EXCISION OF THE TRAPEZIUM AND INTERPOSITION ARTHROPLASTY WITH GELFOAM FOR THE TREATMENT OF TRAPEZIOMETACARPAL OSTEOARTHRITIS

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Excision of the trapezium with Gelfoam interposition was performed in 35 thumbs, 34 of which were evaluated after an average 5 years. Twenty-four patients had unilateral procedures. The follow-up examination included a standardized questionnaire and clinical and radiological examinations. Pain relief was achieved in all cases. The patients considered that 32 of their operated hands had improved function, while two had not improved. All patients were satisfied with the final postoperative result. Adduction of the thumb to the index finger, and opposition to the tip of the little finger was possible in all cases. Weakness, in comparison to the other thumb, of lateral pinch (71%; P = 0.0001), tip pinch (74%; P = 0.007), and grip strength (85%; P = 0.006) were observed. The first web span was preserved in all hands. Calculation of the trapezial space ratio demonstrated only slight, insignificant shortening (7%; P = 0.06) of the thumb ray. No significant correlations between the postoperative trapezial space ratio and lateral pinch strength, tip pinch strength, and grip strength were observed. We conclude that excision of the trapezium and Gelfoam interposition has no specific complications and is a reliable surgical treatment for osteoarthritis of the trapeziometacarpal joint.


INTRODUCTION

Osteoarthritis of the trapeziometacarpal joint predominantly affects middle-aged women and is often bilateral. Most cases can be managed successfully by conservative means, but surgery is indicated in resistant cases (Armstrong et al., 1994). Numerous operative procedures have been described for the treatment of this condition. Simple excision of the trapezium is the classical treatment and provides good pain relief (Dhar et al., 1994; Gervis 1973; Iyer, 1981; Varley et al., 1994). However, it may be associated with subluxation and dislocation, or proximal migration of the thumb metacarpal which allows abutment between the base of the thumb metacarpal and the scaphoid or trapezoid (Conolly and Rath, 1993) and the development of degenerative changes at the pseudoarthrosis (Iyer, 1981). Theoretically shortening of the thumb ray may diminish thumb strength. The risk of these complications has led surgeons to interpose materials within the space created by removal of the trapezium, or create a suspensory ligament. These options include tendon interposition using a rolled-up slip of the flexor carpi radialis (Damen et al., 1997) or palmaris longus (Dell and Muniz 1987), palmar oblique ligament reconstruction and tendon interposition (LRTI) (Burton and Pellegrini, 1986), the creation of a suspension tendon sling (Kleinman and Eckenrode, 1991; Sigfusson and Lundborg, 1991), and insertion of a pericorneal collagen xenograft (Permacol™) (Belcher and Zic, 2001) or a costochondral allograft (Trumble et al., 2000). Others have advocated the use of synthetic materials such as Gelfoam (Goldner and Clippinger, 1959; Dell and Muniz, 1987), Gore-Tex™, and polypropylene (Marlex™) (Muermans and Coenen, 1998) to fill the “trapezial space”. Several forms of Silicone implant arthroplasty are also available, which either replace the excised trapezium (Swanson, 1972), or resurface the base of the thumb metacarpal (Kessler 1973). Polyurethane implants (Tecoflex™) (Sollerman et al., 1993), and total joint arthroplasty can also be used (de la Caffiniere, 1991).

None of the large number of procedures is completely satisfactory. The purpose of this retrospective clinical study is to investigate whether excision of the trapezium and Gelfoam (Pharmacia and Upjohn Co., Kalamazoo, Michigan, USA) interposition prevents proximal migration of the thumb metacarpal and improves thumb function.

PATIENTS AND METHODS

Thirty-five interposition arthroplasties with Gelfoam were performed in 30 patients between July 1990 and October 1996. All patients had symptomatic trapeziometacarpal osteoarthritis classified radiologically as Eaton stages 2–4 (Eaton and Littler, 1973). Twenty-nine of the 30 patients (34 procedures) attended for a follow-up examination at a mean of 5 (range, 4–10) years after surgery. All patients were examined by one of
the authors (IN), who had not been involved in their surgery. There were 22 women and seven men with a mean age at the time of surgery of 60 (range, 46–74) years. Five patients had undergone bilateral surgery. The dominant hand was operated in six of the unilateral cases.

