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Removal of fractured implant abutment screw in a single posterior tooth with or without microscope: a case report

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Although fracture of abutment screw appears in small proportion of mechanical complications, removing fractured screw is harassing situation to clinicians, often leads to fixture removal. Several studies have been presented the screw removal techniques, but usually withdrawing the remnant with a sharp edge instrument should be the first choice of treatment. In this report, we described successful screw removal cases with simple anti-rotation movement of endodontic explorer, with or without microscope. **(THE JOURNAL OF KOREAN ACADEMY OF OSSEOINTEGRATION 2021;13(1):10-15)**

Key words: Dental abutment, Periprosthetic fractures, Prosthesis loosening, Prosthesis failures, Single-tooth implants

INTRODUCTION

With an explosive increase in the cases of dental implantation in the last decade, clinicians are faced with several postoperative complications. Complications in the field of implantology can be divided into biological complications (unsuccessful osseointegration and peri-implantitis) and mechanical complications (veneer material fracture, screw loosening, screw fracture, and fixture fracture)[1].

Mechanical failure accounts for a larger proportion of implant failure than biological failure[2]. The most frequent mechanical failures are acrylic resin fracture (22%), followed by screw loosening of the abutment (7%~10%), porcelain fracture (7%), implant component fracture (2%~4%), and fixture fracture (1%~2%)[3,4].

Mechanical fractures can occur in the fixture or any of the other components. Goodacre et al.[3] reported that the occurrence of abutment screw fracture had a fourtimes higher ratio than fixture fracture during the early to mid-loading period. Abutment screw fracture often results in the prosthesis falling out, leaving the component inside the fixture screw. Some clinicians suggest that screw fractures could be a safety component of the fixture[5], as it seems to replace the fixture fracture at times. However, the remnant frequently precludes the reuse of the fixture, sometimes leading to the removal of the fixture.

The primary reason behind screw fracture is undetected screw loosening, possibly due to bruxism, an ill-fitting suprastructure, overloading, or malfunction[1] implants with excessively long height leading to screw loosening, even culminating in abutment fracture[6]. Screw loosening occurs more frequently in single-tooth implants (8%) than multiple-unit fixed prostheses (5%)[7].

Bickford suggested that the screw loosening process occurs in two stages: initially, external forces applied to the screw joint cause slippage, releasing the preload. In the next stage, the loosened body involves a continual decline of preload below the critical level, resulting in thread turn and loss of function[8]. Furthermore, the loosened body will convert the occlusal force to lateral force, thereby increasing the inappropriate force on the implant system resulting in alveolar bone resorption or fracture of the connecting part in the long run[9].

Several studies have described methods for screw retrieval; however, no consensus has yet been reached on abutment screw removal[10,11]. In this clinical case report, we present three cases of abutment fracture in a single-tooth implant by a conservative method with or without visual aids.

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CASE REPORT

1. Case 1

A 60-year-old female patient visited our clinic with an i27 implant abutment screw that had fractured the previous night. A periodontal flap was elevated to expose the fixture hole (Figure 1b). A microscope (OPMI pico S100, ZEISS, Germany) was used to improve the visibility. By viewing through the microscope, a fractured screw thread tip was detected (Figure 1c). Although technically demanding, the remaining part was removed using an endodontic explorer by rotating it counter-clockwise (Figure 1d). A new adequate healing abutment (5.0 mm × 7 mm) was placed, and the seating was confirmed through radiography (Figure 1e).

2. Case 2

A 62-year-old male patient visited the clinic with an i16 implant fixture with a fractured screw covered by gingival tissue.

