Implant failure due to Titanium hypersensitivity/allergy? - Report of a case

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SUMMARY

Six titanium implants were placed in the mandible between the left and right mental foramen of a 49-year old female patient. The implants were all constructed of the same grade IV titanium. Three types of implants were used, namely LIBB compression implant, cylindrical implant and Brånemark-like implant. These three types of implants were placed as part of a research project, which received approval from the ethics committee. The patient developed a severe reaction to all the implant units, with both clinical and radiological features of complication. The localised tissue reaction was severe enough to warrant removal of all the implants. The surrounding soft tissue was submitted for histological analysis, which revealed a chronic inflammatory response with concomitant fibrosis around all the implants as well as foreign body giant cell reaction around two implants. Following implant removal the patient recuperated well and the soft and hard tissue healed satisfactorily.

Following is a case report of a possible true titanium allergy in a clinical setting.

INTRODUCTION

There does not seem to be any proven reported incidence of true titanium allergy in the dental implantation literature. An exhaustive search of the literature has revealed three publications dealing with true documented titanium allergy.[1-3] However, numerous publications in the orthodontic, orthopaedic, ophthalmic and dermatological literature deal with hypersensitivity reactions to various materials, including titanium oxide in particular.[4-8] Contact dermatitis due to titanium has been reported extensively and appears to be quite common.[5-8]

The dental literature is replete with differing reasons why implants fail. In the review article by Esposito *et al,* [9] various reasons for the aetiopathogenesis of implant failure were analysed and documented. These included three major etiologic factors, which in some instances, may overlap: infection, impaired healing and overload. There is one reference to allergy against the material as a cause of implant failure.

CASE REPORT

A female patient, age 49, presented at the Department of Maxillo-Facial and Oral Surgery for mandibular implants to replace her non-functional mandibular denture. Clinical examination revealed an atrophic lower alveolar ridge, but otherwise normal intraoral findings. Her medical history included an episode of rheumatic fever and cardiac surgery for mitral valve replacement (material[s] unknown), knee ligament repair, hysterectomy, ganglion removal from the hand and placement of a steel k-wire for a metatarsal fracture. She was on daily warfarin therapy as a result of the

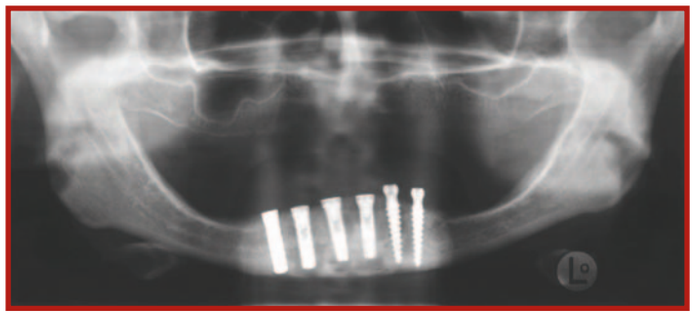

Figure 1a: Post-operative orthopantomogram after implant placement showing illdefined radiolucent areas around all the implants.

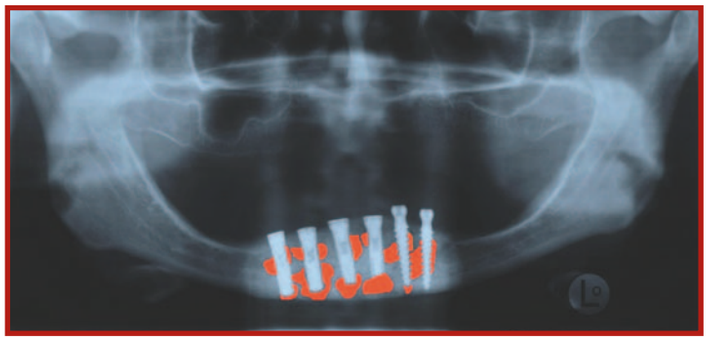

Figure 1b: Post-operative orthopantomogram after implant placement showing illdefined highlighted radiolucent areas.

mitral valve replacement. She reported no allergies and was leading a normal life.

The patient consented to participation in a research project for which ethical approval was obtained. Six endosteal implants consisting of the same grade IV titanium, from the same manufacturer, were placed in the anterior mandible between the mental foramina under general anaesthesia. This was done using a W+H Elcomed hand piece with direct saline pump. Two implants were cylindrical units (GMI, Southern Implants), two were single-stage compression implants (LIBB, Southern Implants) and two were Brånemark-like designed implants (IBS, Southern Implants). The cylindrical and Brånemark-like units are two-stage implant procedures. The incision area for the two-stage implants was sutured with Vycryl 3-0 sutures.

The patient was discharged on the same day of surgery. Post-operative management included prescribing Amoxicillin 500mg q8h and Ibuprofen 400mg q8h for five days. At one week follow-up examination the patient reported a persistent discomfort surrounding the operative area.

