Two-stage treatment of a growth arrest of the distal radius—a case report

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In 1996, a 9-year-old boy presented with the typical appearance of a peripheral growth arrest of the right distal radius. The hand was radially deviated with a prominent end of the ulna (Figures 1 C and E) (Nelson et al. 1984). The boy had been operated on 2 years previously with repeated attempts at reduction of a distal radial epiphyseal fracture and the use of K-wires across the physis (Horii et al. 1993).

Radiographs and CT showed a partial distal radial physeal closure located dorsally and radially, with a marked ulnar overgrowth and a radial tilt of the radius (Figures 1 A, B and D).

We planned with clinical and radiographical examinations every year during the intervening period. The first stage consisted of an immediate epiphyseal bar resection (Figure 2A) to allow the radius to straighten and regain as much length

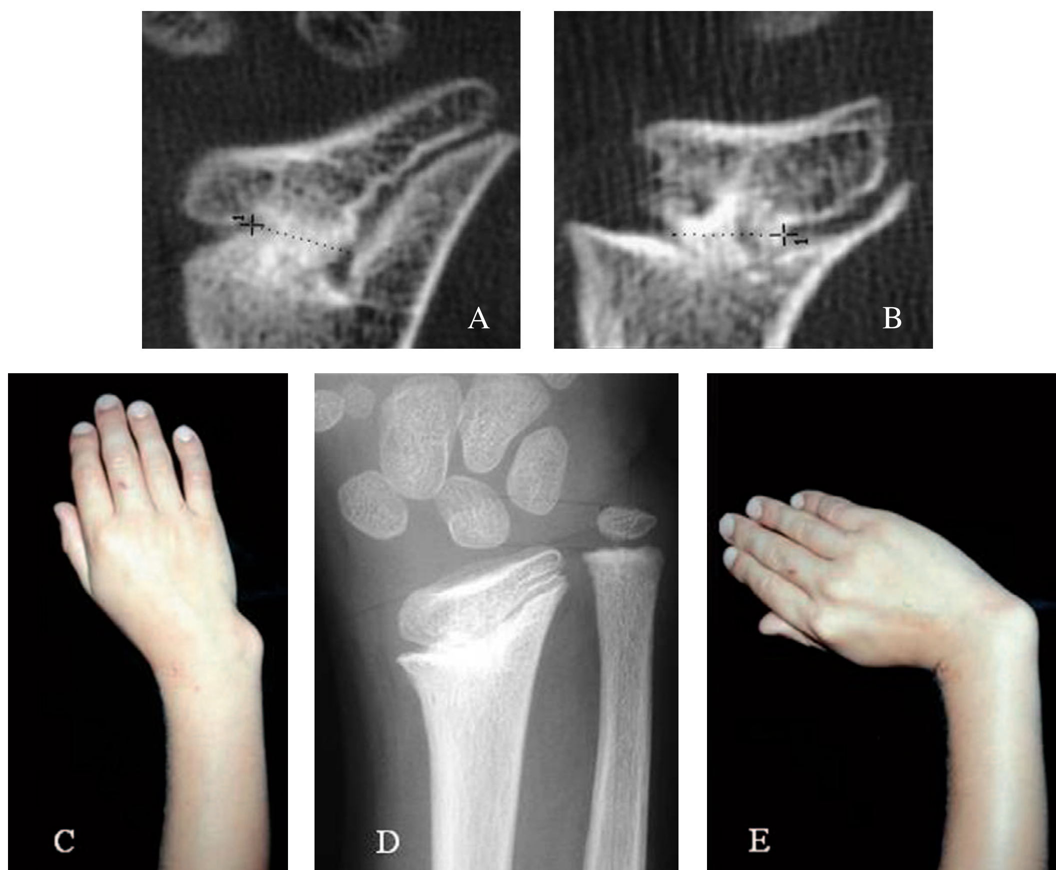

Figure 1. Partial epiphyseal closure at age 9, 2 years after a fracture of the distal radius (C and E: wrist in radial deviation). Radiograph (D) and scans (A and B) reveal marked ulnar overgrowth and radial tilt of the radius.

