Late Osseointegration Failure of Implant Case

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CASE REPORT

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ABSTRACT

Aim: Dental Implants success rates are indicated by their ability to osseointegrate to the surrounding bone. And although reported implant success rates are very high, failures continue to occur. Implants ensure their success with careful diagnostic methods, and most times any contributing factors that can inhibit success can be accommodated through adjustments to treatment.

Methods and Materials: A 77 year old female presents with a fractured tooth to the gumline that would require extraction. After being given her treatment options, patient chose to receive an implant in the anterior maxilla. This article is a retrospective view of this case.

Results: Implant #10 appeared to have initial osseointegration. Radiographs taken at each step exhibit the deterioration of bone over time. Clinical signs of implant failure began 3 weeks after restorative impression. Patient also began experiencing symptoms such as discomfort upon palpation to the site at this time. This case resulted in removal of the implant due to total failure to osseointegrate.

Conclusion: With primarily anterior occlusion, it is possible the late failure of the implant is due to occlusal overload. Another factor that is prevalent in this case is previous medication taken for history of rheumatoid arthritis that can interfere with osseointegration.

Key Words: Implant, implant failure, osseointegration, dental implant, maxillofacial surgery, osteoporosis.

INTRODUCTION

Implants are being utilized in the treatment of partially edentulous ridges with fairly high success rates. (1) Implant success relies heavily on meticulous planning including bone quality, bone quantity, and patient health. Many factors contribute to implant success with regards to a person's health including patient history, patient compliance, and medications. A successful implant will osseointegrate with its surrounding bone. The definition of osseointegration is 'direct structural and functional connection between the living bone and the surface of a load bearing implant', defined by Branemark, 1983. The American Academy of Implant Dentistry defined osseointegration in 1986 as 'contact established without interposition of nonbone tissue between normal remodeled bone and an implant entailing a sustained transfer and distribution of load from the implant to and within the bone tissue.' Once osseointegrated, an implant does not exhibit movement independent of the bone with which it is attached.(2) The type of implant can also lend towards success. A study claims that anodized implant surfaces can osseointegrate to a higher degree when compared to a machine finished implant. (3)

Even with careful treatment planning, there are still a small percentage of dental implant failures that depends on

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multiple factors such as the patient's medical status, patient age, site of implant placement, surgeon's level of experience, the precision of surgical technique, and the type and surface of implants. (4) Failures can occur prior to or after occlusal loading and are classified into "early failures" (due to unsuccessful osseointegration) and "late failures" (due to loss of osseointegration). (5)

Here we report a case of late failure after prosthetic loading due to loss of osseointegration related to patient specific biological reasons.

CASE REPORT

Institutional review board approval was not required as patient was treated with approved diagnostic and therapeutic procedures according to generally accepted standards of care in this retrospective review of one case. Patient signed consent forms related to treatment and use of case in teaching materials.

Pre-operative

A 77-year-old Caucasian female presents for dental treatment. Medical history significant for rheumatoid arthritis, bipolar disorder, and depression. Patient says she has suffered from depression since become debilitated mentally as a young adult. During some of her appointments it is noted she has anxiety and feels restless and requests to be reappointed. She recalls her arthritis began limiting what she was able to do in her mid-60s resulting in stress fractures and assistance of a cane for ambulation. Current medications include RANKL inhibitor, Denosumab and a Disease Modifying Anti Rheumatoid medication (DMARD's), Methotrexate for over five years. Patient appeared in good spirits and explained her lifestyle as an author that gave a stable financial ground as she aged. Her sharp mind was opposite of her depleted physical strength. Despite being reliant on friends and acquaintances for transportation, the patient became compliant with hygiene and minor restorative care in her following appointments. A full mouth series was taken during her initial visit. This included a periapical radiograph of the area of discussion (Figure 1a). The patient had removable partial dentures but did not wear them due to feeling abrasive from dry mouth. Without the partials, her biting force and chewing were mainly on anterior teeth.

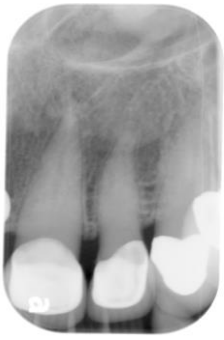

Figure 1a

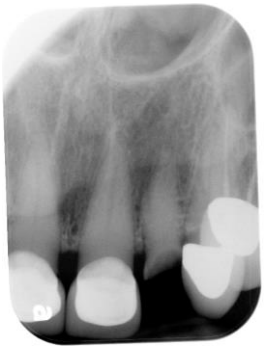

Figure 1b

She presented six months later in January 2018 with fractured crown #10. The tooth was fractured to the gumline (Figure 1b). Patient was primarily in anterior occlusion due to loss of posterior teeth. Treatment options that were discussed with the patient included a bridge which would involve removing adjacent crowns prior to fabrication, a removable appliance, no treatment, and the option of an implant. The procedure of an implant was explained, including the risks and benefits and the restorative options including different abutments and materials. Patient was interested in the implant option. A referral was sent to the oral and maxillofacial surgeon. Implant risks and benefits were discussed with the patient. The main predictors for implant success are the quantity and quality of bone, patient's age, location of implant placement, length of the implant, axial loading, and oral hygiene maintenance. (6)