Clinical examination of the affected site revealed minimal soft tissue swelling with no signs of puss drainage or obvious infection. It was decided to continue with the medication and to add Metronidazole 400mg for additional anaerobic organisms. However, her symptoms became progressively worse, and five days later she presented with swelling in the submental region and labial sulcus, frank pain, hyperaemia of the surrounding soft tissues and still no signs of pus or necrotic tissue.

An orthopantomogram (Fig. 1a and 1b) and mandibular occlusal (Fig. 2) radiographs revealed ill-defined radiolucent areas with ragged margins (Fig. 1b) at the apices and lateral aspects of all implants. The radiological picture did not resemble a typical peri-implant breakdown process usually associated with peri-implantitis, but was suggestive of a widely spreading non-infective osteolytic process. Anti-inflammatory and analgesic medications were continued for another week, and the broad-spectrum antibiotic regimen was altered to cover aerobic and anaerobic organisms. Despite these measures the patient's symptoms worsened and she returned earlier than the scheduled follow-up appointment for review of her symptoms.

It was then decided to remove the implants. Intra-operatively the implants were found to be mobile and surrounded by hyperaemic soft tissue. A thorough debridement of the affected area and curettage of the hyperaemic soft tissue was performed.

Eight surgical samples from the soft tissue surrounding the implants were retrieved for histological analysis. All the samples exhibited foci of subacute inflammation and moderate chronic inflammation consisting of lymphocytes, plasma cells and histiocytes with con-

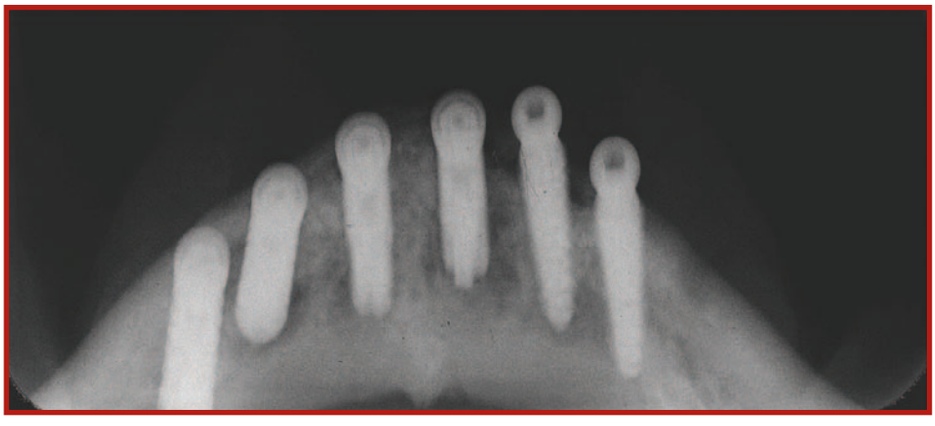

Figure 2a: Post-operative mandibular occlusal radiograph after implant placement showing ill defined radiolucent areas around all the implants.

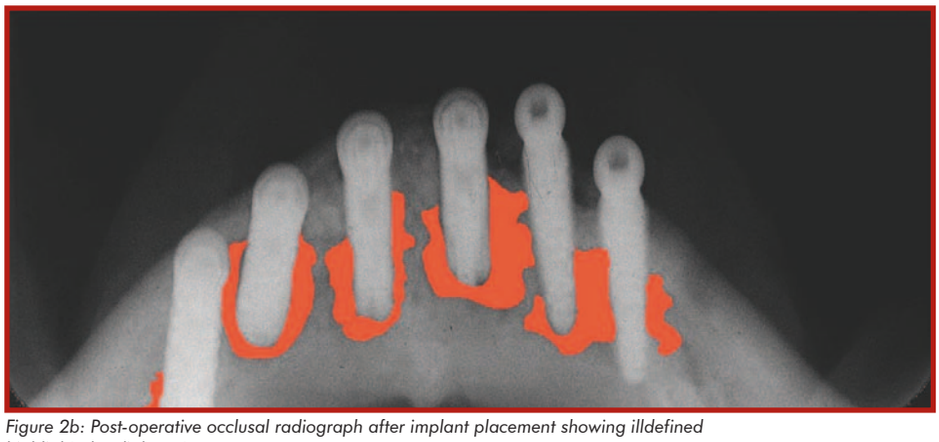

Figure 2b: Post-operative occlusal radiograph after implant placement showing illdefined highlighted radiolucent areas.

