

## ABDUCTOR POLLICIS LONGUS “HAMMOCK” LIGAMENTOPLASTY FOR TREATMENT OF FIRST CARPOMETACARPAL ARTHRITIS

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**The association of trapeziectomy with ligamentoplasty is a simple treatment for osteoarthritis at the base of the thumb. Here we present the long-term results of a technique that creates a “hammock” under the first metacarpal bone using the Abductor Pollicis Longus tendon. This paper reports the results of treatment by this operation of 60 thumbs in 50 patients, including 13 men and 37 women of average age 60 (46–75) years. Thirty thumbs presented with severe pain and 30 with moderate pain. At final follow-up, 47 thumbs (78%) had experienced dramatic relief of pain following the procedure, 12 (20%) thumbs still had mild pain and one (2%) thumb had severe pain. No patients needed revision.**

**Keywords:** trapeziectomy, osteoarthritis, first CMC joint, APL, ligamentoplasty

The surgical treatment most commonly used for osteoarthritis of the trapeziometacarpal joint is trapeziectomy, with or without tendon interposition or suspension ligamentoplasty.

Excision of the trapezium was first proposed by Gervis (1949), and this procedure alone has been widely used for this condition, with excellent initial relief of pain (Dhar et al., 1994; Gibbons et al., 1999; Varley et al., 1994). There has been concern that this procedure results in thumb weakness as a consequence of inevitable shortening of the thumb ray and may be complicated either by subluxation of the pseudoarthrosis between the base of the thumb metacarpal and the scaphoid or, in the long term, by painful osteoarthritis of this pseudoarthrosis (Conolly and Rath, 1993).

The main aim of tendon interposition (Amadio et al., 1982; Belcher and Nicholl, 2000; Damen et al., 1997; Dell and Muniz, 1987; Lucht et al., 1980; Menon et al., 1981) or suspension ligamentoplasty (Atroshi and Axelsson, 1997; Eaton et al., 1985; Kaarela and Raatikainen, 1999; Kleinman and Eckenrode, 1991; Nylen et al., 1993; Sirotakova et al., 2007; Tomaino et al., 1995) is to minimise shortening of the thumb ray after resection of the trapezium. A number of tendons have been used for the suspension ligamentoplasty, including Flexor Carpi Radialis, Extensor Carpi Radialis Longus and Abductor Pollicis Longus (Brunelli et al., 1989; Kaarela and Raatikainen, 1999; Rutegard et al., 1994; Saehle et al., 2002; Sigfusson and Lundborg, 1991; Sirotakova et al., 2007). Whether preservation of thumb length preserves thumb strength is debated as others have found no significant correlation between the

postoperative trapezial space and the overall degree of patient satisfaction, pain relief or improvement in the thumb function or strength (Belcher and Nicholl, 2000; Davis et al., 2004; Downing and Davis, 2001; Field and Buchanan, 2007).

We present the long-term results of our use of a new technique of trapeziectomy associated with ligamentoplasty using the Abductor Pollicis Longus tendon.

### PATIENTS AND METHODS

The study includes 60 hands in 50 patients (ten bilateral) suffering from osteoarthritis of the carpometacarpal joint of the thumb who were operated on by the same surgeon (C.M.) at our clinic between 1996 and 2001. All procedures were carried out as a day case under axillary block and tourniquet. The cases were graded pre-operatively into Grade 2 in 31 cases, Grade 3 in 26 cases and Grade 4 in three cases (Eaton and Littler, 1973). None of the patients had responded satisfactorily to conservative treatment with splinting, oral anti-inflammatory drugs and/or intraarticular steroid injections. This study comprised 37 women and 13 men of an average age of 60 (range 46–75) years. Thirty-nine operations were carried out on the right thumb and 21 on the left. Forty-one of the treated thumbs were on the dominant hand. Only 20 patients were retired at the time of the operation.

