

Management of a Fractured Implant Abutment Screw

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INTRODUCTION

Dental implants have been a life-enhancing modality for partially and completely edentulous patients. Implants can successfully support a cemented or screw-retained single crown. However, this modality is not without complications: A fractured abutment screw may occur when the prosthesis is under functional cyclic loading. The abutment screw may be overloaded and fracture, leaving the abutment and coronal screw fragment inside the abutment/crown and the apical fragment in the fixture itself.

Abutment screw fracture is a rare event, occurring less than 0.5%.¹ Nonetheless, when a fracture occurs, it is very disturbing for the clinician.

Occlusal loading is a multidirectional and variable magnitude force.^{1,2} Even though an integrated implant transmits the load to the surrounding bone, the load is transmitted through the abutment and its retaining screw. There is a slight wobble of the abutment during functional loads.¹⁻⁴ The abutment screw will receive tensile and bending movements that can induce a fatigue fracture.¹⁻⁴ The crown will generally dislodge, and the apical end of the screw will remain in the fixture. This needs to be removed so that a new screw can be placed and the crown occlusally adjusted to preclude a repeat fracture.

There are several techniques for managing a fractured abutment screw.²⁻⁴ These include implant removal and retreatment, fabrication of a cemented cast post and core, screw fragment retrieval, and other techniques.

Many (but not all) implant companies offer fracture screw removal kits, but they are expensive and do not consistently remove the fracture segment. The technique presented herein has been used for many years by this author with consistent results, and it salvages the crown as well. This complete technique has never before been reported in the literature. Since these are case reports and not a randomized controlled trial, this is low credibility evidence.

Case reports and a technique for abutment, fragment retrieval, and crown-abutment separation and crown recementation and overdenture retainer fracture are discussed herein.

CLINICAL CASES

Case #1

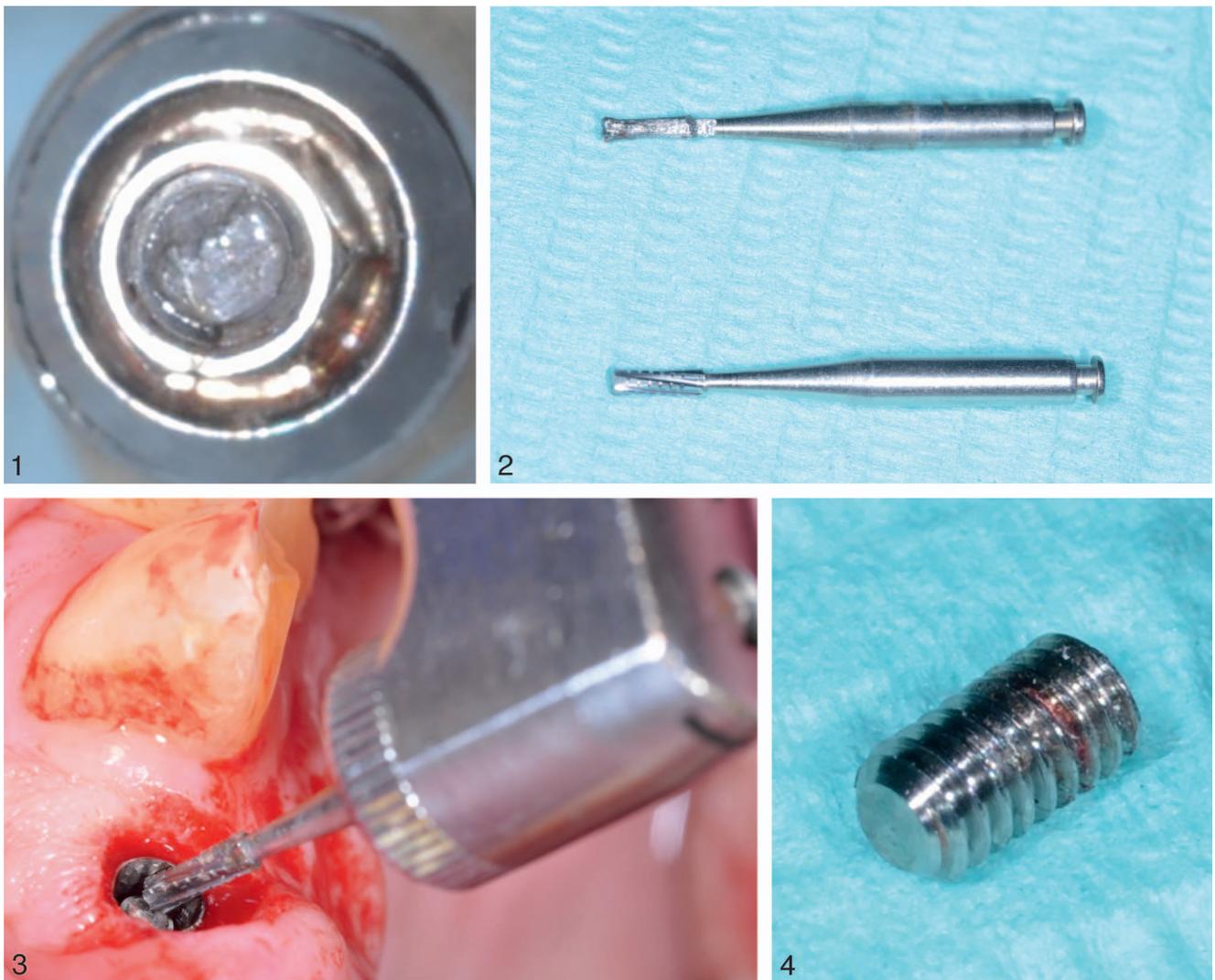
A 66-year-old male patient had an implant supported crown at site #5, the maxillary right first premolar. Five years after placement, he presented with the porcelain fused to the metal crown and a fractured abutment screw. The crown/abutment/coronal-screw fragment was in one piece (Figure

