

Case Report

Custom abutments on tilted implants in the maxilla: A clinical report

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ABSTRACT

The aim of this work is to describe a case of severe disparallelism between two implants supporting a cement-retained bridge, placed in the maxilla, employing two custom-angled abutments. Fractured abutment screw and fractured abutment involved two implant restorations in the maxilla. Once prosthetic components have been removed, a new prosthetic rehabilitation has been planned. The divergence between the implants was measured, obtaining an angle of divergence of 39°. Then, two custom-angled titanium abutments and two metal-ceramic splinted crowns were realized.

Key Words: Dental abutments, implant-abutment connection, implant-abutment design, implant-abutment interface

INTRODUCTION

The implant-prosthetic management of tilted implants represents one of the most daring challenges in implant dentistry. In several clinical situations, resorbed bone may result in non-parallel implants, which can cause disparities between the implant long axis and the abutment long axis. Several studies reported that angulated implants were not associated with an increased risk for bone loss and may be a satisfactory therapeutic choice to avoid grafting procedures.^[1-4] Nevertheless, non-parallel implants should be restored with preangled or custom-angled abutments to achieve prosthetically desired parallelism between implants and to make an appropriate fabrication of implant restoration.^[1-5] Several studies showed no statistically significant differences between straight and angled abutments in terms of clinical performance. However, angled abutments may result in increased stress on the implants and adjacent bone. The stresses generated through off-axis loading

increase in relation to the abutment angulation, but there is no consensus regarding what extent of angle increasing implant or bone failure. Nevertheless, the use of custom abutments may improve the prosthetic management and biomechanics, in cases where tilted implants can occur.^[1-3] Custom abutments can be used for cement- or screw-retained single crowns or cement-retained bridges. The benefits of the custom abutment include the possibility of using a high-performance ceramic material, individualize the position, the angulation, the emergence profile of abutment, and future crown margin position of the final restoration. In the literature, several cases of correction of the divergence between implants in maxillary or mandibular total rehabilitations, or in screw-retained single crown are described.^[5-10] However, data regarding the use of custom abutments on tilted implants for cement-retained bridges are poor. Then, the purpose of this work is to describe a

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case of severe disparallelism between two implants supporting a cement-retained bridge, placed in the maxilla, using two custom-angled abutments.

CASE REPORT

A 65-year-old female patient, nonsmoker, with stabilized chronic periodontitis and in good general health conditions presented a second degree mobility of cement-retained implant crown in first molar position (26), and gingival inflammation in second premolar position (25) where a fractured abutment was found. The implant-prosthetic rehabilitation has been realized 3 years before our first visit. The patient did not report signs or symptoms of bruxism. The implants had been placed were: 3.5 mm × 11 mm for 25 and 4.0 mm × 9 mm for 26 positions (Astra Tech Osseospeed TX Dentsply-Internal-Hexagon). Clinical and radiographic examinations showed the fracture of the abutment in the 25 positions and a fracture of the screw-abutment in the 26 positions [Figure 1]. A diagnostic and therapeutic algorithm was employed, according to De Marco *et al.*^[11] Prosthetic components have been removed [Figure 2a and b]. Then, a preliminary radiographic examination and a careful clinical examination excluded signs and symptoms of mucositis and periimplantitis. Therefore, a new

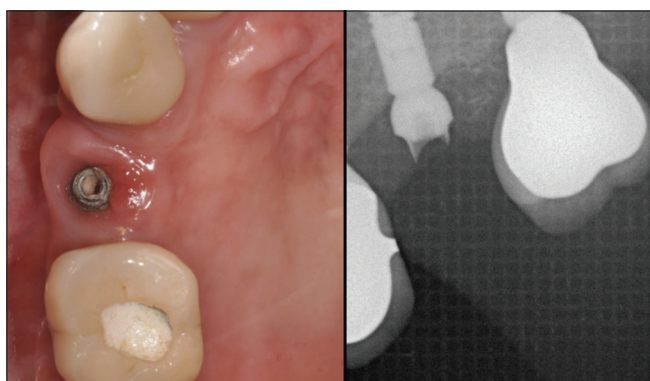


Figure 1: Clinical and radiographic examinations showed the fracture of the abutment of the 25 and a drilling-out crown corresponding to the 26.

prosthetic rehabilitation has been planned [Figure 2c]. New healing abutments were applied for 2 weeks to reduce the gingival inflammation and to condition the transmucosal route again. The application of the pick-ups showed an important disparallelism, highlighted also by the examination of models [Figure 3]. Then, the impression was taken in alginate to make an individual impression tray. The window of the tray was very wide to compensate the extreme divergence of the fixtures. The implant impression is taken with a single-phase and single-component technique, using impregum polyether material-3M™ [Figure 4]. During the implant impression, the implants were not splinted to obtain a more elastic return of the material on the removal of the tray. Atlantis™ 3D software was performed to realize a virtual design of the individualized abutments and crowns [Figures 5 and 6]. The divergence between the fixtures in the mesiodistal projection was measured, obtaining an angle of divergence of 39° [Figure 7]. The software program for Atlantis abutments sets the finishing margins in relation to the free gingival margin, the patient's periodontal biotype, and the ideal level for easy and safe removal of excess cement. In this case, chamfer is the margin design and different heights were chosen, in particular, 1.5 mm subgingival in buccal and palatal views, 1.0 mm in mesial and distal views. Atlantis abutments were milled from a solid blank of titanium to fit the proprietary prosthetic platform [Figure 8]. Thus, the abutments and the structures are checked clinically and radiographically [Figure 9]. Two splinted metal-ceramic crowns were made, and finally, they were cemented with provisional cement Temp bond Kerr™. Clinical and radiographic evidence shows a good integration of prosthesis to implants [Figure 10].