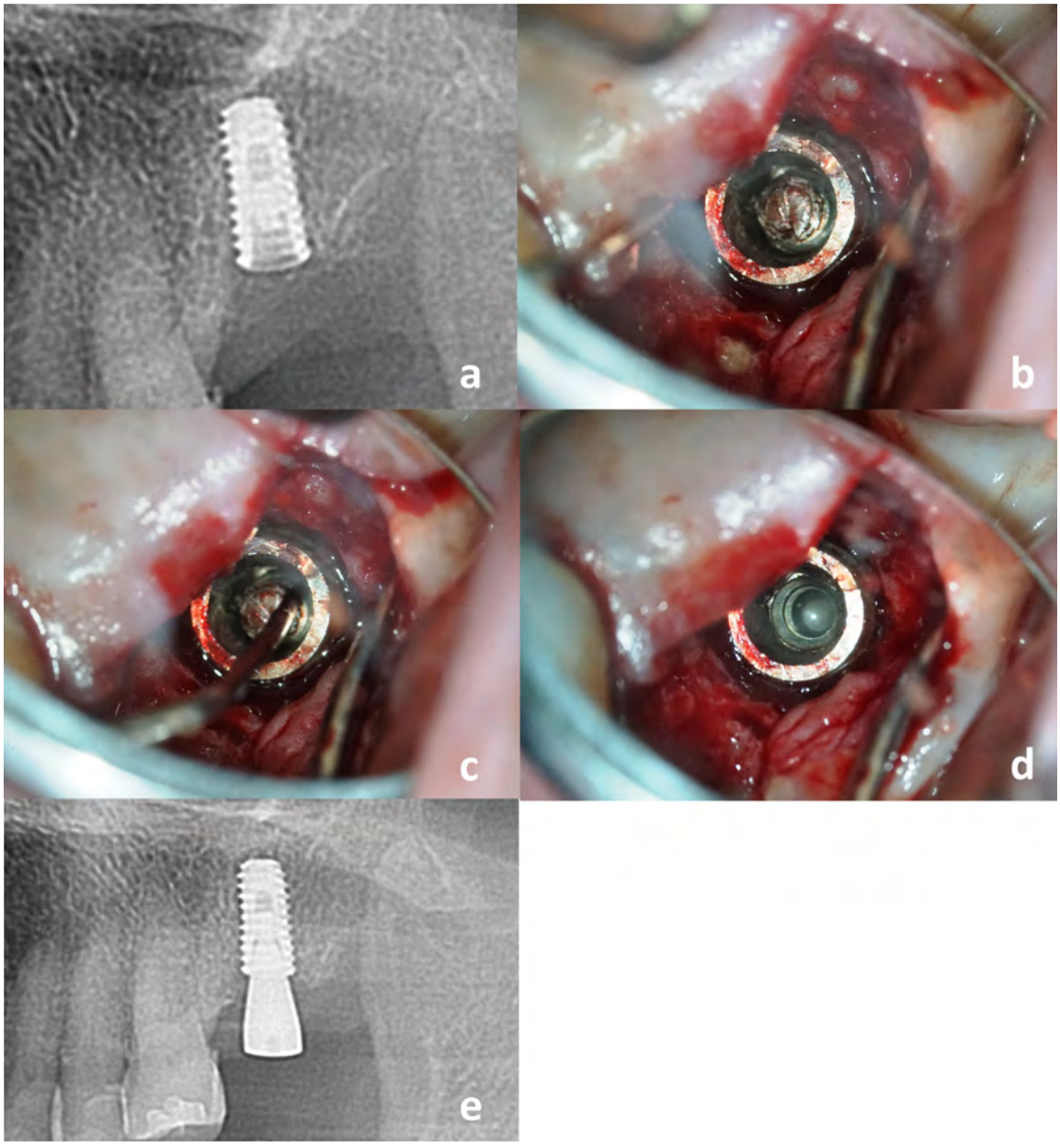

Figure 1. (a) Panoramic view of the fractured screw. (b) The fractured screw thread tip. (c) The endodontic explorer is moved counter-clockwise to move the fragment outward. (d) After verifying there is no internal thread worn out, healing abutment is placed. (e) New healing engagement is confirmed.

An internal tapered joint type implant fixture (Implantium, 4.8 mm × 10 mm, Dentium, Seoul) had been placed 2 years before the fracture, followed by the screw & cement-retained prosthesis (SCRP) type implant crown installation. There was no sign of screw loosening during the 2-year follow-up period before the prosthesis detachment due to screw fracture.

