Technical note

A new procedure for fractures of the medial epicondyle in children: Mitek® bone suture anchor

J. Rigal, T. Thelen *, A. Angelliaume, J.-R. Pontailler, Y. Lefevre

Service de chirurgie orthopédique pédiatique, hôpital Pellegrin, CHU, place Amélie-Raba-Léon, 33076 Bordeaux, France

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ABSTRACT

We present a new bone suture anchor technique for fractures of the medial epicondyle. The hypothesis was that the results would be similar to those with the divergent K-wire fixation. This retrospective study included 40 patients who presented with displaced fractures of the medial epicondyle: one group was treated with a Mitek® non-resorbable bone suture anchor (group A: n=21), the other by K-wire fixation (group B: n=19). A medial approach was taken with an anchor placed above the olecranon fossa. The epicondyle was then repositioned by bone suture. After a mean follow-up of 18.6 months, union was obtained in all epicondyles. There was no difference in flexion-extension of the elbow. The rate of hypertrophy of the medial epicondyle was similar in both groups (57%). The bone suture anchor of the medial epicondyle is an effective technique that does not require hardware removal and is an alternative treatment option to divergent K-wire fixation.

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1. Introduction

Fractures of the medial epicondyle represent 11 to 20% of elbow fractures. Non-surgical management with a plaster cast has been used for many years but non-union (and thus valgus instability) has been observed in 60% of cases [1,2] so that at present surgeons prefer surgical treatment with wire or screw fixation. The disadvantage of these two methods of fixation is that the hardware must be surgically removed.

The goal of this study is to present the Mitek® bone suture anchor, a new technique for fractures of the medial epicondyle that associates the advantages of surgical fixation with no need for hardware removal. Our hypothesis was that the results of this technique would be similar to those by divergent K-wire fixation.

Patients who presented with a displaced fracture of more than 5 mm on AP and lateral X-rays were included in the study. Exclusion criteria were patients older than 14 and all of the general contraindications to surgery. Patients were divided into 2 groups according to surgical treatment: group A for bone suture anchor and group B for divergent K-wire fixation. Preoperative displacement was 9.4 mm [5.5–12.6] in group A and 7.2 mm [6.4–8] in group B.

Distribution of patients according to the Marion and Faysse [3] classification was equivalent in both groups (Table 1). The procedure was performed within 24 hours after injury by 2 surgeons according to the following technique.

2. Materials and methods

This is a continuous retrospective study in 40 patients (17 girls, 23 boys) presenting with a fracture of the medial epicondyle who underwent surgery at a mean 10.2 years old [± 1.68], between December 2009 and January 2012.

* Corresponding author.
E-mail address: thomas.thelen@chu-bordeaux.fr (T. Thelen).

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### Table 1
Distribution of fractures according to the Marion and Faysse classification.

<table>
<thead>
<tr>
<th>Type</th>
<th>Stage I: undisplaced</th>
<th>Stage II: displaced</th>
<th>Stage III: impacted</th>
<th>Stage IV: elbow dislocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Group B</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

Fig. 1. Target area for anchor implantation (target).

Fig. 2. Pathway of the awl (AP X-ray).

Fig. 3. Pathway of the awl (lateral X-ray).

Fig. 4. Implantation of the Mitek® anchor.

through the bone in the epicondyle fragment (Fig. 5). The fragment was positioned for anatomical reduction. The sutures were firmly knotted when this was achieved (Fig. 6). There was no periosteal suture.

Surgery lasted a mean 43.8 minutes (23–81) in group B and 46.7 minutes (28–80) in group A. There was never more than slight bleeding (less than 100 cm³). No intraoperative complications were observed.

AP and lateral radiographs of the elbow were obtained (Figs. 7 and 8).

Postoperative management included immobilization in a plaster cast for 6 weeks. There was no rehabilitation after the cast was removed.