DISCUSSION

Nowadays, a lack of parallelism among implants may be reduced to almost 0°. This allows to preserve



Figure 2: (a) Abutment fractured of the 25 was removed, (b) Abutment screw fractured of the 26 was removed, (c) A radiographic examination excluded radiographical signs of peri-implantitis.

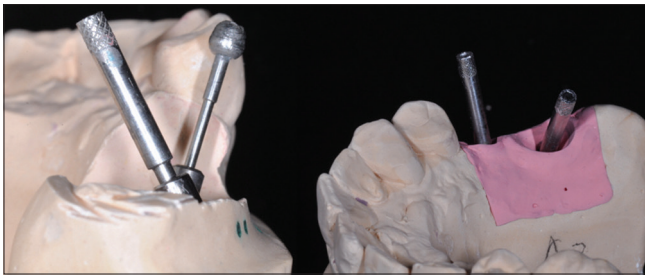


Figure 3: The examination of models showed an important disparallelism between implants.

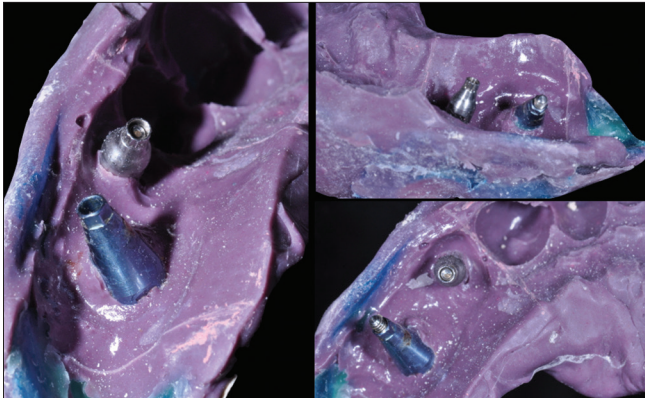


Figure 4: A single-phase technique employing mono-component polyether was used for implant impression.

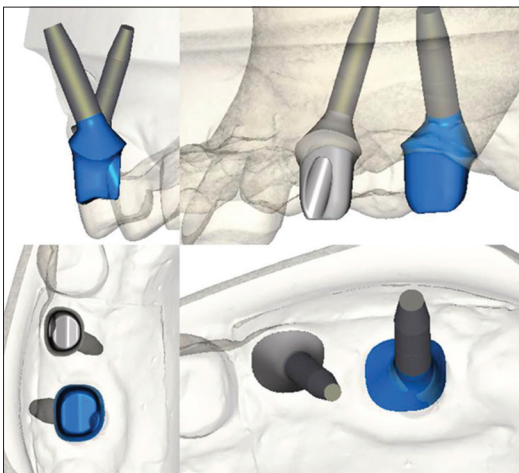


Figure 5: Atlantis three-dimensional editor was performed to realize a virtual design of the individualized abutments.

the stiffness of the abutments, their retentive and stabilizing capacity, guaranteeing easy access to the screw-abutments, and ensuring all levels of implant shoulders in iuxta gingival zone, which simplifies routine oral hygiene. Custom abutments are able to correct angulation when implants are placed in tilted positions. Custom abutments provide better potential than stock abutments for ideal crown contours and peri-implant soft-tissue support, leading to optimal

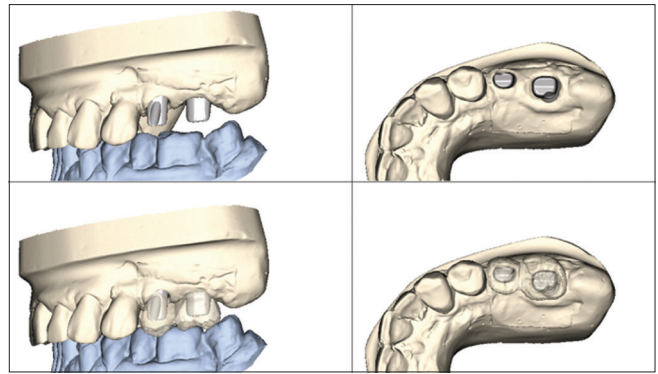


Figure 6: Atlantis three-dimensional editor was performed to realize a virtual design of the crowns.