### Surgical technique

An incision of about 5 cm in length starting at the base of the dorsum of the thumb was extended longitudinally

across the anatomical snuff box to expose the Abductor Pollicis Longus and Extensor Pollicis Brevis tendons. The branches of the superficial radial nerve were carefully identified and retracted (Fig 1). After retracting the Abductor Pollicis Longus and Extensor Pollicis Brevis tendons on each side, the radial artery is seen. This is a helpful landmark because it lies directly over the scaphotrapezial joint. Small arteries arising from its deeper and distal surface and extending towards the trapezium were dissected and ligated or coagulated. The capsule overlying the trapezium was exposed and opened as an "H" shape and the trapezium excised from its soft tissue envelope piecemeal with a rongeur. The Flexor Carpi Radialis tendon was identified as it passes through a groove in the trapezium and preserved (Fig 2). The suspension by the "hammock" was created by the use of two of the, usually, three slips of the Abductor Pollicis Longus tendon. These were divided proximally, after release of the first extensor compartment, to create strips of distally based Abductor Pollicis Longus approximately 6 cm in length, attached to the base of the first metacarpal. Sometimes the Abductor Pollicis Longus has only one tendon and so it was necessary to divide this longitudinally into two equal parts (Fig 3). The principle of the ligamentoplasty was the suspension of the first metacarpal bone by a tendinous "hammock" that interposed itself in the space created by the trapeziectomy. To achieve this, each Abductor Pollicis Longus tendon slip was wrapped two or three times around the Flexor Carpi Radialis tendon (Fig 4). The Abductor Pollicis Longus tendon slips were then crossed for a last time and sutured to the base of the first metacarpal bone with an absorbable suture, creating a true "hammock" in which the base of the first metacarpal bone rests. The dorsal capsule over the trapezial space was closed without tension (Fig 5). The thumb was immobilised for 3 weeks in a plaster cast, after which active movement and use of the thumb were allowed.

### Assessment

An independent assessor reviewed the patients clinically pre-operatively and in the last follow-up at a mean of 48.4 (range 22–75) months after surgery.

A questionnaire was used to assess thumb pain pre-operatively and thumb pain, satisfaction with the procedure and time of return to normal daily activities on final review postoperatively. Pain was graded as severe, mild or no pain. The patients were asked whether they felt that the activities of daily living were improved, remained the same or worsened after the procedure, and when they returned to normal daily activities.

Clinical assessments included measurements of ranges of movement at the thumb interphalangeal and metacarpophalangeal joint using a goniometer, which was also used to measure web space abduction (palmar abduction in degrees). Opposition was assessed using the method proposed by Kapandji (1986). Grip strength and thumb pinch were measured using the same Jamar dynamometer (Jamar Technologies Inc., Clifton, NJ, USA) (in kg) throughout the study.

The presence of any complications or secondary interventions was also recorded.

Standard postoperative anteroposterior and oblique view X-rays were used to measure the distance from the distal scaphoid to the proximal end of the thumb metacarpal, and this was compared with the same measurement on the pre-operative X-ray.

### RESULTS

The average follow-up was 48.4 (range 22–75) months.

Thirty thumbs presented with severe pain and 30 with moderate pain. At final follow-up, 47 thumbs (78%) had experienced dramatic relief of pain following the procedure, 12 (20%) thumbs still had mild pain and one (2%) thumb had severe pain.

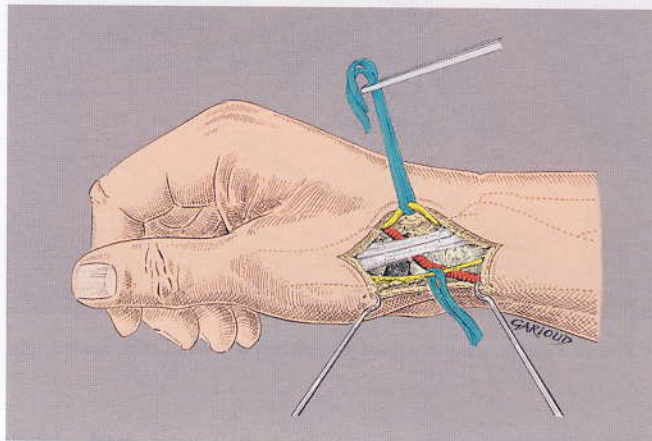


Fig 1 Diagram showing the branches of the superficial radial nerve and the radial artery deep to the Abductor Pollicis Longus and Extensor Pollicis Brevis.

