

CASE REPORT



PEER-REVIEWED



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The Bonded Single-Wing Zirconia Bridge

A conservative and esthetic treatment option to replace missing maxillary lateral incisors

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There are several possible treatment options for the replacement of a missing maxillary lateral incisor.¹ These include placing an implant or a mini-implant, orthodontic substitution, autotransplantation, and placing a bonded bridge. Because each of these approaches has different indications and inherent advantages and disadvantages, they should be assessed on a case-by-case basis.

Implants

Due to the longevity and relatively high success rates of implants, they are one of the most popular treatment options. However, there are several disadvantages associated with placing an implant in the anterior maxilla. A missing anterior tooth is generally the result of trauma or agenesis. In both of these circumstances, there is commonly inadequate bone for an implant, and both hard- and soft-tissue grafting is required. A second disadvantage is the potential for implant failure. This can be due to peri-implantitis² or due to thinning of the supporting tissue, which can result in blue or grey show-through.³ For younger adult patients, a third and significant disadvantage is relative intrusion of the implant due to late vertical maxillary growth.⁴ It is well known that late maxillary growth can occur, and there is no definitive way to predict when it will occur.⁵⁻⁸ For this reason, the belief that an implant can be safely placed in, for example, a 19-year-old female patient or a 21-year-old male patient is not supported by the literature.⁹⁻¹⁰ A mini-implant has been proposed as an intermediate treatment option.¹¹⁻¹² However, there is minimal

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information in the literature to support this concept. A final disadvantage of implant placement in these cases is related to increased awareness of the maxillary transverse deficiency and its relation to the airway. With the current technology, adult patients who have passed the window for tooth-borne palatal expansion can still undergo palatal expansion. The expansion can be accomplished with an implant-borne palatal expander.¹³ However, if the patient has an implant in the anterior maxilla, it is not possible to do adult palatal expansion because the presence of the implant makes it impossible to redistribute the space after expansion.

Orthodontic Substitution

Orthodontic substitution, especially canine substitution to replace congenitally missing maxillary lateral incisors, is a commonly used option.¹⁴ However, there are clinical requirements for this treatment. The canines should be small enough so that they can be reshaped to look like lateral incisors, and they should also be similar in color to the adjacent central incisors. In addition, the orthodontic movement should be accomplished in a manner that doesn't result in loss of arch length.¹⁴

Autotransplantation

Autotransplantation can be a viable treatment option when the timing requirements are met. This option is most



(1.) Pretreatment retracted photograph of a 13-year-old female patient who presented with missing maxillary lateral incisors, retained primary maxillary canine teeth, and her permanent canine teeth orthodontically moved into the maxillary lateral incisor positions. **(2.)** Retracted view after the primary canine teeth were extracted and the permanent canine teeth were orthodontically moved back into their correct positions. **(3.)** Soft- and hard-tissue deficits were present at the maxillary lateral incisor sites. **(4. AND 5.)** Palatal and retracted facial views of the increased tissue volume at the lateral incisor sites following connective tissue grafting.

commonly used when a maxillary central incisor is ankylosed or lost due to trauma. An osteotomy is created at the site of the missing central incisor, and a tooth (commonly a mandibular second premolar), is surgically extracted, placed in the osteotomy site, and stabilized. Ideally, autotransplantation should be accomplished when the root of the donor tooth is approximately three quarters of the way formed, which is usually around age 10 to 12. This technique has been used for many decades in Europe,¹⁵ and it is reported to have a high rate of success when a stringent protocol is used.¹⁶

Bonded Bridges

The final treatment option is the bonded bridge. This treatment has been available since it was first described by Howe and Denehy in 1977.¹⁷ When bonded to an enamel substrate, bonded bridges with metal frameworks were very successful.¹⁸ Initially, the technique required two wings to be bonded to the abutment teeth adjacent to the pontic. However, over time, it became clear that a pontic with one wing bonded to the larger abutment tooth was preferable to the two-wing technique.¹⁹⁻²⁰ In addition, the metal wings lowered the value of the abutment teeth, resulting in less-than-ideal esthetics. For this reason, the metal framework fell out of favor. Several other framework materials were utilized, including reinforced composite, leucite-reinforced glass-ceramic,

“When treatment planning a bonded bridge, the edentulous site should be approximately the same width as the contralateral tooth.”

and lithium disilicate; however, none of these materials demonstrated the necessary degree of fracture resistance. In recent years, the material of choice has become zirconia.²¹⁻²² Its fracture resistance approaches that of metal,²³ and its white color doesn't change the color of the abutment tooth, making it an ideal substrate material. The substructure should be constructed from 3Y zirconia, and then glass-ceramic or lithium disilicate should be layered on the facial surface of the pontic to improve the esthetics. To optimize the success of bonded single-wing zirconia bridges, there are soft-tissue, pre-prosthetic, and prosthetic factors that should be considered.