After the administration of local anesthesia, the i16 fixture hole was exposed by elevating a periodontal flap. Using an endodontic explorer tip, the clinician traced the fragment's cutting plane tactilely and rotated it counter-clockwise. The remaining

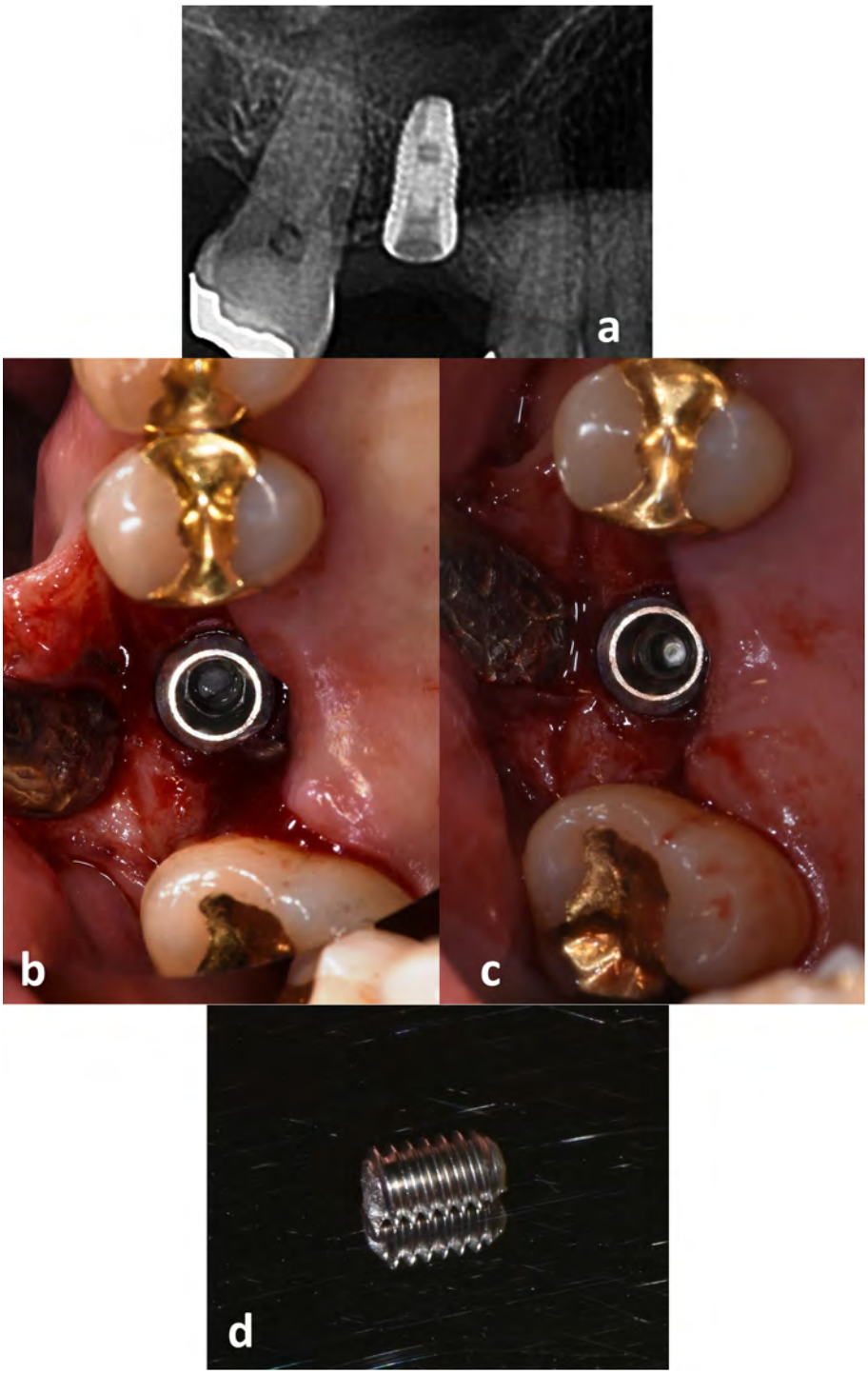

Figure 2. (a) Panoramic view of the fractured screw. (b) The flap is elevated for visibility. Abutment screw fractured horizontally, with partial step height. (c) The fractured piece is removed with endodontic explorer. (d) Photo of fractured component taken after removal.

screw component was successfully removed through the internal thread with adequate force, and an adequate healing abutment (6.5 mm × 3 mm) was engaged (Figure 2a~d).