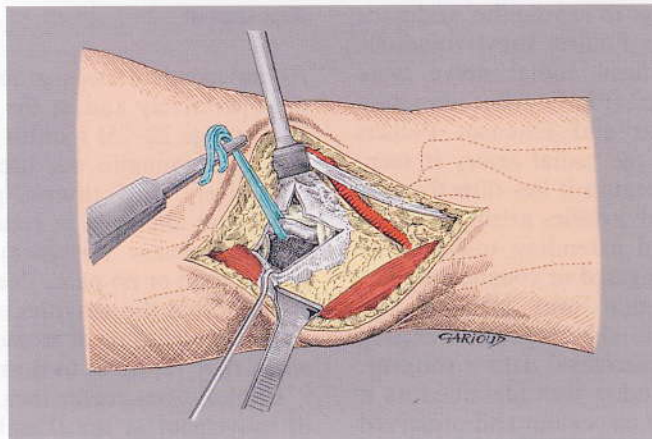


Fig 2 Diagram showing the Flexor Carpi Radialis tendon, which is seen at the bottom of the trapezium space after trapeziectomy.

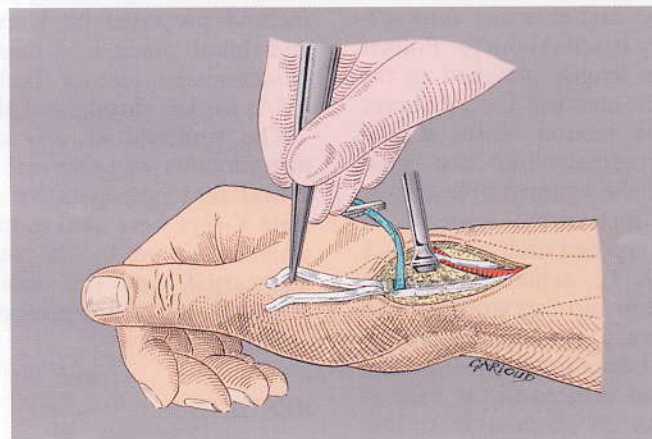


Fig 3 Diagram showing the technique of harvesting two distally based slips of the Abductor Pollicis Longus tendon.

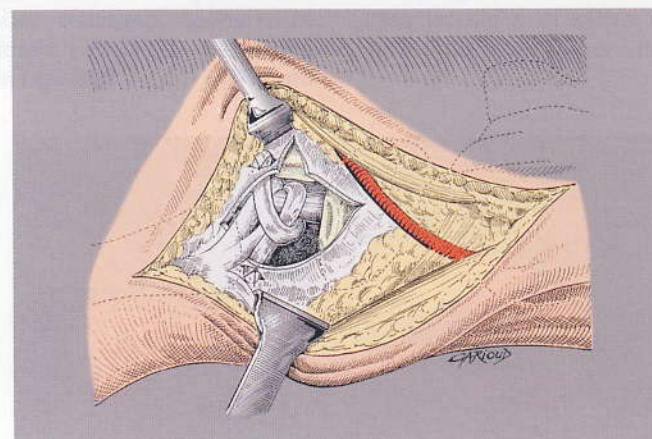


Fig 4 Diagram showing the Abductor Pollicis Longus tendon passed several times around the Flexor Carpi Radialis tendon crossing them from each side.

Subjectively, 57 cases (95%) felt that they had been improved, two cases (3%) felt that they did not benefit from the procedure and a single

patient, who had developed CRPS Type I (2%), felt that his condition had been worsened by the procedure.

