



Multidisciplinary management of a young female with infraoccluded dental implants: a case report

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Abstract

Objective: Placement of a dental implant during early adolescence may result in an unesthetic outcome or even loss of function. The presented case describes the treatment of infraoccluded dental implants and the esthetic complications for a young adult female who had received two dental implants in the canine positions when she was 16 years old.

Clinical considerations: After examination and diagnosis, a multidisciplinary approach was implemented, including the removal of one infraoccluded implant, followed by hard and soft tissue reconstruction prior to implant replacement into an ideal three-dimensional

position. On the contralateral side, a subepithelial connective tissue graft was performed, in conjunction with the modification of the emergence profile of the abutment and definitive crown. The anterior sextant was treated as a comprehensive esthetic rehabilitation that involved two additional laminate veneers and two all-ceramic crowns.

Conclusions: This multidisciplinary approach successfully managed the complication that resulted from infraoccluded dental implants. The final esthetic outcome satisfied the patient's chief complaint, and was documented to be stable at the 1-year follow-up.

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Introduction

It is well documented that the maxilla changes dramatically during growth across all three planes of space.¹ Placement of a dental implant during early adolescence may result in an unesthetic outcome or even loss of function in the long term due to the incomplete growth of the facial skeleton and the ankylosis of osseointegrated dental implants.² It has also been noted that appositional bone growth in the dental alveolus increases the vertical dimension of the jaw, moving the primary teeth in an occlusal direction without changing the position of the permanent buds.³ Hence, it has been suggested that dental implants placed

in the early mixed dentition have a poor prognosis for later in life.² In some severe cases, dental implants may remain stationary and eventually become buried in the alveolar bone.

However, the ideal timing for implant placement in late adolescence varies, since it is difficult to predict when maxillofacial growth will cease.³ On the other hand, concerns for delayed implant placement are the resorption of the alveolar ridge over time, and the patient's desire to restore missing teeth earlier. In the current case report, a young female received two dental implants at the age of 16, in conjunction with orthodontic treatment, to replace bilateral canines. Over the years, her peri-implant hard and soft tissue collapsed, and a grayish shine-through discoloration became evident. The patient's general display of the smile was also asymmetrical, with disproportionate crowns. The successful management of this complicated esthetic case is presented in this article.



Fig 1 (a) The patient's initial unesthetic smile. **(b to d)** Extraoral views. **(e to g)** Intraoral views.



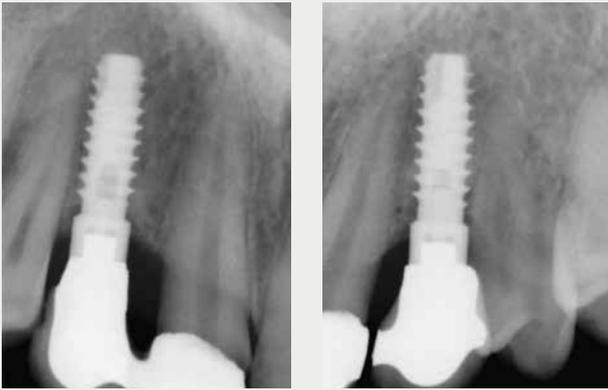


Fig 2 Radiographic examination showed implants 6 and 11 with stable, two-dimensional (mesiodistal) bone level.

Case report

A 24-year-old female presented at our private clinic with the desire to improve her smile (Fig 1a). Clinical examination revealed a long porcelain crown with a receded soft tissue margin over the maxillary left canine position (Fig 1b to g). A grayish hue over the labial soft tissue of the implants was also evident. The patient stated that she had undergone the implant therapy at the age of 16. Clinical and radiographic (Fig 2) examination showed that both implants were fully osseointegrated. The treatment that had been rendered 8 years previously was mesialization of both canines to replace missing lateral incisors, and the placement of two implants to restore the canine spaces. To improve the esthetic outcome, the canines were treated with full-coverage ceramo-metal restorations splinted to the implant-supported crowns. The patient was unsatisfied with the results and was eager to solve her esthetic concerns.

