

Silicone replacement for non-union of the scaphoid

7 cases followed for 9 (5-18) years

George P Ashcroft¹, Douglas C D'Netto² and Zuhair Alsindi³

In the years 1971-1983, 7 patients underwent excision of the scaphoid with replacement by a silicone rubber implant because of painful nonunion of a scaphoid fracture. The patients were reviewed 9 (4.5-18) years postoperatively. All patients returned to work, 2 patients being completely pain-free, 4 having only occasional pain on heavy activity, and 1 having pain

on normal activity. The range of motion, power and pinch grip were near-normal in all. Radiographic examination showed progressive dorsal intercalated segment instability with carpal collapse and arthrosis. There was no evidence of fragmentation of, or reaction to the prosthesis. 1 prosthesis was dislocated, and no patient required a revision operation.

¹Department of Orthopedics, Aberdeen Royal Infirmary, Aberdeen, Scotland; ²North Tyneside District General Hospital, North Shields, Tyne-and-Wear and Ashington Hospital, Ashington, Northumberland; and ³The Disablement Services Centre, Sherwood Hospital, Nottingham, England
Correspondence: Mr. G P Ashcroft, Department of Orthopedics, Ward 11/12, Aberdeen Royal Infirmary NHS Trust, Forresterhill, Aberdeen AB9 2ZB, Scotland. Tel +44-224 681818, ext. 52221. Fax -224 685307
Submitted 91-12-10. Accepted 93-03-06

We report the long-term follow-up of 7 patients who underwent replacement silicone scaphoid arthroplasty.

Patients and methods

Between 1971 and 1983 7 patients at our hospitals underwent replacement arthroplasty of the scaphoid for painful non-union. All patients are included in this review with average length of follow-up 9 (5-18) years. The average age at the time of operation was 42 (26-54) years, and the average duration of symptoms 5 (1-18) years. All were men with the dominant hand being affected in 4 out of 7. Three patients had had previous surgery on the affected wrist, 1 having previous excision of an avascular proximal pole and the 2 others Russe (1960) type bone grafting; 1 patient was grafted twice. In 5 out of 7 patients there was established radioscapoid arthrosis at the time of presentation. Pain in the affected wrist on normal daily use was the main symptom in all patients; they had been unable to carry out their normal work, due to pain, for several months prior to surgery.

Operative technique

The scaphoid was excised through an anterior approach (Russe 1960) and replaced by a silicone rubber prosthesis originally designed by Dow Corning Corporation Ltd (Swanson 1970). In 2 patients a

slightly undersized prosthesis was chosen as the larger one tended to dislocate when the wrist was put through a full range of movement. In 1 instance the prosthesis was stabilized by a K-wire. The average tourniquet time for the operation was 1 hour. The wrist joint was immobilized for 6 weeks in a padded plaster including the thumb, after which a course of physiotherapy was instituted. 1 patient suffered evidence of late median nerve compression and underwent carpal tunnel decompression, 4 patients suffered from a neuropraxia of the median nerve which resolved without intervention. No prosthesis has had to be removed and no other secondary surgical procedures have been required.

At follow-up, details were noted about pain, function, and patient satisfaction. Measurement of wrist movement was carried out using a standard goniometer. Both power grip and pinch grip were measured in 6 of the 7 patients.

Anteroposterior and lateral radiographs were taken of both wrists for comparison with preoperative films. Evidence of instability was looked for using standard measurements of the radiolunate angle and scapholunate angle (Green 1988). Carpal height and carpal translation ratios were measured as indicators of carpal collapse (McMurty et al. 1978, Youm and Flatt 1980). Evidence of arthrosis was looked for in the 5 articulations of the scaphoid articulation (Kleinert et al. 1985). Radiographs were also scrutinized for evidence of dislocation of the trapezial stem and subluxation, dislocation or fragmentation of the prosthesis.

