

# Various Treatment Modalities for Retrieval of Broken Abutment Screw in Implant Prosthodontics

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## ABSTRACT

Dental implants made of titanium for replacement of missing teeth are widely used because of ease of technical procedure and high success rate, but are not free of complications and may fail. Out of all the failures related to implants, prosthetic failures amounts the most. Among prosthetic failures, fracture of the prosthetic screw is very common and continues to be a problem in restorative practice and it is a great challenge to remove the fractured screw conservatively. There are various techniques and instrument kits which are available for retrieval of fractured abutment screw. However, there is a lot of ambiguity among the implantologist regarding their use and practice. This article reviews the basic instrumentation concept, stepwise procedure and other technicalities related to the same. This article also enlightens various unconventional methods which are reported in the literature.

**Keywords:** Abutment screw retrieval, Damaged internal threads, Implant screw fracture, Implant screw loosening.

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## INTRODUCTION

Oral implantology is an ever growing field in the practice of general dentistry due to the simplification of technical procedures. Implant treatment is considered as a safe technique with high rates of success.<sup>1</sup> Titanium endosteal implants are widely used due to the advantages offered by their mechanical properties and excellent anchorage in the jawbone, known as 'osseointegration'.<sup>2</sup> With proper diagnosis and treatment planning, appropriate placement, adequate prosthetic design, and proper maintenance, dental implants can achieve a success rate of 97 to 99%.<sup>3,4</sup> The success of dental implants is based primarily on the extent of osseointegration.<sup>5,6</sup>

Quality restorations are the requirement of an implant design and procedures of fabrication are characteristic to each implant system. During the phase of diagnosis and treatment planning, it is of utmost importance to have knowledge about the possible complications that could be associated with the treatment plan.

The failure of dental implants is not only due to biological factors, such as unsuccessful osseointegration or the development of peri-implantitis, but, it may also result from technical complications. These complications are relatively rare. In contrast, prosthetic complications are not uncommon.

Failures of implant-supported restorations result from technical problems and can be divided into two groups: those relating to implant components, and those relating to the prosthesis. Technical problems related to implant components include abutment screw fracture.

Screw loosening,<sup>7-9</sup> which can lead to screw breakage, is seen infrequently in today's dental practices but was seen more often in the earlier years of implant placement. Kitagawa et al reported that it was usually associated with the external hex prosthetic connection.<sup>10</sup> This challenge led other implant manufacturers to design internal connections that were more stable and would prevent the problem.<sup>11,12</sup>

If a screw loosens, and the problem is not corrected early, it can break in one of two ways: the 'favorable' way or the 'unfavorable' way. The favorable way is when the threads are not binding, and the fragment is loose; this allows for easier retrieval. The unfavorable way is when the fragment threads bind due to deformation, structural damage, or thread locking compounds; this requires extreme care and effort for retrieval. It is easy enough for most of us to inspect the case to determine which of these situations is present.

## COMPLICATIONS

In general, these complications can be grouped into the following five categories:<sup>13</sup>

- Veneering material fracture
- Prosthetic screw loosening
- Prosthetic screw fracture
- Implant fracture
- Framework fracture

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Although loosening of screws is not a serious complication in itself, it creates a difficult situation for both the patient and the dentist. Screw loosening is more often associated with single-unit restorations. Screw loosening occurs when compressive occlusal forces are higher than the tension in the screw-implant assembly that holds the components together (the clamping force). The quality of fit and adaptation of components have also been demonstrated to affect the stability of the screw joint.<sup>14</sup>

The subsequent complications from screw loosening that can ensue include screw fracture, dislodgement of the prosthesis, or failure of the implant. Screw fracture occurs more readily with a loose screw as it is more prone to excessive lateral loads. It has been proposed that the fit of the prosthesis should be such that when a screw is tightened with a torque device, the screw should rotate only about a quarter of a turn (90°) between a firm hand tightening of the screw and achievement of the recommended torque level. Preventing screw loosening may be best accomplished by tightening the screws using either a hand or electronic torque device.

Jung et al in 2004 concluded that, over a 5-year period, the incidence of fracture of abutment screws was 3.9% and loosening of abutment screws was 6.7%.<sup>8</sup> In the traditional implant prosthesis, the prosthetic screw was intentionally designed as the weakest link within the system. In case of any excessive mechanical stress, the weak prosthetic screw would fail, thereby preventing damage to the bone-implant interface. Fracture of the screw is likely to be attributable to material fatigue.

### Treatment Modalities for Retrieval of Broken Abutment Screw in Implant Prosthodontics

Goodacre et al in 2003 found that prosthesis screw fracture was noted almost equally with fixed complete dentures (3%) and fixed partial dentures (5%). The mean incidence was 4% but was found to range from 0.0 to 19%. Of 7094 screws evaluated, 282 fractured.<sup>7</sup>

Removal of fractured abutment screw segments should be performed using low speed (600 RPM) rather than at (2,000 RPM), to minimize temperature rise in adjacent bone.

