracture to the distal ulna in an inverted V-shaped configuration with two transphyseal fracture lines and significant ulnar shortening.

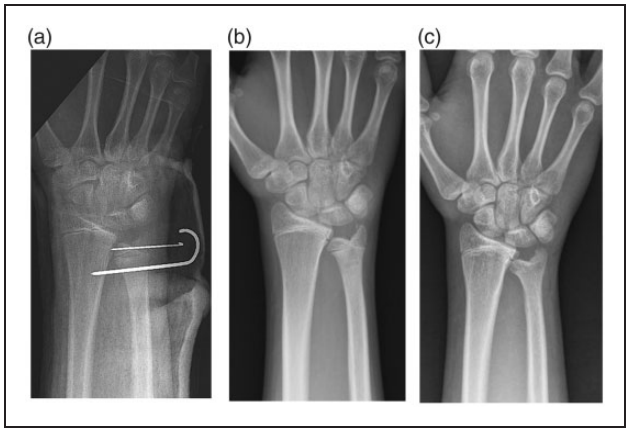


**Figure 2.** Immediate postoperative (a), 3 months (b) and 1 year (c) follow-up X-rays. Distal ulnar physeal closure was observed.

We report a case of a 14-year-old boy who sustained an injury to his right wrist, while roller skating. On examination, there was tenderness over the ulnar border and painful restriction to wrist movement, but no significant deformity. Radiographs revealed a displaced Salter-Harris (SH) Type IV fracture of the distal ulna with no injury to the radius (Figure 1). Subsequent CT-scan (Figure 1(c)) clarified the fracture pattern, showing two displaced transphyseal fragments, one including the ulnar styloid, in an inverted V-shaped configuration, with a significant articular incongruence and 9 mm ulnar shortening (contralateral 2.5 mm negative variance). A single trial of closed manipulation under sedation was attempted but failed to achieve any significant reduction. Open reduction was then performed through a dorsal approach between the fifth and sixth extensor tendon compartments. The medial and lateral fragments were elevated by direct manipulation, and reduction was aided by forearm supination and elbow flexion. Anatomical reduction was confirmed by fluoroscopy and direct visualization of the articular surface. One 1 mm K-wire was introduced percutaneously through the ulnar border into the epiphyseal segment, parallel to the growth plate, stabilizing both articular fragments. A second parallel 1.8 mm K-wire was introduced proximal to the growth plate, fixing the metaphyseal extension of the fracture and stabilizing the distal radioulnar joint (DRUJ) (Figure 2(a)). The arm was immobilized in a neutral position with an above-elbow splint. The K-wires were removed at 3 weeks and the plaster maintained for 6 weeks. At 3 months follow-up, the fracture was fully healed (Figure 2(b)), and the patient showed painless unrestricted motion. Premature physeal closure was observed at 1-year follow-up (Figure 2(c)), with ulnar shortening of 6 mm. Clinically, the patient showed symmetrical grip strength (39 kg) and minimal loss in range of movement (within 5° of the contralateral side). Excellent results were obtained on functional assessment, scoring zero in the patient-rated wrist evaluation.

Physeal injury to the distal ulna is uncommon and typically a SH Type II pattern is observed. In a review of 163 physeal fractures of the distal forearm, only six ulnar physeal fractures were found, and just one was isolated (Cannata et al., 2003). We found only two cases of isolated SH Type IV ulnar fractures previously reported (Kasis et al., 2004; Marrannes et al., 2020). In these cases, a single Type IV fracture pattern was present, as opposed to the more complex double line fracture configuration, observed in our patient.

Open reduction and K-wire fixation is recommended for distal ulnar physeal injuries, but different K-wire configurations have been reported. In a case of SH Type IV ulna fracture (with concomitant radius fracture), O'Hagan et al. (2012) placed two longitudinal K-wires, traversing the growth plate. Kasis et al. (2004) and Marrannes et al. (2020) placed three wires parallel to the growth plate (two divergent wires in the epiphyseal segment plus one in the metaphyseal segment). Marrannes et al. used an anterior approach as opposed to our dorsal approach.

Growth arrest following distal ulnar physeal fractures is very common. While anatomic reduction offers the best chance of avoiding this outcome, the risk remains high, probably reflecting the significant tissue damage and ischaemia during the trauma. As with our patient, premature physeal closure was observed after 12 to 18 months in previous reports. Despite the resultant ulnar shortening being verified, good short-term functional results were also achieved in these cases. Nevertheless, we

recommend that patients should be followed radiographically until skeletal maturity for early detection of significant ulnar shortening.

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**ORCID iD** Rui Barbeiro Gonçalves https://orcid.org/0000-0001-5655-4078

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**Rui Barbeiro Gonçalves[1,*], Joana Ovídio[2] and Pedro Jordão[2]**

[1]Orthopaedics and Trauma Department, Centro Hospitalar Universitário de Lisboa Central, Lisbon, Portugal
[2]Pediatric Orthopedic Department, Hospital Dona Estefânia – Centro Hospitalar Universitário Lisboa Central, Lisbon, Portugal
*Corresponding author: rbarbeirogoncalves@gmail.com


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## The value of preserving the full middle phalanx in distal long finger amputations: A series of 59 cases

Dear Editor,

Generally, the distal interphalangeal (DIP) joint is considered a better amputation site than the diaphysis of the middle phalanx because it maintains more length and enables full flexion and extension of the proximal interphalangeal (PIP) joint. Therefore, we hypothesized that there would be no difference in outcomes between long finger amputations at the DIP joint versus through the middle phalanx as long as we kept the insertions of the flexor digitorum superficialis (FDS). In this study, 33 patients (39 fingers) had amputations through the DIP joint and 26 patients (29 fingers) through the diaphysis of the middle phalanx. The indication for amputation was trauma in 48 patients, vascular problems in three patients and sepsis in eight patients. The mean (range) follow-up time was 51 months (12 to 113). The mean age was 49 years (17 to 90). The local independent ethics committee approved the study, and all patients gave written, informed consent to participation.

Regarding clinical and functional results, metacarpophalangeal joint range of motion, pulp-to-palm distance, grip strength, length of time off work and QuickDASH score, and complications (cold intolerance and dysesthesia), there were no significant differences between the DIP joint and middle phalanx groups (Table 1). However, patients who had lost a portion of a single finger ($n = 53$) had greater mean grip strength and a lower QuickDASH score than patients who had lost portions of multiple fingers ($n = 6$) ($p = 0.036$). The overall complication incidence was 20% ($n = 12$) when considering all participants. Two of these patients (3%) developed neuroma. Four patients (6%) underwent a total of six revisions. These revisions included bone resection for stump remodelling for two patients, one of them with nail matrix removal. The other two were for tenolysis and resection of the flexor digitorum profundus (FDP) tendon impinging at the first annular pulley. Those two patients subsequently developed a lumbrical plus finger, which required resection of the lumbrical muscles in the affected finger. Overall, six patients were severely disabled after their partial long finger amputation, with QuickDASH scores averaging greater than 54.

Similar to Chow and Ng (1993), we frequently found cold intolerance and distal dysesthesia as complications of finger amputations. Dos Remédios et al. (2005) analysed 46 finger replantations and found better outcomes for dysesthesia and cold intolerance, but smaller PIP joint ranges of motion than we did. In a recent meta-analysis of traumatic finger amputations at all sites, Vlot et al. (2018) reported an incidence of a neuroma of 7% among patients with traumatic amputation (two-thirds of whom wanted to undergo revision surgery), and Van der Avoort et al. (2013) found 8%