Management of a Dislodged Implant-Supported Crown Due to an Abutment Fracture: A Case Report

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Abstract

Fracture of implant components is a relatively common scenario encountered in prosthodontic clinical practice. This clinical report describes the management of a dislodged implant-supported crown due to a fractured prosthetic abutment in the esthetic zone. The fractured abutment segment was locked in the implant and was successfully removed without damaging the implant; hence, a new implant-supported crown could be fabricated. We also describe a similar case in which a locked-in abutment resulted in a modified treatment plan.

Introduction

Single implant-supported restorations are widely used in contemporary clinical practice to achieve predictable esthetic and functional outcomes. However, complications may be encountered and can be divided into surgical complications, biologic complications (e.g., implant failure), mechanical/technical complication and esthetic/phonetic complications. Several mechanical/technical complications with fixed implant-supported prostheses have been reported in the literature including veneering porcelain fracture (14%), prosthetic screw loosening (7%), abutment screw loosening (6%),

prosthetic screw fracture (4%), metal framework fracture (3%), abutment screw fracture (2%), and implant fracture (1%) [1]. Material fatigue due to excessive forces is the primary cause of mechanical/technical complications [1].

One possible mechanical complication is the fracture of a prosthetic component such as the retaining screw or the abutment. The aetiology of such fractures is multifactorial and can be attributed to occlusal overload (including parafunctional habits), undetected screw loosening, non-axially directed forces, suboptimally designed, ill-fitting or non-passive prostheses, and lack of sufficient material thickness. Fractured segments require removal before the implant can be utilized again to support a prosthesis. Such mechanical complications may demonstrate a variety of clinical presentations such as separated prostheses, separated prosthetic components, and loose prostheses.

Titanium and zirconia abutments are widely used because of biocompatibility and strength [2]. However, when sufficiently thin, they are susceptible to fracture due to material fatigue contributing to crack formation, propagation and eventual fracture. The retrieval of such fractured fragments can be challenging and is not always successful. Fractured fragments at times may be wedged-in or locked-in the implant further complicating retrieval. Careful technique selection and execution is needed to avoid damaging the implant connection and internal threads.

Retrieval of fractured fragments can be attempted by utilizing non-destructive methods such as scalers, periodontal probes, modified dental instruments, and manufacturer recommended systems. Many implant companies provide customized repair, removal and retrieval kits with associated catalogues and manuals, which at times could be the best option for retrieval of fractured hardware.

The purpose of this case report is to describe the emergency management of a fractured prosthetic component of a single implant-supported crown in the esthetic zone with a specifically designed retrieval tool. This report aims to highlight the particular clinical and radiographic presentation of a fractured and wedged fragment, emphasizing the significance of thorough clinical and radiographic examination as well as utilization of appropriately designed tools to prevent damage to the internal threads and the connection of the implant. The report also describes the management of a similar situation presenting with a locked-in prosthetic abutment resulting in redirection of the treatment-plan.

Case report

Chief complaint and history of chief complaint:

A 30-year-old female patient with a non-contributory medical history presented on an emergency visit with a chief complaint of a "dislodged implant crown" one week prior. Before its dislodgement, the patient first reported noticing mobility of the maxillary left lateral incisor implant-supported crown. The patient reported using an essix retainer (with the crown inside) for esthetic purposes.

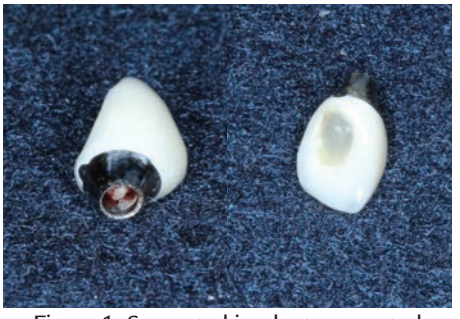

Figure 1: Separated implant supported prosthesis with intact composite resin and Teflon tape in the screw access channel with no screw. Note thin metal collar of prosthetic abutment.

The patient had initially presented in 2009 with bilateral congenitally missing maxillary lateral incisors and underwent pre-prosthetic orthodontic treatment. After completion of orthodontic treatment and creation of sufficient space, bone augmentation was performed and two AstraTech implants (narrow 3.0x11 mm OsseoSpeed TX) were inserted in the 12 and 22 sites and restored with porcelain-fused-to-metal screw-retained implant-supported crowns in 2011.

