Late results of the Souter-Strathclyde total elbow prosthesis in rheumatoid arthritis

6/19 implants loose after 5 years

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We performed total elbow replacement, using the Souter-Strathclyde prosthesis in 19 elbows of 18 patients with rheumatoid arthritis and followed the patients for 5 (1–11) years. Pain relief was achieved initially in all patients. The average range of flexion–extension was increased by 12° and pronation–supination by 40°. There were no infections. 1 patient sustained an intraoperative fracture of the medial epicondyle, 3 patients developed neuropathies and 1 patient had an immediate postoperative dislocation of the joint.

At follow-up, 6 prostheses had radiographic loosening, with sagittal tilting and migration of 4 humeral components. 2 patients had clinical symptoms of loosening.

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Previously we have reported our experience with the Souter-Strathclyde elbow prosthesis for rheumatoid arthritis (Sjödén et al. 1988, Sjödén and Blomgren 1992). We now present our results of an extended series of 19 total elbow replacements in 18 patients.

Patients and methods

From 1982 to 1992, we used the Souter-Strathclyde unconstrained prosthesis for total elbow replacement in 15 women and 3 men with seropositive rheumatoid arthritis. Their mean age at operation was 62 (50–76) years. In 10 patients, the non-dominant elbow was operated, and 1 woman was operated on bilaterally. All patients were on treatment with NSAID and 1 patient also received 8.75 mg prednisolone per day. The elbows were radiographically in stage 4 or 5 according to Wadsworth (1982). The indications for operation were pain at rest and decreased mobility with severe destruction of the joint.

Cement fixation (Palacos® with gentamicin, Schering Corp) was used on both the ulnar and humeral sides. Prophylactic intravenous antibiotics were routinely employed. 2 elbows were primarily operated with a long-stem humeral component due to insufficient bone on the radial epicondyle. Postoperatively, the elbow was immobilized in a posterior splint at 90° of flexion for 5 days. Then passive movements were started and the splint was used intermittently. Active motion was started and the splint was discarded after 2 weeks.

The average observation period was 5 (1–11) years, with a clinical and radiographic examination at follow-up. Of the 18 patients, 6 had died by the time of this review. The final results in these patients were obtained from the most recent clinical charts and radiographs.

Results

1 woman presented with a dislocated elbow 6 weeks after surgery. She was treated with open reduction and immobilization for 4 weeks in an external Hoffman fixator (Sjödén and Blomgren 1992). The elbow regained full stability and a completely pain-free range of motion. However, the humeral component is now radiographically loose.

Neurological complications occurred in 3 cases, 2 ulnar neuropathies and 1 combined radial and ulnar neuropathy. While the radial nerve partially regained function, 1 ulnar neuropathy persisted and the others were transient.

One woman had a revision done 4 months after primary surgery, due to loosening of the humeral component following an intraoperative fracture of the medial epicondyle (Sjödén et al. 1988). One woman

Table 1. Preoperative and postoperative data in patients operated on with the Souter-Strathclyde elbow prosthesis

Case	Sex	Age	Follow-up (mos)	Flexion pre	Flexion post	Extension pre	Extension post	Pronation pre	Pronation post	Supination pre	Supination post	Complications[a]	Mm radiolucency[b]	Comments
1	M	60	101	120	155	20	35	80	80	80	70	–	< 2	Died
2	F	66	102	90	125	75	65	0	20	0	0	N	< 2	Died
3	F	75	128	135	120	5	40	60	60	60	60	N	≥ 2	Revision (9 yrs; fracture)
4	M	76	84	140	140	30	35	45	90	45	45	–	< 2	Died
5	F	55	109	105	120	40	20	0	0	0	45	–	n	
6	F	56	69	130	155	50	25	60	80	60	90	–	< 2	Died
7	F	67	74	110	140	30	50	10	60	10	80	F	< 2	Revision (4 mos). Died
8	F	62	73	140	150	20	15	90	90	45	90	–	≥ 2	Humeral migration
9	M	73	71	130	125	50	40	80	80	80	90	–	≥ 2	Humeral migration
10	F	55	52	110	130	30	40	80	60	70	60	–	≥ 2	
11	F	58	37	110	150	40	30	90	90	60	80	D	≥ 2	Humeral migration
12	F	71	52	150	130	50	50	70	70	70	90	–	≥ 2	Humeral migration
13	F	65	47	130	150	80	50	90	90	60	70	–	n	Long stem
14	F	51	34	115	125	45	55	80	90	80	90	–	< 2	
15	F	63	12	110	135	20	20	80	70	0	60	–	< 2	Died
16	F	50	33	100	110	50	50	30	90	0	45	N	n	
17	F	66	32	140	155	20	30	60	90	60	90	–	< 2	
18	F	56	16	110	115	50	70	0	80	0	70	–	n	Long stem
19	F	58	15	140	150	40	60	70	70	60	90	–	n	Long stem