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During the time of fracture an Essix (Dentsply Sirona) custom clear appliance with the crown in the space of #10 served as a temporary tooth replacement. Patient was pleased with this fabrication and found it comforting to have the appliance in public.

Implant therapy

During patient's initial visit with oral and maxillofacial surgery (OMFS) in March 2018, a cone beam computed tomography (CBCT) was performed and virtual implant treatment planning was done for extractions of #10 and immediate implant placement and allogenic bone grafting as needed. A medical decision was made by the treating surgeon during the initial consult that the medical history or the medication list was not burdensome to obtain any other consults from the rheumatologist. Further with failing and fractured crowns, extraction of the remaining root tip was inevitable without elective options.

Patient was seen in April 2018 for extraction of root tip #10 and immediate placement of implant with a bone graft. The patient was anesthetized with 2% Lidocaine with 1:100,000 epinephrine. A full thickness mucoperiosteal flap was elevated at tooth #10. Periotomes were utilized to release PDL fibers surrounding #10. #10 extracted atraumatically, all bony walls were deemed intact and proceeded to immediate implant placement. The implant site was prepared utilizing standard Zimmer protocols. Of note, the extraction socket and implant osteotomies site were relatively dry with minimal bleeding bone, a tell-tale sign of dense sclerotic and poorly vascularized bone. After the socket was irrigated, a 4.1x13mm Zimmer TSV implant was placed and adequate primary stability was achieved with insertional torque values of over 50 Ncm. The site was irrigated and a cover screw was placed. Collaplug was applied over the implant and the flap was sutured with 4-0 vicryl. The patient tolerated the procedure well and was dismissed with appropriate post-operative written and verbal instructions as well as a regimen of Amoxicillin 500 mg 1 tab tid for five days, continue with chlorohexidine 15 ml swish bid for five days, Norco 1 tab q 6h prn pain (10 tabs), and ibuprofen 800 mg 1 tab q 6 h prn pain.

Patient was seen two weeks post op on April 11, 2018. She reported no mouth pain since surgery. She has not worn her 'flipper' but would like a new one made for esthetic purposes. During the post op exam there was no drainage or tenderness to palpation. The area appeared to be healing well with no signs of infection. Patient was requested to continue use Peridex swishing twice daily and an atraumatic diet. She was appointed for fabrication of a new interim removable partial denture.

Patient presented July 2018 for impressions for a new interim acrylic removable partial denture. This was processed and fitted to patient to keep pressure off of the site #10.

After five months from initial implant placement, patient returns to OMFS to have the implant uncovered and a healing collar placement. Patient reports that she is healing well and has no complaints. Patient denies any pain from the surgical site. She denies recent history of increased facial swelling, fevers, chills, nausea, or emesis.

Focused OMFS exam was performed, the implant site appears healed without any signs or symptoms of implant failure. Probing depths were normal at uncovering with no suspicion of periimplantitis. Clinical examination is imperative for determining whether implants are osseiointegrating. (5) The site was deemed ready for a healing abutment. Verbal and written consent was obtained for the procedure. A crestal incision was made with a 15 blade and a full thickness mucoperiosteal flap was reflected. A handpiece with #4 surgical bur was used to perform osteoplasty of excess bone from cover screw with copious amounts of irrigation. The cover screw was removed, the implant 'reverse torque' tested to 30 Ncm, a definitive confirmation of initial healing of dental implant to bone surface. It is noted that there is not strong evidence to support reverse torque testing and that there are other methods that provide objective data. (7) A 5 mm Zimmer healing abutment was placed with a thumb driver. The site was irrigated with copious amounts of sterile water under the flap. The flap was closed with 3-0 chromic gut suture. Hemostasis was achieved and a periapical radiograph was obtained to confirm healing abutment seating (Figure 2a).

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Oral hygiene instructions were reinforced to the patient. Patient's interim partial was also checked so that the surgical area was relieved of pressure.

