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A simplified technique for retrieval of a fractured prosthetic screw using intraoral tips: Case report

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Abstract
The success of dental implants largely depends on the degree of osseointegration. Failures, however, can arise not only from biological issues like poor osseointegration or peri-implantitis but also from technical problems. One significant issue is the fracture of the implant abutment screw, as the remaining fragment within the implant can hinder its ability to function effectively as an anchor. This clinical report outlines a straightforward and cost-efficient method for removing fractured screw fragments, using intraoral tips of light body polyvinyl siloxane (PVS) enabling the continued use of the existing prosthesis. This is a non-invasive retrieval technique demonstrates its effectiveness and potential for improving clinical outcomes in dental implantology.

Keywords: Dental implant, implant abutment, prosthetic screw fracture, intraoral tip, retrieval of fractured screw

Introduction
The use of osseointegrated, implant-supported prostheses for replacing missing teeth has become a well-established procedure in modern dentistry. Although implant dentistry demonstrates a success rate exceeding 90%, complications can still occur, and implants may occasionally fail [1]. Failures in implant-supported restorations are often linked to technical problems, which are generally classified into two categories: issues involving the implant components and those related to the prosthesis itself.
Among implant component failures, abutment screw fractures are relatively common. Implants with a butt-joint and an external hex connection to the abutment tend to be more prone to screw loosening than those with an internal taper or conical joint that includes an anti-rotation mechanism [1, 2] For implants to function effectively, they must endure substantial chewing forces. The tensile preload generated in the screw during tightening provides the mechanical stability required to resist these forces. This preload the clamping force that maintains the connection under static and functional loads is typically achieved by tightening a screw to a specific torque value.
Several factors influence the preload, including the applied torque, the presence and type of lubricants, the physical characteristics of the contacting materials, and the degree of screw settling after tightening. Surface irregularities can increase friction, which in turn reduces preload. However, removing and retightening the screw can help smooth these imperfections. The use of lubricants further reduces friction, allowing for greater preload [3].
If an abutment screw fractures, the retained segment inside the implant must be extracted. Leaving it in place can result in the implant remaining osseointegrated but unable to support a prosthesis, thereby rendering the restoration nonfunctional [4]. Management of a fractured screw begins with a comprehensive patient history and careful clinical examination to determine the cause, as prevention of recurrence is essential [5]. Confirmation of the fracture and identifying its exact location are critical. Fractures occurring above the implant platform are generally easier to manage than those positioned more apically [5, 6]
The removal technique depends on the fracture site relative to the implant head. When the

break is above the platform, hand instruments such as explorers, straight probes, or haemostats can be maneuvered in a counterclockwise direction to loosen and retrieve the fragment [5]. For fractures occurring below the implant head, specialized tools may be necessary. Commercially available implant repair kits such as the ITI® Dental Implant System (Institut Straumann AG, Switzerland) and the IMZ® TwinPlus Implant System (DENTSPLY Friadent, Germany) offer components like drills, drill guides, and manual tapping devices for this purpose [7]

This clinical report describes a case where a fractured implant abutment screw was successfully removed using a simple alternative method.

Case Report

A 62-year-old male patient presented to our department with complaints of discomfort and a dislodgement of implant support crown on 37 regions. Clinical examination and radiographic evaluation revealed a fractured prosthetic screw with 37 regions. The lower portion of the screw remained lodged within the implant threads. The implant was securely osseointegrated and exhibited no indications of peri-implantitis. Two treatment options were considered: attempting to retrieve the fractured screw or removing the implant in case where other treatment options were not viable and replacing it with a new one. Implant was osseointegrated and exhibited no indications of peri-implantitis hence first treatment option was chosen. After discussion with the patient and obtaining their consent, it was decided that the fractured screw would be removed and the implant to restored with prosthesis. Therefore, the retrieval of the prosthetic screw was planned.

Medical History

- No significant systemic conditions; non-smoker.
- History of successful dental implants placed five years prior.

Clinical Examination

- Tenderness upon palpation in the molar region.
- Radiographs confirmed the presence of a fractured screw within the implant fixture.

Materials and Methods

The retrieval procedure utilized

- Intraoral tips

Procedure:

- **Anesthesia:** local anesthesia Inferior alveolar nerve block, lingual nerve block and buccal nerve block was administered for patient comfort.
- **Access Preparation:** Radiograph was taken using probe to locate the position of an implant. Using tissue punch drill flap implant site was accessed, avoiding damage to the implant.
- **Retrieval of the Screw:** intraoral tip is cut into appropriate diameter to engage the screw. After ensuring proper engagement of tip into screw, the tip was rotated anticlockwise to remove the screw. Radiograph was taken to assure removal of prosthetic screw.
- Healing abutment was placed. After proper healing, healing abutment was removed and open tray implant impression was made and new prosthesis was fabricated.
- Follow up at 7 day, 1,3 and 6 month showed no signs inflammation and mobility with good patient's satisfaction.