The patient reported no complaints regarding the crowns 12 and 22 in the past except the hyper-occlusion and incisal chipping of the 22 implant-supported prosthesis noted at recalls in 2012 and 2015. The patient was advised to utilize an optimally designed and appropriately thick night-guard appliance instead of the thin essix retainer for more efficient management of the effects of the reported nocturnal bruxism.

Clinical and radiographic examination:

Comprehensive extra and intraoral examination was performed. Findings of the extra oral examination were not remarkable. Assessment of the dislodged 22 crown revealed that the crown abutment had fractured and the fragment was present inside the internal connection of the implant along with the abutment screw. The metallic abutment of the separated prosthesis showed deformation (Figure 1).

The area was irrigated with Chlorhexidine gluconate 0.12% and inspected carefully. The implant site was almost completely covered with

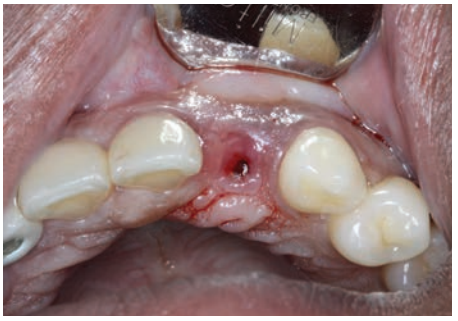

Figure 2: Clinical presentation after removal of the essix appliance revealed partial soft tissue coverage of the implant site with minor inflammation and bleeding associated with the use of the separated crown within the essix appliance for esthetic purposes.

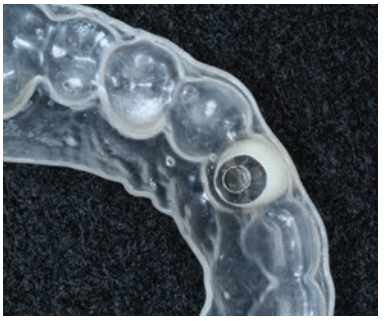

Figure 3: Essix appliance with separated implant-supported crown utilized by the patient for esthetic purposes as a provisional prosthesis.

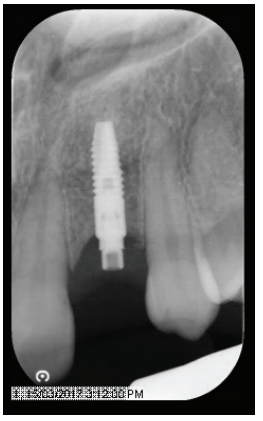

Figure 4: Periapical radiograph revealing a titanium abutment screw and a fractured fragment of the prosthetic abutment in the implant.

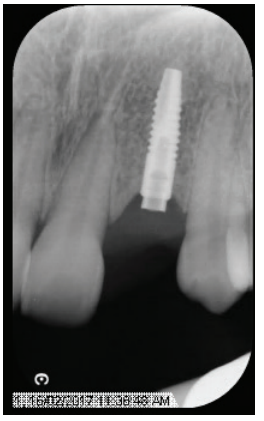

Figure 5: Periapical radiograph showing the fractured fragment of the prosthetic abutment in the implant in maxillary left lateral incisor site after removal of the abutment screw.

soft tissues (Figure 2), and the patient reported inserting the crown into her essix appliance and utilizing the appliance as a provisional prosthesis for esthetic purposes (Figure 3). Hence, minor inflammation of the keratinized tissues around the implant site was visible possibly due to the contact with the fractured edge of the prosthetic abutment. No other abnormalities were detected in the site, and the patient reported no tenderness to palpation.

A periapical radiograph was obtained which demonstrated optimal bone levels around the 22 implant and the presence of an intact abutment screw and a fractured segment of the prosthetic abutment in the implant. The abutment screw and the fragment of the abutment had the same radio-density as the implant suggesting that all three structures were made out of the same metal (titanium) (Figure 4).

Based on the clinical and radiographic findings, diagnosis of a fractured prosthetic abutment was made. Patient was informed that the prosthetic abutment had fractured with a segment of it retained inside the implant. In order to fabricate a new implant-supported crown, the fractured segment first needed to be removed.

