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Case Report

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Case Report: Management of Late Dental implant failures

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ABSTRACT

Biologic causes of dental implant failures can be divided into Early and Late failures. Early failures are related to inability to achieve osteointegration or loss of osteointegration and are related to poor surgical technique, infection, poor bone density, inadequate bone support, smoking, and impaired host response. Late failures occur after osteointegration is achieved and the implant has been restored, and are related to mechanical complications and Periimplantitis. The goal of this article is to give a review on Late dental implant failures, and report on management of molar implants with late implant failures for two patients.

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Introduction

Dental implants have proven over time to be an efficacious and effective way to replace missing teeth. They have high success rates of 93.4% in the maxilla and 97.9% in the mandible [1]. In looking at the maxilla and mandible, rates of success appear to be higher for the anterior compared to the posterior areas of the mouth [2]. Despite having a high success rate, dental implants still undergo failure due to conditions such as poor bone quality, prior periodontal disease, bruxism, overload of the implant prosthesis and other mechanical complications, infection, smoking habits and host related factors [3].

Dental implant failures can be divided into Early and Late failures. Early failures occur prior to implant restoration and is due to failure for osteointegration to occur or due to loss of osteointegration. Early failures occur from biologic complications and can occur due to excessive heating of bone during implant placement, over preparation of the implant site, low density bone affecting primary stability of the implant and reduced bone to implant contact [4]. Late failures occur after osteointegration and implant restoration and occur from biological and mechanical complications such as Periimplantitis, poor prosthetic design and parafunctional habits.4 Early dental implant failures are more frequent in the maxilla while Late dental implant failure occur more in the posterior mandible [4].

Conditions such as poor bone quality, prior periodontitis, overload, mechanical complications, prior radiation therapy have an impact on osteointegration of dental implants and long-term success of dental implants and can result in failure of implants to integrate or loss of osteointegration [3]. Late failures of dental implants occur more in the posterior aspects of the mouth. Studies have shown that occlusal forces are 3-4 times more in the posterior molar region compared to the incisor region [5].

Mechanical complications are related to improper implant framework design, overloading of dental implants, parafunctional habits like bruxing and clenching and poor implant stability [5]. Overloading of dental implants usually occurs due to inadequate occlusion, and presence of distal extension or cantilevers in implant supported prosthesis as well as lack of passive fit of prosthesis over implants. Because the posterior area of the mouth is subject to significant forces, peri-implant vertical bone loss that occurs for restored implants can occur due to both Periimplantitis and occlusal trauma [6]. The prevalence of Periimplantitis is 4-15%.6 While bacterial insult is believed to be the primary cause of Peri-implant Mucositis, stress factors caused by poor biomechanical environment is believed to be the cause of Periimplantitis [7]. Albreketson and colleagues found in their study that most implant failures from Periimplantitis occur within the first few years following implant placement and not within 20-30 years [8].

Periimplantitis is defined as plaque associated pathologic diseases that affect tissue around dental implants causing inflammation of the peri-implant mucosa and bone loss [7]. Bacterial colonization is a prime factor for Periimplantitis and it is caused by poor oral hygiene, cement retained in the sub-gingival area and micro-gaps between the implant components [7]. Nonsurgical management of sites with periimplantitis involves mechanical debridement, with titanium curettes or prophy jets, in addition to local delivery of antimicrobial agents such as Chlorhexidine chips, irrigation with Chlorhexidine, and local delivery of antimicrobial agents such as minocycline and doxycycline gels as well as using lasers for laser

decontamination and systemic antibiotics such as Metronidazole and Amoxicillin or Clindamycin [7].

Surgical therapy for Periimplantitis involves getting access to the site with bone loss with a gingival flap and debriding the implant followed by grafting the defect with a bone graft and membrane. Defects treated with bone grafts and membranes had better result than those treated with bone graft or membranes alone [7]. For cases of Severe Periimplantitis, implant removal due to extensive bone loss or mobility would be necessary. The goal following removal involves grafting the site and replacing with a wider diameter implant, replacement with a tooth borne fixed partial denture, or a removable partial denture.

