

# Distraction Arthroplasty for Basal Thumb Osteoarthritis: 10-Year Follow-Up

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**Purpose** Trapeziectomy has frequently been used to treat basal thumb osteoarthritis. However, complications, such as shortening of the thumb ray and reduced mobility and strength, can occur. The aim of this study was to present a 10-year follow-up of distraction arthroplasty without trapeziectomy.

**Methods** Fifteen patients were followed for a mean of 121 months (range, 121–124 months). Subjective outcomes were evaluated with the Disabilities of the Arm, Shoulder, and Hand questionnaire, while the pain intensity was assessed with a Visual Analog Scale both before surgery and at the end of follow-up. Objective outcomes were obtained using the Kapandji score and an assessment of grip and pinch strength. Preoperative and final postoperative x-rays were obtained to evaluate metacarpal subsidence and progression of trapezium-metacarpal joint arthritis.

**Results** The Visual Analog Scale score was reduced from  $9.4 \pm 0.5$  before surgery to  $2.5 \pm 1$  at follow-up. The mean Disabilities of the Arm, Shoulder, and Hand questionnaire score was  $75.6 \pm 12.6$  before surgery and  $16.9 \pm 4$  at 10 years. Hand grip strength of the operated side ( $26 \pm 5.5$  kg) achieved 95% of functionality compared to the opposite side, while key pinch strength ( $6.4 \pm 1.6$  kg) reached 93%. A Kapandji opposition score of 10 points was found in 12 patients, a score of 9 was found in 1, and a score of 8 was found in 2.

**Conclusions** Distraction arthroplasty of the trapeziometacarpal joint ensures good results in long-term follow-up, when performed in patients with stage I–II basal thumb osteoarthritis. (*J Hand Surg Am.* 2023;48(8):796–802. Copyright © 2023 by the American Society for Surgery of the Hand. All rights reserved.)

**Type of study/level of evidence** Therapeutic IV.

**Key words** Basal thumb osteoarthritis, distraction arthroplasty, rizoarthrosis, trapeziometacarpal joint.

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THE SADDLE-SHAPED ANATOMY of the trapeziometacarpal (TM) joint makes it susceptible to osteoarthritis and degenerative changes.<sup>1,2</sup> For decades, trapeziometacarpal osteoarthritis (TMO) has been surgically treated with a trapeziectomy, which for many years has been considered the gold-standard treatment for this pathology.<sup>3</sup> In recent years, the management of TMO has greatly developed with the introduction of new surgical techniques and materials. Several osteotomies, denervation techniques, suspensionplasty with autologous tendon or artificial tape, interposition

material (biological and artificial), and total joint arthroplasty were reported in the literature with promising results.<sup>4–22</sup> However, trapeziectomy can lead to shortening of the first ray, metacarpophalangeal hyperextension, and decreased thumb movement and strength.

In 2007, the senior authors described the TM distraction arthroplasty, which did not require trapeziectomy.<sup>23</sup> During the first phases of basal thumb osteoarthritis, patients can experience painful instability of the trapeziometacarpal joint with reducible subluxation. The TM distraction arthroplasty is recommended for the initial stages of osteoarthritis because it preserves the trapezium, eliminates subluxation, and reduces crepitus between the metacarpal (MC) and trapezium. Its purpose is to reduce surgical and postoperative recovery times by maintaining length and stability of the base of the first MC. This study reports a 10-year follow-up of patients affected by TMO and treated with TM distraction arthroplasty.

