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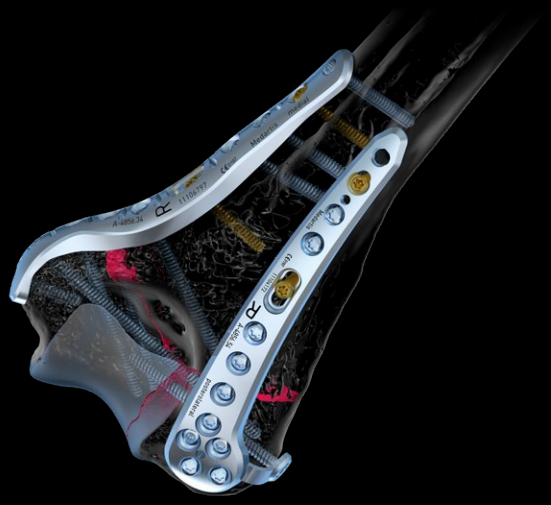
CASE REPORT



Personalized 3D-Guided Osteotomy for Anatomic Correction of Cubitus Varus

The Surgeon

Dr. Franck Plotard Huchard

Dr. Franck Plotard Huchard is a hospital physician specializing in upper extremity orthopedic surgery. Practicing at the Hôpital Nord-Ouest in Villefranche-sur-Saône (69), he treats numerous complex trauma cases and provides comprehensive follow-up care.

Introduction

Cubitus varus is a common deformity resulting from trauma to the distal humerus in children.[1] Achieving optimal reduction of these fractures can be challenging, and damage to the growth plate may lead to asymmetric growth of the distal epiphysis, resulting in elbow misalignment. Functional impairment varies, as patients are often very young and possess a remarkable capacity for adaptation.[1,2] Elbow disability may only become apparent once the patient starts doing sport.[2] Early treatment appears to be beneficial, as surgery in adolescents is more difficult than in pediatric patients.[3,4] However, correction of the malunion is typically accompanied by a perceived improvement, in addition to aesthetic considerations. Recently, three-dimensional (3D) printing-guided osteotomy has gained attention because of its high rate of excellent outcomes.[5]

The Case

Patient History/Profile

The patient, a 16-year-old male, sustained an untreated fracture of the distal end of the left humerus during early childhood in a country with limited access to healthcare. He is now considered radiographically mature and is no longer eligible for pediatric osteosynthesis techniques. He plays soccer at club level and plans to pursue a career as an electrician . His main functional limitation is the transition from the forearm to the running phase, as the deformity of his elbow causes interference between his trunk and forearm. He also reports reduced strength compared to the contralateral side and a higher incidence of injuries on this side.

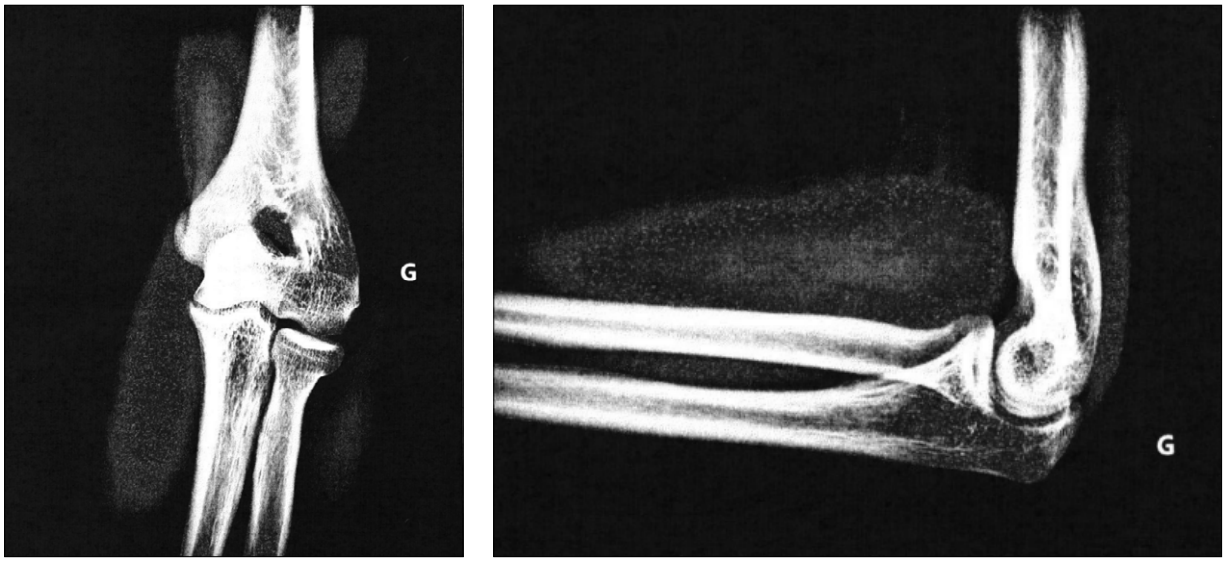


Figure 1: Preoperative X-rays frontal (left) and lateral (right)

Pre-operative Analysis

A bilateral CT scan of the humeri was performed, with 3D analysis by the Medartis CMX team. A closing wedge osteotomy was planned.