Management:

Due to the partial soft tissue coverage of the implant site, local aesthetic was used to ensure patient comfort while gaining access to the abutment screw and the fractured abutment fragment. The abutment screw was untorqued with the hex driver and removed without difficulty. Upon inspection, the abutment screw was noted to be intact, with no fracture, damage, stripping, wear or obvious fatigue evident in the threads.

Figure 6: Abutment retrieval instrument (Fragment Fork) provided by the manufacturer (AstraTech) to aid with the retrieval of the fractured abutment fragment.

By removal of the screw, access was gained to the fractured abutment segment remaining inside the implant. It was expected that the fractured abutment segment will be removed without difficulty or resistance. However, the segment was observed to be solidly wedged inside the implant preventing its removal (Figure 5).

Conventional clinical instruments such as a sharp dental explorer, periodontal probe and ultra sonic scalers were utilized to attempt retrieval of the fractured segment from the implant without success. After exhausting the utilization of common dental instruments, it was decided to order the special retrieval tool from the manufacturer (Figure 6) and reschedule the patient. Insertion of a healing abutment was not possible due to the presence of the fractured segment. The patient was informed and provisionalized with the same essix retainer and the crown inside the retainer. The patient was advised to be careful since the separated crown could be a choking hazard.

At the next appointment, the retrieval tool was utilized according to the manufacturer's recommendation. The Fragment Fork was inserted into the restorative driver handle, inserted inside the implant and the fractured abutment fragment, and engaged the segment. Once the segment was firmly engaged by the retrieval tool, slight

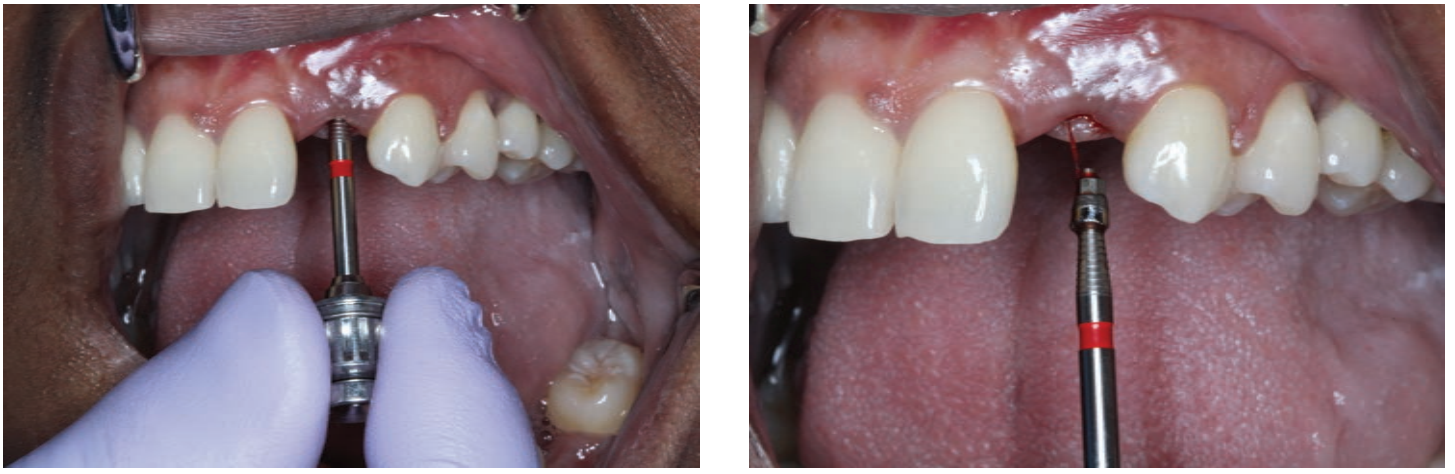

Figure 7: Removal of the fractured abutment fragment with the retrieval instrument.