As a result of implants not having a periodontal ligament, forces transmitted to crestal bone from implants are higher than from natural teeth [9]. Without periodontal ligament implants unlike natural teeth which have better proprioception, more even distribution of occlusal forces and adaptation to overload such as thickening of the periodontal ligament implants have bone loss or fracture of implant components due to overload [9]. Due to heavy occlusal forces, narrow implants utilized in the posterior region of the mouth are prone to overload and potential fracture. Because of the bio-mechanical forces in the area, the goal in replacement of molar teeth is to utilize either two narrow implants mimicking molar roots and dispersing forces more evenly amongst them or to use wide diameter implants with narrow occlusal tables in order to prevent overloading posterior implants, and preventing lateral and bending forces on the implants [10,11]. Masticatory forces are vertical in nature and are transmitted along the long axis and average less than 70Newtons, non-axial masticatory forces vary in location in the mouth and chewing stroke and are less than 50 Newtons in bucco-lingual direction and 20 Newtons in the anterior-posterior direction [9]. There are thresholds for non-axial forces on implants above which these forces can result in loss of interproximal bone, crater like bone defects and potential periimplantitis around dental implants [12,13].

Patients that lack anterior disocclusion, proximal contact support, have crossbite or limited posterior contacts would be at higher risk of horizontal and anterior-posterior forces [9]. Patients with high risk of excessive forces such as bruxers and clenchers have been shown to have 7-8 times that of normal masticatory forces [9]. Mohanty and colleagues found a failure rate of 13%, and 86.3% survival rate for Bruxers after implants were followed for 8-10 years [14]. Complications related to overloading dental implants occur more with posterior restorations [9]. The most common biologic complication from overload involves crestal bone loss, while the most common restorative complication from overload involves screw loosening, screw fracture, and porcelain fracture [9].

Crestal bone loss from overload occurs due to difference between bone elasticity and titanium because titanium is stiffer than bone a stress gradient occurs at the interface between titanium and bone. Screw loosening has an incidence of 3%-38%, they occur when occlusal forces are higher than tension in screw implant assembly and it occurs less for wider diameter implants compared to narrow diameter implants [9]. Screw fracture occurs due to excessive shearing forces and indicates excessive lateral forces on the implants, there is a high incidence of crestal bone loss noted with implants with fractured screws [9]. Addressing screw fractures involves modification to prosthesis design such as removal of the cantilever, adding implants or fabricating a prosthesis with new design [9].

Material fracture occurs due to excessive forces after implant placement and restoration or material fatigue overtime. Higher forces on implant prosthesis can occur close to access holes or with forces on veneer materials such as acrylic and porcelain. For patients who are bruxers or have high occlusal forces, and location of implant is in non-esthetic areas, use of gold is often recommended. Acrylic resins appear to have less rate of abutment and screw fracture, but the material has a higher fracture rate than porcelain. Use of night guards are recommended to reduce excessive forces from parafunction and evenly distribute forces [15].

Additionally, use of wide diameter implants can also be utilized with the goal of directing the centric point to the implant using a narrow occlusal table, reducing bending forces on the implant, and eliminating cantilever forces on the crown compared to wider occlusal tables. When the mesio-distal distance is 8mm then a wider diameter implant is typically the best option for replacing molar teeth, when the site is 12mm in mesiodistal diameter, use of 2 narrow implants are recommended [16]. Wadha and colleagues compared wide (6mm diameter) implants to standard implant in the posterior maxilla and mandible and found that wider implants had higher stability, lower cantilever stress and six year survival rate of 97.29% compared to standard implants with 94.87% survival rate showing that single wide diameter implants are better able to resist occlusal stress compared to single standard implants [17]. Lung and colleagues studied strain in loaded 3.5mm, 4.3mm and 5mm implants and found that the highest amount of strain for laterally loaded implants occurred for 3.5mm implants, followed by 4.3mm diameter implants and that 5.0mm had the least amount of strain transmitted to bone during lateral loading [18]. Schwartz-Arad and colleagues studied single immediately placed molar implants and found a success rate of 90% over a 5 year period for nonsmokers. They concluded that use of single implants to replace molar teeth is a viable and effective way to replace molar teeth [9].

Curtis and Colleagues reviewed strategies to utilize in reduction of overload of implants and implant components and recommended that during the treatment planning phase, identifying bone density and volume concerns, planning a restorative design to limit occlusal overload as well as identifying patients at risk of excessive forces is essential to reduction of occlusal overload around implants [9]. Additionally, utilizing restorative designs that minimize and evenly distribute occlusal stress, and fabrication of implant restorations in the posterior quadrants that use narrow occlusal tables, and shallow cusp anatomy to decrease forces to prosthetic parts. Splinting of adjacent single unit molar implants for patients at risk of high occlusal loads are also recommended in addition to cautious use of cantilevers and use of night guards for bruxers, clenchers, restorations with cantilevers and implant restorations that do not have proximal natural tooth contacts [9].