3. Case 3

A 68-year-old female patient visited the clinic with the chief complaint of an i16 implant that fractured while having dinner the previous night. The patient reported that the implant crown was placed at least five years earlier.

From the radiograph of the implant, we could clearly see a broken screw inside the tapered internal-type fixture. After the administration of local anesthesia and elevation of a periodontal flap, the tip of the endodontic explorer with a counter-clockwise movementwas used to successfully remove the fractured segment from the fixture. A radiographic examination was performed after a suitable healing abutment hookup (Figure 3a~c).

DISCUSSION

All the patients mentioned above had single-tooth implants with an internal-tapered joint in the posterior area. Implant components are known to fracture more frequently in the posterior region[12,13]. Dental implants in the posterior region are easily exposed to excessive occlusal forces (200 lbs) compared to the anterior region (25~100 lbs)[12] and screw loosening is the most common restorative failure in replacing a single posterior tooth

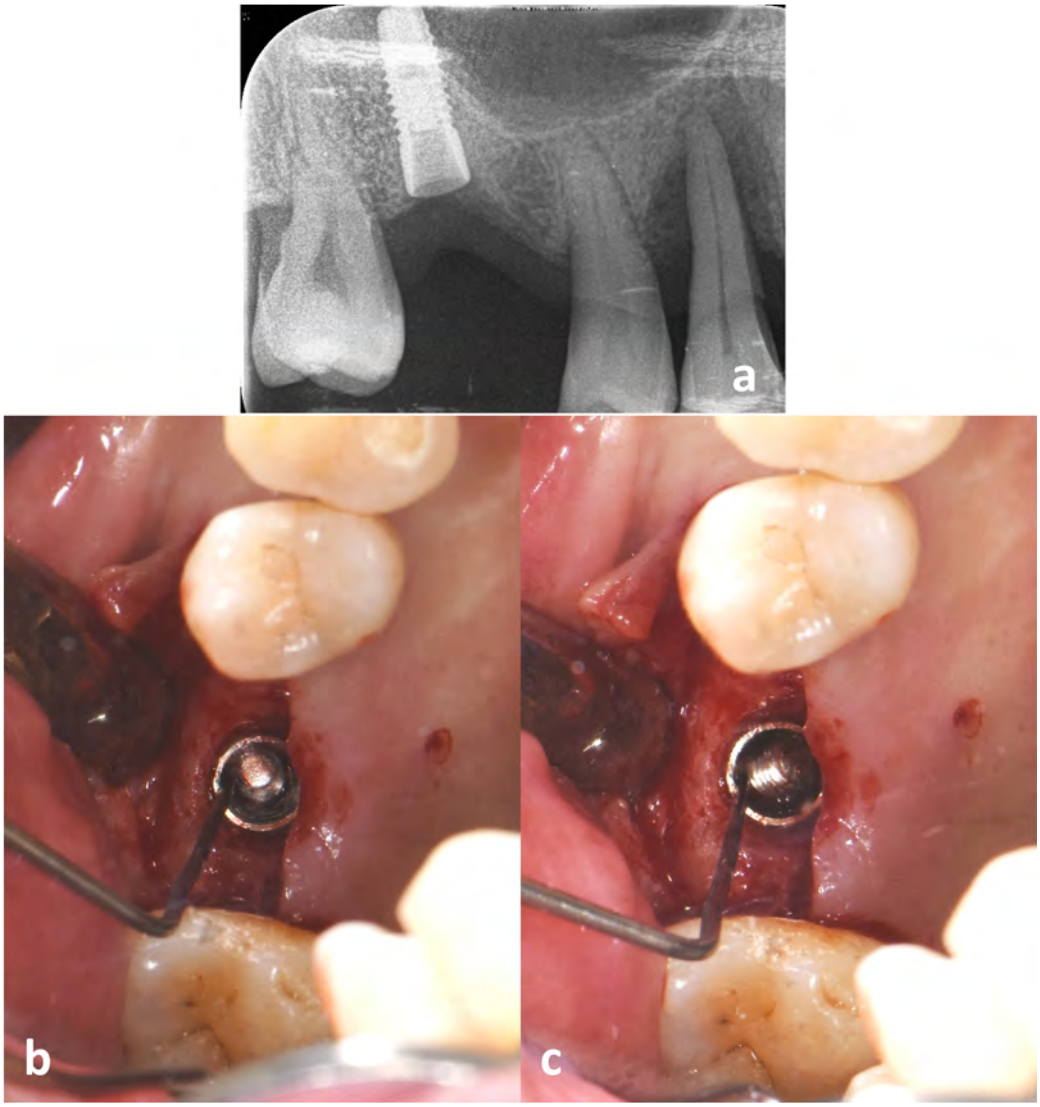

Figure 3. (a) Fractured screw observed on periapical radiograph. (b) The fragment's end point is found using an endodontic explorer. (c) The fragment is removed through counter-clockwise rotation.

with implant therapy, (~26%) in an earlier year[13]. According to Balshi et al.[14], the proportion of screw loosening of splinted implants declined (8%) compared with single tooth replacement (48%) during the same 3-year analysis. All the patients mentioned above had a single-tooth implant, which is vulnerable to fracture.

Implant abutment design plays a key role in implant therapy by affecting the force transmission mechanism at the interfaces between the fixture and the abutment. Merz et al. reported that the butt joint and external hex connection type were more prone to screw loosening than the internal-taper/cone joint due to the force concentration on the abutment screw. Conversely, the internal type has the advantage of off-axis loading by resting on a tapered interface[15]. Although most screw fractures are reported on external type, internal-type screw fractures can be observed easily due to clinician preference[16]. All the cases reported here were of the internal-tapered type, with the fracture fragment remaining below the tapered surface.

