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Rapid retrieval of fractured implant abutment screws with a custom-made screwdriver

KEYWORDS

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The success rate of dental implant is high and some of them are free of complications. However, screw loosening, especially for single implant-retained crowns, is the second most common technical complication proceeded by veneering material wear or chipping.¹ Frequent screw loosening may lead to the screw fracture. With recent advances in implant design and material strength improvement, the incidences of screw loosening and screw fracture of implant-supported single crowns over a 5-year period are 8.8% and 0.18%, respectively.²

The difficulty of retrieving a fractured screw depends on the mobility of the fractured fragment, the type of abutment connection, and the level of fracture. Fortunately, the fractured screw fragments are frequently loose in the implant. Screw fracture usually occurs at the junction of the screw head and the shank or where the threaded portion begins.³ Various methods for retrieving fractured screw are reported.⁴ Most of them are time-consuming and risky. In this article, we demonstrated an efficient and safe method for retrieving the fractured abutment screws using a custom-made screwdriver modified from an 18-gauge syringe needle.

Clinical procedures for retrieving the fractured abutment screws using a custom-made screwdriver were described as follows: (1) Check the condition of the implant and soft tissue and verify the level of the fractured screw with periapical radiographs (Fig. 1A and B).⁵ (2) Confirm the accessibility of the screw fragments. If

the fractured screw was at the level of the implant's internal thread, a gingivectomy was required to expose the implant platform for better access (Fig. 1C). (3) Verify the mobility of the fractured screw fragment with a sharp dental explorer (TU17/23 double-ended explorer; Hu-Friedy Manufacturing, Co., Chicago, IL, USA) (Fig. 1D). The mobility could be either rotation or rocking. If the fragment was stuck in the implant, try to loosen it with an ultrasonic instrument (Cavitron Select SPS, Slimline ultrasonic insert 30K; Dentsply Sirona Inc., Fair Lawn, NJ, USA). (4) Shorten an 18-gauge needle and modify the tip to two to four claws to make a custom-made screwdriver (Fig. 1E, F, G and H). (5) Adjust the claws wide enough to grasp the fractured screw (Fig. 1I and J). (6) Air dry the exposed fractured screw. Place the custom-made screwdriver onto the fractured screw. Once in contact with the top of the fractured screw, gently press the claws in an apical direction to grasp the fractured screw. Rotate the screwdriver in the counterclockwise direction until the screw fragment could be removed by custom-made screwdriver or by mosquito forceps (Fig. 1K, L and M). (7) If the male part of the abutment was stuck in the implant, remove it with the TU17 end of the dental explorer. (8) Place a new healing abutment to verify if the internal threads of the implant were still intact and to push the gingiva away from the implant platform (Fig. 1N). Take a periapical radiograph to check the fitness of the healing abutment. (9) Keep the healing abutment in place

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Figure. 1 Clinical intraoral photographs and radiographs of our cases and clinical simulations. (A) The level of screw fracture was above implant platform. (Zimmer Dental, TSV® Dental Implant 4.5mmD; Palm Beach Gardens, FL, USA) (B) The level of screw fracture was deep in the implant. (Nobel Biocare, Branemark Implant WP, Zurich, Switzerland). (C) Implant platform and abutment screw fragment were partially covered by the gingiva. (Nobel Biocare, Branemark Implant WP) (D) The screw fragment was pushed by the #TU23-end of the dental explorer to verify the mobility of the screw fragment. (E, F, G and H) Two-, three- and four-claw custom-made screwdriver were modified from an 18-gauge syringe needle. (I and J) Adjust the claws to be slightly larger than the fractured screw. (K) The claws grasped the fractured screw. (L and M) The screw fragment removed by the custom-made screwdriver or by mosquito forceps. (N) The new healing abutment in place. (O) After adjusting the overhanging restoration of tooth 17, the old crown with a new abutment screw was delivered. (P) Abutment screw fracture occurred at the different levels. (Q) Sectioned implant replica; note the gap between the abutment screw and the inner thread of the implant replica. (Nobel Biocare, Branemark Implant RP). (R) A small protuberance at the fractured surface of the abutment screw. (S) The horizontal fractured surface was relatively flat with no protuberance (Zimmer Dental, TSV® Dental Implant 4.5mmD). (T) Multiple contact points between the claws and the fractured screw surface. (U) The claws of a custom-made screwdriver grasped the fragment of the fractured screw.

for at least 5 minutes, and then remove it and inspect the implant platform carefully to ensure there was no deformation or fracture. (10) If the dislodged implant-prosthesis was intact, remove the broken abutment screw head and replace it with a new abutment screw (Fig. 1O). If the dislodged implant-prosthesis was not suitable for replacement, either abutment fracture or distortion, take a new impression for refabrication of the implant-prosthesis.

In the case of abutment screw fracture, initial treatment in the form of conservative retrieval is always the first and most advisable option. Traditionally, the dental explorer with counterclockwise rotation is the tool of choice to retrieve the remaining fractured screw fragments. However, this method is time-consuming and may not be applicable in cases where the fractured surface is relatively smooth.

In this article, we described a simple, safe and effective technique for retrieving screw fragments using a custom-made screwdriver modified from an 18-gauge needle, which was suitable for fractured screw with mobility. Screw fracture usually occurs at the weak point – the narrowest part of the screw (Fig. 1P). The fractured screw is loose in the implant due to the tolerance between the screw and the inner thread of implant (Fig. 1Q). Only when debris falls into the gap will the fractured screw become stuck in the implant. Oblique fracture at the shank region or fracture at the threaded region, may result in a small protuberance at the edge of the fractured screw (Fig. 1R). The protuberance gives us the opportunity to push the fragment by a dental explorer. However, horizontal fractures at the shank usually result in a flat surface with no protuberance, which makes it difficult for the dental explorer to rotate it in a counterclockwise direction (Fig. 1S). Despite the presence of the protuberance at the fractured surface, it is still difficult to rotate the screw because of one point contact and the need for high tactile sensation. On top of that, the tip of the dental explorer is too large to be inserted into the gap between the screw and the implant (Fig. 1D). Screw retrieval is difficult; it is even more difficult on the maxillary posterior region as the procedure is mostly performed under the mirror view.

The custom-made screwdrivers provide multiple contact points on the screw surface (Fig. 1T). The claws are thinner and more flexible which could enter the gap and grasp the screw (Fig. 1U). More friction force is provided by this method. As the force application is right above the screw like a standard screwdriver, it is easier to operate in a counterclockwise direction, even if it is on the maxillary posteriors.

The fractured screw without mobility is the most difficult to retrieve. It needs special removal kits provided by the implant manufacturer. However, this may cause damage to the internal threads or platform of the implant if used incorrectly. The heat generated during the drilling process may disrupt the osseointegration of the implant.

Additionally, metal debris from the drilling process may fall into the gap and further seize the screw. The removal kit should be used cautiously only when the screw is completely stuck and cannot be loosened by Cavitron. In the simplest case (an implant with an internal connection design, the abutment screw fractures at the shank region, and the screw fragment is mobile), the fractured screw can be retrieved within few minutes with the technique described above.

Declaration of competing interests

The authors have no conflicts of interest relevant to this article.

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