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HORIZONTAL AND VERTICAL IMPLANT FRACTURE DUE TO FUNCTIONAL LOADING: A RARE CASE SERIES

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ABSTRACT

Patients who are partially edentulous can greatly benefit from implant-supported prostheses. Intervention may be necessary for problems like fracture, loose screws, or fixture failure, even with high success rates. **Clinical case:** In this case study, a thorough management plan for removing a horizontally fractured implant fixture and the potential reasons for the fixture fracture in the 36 regions of a 56-year-old patient and the vertically fractured implant in the 46 regions of a 48-year-old male patient are presented. **Treatment:** Broken implants are extracted with forceps to destroy osseointegration. **Result:** The damaged implants were removed. The patient's parafunctional habits were assessed. Due to a severe chewing habit brought on by bruxism, the patient experienced attrition.

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INTRODUCTION

Mechanical issues are one issue with implant restorations. Fractures of implant fixtures should be replaced or extracted from the bone, though they are not common among the complications. A damaged implant should be completely removed, along with the surrounding bone, using a trephine or surgical bur. Severe bone abnormalities often result from the removal of fixtures. Overload, improper prosthesis placement, and defects in implant design or materials were the main causes of implant fractures, according to Thomas et al. Furthermore, previous studies have shown that peri-implant inflammation was present in 59% of broken implants prior to fracture, abutment or screw breakage, or loosening. (1) Dental implant fractures are expected to occur between 0.16% and 3.5% of the time. A study found that the incidence had a mean of 0.52% and varied from 0.2% to 2.3%. The risk of fracture can be affected by factors like implant diameter, restoration type, and occlusal forces. (2) According to these results, if precautions are taken by looking at the phenomena that might occur prior to implant fracture, it might be possible to partially prevent implant fracture. The factors that might affect implant fixture fractures were evaluated in this study. (3)

MATERIALS AND METHODS

The study was carried out at KGMU, Lucknow, in the Department of Prosthodontics, Crowns & Bridges. Implants that show some degree of bone loss or movement are removed using forceps to break osseointegration. However, the flap is raised and the surrounding bone is cut away with a small surgical bur, etc., before being cut away with forceps for implants with strong osseointegration and little bone loss. Implant removal kits are available from a number of companies. A trephine bur that is the proper size for the diameter of the implant can be used to remove it by only damaging the surrounding bones. Some companies sell kits that use a unique technique to break down osseointegration. After securely fastening the kit to the implant hex driver, osseointegration is destroyed when the operator applies a strong reverse torque. These kits facilitate implant removal and lessen trauma when used appropriately.

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CASE PRESENTATION:

A 56-year-old man presented with pain and movement in his posterior mandibular implantarea. Two years before, he had undergone implant surgery to replace teeth 36 and 37. The following was discovered by radiographic assessment utilizingperiapical imaging.

A radiograph of the left posterior mandible displaying two nearby implants. While the implant at site 36 has substantial radiolucency that suggests bone loss at the apex and horizontal fixture fracture, the implant at site 37 seems intact.(Figure 1A)

In Figure 1B, the surgical site in the posterior mandible is exposed by an open flap. Granulation tissue and blood were found in the location of the failed implant. Figure 1C shows the implant's recovered fragmented part in a metal dish. Figure 1D shows that the failing fixture was removed, the defect site was debrided, and guided bone regeneration was permitted. A delayed re-implantation regimen was designed to guarantee

