Experience with silastic prostheses in rheumatoid hands

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Use of silicone rubber ('Silastic') prostheses for the replacement of metacarpophalangeal (MCP) joints in rheumatoid arthritis was advocated by Swanson (1969), who considered the overall results of the operation superior to that of all previous surgical techniques.

This report presents results of a short-term follow-up of twelve patients who had silastic MCP implants. Three subjects had joint replacements in both hands, nine in one hand; a total of 48 MCP joints were replaced in fifteen hands. All the operations were carried out by J. V. J.

Material and methods

Eleven patients suffered from rheumatoid arthritis and one from ankylosing spondylitis with severe hand-joint involvement. Their ages ranged from 39 to 69 years (mean 50); eight were female. The duration of disease ranged from 4 to 32 years (mean 17).

Ten patients were seropositive (DAT), seven had rheumatoid nodules, and two had arteritis further complicated in one by peripheral neuropathy of the lower limbs.

All patients were assessed immediately before hand surgery and again postoperatively on one or several occasions for 4 to 27 months (mean follow-up period 16 months). A printed evaluation form* was used for recording the ranges of active finger-joint movements and the presence and severity of joint and tendon abnormalities, which were graded as mild, moderate, or severe according to pre-defined criteria. Grip strength measurements were the mean of three readings, using a rolled sphygmomanometer arm cuff inflated to 50 mm. Hg. Power grip was assessed by the patient's ability to grasp, and hold against resistance, light-weight cylinders and spheres of from 1" to 5" in diameter.

Active finger flexion was recorded by measuring the distance between finger pulp and distal palmar crease.

At the follow-up examinations each patient was also asked for his assessment on a number of points as shown in Table I, and about his ability to carry out the tasks of daily living, such as dressing, eating, opening doors, writing, etc.

Standard hand x rays and photographs were taken before and after the operation. Indications for surgery were:

(1) Severe and progressive MCP joint destruction with resulting functional disability.

Table I Patients' assessment of silastic MCP prostheses

Patient no.	1	2	3	4	5	6	7	8	9	10	11	12
Sex	M	M	M	F	F	F	F	F	F	F	F	F
Age (yrs)	63	63	51	69	62	58	45	55	42	39	42	60
Regained activities	+	+	+	+	+	+	+	○	○	○	○	○
Lost activities	○	○	○	○	○	○	○	○	○	○	+	○
Desire for further MCP prostheses	+	+	+	+	+	+	+	+	+	+	+	+
Pain relief	+	+	+	+	+	+	*	+	+	+	+	+

Result	Excellent	Improved	No change	Worse
Functional	5	5	2	0
Cosmetic	5	6	1	0

Key: + yes; ○ no; * absent before and after operation.

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* Assessment form, Swanson Prostheses World Field Trial.

- (2) Relatively quiescent arthritis in other joints.
- (3) Stable wrists and reasonably good function of the other finger joints, and of the hand flexors.
- (4) A co-operative patient.

Cosmetic considerations alone were not an indication for surgery.

Sterilization of implants

These are now available* in graded sizes, pre-sterilized by gamma irradiation. A 'sizing set' of implants is sterilized by autoclaving and the appropriate packet is opened only after finding the correct size by trial. Unused prostheses can be resterilized by autoclave.

Points of technique

Despite much enthusiasm elsewhere for the separate vertical incisions, the single horizontal 'scalloped' incision just proximal to the bases of the proximal phalanges was used. This gives adequate exposure and, with care, does not interrupt the dorsal venous drainage nor cause oedema of the fingers.

In addition to removing synovium, freeing the volar plate, and releasing flexion displacement, the technique followed that described by Swanson (1969). Normally the 'Hall' Air Drill was used for bone section and to drill out the bone shafts. The ulnar intrinsic tendons were freed and attached to the radial extensor hoods of the adjacent finger. Closure was done without drainage after overlapping the extensor aponeuroses vertically in order to relocate the extensor communis tendons. No routine antibiotics were given. Tourniquet time did not exceed 45 minutes.

Postoperative care

The hands were elevated, and the wounds were inspected after 48 hours. Early gentle movements were encouraged. As soon as possible (usually 3 to 5 days), the hands were fitted with a 'Plastazote' splint with a dorsal gibbet giving elastic traction towards the radial side and dorsally. At night a volar splint padded with sheepskin was worn.