[a]Complications: N neuropathy; F fracture intraop.; D Dislocation.
[b]n none.
Cases 1–7 included in previous report by Sjödén et al. (1988).
Cases 1–14 included in previous report by Sjödén and Blomgren (1992).
Cases 8 and 17 bilateral.

sustained a fracture of the medial epicondyle 9 years after the initial prosthetic implantation and was successfully revised using a long stem humeral component.

At reexamination, the range of flexion–extension had increased by 12° and the range of pronation–supination by 40° (Table 1). Flexion increased from 122° to 136°, while the extension lag was almost the same (39° and 41°). Pronation increased from 57° to 72° and supination from 44° to 69°. No ulnar components showed any sign of subsidence and no radiolucency > 1 mm was detectable around the ulnar cement-bone interface.

A radiolucent zone < 2 mm was evident in 8 elbows around the humeral component, while radiolucency ≥ 2 mm was noted around 6 humeral components. The humeral component showed ventral displacement of the proximal end in 4 of the 6 elbows with a large radiolucency (Figure 1). 2 of the displacements occurred in the dominant arm and 2 in the non-dominant side. 2 patients experienced pain only on activity, 2 elbows were painful at rest while 2 loose prostheses showed no clinical manifestations.

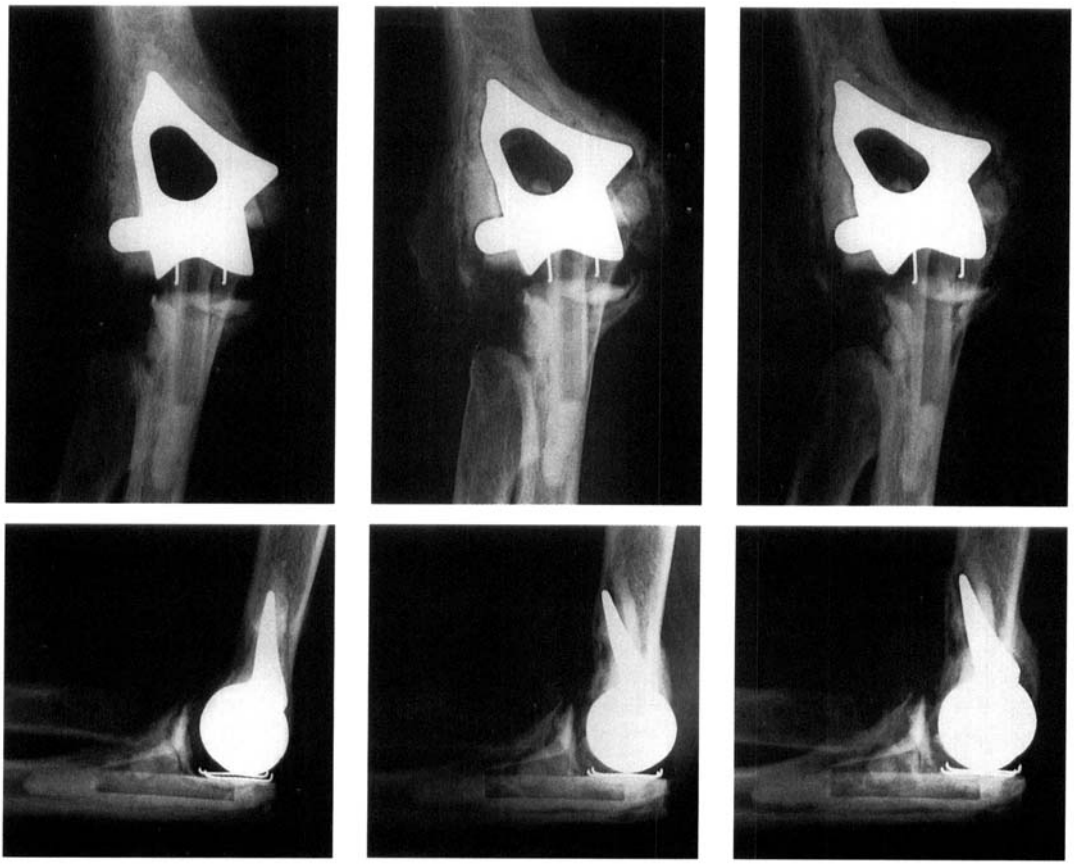
Discussion

Forces acting on the elbow are dominated by the muscle actions. With extension and flexion of the elbow, the resultant force over the joint changes direction. This transmits cyclic stresses into a humeral implant (Amis et al. 1979, Amis 1990). The early types of total elbow replacement were designed as totally constrained hinges. It soon became apparent that loosening was a major problem (Souter 1973, Dee 1977). This led to the development of semi-constrained and unconstrained prostheses.

A semi-constrained prosthesis allows a few degrees of mediolateral motion between the humeral and ulnar components. If the ligamentous constraints are inadequate, the prosthesis will behave like a fully constrained prosthesis, as it will reach the limits of its own constraints. Indeed, a high incidence of loosening was reported (Morrey et al. 1981).