Table 1. Details on 7 men with silicone replacement for nonunion of the scaphoid

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	X	Y
1	54	R	4 (6)	Heavy manual	Retired 1 yr ^a	1	38	17	40	67	NA	NA	NA	NA	NA	NA	NA	27	82	.47	.37	1	2
2	49	L	14 (10)	Miner ^b	Miner ^b	2	90	100	100	67	77	85	7	55	.56	.35	2	22	67	.54	.35	5	1
3	26	R	5 (8)	Unemployed	Fish worker	3	78	88	85	75	85	80	9	47	.57	.29	0	15	69	.54	.37	1	
4	43	L	8 (7)	Plater	Plater ^c	3	100	92	100	100	90	100	10	84	.52	.34	1	11	103	.5	.38	5	1
5	45	R	6 (2)	Wagon driver	Tavern keeper	2	69	100	70	80	94	80	11	61	.50	.35	2	19	60	.47	.39	4	1
6	37	L	18 (5)	Overseer	Typesetter	3	75	77	64	40	83	88	10	65	.52	.34	1	25	90	.49	.38	4	1
7	41	R	5 (5)	Mechanic	Mechanic ^d	2	82	77	100	91	81	89	4	54	.57	.4	2	22	90	.52	.42	5	3
Mean	42		9				76	79	80	74	85	87	8.5	61	.54	.35	1.3	21	81	.5	.38	3.6	

- A Case
- B Age at time of operation
- C Side
- D Follow-up, yr (mo)
- E Preoperative work (see F)
- F Postoperative work
 - ^a Initially returned to heavy work, then retired due to polyarthritis. Poor result from arthroplasty
 - ^b Initially took up old employment, but changed job due to eye injury. Good result from arthroplasty
 - ^c Later tavern keeper
 - ^d Later joiner
- G Pain
 - 1 Normal activity
 - 2 Occasional
 - 3 None
- H-M Percentages of healthy side
- H Flexion
- I Extension
- J Ulnar deviation
- K Radial deviation
- L Grip
- M Pinch
- Preoperative examination
- N Radiolunate angle (normal < 15°)
- O Scapholunate angle (normal range 30°-60°)
- P Carpal height ratio (normal range 0.51-0.57)
- Q Carpal translation ratio (normal range 0.27-0.33)
- R No. of articulations showing arthrosis (range 0-5)
- Postoperative examination
- S Radiolunate angle
- T Scapholunate angle
- U Carpal height ratio
- V Carpal translation ratio
- X No. of articulations showing arthrosis
- Y Complication
 - 1 Early median nerve neuropraxia,
 - 2 Late median nerve compression,
 - 3 Dislocated prosthesis (see Figure 1)

Results

All patients stated that they were satisfied with the results of surgery. 2 patients were completely pain-free, 4 had pain on heavy activity only, and 1 patient had pain on normal activity although this was less severe than preoperatively. All had returned to work (including 1 previously unemployed) involving heavy labor. 2 patients experienced difficulty on rotatory movements, such as using screwdrivers, and 1 of these had difficulties with using a spade while digging. 1 patient experienced pain in all daily activities.

Radiographs showed evidence of progressive arthrosis, instability and carpal collapse in all patients (Table 1).

Discussion

In our experience, a persistently painful non-united fracture of the scaphoid requiring surgery is uncommon. A number of studies have shown that long-standing non-union appears to predispose to progressive arthrosis of the intercarpal joints (Ruby et al. 1985, Vender et al. 1987). In an attempt to prevent such change, early operative intervention with grafting plus or minus internal fixation for unstable scaphoid fractures is advocated by a number authors (Herbert and Fisher 1984, Leyshon et al. 1984). It remains to be seen whether such early intervention, along with grafting/fixation for non-union, will reduce the long-term