Physiotherapy and occupational therapy began early and was intensive, stressing extension at the MCP joints and flexion at the PIP and DIP joints. The splints were worn for 5 to 6 weeks.

The sutures remained in the skin until sound healing ensued—usually 9 to 10 days. There has been no breakdown of any wound even in patients receiving long-term steroid medication and in two with arteritis. The usual in-patient stay was 10 to 14 days. This could have been less but the patients did not live near our hospital and the early intensive physiotherapy and occupational therapy by a team involved in the treatment was thought to be important. None of our patients was at work at the time of the operation so that time lost from work for treatment could not be assessed.

Results

Subjectively the majority of patients were pleased with the functional and cosmetic result of the opera-

tion, with the increased range of hand activities they were able to perform, and with the universal relief of pain (Table I).

In particular, two patients were delighted to be able to play the piano and clarinet again.

One was a professional musician who, although he resumed the clarinet, was still unable to play the violin because of continued disability in the left hand. He had MCP joint synovectomies of all fingers of both hands, and replacement of the 2nd and 3rd right and 3rd left MCP joints. 25 months after the operations, the fingers with silastic prostheses had greatly improved in function and were pain free, while those with synovectomy but without prostheses had deteriorated (two fingers had developed swan-neck and one a *boutonnière* deformity; soft tissue swelling had recurred in three MCP joints, subluxation in one, and disabling pain in two; ulnar drift had increased). He is anxious to have further replacement surgery.

A retired woman reported that she could play the piano again with a good degree of competence. She had silastic prostheses in all MCP finger joints of both hands 26 and 17 months previously. A *boutonnière* deformity of the left index finger remained and there was mild synovial swelling of one MCP joint; preoperatively moderate synovial hypertrophy had been present in all eight MCP joints. Volar subluxation and lateral instability were absent where they had been present preoperatively (the former in seven, the latter in four MCP joints) and she had no pain. Ulnar deviation, although present, was improved in degree. No new tendon deformities had developed and grip strength and power grip were improved in both hands.

Only one patient reported loss of activity and some persistent pain. This was due to a volar bony spur of the 5th metacarpal. She underwent further surgery for this, during which a new silastic prosthesis was inserted into the little finger as the original one was seen to be faulty with a tear in the 'joint' area, probably due to trauma during its insertion.

Table II (opposite) shows objective follow-up findings. It shows that the majority of patients had absence, or alleviation, of many abnormal features which had been present preoperatively, and which had caused dysfunction and pain. Measurements of hand function showed improvement of grip strength, power grip, and active finger flexion. Records showing preoperative pinch grip were lacking, but it was satisfactory in all fifteen hands postoperatively. The only two features showing deterioration in a minority were lateral instability and ulnar deviation.

A change in excess of 10° within the normal range of active movement was considered significant. Surprisingly, only twelve joints (25 per cent.) exhibited a postoperative increase in range; it was diminished in 25 (52 per cent.) and unchanged in eleven joints (23 per cent.). The smaller range was due mainly to greater limitation of flexion (nineteen joints), although some of these also had less extension. Thus MCP mobility, and in particular flexion, was diminished or unchanged in the majority; in contrast, movement at the corresponding proximal and distal inter-

* Lepetit Pharmaceuticals, Maidenhead, Berkshire.

Table II MCP joint changes after replacement with silastic prostheses

Joint changes	No. of affected joints before operation	Follow up			
		Completely relieved	Moderately improved	Unchanged	Worse
Synovial swelling	39	30	0	9	0
Joint crepitus	30	25	0	5	0
Pain on motion	30	29	1	0	0
Volar subluxation	44	32	7	5	0
Lateral instability	28	14	4	5	5
Ulnar deviation	46	26	0	14	6
Radial deviation	2	2	0	0	0
Intrinsic tightness	14	13	0	1	0
	No. of hands		Improved	Unchanged	Worse
Grip strength	15		11	1	3
Power grip	12*		8	5	0
	No. of fingers		Improved	Unchanged	Worse
Active finger flexion	40*		23	14	3

* Pre-operative readings not available in three hands and eight fingers

phalangeal joints tended to be increased, thus facilitating an overall improvement of finger flexion (Fig. 1). The arithmetic mean of MCP joint movement at follow-up was 51°, compared with a preoperative value of 59°. The radial three fingers had a greater postoperative mean range (54°) than the little fingers (40°).