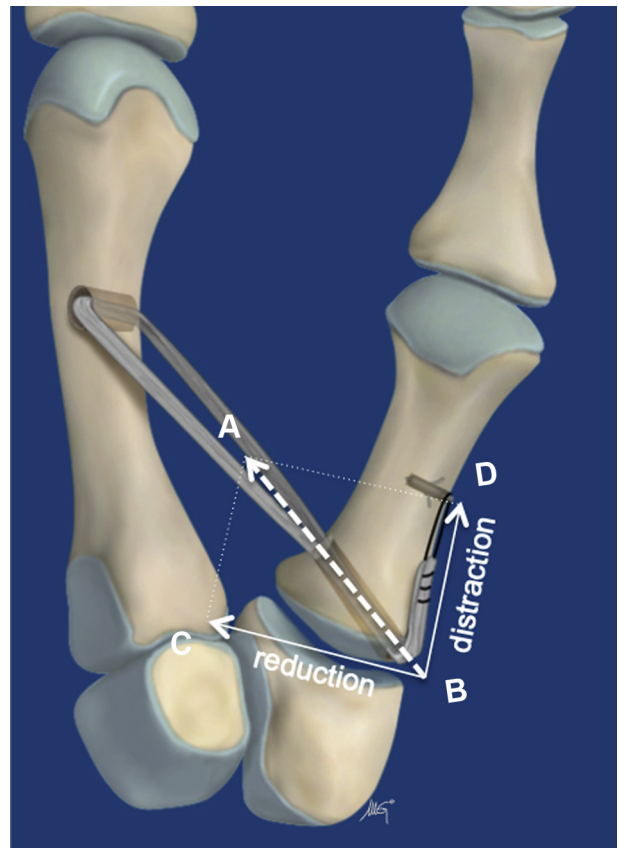
## MATERIALS AND METHODS

Fifteen distraction arthroplasties were performed in 15 patients—9 women and 6 men—with TMO at stages I–II of the Eaton-Littler classification following unsuccessful nonsurgical therapy (orthosis, occupational therapy, and steroid joint injection) between 2007 and 2011.<sup>7</sup> All patients reported severe pain and difficulty with daily activities before surgery. The mean age at surgery was 64 years (range, 55–83 years). The dominant hand was operated in 11 cases (9 right-handed). The follow-up was an average of 121 months (range, 121–124 months).

Indications for distraction arthroplasty include reducible subluxation of the TM joint with mild to moderate radiographic signs of osteoarthritis and no or minimal signs of periarticular disease. The procedure is not recommended for carpal stiffness and severe TMO. Its parameters extend from stages I–II of the Eaton-Littler classification and stages 1–2 of the Dell classification.<sup>7,8</sup> Distraction arthroplasty indications are confirmed when, at fluoroscopic examination, subluxation of the TM articulation can be reduced by longitudinal traction of the thumb and medial-to-lateral pressure at the base of the first MC.

### Surgical technique

A dorsal incision and capsulotomy expose the TM joint.<sup>23</sup> At that point; a 5-mm oblique bone tunnel is drilled from the dorsoradial part of the base of the MC to the ulnar side, at the level of the proximal metaphysis. Through a second incision at the level



**FIGURE 1:** The biomechanical effect of distraction arthroplasty. Vectors of reduction and distraction work together to stabilize and distract the TM joint; the force applied to the A–B tendon graft is divided according to the law of parallelograms, a B–C vector that reduces subluxation and stabilizes the trapeziometacarpal joint, including the B–D vector that reduces axial load.

of the middle third of the diaphysis of second MC, a 3.5-mm bone tunnel is made in a slightly oblique direction, toward the first hole. Correct positioning of the tunnels is conducted under fluoroscopic control. A palmaris longus tendon graft is inserted (with the aid of an arthroscopic meniscal grasper) in the transosseous tunnel of the second MC, while the 2 ends of the graft are passed through the first MC tunnel. The graft is pulled out with tension, angled along the first MC, and sutured to it with capsular and periosteal stitches or with transosseous sutures or anchors (Fig 1). Distraction and reduction of subluxation are checked under fluoroscopy. A synovectomy and a periarticular osteophyte debridement are carried out on the dorsoradial side of the TM joint. After wound closure, a compression bandage is applied, with a cast from the distal third of the forearm to the interphalangeal joint of the thumb.

