



CLINICAL REPORT

PLATFORM-SPECIFIC RETRIEVAL OF A DEEPLY FRACTURED IMPLANT SCREW FRAGMENT WITH INTERNAL THREAD RESTORATION: A CLINICAL REPORT

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Received: Jul 18 2026; **Accepted:** Aug 25. 2026; **Published:** Oct 22. 2026

Abstract

Background: Fracture of an implant prosthetic or attachment screw is an uncommon but potentially challenging mechanical complication, particularly when the fractured fragment is short, deeply positioned, and firmly retained within the internal implant connection. Although several conservative and mechanical retrieval techniques have been described, removal of deeply retained fragments may result in damage to the internal connection and may compromise subsequent implant restorability.

Clinical Report: A deeply retained fractured screw fragment was identified within a Straumann BLX implant with a Regular Base connection in the maxillary posterior region. The residual fragment was approximately 2 mm in length and could not be removed using conventional manual instrumentation. To minimize the risk of uncontrolled instrumentation and damage to the implant connection, a platform-specific service set was used. Guided drilling was performed with controlled depth limitation and intermittent irrigation to remove the fractured fragment. The internal implant threads were subsequently restored using sequential platform-specific taps. Successful seating of a new healing abutment confirmed restoration of the internal connection, and postoperative radiographic evaluation demonstrated preservation of the implant. The implant was subsequently incorporated into the planned maxillary overdenture rehabilitation.

Conclusion: This clinical report demonstrates that a platform-specific guided retrieval protocol combined with controlled internal-thread restoration may provide an implant-preserving option for selected cases of deeply retained fractured screw fragments. The technique may be particularly useful when conventional retrieval methods are unsuccessful and preservation of an otherwise osseointegrated implant is clinically desirable. Further clinical and experimental studies are required to establish the predictability, indications, and long-term mechanical performance of this approach.

Keywords: dental implant; fractured screw; screw retrieval; implant-abutment connection; internal thread restoration; guided drilling; implant-supported overdenture; implant preservation

1.INTRODUCTION

Implant-supported prosthodontic rehabilitation is widely used for the treatment of partially and completely edentulous patients. The long-term function of these restorations depends not only on successful osseointegration but also on the stability and mechanical integrity of the implant– prosthetic

connection. Mechanical complications involving prosthetic components remain an important part of implant maintenance, with abutment screw loosening and fracture among the complications that may require additional clinical intervention even when the implant itself remains osseointegrated and clinically stable.^{1–3}

Abutment screw fracture is generally associated with

mechanical fatigue developing after repeated loading of the implant–prosthetic connection. Loss of preload, inadequate or excessive tightening torque, prosthetic misfit, occlusal forces, screw and connection design, and repeated functional loading may all contribute to this process.^{1,3} In overdenture treatment, attachment components are exposed to additional mechanical demands because the prosthesis is repeatedly removed and inserted by the patient. Repeated engagement and disengagement of the attachment system, together with functional loading during mastication, may contribute to wear and mechanical deterioration of the attachment components over time.

Once a screw has fractured, the choice of treatment depends primarily on the position, accessibility, and degree of engagement of the remaining fragment. A coronally located fragment that is clearly visible may sometimes be removed with simple hand instruments or other conservative methods without modifying the implant connection.^{7,8} The clinical situation is more difficult when only a short portion of the screw remains accessible and the fragment is located deep within the internal connection. In such cases, direct mechanical engagement may not be possible, and repeated attempts at removal may increase the risk of damaging the internal threads or other components of the implant connection.^{5,9}

A range of techniques has been described for the removal of fractured implant screws. These include manual exploration, ultrasonic instrumentation, modified instruments, reverse drilling, dedicated retrieval systems, and rotary drilling techniques.^{9,11,15} Conservative methods are generally considered preferable when they can achieve removal without altering the implant. However, their effectiveness depends on the clinical characteristics of the fracture. A deeply positioned fragment with limited coronal access may require a different approach when it cannot be mobilized using conventional instrumentation.^{5,9}

Magnification may improve visualization and precision during conservative retrieval. Patel et al. described the use of a dental surgical microscope to facilitate access to a fractured implant abutment screw, illustrating the importance of adequate visualization when attempting to preserve the implant connection.⁸ Similarly, conservative retrieval has been successfully reported in cases where sufficient access to the fractured fragment was available.⁷ These approaches are particularly valuable because they avoid unnecessary modification of the implant. Their applicability, however, becomes limited when the fragment is deeply retained and there is insufficient exposed surface for engagement.