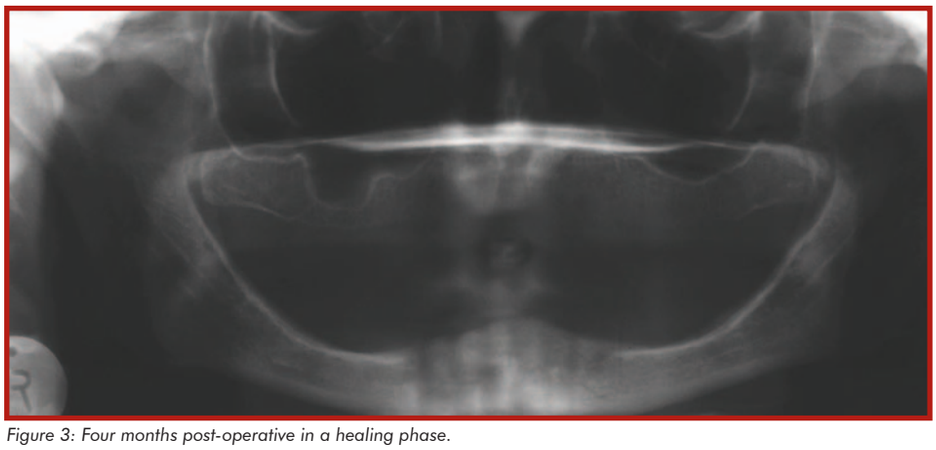

Figure 3: Four months post-operative in a healing phase.

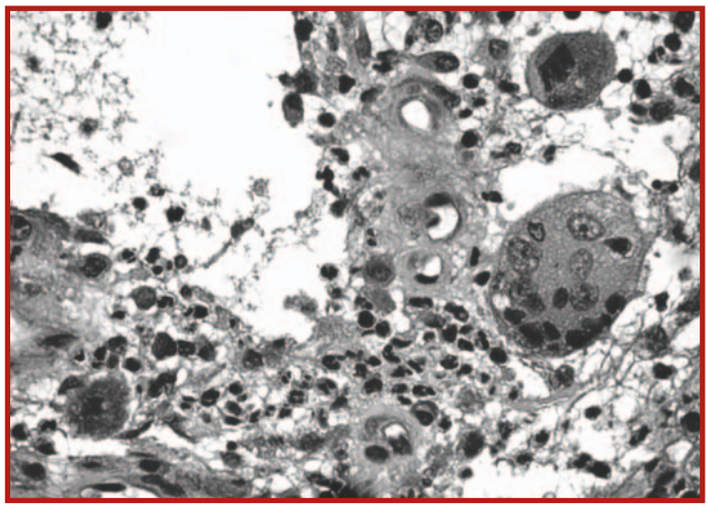

Figure 4: Photomicrograph of a hematolxyllin and eosin stained tissue section showing granulation tissue with foreign giant cell reaction (Original magnification: x200).

comitant fibrosis. In addition, seven samples showed granulation tissue within which isolated foreign body giant cells were present (Fig. 4). No micro-organisms were detected from any of the tissue samples.

DISCUSSION

It is uncertain whether a true titanium allergy exists as only three cases have been reported,[1-3] none of which involved dental implants.

Stejskal, *et al*[10] reported allergic reactions to metals of delayed hypersensitivity type (type IV11) which can involve the oral tissues. They reviewed the possibility soft increased lymphocyte sensitiSation to various metals in 3162 subjects. One of the metals under consideration in their study was titanium. Their results indicated a definite prevalence of a positive response to many metals, including titanium. They also proposed that binding of metals with cell proteins changes the autogenicity and make them vulnerable to attack from immunocompetent cells. However, their publication did not indicate whether there are grounds for an allergic response to titanium when used in implant dentistry. These authors proposed a possible mechanism for the multi-symptoms experienced by patients with chronic fatigue syndrome who have a reaction against metals. The case presented in this paper had no signs of chronic fatigue syndrome.

Various monoclonal antibodies have been analysed in cells of perivascular infiltration adjacent to steel and titanium: [11]CD 1a (Langerhans cells), CD 4 (T-helper cells), CD 8 (T-suppressor cells), CD 11c (monocytes and macrophages), CD 45 RO (memory cells), CD 45 RA (naive cells), eosinophil cationic proteins (ECP), neutrophil elastase and HLA-DR. The conclusion was no differences in sensitisation towards these two metals occurred.[12] This phenomenon has been called the 'pre-sensitisation' phase and most probably occurred in the case discussed here, since there might have been previous sensitisation to the steel k-wire, which had been placed years previously. This k-wire was also removed after two weeks, as the wire remained loose postoperatively. The inflammatory infiltrate around the dental titanium implants, as seen in this case, has also been described previously in cases involving other titanium devices, such as for hip and knee implants.[13] No overheating during the implant placement has taken place, as all patients done under this protocol received the same treatment.

CONCLUSION

This reported case, with no particular history of an allergic reaction to titanium, most probably presented pre-operatively with an allergic-delayed-type hypersensitivity (type IV) for steel, since a steel k-wire previously inserted for fixation of a metatarsal fracture, remained loose and had to be removed after two weeks. This case might be the first indication that true titanium allergy or hypersensitivity to dental titanium implants does exist.

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