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Case Report of Multiple Implant Failure in a Patient with Ankylosing Spondylitis

D. Barker*, F.S.A. Nohl†, K.R. Postlethwaite‡ and D.G. Smith§

Abstract - *This report details a case of multiple implant failure (so-called 'cluster phenomenon') in a patient with ankylosing spondylitis and considers some factors for implant failure including reduced bone density. It highlights the relationship between ankylosing spondylitis and osteoporosis although no direct link is made between these conditions and the implant failures in this case.*

KEY WORDS: Multiple implant failure; cluster phenomenon; ankylosing spondylitis; osteoporosis; bone mineral density; bone grafting.

The use of dental implants is a predictable and successful treatment modality for restoring missing teeth. However while implant failure is relatively uncommon, many studies describe a few patients who experience the loss of multiple implants, the so-called "cluster phenomenon"[1-4]. Implant failure has been comprehensively reviewed and the following endogenous factors have been commonly associated with failure: medical status; smoking; bone quality, quantity and anatomical location; bone grafting; irradiation therapy and parafunction[5,6].

With regard to multiple implant failures in the same individuals, it has been suggested that systemic factors may play an important role, as clearly these factors would affect all of the implants in the same way. Several genetic factors have been examined but no association with implant failure has been shown to date[7]. A retrospective analysis of multiple implant failure in the maxilla published by Ekfeldt et al (2001) examined a group of twenty-seven patients who had lost at least half of their implants[8]. The authors did not identify any specific factors responsible for the cluster phenomenon, but did conclude that all the factors broadly outlined above, are of importance. In particular they highlighted bone quality and quantity and also singled out osteoporosis as an example of an underlying medical condition that may contribute to failure.

Osteoporosis is reduced bone mass per unit bone volume. The patient reported in this paper had ankylosing spondylitis, a condition in which osteoporosis is a frequent complication[9,10], with up to half of patients having been reported as having osteopenia or osteoporosis[11,12], although its pathogenesis has not been well defined[10].

* BDS, FDS RCS, FDS (Rest Dent) RCS
† MBBS, BDS, MSc, MRD, DDS, FDS RCS, FDS (Rest Dent) RCS
‡ BDS, MBChB, FRCS, FDS RCS
§ BDS, DRD RCS, FDS RCS (Edin), FDS RCS (Eng)

CASE REPORT

Relevant history and examination

A fifty-six year old Caucasian male was referred to Newcastle Dental Hospital in 1998 by his general dental practitioner, with regard to an uncomfortable and loose upper complete denture. He had lost his remaining maxillary teeth three years previously as a result of periodontal disease. In the mandible the following teeth were present: 45, 44, 43, 33, 34, 35, 36. A conventional fixed bridge replaced: 42, 41, 31, 32. Examination revealed an inadequate level of oral hygiene, periapical pathology associated with 34 and generalised horizontal bone loss of around one half to two thirds. The 45 and 36 in particular carried a poor prognosis.

The upper denture bearing area was seen to be irregular in shape and markedly resorbed. A dental panoramic tomogram (DPT) revealed only a very thin section of alveolar bone below the maxillary sinuses (Fig 1). The complete upper denture had been optimised considering the anatomical constraints, however its prognosis was deemed to be very poor and following treatment of the lower dentition (including the extraction of 45 and 36) arrangements were made for bilateral sinus floor augmentation, buccal onlay grafting and, following a period of healing, implant placement with a view to providing the patient with an implant retained prosthesis.

With regard to relevant medical history, the patient was generally fit and well and indeed undertook several long distance walking expeditions during the course of his treatment. However he was diagnosed with ankylosing spondylitis in 1965 and while this condition was largely quiescent at the time of his referral and did not cause the patient problems, he had experienced significant symptoms of back pain in the past. This had left him with marked kyphosis and reduced neck movements with limited rotation and poor flexion. Other joints had been largely unaffected. He had also experienced episodes of iritis and disturbed bowel function that had been attributed to the ankylosing spondylitis. The symptoms largely resolved around twenty years ago when the patient was aged around