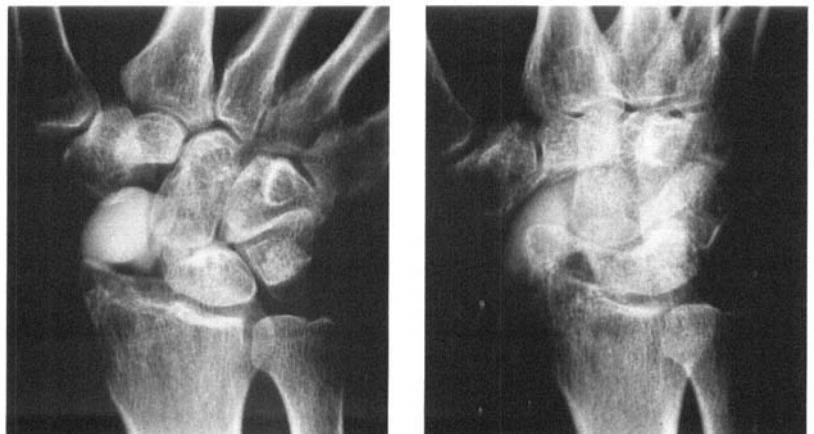


Figure 1. Case 7. A 46-year-old man reviewed 5 years after operation, had only occasional pain on heavy activity, was successfully retraining as a joiner after compulsory redundancy. His hobby was woodwork. Anteroposterior radiographs in ulnar and radial deviation showing dislocation of implant with dislocation of trapezial stem and 180° rotation of implant.

incidence of non-union associated with radiocarpal arthrosis.

Despite Swanson's promising early results with the silicone scaphoid implant, Kleinert et al. (1985) in their review of 23 patients reported a number of problems. The radiographic evidence of progressive carpal collapse and instability was seen in both our own and Kleinert's patients. Such a radiographic change is not surprising if one considers that the implant is devoid of any ligamentous attachment, with the trapezoid peg providing only limited stability of the distal pole of the implant. As the scaphoid relies on its ligamentous attachments for stability, the proximal pole of the implant will tend to dislocate dorsally and rotate, especially during palmar flexion and pronation (Linscheid 1972, Green 1988). Thus, the lateral column stabilizing effect of the scaphoid is lost, and this will inevitably lead to abnormal loading on the other intercarpal joints, with progressive collapse and arthrosis. However, most of our patients did not have serious problems from these changes.

References

- Green D P. Operative hand surgery. Churchill Livingstone, Edinburgh, 2nd ed. 1988; 2, Chapter 20: 897-92.
- Herbert T J, Fisher W E. Management of the fractured scaphoid using a new bone-screw. *J Bone Joint Surg (Br)* 1984; 66 (1): 114-23.
- Kleinert J M, Stern P J, Lister G D, Kleinhans R J. Complications of scaphoid silicone arthroplasty. *J Bone Joint Surg (Am)* 1985; 67 (3): 422-7.
- Leyshon A, Ireland J, Trickey E L. The treatment of delayed union and non-union of the carpal scaphoid by screw-fixation. *J Bone Joint Surg (Br)* 1984; 66 (1): 124-7.
- Linscheid R L, Dobyms J H, Beabout J W, Bryan R S. Traumatic instability of the wrist. Diagnosis, classification, and pathomechanics. *J Bone Joint Surg (Am)* 1972; 54 (8): 1612-32.
- McMurty R Y, Youm Y, Flatt A E, Gillespie T E. Kinematics of the wrist. II. Clinical applications. *J Bone Joint Surg (Am)* 1978; 60 (7): 955-61.
- Ruby L K, Stinson J, Belsky M R. The natural history of scaphoid non-union. A review of fifty-five cases. *J Bone Joint Surg (Am)* 1985; 67 (3): 428-32.
- Russe O. Fracture of the carpal navicular: diagnosis, non-operative treatment, and operative treatment. *J Bone Joint Surg (Am)* 1960 Jul; 42: 759-68.
- Swanson A B. Silicone rubber implants for the replacement of the carpal scaphoid and lunate bones. *Orthop Clin North Am* 1970; 1 (2): 299-309.
- Vender M I, Watson H K, Wiener B D, Black D M. Degenerative change in symptomatic scaphoid nonunion. *J Hand Surg (Am)* 1987; 12 (4): 514-9.
- Youm Y, Flatt A E. Kinematics of the wrist. *Clin Orthop* 1980; 149: 21-32.