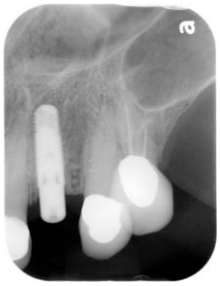

Figure 2a

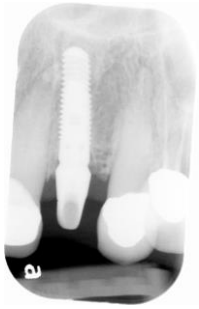

Figure 2b

Post- operative:

Patient was cleared for impression on September 12, 2018 by OMFS for fabrication of prosthetic crown. She arrived in one month for initial design of restoration and impressions. The restorative team reviewed crown fabrication and different materials with patient. The team also discussed pros and cons and limitations of patient's specific case. With given information, patient and restorative team elected to have a prefab abutment with abutment supported porcelain fused to metal crown with noble metal. Patient was made aware that there may be slight metal exposed at the most gingival aspect matching the existing porcelain fused to metal crowns. (8) Crown was initially designed to be cement retained. Patient elected to proceed. A bite registration and final impression of maxillary with impression post was taken with poly vinyl siloxane closed impression tray technique. Opposing mandibular and shade selection was completed.

Patient returned in three weeks for crown delivery. Periapical radiograph was taken to view abutment seating (Figure 2b). The abutment fit properly however clinical observation was that antirotation of crown on abutment was incorrect. The abutment was cylindrical in shape and the crown was moveable on the abutment. The crown also appeared to not be in alignment with other teeth in arch as it did on the laboratory model. Crown was resent to lab to correct, fuse, and prepare as a screw retained crown instead of keeping it cement retained. This would not allow the crown to move along the abutment in case the antirotation was not established. The healing collar was reapplied and next steps were explained to patient. Patient said she was fine with the crown slightly twisted but would proceed with what her dental team recommended as best for her. Screw retained crowns may compromise some of the esthetics, however they eliminate the need for cement. Residual cement has also been a known cause of implant failures. (9)

Patient presented for crown #10 try in on November 7, 2018. The laboratory changed the design of the restoration from cemented to screw retained. The crown was cemented to abutment with screw hole visible. The healing collar was removed, the restoration was properly seated torqued to 30Ncm using Zimmer torque wrench tool. A periapical was taken to verify seat (Figure 3a). Clinical appearance showed restoration slightly rotated to mesial but patient was pleased with crown. The restorative team placed Teflon tape and composite to close screw access. Patient was interested in Valplast (esthetic) removable partial denture for the mandibular.

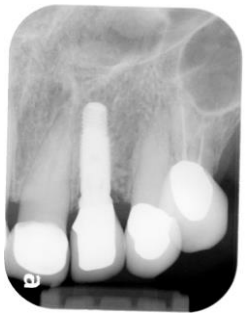

Figure 3a

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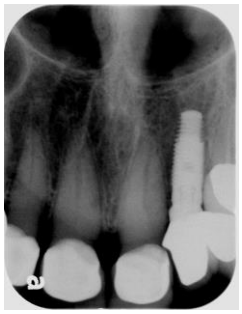

Figure 3b

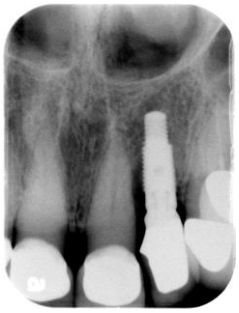

Figure 4

Patient presented on November 27, 2018to the clinic with pain at implant area. There was nothing obvious on the periapical radiograph (Figure 3b) nor was there any mobility to the crown. Erythematous gingiva was present on the buccal, heavy occlusion noted on distal lingual ridge, and tenderness to palpation on buccal. The heavy occlusion was adjusted. Chlorohexidine rinse was given for the inflammation and plaque accumulation. Patient had reported slight 'tightness' when flossing. Patient was requested to call if pain or discomfort persisted. It was discussed with patient that this could be a sign of bone loss or movement of implant/tooth.

The patient called the clinic on December 7, 2018 stating her tooth was very loose. Clinical exam revealed that tooth was mobile, with exudate from lingual. Periapical radiograph indicated bone loss surrounding the implant (Figure 4). Patient denied soreness. The screw was accessed to tighten and the entire implant was rotating. Patient had her flipper with her that she wore during healing of implant. OMFS was immediately contacted and treatment was discussed with patient. OMFS clinicians found deep pockets on the mesial and distal side of the implant with probe depths greater than 6 mm. With rapidly advancing bone loss around the implant, it was decided the implant needed to be removed to avoid damage to adjacent teeth and spread of space infection. Patient was given local anesthetics. The crown with implant was removed and irrigated copiously with Chlorohexidine and normal saline. Patient was instructed to wear interim removable denture for next two weeks and returned for a follow up with OMFS with uneventful healing at the failed implant site.

