

Trapezium replacement arthroplasty

Thirty-one patients (34 joints) with pain due to carpometacarpal joint derangement were reviewed $\frac{1}{2}$ to 12 years after a trapezium replacement arthroplasty using a Swanson silicone prosthesis. At review, 25 hands were free from pain, and nine had some pain on exertion. Mobility and strength were generally well restored. The radiographic examination revealed 12 prosthesis-fractures, three dislocations, and five cases of incongruity. However, all patients were satisfied with the results of the operation.

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The aim of this study was to assess the results obtained with Swanson silicone implant arthroplasty (Figure 1) for the first carpometacarpal (CMC) joint, and to compare early and late results.

Patients and methods

Of 36 patients operated for painful derangement of the CMC-I joint, 31 (28 females and 3 males) were alive for review on average 6 ($\frac{1}{2}$ -12) years after the operation. The average age at the time of the operation was 59 (47-70) years. The patient's occupations were: seven housewives, eight industrial workers (one male), two male construction-workers, four nurses, three cooks, two shop-assistants, two cleaning-women, two secretaries and one mail-woman.

Three patients had bilateral operations. Of 34 joints followed up, 32 had been operated for arthrosis and two for rheumatoid arthritis.

Surgical technique

The approach was through a straight dorso-radial incision. The radial artery was identified and retracted proximal-ulnarward. The capsule of the trapeziometacarpal joint was incised longitudinally and the capsule carefully reflected on both sides of the joint. With traction on the thumb the borders of the trapezium were easily identified. The bone was successively freed from the sides by sharp dissection. Removal in one piece was facilitated by direct traction on the bone by a towel clip plus an elevator. Small fragments of bone from the volar aspect of the trapezium were sometimes left in place to buttress the palmar capsule and ligaments. The trapezium was replaced by a Swanson silicone prosthesis of appropri-



Figure 1. Swanson silicone prosthesis intact and in good alignment 7 months after operation.

Figure 2. Heavy wear of head of prosthesis and fracture of the stem 9 years postoperatively. Clinically good motion, stability and strength. No pain.

ate size with regard to motion and stability. The need for reinforcement of the dorsal aspect of the joint was dictated mainly by capsular weakness and/or adduction of the thumb. In 15 joints the dorsal capsule was reinforced by a 2-cm-long, distally based slip of the extensor carpi radialis longus tendon. Postoperatively the joint was immobilized by plaster to the lower arm for 5-6 weeks with the thumb in radial and slight volar abduction.

Follow-up examinations

A follow-up protocol was designed for registration of the following criteria:

- A. The patients' assessment of pre/postoperative pain at rest and on exertion; mobility and strength.
- B. Objective range of motion including volar and radial abduction, circumduction; grip- and pinch-strength measured by a Martin Vigorimeter (Sol-

gaard et al. 1984), using the smallest ball for pinch strength and the middle-sized ball for grip-strength; the grinding-test, i.e. pain provoked by axial pressure combined with passive rotation of the CMC-joint.

- C. Radiographic evidence in six projections of prosthetic fracture, dislocation, wear or incongruity; measurement of the angles between the first and the second metacarpals in maximal volar and radial abduction.

Results

Some postoperative swelling was frequent and sometimes prolonged for 2–3 weeks. No wound complications were encountered and primary healing was attained in all cases.

All of the patients were satisfied with the results as regards pain, and none felt that the joint had appreciably deteriorated since the operation. Of the 34 joints, nine had slight or occasional pain on exertion (none requiring analgesics). The grinding-test provoked pain in only two of the 34 joints.

With one exception all of the patients returned to their previous occupation. The exception was a female industrial-worker who, in her absence, was replaced by a machine.

Motion

On the patients' own assessment, motion had increased after operation in 31 joints, was unchanged in two and had decreased in one. Thumb-palm opening as defined by Swanson et al. (1981) was 6–8 cm in 19 joints, 4–6 cm in 14 joints, and 4 cm in one (ankylosed) rheumatic joint.

Radiographically, volar abduction was 30°–40° in 26 thumbs and radial abduction was 30°–40° in 17 thumbs. Radiographic measurements consistently gave lower values than clinical ones (Table 1).

Circumduction was full in all 33 mobile joints, i.e. the thumbs could parallel the flat hand in maximal radial abduction and touch the proximal flexion crease of the ring finger (Rajan et al. 1982).

Table 1. Radiographic assessment of carpometacarpal motion after trapezium replacement arthroplasty.

	No. of patients	
	Volar abduction	Radial abduction
<20°	2	3
20°–39°	27	30
40°–54°	5	1
>55°	0	0

Table 2. Radiographic findings after trapezium replacement arthroplasty.

