



## Sesamoid arthrodesis for moderate metacarpophalangeal hyperextension associated with trapeziometacarpal osteoarthritis treated by total arthroplasty

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**A total of 32 (12.5%) thumbs were treated with trapeziometacarpal osteoarthritis and moderate metacarpophalangeal hyperextension (30°-50°), placing the Arpe® implant and sesamoid arthrodesis of the metacarpophalangeal joint in the metacarpal bone head.**

**In 28 patients were treated with radial sesamoid arthrodesis at the metacarpal head and 4 patients with ulnar sesamoid arthrodesis.**

**All patients were functionally stable at final follow-up, with a correction of the hyperextension deformity, although 2 patients with ulnar sesamoid arthrodesis had a new surgical procedure due to reproduction of the metacarpophalangeal hyperextension deformity. The mean pinch strength increased significantly. The preoperative VAS score was 6.7 and the postoperative was 1.4. The preoperative DASH score was 51.8 and in the last review it was 12.6.**

**The purpose of the study is to evaluate the results of the sesamoid arthrodesis as a treatment of moderate (30°-50°) metacarpophalangeal hyperextension in patients undergoing type Arpe® total trapeziometacarpal arthroplasty.**

**Keywords:** Thumb metacarpophalangeal joint ; total arthroplasty ; hyperextension.

### INTRODUCTION

The natural history of carpometacarpal osteoarthritis (CMC OA) influences the neighboring joints and mainly the metacarpophalangeal joint (MCP) (5,17,18).

The preoperative incidence of MCP joint hyperextension of over 30° associated with CMC OA have been referred in some studies of patients treated with trapeziectomy as an 18% (2,11).

The experience with the Arpe® in thumb CMC joint replacement has been good with a 10-year

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survival rate for implants that remain functional at 93.9% (8). If there is a concomitant hyperextension of the MCP joint, it should be treated while placing the prosthesis to achieve a good outcome of the total CMC arthroplasty in the future (6,20). There are few publications on the treatment of MCP joint hyperextension in patients with previous CMC OA treated with prosthesis (14).

However, there are multiple treatments of the MCP joint of the thumb published for different causes, such as post-trauma, rheumatic diseases and degeneration as a side effect of CMC osteoarthritis:

Davis and Poulter reported that temporary fixation of the MCP joint in deformities of less than 30° did not improve MCP hyperextension deformity; (14) Kessler performed a tenotomy of the extensor pollicis brevis at its musculoskeletal junction, passing it around the MCP joint in the volar direction and crossing the neck of the metacarpus as tenodesis; (6) Tonkin described sesamoid arthrodesis; (22) Norris et al described a volar tenodesis of the MCP joint of the thumb using a free graft of palmaris longus. It passes in the volar direction to the flexor tendon and crosses the proximal phalanx and the metacarpus; (12) Eaton, Floyd and Schuurman described a volar capsulodesis (3,20). Multiple authors recommended MCP arthrodesis when the hyperextension is over 40° (7).

In this study, we try to expose the management of moderate hyperextension of the MCP joint (30°-50°) in patients undergoing total Arpe® type CMC arthroplasty.

## MATERIALS AND METHODS

In 1999 we started a prospective cohort study of patients with CMC OA treated with total type Arpe® arthroplasty. Thirty-two patients with a concomitant moderate hyperextension of MCP joint (30°-50°) were treated between 2004 and 2012.

The inclusion criteria of the study were patients that had undergone total thumb CMC joint arthroplasty for osteoarthritis of this joint with Arpe® implant and had moderate hyperextension of MCP joint (30°-50°), without CMC OA, which had been treated by arthrodesis between the sesamoid bone and the metacarpal head.

The surgical technique chosen to treat the hyperextension of the MCP joint was the arthrodesis of the radial sesamoid to the metacarpal head, in line with Tonkin's technique (22). We place the Arpe® prosthesis at the CMC joint by a dorsal approach as has been described previously (8). Then we approach the MCP by the radial side in the union between the dorsal and volar skin with a curved incision of about 3 cm centred at the MCP joint level. The volar plate was mobilized along with the sesamoid by dividing the accessory collateral ligament at its insertion into the edge of the volar plate and advancing the volar plate proximally. The articular surface of the sesamoid was denuded of cartilage. A defect was created in the head-neck junction of the metacarpal, slightly larger than the size of the sesamoid bone. The sesamoid was held in the defect created by passing a suture from the volar aspect through two holes in the sesamoid-volar plate complex and the metacarpal neck. To provide more precise control of entry point, two free straight needles were loaded separately into a Kirschner wire driver and used to pass the 3/0 Prolene suture through the sesamoid-volar plate complex and metacarpus. The interosseous suture was tied over the metacarpus under the extensor tendons as a permanent suture. Prior to securing the sesamoid-metacarpal suture, a fine Kirschner wire was inserted across the MCP joint to maintain it at 30° of flexion. The sesamoid was further secured by suturing the proximal radial edge of the palmar plate to metacarpal periosteum and to aponeurotic fibers of the insertion of abductor pollicis brevis. A plaster spica protects the MCP joint and allows motion of the interphalangeal joint. The Kirshner wire and plaster are removed at 5 weeks when active flexion is allowed. (Figure 1).