**TABLE 1. Patient Demographics and Measurements at 10 Years of Follow-Up**

Patient	Age (y)	Sex	Initial Eaton-Littler Stage	Radiologic Progression at Follow-Up	Grip Strength, kg	Key Pinch, kg	Kapandji	Grind Test	VAS Pain
1	58	M	II	No progression	25	8	9	Negative	2
2	55	M	II	No progression	24	8.5	10	Negative	1.5
3	59	F	I	No progression	20	6	10	Negative	2.5
4	61	M	I	Progression — stage II	27.5	9	10	Negative	3
5	69	F	II	No progression	18	6	10	Positive	3
6	68	F	I	No progression	24	5	10	Negative	2.5
7	61	F	II	No progression	24	6	10	Negative	2
8	83	F	II	Progression — stage II	18	4	9	Positive	3.5
9	71	F	II	No progression	27	5	10	Negative	2
10	64	M	II	No progression	34	8	10	Negative	2.5
11	55	F	I	No progression	24	5.5	10	Negative	3
12	68	F	I	No progression	26	5	10	Positive	3
13	65	M	II	No progression	37.5	8.5	10	Negative	2
14	62	F	I	Progression — stage II	29	5	8	Positive	3
15	62	M	II	No progression	32.5	7	10	Negative	2

VAS, Visual Analog Scale.

### Postoperative management

After 5 days, the plaster orthosis is removed and changed to a thermoplastic orthosis. The patient is followed by a therapist and may take the orthosis off at least twice a day to perform gentle active exercise, without loading the thumb for the first 6 weeks. Contact sports are not recommended for 3 months.

### Follow-up

Patients were clinically examined and interviewed in detail about complaints and function. The pain intensity was assessed with a 10-point Visual Analog Scale score (0 points indicates no pain and 10 points indicates unbearable pain). Patients filled out the Disabilities of the Arm, Shoulder, and Hand questionnaire before surgery, as well as after follow-up. Thumb mobility was measured with the Kapandji score, with pain assessed through the grind test.<sup>24</sup>

Grip strength measurements were also done via a comparison to the contralateral side with the Jamar Hydraulic Hand dynamometer (Patterson Medical) and a pinch dynamometer, taking into account limb dominance in all right-handed individuals. In addition, we did a radiological evaluation of the thumb TM joint. We used x-rays in the anteroposterior and oblique projection before and after surgery and at the end of follow-up to check the positions of the first and second MC bones.

The described procedures are in accordance with the ethical standards of the responsible human experimentation committee of the Sant'Andrea Hospital of Rome, Italy and the 1975 Declaration of Helsinki, revised in 2000 and 2008. A specific informed consent was signed by each patient in this study, based on the regulations of the ethics committee.

## RESULTS

### Clinical findings

The Visual Analog Scale score was reduced from  $9.4 \pm 0.5$  before surgery to  $2.5 \pm 1$  at follow-up. The mean Disabilities of the Arm, Shoulder, and Hand questionnaire score changed from  $75.6 \pm 12.6$  before surgery to  $16.9 \pm 4$  at 10 years. Hand grip strength of the operated side ( $26 \pm 5.5$  kg) was 95% of the opposite side; key pinch strength ( $6.4 \pm 1.6$  kg) reached 93%. The grind test was negative in 11 patients (73.3%), while in 4 patients it was positive (26.6%), with only 2 symptomatic patients (Table 1).

A Kapandji opposition score of 10 points was found in 12 patients, a score of 9 was found in 1, and a score of 8 was found in 2.