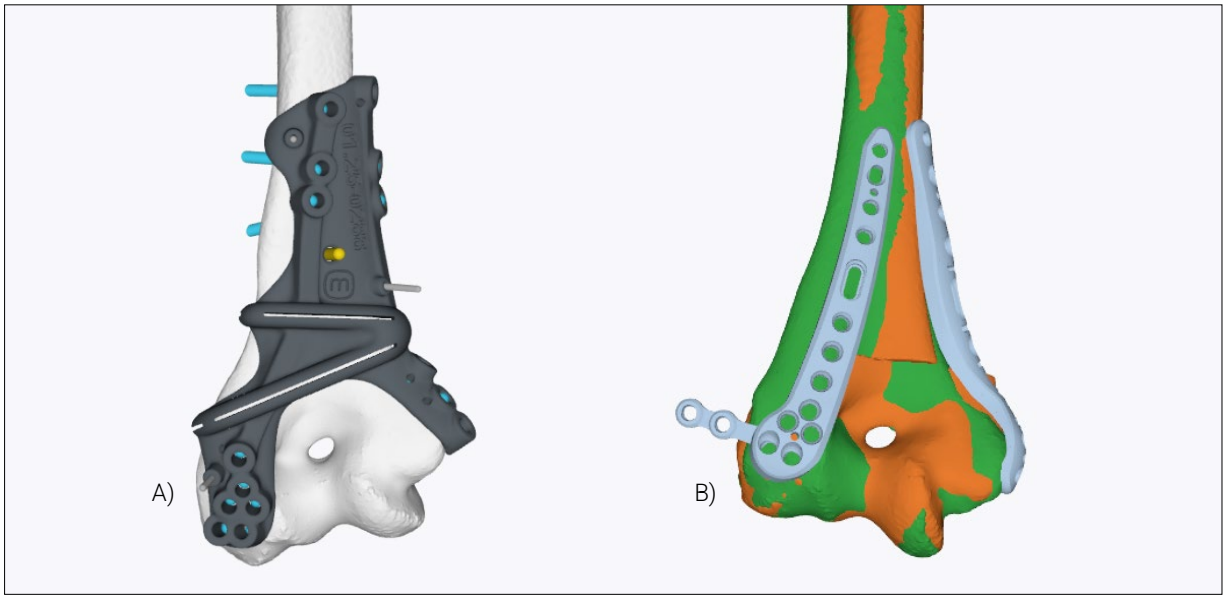


Figure 2: A) 3D Reconstruction of the left elbow with the designed cutting guide.
B) the planned final result with superimposed the contralateral elbow (in green)

Surgical Treatment

The procedure was performed via a posterior approach with medial and lateral paratricipital exposures. The patient was positioned in the lateral decubitus with a pneumatic tourniquet placed very proximally on the arm. After neurolysis of the ulnar and radial nerves, the triceps was elevated from its humeral insertion to allow placement of the custom-made cutting guide. This guide was temporarily secured with K-wires, allowing the screw holes to be drilled. The osteotomy was performed along the cutting guides using a cooled oscillating saw. After removing the cutting guide, the humerus was perforated proximally and distally using a square-tipped drill bit.

We used standard Medartis distal humerus osteosynthesis plates in accordance with the plan.

Intraoperative Findings

Although the size of the cutting guide was a source of preoperative concern, intraoperatively it did not present any difficulties. Bone debridement appeared essential to minimize the risk of pseudarthrosis. Placement of the plates with locking screws distally allowed for manual compression across the osteotomy site before insertion of the proximal screws.

