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RETRIEVAL OF FRACTURED ABUTMENT SCREW BY ULTRASONIC SCALER – A CASE REPORT

Dentistry

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ABSTRACT

Implant component failure may occur due to biological and mechanical etiologies, including compromised osseointegration and the development of peri-implant diseases such as peri-implantitis. Mechanical complications commonly reported in implant therapy include fracture of the prosthetic crown, framework fracture, abutment screw loosening, and abutment screw fracture. Such complications may compromise the functional and long-term success of dental implants, rendering the restoration clinically ineffective. Among mechanical failures, screw loosening and screw fracture represent significant complications, with an increasing incidence in implant prosthodontics. Management of a fractured screw often necessitates retrieval of the fractured screw fragment, as prosthetic rehabilitation requires removal of the broken segment from the implant screw channel. Various techniques have been described for retrieval of fractured screw fragments from the implant body. The present case report describes an instance of implant abutment screw fracture and highlights the use of a piezoelectric ultrasonic scaler for atraumatic removal of the fractured fragment.

KEYWORDS

Dental implants, Abutment screw fracture, Retrieval methods, Ultrasonic scaler.

INTRODUCTION

Dental implants represent a predictable treatment modality for the replacement of missing or severely compromised teeth and provide improved comfort and functional stability. [1] They offer a prosthetic restoration that closely simulates the form and function of the natural dentition. [2] In addition, implants transmit functional loads to the surrounding bone, thereby helping to preserve alveolar bone volume and density in the absence of a natural tooth, which may contribute to maintenance of facial contours. [3] Dental implants are widely accepted as a highly successful option for oral rehabilitation. A critical biological determinant for long-term implant survival is the achievement and maintenance of osseointegration. [4] Despite the high overall success rates reported for osseointegrated implants, implant failures though uncommon can still occur. [5]

Implant therapy may be associated with various complications. These potential complications can be broadly categorized into six domains: esthetic, phonetic, functional, biological, mechanical, and ergonomic. [6] Mechanical complications include retention loss, prosthetic crown fracture, framework fracture, screw loosening, and screw fracture. [7]

Prosthetic complications of implant components: Causes & prevention:

Table: 1

Prosthetic complication/ failure	Common causes / etiology	Prevention / how to reduce risk	Key references
Screw loosening (abutment/prosthetic)	Inadequate preload (under-torque); embedment relaxation/settling effect; non-passive fit; occlusal overload; lateral forces; cantilever; bruxism; repeated tightening cycles.	Use calibrated torque wrench and manufacturer torque; retorque after 5–10 min; ensure passive fit; reduce cusp inclination; narrow occlusal table; eliminate interferences; minimize cantilever; consider splinting; night guard for bruxers.	[4,6,8-10]
Screw fracture	Usually preceded by repeated loosening → cyclic fatigue; overload; cantilever forces; framework misfit causing stress concentration; over-torque; component wear.	Manage loosening early; correct torque + retorque; reduce cantilever; optimize occlusion; avoid lateral overload; replace worn/damaged screws; manage parafunction with night guard.	[4,6,8-10]
Ceramic veneer chipping / crown fracture	High occlusal load/bruxism; excursive contacts; inadequate ceramic thickness; unsupported porcelain; poor framework support/design; material limitations (veneered zirconia).	Provide adequate framework support and thickness; adjust occlusion to reduce lateral contacts; consider monolithic materials in high-load cases; night guard for bruxers.	[4,6,8-11]
Framework fracture (metal/zirconia)	Long-span FDP; inadequate connector dimensions; cantilever; parafunction; cyclic fatigue; non-passive fit; design/manufacturing flaws.	Design adequate connector dimensions; limit span and cantilever; ensure passive fit with verification jig; optimize occlusal scheme; manage parafunction.	[4,6,8-11]
Loss of retention (decementation)	Short abutment height; excessive taper; contamination during cementation; inadequate resistance form; occlusal overload.	Optimize abutment height/taper; moisture control and cement protocol; occlusal control; prefer screw-retained design when retrievability is required.	[4,6,8-11]
Implant fracture (rare catastrophic)	Severe overload/bruxism; narrow diameter implant in posterior region; cantilever; malposition leading to bending moments; inadequate implant number/distribution.	Appropriate planning: adequate implant diameter/number/distribution; avoid long cantilevers; control occlusion; provide night guard when indicated.	[4,6,8-11]
Abutment fracture	Overload; cantilever; parafunction; thin/weak abutment design; long-term fatigue.	Select appropriate abutment material/design; reduce lateral loads; optimize implant position and load distribution; manage parafunction.	[4,6,8-11]

