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Abutment fracture and the technique Used to Remove the fracture portion of the Abutmet: Case Report

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Abstract

This clinical report presents a case of abutment fracture, due to occlusal overload, occurred with an implant-supported restoration on right mandibular first molar of a female patient. After 6 months of prosthetic reconstruction implants, the patient returned to the clinic due to the loss of implant crown. The fractured fragment of the abutment with the screw protective cotton had remained within the crown of the first molar. A periapical radiograph was taken, which revealed that the base portion of the abutment had remained within the internal hex of the fixture. After removing the abutment screw, the base portion of the fractured abutment did not move due to the close connection and the presence of Morse taper. After applying the methods explained in previous studies, an ultrasonic tip was used counterclockwise to remove the base segment of the implant. The fractured segment of the implant was removed without destroying the implant. Various factors are responsible for the fracture of abutments, including excessive occlusal forces, implant position, implant diameter, inadequate prosthetic adjustment, prosthesis design, metal fatigue, manufacturing defects and galvanic activity. This paper explains the reasons for abutment fractures and a novel technique used to remove the fractured portion.

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Introduction

Implant-supported prostheses protect tooth structures and increase the survival time of treatment (1). Previous studies have shown an overall success rate of 95.3% for implants (2). Implant failures are classified based on the time they occur; early failures are those that occur before or at the time of abutment placement and delayed failures occur after occlusal loading when there are problems with the implant prostheses (3). Some of the factors responsible for fractures are excessive occlusal loads, implant location/position, an inadequate number of implants supporting the prosthesis due to an improper biomechanical plan, implant diameters under 3.5 mm, etc (4).The risk factors are divided into 3 main categories for diagnostic purposes: patient-related factors, implant-related factors and prosthesis-related factors.

Patient-related factors include pocket depths over 5 mm, bone resorption, parafunctional factors, the vertical dimension of the crown, implant position in the jaw, the nature of the

opposing teeth, etc. Implant-related factors include implant diameter, implant design, etc. Prosthesis-related factors include cantilever, etc. In the presence of more than 3 factors, the risk of implant fracture increases (5-7).

The connection between the abutment and the fixture might be in the form of an internal or external hex. In the external hex implant, the space around the abutment screw is located above the implant body; therefore, there is a higher risk of fracture at the abutment site. In the internal hex implant, the space around the abutment screw is within the implant body; therefore, the risk of fracture is higher in the implant crest (8). One of the advantages of some implant systems is the attachment of the abutment to fixture in the presence of Morse taper, which in Dio implant system is 6° for an implant with 3.8mm diameter. Morse taper facilitates the placement of the abutment and due to the wider area of contact with the abutment, there is a decrease in the odds of screw loosening. This paper describes the reasons for the abutment fracture and explains how to remove the fractured portion of the abutment through reporting a case of abutment fracture in a patient.

Case report

A 50-year-old female referred to our clinic for an implant-supported prosthesis on the right mandibular first molar. The right mandibular second premolar required root canal treatment and reconstruction of its destroyed crown. The patient had received an implant 3.8mm in diameter and 10mm in length. Four months after placing the implant, the final impression was taken with polyvinyl siloxane (Panasil, Kttenbach GmbH, Germany) impression material. The abutment was placed with a 15° angle. Adaptation was confirmed with the use of a periapical radiograph and the abutment screw was tightened with a 35-N torque. The prosthesis was adjusted with minimum contact at the centric relation, with no contact at the eccentric relation, and cemented with zinc oxide-eugenol cement (kerr,Italy). The patient did not return for the treatment of the right mandibular second premolar with a post-and-core plan.

After 6 months, the patient returned with complaining of a loose crown on the implant. Clinical examination showed the remaining of one part of the abutment with the screw protective cotton within the crown (Figure 1). A periapical radiograph was taken, which showed that the base portion of the abutment had remained within the internal hex (Figure 2).

Figure 1. The fractured fragment of the abutment with the screw protective cotton within the crown

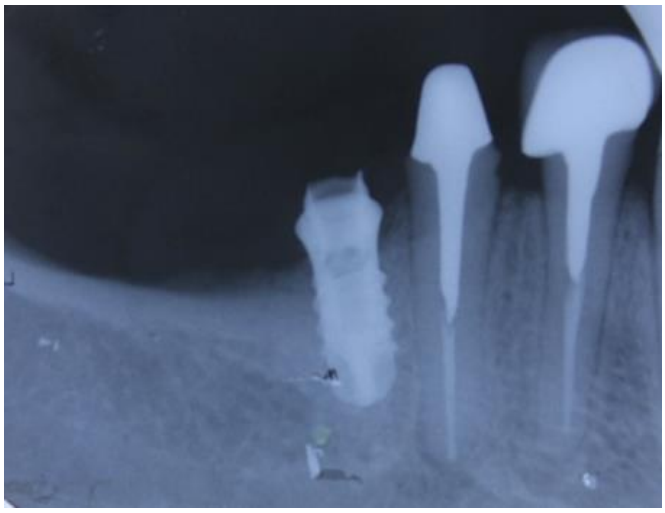

Figure 2. The base portion of the fracture abutment within the internal hex of the fixture

After removing the abutment screw, the base portion of the fractured abutment resisted to removing due to the close attachment and the presence of Morse taper. Despite attempts with a dental explorer and a periodontal curette, removal of the base portion of the abutment was not successful. Therefore, an ultrasonic tip was used counterclockwise to remove the base portion of the abutment (Figure 3). The fractured part of the abutment was removed without damaging the implant (Figure 4).