Case Report 1

A 72-year-old male patient presented to our periodontal practice with implants #18 and #19 (4.7mmX11.5mm Legacy 2 Implant direct implant) that were placed by another dentist 10 years earlier. Clinically, the patient presented with edematous tissue, poor oral hygiene, deep probing depth and inflammation around #18 and #19. X-rays showed severe bone loss around #18 and moderate bone loss #19. (Figures 1a and 1b) He had Grade II wear facets generally in his mouth and had not been wearing his maxillary night guard. Based on our findings it was determined that removal of implant #18, degranulation and regeneration of the site with freeze dried bone allograft (FDBA)and membrane barrier would be necessary in addition to debridement of implant #19 and grafting

of defect present around it. Followed by replacing implant crown for #19 with an interim crown with a narrower occlusal table and light occlusal contact and #18 with a new implant after site has complete healing. Impressions for a new maxillary night guard was also completed.

Figure 1a: Initial presentation showing inflammation, around implants #18 and #19

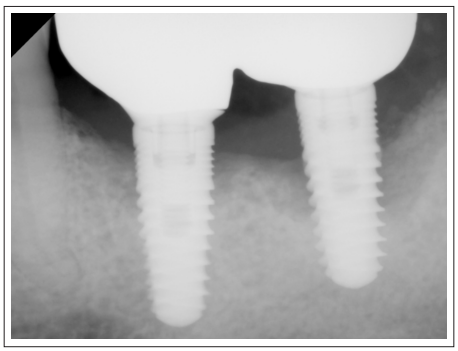


Figure 1b: Initial presentation x-rays

The bridge was sectioned to allow removal of #18. Under local anesthesia a flap was raised, (Figure 2 and 3) extraction of implant #18 was performed using elevator and forceps, the extraction site was degranulated and irrigated with saline. Ridge preservation was performed utilizing freeze-dried bone allograft (FDBA) and bioabsorbable vicryl mesh membrane. #19 was debrided, irrigated with saline and FDBA allograft and bioabsorbable vicryl mesh membrane used for guided bone regeneration(GBR). Closure was performed using PTFE sutures. Prescriptions for Amoxicillin 500mg (twenty-one tabs, 1 tab three times daily for 1 week) was given. Patient was advised to use over the counter pain medication and to use saline rinses twice daily for 1 week. He presented in two weeks for suture removal and was healing well from the procedures, his night guard was inserted. His general dentist replaced his implant crown for #19. He presented back for follow up four months later (Figures 4 and 5).

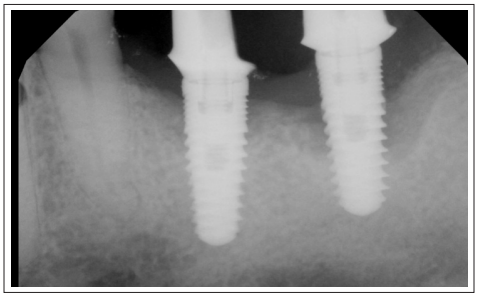


Figure 2: Abutments #18 and #19

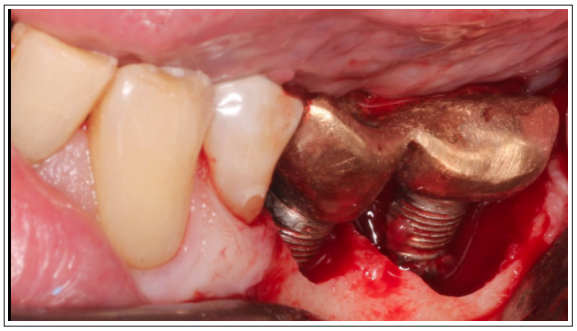


Figure 3: Clinical picture showing severe bone loss #18 and moderate bone loss #19