Ultrasonic instrumentation has also been used extensively for fractured screw retrieval. The vibration produced by the instrument may help loosen the fractured component and allow it to be removed with limited intervention. Recent systematic evidence indicates that ultrasonic techniques can achieve favorable results, although their success is influenced by the accessibility and characteristics of the fractured fragment.^{4,6} When the fragment is positioned deeply within an internal implant connection, direct contact between the ultrasonic tip and the fractured screw may be difficult to establish. In these circumstances, another retrieval method may be required.

The current literature therefore favors a clinical decision-making process based on the individual fracture rather than a single preferred retrieval technique. Mizumoto et al. proposed a risk-based approach that considers factors such as fragment accessibility, fracture location, engagement within the implant, and the potential for damage during retrieval.⁵ A recent systematic review and meta-analysis by Arshad et al. likewise demonstrated variability in the effectiveness of retrieval techniques and emphasized the importance of selecting the method according to the clinical characteristics of the fractured screw.⁴

Drilling techniques can be useful when conservative retrieval is unsuccessful, particularly when the fractured component is deeply positioned. However, drilling must be performed with considerable care because uncontrolled instrumentation may damage the internal implant connection. Martínez-Alcaraz et al. compared conventional retrieval methods with drilling techniques in vitro and evaluated both screw retrieval and changes to the implant–abutment connection. Their findings showed that drilling systems could provide a higher retrieval success rate while producing no statistically significant differences in the measured changes in the internal thread structure among the evaluated techniques.¹⁰ These findings support controlled drilling as a possible option in selected cases, provided that the instrument is accurately positioned and the amount of material removed is carefully controlled.

Moorthy et al. also demonstrated that the effectiveness of fractured screw retrieval may differ according to both the implant system and the retrieval method used.¹² This is clinically relevant because implant connections differ in geometry, internal dimensions, thread configuration, and component design. Consequently, retrieval procedures should be adapted to the specific implant system rather than applied as a universal protocol.

Customized and platform-specific guidance may provide additional control when drilling is required. By maintaining the instrument in a predetermined trajectory, a guide may help reduce eccentric drilling and limit

unnecessary alteration of the internal implant structure. Yoon et al. described the use of a customized drill guide and rotary instrument for the safe removal of a broken abutment screw, demonstrating the potential value of guided instrumentation when conventional retrieval is difficult.¹³ More recently, other clinical techniques have continued to emphasize preservation of the implant connection during fractured screw removal.^{14, 15}

The preservation of an osseointegrated implant is an important consideration in these situations. If the implant remains clinically stable and there is no indication for fixture removal, successful retrieval of the fractured component may avoid additional surgery and preserve the existing implant position. Removal of an otherwise functional implant may involve further bone loss, additional healing, increased treatment time, and the need for subsequent implant rehabilitation. For this reason, contemporary retrieval strategies increasingly focus on removing the fractured component while maintaining sufficient internal implant structure for continued prosthetic use.^{11, 13, 14}

Successful removal of the fractured screw does not, however, necessarily restore the implant to a prosthetically usable condition. If the internal threads have been damaged during retrieval, additional treatment may be required before a new component can be inserted. In selected cases, controlled restoration or reformation of the internal threads may restore the connection sufficiently to permit placement of a new prosthetic component. The decision to perform such a procedure depends on the extent of thread damage and the amount of remaining implant structure. The objective is to restore the functional connection while avoiding unnecessary removal of additional implant material.

The present clinical report describes the management of a deeply retained, approximately 2-mm fractured Locator attachment screw within a Straumann BLX implant with a Regular Base connection in the posterior maxilla. Initial conservative retrieval using a periodontal probe was unsuccessful because of the limited accessibility of the fractured fragment. A platform-specific guided retrieval system was subsequently used to provide controlled access for drilling and removal of the retained screw fragment, followed by sequential restoration of the internal threads. Placement of a new healing abutment confirmed restoration of the internal connection, and the implant was subsequently incorporated into the planned maxillary overdenture rehabilitation.

The purpose of this clinical report is to describe an

implant-preserving approach for the management of a short, deeply retained fractured attachment screw and to discuss the practical considerations associated with guided retrieval and subsequent restoration of the internal implant connection when conventional conservative techniques are unsuccessful.

CASE PRESENTATION AND CLINICAL TECHNIQUE

A patient presented with a fractured screw fragment retained within a Straumann BLX implant with a Regular Base connection in the maxillary left second molar region (#16 according to the Universal Numbering System; FDI 6). No prosthetic crown was present at the time of evaluation. The retained fragment was located deeply within the implant body and was estimated to be approximately 2 mm in length. Initial retrieval using a periodontal probe was unsuccessful (Figure 1).



