



Success or Failure of a Dental Implant: It's Relationship to Bone Density: A Case Report of a Failed Implant

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Abstract

Aim: The purpose of this article is to illustrate the relationship of bone quality and the prognosis of dental implant.

Background: Reported success rates for dental implants are high. Thus, an implant-supported restoration offers a predictable treatment for tooth replacement. Nevertheless, failures that mandate immediate implant removal do occur.

Case Description: A case involving a 40-year-old male patient who had a missing mandibular left first molar is reported. A mucoperiosteal flap was made using interdental and crevicular incisions. The osteotomy was performed starting with the pilot drill, then the depth of the osteotomy was assessed using the shoulder depth gauge. The site was gradually enlarged using reamers with progressively increasing diameters. The implant (Bicon's Nano Tite™) was then placed. However, three months later at the second stage surgery, the implant was found to be clinically mobile. The surgical site selected in this case had fine trabeculated bone with thin cortical plates (D4 bone) that apparently contributed to the failure of dental implant.

Summary: Implant therapy has become common practice and will continue to increase in popularity. This also implies that dental professionals will have to learn more how to deal with implant failure and related complications. Why an implant does not integrate could have a multifactorial etiology.

Clinical Significance: The type and quality of bone available to support a dental implant are very important, so attention should be directed to all the factors responsible for the success or failure of a dental implant. In cases involving D4 bone, one must consider other treatment modalities for replacement of a missing tooth or use caution in the placement of the implants, especially in the high-load-bearing molar areas.

Keywords: D4 bone, implant failure, mucoperiosteal flap, osteotomy

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Introduction

An implant-supported restoration is a predictable treatment option for tooth replacement. Reported success rates for dental implants are high; however, there is still a paucity of data in the literature regarding follow-up of implants in function for at least five years or more.¹ Nevertheless, failures that mandate immediate implant removal do occur. The consequences of implant removal jeopardize the clinician's efforts to accomplish satisfactory function and esthetics. For the patient, this usually involves additional cost and dental procedures.

Reported predictors^{2,3} for implant success and failure are generally divided into patient-related failures (e.g., general patient health status, smoking habits, quantity and quality of bone, oral hygiene maintenance, etc.), implant characteristics (e.g., dimensions, coating, loading, etc.), implant location, and the clinician's experience.

Background

Success of dental implants is commonly defined by implant survival and implant failure is a multifactorial process and can be attributed to many factors. There are various causes related to early (overheating, contamination and trauma during surgery, poor bone quantity and/or quality, lack of primary stability, and incorrect immediate load indication) and late failures (periimplantitis, occlusal trauma, and occlusal overloading).

Ongoing marginal bone loss (MBL) also could put at risk implant survival in the long-term. Brånemark⁴ suggested criteria for assessing MBL, among other parameters; namely, during the first year after abutment connection, 1.0 mm of MBL is to be expected followed by a loss of 0.2 mm per year. Today, these criteria are still frequently referred to as the “gold standards” to determine implant success. Bone loss greater than these parameters may lead to implant failure.

Thanks to a better understanding of bone physiology and soft tissue behavior around the implant neck and body, these criteria may not be accurate for the wide variety of implant systems available today.⁵

An implant that causes clinical symptoms, such as continuous pain, mobility, etc., is considered faulty. However, MBL is rarely symptomatic, which may hinder long-term implant survival.⁶ Although reports⁶ on the dynamics of MBL over time are incomplete, the MBL rate changes at different stages during the life of an implant. Given the accumulation of MBL data, calculations should not include the smooth polished neck portion of an implant fixture. The long-term prognosis of an implant cannot be established based only on first-year MBL calculations. Follow-up is essential to determine and predict a future clinical course. However, four clinically detectable MBL patterns may be used for clinical follow-up and assessment. These hypothetical patterns

of implant MBL after the first year are (1) a low rate of MBL over the years (Brånemark and Albrektsson's⁴ pattern), (2) a low rate of MBL in the first few years followed by a rapid loss of bone support, (3) a high rate of MBL in the first few years followed by almost no bone loss, and (4) a continuous high rate of MBL leading to complete loss of bone support.

