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Foreign body response around total prosthetic metal-on-metal replacements of the temporomandibular joint in the UK

A.J. Sidebottom^{a,*}, B. Speculand^b, R. Hensher^c

^a *Maxillofacial Unit, Queens Medical Centre, Nottingham, UK*

^b *Maxillofacial Unit, University Hospital Birmingham, Birmingham, UK*

^c *11 Harcourt House, 19A Cavendish Square, London W1G 0PN, United Kingdom*

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Abstract

Replacements for the temporomandibular joint were developed in the early 1960s. Problems with various prostheses, notably the Kent VK1, led to detailed analysis of their risks and complications. In 1999 one type of prosthesis (the Christensen) was converted from an acrylic condyle on cobalt-chromium fossa to metal-on-metal cobalt-chrome condyle and fossa. This has been popular for the last 15 years in the UK, but since it was converted to the metal-on-metal variant there have been several cases of foreign body giant-cell reactions to the prosthesis. Of the 9 cases seen (out of 106 placed), 4 were found retrospectively to be sensitive to one of the metal components of the prosthesis; the others have not been tested to date. Other potential causes of this reaction are point contact, micromovement, or a lymphocyte-mediated response to the prosthesis.

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Introduction

Total replacement of the temporomandibular joint (TMJ) has been a recognised treatment for severe degenerative disease of the TMJ for 40 years. It is also useful in the management of ankylosis, severe loss of tissue in rheumatoid diseases, after injury, and after resection of tumour with loss of height in the ramus in adults. We use costochondral grafting in growing children as no prosthesis can grow with the child, and would therefore require early revision.

We have previously reported our experiences with total replacement of the joint^{1,2} and have been using the Christensen system since 1991; 77 metal-on-metal, and 29 metal-on-acrylic, prostheses have been placed during this

time. We have experienced a particular problem with this system recently, which has led us to abandon its use.²

Methods

We retrospectively audited all cases in our three practices in which we had used the Christensen total temporomandibular joint replacement system, to investigate the incidence of formation of a jelly-like substance around the prosthesis.

Results

Of the 77 metal-on-metal prostheses, 7 showed a foreign-body-type giant cell reaction. A further 2 of 29 cases were seen when metal-on-acrylic prostheses had been used. Patch

* Corresponding author.

E-mail address: andrew.sidebottom@nuh.nhs.uk (A.J. Sidebottom).



Fig. 1. Left traction facial nerve palsy (case 1: reproduced with the patient's permission).

testing of two of the metal-on-metal cases showed a reaction to cobalt, and 2 showed an allergy to nickel or to multiple metals. None of the other patients have been tested to date. All remaining cases are now over one year postoperatively with no similar symptoms and improved postoperative outcomes.

The following two cases illustrate the typical progress of these patients postoperatively.

Case 1

A 64-year-old woman presented with severe pain and limited mouth opening with a pain score of 7/10 on a visual analogue scale (VAS) and mouth opening of 27 mm since a post-traumatic right condylectomy 10 years previously. She had developed degenerative changes of the opposite condyle, which did not respond to standard conservative measures or to arthroscopic lysis and lavage.

She had bilateral total Christensen joint replacements, and after 3 months was pain-free with mouth opening of more than 40 mm. After 6 months she started to develop symptoms of pain, facial swelling, and later left facial palsy (Fig. 1). The symptoms were less pronounced on the right side. Patch testing confirmed an allergy to cobalt. All other tests including ultrasound-guided fine needle aspiration, C-reactive protein concentration, and erythrocyte sedimentation rate (ESR) were within reference ranges.

The implant was removed and at operation a jelly-like material was encasing the whole prosthesis (Fig. 2). The joint was temporarily maintained with a silastic spacer for 6 months and intermaxillary fixation for 6 weeks. Histological analysis of the periprosthetic tissue showed necrotic

inflammatory cells and birefringent crystalline material, features that were consistent with reaction to damaged prosthetic material.

The patient had a computed tomogram (CT), and a custom-made TMJ Concepts titanium condyle to high molecular weight polyethylene bonded to titanium fossa was placed 6 months later. It is now two years since the operation and her facial nerve function has fully recovered; after 6 weeks postoperatively she was pain-free with mouth opening of more than 40 mm.

Case 2

A 51-year-old woman was referred in 2002 with a 10-year history of right TMJ dysfunction, having been treated conservatively elsewhere, including sinus washouts, and removal

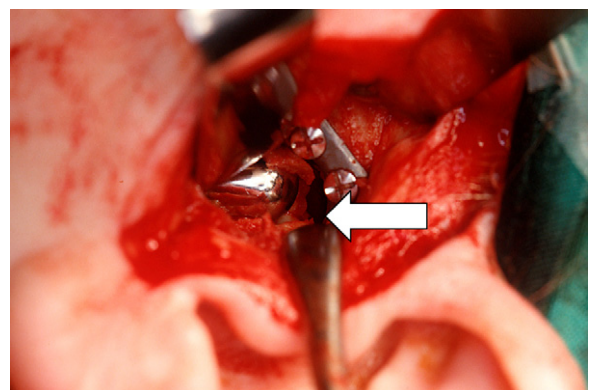


Fig. 2. Jelly-like substance surrounding the joint (case 1: reproduced with the patient's permission).