Various treatment modalities available are as follows:

- A rotary motor with a carbide bur
- Er:YAG laser
- Post and core
- Various retrieval instruments.

The methods employed to grasp the broken fragments or screw are determined according to the location of the fracture abutment—above or below the head of the implant. If an abutment screw fractures above the head of the implant, an explorer, a straight probe or hemostats might

be successful. The tip of the instrument is moved carefully in a counter-clockwise direction over the surface of the screw segment until it loosens. If the screw fracture occurs below the head of the implant, other methods are required. Several implant repair kits are available.

### A Rotary Motor with a Carbide Bur

A number of methods are described for removal of a fractured screw segment from the internal threads of dental implants.<sup>15</sup> The majority of these methods utilize a rotary motor with a carbide bur for retrieval of the fractured screw segment. System for screw fragment removal includes the following parts:

- A manual centering device that fits the internal connection of an implant
- A deeper centering device
- A reverse carbide cutting drill
- A claw reamer bur
- An extension holder (Fig. 1).

### Er:YAG laser

Avi Reyhanian et al in 2012 described the use of Er:YAG laser in retrieval of broken abutment screw.

A 'V' shape incision was made with the Er:YAG laser with wavelength 2,940 nm (Figs 2 to 11).



Fig. 1: Components of a typical commercial screw removal system



Fig. 2: Broken abutment screw as seen on radiograph



Fig. 3: 'V' shape incision by laser

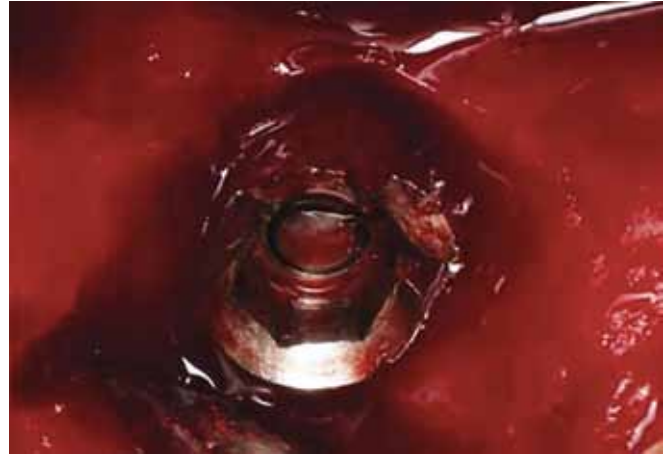


Fig. 4. The buccal and palatal flaps were lifted and the area explored, there is granulation tissue around the neck of the implant



Fig. 5: The granulation tissue was ablated using the laser



Fig. 6: The broken hexagon slot was straightened, using a round diamond bur and the head of the implant was rendered smooth. A slot was created with a surgical drill on the head of the fractured screw



Fig. 7: A screwdriver was successfully used to unscrew the broken abutment screw



Fig. 8: Decortication of the buccal bone was then performed

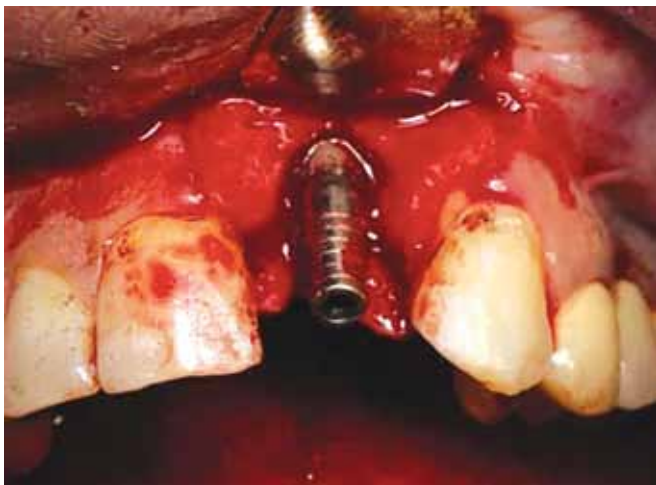
### Post and Core

K Harshakumar, Shashank Bhatia, R Ravichandran and PT Joy reported (Figs 12 to 19).<sup>16</sup>

### Various Retrieval Instruments

Decision for abutment screw retrieval should be made as follows:

- If abutment fractures at screw head then hemostat/ pliers are used.
- If it is not fractured at screw head then,
  - If the fragment is rotatable then abutment screw remover is used.
  - If it is not rotatable then reverse drilling instruments are used.