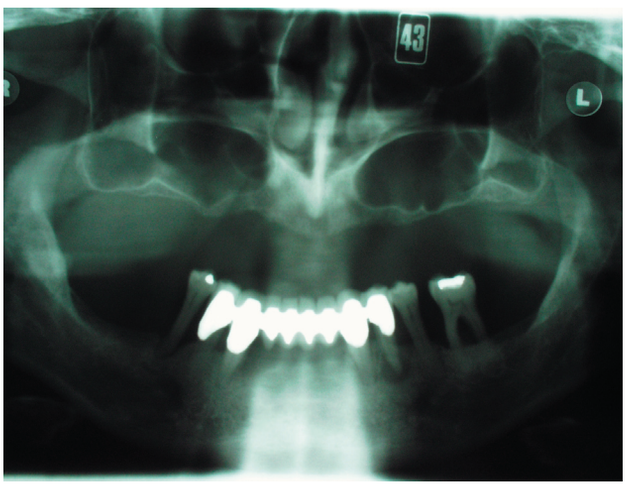

Figure 1. *Pre-op DPT revealing deficiency of available bone for implant placement*

40 years. He also had a spontaneous pneumothorax in 1980. The patient was a retired college lecturer and had been a non-smoker for over thirty years.

Treatment

The relevant dates for fixture placement and failure are shown in Table 1.

A bilateral sinus floor augmentation procedure was carried out in May 1999 using donor bone from the right anterior iliac crest and Bio-Oss®, fixed with miniplates. Unfortunately the patient experienced swelling over the right cheek one month post-operatively which resolved with a course of antibiotics. A CT scan taken four months after the graft revealed a good result with satisfactory bone for implant placement.

Four implants were placed six months post grafting as detailed in Table 1. Unfortunately, the patient experienced a further episode of swelling and subsequent investigation revealed one of the implants had not integrated and was freely mobile. It was removed and the decision was made to place three further fixtures. The abutment connection surgery for these three fixtures revealed that a further two implants had failed and a further two failed two months later. In all cases marked, clinically discernible mobility was seen.

After a lengthy discussion with the patient the decision was made to carry out a second sinus lift procedure, using bone from the left iliac crest and Bio-Oss®. This was carried out February 2004. Five further fixtures were subsequently placed, but unfortunately two of these have since had to be removed.

Prior to implant placement after the second sinus lift, a CT scan was obtained and planning was carried out using SimPlant® Interactive CT Software. This software has a function to measure CT density measurements using Hounsfield Units (HU). The measurements recorded at the sites of implant placement are shown in Table 2.

In total seven out of the twelve fixtures placed (58.3%) have been removed due to failure. Three fixtures (25%) were removed before or at the time of abutment connection surgery. The mean time from fixture placement to removal for all of the failed fixtures was 8.1 months (SD ±2.7) and the average time from abutment connection surgery to removal of the four failed fixtures that underwent second stage surgery was 3.3 months (SD ±1.9)

As shown in Table 1, two of the surviving implants have now been in place for over five years. However, although

Table 1.

Position	*17*	*15[1]*	*15[2]*	*14*	*13*	*12*	*22*	*24[1]*	*24[2]*	*25*	*26*	*27*
Fixture details												
Make and type	NB4	NB4	LC		LC	LC	LC	NB4		LC	NB4	
Platform	WP	WP	RP		RP	RP	RP	WP		RP	WP	
Length	13	13	13		10	13	11.5	10		11.5	10	
Procedure dates												
Fixture Placement (mm/yy)	01.00	01.00	08.04	07.00	08.04	08.04	08.04	01.00	07.00	08.04	01.00	07.00
Abutment Connection (mm/yy)	07.00	07.00	-	-	03.05	03.05	03.05	-	01.01	03.05	07.00	01.01
Removal (mm/yy)	-	01.01	03.05	01.01	-	06.05	-	05.00	03.01	-	-	03.01
Removed implants												
Time from placement (months)	-	12	7	6	-	10	-	4	9	-	-	9
Time from abutment connection (months)	-	6	-	-	-	3	-	-	2	-	-	2
Surviving implants (to July 2005)												
Time from placement (months)	66	-	-	-	11	-	11	-	-	11	66	-
Time from abutment connection (months)	60	-	-	-	4	-	4	-	-	4	60	-

Key: NB4= Nobel Biocare Mark IV Brånemark implant; LC=LifeCore implant; WP=wide platform; RP=regular platform

Table 2.