1). A radiograph revealed a well-integrated implant (Implant Direct, Ventura, Calif) with slight cervical but clinically insignificant marginal bone loss. The fragment retained in the fixture was removed by reverse rotation of a festooned #557 burr. First, the lateral flukes of a latch #557 burr (SS White, Longwood, NJ) were removed with a stone, leaving only the end cutting blades intact (Figure 2). The burr was placed in a slow-speed handpiece, and the rotation direction was reversed to counterclockwise (Figure 3). The burr end was then placed directly against the fragment end that remained in the fixture. The burr was slowly rotated against the fractured piece to reverse rotate the screw fragment out of the fixture (Figure 4). Care was taken not to touch the threaded walls to prevent any gouging damage. After the fragment was exposed, the handpiece was placed in regular rotational mode, clockwise, and a #33 1/3 burr (SS White) was placed in the contra-angle. This rotating burr was placed against the exposed fragment to rotate it completely out of the fixture. The screw hole was then flushed with dilute aqueous (10:1) sodium hypochlorite to remove any debris. The crown with the cemented abutment/abutment-screw-fragment complex was placed in a dental porcelain oven and taken to 100°/minute to 1000°C, then held there for 20 minutes (Figures 5 and 6). The crown/abutment/screw-fragment was then removed from the oven and allowed to cool to ambient temperature. The abutment was then easily separated from the inside of the crown (Figure 7). The metal portions of the crown and abutment were polished. The salvaged abutment was fitted with a new abutment screw, and the new abutment screw, abutment, and crown were then seated into the fixture and assessed for fit and occlusal function. The occlusal scheme was evaluated, and the opposing facial cusp was relieved by selective grinding and polishing. The abutment screw was torqued into place, and the crown was then recemented with resin modified glass ionomer cement (FujiCEM, ESPE, 3M Co, Minneapolis, Minn). Before setting, the excess cement bulk was blown off with a water air jet and the crown margins flooded with water to prevent excess cement from forming a hard set. After a 2-minute initial set, any residual marginal cement was removed. The patient has been in uneventful function for a year.

Case #2

A 54-year old male fractured the abutment screw (Locator, Zest Anchors, Carlsbad, Calif) of an implant retained maxillary palateless complete overdenture. The screw fragment was removed in the same fashion as described in Case #1. A new abutment retainer was installed and torqued, and the denture was occlusally adjusted to a group function to relieve off-axial loading. The abutment has not refractured in 1 year.