Soft-Tissue Factors

Oftentimes, there is a soft-tissue deficit at the pontic site. This requires a soft-tissue grafting procedure to provide the correct emergence profile for an ovate pontic.²⁴ It has been reported that the volume of soft tissue created with a connective tissue graft remains stable under an ovate pontic over the long term.²⁵ The ovate pontic site can be created 3 months after the grafting procedure.²⁴

Pre-Prosthetic Factors

When treatment planning a bonded bridge, the edentulous



(6.) Tooth model demonstrating the technique used to prepare the canine abutment teeth for bonded single-wing zirconia bridges. Note the anti-rotation groove placed on the mesial aspect of the canine abutment. (7.) Posttreatment palatal view of the bonded zirconia bridges. Note the anti-rotation extensions of the framework that contact the palatal surfaces of the central incisors. (8. AND 9.) Posttreatment retracted and smile views of the bonded zirconia bridges.

site should be approximately the same width as the contralateral tooth. The abutment tooth should be large enough to provide 30 mm² of enamel surface and a 3 mm connector height.²⁶ In addition, the zirconia wing must be at least 0.7-mm thick.²⁶ Because it must be bonded to an enamel substrate and only minimal tooth structure can be removed from the lingual surface of the abutment tooth, the space to accommodate the necessary wing thickness is commonly created orthodontically or with enameloplasty of the opposing tooth.

Prosthetic Factors

When replacing one tooth, the bridge will have only one wing bonded to the largest abutment tooth.¹⁹⁻²⁰ Therefore, the abutment tooth should have an anti-rotation groove or box adjacent to the pontic site to provide resistance form.²⁷

In addition, the bridge should have a small extension onto the lingual surface of the adjacent tooth to provide resistance from facial movement of the pontic.¹ This extension is not bonded, and the contact between it and the adjacent tooth is flossable. Single-wing bridges should be bonded with a dual-cure resin cement that is designed to be used with zirconia, and a precise protocol should be followed.²⁸⁻³⁰ There should be no contact on the pontic in maximum intercuspation or in excursions.

“Single-wing bridges should be bonded with a dual-cure resin cement that is designed to be used with zirconia, and a precise protocol should be followed.”

Case Report

A 13-year-old female patient was referred for an evaluation for a restorative treatment plan. She presented with retained primary maxillary canine teeth, and although she was congenitally missing teeth Nos. 7 and 10, she had been in active orthodontic treatment for one year, and teeth Nos. 6 and 11 were in the lateral incisor positions (Figure 1). During the examination, it was noted that the canine teeth were large mesiodistally and had high yellow chroma. For these and other reasons, the decision was made to distalize the canine teeth to make room for bonded bridges to replace the missing lateral incisors.

The patient's primary canine teeth were extracted, and she continued with orthodontic treatment

until teeth Nos. 6 and 11 were retracted into their correct positions in the arch (Figure 2). However, at the completion of the retraction, there were hard- and soft-tissue deficits at the edentulous sites of teeth Nos. 7 and 10 (Figure 2 and Figure 3). After removal of the orthodontic appliances, connective tissue grafts were placed at the tooth No. 7 and 10 sites to create adequate soft tissue for ovate pontics (Figure 4 and Figure 5). Following the healing period, tooth bleaching was accomplished with home bleaching trays (Clear Mouthguard

Material, Great Lakes Dental Technologies). Teeth Nos. 6 and 11 were then prepared for bonded single-wing bridges (Figure 6), and the zirconia bridges (KATANA™ Zirconia HTML PLUS, Kuraray Noritake) were bonded into place with a dual-cure resin cement (PANAVIA™ V5, Kuraray Noritake) (Figure 7 through Figure 9). In this case, the canines were selected as the abutment teeth because their shape permitted the placement of better retention grooves than the central incisors. A clear retainer (Clear Splint Biocryl, Great Lakes Dental Technologies) was fabricated and delivered for orthodontic retention. Also, in the event that either of the bridges de-bonded, the retainer would retain them until they could be re-bonded.

Conclusion

There are several options available for the replacement of missing maxillary lateral incisors. Although the placement of implants and mini-implants, canine substitution, and autotransplantation can offer advantages when indicated in certain cases, these treatments present with many disadvantages. Bonded single-wing zirconia bridges offer many advantages, particularly for younger patients, and when placed using the techniques outlined in this article, they can deliver outcomes with excellent esthetics that achieve long-term success. 🌸

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