ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at:www.ijdsir.com

Volume – 8, Issue – 3, June – 2025, Page No. : 30 - 35

Implant Abutment Screw Rescue Techniques: A Comprehensive Review

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Citation of this Article: Dr.Smita Khalikar, Dr. Kishor Mahale, Dr.Sonali Khedkar, Dr. Sharayu Bangar, Dr. Vilas Rajguru, Dr. Sonali Mahajan, Dr. Ulhas Tandale, "Implant Abutment Screw Rescue Techniques: A Comprehensive Review", IJDSIR- June – 2025, Volume – 8, Issue – 3, P. No. 30 – 35.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

The fracture of implant abutment screws presents a significant challenge in implant prosthodontics, potentially compromising the integrity of the implant system. The retrieval of fractured screws requires precise techniques to prevent damage to the implant body. Various retrieval methods range from manual approaches using explorers and ultrasonic scalers to advanced techniques involving customized drill guides and rotary instruments. This review provides a comprehensive overview of the available techniques for retrieving fractured abutment screws, analyzing their effectiveness, advantages, limitations, and clinical applications.

Keywords: Bruxism, Slow Jiggling Motion, Polymerization

Introduction

The long-term success of dental implants relies on the structural integrity of the implant-abutment complex. Abutment screw fractures, though relatively uncommon, pose significant clinical challenges that require careful management. Several factors contribute to these fractures, including mechanical overload, material fatigue, improper prosthetic design, and ill-fitting components. The retrieval of fractured screws is crucial to preserving the integrity of the implant and ensuring the longevity of the prosthesis. Various techniques have been developed, each with distinct indications and limitations. This review explores the causes of abutment screw fractures and examines the various retrieval methods reported in the literature.

Causes of Abutment Screw Fracture

A] **Biomechanical Overload**[7]: Excessive occlusal forces, particularly from bruxism and parafunctional habits, can place excessive stress on implant components, leading to screw loosening and fracture.

B] **Ill-Fitting Prosthetic Components**: Inadequate seating of the abutment or misaligned prosthetic structures can create internal stress, increasing the risk of screw breakage[7].

C] Peri-Implant Bone Loss[7]: Severe bone loss around an implant alters load distribution, causing micro-movements that accelerate screw fatigue and failure.

D] Metal Fatigue[8]: Repeated stress cycles from mastication lead to material fatigue, causing the screw to break at its weakest point.

E] Non-Passive Fit of Prosthetic Structures[7]: A prosthesis that does not fit passively exerts uneven forces on the implant-abutment interface, leading to screw failure over time.

F] Inadequate Treatment Planning[8]: Poor implant positioning, insufficient number of implants, or incorrect occlusal force distribution can increase the likelihood of screw fractures.

Screw Retrieval Techniques

A] Manual Retrieval Techniques

- **Explorers and Hand Instruments**[2]: Simple retrieval attempts can be made using sharp explorers or hand scalers to engage and rotate the broken screw. When the fragment is accessible, instruments like probes or spoon excavators can aid in removal.
- **Ultrasonic Scalers**[2]: The application of ultrasonic vibrations helps loosen the screw fragment without damaging the internal implant threads. This minimally invasive approach preserves implant integrity.

B] Specialized Retrieval Kits and Techniques

- **Screw Removal Kits**: Commercially available kits, such as fragment forks and screw extractors, are designed for specific implant systems and facilitate efficient retrieval of broken screws, like nobelbiocare, osstem implant system[1]
- **Customized Drill Guides**[1]: The customized drill guide was fabricated using an implant impression coping that could specifically fit to the internal structure of the implant fixture[1]. To be able to maintain the bur position at the center of the coping, the impression coping modified using autopolymerizing acrylic resin. The channel of the impression coping filled with autopolymerizing acrylic resin, and when the resin reached the dough stage, a #329 bur inserted. The bur moved back and forth until the resin completed polymerization. The central access hole with a depth of 0.5 mm was made with a #329 bur on top of the broken screw, and the reverse tap drill was used in a contra-angle handpiece with a counter-clockwise and fracture screw and abutment is removed[1]

Figure 1:

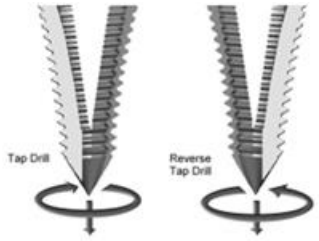

Figure 2:

Figure 3:

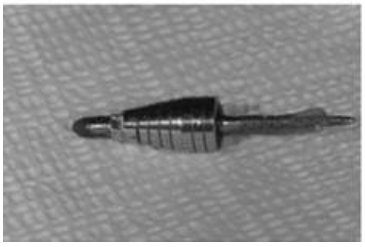

Figure 4:

- **Reverse-Tapping Rotary Instruments**[7]: These instruments engage the central hole of the fractured screw, allowing controlled counter-clockwise removal.