FIG. 1 Changes in range of movement of 48 MCP, PIP, and DIP joints after silastic MCP joint replacement

Radiological findings support the clinical observations of relief of subluxation, lateral instability, and ulnar deviation. There was no evidence of progression of osteoporosis or of cystic and erosive changes, and films from two patients showed some postoperative healing of erosions. Figs 2 and 3 (overleaf) show preoperative and follow-up x ray appearances.

Discussion

We realize that our postoperative follow-up period is short, and that this study is lacking in controls. However, the results reported to date are encouraging, for the great majority of patients with implants achieved improvement in power and dexterity, and all had relief from pain. In addition, a cosmetically more acceptable hand proved to be of psychological benefit (Figs 4 and 5, overleaf). The fact that all patients would, seemingly without hesitation, subject themselves to further hand surgery if offered, and that some were actively seeking this, must represent their high degree of satisfaction.

There were no postoperative complications, and wound healing was by first intent in all despite the presence of widespread arteritic lesions in two patients, nodules in seven, and positive differential agglutination tests for rheumatoid factors in ten. From this admittedly limited experience, we have no reason to share the pessimism of others (Holt, 1969; Barron, 1969) concerning hand surgery in the presence of vasculitis, or difficulty with healing in such patients (Ansell, 1969). However, none of the patients had clinically obvious Raynaud's phenomenon and great care was exercised to keep the tourniquet time to a minimum, to prevent pressure and other unnecessary trauma, and to ensure an optimum temperature during surgery.

Slipping out or breakage of the prostheses *in situ* did not occur but the degree of general disablement in our patients was such that heavy use of their hands could not be contemplated, and undue mechanical stress to the artificial joints was thus avoided.

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FIGS 2 AND 3 Radiological appearances of hands before (left) and after (right) insertion of MCP implants

FIG. 4 *A right hand before and after replacement of all four MCP finger joints*

FIG. 5 *Appearance of hands with silastic prostheses in all eight MCP finger joints. Above: Before operation Below: At follow-up*

We do not regard an increased range of movement at MCP level as a *sine qua non* for operative success. Despite a diminished postoperative range in many, functional improvement ensued by a combination of improvement of interphalangeal joint movement and freedom from pain.

A natural tendency towards spontaneous remission in the proximal interphalangeal joints, with disease progression at MCP level in comparatively early disease, was reported by Kay (1969). As yet observations are not available in long-standing rheumatoid arthritis, but if this tendency were to persist, one might be justified in expecting good long-term results from MCP replacement.

It is uncertain whether the decrease of movement is due to fibrosis of the integral hinge-joint reported by Calnan (1969), or to other factors such as insufficient use after the discharge from hospital. The fact that movement is more impaired in the less active little fingers compared with the first three fingers would seem to point to the latter cause. It might be argued that a less mobile joint has greater stability, and if lack of mobility be compensated at the more distal joints function need not suffer.

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Addendum

Since this paper was submitted for publication the MCP implant in the 5th finger of one patient (Case 11, Table 1) has become dislocated, necessitating two further operations with prosthetic re-insertion. This patient has progressive disease with marked osteoporosis and loss of cancellous bone in the proximal phalanges with poor retention of the prosthesis. Further functional deterioration has therefore occurred, but relief of pain persists in the operated hand. The progress of the other patients remains good.

It appears that the replacement of the destroyed metacarpophalangeal joint in the rheumatoid hand is technically possible and subjectively and objectively worth while. Until we can prevent joint destruction, more effort must be employed in perfecting joint design and overcoming the remaining problems. These are in the main: recurrent ulnar drift, lateral instability, loss of extension at the MCP joint, and the high costs of the joints used in this series.

Summary

Twelve patients had joint implants in 48 metacarpophalangeal joints, using silicone rubber prostheses. All had detailed pre- and postoperative hand assessments with follow-up studies for a mean period of 16 months. The majority showed considerable subjective and objective improvement in hand function and all had relief from pain.

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