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FIGURES 1–4. **FIGURE 1.** The fractured abutment screw is inside the cemented abutment. **FIGURE 2.** The side cutting blades are removed with a stone, leaving the end cutting blades intact. **FIGURE 3.** The festooned burr is turned atop the screw fragment in the fixture to rotate it out of the fixture, taking care not to scar the internal fixture walls. **FIGURE 4.** The fragment is removed with the festooned #557 burr rotating counterclockwise and then with a #33 1/3 burr rotating clockwise against the fragment side.

Case #3

A 68-year-old male with a two implant retained (positions #22 and 27) mandibular complete overdenture fractured at the #27 abutment (Zest Anchors). The screw fragment was retrieved in the fashion described earlier. A new retainer abutment was installed and torqued, and the denture was repaired with new posterior flat plane denture teeth to relieve off-axial loads. After 2 years, the abutment has not yet refractured.

DISCUSSION

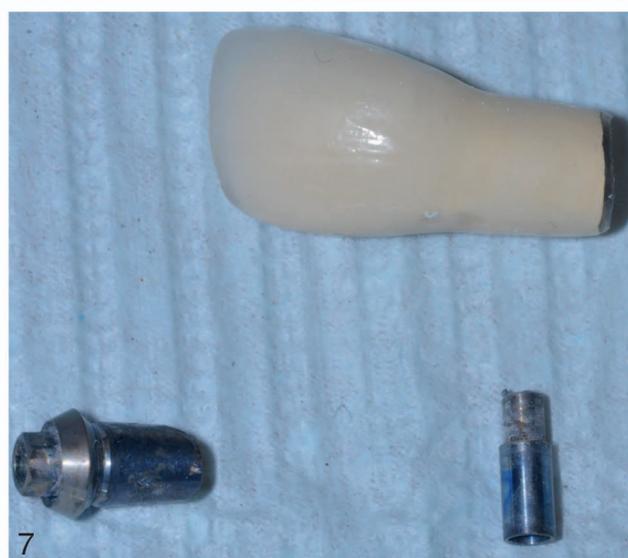
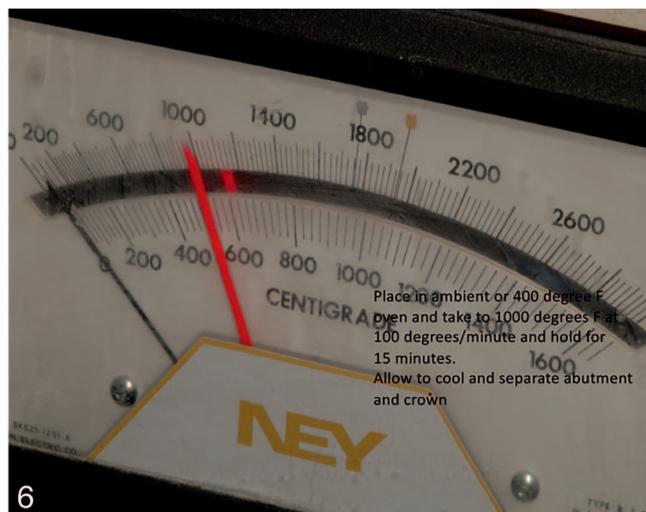
A common complication of implant prosthetics is with components.¹ The abutment screw connects the abutment to the fixture and can fracture under occlusal functional load.

In preparation for treatment of a patient presenting with an abutment screw fracture, a radiograph should be taken to ensure osseous support quality of the supporting implant. The

fixture screw hole should be flushed with a dilute solution of sodium hypochlorite (0.5%) and rinsed with water to ensure removal of any organic or particulate debris that may inhibit removal of the fragment.

Fragment removal is accomplished with a festooned #557 burr in a reversed, counterclockwise, handpiece. When the coronal of the fragment is accessible, then a #33 1/3 burr in right-hand rotation (normal, clockwise) is touched against the fragment. This will rotate the fragment completely out of the fixture, and this should be held fast with a small-orifice aspirator tip. It is this author's experience that continuing the reverse turn #557 causes wobbling of the fragment that may cause it to actually turn back into the fixture. Thus, a #33 1/3 is used to complete the removal of the fragment.