Considering the patient's occlusal scheme and teeth alignment, orthodon-



Fig 3 (a) Evaluation of the previous implant position: occlusal view after removal of the existing restorations. (b) Implant 6 exhibited a thin biotype with correctable position. (c) Implant 11 showed an unfavorable position for an ideal esthetic outcome.

tic treatment was recommended in the initial plan, but the patient refused this option. Hence, distalization of the canines, as well as the correction of the occlusion, was not considered as a possible approach. The alternative option that was subsequently considered and adopted was a minimal conservative



treatment focusing only on the anterior sextant.

A diagnostic wax-up was prepared, and the treatment plan was finalized after the removal of the existing implant restorations in order to better visualize the exact implant position (Fig 3). At this point, the diagnostic wax-up was presented to the patient and evaluated through a composite resin mock-up (Protemp 4 Temporisation Material, 3M ESPE). To achieve the ideal esthetic result, full-arch esthetic crown lengthening was also recommended to correlate the patient's smile line. However, she refused the ideal comprehensive plan, seeking only the correction of the anterior sextant.

The following treatment plan was proposed and rendered:

1. Metal-reinforced provisional restorations for teeth 6 and 7 (cemented type), and teeth 10 and 11 (cemented on tooth 10 with a cantilever over tooth 11).
2. Implant 11 removed, with hard and soft tissue augmentation procedures.
3. Subepithelial connective tissue graft (SCTG) over implant 6.
4. After 6 months, a crown lengthening procedure over the central incisors, and implant 11 placed into a correct three-dimensional (3D) position.
5. After 4 months, a screw-retained provisional restoration delivered on implant 11.
6. Fabrication and delivery of implants 6 and 11, definitive gold customized abutment and ceramo-metal restorations, porcelain laminate veneers for teeth 8 and 9, and feldspathic porcelain crowns for teeth 7 and 10.

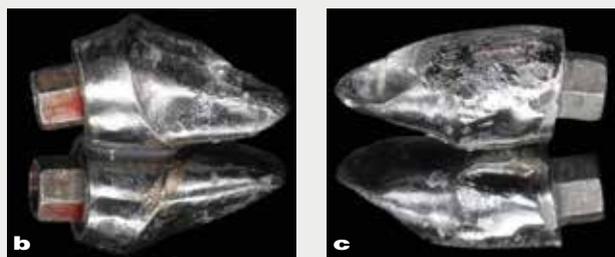


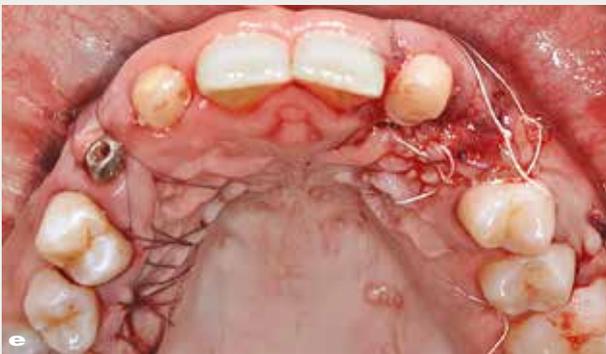
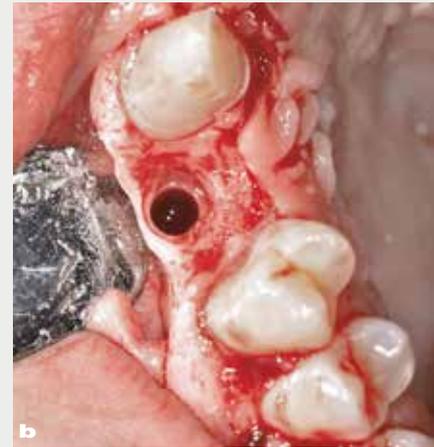
Fig 4 (a) Provisional restorations on teeth 6 and 7, and 10 and 11 (cemented type). (b and c) Reduction of the emergence profile of the original abutment (b) to favor better peri-implant soft tissue contour and stability.