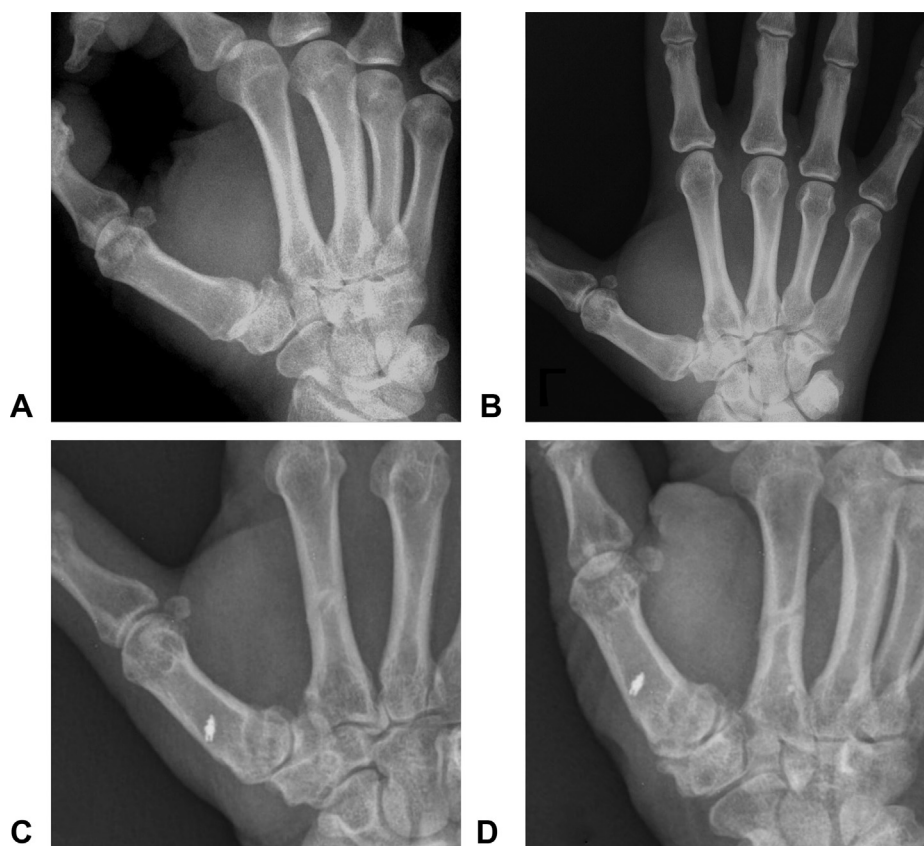
### Radiological findings

After a mean time of 10 years after surgery, 12 patients showed no signs of progression of osteoarthritis at the TM joint (Figs 2, 3). No further subluxation or subsidence were noted during radiographic follow-up.



**FIGURE 2:** **A, B** Preoperative x-rays of a 63-year-old woman. Stage II Eaton-Littler with thumb subluxation and a medial osteophyte < 2 mm. **C, D** Postoperative follow-up at 4 years. **E, F** Postoperative follow-up at 10 years without radiological evidence of TMO progression.





**FIGURE 3:** **A, B** Preoperative x-rays of a 58-year-old woman. Stage II Eaton-Littler with thumb subluxation and slight narrowing of the TM joint with sclerosis. **C, D** Postoperative follow-up at 10 years without radiological evidence of TMO progression, along with obvious reduction of subluxation.

Three patients (20%) had radiological progression of the disease (Eaton-Littler stages II–III).

### Complications

One patient sustained a second MC intraoperative fracture while drilling the tunnel (4.5 mm) in the second MC. The fracture was treated immediately with a 2-mm plate osteosynthesis, without evidence of long-term complications.