Prosthesis misfit / lack of passive fit	Impression inaccuracies; cast distortion; CAD/CAM errors; laboratory inaccuracies; multi-unit distortion → strain on screws/framework.	Open-tray impressions for multi-unit cases; verification jig; sectioning/welding if required; accurate digital workflow; confirm passive fit clinically and radiographically.	[4,6,8-11]
Wear of components / screw channel damage	Repeated insertion/removal; misfit; contamination; inappropriate instruments; micromovement.	Follow maintenance protocol; avoid reusing damaged screws; replace worn components; ensure fit and correct tightening protocol.	[4,6,8-11]
Occlusal overload related prosthetic failure (major driver)	High bite forces; parafunction; steep cusps; cantilever; offset loads; implant malposition.	Implant-protective occlusion: axial loading; reduce lateral contacts; narrow occlusal table; short cantilever; manage bruxism with occlusal guard; periodic occlusal review.	[4,6,8-11]

Methods for Extracting Broken Abutment Screws:
Depending on the location and accessibility of the breakage, there are a number of methods for removing fractured abutment screws:

Explorer or Probe Method: Dental explorers or probes can be used to engage and loosen the screw fragment by rotating it counterclockwise until removal is accomplished in cases of fractures that occur at or below the level of the implant head.[12-14]

Ultrasonic Scaling Technique: The exposed part of the broken screw can be placed directly onto an ultrasonic scaler with a fine tip. The fragment is gradually unthreaded by the vibrational forces produced. During the removal process, lubricants such as mineral oil or eugenol can be applied to ease handling and reduce friction.[12-15]

Mechanical Gripping: Surgical forceps or hemostats can be used to grasp and extract the fractured piece directly when the fracture occurs above the implant head, allowing adequate access to the broken segment.[12-13]

Rotary Instrument Approach: A shallow 1mm groove is made across the top surface of the broken screw fragment using a high-speed dental handpiece fitted with a diamond bur. This slot facilitates the extraction process and offers purchase for removal tools. [12,14]

A low-speed contra-angle handpiece with a 1/4 round carbide bur in reverse mode aids in screw removal. It holds the head of the fragment and mainly acts as a screwdriver.

Systems for Specialized Screw Retrieval
Dedicated screw retrieval kits provide an alternate option when abutment screw fractures occur at considerable depths and traditional removal techniques are insufficient. These specialized systems are made especially to remove damaged implant parts.

Among the commercial systems that are available are:
For controlled screw extraction, the ITI® Dental Implant System from Institute Straumann AG (Switzerland) offers a complete retrieval kit that includes precision drills, two drill guides, and six specialized manual tapping tools.[16]

The retrieval components for the IMZ® Twin Plus Implant System are available from Dentsply Friadent (Germany) and are made specifically for their implant platform.[17]

The Replace Screw Removal Kit is made by Nobel BiocareTM (Yorba Linda, California, USA) and is specifically designed for their implant systems.[18]

The Certain®-Screw Removal Kit, manufactured by Biomet 3iTM (Florida, USA), was created especially for use with their implant components.[19]

These manufacturer-specific kits typically include precision instruments and guided drilling systems that allow for controlled access to deeply fractured screw fragments while preserving the integrity of the surrounding implant structure.

Procedural Steps for Implant Screw Retrieval Using Specialized Kits
The systematic approach for removing fractured screws involves the following sequence:

Initial Setup: Position the appropriate drill guide securely onto the implant platform to ensure precise alignment and prevent damage to surrounding structures.