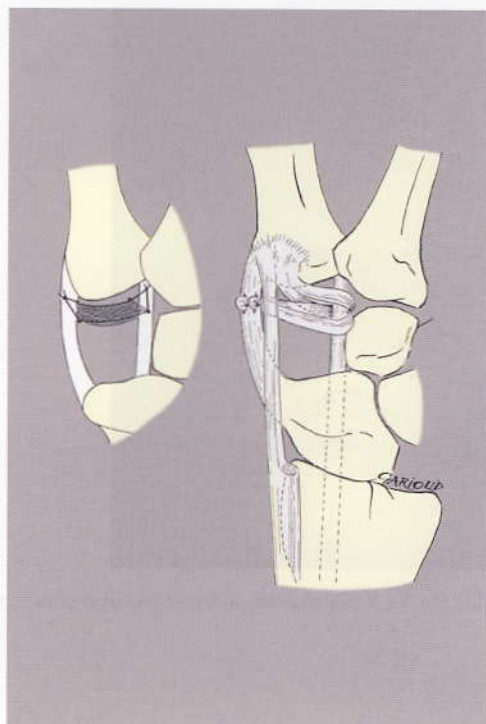


Fig 5 Diagram showing the "sling" principle with suspension of the first metacarpal bone on a "hammock", which is interposed between the first metacarpal and scaphoid. The Abductor Pollicis Longus slips are then crossed over again and stitched to the capsule at the base of the first metacarpal bone with PDS sutures.

The results of the measurements of the ranges of motion of the interphalangeal and metacarpophalangeal joints of the thumb, the angle of the first web space (web space abduction), thumb opposition and grip and pinch strength are shown in Table 1.

Four cases (7%) developed inflammation of the Flexor Carpi Radialis tendon 3 months postoperatively. This was treated conservatively with steroid injection and oral anti-inflammatory drugs. Two cases developed CRPS Type 1 (syn. reflex sympathetic dystrophy, algodystrophy), which took 20 and 32 weeks, respectively, to resolve. One case developed a reaction to the suture, which was treated conservatively. All the seven complications (12%) were resolved. No patient required a secondary intervention.

The measurements on X-ray of the scaphometacarpal height (Figs 6a and b) showed a collapse from an average of 6.77 cm pre-operatively to an average of 6.03 cm postoperatively.

DISCUSSION

Ligament reconstruction and tendon interposition (LRTI) using the Abductor Pollicis Longus was initially described after failed silicone arthroplasty, to stabilise the first and second metacarpals with a strip of Abductor Pollicis Longus tendon introduced through their bases for a suspensionplasty (Thompson, 1989). Brunelli et al. (1989) used the Abductor Pollicis Longus as a stabilisation between the bases of the first and second metacarpals to fasten the base of the thumb. A technique wrapping an Abductor Pollicis Longus tendon strip through a hole made in the FCR tendon was described by Sigfusson and Lundborg (1991). Others have used the Abductor Pollicis Longus to perform a sling, or hammock, arthroplasty (Kaarela and Raatikainen, 1999; Rutegard et al., 1994; Saehle et al., 2002). Most recently, a further variation of sling, or hammock, has been described in which the abductor pollicis longus tendon is woven around the Flexor Carpi Radialis and the Extensor Carpi Radialis Longus tendons to produce the sling or hammock (Sirotakova et al., 2007).

Early techniques using the Abductor Pollicis Longus tendon used two incisions: one for harvesting the tendon strip and the other one for building the interposition and suspension around, or through, another tendon (Sigfusson and Lundborg, 1991; Thompson, 1989). More recent techniques, including ours, have used a single incision (Kaarela and Raatikainen, 1999; Sirotakova et al., 2007) and have also avoided drilling a hole in the base of the first metacarpal (Sirotakova et al., 2007).

With our technique, pain relief was obtained in 78% of the cases; these results were comparable to other ligamentoplasty techniques, which quote very varied results in this respect. Our satisfaction rate was 95%.

Table 1

	Average pre-operative	Pre-operative range	Average postoperative	Postoperative range
MCP joint ROM (deg)	345	10-60	41.6	20-60
IP joint ROM (deg)	33.9	10-60	39.3	0-60
Web space abduction (deg)	73.7	55-100	84.6	75-100
Thumb opposition (Kapandji score)	8.1	4-10	9	7-10
Grip strength (kg)	16.	2-36	29.1	14-60
Pinch strength (kg)	2.9	0-6	6	4-12

MCP: metacarpophalangeal; IP: interphalangeal; and ROM: range of movement.