At follow-up all patients completed a standardized questionnaire, and were asked about their satisfaction with the operative procedure. Pain at follow-up was graded as none, mild, moderate, or severe (Table 1). Pain levels were compared with those before surgery, and the need for analgesic medications was also assessed. The ability to perform activities such as unscrewing the lid of a jar, turning a key, buttoning or unbuttoning a blouse was compared to that before surgery and was graded as satisfactory, mild improvement, no improvement and worse. The patients were also asked about the appearance of the operated hand compared to before surgery, and this was graded as better, not different or worse.

The objective examination included evaluation of the operation site for sensory radial nerve dysfunction and ability to adduct the thumb to the index ray and oppose it to the tip of the little finger. The first web span was measured between the longitudinal axis of the thumb and index metacarpals. Lateral (key) pinch, tip pinch and grip strength were measured using Jamar Dynamometers (Preston, Clifton, NJ, USA). For these evaluations each patient was asked to perform each test three times with each hand, and the mean was calculated.

Posteroanterior and lateral radiographs of both hands were obtained on seated patients, with the elbow flexed to 90°, and the forearm fully pronated. The X-ray beam was focused 90 cms from the plate. These radiographs were used to calculate the trapezial space ratio for both the operated and non-operated thumbs. This was done by dividing the trapezial space height by the length of thumb proximal phalanx (Kadiyala et al., 1996). The radiographs were also inspected for osteolysis or cyst formation (indication of reactive synovitis) and the development of osteoarthritis between the distal pole of the scaphoid and the base of the thumb metacarpal.

### Surgical technique

The trapezium is approached through a longitudinal incision on its radiopalmar aspect, protecting the sensory branch of the radial nerve. The capsule is opened longitudinally in the interval between the abductor pollicis longus and extensor pollicis brevis. The trapezium is removed piecemeal. Moderate longitudinal traction is exerted on the thumb and its metacarpal is stabilized with two Kirschner wires, which are inserted in a criss-cross fashion from its base into the capitate and the scaphoid. The space created after removal of the trapezium is impacted with pieces of Gelfoam. The capsule is closed, and the hand is immobilized in a bulky dressing. At 3 weeks the Kirschner wires are removed, and active and passive motion of the thumb is allowed.

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<th>Table 1—Pain level definition</th>
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<td><strong>Type of pain</strong></td>
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### STATISTICAL ANALYSIS

Paired parametric data for patients who underwent unilateral surgery (first web span, lateral pinch, tip pinch, grip strength and trapezial space ratio) were compared using Student’s t-test. Pearson’s correlation coefficients (r) were used to analyse relationships between the postoperative trapezial space ratio and lateral pinch, tip pinch and grip strength.

### RESULTS

Complete pain relief was achieved in 23 of the 34 operated hands. Seven had mild pain and four moderate pain. Nine of the 11 patients with persistent pain only experienced pain during activities, but the other two also had occasional rest pain. The patients reported significant pain reduction compared to the preoperative state for 29 of the 34 surgical procedures, while the other five reported only mild improvement. No patient reported pain worse than that before surgery. In 29 operated hands the patients had no need for analgesic medications, and in five mild analgesic medications were used occasionally. All patients were satisfied with the postoperative result.

The ability of 29 operated hands to perform activities was markedly improved. In three it was moderately improved and in two there was no improvement. Seventeen patients considered the appearance of their operated hands had been improved, twelve reported no change, and five considered their appearance worse. No patient had any sensory radial nerve dysfunction, and all were able to adduct their thumb to the index finger and to oppose it to the tip of the little finger.

The mean first web span for the operated hands was 71° (range, 50–100°), compared with 72° (range, 50–100°) for the non-operated hands.

The mean lateral (key) pinch for all operated hands was 4.1 (range, 2–8) kg. For the patients who had unilateral surgery this was 4.3 (range, 2–8) kg, compared with 6 (range, 3–8) kg for the non-operated hands: this difference is significant (P = 0.0001). The mean tip pinch of all the operated hands was 3.7 (range, 2–7) kg. For
the patients who had the operation performed on one hand this was 3.9 (range, 2–7) kg, compared with 5.2 (range, 3–8) kg for the non-operated hands: this difference is also significant ($P = 0.0007$). The mean grip strength calculated for the all the operated hands was 16.7 (range, 4–32) kg, and for the patients who had the operation performed on one hand this was 18 (range, 11–32) kg, compared with 21.5 (range, 11–36) kg for the non-operated hands: this difference is also significant ($P = 0.006$).