Discussion

Prosthetic screw fracture is a challenging complication encountered in implant-supported prostheses [10] Effective retrieval of the fractured screw without damaging the internal threads of the implant is critical for preserving the implant's functionality. Several authors have previously explored various techniques for retrieving fractured screws, each with its strengths and limitations [4]. The use of intraoral tip in this case provided a practical and effective method for retrieving a fractured prosthetic screw. The intraoral tips facilitated precise application and minimized the risk of trauma to surrounding tissues. This technique emphasizes the importance of material selection and innovative approaches in managing complications in implant dentistry.

A screw can be conceptualized as a spring under tension due to preload, with friction forces within the threads maintaining the stretch. Generally, increased preload results in a tighter and more secure screw joint. However, the preload should not surpass the screw's ultimate tensile strength. Given the significant role preload plays in ensuring the stability of a screw joint, it is essential to understand the phenomenon of loosening [23].

Screw fracture and loosening are interrelated issues. Research suggests that loosening often represents the initial phase of screw fracture [17]. When loosening occurs, surface damage is typically observed at areas of high stress, such as the screw head and the first thread. Consequently, some experts advise replacing loose abutment screws, as they may have undergone fatigue that predisposes them to fracture [7].

Preventive measures include considering factors such as the number, position, dimensions, and design of implants, as well as the prosthesis design during treatment planning [25]. To resist high bending stresses, implants should be as long and wide as possible, utilized in sufficient numbers, and strategically positioned to allow axial loading. Fracture of implant components is more commonly observed in posterior regions and among partially dentate patients compared to completely edentulous individuals [15].

Routine retightening of abutment screws approximately ten minutes after the initial torque application is recommended. [17] Increasing the torque value of abutment screws to above 30 Newtons has been shown to enhance abutment and implant stability, reducing the likelihood of screw loosening. Strategies to prevent screw-retained prostheses from loosening include:

- Using appropriate fixation screws.
- Replacing loose screws rather than retightening them.
- Prompt investigation when looseness of the prosthesis is detected by either the clinician or patient.
- Incorporating dimples inside the abutment screw cylinder above the screw.

For instance, studies conducted by Alevizakos V *et al*. demonstrated the use of ultrasonic devices to dislodge fractured screws. While effective, these methods often require specialized tools and carry a risk of heat generation, which could compromise the surrounding bone [6]. Similarly, Reyhanian A *et al*. presented a case where Er: YAG laser were employed to retrieve fractured screws; however, this approach risks damaging the implant's internal threads, making subsequent prosthetic rehabilitation more complex [10].

In contrast, the innovative intraoral technique described in this report offers a practical and cost-effective alternative for retrieving fractured screws. This approach requires minimal specialized equipment and can be performed chairside, reducing treatment time and costs. Additionally, it minimizes the risk of iatrogenic damage to the implant, preserving its long-term functionality.

Previous studies, such as those by Carlson B *et al*., emphasized the importance of early detection and intervention in cases of prosthetic screw loosening to prevent fracture [11]. In alignment with their findings, this case report highlights the significance of timely diagnosis and the use of simple, accessible techniques for screw retrieval. Furthermore, it underscores the need for preventive measures, such as appropriate torque application, routine retightening, and the replacement of loose screws to mitigate the risk of fracture, this case also adds to the growing body of evidence that supports a multidisciplinary approach to managing implant complications. Collaboration between clinicians, technicians, and patients is vital for the successful resolution of screw-related complications and ensuring the longevity of implant-supported prostheses [17].

Fig 1: Clinical and Radiographic (RVG) photograph of implant region showing screw fracture

Fig 2: Intraoral tip engaging the screw

Fig 3: Retrival of screw by rotating intraoral tip anticlockwise

Fig 4: Retrieved screw

Fig 5: Clinical and radiographic photograph showing complete removal of fractured screw