Implant position	*Bone quality (Hounsfield Units, HU)*	
	Mean	*St Dev*
15	506.09	232.16
13	512.13	98.61
12	496.21	555.76
22	487.07	587.73
25	618.38	276.84

these fixtures remain in function, are non-mobile and are asymptomatic, they have experienced over 50% bone loss and can therefore be classified as having failed according to the criteria of Albrektsson[12].

DISCUSSION

It is acknowledged that implants placed in the maxilla have a significantly lower success rate than those placed in the mandible[5,13]. Furthermore it is known that bone grafting negatively influences implant success rates[4,5,14] with failure rates for sinus lifts, onlay grafts and inlay grafts (Le Fort I) being reported as 9%, 21% and 18% respectively[6]. The implant failures reported are broadly in line with the results of the work by Ekfeldt et al (2001) looking at multiple implant failure in the maxilla[8] and the meta-analysis of Esposito et al (1998)[5] although importantly, these reports did not include cases where there had been bone grafting.

In a retrospective analysis of implant placement in bone grafted maxillae[4], 11 out of 49 patients were seen to have significantly reduced success rates. Further examination of this group showed their relative bone mass density - measured by single-photon gamma absorptiometry – to be significantly lower than that of a matched control group receiving the same treatment. However, it is important to note that the treatment carried out in this study was simultaneous graft and implant placement as a one-stage procedure. The authors concluded that in addition to local complications, general disorders, such as osteoporosis, must be considered in cases of excessive implant loss. Although the literature fails to show a relationship between implant loss and osteoporosis[6,15], there does seem to be a consensus between clinicians that this condition may have a role in implant failure. This association appears to centre on the fact that bone density influences the initial stability of the implant.

Various studies have shown that the bone mineral density of subjects with ankylosing spondylitis is reduced[10,16]. The best biologic method of evaluating bone density is histomorphometric analysis of a bone sample[17] but this is not feasible for clinical practice, where tactile perception allows a crude classification of bone quality to be made: soft, normal and dense bone[18]. CT offers the best radiographic method for determining the quality of bone[19] and software programmes facilitate the evaluation of bone density by Hounsfield Units (HU). Based on the classification of Lacan and Teman (1999)[20], it would appear that the bone density of the patient in this case report, shown in Table 2, could be described as dense cortical-spongy bone rather than low density bone, and therefore a reasonable quality for implant placement.

Ankylosing spondylitis is a painful, chronic rheumatic disease with a prevalence of less than 1% of the population. It typically affects young adults, with men more severely affected than women[21].

The patient in this report has also experienced inflammatory eye and bowel conditions in the past, both of which are relatively frequent occurrences in patients with ankylosing spondylitis[21]. The occurrence of spontaneous pneumothorax with ankylosing spondylitis however, is rare[22].

No factors for why such a high number of fixtures failed in this patient have been identified. All bone grafting and fixture placement surgery was carried out by an experienced surgeon according to standard protocols. The patient in this case had been a non-smoker for over thirty years so no significant effect from his past smoking habit would be expected[23]. There is no evidence that a past history of periodontitis will adversely affect implant survival[6,24,25], and despite the fact the patient was dentate in the opposing arch, there is little evidence to suggest that any kind of parafunction may have resulted in implant failure[6]. In any case, no loading of the fixtures or upper ridge was experienced for one week following fixture placement and abutment connection surgery as the denture was retained by the hospital. It was adjusted and lined with a resilient denture material prior to being given back to the patient.

To our knowledge, only one paper has reported implant failure in a patient with ankylosing spondylitis, and this was an indirect observation with no link made[27]. It is not our intention to propose an association between ankylosing spondylitis and multiple implant failure based on one case report alone, and nor do we suggest that ankylosing spondylitis is any kind of contraindication to implant placement. We merely aim to add the knowledge of this case to the paucity of information currently available on multiple implant failure and raise awareness of clinicians to the association between ankylosing spondylitis and osteoporosis.

MANUFACTURER'S DETAILS

- Bio-Oss®. Geistlich Biomaterials, Wolhusen, Switzerland
- SimPlant® Interactive CT Software. Materialise, Leuven, Belgium
- Nobel Biocare®. Gothenburg, Sweden
- Life Core® Biomedical Inc. Chaska, Minnesota, USA

ADDRESS FOR CORRESPONDENCE

Mr Dean Barker, Consultant in Restorative Dentistry, Aberdeen Royal Infirmary, Foresterhill Road, Aberdeen AB31 6NL. E-mail: dean.barker@nhs.net

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