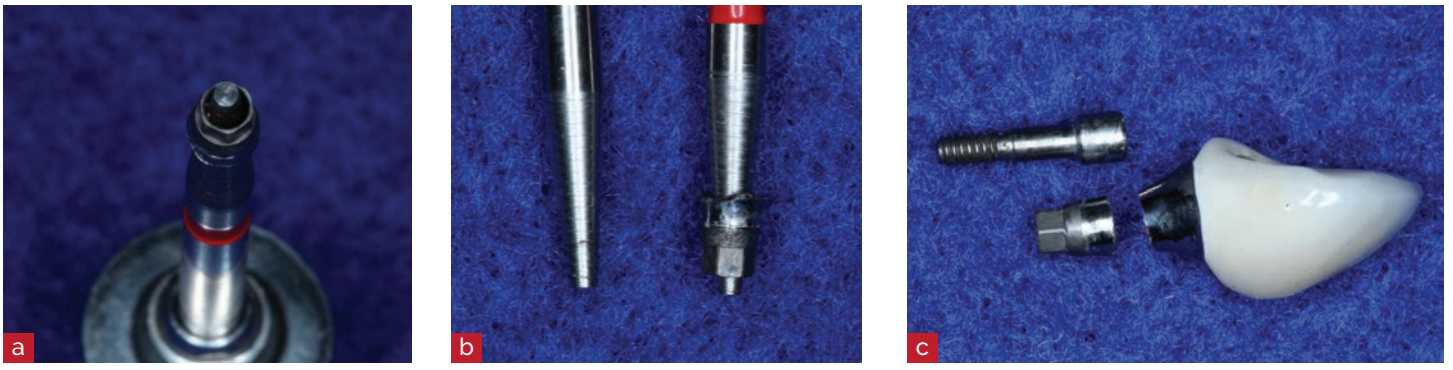

Figure 8: The retrieved fractured abutment fragment is shown on the retrieving instrument (a, b) and after separation from the retrieving instrument (c).

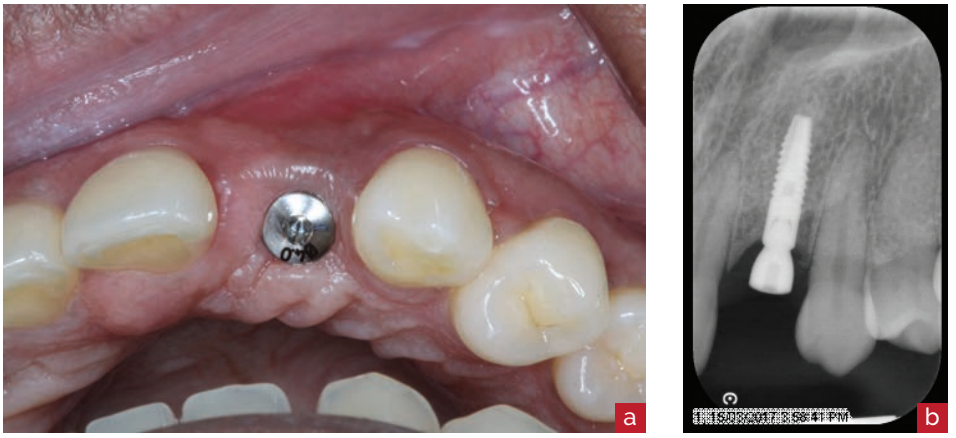

Figure 9: a. 3x4 mm healing abutment inserted, b. periapical radiograph showing complete seating of healing abutment after removal of the fractured abutment fragment.

wiggling motion loosened the stuck segment and allowed its removal (Figure 7). After retrieval of the abutment fragment, it was separated from the retrieving instrument with a haemostat (Figure 8), and the fragment and the implant were carefully inspected. No damage was present to the internal aspect of the implant. No debris or fractured pieces were detected. A 3x4 mm healing abutment was inserted and hand tightened, and a periapical radiograph was obtained to confirm complete seating and integrity of the implant axial walls (Figure 9). The patient was ultimately provisionalised with an implant-supported acrylic screw-retained crown before proceeding to the definitive crown. The patient was very satisfied with the outcome of treatment.

Discussion

Despite the success of dental implant treatments, implant-supported restorations can experience mechanical complications which may manifest in a variety of clinical presentations. One such mechanical complication is the fracture of a prosthetic component, which may occur for a variety of reasons. Factors that may potentially play a role in the fracture of the restoration abutment are undetected screw loosening, parafunction, non-axial biomechanical overloading, micro-movement of the abutment under functional loading, unfavourable prosthetic thickness, and poor design or fit of prosthetic components. Such fractures may be preceded by other mechanical complications such as (repeated) screw loosening or veneering ceramic chipping [3]; however, some catastrophic prosthesis fractures do not appear to have such "warning" signs or symptoms.