Pilot Drilling: Using a contra-angle handpiece, operate the pilot drill at 1,000-1,250 RPM with abundant saline irrigation. Apply a gentle reverse pushing motion to create a controlled penetration of 1-2 millimeters into the fractured screw head. This establishes an initial purchase point for subsequent instrumentation.

Preparation for Tapping: Before proceeding with the next drill size, manually tap the created purchase point to ensure proper engagement and stability.

Debris Management: Thoroughly suction any metal debris generated during drilling and irrigate the area to remove all particles and maintain clear visualization.

Final Extraction: Complete the retrieval process by engaging the tap drill at a reduced speed of 70-80 RPM to carefully extract the broken screw fragment from the screw chamber. The lower rotational speed provides better control and reduces the risk of further fragmentation.

This methodical approach ensures controlled removal while minimizing potential complications or damage to the implant fixture.[20-21]

Tissue Management and Supplementary Instrumentation.
Soft Tissue Access Procedures: Accessing the implant platform requires a small amount of surgical exposure when dental implants are hidden beneath soft tissue. There are two main techniques that can be used to remove tissue:

Laser Surgery: To carefully remove excess tissue surrounding the implant site, soft tissue lasers can be applied in a circumferential pattern. This method provides controlled tissue ablation with improved healing properties and little bleeding.[22,23]

Electrosurgery: In these clinical settings, electrocautery offers an alternate method of soft tissue management that effectively removes tissue while preserving hemostasis.[24]

Clinical Objective: The purpose of this case presentation is to show a simplified alternative method for extracting broken implant abutment screws and then installing a replacement abutment that permits the patient to continue using their existing prosthetic restoration without requiring complete remake of the prosthesis.

The focus is on providing a practical, minimally invasive solution that preserves the patient's current prosthetic investment while effectively addressing the mechanical complication of screw fracture.

CLINICAL CASE PRESENTATION

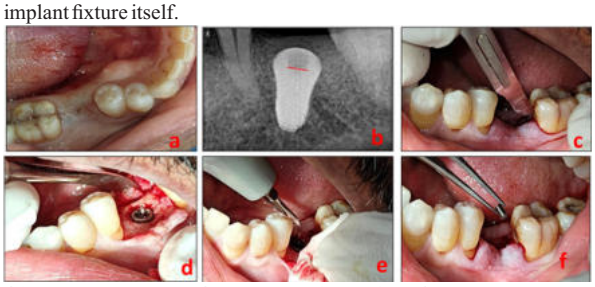
A 56-year-old male patient sought treatment at the Department of Periodontics, RUHS College of dental sciences (GDCH), Jaipur presenting with a displaced prosthesis associated with a mandibular left first molar .

The patient reported that this complication had been present for approximately one week. The patient's dental history revealed that the implant placement had been performed seven year prior to presentation. The implant had been successfully restored with a screw-retained porcelain-fused-to-metal crown.

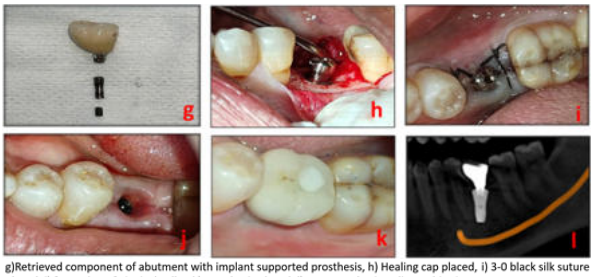
Clinical Findings: Upon intraoral examination, the implant platform was found to be completely covered by overlying soft tissue. Clinical signs of infection (erythema, edema, and bleeding on probing)were not evident. (Fig a).

Radiographic Evaluation: IOPAR was taken to confirm the presence of a fractured abutment screw that remained threaded within the implant body. The radiographic analysis revealed no structural damage to the

implant fixture itself.



a)Clinical presentation at the baseline , b) IOPAR showing level of abutment fracture c) crestal incision joining the crevicular incision distal to 2nd PM & mesial to 1st Molar, d) full thickness muco-periostal flap reflection and exposure of implant, d), e) retrieval of broken abutment part with p1 tip of piezoelectric ultrasonic scaler, f) retrieved broken component



g)Retrieved component of abutment with implant supported prosthesis, h) Healing cap placed, i) 3-0 black silk suture placed, j) formation of gingival collar, k) prosthesis placed, l) post prosthesis radiographic view

However, there was no radiographic evidence of marginal bone resorption around the implant site. (Fig b)

This clinical scenario presented a complex case requiring both management of the soft tissue and removal of the fractured screw component while preserving implant integrity.

