Partial arthroscopic trapeziectomy with ligament reconstruction to treat primary thumb basal joint osteoarthritis

P. Desmoineaux*, C. Delaroche, P. Beauflis

Versailles Hospital Centre, Versailles Saint-Quentin University, 177, rue de Versailles, 78157 Le Chesnay cedex, France

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Summary Since the outcome of partial trapeziectomy is not always satisfactory, we proposed using arthroscopy to perform partial trapeziectomy and to perform ligament reconstruction with the abductor pollicis longus tendon. A tendon strip was left intact at its insertion at the base of the first metacarpal and then slipped into the trapeziectomy space. It was fixed into a blind tunnel at the base of the second metacarpal with a bioabsorbable interference screw. Forty-nine patients were surgically treated between 2006 and 2009. With an average follow-up of 3.6 years, 83.5% of patients were satisfied with the procedure; 96% of thumbs were stable and 74% were pain free. The average recovery time was 4.5 months. There were four cases of radial nerve branch irritation and one case of flexor carpi radialis tendinitis; there were no cases of complex regional pain syndrome. This minimally-invasive technique is a less-aggressive treatment approach for thumb carpometacarpal joint arthritis, which simplify postoperative recovery.

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Introduction

Partial trapeziectomy with open ligament reconstruction is an effective treatment for thumb carpometacarpal (CMC) joint arthritis [1,2].

Because of reported complications such as injury to the terminal branch of the radial nerve, collapse of the thumb column, lack of strength and complex regional pain syndrome (CRPS) [3], arthroscopic techniques have been developed [4,5].

An anatomic study on 14 thumbs showed that good partial resection of the trapezium was possible with arthroscopy [6]. In our series of 35 partial arthroscopic trapeziectomy without ligament reconstruction between December 2002 and January 2006, the strength, range of motion and pain outcomes were satisfactory after 4.5 months. However, 18% of patients considered their thumb as unstable. We wanted to improve on these partial trapeziectomy results by adding ligament reconstruction with a strip of abductor pollicis...
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Figure 1  Intraoperative location of portals and saline distension of joint.

In order to create a "suspensionplasty" and to reconstruct the intermetacarpal ligament.

Surgical technique

This was an outpatient procedure performed under regional anaesthesia. The patient was placed in dorsal decubitus on a table with arm boards; a tourniquet cuff was used with a counter-support pad on the anterior side of the arm. Joint distraction was accomplished with a metal mesh finger trap on the two thumb phalanges and a traction tower at 2 kg.

The trapeziometacarpal joint was located by distal to proximal palpation then outlined; two vertical lines were also drawn parallel to the radial and ulnar side of the nail. Dorsoradial and dorso-ulnar approaches were made after needle placement and trapeziometacarpal joint distension with saline (Fig. 1). The procedure was done with a short barrel, 2.7 mm, 30° arthrooscope and a 3.5-mm reamer.

In the first step, the viewing portal was placed on the dorsoradial side. The joint surfaces were inspected (Fig. 2) and the reamer introduced in the dorso-ulnar portal (Fig. 3). The inferior face of the trapezium was resected by performing a remodelling arthroplasty and shaving down to subchondral bone. The grooves on the reamer (3.5 mm) were used to determine the depth of the resection needed (Fig. 4). The resection was subsequently performed to this depth. The goal was to resect the bone equally, without leaving a lateral or dorsal edge. Osteophytes and foreign bodies were removed. The base of the second metacarpal was exposed behind the pommel of the trapezium saddle (Fig. 5). The instruments were then reversed to finish the trapeziectomy on the lateral side and remove any potential lateral horn. After the bone was resected, a shaver was used through both portals to perform a synovectomy.

With a 2.5-mm drill bit in the dorsoradial portal, a 10-mm blind tunnel was made at the base of the second metacarpal, in the dorsal direction (Fig. 6). The required transplant length was determined by measuring the distance between the lateral edge of the trapezium and the base of the second metacarpal; the average length was 36 mm.