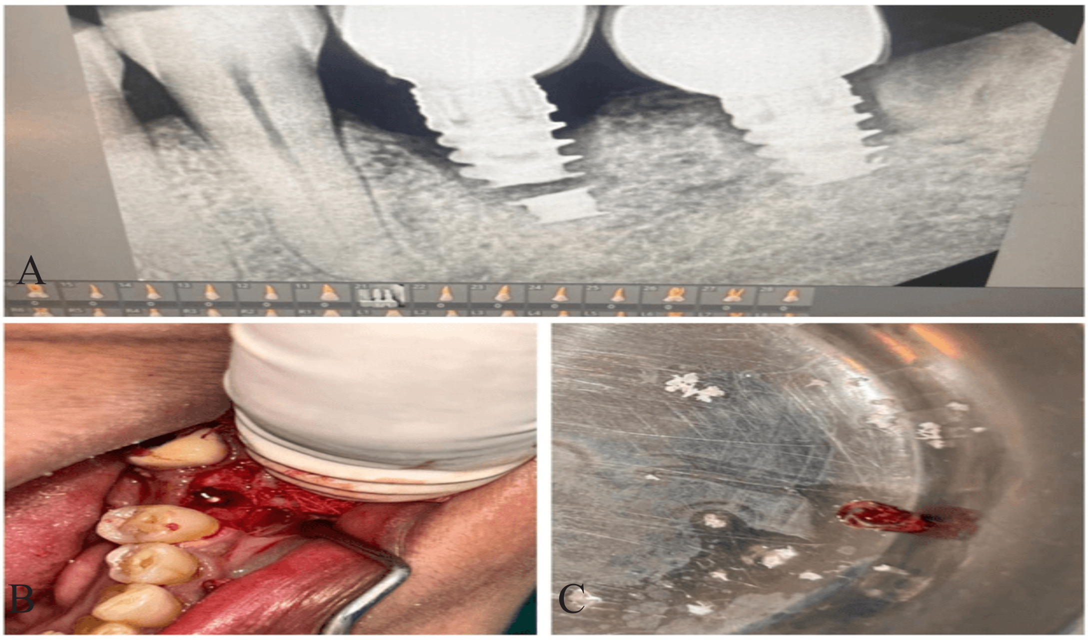

Figure 1. (A) Horizontally fractured implant, **(B)**Retrieval of horizontally Fractured implant, **(C)** Fractured implant retrieved

adequate osseous healing.

The following variables were examined: sex, age, implant type, implant diameter and length, bone grafting material, parafunction, implant fracture time, pre-implant clinical symptoms, implant fracture treatment, and complications.

In the second case, a male patient of 48 years had an implant-supported prosthesis in the 46 region

And presented with pain after one year of rehabilitation. After which, the radiograph of the patient was taken, which shows a vertically fractured implant **(Figure2A).**

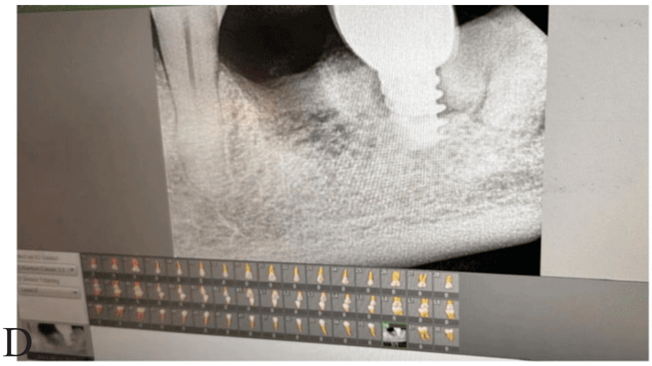

Figure 1 (D) IOPA after Implant retrieval.

After which the flap was raised as shown in **Figure 2 B,** and the vertically fractured implant was removed with the same technique, and a radiograph was taken as shown in **Figure 2C.**

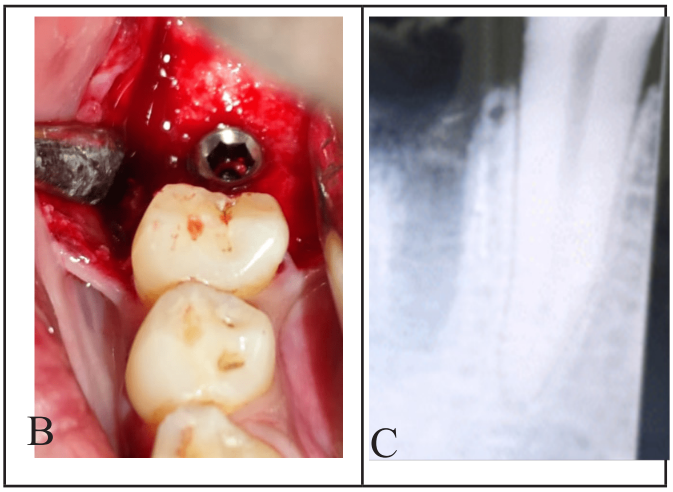

Figure 2 (A) Vertically fractured implant,**(B)** Retrieval of the vertically fractured implant , **(C)** IOPA after retrieval of vertically fractured implant

DISCUSSION

Dental implants are essential to modern prosthodontic practice due to their remarkable success rates and useful advantages. Even though it is uncommon, implant failure poses significant challenges, and issues can arise during any phase—maintenance, prosthetic, or surgery. This particular case is a classic example of late implant failure, which is characterized by component fracture and peri-implant bone loss. This emphasizes that in order to guarantee the success of implant-supported restorations, a dedicated, long-term maintenance program is required. (4)