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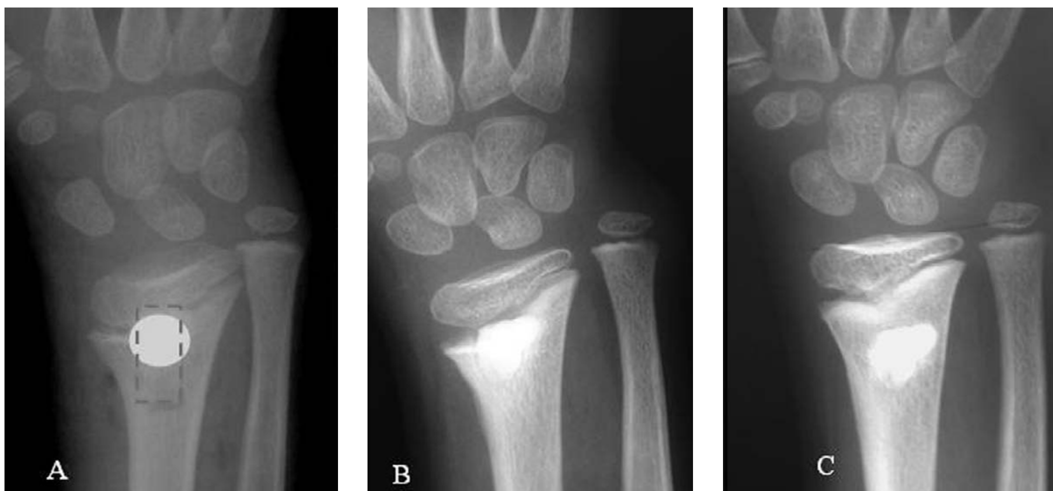

Figure 2. A) preoperatively, with planned epiphyseal bar resection (dotted line) and insertion of methylmetacrylate (ellipse), B) immediately after operation, and C) at age 11.

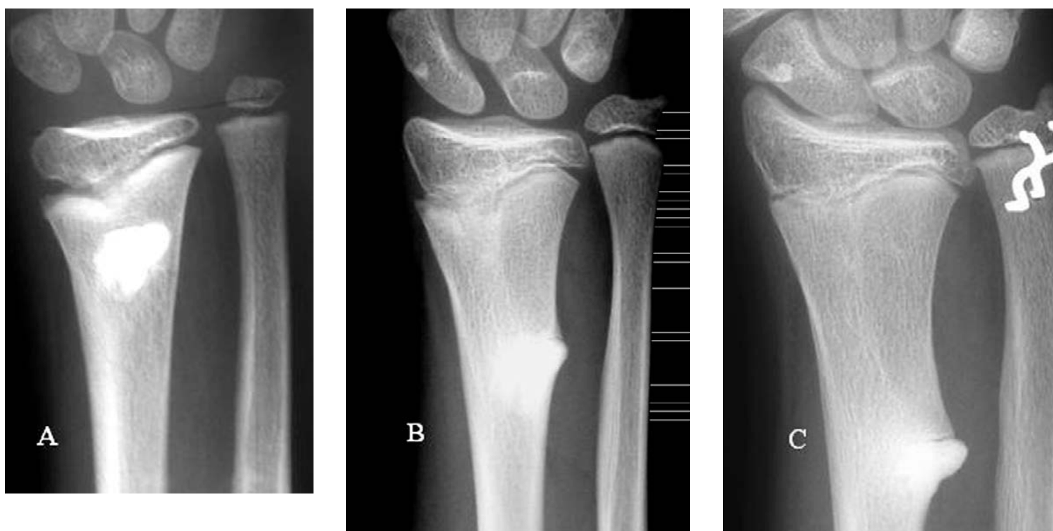

Figure 3. A) at age 13, B) positive ulnar variant preoperatively at age 15, and C) epiphysiodesis of the distal ulnar epiphysis, immediately after operation, showing memory staples.

as possible. After elevation of a dorsal cortical window, the epiphyseal bar was reamed under magnification until epiphyseal cartilage appeared. A methylmetacrylate spacer was inserted into the defect left by the excision of the epiphyseal bar. The still semifluid cement was cast just before acquiring the consistency of dough, with constant sprinkling of water to avoid excessive heating (Figure 2B).

The patient was given regular check-ups during the following 6 years (Figure 2C at age 11 and Figure 3A at age 13). When he was 15 years old, and approaching the end of his full growth, it was time to correct the ulnar plus variant (Figure 3B) by an epiphysiodesis of the distal ulnar epiphysis (Figures 3C and 4A).

Follow-up radiographs at age 16 showed a neutral ulnar variant (Figure 4B). New radiographic and clinical examinations at the age of 16.5 years showed a good outcome (Figure 5).