### DISCUSSION

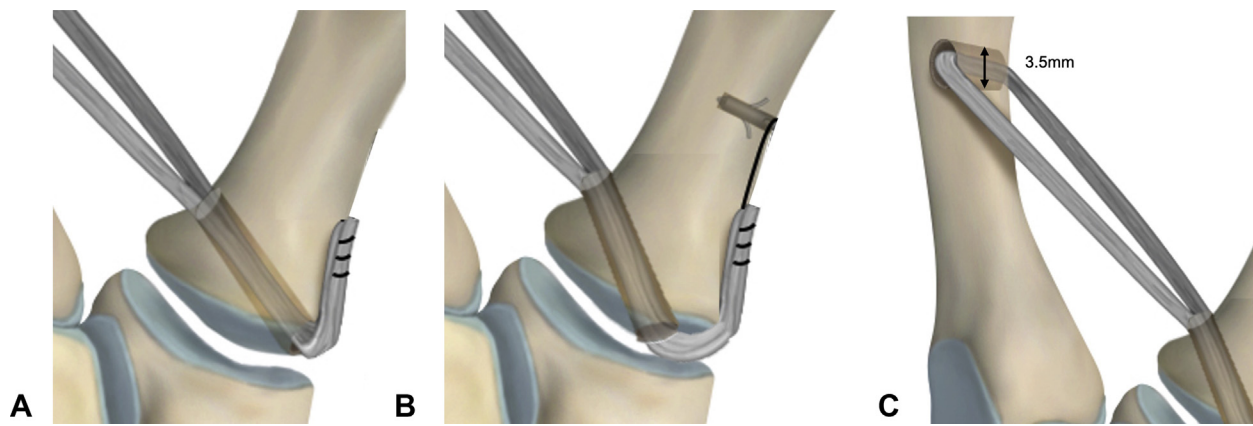
Trapeziometacarpal distraction arthroplasty, unlike other arthroplasties, preserves the trapezium and is, therefore, a less invasive technique. From the time of publication of this technique in 2007, there have been no reports about its long-term results.<sup>25–27</sup>

After a mean follow-up of 10 years, no long-term complications occurred, with 1 intraoperative complication treated during the same surgery resulting in a satisfactory outcome.

The tendon graft suspends the base of the first MC bone, while not limiting its mobility. At the same time, it reduces crepitus during movements at

the base of the first MC bone on the trapezium, decreasing pain. The distraction arthroplasty is not a simple stabilization or ligamentous reconstruction of the TM joint because it acts on the functional anatomy of the joints, reducing subluxation and stabilizing the base of the first MC. It decreases the functional stress on the TM joint, which is distracted and hinged to the second MC bone. This procedure acts on the joint with the interposition of tendon tissues at the trapezium wear point. Synovectomy and debridement contribute to restoration of the joint.

In the last 2 decades, joint distraction was proposed to treat osteoarthritis.<sup>28,29</sup> Ottenhoff et al<sup>30</sup> reported good clinical results in 20 patients treated with 8 weeks of TM joint distraction with an external fixator. Two years after joint distraction, physical function and pain scores had improved significantly compared to baseline in 14 of 19 patients ( $P < .001$ ). Trapeziometacarpal joint distraction with the present technique does not have the same strength as an external fixator, so tension on the graft may progressively decrease, but the clinical benefits seem to



**FIGURE 4:** **A** Original direction of the tunnel at the base of the first MC. **B** Intra-articular placement of the first MC tunnel, with optional use of an anchor for the graft suture. **C** Change in tunnel size from 4.5 mm to 3.5 mm.

persist in patients over time, even with a tendon distraction.

Over the last years, the authors tried to improve this technique to achieve a better outcome: the tunnel diameter was decreased from 4.5 mm to 3.5 mm to reduce the risk of intraoperative fractures, and the direction of the tunnel in the first MC was also changed by drilling an intra-articular hole so the tendon graft inside the joint could also cushion crepitus and preserve cartilage. The first MC tunnel is made with the thumb in adduction, with the entry point in the midline of the lateral articular surface of the base of the first MC (Fig 4). Only 6 patients in the present study received the new tunnel placement at the base of the first MC.

The most crucial consideration is the surgical indication: it should be performed in the early and mild TMO states (Eaton-Littler stages I–II). Because of a minimally invasive surgical incision, a notable problem is managing the medial osteophyte.

This study is limited by its retrospective nature and small number of patients. The small sample and the lack of a control group do not allow comparison of this technique with other procedures. The information obtained from this small series is valuable because it shows promising long-term results with a technique that has distraction, joint interposition, and subluxation reduction of the first MC as its key concepts. The authors advise performing the distraction arthroplasty without trapeziectomy in patients with basal thumb osteoarthritis, in stages I–II of the Eaton-Littler classification. The results are satisfactory regarding pain reduction, strength preservation, and maintenance of the thumb range of motion. It is inevitable that some patients will be subjected to revision procedures over time for the

progression of osteoarthritis. However, other surgical options will always remain possible.

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