Fig. 3. Preoperative appearance of case 2 (reproduced with the patient's permission).

of impacted wisdom teeth. Her pain had increased so much that she had to give up her job as a deputy head teacher. Arthroscopy of the right TMJ in 1999 had showed adhesions and a displaced intra-articular disc. She developed ankylosis in 2000, which was treated by gap arthroplasty with an interpositional postauricular dermal graft secured with a Mitek bone anchor. This initially relieved her symptoms, but later that year she was involved in a road traffic crash and had a whiplash injury that caused deterioration of her TMJ symptoms.

In November 2002 her mouth opening had decreased to 8 mm. A panoramic radiograph and coronal CT (Figs. 3 and 4) showed ankylosis of the right TMJ with a titanium screw in the joint. In October 2003, a right Christensen total TMJ replacement was inserted, at the same time as a left sided coronoidectomy. At operation her mouth opening increased to 35 mm.

Two weeks postoperatively mouth opening had decreased to 13 mm with slight weakness of the upper right branches of the facial nerve. Mouth opening deteriorated further and her analgesic requirements increased to morphine 40 mg/day with gabapentin 100 mg three times daily. Six weeks later she developed a complete paresis of all lower branches of the right facial nerve (Fig. 5).



Fig. 4. Preoperative computed tomogram (case 2).

At that stage the Christensen components were removed, and the joint space was found to be filled with a yellow amorphous material. A magnetic resonance scan (MRI) taken after removal of the components showed that it had a honeycomb appearance within and around the right parotid gland (Fig. 6). Histological examination of specimens of the soft tissue confirmed a foreign body giant cell reaction (Fig. 7).

Three months after removal of the Christensen components, she was given a trial of prednisolone 40 mg daily. Over the next 2 months her right face began to soften and the lower



Fig. 5. Postoperative appearance with traction facial palsy that developed at 6 weeks (reproduced with the patient's permission).

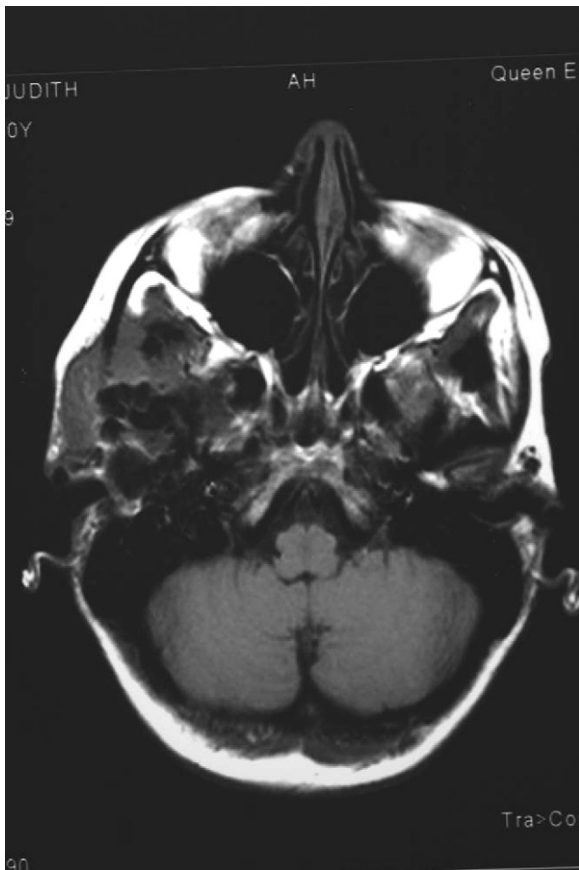


Fig. 6. Magnetic resonance scan showing honeycombing of tissues.

branches of the right facial nerve started to recover. Her analgesic requirements were tramadol as needed and gabapentin 900 mg/day. After 4 months her mouth opening had increased to 18 mm. She was treated nearer home by insertion of a gold weight to the right upper eyelid, to assist closure of the lid.

Ten months after her second procedure her mouth opening had increased to 22 mm and her facial nerve branches had recovered to include the zygomatic branch, though there was persistent weakness of the right temporal branch. An MRI in

November 2004 showed complete atrophy of the superficial pole of the right parotid gland. The right side of her face remained painful and was subject to intermittent episodes of swelling. Subsequent dermatological patch testing for metal allergy confirmed that she was allergic to cobalt. The right TMJ functions as a gap arthroplasty, and her dental occlusion has not deteriorated.

Discussion

We are drawing attention to a problem that has occurred in 3 practices within the UK. Orthopaedic papers suggested that this may be a problem with gliding metal-on-metal joints generally as a result of point contact wear, but it is currently a topic of much debate also in total hip replacements that fail. Four possible causes have been suggested: metal allergy, point contact wear phenomenon, micromovement, and lymphocyte-mediated immunological reaction to the prosthetic material.

