Letter to the Editor

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Resorbable magnesium screws for fixation of medial epicondyle avulsion fractures in skeletally immature patients: A comparison with Kirschner wires

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We read with interest the publication by Baldini et al.[1] The authors stated that Young's modulus and density of magnesium screws are more similar to bone than titanium/stainless steel, which would reduce bone resorption around the implant due to the "so-called stress-shielding." We usually do not see bone resorption around stainless steel and titanium screws. In contrary to the former, Baldini et al.'s[1] images show extensive reduction of bone density around the magnesium screws at 1 and 3 months, with their previous publication[2] still showing reduced bone density at 6 months in some areas around the magnesium implants used to fix a medial epicondyle fracture. Baldini et al.[1] highlighted that magnesium alloys appear to be biocompatible (capability to coexist with living tissues) and osteoconductive (bone grows on the surface). The initial reduction in bone density around the magnesium screws seems to contradict the latter during the initial post-operative period. Even the magnetic resonance imaging (MRI) images taken 2 years post-operatively[1] show an abnormal signal in the entire area of the medial epicondyle/condyle, indicating that normal bone structure and quality was not restored.

Baldini et al.[2] previously reported breakage of one magnesium screw following medial epicondyle fixation, with the screw fragment sitting within the soft tissues under the skin, but did not record this complication in the current publication? Waelti et al.[3] reported breakage of the bone fragment fixated with a magnesium screw in 4 and screw breakage in 16 out of 35 children. The bone fragment fractures reported by Waelti et al.[3] will be the result of the bone lysis and reduction of bone strength caused by the magnesium-alloy reaction. The images provided by Baldini et al.[1] in their third figure show a periosteal reaction at the lateral aspect of the distal humerus, with markedly reduced bone density extending from the distal magnesium screw toward the lateral side, which could represent a stress fracture. We cannot explain the subperiosteal reaction otherwise.

Baldini et al.[1] reported no significant difference between their two groups regarding return to sport, without identifying if the patients returned to their pre-injury level of activities or not and how long it took for patients to return to their pre-injury activity level. The used Mayo Elbow score does not consider return to sport and level of sportive activity (https://www.orthopaedicscore.com/scorepages/mayo_elbow.html; accessed 15 March 2023).

We would like to point out two technical points. The first is regarding measurement of medial epicondyle fracture displacement. Baldini et al.[1] stated under methods that they had recorded "degree of displacement" but did not provide measurements for the groups other than that displacement was >5 mm. However, the authors used only antero-posterior (APR) and lateral radiographs (LR) to measure displacement of the medial epicondyle. Souder et al.[4] described the distal humerus axial view to evaluate displacement of medial epicondyle fractures, with it being more accurate in demonstrating displacement than APR, LR, and internal oblique radiographs (IOR). APRs underestimated displacement by a mean of 5.5 mm and IR by 3.8 mm, with the lateral view not visualizing displacement <10 mm. Therefore, Baldini et al.[1] will not have known the real amount of fracture displacement, before and after reduction. The second point is the quality of the reduction. Klatt et al.[5] demonstrated a consistent radiographic position of the medial humeral epicondyle on APRs and LRs throughout skeletal maturation, which indicates that Baldini et al.'s[1] presented screw fixation transfixed the medial

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humeral epicondyle in a non-anatomic position. It is important that the surgeon is familiar with the normal position of the medial epicondyle and that an open reduction restores the normal anatomy, which was not the case here, as visible on the LRs and especially the MRI images. Such malunion might have a negative impact on flexor function and grip strength and return to pre-injury activity level, which was not assessed.

Grahn et al.[6] followed up 41 children who had non-operative and 40 children who had operative treatment and identified that open reduction and stainless steel screw fixation did not improve outcome. In contrary, non-operatively treated children experienced significantly less pain and had a significantly better cosmetic outcome, with all non-operatively treated children having had returned to the same or higher level of sport as before the injury, but six children treated operatively had to downgrade their sporting activities.

In summary, we do not think that there is a practical advantage in using magnesium screws over other metal implants and would not consider their use because of the extensive associated osteolysis and reduced bone strength, which can result in fragment fractures.[3] Stainless steel/titanium screws do not need to be removed unless they cause localized symptoms or in young patients to preserve physeal growth. What is more important than the choice of screw is to possibly expand the indications for non-operative management,[6] rather than a strict 5-mm threshold for surgery.

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