Clinical and radiological assessments were made preoperatively, at 3 months and at the last revision. Clinical examination consisted of the range of motion evaluation using the criteria of the International Federation of Societies for Surgery of the Hand (5). Pinch strength was measured using the B&L Engineering mechanical pinch gauge (Alimed Inc, Dedham, MA). Pain was measured using a visual analogue scale (VAS) and patient satisfaction was measured using the DASH (disabilities of the



**Fig 1.** — Checking of arthrodesis in surgery

arm, shoulder, and hand) questionnaire adapted to Spanish version (16).

Continuous variables were assessed by using the mean and standard deviation (SD) or median and range of the data. Statistical analysis and determination of statistical significance ( $P < 0.05$ ) were performed by using the SPSS package (SPSS Inc., Chicago, IL).

The study was approved by the hospital ethics committee. Informed consent was obtained from the patients participating in the study.

## RESULTS

In the period between 2004 and 2012 a total of 256 thumbs with CMC OA were treated by placing Arpe® implant. Thirty-two (12.5%) presented moderate concomitant hyperextension of the MCP joint (30°-50°). In 20 patients, the operation was performed at the same time as the prosthesis was placed, and in eight patients it was performed later, one to five years after the prosthesis placement.

Thirty women (93.7%) and 2 men (6.3%) were analysed with an average age at surgery of 60.1 years (range 55-67 years); all of them had a Eaton-Littler grade II/III CMC OA.

The MCP hyperextension averaged 37.5° (30°-50°). Four patients had moderate ulnar laxity associated with MCP hyperextension (12.5%). The mean follow-up time was 8.68 years (range 5-13 years).

Twenty-eight patients (87.5%) were treated with radial sesamoid arthrodesis at the metacarpal head and 4 patients (12.5%) with ulnar sesamoid

arthrodesis due to MCP hyperextension, and associated instability in the frontal plane (ulnar collateral ligament laxity).

All of the 28 patients who underwent arthrodesis of the radial sesamoid were functionally stable (Figure 2) at final follow-up.

Two of the four patients who underwent ulnar sesamoid arthrodesis presented a recurrence of the MCP hyperextension deformity greater than 30°, which was considered a failure. In these two patients new surgical procedure was performed, associating an arthrodesis of the radial sesamoid to the previous arthrodesis.

Table I compares the ranges of movement preoperatively, early postoperative and in the last revision ( $p<0.001$ ). It is observed that the average preoperative flexion score decreased in comparison with the postoperative; also it is seen that with time some correction obtained in the early postoperative

**Table I.** — Ranges of movement preoperatively and in the last revision

Range of Motion	Preoperative	Postoperative 3 months	Last follow up
Flexion	43.1° (25°-65°) SD 11.12	33.9° (20°-55°) SD 9.89	39.8° (25°-55°) SD 8.17
Extension	37.5° (30°-50°) SD 6.35	3.9° (0°-10°) SD 4.16	12.8° (5°-20°) SD 5.81
Kapandji Opposition	7.4 (9-6) SD 0.7	8.1(9-7) SD 0.53	8.3 (9-7) SD 0.52



**Fig 2.** — Checking of arthrodesis in surgery

was lost. Therefore with time there is a slight loss of the correction of the MCP joint hyperextension.

The mean pinch strength significantly increased from 3.6 kg (range 2.5-4.5 kg and standard deviation (SD) 0.61) in the preoperative to 4.8 kg (range 3-5.5 kg and SD 0.76) in the last revision ( $p<0.001$ ). The preoperative VAS score was 6.75 (range 6-9 and SD 0.80) and postoperative VAS score was 1.43 (range 0-3 and SD 0.98) ( $p<0.001$ ). The preoperative DASH score was 51.8 (range 32-91.2 and SD 14.43) and in the last revision the DASH score was 11.8 (range 2.1-29.3 and SD 7.6) ( $p>0.001$ ).