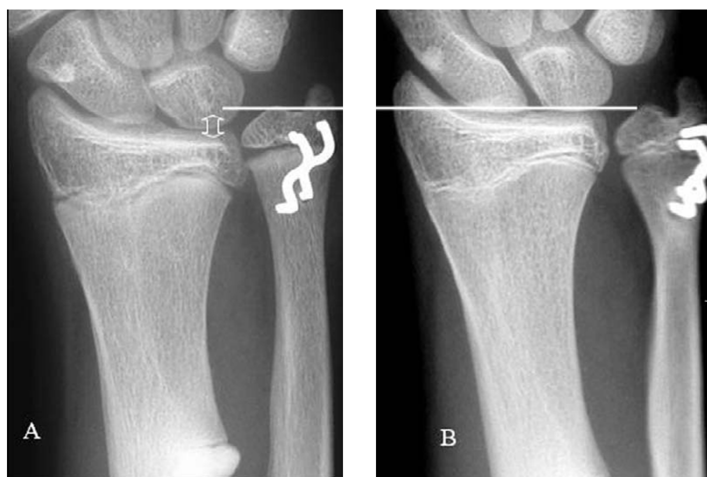

Figure 4. Correction of the positive ulnar variant between ages 15 (A) and 16 (B).

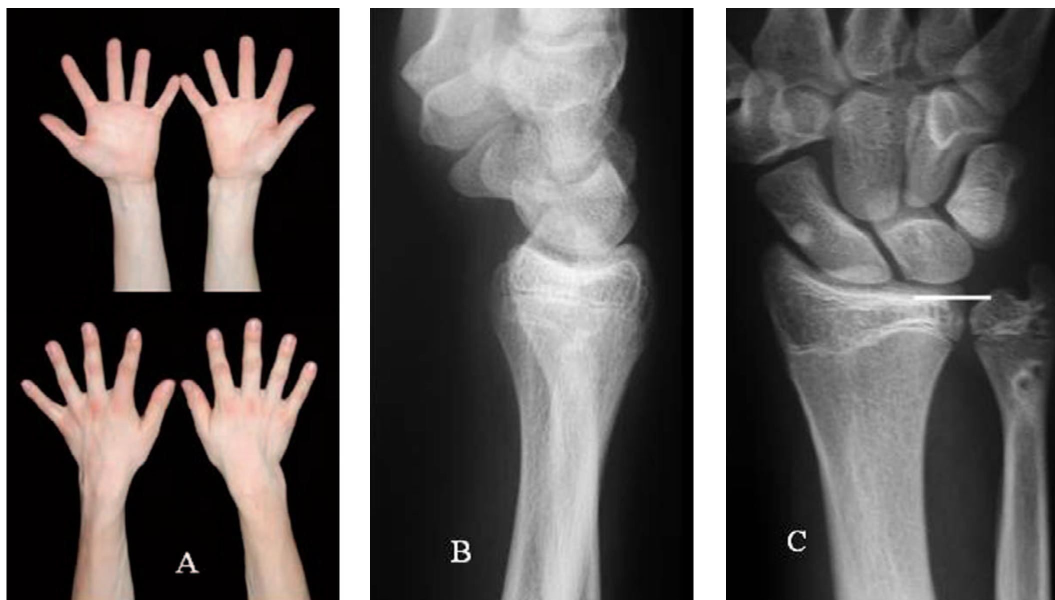

Figure 5. Results at age 16.5 years.

Discussion

Epihyseal fractures of the distal radius are particularly prone to growth arrest (Lee et al. 1984) because of a bone bridge linking metaphysis to epiphysis.

Adolescents with progressive deformity after post-traumatic distal radial growth arrest can be treated with ulnar epiphysiodesis (Bronfen et al. 1994, Waters et al. 2002), ulnar-shortening osteotomy (Aminian and Schoenecker 1995, Valverde et al. 1996), lengthening osteotomy of the distal radius (Hove and Engesaeter 1997), radial osteotomy, combined radial and ulnar epiphysiodesis (Bronfen et al. 1994), epiphysiodesis of the distal radius and ulna with an opening wedge osteotomy and bone grafting of the distal radius (Tang et al. 2002), or even the Ilizarov technique (Aston and Henley 1989).

In younger children, the surgical strategy is different because of the substantial growth potential of long bones. The value of epiphyseal bar resec-

tion and interpositional materials (Martiana et al. 1996) to treat post-traumatic partial growth arrest of the distal radius has been known for many years (Bright 1974, Langenskiold 1975, 1981, Peterson 1984, Ogden 1987, Williamson and Staheli 1990). Unlike some authors, we do not consider that biological interposition materials are more effective than cement spacers. We used acrylic cement because it has good biological tolerance, gives a perfect filling of the reamed cavity and because it is radio-opaque (visual marker).

Epiphyseal bar resection must be performed as soon as bar occurrence or deformities are detected (Meier et al. 2004). However, it is not an easy procedure; recurrence is common (Hasler and Foster 2002), with poor outcome (Hove and Engesaeter 1997).

Optimal treatment of postinjury partial epiphyseal closures implies that maximal time must be given both to the ulna and the radius to grow. After maximal radius growth, ulnar growth is stopped with an epiphysiodesis of the distal ulna. This second stage contributes to the final correction of a residual radio-ulnar length discrepancy.

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