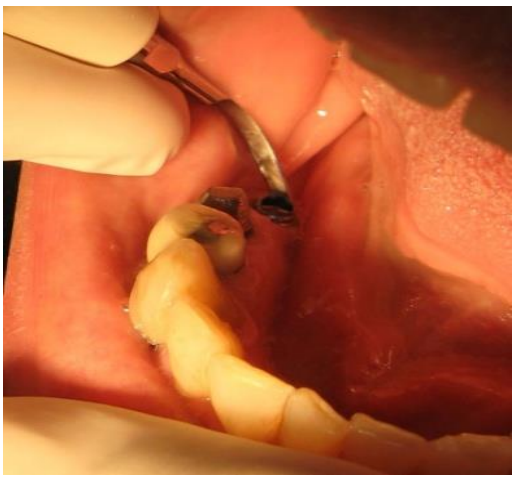

Figure 3. The ultrasonic tip (ccw)

Figure 4. Removal of the base portion of the fracture abutment

Discussion

Abutment fracture reports are rare in clinical situation. Implant components fracture are frustrating for both dentist and patient. Always Dentists do not have access to special kits for screw removal in their offices. Applying ultrasonic device is important because it makes it possible to remove the fractured part in a short time and in a safe procedure for patient and implant body. Use of ultrasonic is very safe for threads of internal surface of implants and useful for all kind of implant systems and it is also cost-effective (9). In contrast to the methods of removing fractured portion, which create a notch on the top surface of the broken fractured portion, the potential to protect the threads of internal surface of implants understandably becomes increasingly difficult and unpredictable (9).

Abutment fracture is one of the implant prosthetic problems, when the abutment system uses morse taper, it might be "cold welding" to the fixture body (8); like the present case.

To manage the presented case, an ultrasonic tip was applied counterclockwise (ccw) to remove the base portion of the fractured abutment which resulted in the fracture of the seal of the abutment, occurring due to the Morse taper, in order to remove the remaining part of the abutment. Studies on the removal of fractured abutments are limited. In one case, Roe used a modified crown-and-bridge remover for removing a fractured abutment (10).

Several factors are involved in the fracture of implant components, including excessive occlusal forces (2, 5, 11-16), location of the implant (5, 11, 13, 15-19), implant diameter (5, 11, 17), inadequate fit of prosthesis (11), metal fatigue (20), age and gender (5).

In the present case, a combination of excessive occlusal forces, angled abutment (21) and the small diameter of the implant were responsible for implant failure. Absence of an adjacent tooth, loss of contact and lone-standing implants cause metal fatigue and fracture (16).

Occlusal forces

A large number of studies on excessive occlusal forces have attributed implant fractures to a history of bruxism and parafunctional habits (2, 5, 11-16). Based on a study by Rangert, bruxism and occlusal forces are responsible for implant fractures in 56% of patients. Therefore, parafunctional habits have been reported as a major etiologic factor for the fracture of implant components (15). The present case had no history of bruxism and clenching.

The location of the implant

The load on the implant differs based on the location of the implant and the prosthesis in the dental arch, in partially edentulous patients compared to fully edentulous patients and also in the posterior area compared to the anterior area (15, 17). Several studies have reported higher risks for the fracture of implant components in partial edentulism and in posterior areas (5, 11, 17). In a study by Rangert, 90% of fractures had occurred in the posterior area and 77% of prostheses had been supported with one or two implants (15). Another study on single-tooth implants showed that fractures occur only in the molar area, especially in the first molar area (18).

Similar to the situation in the present case, a combination of excessive occlusal forces, buccolingual movement of the mandible and cusp groove orientation leads to excessive laterally directed forces (13).

The implant axis angle and angled abutments

Dental implant position also affects biomechanical force distribution. If the axis of the implant is placed at a certain distance from the center of the crown prosthesis, force created by the distance from the point of occlusal to the axis of the implant, may lead to screw loosening or fracture component. However in the case of fix prosthodontics, if the compensation is part of the tripod, conditions may be desirable. (11,15).

By increasing the force angle for up to 15°, the forces increase by 25%. In the present case, a 15° abutment had been

used due to the lingual position of the fixture, which might be considered a reason for an increase in occlusal forces [8].

Implant diameter

Implants with low diameters exhibit high susceptibility to fracture [5, 11]. An increase in the platform diameter results in a decrease in forces applied to the screw and abutment components, resulting in a decrease in the odds of screw loosening and abutment screw fracture. The strength of the abutment screw or implant body is proportional to r4. The ideal implant diameter in the molar area is 5–6 mm (8). In the present case, the diameter of the implant was 3.8 mm.

Prosthesis fit

Inadequate fit of prosthesis results in stresses at screw joint and shearing forces on the implant, making it susceptible to fracture, which might occur after screw loosening (11).

Age and gender

Implant fractures are more common in males at a mean age of 56.9 years. The patient in the present case was a 50-year-old female.

Conclusion

In the present case, the etiology of the implant failure was a combination of excessive occlusal forces due to the absence of occlusal contact on the adjacent tooth, small implant diameter, implant location and angled abutment. Although management of the fractured implant components might result in the development of new techniques, they are time-consuming and in most cases frustrating. The most important intervention is to prevent fractures. Therefore, to this end, use of implants with wider diameters, increasing the number of implants (especially in posterior regions), creation of an optimized and distributed occlusion, making sure of a passive fit of the prosthesis, decreasing cantilever, decreasing the buccolingual width of the crown and occlusal splint in patients with parafanctional habits should be considered.

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