**Fig. 9:** The purpose of decortications was to encourage bleeding, providing progenitor cells to the site. A new abutment was then inserted into the implant



**Fig. 10:** The mucoperiosteal flap was re-positioned and sutured with silk 3-0, paying particular attention to primary closure of the flap



**Fig. 11:** Postoperative radiograph



**Fig. 12:** Oral pantomogram of the patient showing abutment screw fracture below the head of implant



**Fig. 13:** Crown with the fractured abutment screw



**Fig. 14:** Prepared post space in implant by removing the internal threads

### *Abutment Screw Remover*

It is a basic procedure. It has following steps:

- *Select abutment screw remover:* Appropriate abutment screw remover should be attached to the handpiece.
- *Remove the screw:* To remove the screw shaft from implant, place the end of the abutment screw onto the fractured screw and rotate counterclockwise while applying light pressure at maximum speed of 50 rpm.



**Fig. 15:** Post space preparation by removing the internal threads using tungsten carbide bur under copious irrigation



**Fig. 16:** Trial of the pattern made by self cure clear acrylic



**Fig. 17:** Custom post and core



**Fig. 18:** Custom post and core cemented to the implant using zinc phosphate cement



**Fig. 19:** Metal ceramic crown fabricated over the cast core

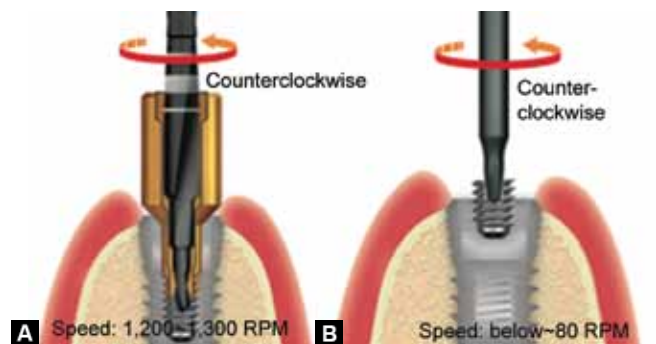
*Reverse Drilling Instruments*

It is an advanced procedure with following steps (Figs 20A and B):

- Select proper rescue drill guide
- Attach rescue drill guide-  
Attach the guide to the handle and then connect it to interface of the implant. The rescue drill guide helps

the center the abutment screw retrieval during reverse drill on the screw.

- Select appropriate abutment screw retrieval reverse drill
- Drill a hole of approximately 1 mm into the fractured screw  
At a speed of 2000 rpm with generous cooling.
- Loose the abutment screw
- Connect abutment screw with retrieval instrument
- Remove the abutment/clinical screw
- Clean implant threads at 50 rpm (Fig. 21).



**Figs 20A and B:** Reverse drilling procedure: (A) Reverse drilling and (B) screw removing



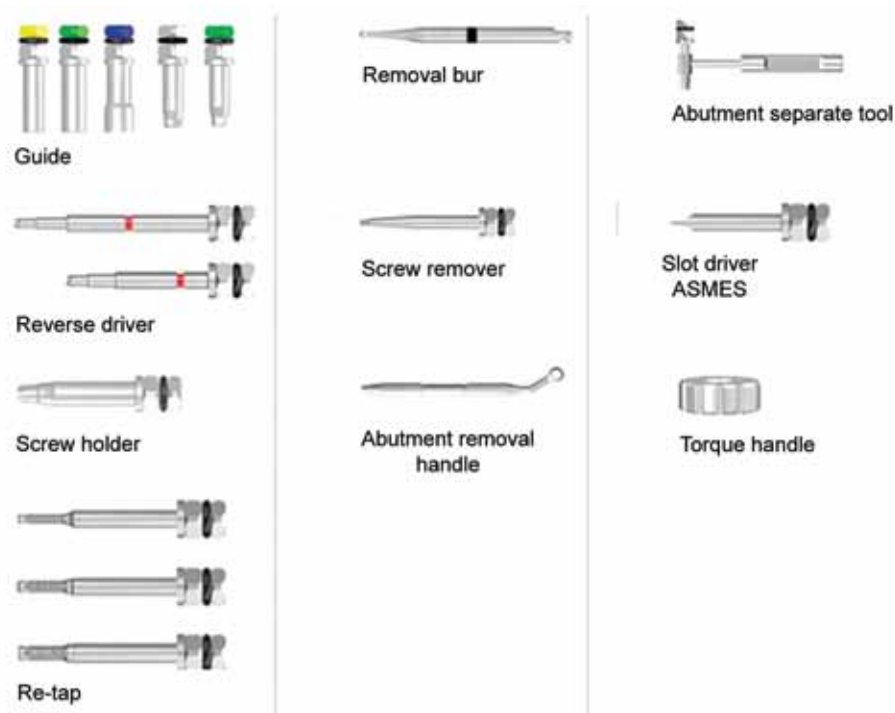


Fig. 21: Abutment screw retrieval kit (Noble Biocare)

## CONCLUSION

Abutment screw fracture is a frustrating complication, which may occur during rehabilitation of the implant. Various management modalities regarding retrieval of fractured screw and subsequent restorations of such cases have been presented in this review article.

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