In the first step, provisional restorations were inserted (Fig 4). During this procedure, a feather-edge tooth preparation was performed on the lateral incisors in an attempt to reduce the emergence profile of the canines. In this way (as described for the BOPT technique),⁴ a slight coronal migration of the facial soft tissue was favored, and a narrowing of the tooth cervical portion was obtained.

Implant 11 was retrieved with a removal kit (BTI Implant Extraction Kit, BTI) (Fig 5a). Following implant removal (Fig 5b), ridge augmentation was performed with a mineralized, freeze-dried allograft (MinerRoss, BioHorizon) (Fig 5c) and a collagen membrane (OsseoGuard, Biomet 3i) (Fig 5d). A SCTG was harvested from the palate and secured in place under the buccal flap on



Fig 5 (a) Implant 11 was retrieved with a removal kit. (b) After the removal of the implant, significant ridge deficiency over the buccal side was noted. (c and d) Ridge augmentation was performed with a mineralized, freeze-dried allograft and a collagen membrane. (e) Soft tissue augmentation with a SCTG was performed over the buccal flap on both sides. (f) A distal cantilever temporary crown for tooth 10 was then fabricated (2 weeks post-operation).



both sides (Vicryl, Ethicon). The cleft over the buccal flap was approximated with interrupted sutures (GORE-TEX, W.L. Gore & Associates) (Fig 5e). On the contralateral side, a SCTG was also performed for tooth 7. A distal cantilever temporary crown from tooth 10 was then fabricated (Fig 5f).

Five months after the implant removal, a reevaluation of the case was done using a hydrocolloid impression and a diagnostic wax-up (Fig 6). The diagnostic wax-up was presented to the patient and evaluated by means of a composite resin mock-up (Protemp 4). The mock-up was used to perform the esthetic crown



Fig 6 Reevaluation of the case was done using a diagnostic wax-up.



lengthening for the two central incisors to reestablish the correct crown length (Fig 7a to c). After the full-thickness flap elevation, the successful ridge augmentation result enabled a correct position for the new implant placement for implant 11, in relation to the alveolar crest (Fig 8a and b).

After 3 months of healing and osseointegration of implant 11, a screw-retained implant-supported provisional restoration was delivered to condition the peri-implant soft tissue (Fig 9). The possible final esthetic outcome was reassessed with the patient, using the composite resin mock-up (Fig 10). A definitive, implant-level impression was taken, together with the impression of the teeth (Fig 11). The double cord technique was used to retract the soft tissue around the prepared teeth, while the single cord technique was used for the central incisors, for which additional porcelain laminate veneers were planned.

Fig 7 (a to c) Esthetic crown lengthening for the two central incisors was performed to correct the incomplete passive eruption, following which a full thickness flap elevation osteotomy and osteoplasty were performed to reestablish the correct biologic width. The surgical stent was used as a landmark for the crown lengthening procedure in order to anticipate the location of the free gingival margin in rapport with the alveolar crest and the planned CEJ.



Fig 8 (a and b) Successful hard and soft tissue augmentation enabled ideal implant placement and favorable soft tissue development.



Fig 9 Screw-retained, implant-supported provisional restoration delivered 3 months after implant placement.



Fig 10 The mock-up was used for the reevaluation of the possible final esthetic outcome.



Fig 11 Implant-level and tooth-level impression for the definitive restorations.



Fig 12 Tooth-supported definitive restorations in the definitive cast: occlusal view. Additional feldspathic porcelain laminate veneer on the central incisors, with full-coverage all-ceramic crowns on the lateral incisors. The resin pattern for the customized abutments is still present on the implants.



Fig 13 After the final try-in, the definitive restorations were bonded to the teeth using translucent composite resin cement.



Fig 14 The definitive customized abutments made with gold alloy.



Fig 15 Final restorations 1 month after cementation.

After the conventional prosthetic steps for the final try-in (Figs 1 to 13), the definitive restorations were cemented on the teeth with translucent composite resin cement (RelyX, Unicem Cement, 3M ESPE). The definitive customized abutments (Fig 14), made with gold alloy, were torqued at 20 Ncm, and the definitive metal-ceramic restorations were cemented with temporary cement (Hy-Bond, Shofu Dental) (Fig 15). At the 1-year follow-up, the esthetic result appeared to be stable both clinically and radiographically (Figs 16 and 17).