Figure 1. Periapical radiograph taken at evaluation.

Because of the short length and deep intra-implant position of the fractured fragment, further non-guided instrumentation was avoided to minimize the risk of damaging the internal connection or implant threads. The implant platform was surgically exposed as required to obtain adequate access for the retrieval procedure (Figures 2 and 3).

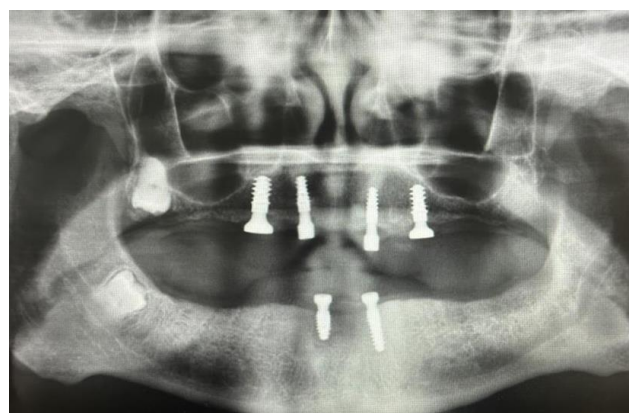


Figure 2 Pre-existing Panoramic Radiograph taken prior to evaluation



Figure 3. Periapical radiograph showing implant abutment in place after screw fragment retrieval.

A platform-specific Service Set designed for the implant connection was selected. The procedure was performed without magnification, and all drilling and tapping procedures were carried out under irrigation. The Guidance Mount TorcFit 2 was attached to the handle in a screw-retained configuration and seated on the implant connection. An MC Drill with a diameter of 1.6 mm was introduced using a low-speed handpiece at 1300 rpm in a counterclockwise direction. The initial drilling step was used to flatten the exposed surface of the fractured screw fragment and create a controlled working surface (Figures 4, 5).



Figure 4. Occlusal View of edentulous ridge showing implant platform cover by gingival tissue.



Figure 5. Incision made utilizing a surgical blade, second uncover.

The Guidance Mount TorcFit 2 was subsequently replaced with the Guidance Mount TorcFit 1. A 1.3-mm CD Drill was then used at 1300 rpm with intermittent drilling. The drill was advanced in a

controlled manner until the depth stop contacted the guidance mount. This predetermined stop limited the drilling depth and helped maintain the instrument within the intended trajectory. The procedure removed the central portion of the retained screw fragment and prepared the internal aspect of the implant for subsequent thread regeneration (Figure 6, 7).

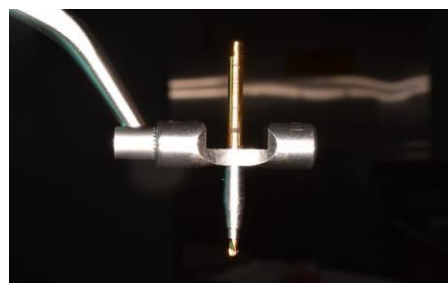


Figure 6. Instrument

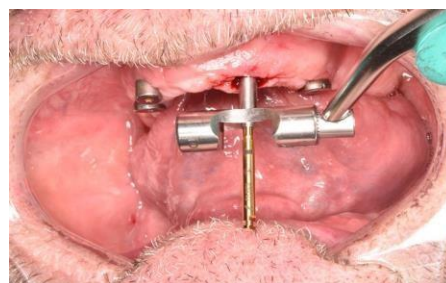


Figure 7. Instrument in place

Following removal of the fractured screw material, the Guidance Mount TorcFit 1 was replaced with the Guidance Mount TorcFit 2. Sequential taps, RC1 through RC4, were used according to the platform-specific protocol. Each tap was advanced by one-half turn in a clockwise direction followed by one-quarter turn counterclockwise to reduce binding and minimize the risk of tap fracture. Each instrument was advanced until the stop contacted the guidance mount. This sequential procedure was used to regenerate the internal threads of the implant (Figure 8).



Figure 8. Locator screw fragment

After completion of the tapping sequence, the implant connection was thoroughly rinsed to remove residual debris. A new healing abutment was then inserted and fully seated. Successful seating of the component provided clinical confirmation that the internal connection had been restored sufficiently to accept the new component (Figure 9).



Figure 9. Implant abutment placed after fragment was retrieved.