The average time before return to daily activities was 8.7 (range 1-32) weeks. A 50 year-old, self-employed business man returned to his daily activities after 1 week, while a 67 year-old woman who developed CRPS Type 1 (syn. Reflex Sympathetic Dystrophy, Algodystrophy) returned to her normal daily activities only after 32 weeks.



Fig 6 (a) An X-ray showing the pre-operative view of osteoarthritis of the right thumb. (b) An X-ray showing a 5-year postoperative view of the same right thumb after Abductor Pollicis Longus ligamentoplasty.

A strict comparison between previous studies is almost impossible because the methodology of assessments varies in the six previous reports of series in which an Abductor Pollicis Longus sling has been used (Brunelli et al., 1989; Kaarela and Raatikainen, 1999; Rutegard et al., 1994; Saehle et al., 2002; Sigfusson and Lundborg, 1991; Sirotakova et al., 2007). As a result, it is difficult to recommend one surgical procedure, ours or another, over the others.

Our complication rate of 11.7% is lower than the series of Conolly and Lanzetta (1993), who presented a series of 100 different ligamentoplasties and had a 30% complication rate. It is interesting to note that no patients in our series, including manual workers, needed a secondary intervention, even with a longer follow-up period.

A possible risk of scaphometacarpal arthritis from complete collapse of the metacarpal onto the distal pole of scaphoid after removal of trapezium has been used as a reason for suspensionplasty, but recent reports have not shown that this is the case after trapeziectomy alone (Belcher and Nicholl, 2000; Davis et al., 2004; Field and Buchanan, 2007). However, most studies have not followed the patients for sufficiently long to detect whether this problem will occur or not.

The aim of associating ligamentoplasty with trapeziectomy in the treatment of osteoarthritis of the first carpometacarpal joint is the creation of a stable, painless thumb with satisfactory strength and reasonable movement, while avoiding scaphometacarpal collapse (Conolly and Rath, 1993). The technique of ligamentoplasty that we present in this paper is easy to

use, with results that are comparable to those of other ligamentoplasties.

#### References

- Amadio PC, Millender LH, Smith RJ (1982). Silicone spacer or tendon spacer for trapezium resection arthroplasty – comparison of results. *Journal of Hand Surgery*, 7: 237–244.
- Atroshi I, Axelsson G (1997). Extensor carpi radialis longus tendon arthroplasty in the treatment of primary trapeziometacarpal arthrosis. *Journal of Hand Surgery*, 22A: 419–427.
- Belcher HJ, Nicholl JE (2000). A comparison of trapeziectomy with and without ligament reconstruction and tendon interposition. *Journal of Hand Surgery*, 25: 350–356.
- Brunelli G, Monini L, Brunelli F (1989). Stabilisation of the trapeziometacarpal joint. *Journal of Hand Surgery*, 14B: 209–212.
- Conolly WB, Lanzetta M (1993). Surgical management of arthritis of the carpometacarpal joint of the thumb. *Australian New Zealand Journal of Surgery*, 63: 596–603.
- Conolly WB, Rath S (1993). Revision procedures for complications of surgery for osteoarthritis of the carpometacarpal joint of the thumb. *Journal of Hand Surgery*, 18B: 533–539.
- Damen A, Van der Lei B, Robinson PH (1997). Bilateral osteoarthritis of the trapeziometacarpal joint treated by bilateral tendon interposition arthroplasty. *Journal of Hand Surgery*, 22B: 96–99.
- Davis TRC, Brady O, Dias JJ (2004). Excision of the trapezium for osteoarthritis of the trapeziometacarpal joint: a study of the benefit of ligament reconstruction or tendon interposition. *Journal of Hand Surgery*, 29A: 1069–1077.
- Dell PC, Muniz RB (1987). Interposition arthroplasty of the trapeziometacarpal joint for osteoarthritis. *Clinical Orthopaedics and Related Research*, 220: 27–34.
- Dhar S, Gray ICM, Jones WA, Beddow FH (1994). Simple excision of the trapezium for osteoarthritis of the carpometacarpal joint of the thumb. *Journal of Hand Surgery*, 19B: 485–488.
- Downing ND, Davis TRC (2001). Trapezial space height after trapeziectomy: Mechanism of formation and benefits. *Journal of Hand Surgery*, 26A: 862–868.

