

Case Report

Clinical benefits of angled screw channel implant prosthesis in the esthetic zone: A case report

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Abstract

Compared to cement-retained implant crowns, screw-retained restorations offer the advantages of retrievability and reduced risk of peri-implantitis related to residual cement. The angulation of the conventional screw should follow the long-axis of the implant. In cases of implant malposition or unfavorable angulation, screw access may compromise functional and esthetic outcomes, especially in the anterior maxillary area. The angled screw channel design allows the screw access angulation to diverge up to 28 degrees from the implant axis. This case report discusses the use of the angled screw channel system to correct a labially tilted implant placement in the anterior maxilla.

Key words: angled screw channel, screw-retained prosthesis, esthetic

Introduction

The implant prosthesis is a successful treatment option that meets the esthetic and functional requirements of dentistry patients. The restoration can be connected to the implant by cement or screw. The advantages of cement-retained implant prostheses include the feasibility of correcting unfavorable implant position, passive fit, and easier control of occlusion.¹ However, mucositis and peri-implantitis related to residual cement are major complications of cement-retained implant prostheses.² Moreover, difficulties in subgingival removal and retrieval of excess cement make the screw-retained prosthesis a better choice.^{3,4} Conventionally, the angulation of the screw has to coincide with the long-axis of the implant. However, the bony structure of the anterior maxilla hinders the ideal positioning of the implant because it does not allow a screw-retained restoration.

In 2004, the angled screw channel (ASC) abutment design (Dynamic Abutment; Talladium International Implantology) was introduced allowing divergence of the screw access angulation from the implant axis. The hexalobular screw head can be engaged with a hexagonal faceted sphere screwdriver, which permits implant-abutment off-axis inclinations of up to 28 degrees.⁵ Nowadays, the angled screw channel abutment is compatible with many implant systems. A cone beam computed tomography (CBCT) analysis showed that screw-retained restorations were frequently achievable (76%) with the use of angled screw channel abutments compared to restorations with

straight abutments (24%). In addition, of the maxillary anterior teeth, the lateral incisors have a greater need for angled screw channel abutment.⁶

We present a case of labially tilted implants in anterior maxilla restored with screw-retained crowns. The angled screw channel abutment was applied to avoid unfavorable screw access from the labial surface.

Case Report

A 49-year-old female patient complained of a tooth mobility problem caused by a traffic accident three days previously. During intraoral examination, ill-fitted margins and grade III tooth mobility over bilateral maxillary central incisors were noted (Figs. 1 and 2). Periapical X-ray showed both teeth with an over-sized post and core and compromised tooth structure (Fig. 3). Given the remaining tooth structure and unfavorable prognosis, tooth extraction was suggested. After discussion of treatment planning with the patient, she agreed to placement of implants after tooth extraction. In CBCT analysis, the surrounding bone volume of the maxillary central incisors appeared to be suitable for immediate implant placement (Figs.

4 and 5). Bilateral maxillary central incisors were extracted and implants (Straumann®, BLT, RC, 4.1 × 12 mm) were placed simultaneously under flapless surgery (Figs. 6 and 7). The wound healed uneventfully following implantation. The provisional prosthesis was determined to be stable until maturation of the osseointegration. After allowing eight weeks for osseointegration, an impression of the implant was taken for fabrication of a provisional prosthesis. The angulation of the implant axis appeared to be tilted too labially when the impression copings were inserted (Fig. 8). The provisional implant restorations were delivered (Fig. 9). The final impression of the definitive prosthesis was taken three months later after the surrounding mucosa had matured (Fig. 10). The unfavorable angulation of the implant could have caused esthetic concerns if screw-retained restorations were planned. Therefore, angled screw channel abutments (Straumann® Angled solutions, AS) were determined to correct the implant angulations and avoid the complication of residual cement of cement-retained prostheses (Figs. 11 and 12). The definitive screw-retained implant restorations were delivered. The patient was satisfied with the esthetic appearance of the final prosthesis (Figs. 13–16).