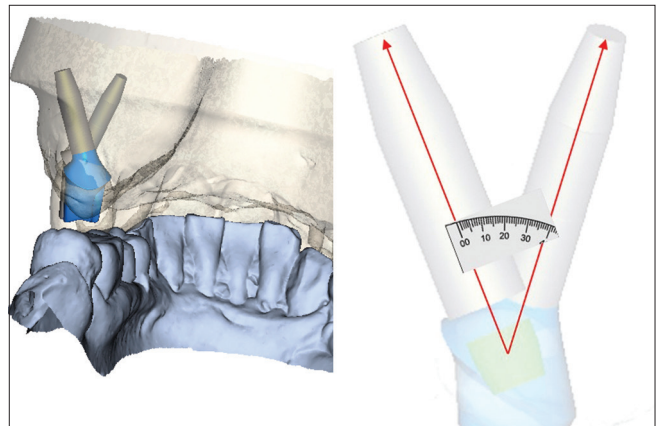


Figure 7: The divergence between the fixtures in the mesiodistal projection was measured, obtaining an angle of divergence of 39°.



Figure 8: Two custom titanium abutments were realized.

esthetic results.^[12,13] Custom abutments show a lot of advantages such as an optimized emergence profile by tooth-based design, a better distribution of stress and load, a positioning of shoulder's abutments at custom levels, an excellent ratio between the volume of the abutment and the volume of the secondary

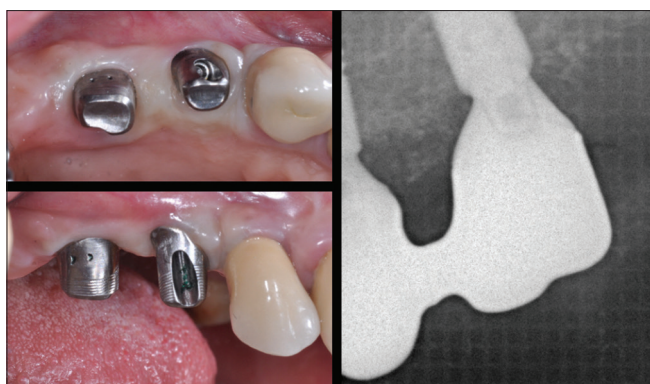


Figure 9: The abutments and the structures are checked clinically and radiographically.



Figure 10: Clinical and radiographic evidence shows a good integration of prosthesis to implants.

structure, which determines a high biomechanical resistance.^[14] Furthermore, the amount of undetected cement can be easily inspected both clinically and radiographically. In the present case report, custom-angled abutments have been created in order to achieve a parallel path of insertion and separation between the implant crowns. Since their interfaces do not require manipulation after machining, custom abutments have the potential to provide the most accurate fit of any abutment type. Several studies showed that in clinical situations where disparallelism between implants can occur, angulated abutments may result in a better distribution of stress and emergence profile, and a better oral hygiene.^[12-15] When a modified prefabricated abutment was compared with a custom abutment, the cost of a custom abutment is lower. In addition, considering the shortage of qualified laboratory technicians, manufacturing of custom abutment reduces time performing prosthetic components.^[15] Custom abutments have better physical properties since the material is processed from a homogeneous mass under more controlled conditions, with no need for abutment inventory.^[12,16] Moreover, most clinical situations are more easily resolved with the software developed for the design and fabrication of the custom abutments.^[16] Several studies showed that the angle of the abutments does not affect the clinical performance.^[1,2,4,15,16] Celletti *et al.*^[15] reported

through a 1-year histological study that the angulation of abutments has no effect on bone levels around implants. Eger *et al.*^[3] showed there is no difference between straight and angled abutments in terms of clinical parameters such as gingival inflammation, probing depth, attack level, and mobility. As far as implant impression is concerned, angulated implants may result in an inaccurate impression, and the impression technique may affect the accuracy of the definitive cast.^[17] A pick-up impression technique was preferred in the described case. However, the implants were not splinted in order to obtain a more elastic return of the material on the removal of the tray. The accuracy of the impression is a crucial step in order to design a prosthesis with a good fit, as a misfit would lead to mechanical and biological complications such as fracture of the implant and plaque accumulation with an unfavorable reaction of hard and soft tissues.^[16] An accurate and precise impression will allow to obtain an accurate and passive prosthesis and therefore a long-term success of the restoration.^[16-18] The placement of implants with different angles may increase the distortion of the impression material on removal.^[16-18] However, the relation between the angulation effect and the number of the implant is a topic still to be discussed.^[18] The recommended impression materials are the polyether and polyvinyl siloxane materials for their dimensional stability, rigidity, and tear resistance.^[18] According to Reddy *et al.*^[17] there is no significant difference in dimensional accuracy in the resulting casts, using the polyether in no angled and angled implants. Otherwise, Schmidt *et al.*,^[18] comparing polyether and polyvinyl siloxane impression materials *in vitro* study, showed that impressions with polyvinyl siloxane exhibited the highest transfer precision. The described case report showed hydrophilic properties of impregum polyether impression material. These features are essential in terms of initial wettability, detail reproduction, quality of pouring and therefore to clinically receive high qualitative impressions.

CONCLUSION

From our experience, custom-angled abutment is a valid prosthodontic solution to achieve the prosthetic parallelism between implants, making an accurate implant-prosthodontic rehabilitation.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the

patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

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