The crown containing the abutment and coronal screw fragment is placed in a porcelain oven (Ney Co, Bloomfield, Conn) and slowly heated to 1000°C at 100°/minute. This rate is done to preclude any temperature gradients that could induce



FIGURES 5–7. FIGURE 5. The crown containing the cemented abutment is placed in a porcelain oven. **FIGURE 6.** The temperature is raised to 1000°C at 100°C per minute and then held for 20 minutes. This causes the cement to turn to ash. **FIGURE 7.** The abutment is then easily removed from the crown.

a crack or fracture of the porcelain.⁵ 1000°C is well below the fusion temperature of feldspathic porcelain.⁵ The oven temperature is held at 1000°C for 20 minutes to ensure that the cement is thermally destroyed; resin and resin-modified glass ionomer cements at 1000°C will turn into carbon ash products.⁶

Rinsing the screw hole with 10:1 dilute aqueous sodium hypochlorite is an effective dissolving agent and not harmful to intact epithelium.

The crown/abutment/fragment is then removed from the oven, and the abutment is easily separated from the intaglio of the crown. Cement ash residue may cause a frictional interface between the abutment and crown intaglio that can make separation difficult; however, this can be overcome by grasping the PFM crown with cushioned forceps and the abutment hex with a mosquito forceps and pulling the pieces apart. Then, ultrasonic cleaning can dislodge any interfering debris from the crown intaglio and the abutment surface.

The metal surfaces of the crown and abutment are polished to remove surface tarnish. The new abutment screw replaces the fractured screw. The new abutment screw/abutment/crown is then seated into the fixture and evaluated for functional relationships. The interproximal contacts and occlusal scheme are evaluated. Any occlusal overloading should be relieved by selective grinding until the crown functions with relief in excursive movements. Off-axial loads are the most detrimental. The new abutment screw is torqued, and the crown can then be recemented with an appropriate luting agent. Care must be taken to ensure there is no remnant marginal cement, which may induce marginal bone loss or peri-implantitis.⁷ This may be especially problematic with resin cements.

When occlusal overload is considered, the patient’s ability to generate an excessive load should be measured in the area of a proposed implant site.^{8,9} The range for human bite load ability is 50–1600 N. Most patients fall into the 200–400 N range.⁹ Patients who are at the upper range may overload an

implant component and induce a fracture. Thus, clinical measurement of bite force capability is a parameter that can be measured and considered in treatment planning.

A patient with a diet of hard foods, such as raw vegetables, may incur high stress loads on implants.¹⁰ The chronic cyclic loads of a hard food diet may induce an overload of an abutment screw.

Different brands of implants have different abutment screw fracture rates.^{11,12} Various alloys are used among manufacturers that may affect fracture toughness. One study by Seetoh and coworkers¹¹ tested three systems. There were failures of at least one component in every system: the abutment screw, the abutment, and/or the implant neck. There were significant differences noted among systems. Various abutment fixture connection designs also affect fracture resistance.^{11,13} The Morse taper abutment-fixture connection may provide more fracture resistance than do external and internal hex designs.¹³ Many of these hex designs also include a Morse-type taper connection.

Importantly, after an abutment screw has fractured, there needs to be an assessment of the occlusal scheme. Cyclic loading can induce stresses that cause an abutment screw fracture.^{14,15} An occlusal scheme that minimizes off-axial loads to the components is important in preventing fracture complications. Plastic and porcelain dentures wear after many years of service, and this may cause a pattern that increases off-axial loads. Thus, the worn occlusal scheme needs to be addressed by adjustment or repair or replacement.

While not well studied, one retainer design may produce less stress than another.^{14–16} Finite elemental analysis has been used to indicate occlusal stresses in systems.^{14–16}

CONCLUSIONS

A fractured abutment screw of a crown supported by an endosseous implant is an unhappy complication. The fragment retained in the fixture can be retrieved with a festooned #557 latch slow-speed burr set in reverse torque. Once the fragment is loosened and advanced coronally, a clockwise-turning #33 1/3 burr is touched to the fragment side to completely remove it. Care is taken not to scar the fixture walls. The cemented abutment and crown can be salvaged by heating the crown/coronal screw fragment to 1000°C for 20 minutes. Upon cooling, the crown and abutment can then be separated. A new abutment screw can be used to secure the repolished abutment.

The patient's diet, occlusal scheme, and maximal bite force should be assessed for overload. The new abutment/screw is torqued into the fixture and the crown occlusally adjusted and recemented for normal functioning. Fractured abutments of overdenture retainers can be treated in the same fashion. Assessment and correction of the occlusal scheme is important.

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