Figure 5:

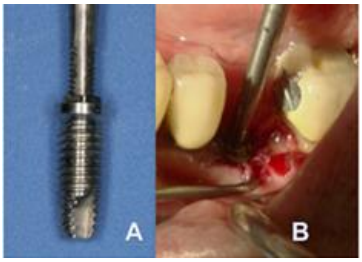

Figure 6:

C] Conservative Approaches Using Prefabricated or Modified Components

- **Hollow Abutment Screws**[4]: Pre-designed abutments with central access holes facilitate retrieval in case of screw fracture[4].

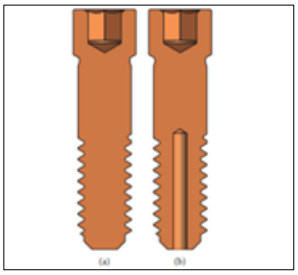

Figure 7:

Figure 8:

- **Self-Made Screwdrivers**[5]:- Existing dental burs and instruments can be modified to create custom screwdrivers tailored to the specific retrieval scenario.

Figure 9:

Figure 10:

- **Modified round-tip scissors used to retrieve the fractured titanium abutment**[8]**:-**

Modify the tips of a pair of round-tip scissors with a cutting disk so that they can be inserted inside the dental implant and have a retentive feature with a notched outer edge. The approximate size of the tips should be less than the diameter of abutment screw, which is 2.3 mm, and the depth of the notch should be less than 1 mm. Use a dental implant analog to customize the size of the tips Insert into wedge fractured abutment and removed in slow jiggling motion

Figure 11:

Figure 12:

- **Plastic Mixing Tips for Retrieval[9]**: Innovative use of plastic mixing tips can engage and rotate the broken screw without damaging the implant body[9].

Figure 13:

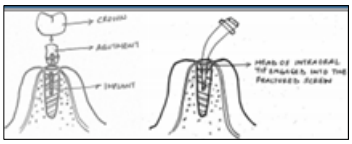

Figure 14:

- **Retrieval of a fractured abutment screw thread from an implant[3]:-**The screw-thread of the abutment screw which fractured away from the body of the screw and retained within the implant removed with the help of endodontic fiel[3].

Figure 15:

Figure 16:

Figure 17:

Screwdriver fashioned from a needle[10]:-A straightforward and cost effective method for removing a screw fractured above or level with the implant platform by using a custom screwdriver fashioned from a hypodermic needle

Figure 18:

Figure 19:

D] Surgical and Last-Resort Methods[6]

- **Flap Elevation for Direct Access**: When conservative methods fail, raising a soft tissue flap improves visibility and control during retrieval[6].
- **Re-tapping the Implant Threads**: If retrieval damages the internal threads, re-tapping tools help restore implant function by reforming the screw channels[6].
- **Implant Removal and Replacement**: In cases where retrieval is unsuccessful or damages the implant, explain to the patient and replacement may be necessary[6].

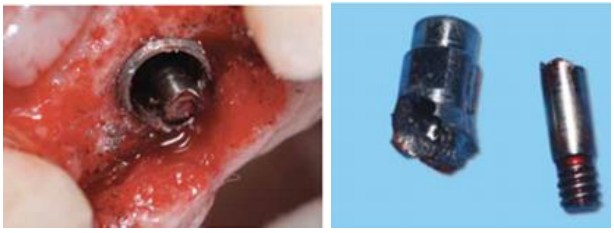

Figure 20:

Clinical Considerations and Future Directions

A] Accurate Treatment Planning[8]

- Conduct thorough pre-treatment assessments to identify risk factors, such as bruxism and heavy occlusal loads.
- Ensure proper implant placement and angulation to evenly distribute occlusal forces.
- Recommend protective devices like night guards to mitigate parafunctional forces.

B] Appropriate Component Selection[7]

- Select compatible abutments and prosthetic components suited to the clinical scenario.
- Consider using titanium abutments, which exhibit greater fracture resistance than zirconia abutments.

C] Achieving Optimal Preload[7]

- Follow manufacturer-recommended torque specifications for abutment screws to achieve appropriate preload and prevent screw loosening.

D] Ensuring Passive Fit of Prosthesis[7]

- Fabricate prosthetic components with a passive fit to minimize undue stress on implant components and reduce the risk of screw fractures.

E] Regular Maintenance and Monitoring[7]

- Schedule periodic examinations to assess implant and prosthetic component integrity.
- Educate patients on maintaining optimal oral hygiene and reporting any abnormal sensations or mobility.

F] Patient Education[7]

- Advise patients to avoid excessive chewing forces on implant-supported restorations.
- Stress the importance of attending follow-up appointments for early detection and intervention in case of complications.

By implementing these preventive measures, clinicians can significantly reduce the incidence of implant abutment screw fractures and enhance the longevity of implant-supported restorations.

Conclusion

The retrieval of fractured abutment screws is a critical aspect of implant prosthodontics, requiring a combination of manual dexterity, specialized tools, and innovative approaches. The choice of retrieval technique depends on the location and extent of the fracture, accessibility, and clinician expertise. A methodical approach, beginning with conservative techniques and progressing to advanced methods as needed, increases the success rate of screw retrieval while minimizing implant damage. Ongoing research and technological advancements continue to improve the predictability and efficiency of screw retrieval procedures, ensuring better clinical outcomes in implant dentistry.

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