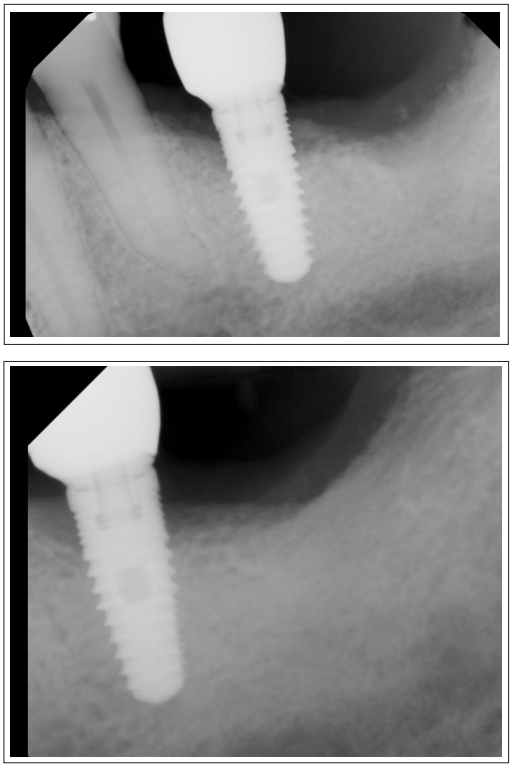


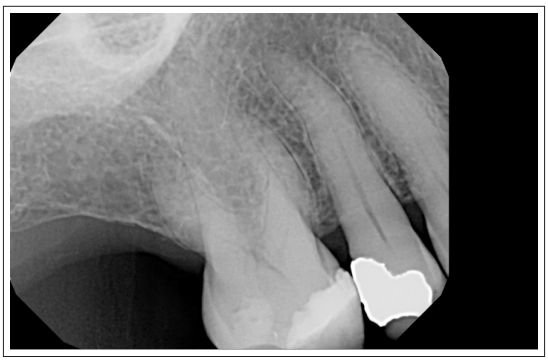
Figure 4 and 5: Following extraction and bone graft #18 and bone graft #19 healing with interim restoration

Overloading of the implants resulted in severe Periimplantitis around implant #18 and moderate Periimplantitis around implant #19. Over contouring of the bridge resulted in cantilever forces on the implants as well as patient being a bruxer and not wearing his night guard contributed significantly to his implant failure. Additionally, failure to attend routine periodontal maintenance visits was also a major contributing factor to his implant failure. Attending periodontal maintenance visits for patients who have implants, especially when they at risk of overload due to parafunctional habits, is essential because complications can be treated early and prevent implant failure.

Case Report 2

A 71-year-old male presented to our office with a crater type defect on mesial aspect of implant #2. He has stopped attending his periodontal maintenance visits due to the pandemic and had not worn his night guard for a few years. His implant had been done eight years earlier, a 4.5mm X11.5mm Legacy 2 implant had been placed by our office and restored by his general dentist six months later (Figure 6,7,8,9,). His implant crown fell out and he wanted

to save his implant. Based on his clinical findings, probing depth showing deep pockets mesial and distal #2 and x-rays, he was diagnosed as having Moderate Periimplantitis. His abutment was removed and replaced with a healing abutment (Figures 10, 11a and 11b). Under local anesthesia, a flap was created and his implant was debrided using plastic scalers. His implant was irrigated using saline solution, guided bone regeneration was completed using Freeze dried bone allograft (FDBA) and bioabsorbable vicryl mesh membrane. Closure of flap was completed using PTFE sutures. Patient was given prescriptions for Motrin 600mg 12 tabs 1 tab every 6 hours as needed for pain, Amoxicillin 500mg (21 tabs, 1 tab three times daily for 1 week) and advised to use saline rinses for 1 week. Patient presented for suture removal in 2 weeks and was healing well. Following 6 months of healing, he was seen by his general dentist to address his crown and we inserted his nightguard (Figure 12). Patient has kept up with his maintenance visits and use of his night guard.



