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Management and Removal of a Fractured Osseointegrated Implant: A Case Report

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Abstract

Implant fractures, though rare, pose significant challenges for clinicians, particularly when they occur in osseointegrated implants. This case report details the clinical management and removal of a fractured osseointegrated dental implant in a patient presenting with functional concerns. The fracture was detected through clinical examination and radiographic evaluation, revealing a complete structural failure of the implant body. A minimally invasive surgical approach was employed to remove the fractured implant while preserving the surrounding bone for future rehabilitation.

Keywords: implant removal, osseointegration, implant fracture, minimally invasive surgery.

Introduction

Dental implants are widely recognized for their durability and high success rates in replacing missing teeth[1]. However, despite their widespread success, complications such as implant fractures can occur, though they are relatively uncommon[3]. Implant fractures, reported in approximately 1-2% of cases,

present significant clinical challenges[5]. Common causes include biomechanical overload, material fatigue, and improper occlusal forces. Biomechanical overload often arises from improper occlusion, parafunctional habits like bruxism, or inadequate force distribution in multi-implant restorations[4]. In addition, occlusal forces can create stress on implants, which lack the shock-absorbing periodontal ligament of natural teeth, making them more susceptible to mechanical failure[6]. Material fatigue, especially in older implants or those with manufacturing defects, also contributes to implant fractures[7].

When an implant is osseointegrated, its bond with the surrounding bone complicates removal in the event of a fracture[8]. Preserving the integrity of the surrounding bone is critical for future treatment. The removal of a fractured osseointegrated implant requires a precise, minimally invasive approach to avoid excessive trauma to the bone, which could complicate future restorative procedures[9]. Early detection through clinical and radiographic examination is crucial. This case report highlights the management and removal of a fractured osseointegrated implant, emphasizing the use of a trephine bur for a controlled, minimally invasive extraction[10]. By preserving the alveolar bone, the site remains viable for future prosthetic rehabilitation, demonstrating the importance of early intervention and a multidisciplinary approach in implant failure management[11].

Case Report

A 66-year-old male presented to the department of Prosthodontics, Government Dental College and Hospital, Chh. Sambhajinagar with the chief complaint of discomfort in a previously placed dental implant in the region of the left mandibular first molar. The implant had been placed 3 years earlier. The patient had no significant medical history that could compromise healing, and oral hygiene was well-maintained.

Upon clinical examination, the implant site revealed a firm and fractured implant of which a sharp projection of the fractured collar/neck of the implant was seen clinically (Fig.1). There was no significant inflammation or infection of the peri-implant tissues. A panoramic radiograph and a cone-beam computed tomography (CBCT) scan were taken to assess the condition of the implant and the surrounding bone (Fig 2)

Additionally, the patient exhibited signs of generalized attrition, suggesting a history of bruxism.

Figure 1: Clinical picture of fractured implant

Radiographic Findings: The radiographic images revealed a diagonally fractured osseointegrated implant neck/collar at the crestal bone level. There was slight bone loss around the implant in it's coronal 1/3rd and rest of the bone appeared to be healthy and intact. (Fig. 2)

Figure 2: OPG of fractured implant with Left mandibular first molar

Diagnosis: The diagnosis was a fractured osseointegrated dental implant, likely due to a combination of biomechanical overload and material

fatigue. The decision was made to remove the fractured implant and plan for future rehabilitation after healing.

Treatment Plan: The treatment plan involved the following steps:

1. Removal of the fractured implant: A trephine bur was chosen for the removal to minimize bone loss and preserve the surrounding tissue for future implant placement.
2. Site preservation: Careful handling of the implant site to prevent trauma and maintain the bone by grafting procedure.