Eaton RG, Littler JW (1973). Ligament reconstruction for the painful thumb carpometacarpal joint. *Journal of Bone and Joint Surgery*, 55A: 1655-1666.

Eaton RG, Glickel SZ, Littler JW (1985). Tendon interposition arthroplasty for degenerative arthritis of the trapeziometacarpal joint of the thumb. *Journal of Hand Surgery*, 10A: 645-654.

Field J, Buchanan D (2007). To suspend or not to suspend: a randomised single blind trial of simple trapeziectomy versus trapeziectomy and flexor carpi radialis suspension. *Journal of Hand Surgery*, 32A: 462-466.

Gervis WH (1949). Excision of the trapezium for osteoarthritis of the trapezio-metacarpal joint. *Journal of Bone and Joint Surgery*, 31B: 537-540.

Gibbons CER, Gosal HS, Choudri ANH, Magnussen PA (1999). Trapeziectomy for basal thumb joint osteoarthritis 3- to 19 year follow up. *International Orthopaedics*, 23: 216-218.

Kaarela O, Raatikainen T (1999). Abductor pollicis longus tendon interposition arthroplasty for carpometacarpal osteoarthritis of the thumb. *Journal of Hand Surgery*, 24A: 469-475.

Kapandji A (1986). Cotation clinique de l'opposition et de la contre-opposition du pouce. *Annales de Chirurgie de la Main*, 5: 67-73.

Kleinman WB, Eckenrode JF (1991). Tendon suspension sling arthroplasty for thumb trapeziometacarpal arthritis. *Journal of Hand Surgery*, 16A: 983-991.

Lucht U, Vang PS, Munck J (1980). Soft tissue interposition arthroplasty for osteoarthritis of the carpometacarpal joint of the thumb. *Acta Orthopaedica Scandinavica*, 51: 767-771.

Menon J, Schoene HR, Hohl JC (1981). Trapeziometacarpal arthritis results of tendon interpositional arthroplasty. *Journal of Hand Surgery*, 6: 442-446.

Nylen S, Johnson A, Rosenquist A-M (1993). Trapeziectomy and ligament reconstruction for osteoarthritis of the base of the thumb. *Journal of Hand Surgery*, 18B: 616-619.

Rutegard JN, Eriksson C, Olson K (1994). Tendon arthroplasty for treatment of trapeziometacarpal arthrosis. *Scandinavian Journal of Plastic Reconstructive Surgery*, 28: 295-298.

Saehle T, Sande S, Finsen V (2002). Abductor pollicis longus tendon interposition for arthrosis in the first carpometacarpal joint. 55 thumbs reviewed after 3 (1-5) years. *Acta Orthopaedica Scandinavica*, 73: 674-677.

Sigfusson R, Lundborg G (1991). Abductor pollicis longus tendon arthroplasty for treatment of arthrosis in the first carpometacarpal joint. *Scandinavian Journal of Plastic and Reconstructive Hand Surgery*, 25: 73-77.

Sirota M, Figus A, Elliot D (2007). A new abductor pollicis longus suspension arthroplasty. *Journal of Hand Surgery*, 32A: 12-22.

Thompson JS (1989). Suspensioplasty. *Journal of Orthopaedic Surgical Technique*, 4: 1-13.

Tomaino MM, Pellegrini Jr VD, Burton RI (1995). Arthroplasty of the basal joint of the thumb: long term follow-up after ligament reconstruction with tendon interposition. *Journal of Bone and Joint Surgery*, 77A: 346-355.

Varley GW, Calvey J, Hunter JB, Barton NJ, Davis TRC (1994). Excision of the trapezium for osteoarthritis at the base of the thumb. *Journal of Bone and Joint Surgery*, 76B: 964-968.

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