Fig 16 (a to c) Long-term (1-year) follow-up examination showed stable results.



Fig 17 (a to c) Long-term (1-year) follow up radiographs showed stable results.

Discussion

The correction of esthetic complications always poses a great challenge for clinicians, especially when the dental implants involved are completely osseointegrated. In this case, implant 11 was removed because it was impossible to restore ideal esthetics with the implant in place. A staged approach was implemented to develop the site for the placement of a new implant, which enabled a better peri-implant soft tissue margin after contour augmentation. The final contour and margin could not be achieved without replacing the implant. On the contralateral site, the margin of the soft tissue seemed to be acceptable, therefore only soft tissue augmentation was planned to correct the shine-through discoloration.

It is not known why the previous clinician decided to mesialize the canines to replace the lateral incisors and place implants at the canine positions, which might pose a greater risk for a significant alveolus remodeling process. In the case of congenitally missing lateral inci-

sors, Kinzer and Kokich⁵ proposed that there are two malocclusions that permit canine substitution for lateral incisors – an Angle class II malocclusion with no crowding in the mandibular arch, and an Angle class I malocclusion with severe crowding in the mandibular arch. The problem with this approach is that it might compromise the final esthetic outcome. In addition to the shape and color difference between canine and lateral incisors, it is difficult to correct the emergence profile with a prosthetic restoration.⁶ In this case, the size of the lateral incisors seemed to be wider than is ideal. In the case of congenitally missing lateral incisors, it is widely accepted that a multidisciplinary approach to create space with a single, implant-supported fixed prosthesis results in the most ideal esthetic outcome.^{5,7}

Kokich found that very minimal alveolar ridge width is lost (1%) after 5 years following distalizing canines.^{8,9} The timing for restoring lateral incisors with dental implants could be deferred until the cessation of growth has been confirmed. Although some authors suggest



that the timing of implant placement for females could be as early as 15 years of age, and after puberty,¹⁰ variations among individuals should be taken into consideration as continuous facial growth might occur after skeletal growth has ceased.^{11,12} Several methods have been developed for the prediction of skeletal and facial growth, with hand-wrist radiographic analysis to correlate with ossification events being a more established method.¹³ Other approaches include cervical vertebrae maturation (CVM),¹⁴ and serial superimposition of lateral cephalometric radiographs.¹⁵ Information should be collected and considered as a whole for the best possible prediction. Chronological age by itself is not a good indicator, as is seen in this case where the dental implant was placed when the patient was 16 years old, and complications still occurred. There is a possibility that when the previous clinician placed the dental implant over the left maxillary canine area, the position and angulation were already not ideal. Therefore, deferring the timing of implant placement will most likely result in a more stable and ideal outcome.

Compared to a previous case report describing a malpositioned implant that had been corrected with an autogenous block graft,¹⁶ the use of allograft and xenograft in this case contributed to less morbidity and higher patient acceptance. The use of the guided bone regeneration technique to restore the alveolar ridge after implant removal was

considered one of the less-invasive viable options.¹⁷ The additional connective tissue augmentation was expected to greatly enhance the esthetic outcome for contour augmentation, and prevent the shine-through effect.¹⁸ The importance of thick facial soft tissue is evident on natural dentition and also on implants.¹⁹⁻²¹ In the same way, undercontoured profiles have been shown to be beneficial in order to gain vertical tissue facially to the implants.^{22,23}

Given the high survival rate of osseointegrated dental implants, esthetic success has become an essential part of the treatment. Esthetic dentistry is not only a professional goal; its results also greatly impact the patient's psychological status and social behavior. Our patient was very satisfied with the final esthetic outcome and more frequently expressed her smile with confidence. When providing dental implants for adolescents, extra caution should be taken to avoid later esthetic or functional complications. This case raised the issue of potential esthetic complications related to implant placement before growth cessation, despite complex and lengthy treatment. It demonstrated that the complications were overcome with successful treatment management.

Conflict of interest statement

The authors declare that there is no conflict of interest.