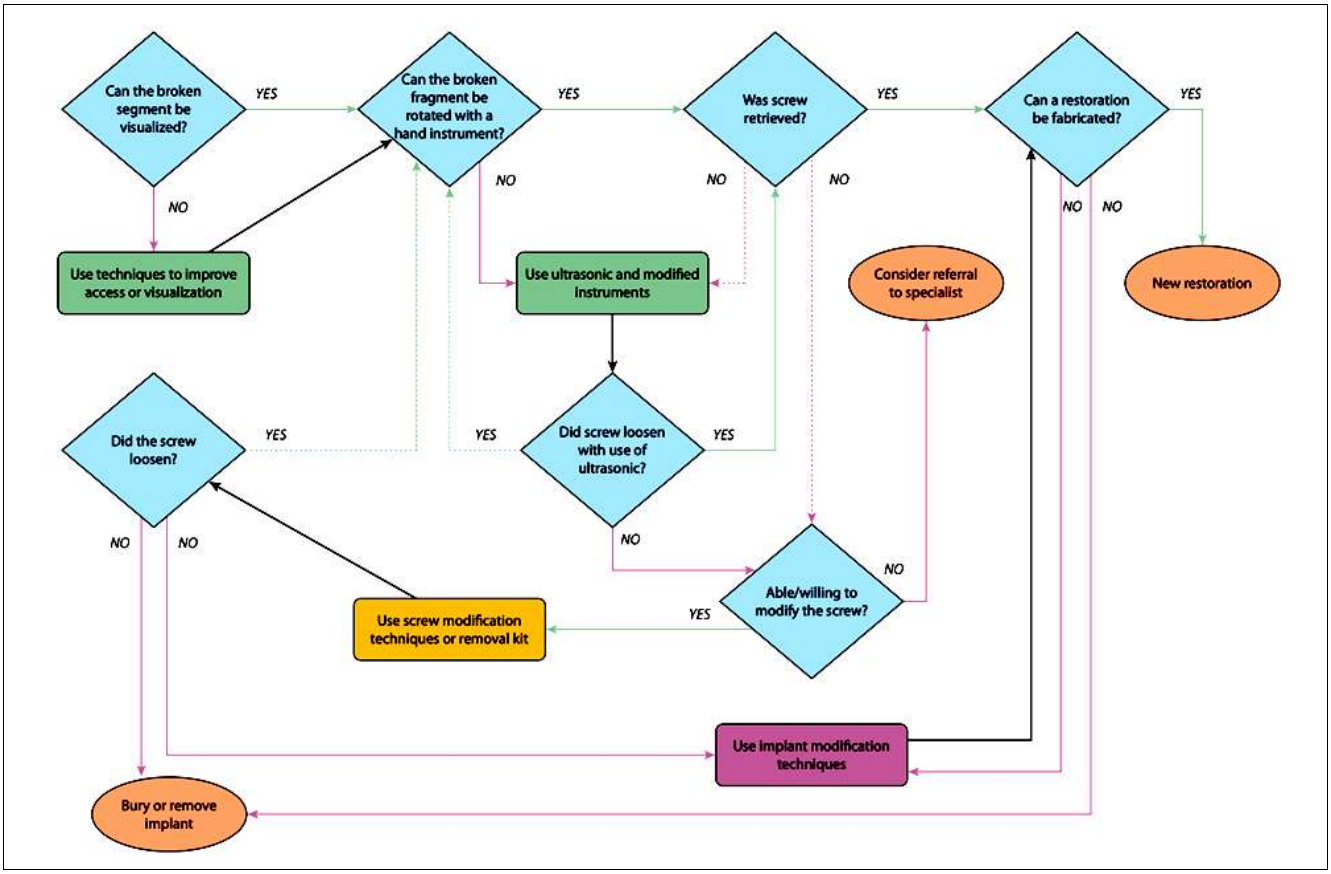

Fig 6: Decision tree for management of fractured screw can be utilised

Conclusion

This case demonstrates the successful retrieval of a fractured prosthetic screw using intraoral tips of light body PVS. The procedure was minimally invasive, preserving the integrity of the implant and surrounding structures. This approach can be considered a valuable addition to the arsenal of techniques available to dental practitioners facing similar challenges. The retrieval of fractured prosthetic screws remains a significant clinical challenge that requires meticulous planning and execution to preserve the integrity of the implant and ensure long-term success [20, 21] The innovative intraoral technique described in this case report demonstrates a practical, efficient, and minimally invasive approach to resolving this complication. By employing simple instruments and techniques readily available in clinical settings, this method minimizes treatment time and reduces the risk of damaging the implant's internal threads.

Previous studies, such as those conducted by Katsavochristou *et al*. have highlighted various methods for addressing prosthetic screw complications, emphasizing the importance of early detection and preventive strategies. Building upon their findings, this case underscores the need for timely intervention and the use of accessible, cost-effective solutions for screw retrieval [4]. This report also reinforces the value of routine maintenance and adherence to recommended torque protocols to minimize the likelihood of screw loosening and fracture. Incorporating preventive measures, as suggested by Mizumoto, Ryan M *et al*. along with innovative retrieval techniques, contributes to the long-term success of implant-supported prostheses [9].

Future research should focus on further optimizing retrieval techniques and exploring advancements in screw and implant design to reduce the incidence of complications. By continuing to refine and share clinical strategies, the dental community can improve outcomes and patient satisfaction in managing implant-supported restorations.

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