Fundamentally, dentists should be concerned about preventing screw loosening before its occurrence. Torquing an abutment screw has a clamping effect, called preload, resulting in friction resistance between the screw and the internal thread[17]. Therefore, in clinical situations, using an adequate preload is essential, and it is recommended that the abutment screw be retightened 10 minutes after the first tightening. In addition, selecting a fixture that is as wide as feasible will diminish the static and fatigue stress of the abutment screw[18,19]. Cho et al.[20] reported that a wide diameter fixture showed less screw loosening (5.8%) than the standard diameter (14.5%), particularly in the single-tooth posterior area.

Nevertheless, screw fractures can occur spontaneously at any moment. Several case studies have shown how to remove the fractured screw fragment with an explorer, endodontic file, straight probe, or hemostats[10,11]. If the fractured segment remains stuck inside the fixture, a notch should be carved on the periphery to make a lever arm[1]. Furthermore, if affordable, clinicians can choose the manufacturer's implant retrieving kit if. Utilizing an additional visual aid, such as a microscope, will enable the clinician to make a precise decision on the fractured section and shorten the chair time in every case.

As seen in our cases, withdrawing the remnant with a sharp edge instrument should be the first choice of treatment. As abutment screw fracture occurs mostly due to screw loosening, the remaining screw has a fair chance of loosening out of the internal screw. The clinician must rotate the instrument counterclockwise immediately after adjusting the tip on the fractured section. At times, the fragment remains unperturbed and seems to be stuck in the fixture, with the expectation of internal thread wear out. Before attempting aggressive treatment such as fixture removal, the clinician should double-check if the sharp-edge tip is properly located. In the first case, we could not remove the fragment successfully because of finite visibility. Subsequently, by applying the endoscope, we noticed that the cut-off edge we expected was not the right edge, and the segment could be removed conservatively.

CONCLUSION

Despite its low incidence rate (2%~4%), abutment screw fracture in dental implants usually presents a challenging situation, sometimes leading to implant removal. Meanwhile, due to the limitations in visibility and approachability, retrieving screw-fractured implants still depends mostly on the clinician's technical sensitivity. As seen in Case 1, using microscopes will help remove fractured screws by improving visibility. By extension, clinicians should make constant efforts to prevent screw loosening and fracture, such as selecting proper implant design considering overall occlusal force control and applying proper preload, especially on posterior single-tooth implants.