State of prosthesis	Alignment		
	Normal	Incongruency	Dislocation
No fault	10	4	
Slight wear	6	1	
Fract. stem + head	6		1
Fract. stem	2		2
Fract. stem + heavy wear	1		
Ankylosis	1		
Total	26	5	3

Strength

Subjectively, strength was improved in 30 hands, unchanged in three and decreased in one. Grip-strength values varied from 30 to 90 kPa for females, with an average value of 64 kPa. The average pinch-strength was 30 (12–50)kPa.

Radiographic findings

In 14 prostheses no fault was found. Slight wear was found in seven, whereas 12 showed fracture and wear. In 26 cases alignment of the prosthesis was normal, incongruity was found in five, and volar dislocation in three (Table 2). Ten of the fractured prostheses had been inserted from 9 to 11 years previously and the remaining two had been inserted 24 and 8 months before, respectively. One fractured prosthesis was worn down to half its normal thickness but was in good alignment (Figure 2). Incongruity between the prosthesis and the scaphoid bone in five cases was deemed to be due mainly to preoperative changes.

Discussion

Arthrosis of the CMC joint of the thumb is a common condition, leading to impaired function due to pain, pinch weakness and instability. In early cases conservative treatment like splinting, steroid injection and antiphlogistic medications often provide pain relief (Eaton 1979). As the condition progresses, surgical intervention is often necessary to achieve long-term relief (Weilby 1971).

Simple excision of the trapezium (Goldner & Clippinger 1959) gives relief of pain, and the range of motion is often improved, but the thumb becomes unstable, which results in a weak pinch grip. Trapeziectomy with soft tissue interposition (Buck-Gramko 1972) gives better pinch strength, and combined with a stabilization procedure (Weilby & Söndorf 1978) the functional result is often satisfactory.

Arthrodesis of the CMC joint provides a pain-free and stable thumb with adequate pinch strength (Mattson 1969), but the procedure demands a long period of immobilization; for many patients the impaired range of motion is uncomfortable, and some develop arthrosis of the joints adjacent to the trapezium (Eiken & Carstam 1970).

Replacement of the trapezium by an endoprosthesis has been recommended by many authors (Swanson 1968, Kessler 1973, Haffajee 1977, Rajan et al. 1982). Swanson's pioneer work is well recognized, and his silicone replacement arthroplasty has been a main surgical alternative since the early seventies. This procedure provides a painless thumb which is fairly stable, and an increased range of motion. In spite of a high rate of dislocations in his follow-up study of 100 hands, Haffajee (1977) concluded that endoprosthetic replacement of the trapezium with a silicone rubber spacer usually made the thumb stable, mobile, strong, and pain-free.

The surgeon has to assess whether the patient demands a strong, stable, pain-free thumb with a diminished range of motion or a mobile pain-free thumb with diminished strength. Arthrosis of the other joints around the trapezium excludes arthrodesis as an alternative.

Our choice of method was governed by the fact that many of our patients desired not only pain relief but also the prospect of improved motion, even though some loss of strength might ensue. The preoperative evaluation of mobility and strength in painful arthrotic joints is often fraught with inaccuracies; before the operation some patients may have little or no pinch strength due to pain and/or instability (Braun 1982). We must admit that no standardized attempt to measure pinch strength was made in this series, and we could therefore not express gains and losses in exact figures. We did find, however, that the patients were well pleased with the pain relief, stability and range of motion. As regards strength, all except one had no sense of loss which in some measure may be ascribed to the absence of pain. On the other hand, post-operative measurements gave higher values than expected when compared to those in healthy individuals (Haffajee 1977).

It is evident from the literature that instability after trapezium replacement arthroplasty has been a discouraging problem (Weilby & Söndorf 1978, Eaton 1979), and some authors report an incidence up to one third. In this series three joints had volar dislocation probably due to immobilization in hyperextension post-operatively; a small articular surface of the scaphoid and weak volar ligament support were possible contributory factors in these cases. In our five cases showing incongruity or subluxation, a small articular surface of the scaphoid plus arthrotic osteophytes seemed to be the main cause and could probably have been rectified at operation by partial excision of the trapezoid bone (Eaton 1979, Swanson et al. 1981).

The fact that pain relief, strength and stability were generally found to be satisfactory in spite of implant breakage, dislocation or incongruity in 20 of our 34 cases proves that although radiographically imperfect, they still functioned well as interposition plasties. The reactive fibrous tissue capsule around these implants probably is an important factor in preserving stability and freedom from pain. Our study confirms the results of Haffajee (1977).

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