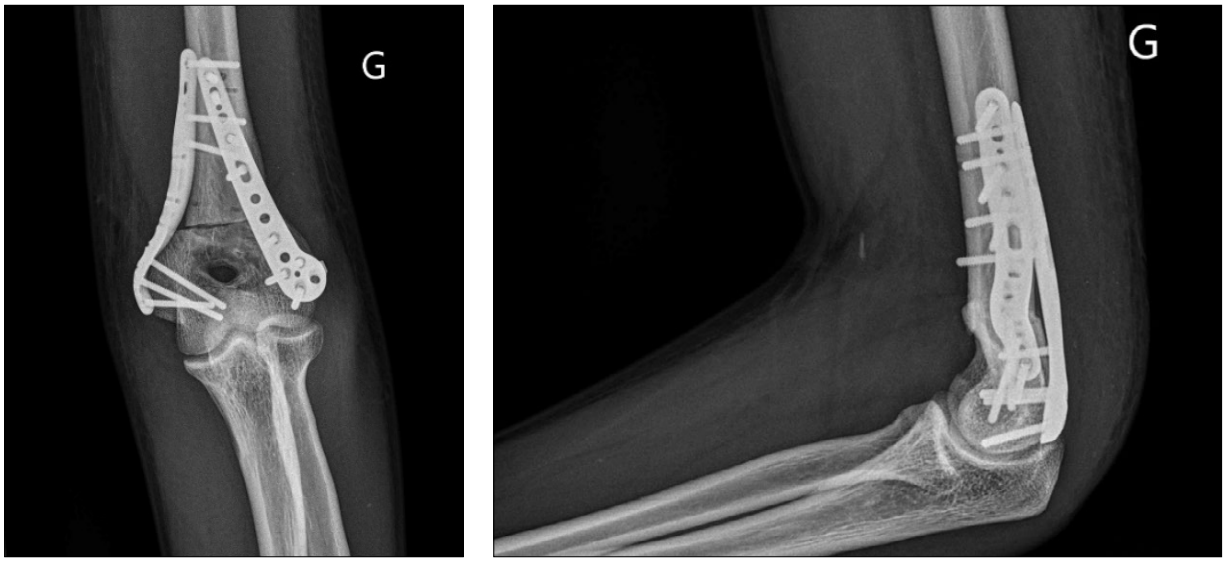


Figure 3: Intraoperative X-rays showing the osteosynthesis material in situ. Frontal (left) and lateral (right)

Postoperative Treatment

An elbow-to-body splint was applied to the left arm. The patient was encouraged to begin mobilization of his elbow as soon as possible, while avoiding forced movements for the first 2 months postoperatively. The patient achieved a full and symmetrical recovery of joint range of motion. A postoperative CT scan confirmed bone union at 3 months after surgery.

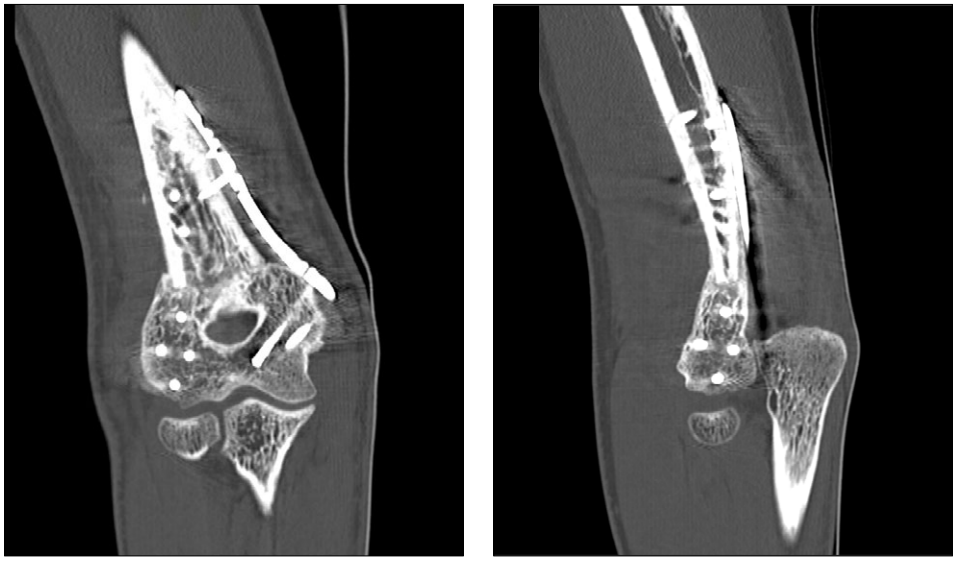


Figure 4: CT slices 3 months postoperative, coronal (left) and sagittal plane (right)

Conclusion

Corrective osteotomy for distal humerus malunion is typically performed in younger patients with high functional demands, even when symptoms may initially seem mild. In these cases, the potential benefits of optimal surgical correction outweigh the risks. This is facilitated by custom-made cutting guides, which enable restoration of anatomy closely matching that of the contralateral side.

References

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