Surgical Procedure

1. The patient was administered local anesthesia, and the surgical field was prepared under sterile conditions.
2. Crestal incision was given and a full thickness mucoperiosteal flap was raised to gain access to the fractured implant.(Fig. 3)
3. A trephine bur, appropriately sized to match the implant's diameter, was selected.
4. The bur was attached to the implant hand piece (20:1) for the removal procedure.
5. The Trephine bur was positioned over the implant and rotated gently, the implant was carefully extracted using a controlled "dancing" motion with the bur to minimize trauma to the surrounding bone.
6. Once the implant was sufficiently loosened, it was carefully extracted without fracturing the surrounding bone, to excise the implant and surrounding osseointegrated bone.
7. The socket was thoroughly irrigated with 2% Betadine-saline solution to clear debris and the integrity of the remaining bone was inspected.
8. Then the socket was grafted using a combination of allograft, xenograft, and a gel sponge, which served as a scaffold for bone regeneration.
9. A chorion membrane was placed over the graft material to promote guided tissue regeneration.
10. 2 implants were placed in 35 and 37 regions for future rehabilitation of the edentulous space by implant supported.
11. Suturing was done using 4-0 silk suturing, simple interrupted sutures were given.

Figure 3: Incision & Reflection, trephine bur placed, implant removal done.

Post-operative Management: The patient was prescribed antibiotics and analgesics to prevent infection and manage post-operative discomfort. The patient was advised on maintaining oral hygiene and was scheduled for follow-up visits.

Outcome and Follow-up: The patient returned for follow-up at 1 week and 1 month post-surgery. Healing was uneventful, and there were no signs of infection or bone loss at the implant site. The patient was planned for a second-stage implant placement after a 6-month healing period.

Discussion

Implant fractures, though rare, can pose significant clinical challenges when they do occur[1]. Several factors contribute to these fractures, including biomechanical overload, excessive occlusal forces, and material fatigue[2]. Biomechanical overload often results from improper occlusion or imbalanced force distribution, especially in patients with habits like bruxism, which increase the stress on the implant components[14]. Over time, this constant overload can lead to structural

fatigue, weakening the implant material and causing it to fracture.

The fracture of the dental implant in present case can be attributed to a history of bruxism, which involves involuntary grinding or clenching of teeth, often occurring during sleep[15]. Bruxism exerts excessive and repetitive forces on dental implants, surpassing the normal chewing pressures they are designed to withstand. These intense forces can lead to various complications, including the fracture of the implant body, loosening of the abutment or crown, and bone loss around the implant[17]. Over time, cyclic loading and material fatigue may weaken the implant, causing it to fail[13]. In patients with bruxism, nightguards or splints are commonly recommended to protect both natural teeth and implants from the damaging effects of grinding[16]. Additionally, addressing the underlying causes of bruxism, such as stress, and using stronger materials or customized implant designs can help prevent fractures[3]. Regular monitoring of the implant and surrounding structures is crucial for early detection of issues like bone resorption or implant loosening, ensuring effective long-term management of the implant[4].

In this case, the fracture occurred at the crestal bone level, complicating the removal process due to the implant's successful osseointegration with the surrounding bone[5]. Osseointegration, while crucial for the implant's stability, presents a challenge during removal because of the strong bond between the implant and bone tissue[6]. This necessitates a careful approach to extraction to avoid damaging the surrounding bone.

To facilitate the removal of the fractured osseointegrated implant, a trephine bur was employed, allowing for a precise and controlled extraction process[7]. The trephine bur's dancing motion enabled the removal of the implant while preserving the surrounding bone structure, which is critical for future prosthetic rehabilitation[8]. Preservation of the bone during removal is essential not only for the success of future re-implantation but also for maintaining the patient's bone architecture and aesthetics[9]. The management of fractured osseointegrated implants requires meticulous planning to ensure minimal trauma to the surrounding tissues[10]. A comprehensive approach involves considering factors such as the implant's design, the patient's specific occlusal forces, and the material properties of the implant to minimize the risk of future fractures[11]. Early diagnosis, combined with a well-planned surgical approach, helps preserve the bone and optimize outcomes for re-implantation or alternative restorative treatments[12].

Conclusion

This case highlights the successful management and removal of a fractured osseointegrated implant using a trephine bur. The preservation of the surrounding bone allows for future rehabilitation, emphasizing the importance of minimally invasive techniques in implant removal. Early diagnosis and appropriate surgical management are crucial for achieving favorable outcomes in similar cases.

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