Criteria for implant success should serve as an aid to clinical follow-up and help to evaluate the clinical outcomes of different implant systems in research. For clinical use, MBL assessment should be easy to apply using radiographs and should permit a quick gross comparison to previous data. That MBL assessment together with Brånemark and Albrektsson's⁴ clinical parameters should help clinicians assess a given condition and predict a future clinical course. Furthermore, the use of MBL assessment also may help in decision making regarding the need for additional tests/therapy (i.e., radiographs, occlusal analysis, prosthetic evaluation, surgical intervention, etc.), the frequency of follow-up visits, and the recommended timing of dental hygiene recall appointments.

According to Brånemark⁴ even with a low MBL rate during the first three years, the MBL pattern is still undetermined in an asymptomatic implant. Frequent follow-up is recommended to determine whether an implant is failing or not. Nevertheless, long-term follow-up is suggested for all MBL patterns.

It is essential to identify a failing implant in time to avoid continuous alveolar bone loss that might complicate the option of replacing the failed implant as well as impair the esthetic outcome when retreating the affected area.

Case Report

A 40-year-old male patient reported to the Department of Periodontology and Oral Implantology in the M. M. College of Dental Sciences and Research, Maharishi Markandeshwar University, Mullana, India, with a chief complaint of replacement of a missing tooth, in the left lower back region.

Medical History

The patient's medical history was normal.

Clinical Examination

The extraoral examination did not reveal any abnormality. The intraoral examination revealed a missing first molar in the lower-left quadrant. However, the clinical assessment of the edentulous area indicated the mesiodistal and buccolingual dimensions were sufficient for a dental implant (Figure 1).

Radiographic Examination

Panoramic radiographic examination (Figure 2)



Figure 1. Mirror image of the potential implant site (area of the mandibular left first molar).

revealed that the bone at the planned implant site was less dense than the adjacent bone.

The preoperative radiograph also revealed that there were horizontally impacted third molars in the mandibular left and right quadrants. The patient was advised to have these molars extracted because these teeth could jeopardize the long-term prognosis for the second molars. This also was the case of the maxillary left third molar. Because the teeth were asymptomatic, the patient was unwilling to have them extracted, and he requested that treatment proceed with the implant procedure. He indicated that he would have these teeth extracted at some future time. So, the extraction was postponed for a later date.

The dentascan reports confirmed that the bone at the implant site was 212H.U (D4 type of bone according to the Misch⁷ classification of bone density (Figure 3).

Surgical Procedure

The implant system selected for use was BICON™ (Bicon Dental Implants, Boston, MA, USA) and the particular implant fixture chosen for this case was the 4.5 × 8 mm Bicon Nano Tite™ implant.

The implant was placed using a full-thickness mucoperiosteal flap. Then the osteotomy was performed using the pilot drill as shown in Figure 4. The depth of the osteotomy was assessed using the shoulder depth gauge (Figure 5).



Figure 2. Panoramic radiograph indicated the bone at the implant site to be less dense than the adjacent bone.