Traction was removed, and then a 7-mm incision was made over the first extensor compartment, 36 mm proximal from the dorsoradial portal.

The insertion of the abductor pollicis longus on the first metacarpal was located through the dorsoradial portal and a 3-mm strip was made using a dissector and cheese-wiring technique until the first compartment incision was reached, where it was then cut (Fig. 7). The tendon strip was recovered through the dorsoradial portal and laced up with three metric PDS suture (Fig. 8A). The length of the laced transplant was verified (Fig. 8B et C); the ideal situation is a
transplant that is 5 mm shorter than the measurement made by arthroscopy (Fig. 9).

Using a K-wire with eyelet (Fig. 10), the transplant was placed in the blind tunnel (Fig. 11–13) and fixed with a 8-mm long, 3 mm diameter bioabsorbable interference screw (Arthrex\textsuperscript{®}, Naples, USA) (Fig. 14). The thumb was positioned to open the first web and in slight antepulsion; traction was released.

The four incisions were then closed with adhesive skin closure strips. After the surgery, a bandage was applied; there was no additional immobilisation; self-rehabilitation with extension, first web opening and opposition movements was encouraged.

### Results

Between April 2006 and December 2009, 49 patients with an average age of 64 years underwent a partial arthroscopic trapeziectomy with ligament reconstruction procedure by a single surgeon. Based on the Eaton Glickel classification \cite{7}, two patients were at Stage 1, 11 at Stage 2, 22 at Stage 3 and 14 at Stage 4. There were no intraoperative complications.

Patients were seen again 3.6 years after the surgery on average for subjective, clinical and radiological evaluations \cite{8, 9}.

Four cases of sensory deficiency were noted on the dorsal side of the first web, with three of these patients having a positive tapping sign suggestive of neuroma. One patient presented with unexplained flexor carpi radialis tendinitis; the condition resolved. No cases of complex regional pain syndrome were observed. No additional surgical procedure was required. Eighty-three percent (83.5%) of patients were satisfied with the procedure; 96% of the thumbs were stable and 74% were pain free. The average recovery time was 4.5 months.

The average Quick DASH score was 15.84. Range of motion increased in opposition (preoperative Kapandji of 8; postoperative score of 9.6) and first web opening (preoperative M1-M2 angle of 44° with postoperative angle of 54°). Strength in grasping and key pinch was also better (13.04 kg vs. 19.34 kg and 4.41 kg vs. 5.56 kg, respectively).
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Discussion

Since no arthroscopic ligament reconstruction technique with partial trapeziectomy to treat thumb CMC arthritis had been described up to now, we wanted to demonstrate its feasibility.

For the partial trapeziectomy step, the main challenges are to completely remove medial osteophytes, the lateral horn and foreign bodies, and not leave a dorsolateral peripheral wall [6]. For the ligament reconstruction step, the challenges are to harvest a strip of abductor pollicis longus that is solidly inserted on M1 (multiple anatomical variations exist [10]) and to get a strip of the right diameter and length. This avoids problems with penetration and fixation into the blind tunnel and ensures the graft has appropriate tension and is centred. Osteoporosis can make tunnel fixation more fragile.

Figure 8  A–C. Lacing up the transplant and verifying length.

Figure 9  Diagram of the ligament reconstruction.

Figure 10  Introducing the K-wire with eyelet.
Despite the precautions taken when making the incisions, the radial nerve was persistently irritated in four of 49 cases [11]. Arthroscopy greatly reduces the risk of CRPS, a complication that is always present in open procedure studies [1—12].

Surgeons who advocate using arthroscopy to treat thumb CMC joint arthritis suggest adding either thermal capsular modification [13,14] or various interposition arthroplasty procedures [15—18] to the partial trapeziectomy.

Conclusion

Partial arthroscopic trapeziectomy with ligament reconstruction led to satisfactory functional results. It restores functional pinch movement and limits collapse of the thumb column. This is a reliable procedure with low morbidity. It should only be used in cases of isolated thumb CMC arthritis without scaphoid-trapezium joint degeneration.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References