Figure 1. Initial frontal view showed ill-fitted margins on both maxillary central incisors



Figure 2. Initial occlusal view



Figure 3. Initial periapical x-ray revealed over-sized posts

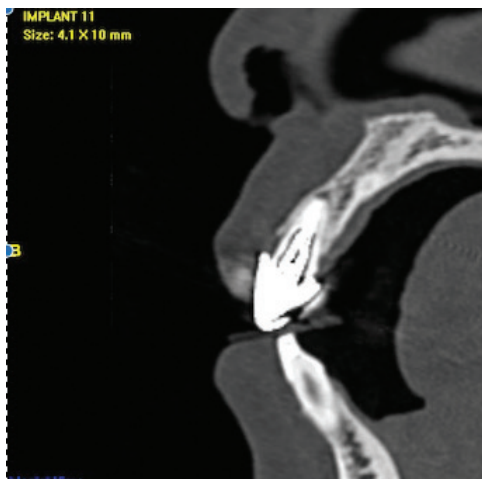


Figure 4. CBCT analysis of maxillary right central incisor

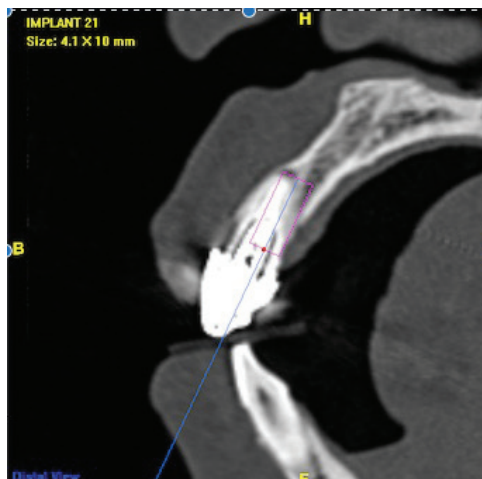


Figure 5. CBCT analysis of maxillary left central incisor

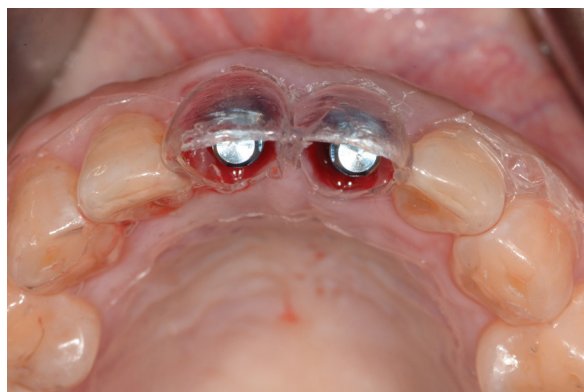


Figure 6. Implants were placed according to the surgical stent

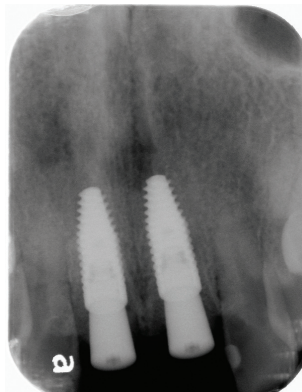


Figure 7. Periapical x-ray was taken after implants were placed



Figure 8. The angulation of implant appeared to tilted too labially



Figure 9. The provisional implant prosthesis was delivered



Figure 10. The soft tissue was modelled by provisiona restorations after 3 months

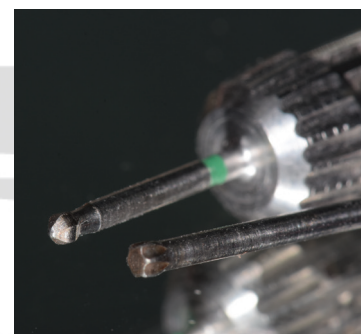


Figure 11. Close-up view of hexalobular surface of screw head

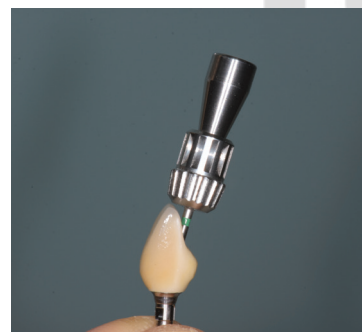


Figure 12. The screw access was corrected by aneled screw channel



Figure 13. The close-up frontal view of definitive prosthesis



Figure 14. The occlusal view of definitive prosthesis. The screw access was located in the ideal position