All patients were seen 6 weeks and 3 months after surgery by a surgeon who had not performed the operation. The divergent K-wires were removed after a mean 3.6 ± 0.4 months in group B.

The mean follow-up at the final consultation was 18.6 months (± 5.0). The clinical evaluation included: pain (Visual analog scale [VAS] adapted to children), articular range of motion, return or not to sports, search for instability.

The radiographic assessment was based on X-rays of the elbow: AP in extension and a lateral view in 90° flexion. These views
made it possible to evaluate the presence or not of non-union, hypertrophic bone formation across from the medial epicondyle (classified as 1: absence; 2: observed but with no clinical consequences; 3: observed with clinical consequences), or periarticular calcifications.

The statistical analysis was performed with SPSS IBM software (version 20; SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Clinical results

3.1.1. At 3 months

The results are presented in Table 2. We did not find any significant difference between the two groups ($P > 0.05$).

3.1.2. At the final follow-up

The results observed at the final 18.6-month follow-up are presented in Table 3. There was no difference found in flexion-extension between the 2 groups; on the other hand, the difference in pronation-supination was significant.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Clinical characteristics of Groups A and B at postoperative month 3.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
</tr>
<tr>
<td>Flexion</td>
<td>115.0 [100–140]</td>
</tr>
<tr>
<td>Extension deficit</td>
<td>23.6 [0–60]</td>
</tr>
<tr>
<td>Pain</td>
<td>0.29 [0–3]</td>
</tr>
<tr>
<td>Instability</td>
<td>2/21 (9.5%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Clinical characteristics of Groups A and B at the final follow-up.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
</tr>
<tr>
<td>Flexion</td>
<td>138.3 [135–140]</td>
</tr>
<tr>
<td>Extension deficit</td>
<td>2.6 [0–10]</td>
</tr>
<tr>
<td>Pronation</td>
<td>85 [80–90]</td>
</tr>
<tr>
<td>Supination</td>
<td>86 [80–90]</td>
</tr>
<tr>
<td>Pain</td>
<td>0.08 [0–1]</td>
</tr>
<tr>
<td>Hypertrophy</td>
<td>12/21 (4.7%)</td>
</tr>
<tr>
<td>Instability</td>
<td>1/21 (4.7%)</td>
</tr>
</tbody>
</table>
We did not observe any postoperative complications such as pain or instability. Immobilization was well tolerated in all cases. All patients returned to their previous level of sports.

3.2. Radiographic results

At the final follow-up union was obtained in both groups.

A hypertrophic scar with no clinical consequences was identified in 12 cases (57%) in group A and 11 cases (58%) in group B.

There were no periarticular calcifications.

4. Discussion

This study confirms that suture anchors of the medial epicondyle are a reliable technique and that the results are equivalent to those of the reference internal fixation technique.

The strong points of our study are the original technique, the intervention of two different surgeons in the protocol, and the mean duration of follow-up (18.6 months).

The limits to our study were the retrospective design of the series and the small size of the study population.

We obtained a rate of union of 100%, like in the literature [4]. These results are much better than those of non-surgical management (non-union in up to 60%) [1,5].

The difference observed in pronation-supination between the two groups is not easy to explain, even if disturbance from the hardware is the probable reason. Indeed, wires were removed after a mean 3.6 months in group B.

Immobilization lasted 6 weeks and could have been reduced to 4 weeks [4], which would have significantly changed the results.

The most frequent postoperative complication in our series was the presence of a hypertrophic scar which, like in the literature [6,7], had no functional consequences.

Certain authors recommend conservative treatment for medial epicondyle fractures to limit the complications associated with hardware removal [8]. This technique makes it possible to avoid this drawback.

5. Conclusion

Bone suture anchors are a feasible technique in clinical practice with results that are equivalent to those of conventional techniques. It is not necessary to remove hardware. This is an obvious advantage for cost and morbidity.

A learning curve is necessary and this surgical technique must be rigorously performed.

Disclosure of interest

The authors declare that they have no competing interest.

References