A postoperative periapical radiograph demonstrated appropriate seating of the healing abutment and preservation of the implant. The implant remained clinically usable and was subsequently incorporated into the planned maxillary overdenture rehabilitation (Figure 10).



Figure 10. Updated Panoramic radiograph showing bone levels and healing abutment in placed.

The sequence of the clinical procedure therefore consisted of controlled exposure of the implant platform, stabilization of the platform-specific guidance system, guided removal of the deeply retained screw fragment, sequential regeneration of the internal threads, and placement of a new healing abutment. This approach allowed the existing osseointegrated implant to be preserved rather than removed following failure of conventional screw-fragment retrieval.

DISCUSSION

Fracture of implant abutment and attachment screws is a well-recognized mechanical complication in

implant-supported prosthodontic treatment. Repeated loading, functional fatigue, screw loosening, wear of prosthetic components, and changes in preload may contribute to screw fracture over time. In overdenture therapy, these problems may be particularly relevant because the attachment components are subjected to repeated insertion and removal during daily use. When a screw fractures, the clinical problem becomes more complex if the fragment is deeply positioned within the implant connection and cannot be grasped directly.

In the present case, a fractured Locator attachment screw was deeply retained within the internal connection of a Straumann BLX implant. Initial attempts at conservative retrieval using a periodontal probe were unsuccessful because only a short portion of the fractured screw was accessible. Under these circumstances, continued manipulation with conventional instruments could have increased the risk of damaging the internal implant connection. A platform-specific guided retrieval technique was therefore selected, with the aim of removing the fractured fragment while preserving the implant and subsequently restoring its internal threads.

The management of fractured implant screws depends largely on the location and accessibility of the retained fragment. A number of techniques have been described, including manual exploration, ultrasonic instrumentation, modified hand instruments, retrieval kits, reverse drilling, and drilling-based procedures.^{4-6,9,11} Conservative techniques are generally preferable when the fractured fragment is visible and can be engaged without removing implant material. Carneiro et al. demonstrated that a conservative approach can successfully retrieve a fractured abutment screw while avoiding damage to the implant.⁷ However, the clinical situation becomes different when the fragment is short, deeply positioned, or firmly engaged in the internal threads.

Magnification and improved illumination can be particularly helpful during conservative retrieval. Patel et al. described the use of a dental surgical microscope to improve visualization and access to a fractured implant abutment screw.⁸ Such an approach may be sufficient when the fractured fragment can be clearly visualized and manipulated. In the present case, however, the depth of the Locator screw fragment and its limited exposed surface made simple mechanical engagement unsuccessful.

Ultrasonic instrumentation is another commonly used method for fractured screw retrieval. The vibration produced by an ultrasonic instrument may loosen the fractured component and allow it to be removed without substantial modification of the implant.^{4,6,9} Recent evidence indicates that ultrasonic techniques can provide favorable retrieval outcomes, particularly when the

fractured segment is accessible.⁴ Nevertheless, their effectiveness depends on the ability to position the instrument directly against the fractured component. When the fragment is located deeply inside an internal implant connection, this access may be limited and the risk of uncontrolled contact with the implant walls may increase.

For this reason, the decision to proceed from conservative instrumentation to a drilling-based retrieval technique should be based on the specific clinical circumstances rather than on a fixed treatment sequence. Mizumoto et al. proposed a risk-based decision-making approach in which factors such as fracture location, accessibility, degree of engagement, and potential damage to the implant are considered when selecting a retrieval method.⁵ The same principle was applicable in the present case. Once conventional exploration had failed, a controlled and guided procedure offered a more appropriate means of reaching the deeply positioned fragment.

An important advantage of the guided technique used in this case was control of the drilling trajectory. The guidance component helped maintain the drill along the intended axis of the implant connection and reduced the possibility of eccentric instrumentation. This is particularly important because unnecessary removal of the internal implant walls or threads may compromise the future use of the implant. A customized drill-guide approach has previously been described by Yoon et al., who reported successful removal of a fractured abutment screw using a customized guide and rotary instrument while maintaining the integrity of the implant connection.¹³

The drilling procedure also needs to be performed with careful control of depth and temperature. Excessive drilling can unnecessarily enlarge the internal connection, while heat generation may be detrimental to the surrounding tissues. For this reason, the use of controlled drilling, intermittent instrumentation, and adequate irrigation is important when rotary instruments are used for screw retrieval. These precautions are consistent with the general principle of minimizing additional damage while gaining sufficient access to the fractured component.^{4,11}

Evidence from laboratory studies supports the potential usefulness of drilling techniques in selected cases. Martínez-Alcaraz et al. compared conventional retrieval methods with drilling techniques and reported a higher retrieval success rate with the drilling systems, without significant differences in the measured changes in the internal thread structure among the evaluated approaches.¹⁰ These findings are relevant to the present case because the principal

objective was not simply to remove the screw fragment, but to do so while maintaining the possibility of restoring the implant.