Figure 15. The frontal view of definitive prosthesis

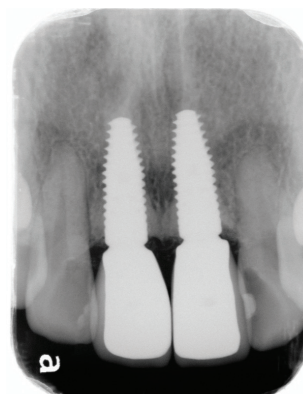


Figure 16. The periapical x-ray of definitive prosthesis

Discussion

Screw-retained restorations provide the advantages of retrievability and avoidance of the biological complications of residual cement in cement-retained restorations.⁷ In cases of malposition of implant or unfavorable angulation, the angled screw channel can accommodate a screw channel angle of up to 28 degrees from the implant axis, while maintaining implant screw alignment.⁵

The various angulations of the angled screw channel may affect the torque value of the screw. This study demonstrated an off-axis angle within 0 to 15 degrees without significant loss of torque value. Nevertheless, at 25 degrees or above, the torque value is reduced significantly.⁸ In various angled screw channel systems, the initial torque value affects the stability of the screw. The higher the recommended torque value of angled screw solutions is, the lower the likelihood of the screw loosening. In addition, angled screw channel restorations are comparable in performance to straight screw access restorations in terms of torque value after cyclic loading.^{9,10}

In the case of fracture strength, laboratory studies have shown that angled screw channel restorations fail at fewer load cycles compared to straight screw. However, under a range of physiological force loadings, the fracture strength of angled screw channel restorations was comparable to that of straight screw restorations.^{11–13}

Abutment thickness was influenced by the angulation of the angled screw channel, especially in the cingulum area of anterior restorations. Fractographic evidence indicated that the critical fracture point was initiated in the most apical part of the angled screw channel. In a clinical study, a similar fracture pattern also appeared in straight screw channel restorations.¹⁴ The results indicated that the titanium base abutment interface design may play a more important role than the angulation of the screw channel. In addition, the more the angulation of the screw channel diverges, the less the thickness of the palatal surface of the anterior zirconia abutment. A catastrophic fracture could occur when the thickness of the restoration is reduced to less than 0.7mm.¹⁵

The CBCT study investigated the probability of use of screw-retained single crown following immediate implant placement and provisionalization in the esthetic zone. The overall frequency of use

of the straight screw channel and angled screw channel was 14% and 84%, respectively.¹⁶ The results indicated that the angled screw channel could be applied in a wider spectrum of sites than the straight screw channel, especially in the anterior maxillary area.

In the case of fracture resistance, the clinical and laboratory performance of angled screw channel restorations is comparable with the performance of straight channel restorations. However, multiple factors, such as initial torque value, configuration of the screwdriver, screw design, implant system, and angulation of screw channel, can affect the resistance of the screw to loosening.¹⁷

In a previous study, the clinical outcomes of angled screw channel restorations remained favorable for three years.¹⁸ Only a small number of mechanical complications, including a loose screw, a ceramic fracture, and an implant failure, were reported in three clinical studies.^{19–21} These complications were similar to those seen in conventional screw-retained implant restorations. No significant differences were found between angled screw channel restorations and straight screw channel restorations.

Angled screw channel solutions can overcome the drawbacks of traditional screw-retained restorations in divergent implant angulation. The treatment options appear to offer favorable results in short-term observations. However, long-term prospective clinical studies are needed to confirm the efficacy of the application.

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