Four patients complained of pain and dorsal tenderness due to suture intolerance and the suture had to be removed. For that reason the knot of the suture now is hidden in the volar-radial area.

## DISCUSSION

Multiple studies have shown that there is variability in the flexion-extension movement range among the normal population. This is due to differences in the shape of the metacarpal head, capsular laxity or both (15). This explains the presence of MCP hyperextension around 20° in 2/3 of normal individuals (4).

The preoperative incidence of MCP joint hyperextension of over 30° associated with CMC OA have been referred in some studies of patients treated with trapeziectomy as an 18% (2,11). In our study the incidence of MCP hyperextension between 30° and 50° associated with CMC OA treated by Arpe® implant was 12.5%. In cases

of CMC OA, non-reducible MCP hyperextension or severe medial instability, the only solution to solve the MCP joint disease would be arthrodesis, which is a contraindication related to the placement of a total arthroplasty, because it favours the overload of the prosthesis, and thus, increase the risk of components loosening and dislocation; In these cases, it is preferable to treat CMC OA by trapeziectomy associated or not to ligament reconstruction and tendon interposition. In our experience with Arpe® arthroplasty in the treatment of CMC OA (8,9) the great importance of treating the MCP joint hyperextension was observed to obtain an optimal result.

When the MCP hyperextension is slight, which means that it does not exceed 30°, it is generally corrected when performing the arthroplasty, since as the thumb gains length, the joint is balanced. A simple surgical gesture such as suturing the abductor pollicis longus more dorsal at the base of the metacarpal when we close the capsule may help balance. Because in our experience, the temporary MCP fixation with a Kirshner wire in 30° flexion does not improve MCP hyperextension deformity.(14).

Another gesture may be the special placement of the prosthetic components when there is MCP hyperextension; the good alignment of the metacarpal stem (avoiding obliquity in any of planes) and correct orientation of the cup with 10° to 15° of dorsal inclination will avoid subluxation when thumb makes forced lateral clamps, which could cause MCP hyperextension.

The moderate passively or dynamic hyperextension of the MCP (between 30° and 50°) when performing the grasp must be treated by arthrodesis of the radial sesamoid to the metacarpal head according to the Tonkin Technique: (22). This intervention is relatively simple, only adds a few more minutes to surgery, and prevents MCP hyperextension. The patients treated by radial sesamoid arthrodesis present a good clinical and functional result with a hyperextension deformity correction and a low decrease in degrees of MCP flexion that does not influences the functionality, as had been published yet by Tonkin (22).

Some of our patients that have been operated on CMC prostheses, and who have not been treated MCP joint, presented afterwards a moderate hyperextension (30°-50°) of this joint, perhaps because it was present before de operation and we trust on its correction with the prosthesis or perhaps it has been developed with evolution. In these cases we have performed the same technique at the moment we have detected it, obtaining the same results as when we did it from the beginning. However, in our opinion, the MCP joint should be accurately evaluated in the preoperative period to perform the hyperextension correction at the same time as the prosthesis is placed.

The use of a permanent suture is not discussed. However, in four cases the suture was removed due to pain in the dorsal area caused by the knot rubbing; so now the suture knot is hidden in the volar area. Another problem with the technique is when the sesamoid is anatomically distal positioned, and difficult to carry it to the junction between the neck and the metacarpal head. In these cases we have chosen to make the hole in the part of the head that is near the neck. The results did not change except for a slight increase in the reduction of postoperative MCP flexion.

We have observed that over time there is some loosening of the hyperextension correction (Table I), without altering the functionality of the MCP joint or the implant, and not as important as Miller and Davis reported (11).

In case of ulnar laxity associated to MCP hyperextension we have not had good results with the arthrodesis of the ulnar sesamoid neither in the

ulnar laxity nor in the hyperextension, with 50% of relapses. The same experience has been reported by Tonkin (22), advising the ligamentoplasty with palmaris brevis in the ulnar side and the radial sesamoid arthrodesis.

In patients with severe ulnar laxity, severe MCP hyperextension (> 50°) or MCP OA, the only solution would be the MCP arthrodesis, which we usually perform with cannulated screws after the articular surfaces preparation according to the ball and socket technique (7,10,19). Theoretically, MCP arthrodesis is relatively contraindicated when there is CMC prosthesis because it overloads the prosthesis (21). However, we performed an MCP arthrodesis in 2 patients (not included in this series) obtaining good results of functionality, without loosening five years after arthrodesis.

Summarizing, the arthrodesis of the radial sesamoid and the metacarpal head is a good technique for the treatment of moderate MCP hyperextension concomitant with CMC OA and must be performed simultaneously with the CMC total arthroplasty.

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