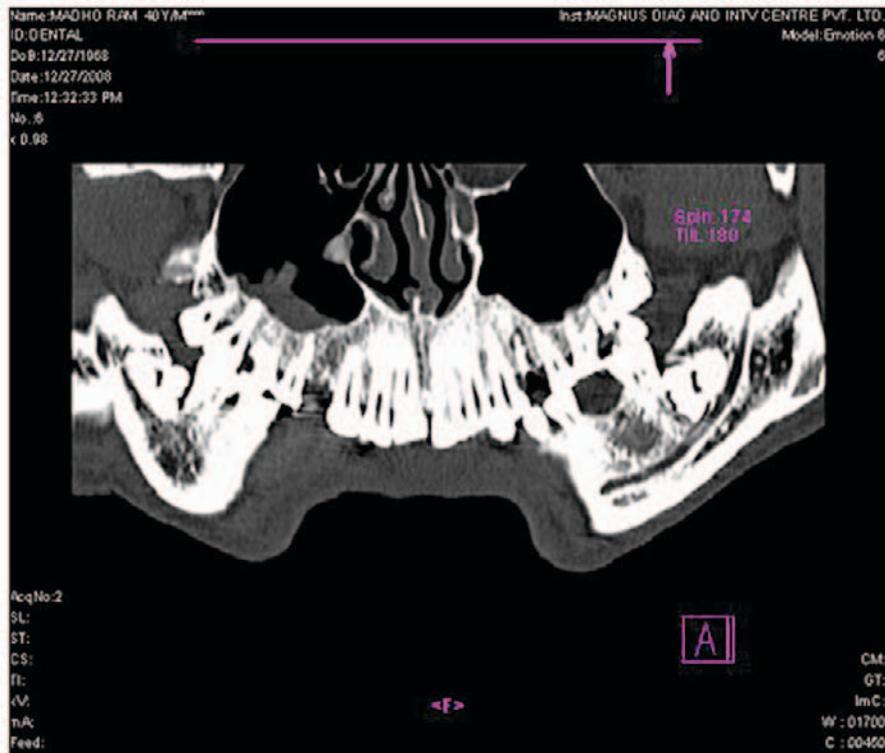


Figure 3. Dentascan showing density at the implant site to be less than the adjacent bone. When the measurements were made, the density was found to be 212H.U.

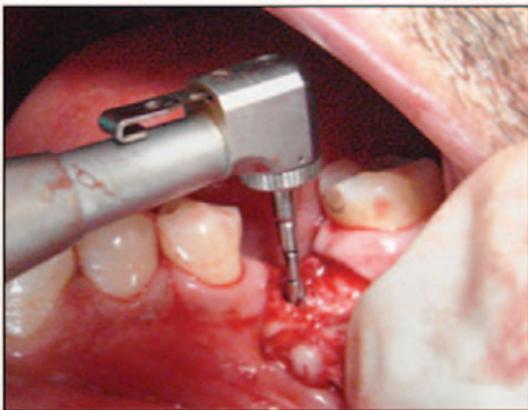


Figure 4. The osteotomy was made using the pilot drill.



Figure 5. Assessment of the depth of the osteotomy using the Bicon shoulder depth gauge.

Subsequently a 2.5 mm reamer was used and the parallelism of the implant was assessed using the paralleling pin (Figure 6).

The osteotomy was gradually enlarged using reamers with progressively increasing diameters. Finally the implant was placed and tapped into the osteotomy 0.5 mm below the alveolar crest

(Figure 7). The flap was sutured in place to achieve primary closure.

After a healing period of three months, the second-stage surgery was performed to uncover the healing plug. On clinical assessment of the implant, it was found to be mobile. The radiographic examination of the implant fixture revealed a periapical radiolucency (Figure 8).

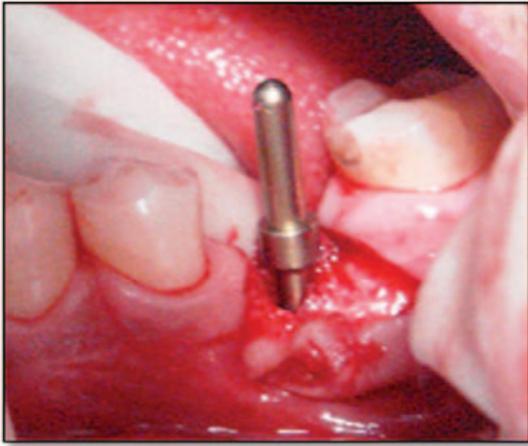


Figure 6. Assessment of the parallelism of the implant using the Bicon paralleling pin.

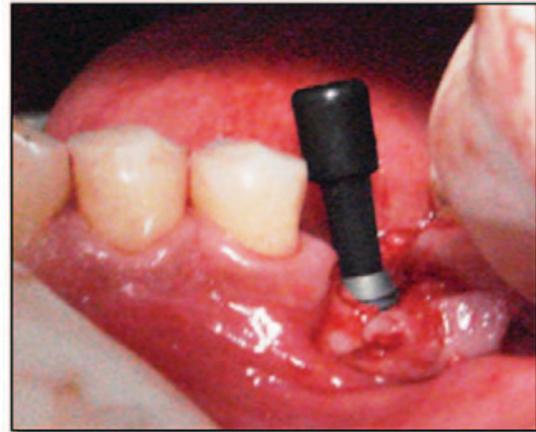


Figure 7. The Bicon Nano Tite™ implant (size 4.5 × 8 mm) immediately after placement.