Unconstrained prostheses have been reported to give excellent pain relief and some gain of motion, while loosening was not reported initially (Ewald et al. 1980). Instead, the complications reported with unconstrained prostheses were dislocations and neuropathies (Kudo et al. 1980, Sjödén et al. 1988). With a longer follow-up, radiolucent zones around the humeral component were reported (Sjödén and Blomgren 1992). In long-term studies with a 5–10 year follow-up, humeral loosening became apparent also in surface replacements of unconstrained design (Ljung et al. 1989, Kudo and Iwano 1990).

Figure 1. A 73-year-old man (case 9) with rheumatoid arthritis and symptoms of loosening of the humeral component.



2 months postoperatively.

5 years postoperatively. Note the periosteal reaction over the tip on axial view.

6 years postoperatively. Note the loss of bone anchorage on the dorsal side of the humeral component distally on axial view.

The design of the Souter-Strathclyde humeral component includes flanges which distally anchor the trochlear implant into the epicondylar ridges. The distal fixation is wide, giving maximum rotational stability (Souter 1985, Souter 1989). However, the prosthetic stem is short, extending only just into the humeral metaphysis. This design may allow for a ventral displacement of the proximal part of the humeral component with the flanges distally acting as a fulcrum.

We found a specific pattern of humeral component loosening in patients operated on with the Souter-Strathclyde prosthesis. There was a consistent ventral migration of the proximal end of the humeral stem. A single case of a similar migration was described by Pöll and Rozing (1991). As the loosening progresses, the distal end of the humeral component migrates posteriorly, destroying the posterior supracondylar cortex.

We suggest that a long-stem humeral prosthesis should be used in active patients. Other unconstrained elbow implants with acceptable long-term results have humeral components with a reasonably long stem (Kudo and Iwano 1990, Ewald et al. 1993). The high complication rate we found with the Souter-Strathclyde elbow prosthesis (5/19) and the high incidence of loosening (6/19) is comparable to another recent report (Lyall et al. 1994). The results imply that joint replacement of the elbow should be reserved for patients with severe rheumatoid arthritis.

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