Primary dentist discussed options with patient. Patient telephone conversations revealed patient was not interested to go through another surgical procedure. Possible treatment options were discussed with the patient which included placement of a new implant and other options. If a patient chooses a new implant in the same site or area of a failing implant, the success rate is 71 %. This number encompasses all patients including those with medical conditions. (10) (11) Implants can be removed the same day and replaced with a larger implant occupying the same site. (12)

DISCUSSION

This was a failure of implant osseointegration. Most likely when the patient presented to the clinic for the abutment try in and the crown appeared 'twisted', this was an indication of failing. This was the clinical sign of periimplantitis where there is color change of the gingival tissue, possible suppuration, and swollen gingiva. (13) The abutment was torqued but had most likely moved the implant within the bone in a clockwise direction, therefore when the crown was seated on the implant, it appeared rotated. Clinical signs of an implant failure include periimplantitis, infection in the site or area, pain, and mobility. (14) The assumption was a laboratory error. At the second attempt, the abutment crown was one piece, which was torqued into place with only a slightly rotated appearance of the crown. Patient was satisfied and the periapical radiograph was within normal limits.

Implant failure can be due to overheating during placement, bacterial contamination, and poor bone quality leading to improper osseointegration. (11) If the adjacent

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bone is compressed during insertion of the implant this too can contribute to implant failure. (15) If implants initially osseointegrate, failure can be from improper loading. This would include overload of prosthesis, improper design of prosthesis, or malocclusion. Bisphosphonate therapy has been linked to causing failure of previously integrated implants. (16) In a study of failed titanium dental implants, there was a presence of macrophages abundantly in the area of the metallic implant than there were in areas further away from the implant. (17) Patients with an increase in age, 60-79, have been found to have an increased failure rate of dental implants. (4) Contributing to this increased rate is tobacco use, diabetes, head and neck radiation, and post-menopausal hormone therapy. (4) In a study of failing implant sites, there was evidence of peri implant radiolucencies in the radiographs and moderate levels of bacteria consistent with infection. (18) This patient's chart indicates there was a history of taking Prolia, however patient was not able to recall how long she had been on this treatment. Prolia or denosumab is prescribed to post-menopausal women for osteoporosis. There is literature to support that this medication can affect the rate of bone remodeling, therefore healing after surgery. (19)

Rheumatoid Arthritis (RA) is a chronic multisystemic disease, with polyarthropathy, marked by inflammatory changes in the synovial membranes and articular structures with widespread fibrinoid degeneration of the collagen fibers in mesenchymal tissues resulting in atrophy and rarefaction of bony structures. RA is considered a relative contraindication when planning dental implants. A review of literature indicated that due to the inflammatory process in bone, a possible decrease in bone regeneration, and link to periodontitis, RA patients have a higher risk of failure with dental implants. (20) Methotrexate (most effective DMARD) is an immunosuppressive drug that is widely prescribed in patients with rheumatoid arthritis and has been known to cause increase implant failures. (21) Methotrexate is known to suppress bone remodeling and could be contributing to medication related osteoradionecrosis of the jaws (MRONJ). (22) Denosumab is a human monoclonal antibody that binds RANKL, preventing RANKL from activating RANK, its receptor on the osteoclast surface. With reduced RANK–RANKL binding, osteoclast formation and function are inhibited with reduced bone turnover. Invasive dental procedures are known to increase the risk of MRONJ. (23) This patient had been on Methotrexate and Denosumab for five years exposing her to increase failure of osseointegration or increased loss of established osseointegration. Further dense sclerotic bone with minimal bleeding during implant placement is a sign of poor quality of bone stock with an increased risk of early implant failures. Despite appropriate torque testing at implant placement and uncovering, rapid breakdown of osseointegration is likely in a systemically and locally compromised bone. The risk of MRONJ of a patient taking Denosumab for osteoporosis is estimated at .04%, this percentage is increased if the patient is taking Denosumab as part of a cancer treatment regimen. (24)

CONCLUSION

While implant survival rates are recorded as high, there is still a small percentage that are failures, typically under 10%. (25) Recognizing possible risk factors can help improve patient outcomes. One retrospective study on implant failures encourages that surgeons assess the patient risk and adjust variables such as implant length, or whether to do an immediate implant placement or consider implant staging options. (14) Careful analysis and proper diagnostic procedures all help with planning a favorable outcome. Following surgical techniques and using materials according to manufacturer's instructions help assure that bone is not overheating or over compressed in the process. (15) During prosthesis delivery, verify occlusion and occlusal load. Bone quality can continue to be affected by medications even after the patient has stopped taking them, such as methotrexate.

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