Moorthy et al. also evaluated different methods for retrieving fractured abutment screw fragments from several implant systems and demonstrated that retrieval outcomes may vary according to the implant system and the technique used.¹² This is an important consideration when applying retrieval protocols clinically. Implant connection geometry differs between manufacturers and implant families, and a technique that is suitable for one connection cannot necessarily be transferred directly to another. Therefore, the use of a platform-specific retrieval system in the present case was intended to improve procedural control and reduce the risk of damage to the Straumann BLX implant connection.

The recent literature further supports individualized management of fractured implant screws. Limírio et al., in a scoping review, described a wide range of approaches, from conservative instrumentation and ultrasonic devices to drilling systems and other mechanical techniques.¹¹ The authors emphasized that treatment selection depends on the characteristics of the fracture and the objective of preserving the implant. Similarly, the recent systematic review and meta-analysis by Arshad et al. demonstrated that the effectiveness of retrieval methods varies according to the clinical circumstances and characteristics of the fractured component.⁴ Thus, the available evidence does not support the use of a single retrieval method for all fractured screws.

In the present case, preservation of the implant was an important consideration because removal of an osseointegrated implant would have required a more invasive treatment and subsequent replacement. A successful retrieval procedure can avoid additional surgery and preserve the existing implant position and surrounding bone. This principle is also reflected in recent clinical reports describing conservative techniques designed to retrieve fractured implant screws while maintaining the internal implant structure.¹⁴

Following removal of the fractured Locator screw, the internal threads were restored and reformed using the platform-specific tapping sequence to restore the functional conditions required for attachment. This step is important because retrieval alone does not necessarily make an implant clinically usable if the internal threads have been substantially damaged. Controlled thread restoration may therefore be considered as part of an implant-preserving strategy in selected cases. The feasibility of such an approach should, however, be judged individually, according to the amount of remaining implant material and the condition of the

internal connection.

The present report has several limitations. It represents a single clinical case and therefore cannot establish the overall success rate or long-term mechanical performance of guided retrieval and thread restoration. The technique may not be suitable for every implant system or every fracture configuration. In particular, cases involving severe deformation of the internal connection, extensive thread damage, or unfavorable access may require alternative treatment, including implant removal. Further clinical and laboratory studies are needed to evaluate the mechanical stability of restored and reformed threads and the long-term performance of implants treated using guided retrieval techniques.

Prevention of screw fracture remains preferable to retrieval. Careful treatment planning, correct implant positioning, appropriate seating of prosthetic components, application of the manufacturer's recommended torque, evaluation of occlusion and prosthetic fit, and regular maintenance are important measures for reducing mechanical complications.^{1–3} In overdenture patients, periodic examination of attachment components and timely replacement of worn parts may also help prevent excessive loading of the attachment screw.

CONCLUSION

Within the limitations of this clinical report, platform-specific guided retrieval followed by controlled internal-thread restoration provided a feasible approach for managing a deeply fractured Locator attachment screw within a Straumann BLX implant. The guided procedure allowed controlled access to the retained fragment and facilitated its removal while preserving the implant connection sufficiently for subsequent prosthetic rehabilitation.

The case supports the use of a stepwise approach in which conservative retrieval methods are considered first and guided drilling is reserved for situations in which the fragment is deeply positioned or cannot be adequately engaged. The choice of technique should be based on the location and characteristics of the fracture, implant connection design, accessibility, and the potential risk of implant damage.

Guided retrieval should therefore be considered a selective implant-preserving rescue procedure rather than a universally applicable technique. When appropriate case selection and careful drilling control are combined with subsequent restoration of the internal threads, this approach may allow preservation of implants that might otherwise require removal.

Nevertheless, prevention through appropriate treatment planning, correct torque application, prosthetic adjustment, and regular maintenance remains the preferred strategy for reducing the occurrence of implant screw fracture.

DECLARATIONS

Conflict of Interest

The authors declare no conflicts of interest.

Acknowledgments

The authors acknowledge the Medical University of South Carolina's institutional digital dentistry resources, including the DREAM Studio, and the technical support provided by Qian Chang Gallo during CAD design, digital modeling, FDM fabrication, and development of the *Ball-Point* Dental Tray Library.

Ethical Approval

Not applicable.

Funding

None.

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