The possibility of metal allergy in total joint replacement has been discussed but has not been considered to be a problem in the past.³ Patients with a loose prosthesis are more likely to be sensitive to the metal components.⁴ In a meta-analysis, roughly 10% of the population were found to be allergic to one or more components of the prosthesis, usually nickel,⁵ of which it contains 1%; the other components are cobalt (62%–67%), chromium (27%–30%), and molybdenum (5%–7%). In patients with a functioning prosthesis this proportion rises to 23%, and in those with a failing prosthesis to 63%. There are sensitive patients who do not have a failing prosthesis, but why is not known. It may be that the symptoms and signs are disguised either because of the depth of the implant in the tissues, or because their pain has been ascribed to another cause.

There is certainly evidence of metallosis in Christensen joints that have been removed for other reasons, notably wear of the acrylic cap in the former type of prosthesis (Figs. 8 and 9). Particulate metal debris is therefore not

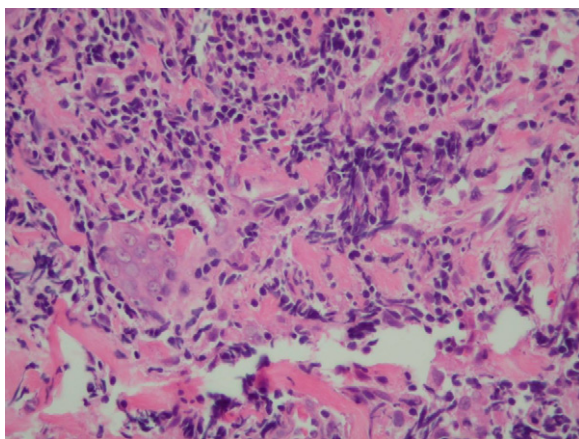


Fig. 7. Histological picture of the foreign-body reaction.



Fig. 8. Metallosis surrounding 20 year old Christensen prosthesis.

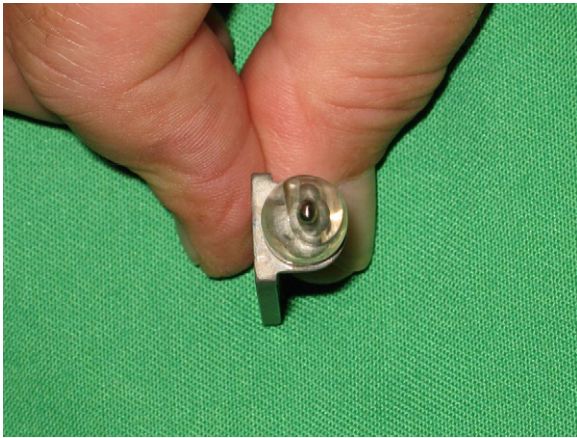


Fig. 9. Wear of Christensen acrylic condylar head at 20 years.

the whole reason; there is clearly evidence that the tissues are exposed to the individual components of the alloy, and testing with an alloy disc against the skin (as can be done preoperatively), may not be sufficient to find out the response of a patient to the implanted material. Patch testing to standard metal series is also not foolproof, as the various salts may cause a different response from those in the prosthesis.⁵ Lymphocyte transformation testing is expensive, and available in only a few centres around the world.

Orthopaedic surgeons do not routinely screen all their patients for allergy to metal, but we now screen all patients to standard metal allergies preoperatively. Should the patient be allergic to any component metal in the condylar head, we use a titanium head rather than cobalt chrome, although the potential for wear on the former is greater³ and the long-term outcomes are not as clear. The TMJ Concepts joint used as an option usually has a cobalt-chrome head, so this component is changed to hardened titanium, the remainder of the condylar component being titanium. Sensitivity may, however, develop after placement of the implant, so preoperative testing may not be wholly foolproof.^{6,7}

Development of immune-mediated osteolysis has occurred in patients who have had joints replaced elsewhere in the body, and is thought to be caused by increased reactivity to

the metals by a lymphocyte-generated response.⁷ This type of reaction could also generate a foreign-body-type response, induce an allergic response, particularly to cobalt,⁸ and may be responsible for failure of the joint.

Micromovement in stock prostheses because the prosthesis is not tightly fitted to the underlying bone may induce a foreign-body-type response. This reaction has not, to our knowledge been seen in custom-made TMJs.

While this is yet another set-back to the routine use of total replacement of the TMJ, we think that it has a place in certain specific cases. Few patients require replacement of the TMJ, so we suggest that the caseload is concentrated in a number of designated centres so that further complications can be discovered quickly, and appropriate measures taken. It is prudent that the British Association of Oral and Maxillofacial Surgeons recently commissioned guidelines for total joint replacement in the UK, which were presented at the 2006 annual scientific meeting. It would also be useful if a national database were established so that this type of problem can be discovered and investigated promptly.

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