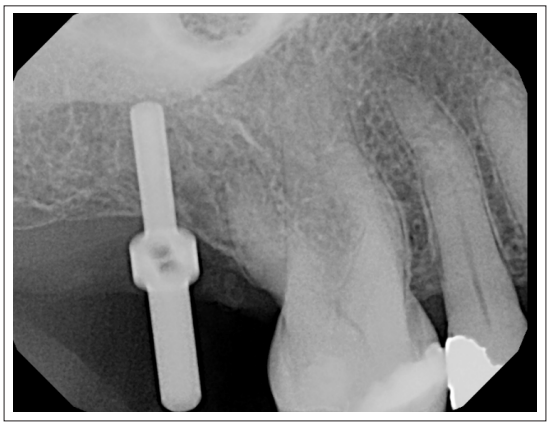


Figure 6 and 7: X-ray implant placement for #2

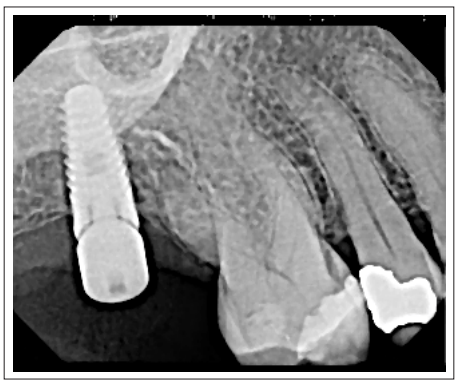


Figure 8

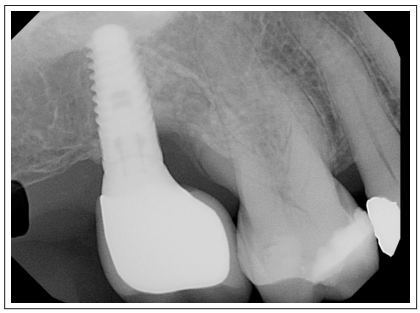


Figure 9

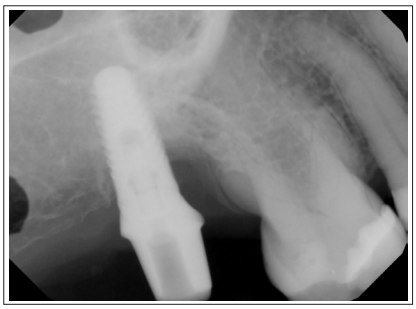
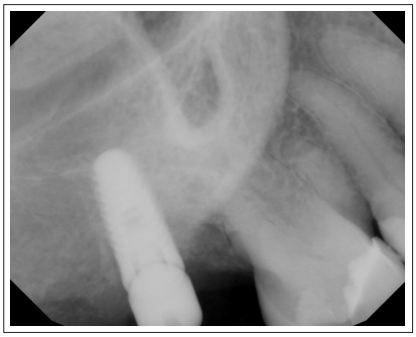


Figure 10



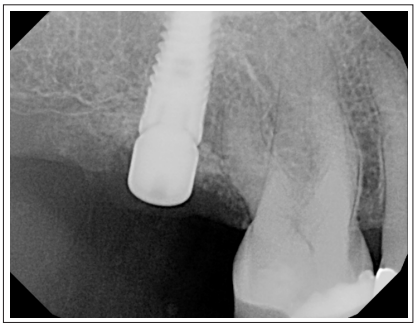


Figure 11a and 11b: healing abutment placed back and Healing after Guided bone regeneration(GBR)

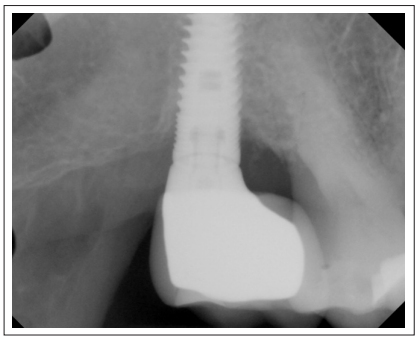


Figure 12: Permanent crown

Discussion

Utilizing dental implants in the posterior areas of the mouth for implant supported restorations presents with complications due to the amount of masticatory, and non-axial forces exerted on implants in the area. It is essential that the bio-mechanical forces in the area are reduced. Curtis and colleagues recommended strategies for reducing occlusal stress on posterior implants including use of narrow occlusal tables, avoidance of cantilever restorations, fabrication of night guards to minimize excessive forces to implants and splinting of adjacent implants to have a better distribution of occlusal load on the implants. They stressed also the importance of frequent monitoring, follow up visits and periodontal maintenance visits to allow assessment of implants, implant components and restorations especially in the posterior quadrants. Additionally, having an accurate history of reason for tooth loss is also helpful for planning posterior implant restorations. If tooth loss occurred from fracture, the implant would have a higher chance of overloading when restored compared to tooth loss from periodontal disease therefore incorporated in the treatment planning would be modifications to reduce stress to implants such as use of night guards.

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