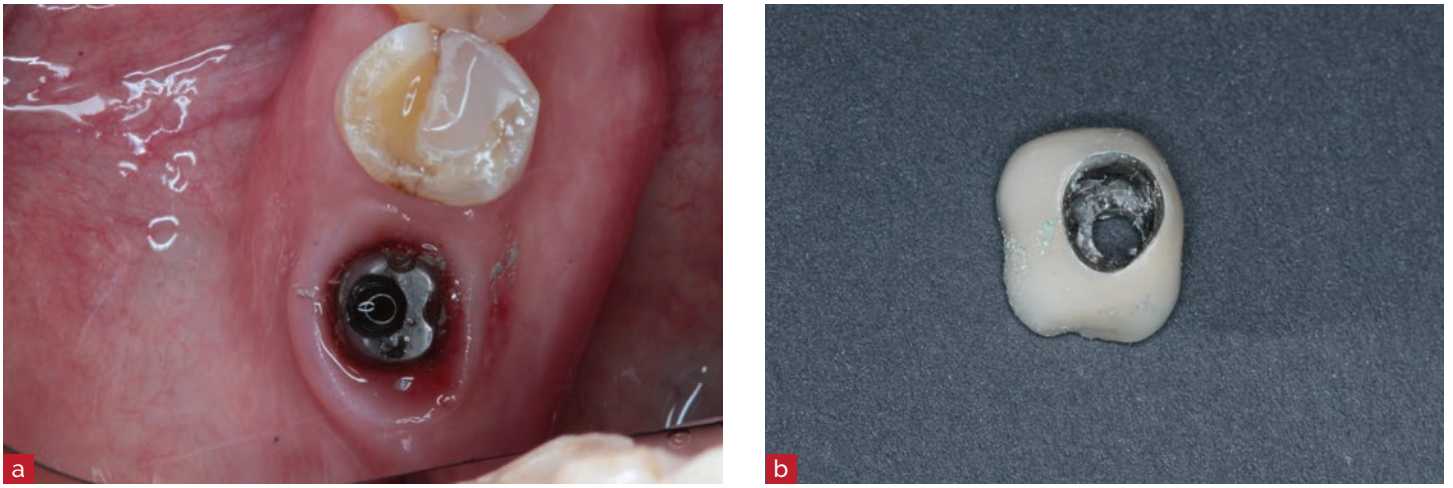

Figure 10: Clinical presentation of the wedged in abutment in 46 implant (a) and the retrieved crown.

In this case, the fracture of the restorative abutment may have occurred due to insufficient thickness of metal on abutment wall combined with a functional overload secondary to nocturnal bruxism. The horizontal vector of forces in the anterior maxilla also may have played a contributing role.

A variety of methods have been proposed in the literature to retrieve a fractured implant restoration segment. These methods include the use of a sharp explorer, spoon excavator, sharp-ended ultrasonic scalers and specially designed abutment removal kits provided by the implant manufacturers. In general, when the fractured fragments are above the implant platform, explorers, probes and haemostats can safely and effectively be used. However, when the fragment is below the implant platform, retrieval may be more feasible with implant retrieval kits and may require additional expertise. Regardless of the method or instrument used for retrieval, the removal of such fracture components may irreversibly damage the implant internal threads or the implant platform. In cases of significant damage, the implant may not be usable as an anchorage for a prosthesis, and, at times, surgical removal of implant may be needed [4].

The implant supporting the prosthesis in this case was a narrow diameter implant (Astra Tech OsseoSpeed TX 3.0x11 mm). Evidence suggests that narrow diameter implants (<3.75mm in diameter) are an accepted treatment modality in areas of limited mesio-distal prosthetic space such as maxillary lateral incisor sites. Despite their clinical success, narrow diameter implants may experience an increase in mechanical complications including fracture due to smaller material thickness which may compromise the strength of the prosthetic components [5]. Evidence suggests that due to the vulnerability of the prosthetic components for single implant-supported crowns, wider diameter implants are recommended when possible due to superior mechanical performance [5, 6].

