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Prospective comparison study of one-year outcomes for all titanium total temporomandibular joint replacements in patients allergic to metal and cobalt–chromium replacement joints in patients not allergic to metal

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Abstract

We aimed to ascertain whether there are any early differences in outcome between all titanium temporomandibular joint (TMJ) prostheses in patients allergic to metal and standard cobalt–chromium prostheses in patients not allergic to metal. All patients who had primary TMJ prostheses placed with one-year follow-up between March 2003 and February 2011 were included. We reviewed the basic characteristics of patients. The outcome variables measured included disease, pain, mouth opening, and diet. A total of 55 patients with 77 joint replacements fulfilled the inclusion criteria. Forty patients had standard cobalt–chromium alloy (Co–Cr–Mo) prostheses (20 unilateral and 20 bilateral), and 15 had all titanium prostheses (13 unilateral and 2 bilateral). Osteoarthritis was the most common disease in both groups. There was significant improvement in pain score at reviews at 6 weeks ($p = 0.001$) and 12 months ($p = 0.03$). Values between groups were not significant ($p = 0.48$ at 6 weeks, and $p = 0.10$ at 1 year). Mouth opening in each group improved significantly with continued gains between assessments at 6 weeks and 12 months ($p = 0.001$) but there were no significant differences between groups. Diet scores were significantly improved one year postoperatively in both groups ($p = 0.001$), but differences between groups were not significant ($p = 0.90$). At one year, outcomes for all titanium prostheses in patients allergic to metal were similarly favourable to those in patients who had no hypersensitivity to metal and had standard prostheses. No patient developed a hypersensitivity reaction, and no all titanium prosthesis failed during the one-year follow-up period.

Keywords: TMJ replacement; All-titanium temporomandibular joint replacement; Cobalt–chromium total temporomandibular joint replacement; Metal-allergic patients; Degenerative arthritis of the TMJ

Introduction

The 2 commercially available total temporomandibular joint (TMJ) prostheses are standard cobalt chromium alloy, and all titanium prostheses. Unlike the all titanium prosthesis, the condylar head of a standard TMJ prosthesis is made of cobalt, chromium, nickel, and molybdenum alloy. The condylar component in both articulates on an ultra-high-molecular-weight polyethylene (UHMWPE) fossa. Roughly 10% of the population are allergic to one or more metallic component of a standard TMJ prosthesis, usually nickel.[1] In functioning hip prostheses this proportion rises to 23%, and to 63% in those with a failing prosthesis.[1] Hypersensitivity is a recognised reason for their premature removal.[2,3] It is current practice for all patients listed for total TMJ replacement in the Nottingham unit to have a patch test for allergy to

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nickel, cobalt, chromium, and molybdenum. Those found to be allergic to any component in the standard prosthesis have all titanium replacements. Unfortunately we know of no studies on outcomes following placement of these prostheses, so patients need to be closely monitored.

We aimed to find out whether there are any early differences in outcome between placement of all titanium TMJ prostheses in patients allergic to metal and standard prostheses in patients not allergic to metal.

Method

The study centre is a national tertiary referral centre for TMJ surgery based in Nottingham, England. Information was retrieved from the departmental TMJ database, which is maintained by the lead consultant surgeon. All primary TMJ prostheses placed between March 2003 and February 2011 with follow-up of at least one year were included in the study. Patients who had not reached one-year follow-up ($n = 14$ prostheses), and those who had had revisions after primary operations had been done elsewhere ($n = 11$), were excluded from the analysis.

We reviewed the age and sex of patients. The outcome variables of interest included joint disease, pain, mouth opening, and diet. The hospital's histopathology department provided the pathological diagnoses postoperatively. Patients assessed pain before operation and after operation at 6-week and one-year follow-up using a 100 mm visual analogue scale (VAS) from 0 (no pain) to 100 (severe pain). Pain was rated independently for both sides by all patients. Diet was also self-reported before operation and at one-year follow-up using a 100 mm VAS from 0 (liquid diet) to 100 (steak or bread roll). Mouth opening was measured as the maximum distance between upper and lower incisors using callipers.

Statistical analysis was done using SPSS® version 19 (IBM). Scores are presented as mean (95% CI). Independent sample *t*-tests and associated *p*-values were used for comparisons between groups

Results

A total of 55 patients (77 joint replacements) fulfilled the inclusion criteria; 40 had a standard TMJ prosthesis (cobalt–chromium–molybdenum) (20 unilateral and 20 bilateral), and 15 had all titanium prostheses (13 unilateral and 2 bilateral). Distribution of age was similar in both groups: median 38 years (range 22–71) in the all titanium group, and 40 years (range 16–72) in the standard group. There were 34 women and 6 men in the standard group, and all patients in the all titanium group were female. All the resected joints were diseased. Osteoarthritis was the most common disease in both groups (59% in the all titanium, 45% in the standard group). The distribution of other diseases is shown in Table 1.

Table 1
Pathological diagnoses.

	All titanium prosthesis ($n = 17$ joints)	Standard prosthesis ($n = 60$ joints)
Osteoarthritis	10	27
Rheumatoid arthritis	3	9
Ankylosis	3	12
Malunion	1	2
Psoriatic arthropathy	0	6
Post costochondral graft	0	2
Ankylosing spondylitis	0	2

All patients with unilateral symptoms or disease scored zero for pain in the healthy joint before and after operation. The mean VAS scores for joint pain are shown in Table 2.

Preoperative mouth opening was limited to the same extent in both groups (Table 3). As expected, mouth opening improved considerably after the joint was replaced, and continued to improve between assessments (Table 3). Differences between groups were not significant.

Preoperative diet scores were similarly restricted in both groups (Table 4). Scores for each group significantly improved one year after operation ($p = 0.001$ for both groups), but differences between the groups were not significant.

Within the study period one replacement failed in the standard group because of spreading otitis externa and subsequent biofilm infection of the prosthesis. No patients in either group reported symptoms suggestive of hypersensitivity to metal.

Discussion

Reported possible reasons for a TMJ prosthesis to fail include allergy to metal, wear at the point of contact, micromovement, and lymphocyte-mediated immunological reaction to the prosthetic material.[4]

Allergy to metallic components in a standard TMJ prosthesis is not uncommon.[1] In our series 15/57 patients (26%) showed definite hypersensitivity on preoperative testing. All were female, which is consistent with the known excess expression of hypersensitivity in female patients.[5]

Table 2
Pain: data are mean (95% CI).

Pain score (mm)	All-titanium prosthesis ($n = 17$ joints)	Standard prosthesis ($n = 60$ joints)	*p*-Value
Preoperatively	64 (45–83)	62 (53–70)	0.80
6 weeks postoperatively	24 (8–40)	19 (14–25)	0.48
12 months postoperatively	11 (3–18)	4 (1–8)	0.10