The mean trapezial space ratio of all operated hands was 0.41 (range, 0.34–0.46), and for the patients who had the operation performed on one hand this was 0.43 (range, 0.34–0.48) compared with 0.46 (range, 0.4–0.54) for the non-operated hands: this difference is not significant ($P = 0.06$). No signs of osteolysis, cyst formation or osteoarthritis between the distal pole of the scaphoid and the base of the thumb metacarpal were observed.

Analysis of the relationship between the postoperative trapezial space ratio and lateral pinch strength, tip pinch strength, and grip strength did not show any significant correlations (lateral pinch: $r = 0.373$, $P = 0.4$; tip pinch: $r = 0.409$, $P = 0.3$; grip strength: $r = 0.395$, $P = 0.4$).

**DISCUSSION**

A wide spectrum of techniques have been advised to preserve the trapezial height, and prevent proximal migration of the thumb metacarpal, scapho-metacarpal abutment and the development of osteoarthritis of the pseudoarthrosis after trapeziectomy. A number of materials have been interposed within the trapezial space, but some cause major complications. Silicone implants may break, fragment and cause synovitis, leading to osteolysis and bone destruction of the thumb metacarpal (Kessler, 1973; Swanson, 1972). Osteolytic changes and synovitis have also been observed around Gore-Tex™ implants, though Marlex™ is well tolerated (Muermans and Coenen, 1998). Polyurethane implants (Tecoflex™) have high rates of dislocation and subluxation (Sollerman et al., 1993), and porcine dermal collagen xenograft (Permacol™) produces a foreign body reaction (Belcher and Zic, 2001). Costochondral allografts do not preserve the trapezial height, and are associated with fractures and complete graft resorption (Trumble et al., 2000). The use of Gelfoam as an interposition material to fill the “trapezial space” was not associated with complications such as breakage, synovitis, osteolysis or bone destruction in our study. Furthermore, its use does not require accurate bone osteotomies or stabilization techniques which are required with some other implants.

Interposition arthroplasty using a rolled-up tendon segment, with or without palmar oblique ligament reconstruction, requires harvesting of a donor tendon from the forearm or wrist (Burton and Pellegrini, 1986; Damen et al., 1997; Dell and Muniz 1987). This adds potential morbidity due to scars, pain, tendon rupture and neuroma formation. Suspension sling arthroplasties (Kleiman and Eckenrode, 1991; Sigfusson and Lundborg, 1991) share the same problems, and, if inserted to tight, may also cause tendonitis.

In this study pain relief was achieved in all cases, although 11 of the 34 thumbs were not completely pain free. Twenty-seven of the 29 patients considered their ability to perform activities improved, and all 29 were satisfied with the final postoperative result. All patients retained good thumb movement, and no adduction contractures of the trapeziometacarpal joint developed.

We found lateral pinch (29%), tip pinch (26%), and grip strength (15%) were weaker in the operated hands than the non-operated ones, which is in agreement with other studies (Dhar et al., 1994; Kleiman and Eckenrode, 1991; Sigfusson and Lundborg, 1991; Varley et al., 1994). However, the results of other studies, which reported slight increases in strength after trapeziectomy, suggest that the weakness pre-existed the surgery and was not caused by it (Davis et al., 1997; Downing and Davis, 2001; Lins et al., 1996).

Downing and Davis (2001) reported decreases of 50–59% in the trapezial space ratio after trapeziectomy alone, or with tendon interposition or LRTI. Burton and Pellegrini (1986) also found a decrease of 50% in the trapezial height after trapeziectomy and LRTI, while Lins et al. (1996) reported a decrease of only 30% after the same procedure. Although the trapezial space ratio was slightly reduced (7%) in our patients, this was not statistically significant. Thus trapeziectomy with interposition with Gelfoam is successful in restoring and maintaining the length of the thumb ray and, in the short term at least, prevents complications associated with proximal migration of the thumb metacarpal. We believe that the use of Kirschner-wires to hold the thumb metacarpal away from the distal pole of the scaphoid for 3 weeks (Davis et al., 1997; Downing et al., 2001), and the formation of dense fibrous scar within the Gelfoam (Pospiech et al., 1995) allows a firm pseudoarthrosis to form.

Although it is widely considered that preservation of the trapezial height, and therefore the thumb length, preserves thumb strength, we, like others, could not find any significant correlation between the postoperative trapezial space ratio and thumb strength (Downing and Davis, 2001).

**References**