Implant failures fall into two primary categories: early (pre-osseointegration) and late (post-osseointegration). The current case serves as an example of a late failure, which occurs following the prosthetic phase. This is often associated with biomechanical overload, peri-implantitis, or material fatigue. The case's radiographs revealed a possible component fracture and a progressive loss of crestal bone, suggesting that mechanical overload was most likely the cause. Numerous reports indicate that occlusal overloading plays a significant role in late implant failure, particularly in the posterior regions where masticatory forces are stronger. (5)

In implant therapy, careful biomechanical planning is essential. The concentration of stress brought on by an insufficient number of implants, improper distribution, and cantilever effects may ultimately compromise the bone-implant interface. This highlights the importance of planning carefully and attentively to prevent such problems. The posterior mandible is subjected to greater occlusal stresses, which, if not distributed evenly, can result in micromovements that cause bone resorption and fixture instability. It's possible that parafunctional behaviors like bruxism or an uneven force distribution led to increased loading on the mesial implant (36) in the example. (4,5) Furthermore, cyclic excessive loading may result in fatigue fracture of implant components, particularly the abutment screw or implant fixture.(6)Fracture eventually results from repeated stress concentrations that exceed the material's yield strength. Such a situation is strongly suggested by the detached fixture visible on the radiograph (Figure 1).

Repeated stress concentrations that surpass the material's yield strength eventually cause fracture. The detached fixture seen on the radiograph (Figure 1) strongly suggests such a situation.

Kim et al. reported a case of implant failure with a fracture at the third thread (6). According to a Morgan et al. paper (7), fracture may occur easily if the peri-implant bone resorption progresses to the third thread, the weakest part of the implant fixture. Prior to implant fracture, Koller et al. (8) and Hsu et al. (9) noted marginal bone loss, which may be an early indicator of implant fracture. Therefore, bone resorption occurs around the implant when it is first exposed to an overload. If the resorption spreads to the fracture-weakened region, a fracture may be likely.

Consideration should also be given to peri-implantitis, an inflammatory condition caused by plaque that progressively erodes supporting bone. Although the radiographs do not clearly show the classic signs of peri-implantitis, such as crater-like bone loss, the radiolucency and failed osseointegration point to a chronic infectious or inflammatory disease. This is especially feasible if the prosthetic's shape or oral hygiene maintenance were subpar. Many studies have been conducted on bacterial colonization and micrographs at the implant-abutment contact. These microorganisms have the potential to act as infection hotspots, causing tissue degradation surrounding implants. Additionally, as seems to have happened with the failed implant, the mechanical stability of the implant is jeopardized once the bone has resorbed past a critical threshold. (9).In order to preserve as much bone as possible, a failing implant should be removed traumatizingly. In this case, the fixture was likely removed using trephine drills or reverse torque techniques. Debridement and socket disinfection were necessary after removal in order to get rid of any contaminated tissue and encourage healing. Research indicates that a 3–6 month healing period following transplantation is necessary to allow for sufficient bone regeneration, which is consistent with delaying re-implantation (Esposito et al., 1998). The remaining deficiency may be improved by bone grafting, especially if implant placement is scheduled for the future. The use of autogenous bone, allografts, xenografts, or synthetic substitutes will depend on the anatomy of the defect and the patient's characteristics. Guided bone regeneration (GBR) uses membranes, either resorbable or non-resorbable, to encourage osteogenesis and stop soft tissue infiltration. It is essential to reevaluate prosthetic design. A single crown arrangement without a splint may be more susceptible to overload in high-load regions, like the posterior jaw. Splinting adjacent implants and enhancing occlusal contacts—specifically, by avoiding interferences with lateral excursions—can reduce mechanical stress. Accurate occlusal modifications may benefit from the use of digital occlusal analysis tools. Furthermore, the size and design of the implant should be reassessed in cases of prior failure. Implants with tapered designs, larger diameters, and superior surface coatings (plasma-sprayed or SLA) may enhance primary stability and osseointegration. When selecting an implant location, the amount of available keratinized tissue and the thickness of soft tissue should be taken into account in order to lower the incidence of peri-implantitis.

Following appropriate healing and retreatment, the prognosis for re-implanted fixtures may still be favorable. However, strict adherence to maintenance practices, such as professional cleaning, radiographic monitoring, and patient observance of dental hygiene, is necessary for long-term efficacy. Additionally, patients need to be taught how to recognize early warning signs of implant issues and encouraged to report them right away.

CONCLUSION

This illustration highlights the complexity of implant issues and the need for a comprehensive approach to diagnosis and treatment. For the best outcomes, clinical, radiological, surgical, and prosthetic knowledge must be combined. At failed implant sites, function and appearance can be successfully restored with careful planning and close monitoring.

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