References

1. Björk A, Skieller V. Growth of the maxilla in three dimensions as revealed radiographically by the implant method. *Br J Orthod* 1977;4:53–64.
2. Oesterle LJ, Cronin RJ Jr, Ranly DM. Maxillary implants and the growing patient. *Int J Oral Maxillofac Implants* 1993;8:377–387.
3. Brodie AG. The growth of alveolar bone and the eruption of the teeth. *Oral Surg Oral Med Oral Pathol* 1948;1:342–345.
4. Loi I, Di Felice A. Biologically oriented preparation technique (BOPT): a new approach for prosthetic restoration of periodontically healthy teeth. *Eur J Esthet Dent* 2013;8:10–23.
5. Kinzer GA, Kokich VO Jr. Managing congenitally missing lateral incisors. Part III: single-tooth implants. *J Esthet Restor Dent* 2005;17:202–210.
6. Chu SJ. Range and mean distribution frequency of individual tooth width of the maxillary anterior dentition. *Pract Proced Aesthet Dent* 2007;19:209–215.
7. Krassnig M, Fickl S. Congenitally missing lateral incisors – a comparison between restorative, implant, and orthodontic approaches. *Dent Clin North Am* 2011;55:283–299.
8. Kokich VG. Maxillary lateral incisor implants: planning with the aid of orthodontics. *J Oral Maxillofac Surg* 2004;62(9 suppl 2):48–56.
9. Kokich VG. Einzelzahnimplantate bei jungen kieferorthopädischen Patienten. *Inf Orthod Kieferorthop* 1994;1:45–62.
10. Lekholm U. The use of osseointegrated implants in growing jaws. *Int J Oral Maxillofac Implants* 1993;8:243–244.
11. Westwood RM, Duncan JM. Implants in adolescents: A literature review and case reports. *Int J Oral Maxillofac Implants* 1996;11:750–755.
12. Krogman WM. Forty years of growth research and orthodontics. *Am J Orthod* 1973;63:357–365.
13. Flores-Mir C, Nebbe B, Major PW. Use of skeletal maturation based on hand-wrist radiographic analysis as a predictor of facial growth: a systematic review. *Angle Orthod* 2004;74:118–124.
14. Santiago RC, de Miranda Costa LF, Vitral RW, Fraga MR, Bolognese AM, Maia LC. Cervical vertebral maturation as a biologic indicator of skeletal maturity. *Angle Orthod* 2012;82:1123–1131.
15. Ghafari J, Baumrind S, Efstratiadis SS. Misinterpreting growth and treatment outcome from serial cephalograms. *Clin Orthod Res* 1998;1:102–106.
16. Gehrke SA. Correction of aesthetical complications of malpositioned implant: a case report. *J Oral Implantol* 2013 [epub ahead of print 15 February 2013].
17. Hotta Y. Recovery of alveolar bone by the guided bone regeneration technique. *J Oral Implantol* 1996;22:138–146.
18. Bressan E, Paniz G, Lops D, Corazza B, Romeo E, Favero G. Influence of abutment material on the gingival color of implant-supported all-ceramic restorations: a prospective multicenter study. *Clin Oral Implants Res* 2011;22:631–637.
19. Langer B, Langer L. Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 1985;56:715–720.
20. Zucchelli G, De Sanctis M. Modified two-stage procedures for the treatment of gingival recession. *Eur J Esthet Dent* 2013;8:24–42.
21. Esposito M, Maghaireh H, Grusovin MG, Ziounas I, Worthington HV. Soft tissue management for dental implants: what are the most effective techniques? A Cochrane systematic review. *Eur J Oral Implantol* 2012;5:221–238.
22. Su H, Gonzalez-Martin O, Weisgold A, Lee E. Considerations of implant abutment and crown contour: critical contour and subcritical contour. *Int J Periodontics Restorative Dent* 2010;30:335–343.
23. Rompen E, Raepsaet N, Domken O, Touati B, Van Dooren E. Soft tissue stability at the facial aspect of gingivally converging abutments in the esthetic zone: A pilot clinical study. *J Prosthet Dent* 2007;97:119–125.