The fractured wedged in segment was retrieved uneventfully in this case, and a new implant-supported crown will be fabricated. However, this is not possible in all situations with a wedged in abutment segment. For example, in a similar case (Figure 10), attempts were made to retrieve a screw-retained PFM implant-supported crown in the 46 site to address an open contact and the resultant patient complaint of significant food impaction. Despite unimpeded access to and complete removal of the intact abutment screw, retrieval of the abutment was not successful. It appeared that – similarly to the current case – the prosthetic abutment was wedged and locked in the internal aspect of the implant. As a result, to address the patient's chief concern, the abutment screw was reinserted, torqued, and a pick-up impression with the existing crown was obtained for a new crown to be fabricated. The new crown was later cemented onto the existing wedged abutment. This second case represents a scenario in which the treatment plan was modified from a screw-retained to a cement-retained prosthesis due to the fact that the prosthetic abutment was not retrievable (Figure 10).

The aetiology of the described abutment fracture in this case is multifactorial with the following factors being likely responsible:

- hyperocclusion/inappropriate occlusal contact (single implant-supported prosthesis should have no occlusal contacts in maximum intercuspation and excursive movements)
- nocturnal parafunction
- unfavourable prosthesis thickness and design
- non-axial biomechanical overloading

We will now expand on these factors.

Hyperocclusion/inappropriate occlusal contact on the single implant-supported prosthesis:

Although the determination of initial occlusal scheme on the restoration was not feasible in this case, it is suspected that the occlusal scheme on the implant-supported crown was inappropriate. For occlusal forces to contribute to mechanical failures, occlusal contact is a necessity, and a single-unit implant-supported prosthesis should be out of occlusal contact in maximum intercuspation and all excursive movements. Had this been the case, it would have been unlikely for occlusal forces to play a significant role in contributing to this technical complication.

Material fatigue caused by nocturnal bruxism:

Bruxism is considered to be a risk factor for mechanical complications as it leads to a sustained and repeated non-physiologic load application that is several times greater than what would typically be generated by a patient during physiologic function. Thorough occlusal adjustments and diligent use of night-guards are advocated to reduce the influence of extraneous stresses on implants and implant-supported restorations [7].

Excessively thin metal walls of the prosthetic abutment:

The narrow diameter of the implant, necessitating the use of a thin prosthetic abutment could have increased the susceptibility to fracture in the abutment. Thin sections of titanium can fracture under occlusal load, especially in areas such as anterior maxilla where off-axial loading occurs, especially in conjunction with an inappropriate occlusal scheme and parafunction.

Recommendations for prevention of similar complications:

- perform appropriate occlusal adjustment, ensuring and maintaining appropriate occlusal contacts and schemes on an implant-supported prosthesis keeping in mind that a single implant-supported crown should have no contact in maximum intercuspation and in excursive movements.
- select an implant of an optimal diameter to ensure adequate thickness of the abutment. In general number, position, dimension and design of implants as well as the design of the implant-supported prosthesis are critical factors to consider during the treatment-planning phase.
- provide an appropriately designed night-guard for patients with daytime or nighttime parafunction to minimize the effects of occlusal overload on implants and implant-supported prostheses.
- ensure that the abutment screws are torqued correctly as abutment screw loosening could increase propensity to fracture the abutment screw or the prosthetic abutment [8].

Since zirconia abutments have documented biocompatibility to the peri-implant soft tissues and no significant difference has been shown in terms of technical complications between metal and ceramic abutments, more research is required to assess and compare the strength of such abutments in thin sections.

Conclusion

Fractures of prosthetic components of implant-supported restorations are common mechanical complications which manifest with a variety of clinical presentations, one of which may be a separated crown with the abutment screw and the fractured abutment fragment remaining inside the implant. This case report highlights the diagnosis and management of a fractured prosthetic abutment fragment locked inside the implant in a patient who sought emergency treatment for a separated prosthesis. Manufacturer recommended instrument was utilized to retrieve the wedged-in fractured fragment without damaging the implant connection or internal threads; hence, the fabrication of a new implant-supported crown was feasible.■

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