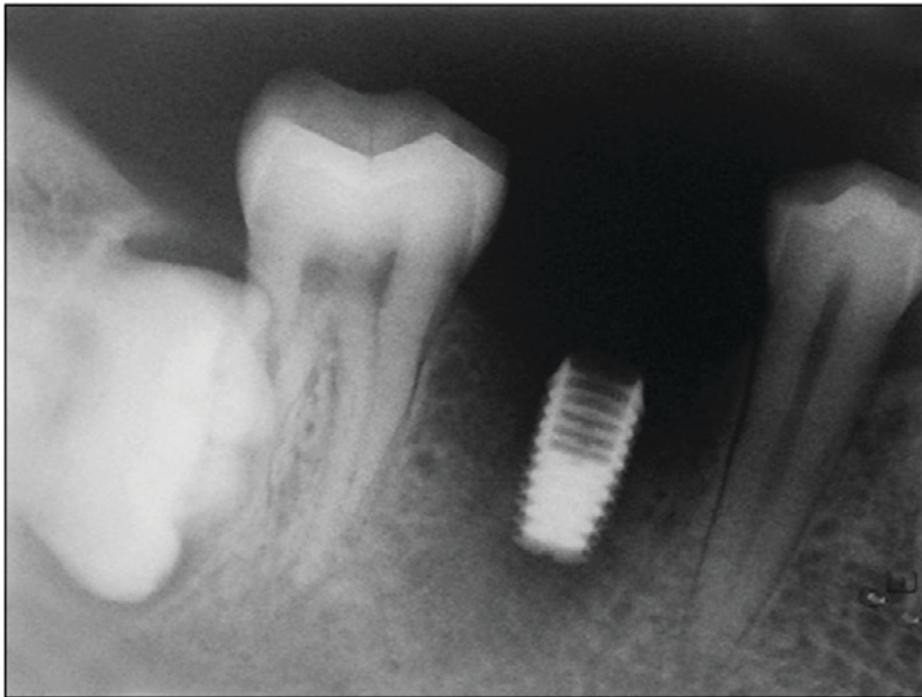


Figure 8. Periapical radiograph taken at the second-stage surgery that shows periapical radiolucency.

Discussion

The use of dental implants to restore missing teeth has become increasingly widespread over the past two decades. Numerous clinical studies with dental implants have revealed encouraging results.^{4,8-10} The successful outcome of any implant procedure requires a series of patient-related and procedure-dependent parameters.¹¹ The volume of bone available and the quality of the bone are highly associated with the type of surgical procedure and

the type of implant used. Both of these factors play a vital role in the success of dental implant surgery.¹²

Clinical reports suggest that dental implants for the mandible have higher survival rates than those for the maxilla, especially compared to the posterior maxilla.^{13,14} Compared to the mandible, the lower survival rate of maxillary implants loaded immediately/early after placement also has been reported.¹⁵ Clinicians generally consider that the basic cause of the difference in the survival rates

between maxilla and mandible is bone quality. Higher failure seems to be associated with the implants in which the surgeon observes a poor degree of bone mineralization or limited bone resistance by tactile assessment while drilling. It is typical that the bone around the implant has better quantity and quality in the mandible than the maxilla.¹⁶

Because mechanical behavior of bone seems to be a vital factor in the achievement of osseointegration, several classification systems and procedures were suggested for assessing bone quality.^{7,17-20} The most popular current method of bone quality assessment is that developed by Lekholm and Zarb,²¹ who introduced a scale of 1-4, based on both the radiographic assessment and the sensation of resistance experienced by the surgeon when preparing the implant site.

Conclusion

Implant therapy has become common practice and will probably continue to grow in popularity in the future. This implies that dental professionals will have to deal more with implant failure and related complications. The density of available bone in an edentulous site has a primary influence on treatment planning, implant design, surgical approach, healing time, and initial progressive bone loading during prosthetic reconstruction. Fine trabeculated bone with thin cortical plates (D4 bone) presents the most arduous endeavor to obtain rigid fixation. Bone trabeculae are sparse and, as a result, initial fixation of any implant design presents a clinical challenge. The present case also revealed that the D4 type bone in the surgical site appeared to have played a major causative role in the failure of the implant. Therefore, bone density should be given a prime consideration before implant placement.

Clinical Significance

The type and quality of bone available to support a dental implant are very important, so attention should be directed to all the factors responsible for the success or failure of a dental implant. In a case involving D4 bone, one must consider other treatment modalities for replacement of a

missing tooth or use caution in the placement of the implants, especially in the high-load-bearing molar areas.

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