REFERENCES

1. Simonis P, Dufour T, Tenenbaum H. Long-term implant survival and success: a 10-16-year follow-up of non-submerged dental implants. Clinical oral implants research 2010;21:772-777.
2. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY. Clinical complications with implants and implant prostheses. The journal of prosthetic dentistry 2003;90:121-132.
3. Brägger U, Aeschlimann S, Bürgin W, Hämmerle CH, Lang NP. Biological and technical complications and failures with fixed partial dentures (FPD) on implants and teeth after four to five years of function. Clinical oral implants research 2001;12:26-34.
4. Rangert B, Jemt T, Jörneus L. Forces and moments on Brånemark implants. International journal of oral & maxillofacial implants 1989;4:241-247.
5. Nergiz I, Schmage P, Shahin R. Removal of a fractured implant abutment screw: a clinical report. The journal of prosthetic dentistry 2004;91:513-517.
6. Nissan J, Ghelfan O, Gross O, Priel I, Gross M, Chaushu G. The effect

of crown/implant ratio and crown height space on stress distribution in unsplinted implant supporting restorations. Journal of oral & maxillofacial surgery 2011;69:1934-1939.
7. Kallus T, Bessing C. Loose gold screws frequently occur in full-arch fixed prostheses supported by osseointegrated implants after 5 years. International journal of oral & maxillofacial implants 1994;9: 169-178.
8. Bickford JH. Introduction to the design and behavior of bolted joints: non-gasketed joints: CRC Press. 2007.
9. Fredrickson EJ, Stevens PJ, Gress ML. Implant prosthodontics: clinical and laboratory procedures. 1995.
10. Satterthwaite J, Rickman L. Retrieval of a fractured abutment screw thread from an implant: a case report. British dental journal 2008; 204:177-180.
11. Quek CE, Tan KB, Nicholls JI. Load fatigue performance of a single-tooth implant abutment system: effect of diameter. International journal of oral & maxillofacial implants 2006;21:929-936.
12. Tagger Green NT, Machtei EE, Horwitz J, Peled M. Fracture of dental implants: literature review and report of a case. Implant dentistry 2002;11:137-143.
13. Eckert SE, Meraw SJ, Cal E, Ow RK. Analysis of incidence and associated factors with fractured implants: a retrospective study. International journal of oral & maxillofacial implants 2000;15:662-667.
14. Scott I, Ash Jr MM. A six-channel intraoral transmitter for measuring occlusal forces. The journal of prosthetic dentistry 1966;16:56-61.
15. Jemt T. Modified single and short-span restorations supported by osseointegrated fixtures in the partially edentulous jaw. The journal of prosthetic dentistry 1986;55:243-247.
16. Balshi TJ, Wolfinger GJ. Two-implant-supported single molar replacement: interdental space requirements and comparison to alternative options. International journal of periodontics & restorative dentistry 1997;17:426-435.
17. Merz BR, Hunenbart S, Belser UC. Mechanics of the implant-abutment connection: an 8-degree taper compared to a butt joint connection. International journal of oral & maxillofacial implants 2000; 15:519-526.
18. Katsavochristou A, Koumoulis D. Incidence of abutment screw failure of single or splinted implant prostheses: a review and update on current clinical status. Journal of oral rehabilitation 2019;46:776-786.
19. Winkler S, Ring K, Ring JD, Boberick KG. Implant screw mechanics and the settling effect: overview. Journal of oral implantology 2003; 29:242-245.
20. Boggan RS, Strong JT, Misch CE, Bidez MW. Influence of hex geometry and prosthetic table width on static and fatigue strength of dental implants. The journal of prosthetic dentistry 1999;82:436-440.
21. Cho SC, Small PN, Elian N, Tarnow D. Screw loosening for standard and wide diameter implants in partially edentulous cases: 3-to 7-year longitudinal data. Implant dentistry 2004;13:245-250.