To retrieve the broken fragment the following steps were undertaken After anesthetizing the area, mid crestal incision was given with 15 number blade and Implant exposure was done. (Fig c)

After locating the site of the screw fracture, the implant body was meticulously cleaned using saline irrigation and dried with air. (Fig d)

The piezoelectric ultrasonic scaler tip (Tip P1) was placed on upper surface of the fractured abutment screw. (Fig e)

The scaler tip was held firm on the upper surface of the fractured fragment and the oscillations were started with minimal power and copious irrigation.

When the vibrating scaler tip contacted the surface of the screw, a moderate reverse torque was applied and fractured abutment fragment spun out of the implant body.

As the fractured abutment screw fragment started loosening, the tip contacting the screw fragment was gradually decreased. The loosened abutment screw was then removed with a tweezer. (Fig f)

Using saline irrigation the internal surface of the implant was again cleaned and healing abutment was placed (Fig h) & 3-0 silk sutures placed. (Fig I)

Healing abutment is placed for two weeks for the formation of gingival collar (fig j)

The patient was instructed on the use of 0.12% chlorhexidine mouthwash, systemic antibiotics (amoxicillin 500 mg thrice daily for 7 days and Diclofenac Sodium 50mg SOS and was seen intermittently for professional oral hygiene maintenance during the follow-up period.

The new abutment was then tried for the fit and preservation which helps to confirm the absence of damage of internal retentive structure of the implant. Abutment was tightened to the implant body with a new screw, existing prosthesis was cemented and radiograph was taken (Fig k -l).

DISCUSSION

A common mechanical complication in implant rehabilitation involves failure of implant components. The abutment screw plays a critical role by connecting the abutment to the implant fixture; however, it may fracture under functional occlusal loading. Abutment screw fracture is considered a particularly challenging complication in implant-supported restorations because the fractured fragment must be removed carefully without damaging the internal threads of the implant body, so that the implant can continue to function effectively.

This case highlights a complication that can occur during the clinical use of implant components. The screw fracture in this patient was most likely associated with occlusal overload, which is among the most frequently reported mechanical complications. In addition, repeated episodes of screw loosening followed by retightening may weaken the screw over time and ultimately result in fracture, causing discomfort and inconvenience to the patient [25]. As a conservative and innovative management approach, ultrasonic instrumentation was used for retrieval of the fractured screw, and this technique contributed to favourable clinical outcomes. Notably, bone loss was minimal, and the peri-implant tissues remained healthy and stable.[26]

Satwalekar P et al., [27] used piezoelectric scaler on low, combined with reverse torque and concluded that screw being in an inclined plane, will unthread when subjected to continuous vibrations. In a study, Joshi et al., [38] used fine round bur no. BR 49 to make groove on the occlusal surface of fractured screw across the diameter. Finally, ultrasonic scaler tip engaged and actuated in the groove. The unconventional technique described in the current article developed simple armamentarium that is cost effective and can be universally used for any implant system.

CONCLUSION

Abutment screw fracture is a well-documented mechanical complication associated with implant-supported restorations. However, its occurrence can be significantly reduced through proper treatment planning, careful evaluation of the occlusal scheme, tightening the screw to the recommended torque, and maintaining regular recall appointments. These measures help prevent repeated screw loosening, which is a major contributing factor to eventual screw fracture.

The present report describes the management of an implant abutment screw fracture using a simple and unconventional retrieval method with minimal armamentarium. The use of a piezoelectric ultrasonic scaler-an instrument routinely available in most dental clinics-proved to be a practical and conservative option for retrieving the fractured screw fragment. Additionally, since the technique is non-invasive, it offers greater patient comfort and satisfaction compared to more aggressive retrieval methods.

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