Lateral maxillary incisor implant: Key issues for esthetic success

Part 2: Prosthetic stages and long-term issues, By Dr Philippe Rusee and Prof. Patrice Margossian, France.

Having discussed in yesterday's article, all of the prosthodontic stages for the replacement of a lateral maxillary incisor and having explained the surgical procedures required to im-prove the final esthetic outcome, in this second part, we discuss the prosthetic stages. Observation of clinical cases over a period of almost 15 years has made it possible to assess, over the different steps in the prosthetic chain, the impact of particular choices of components or clinical procedures on the final esthetic outcome of the Single abutment and the ceramic crown. As a result, for each clinical step, there are recommendations to help optimize and complete the surgical outcome and to ensure a long-lasting result.

In the last section, the esthetic outcome will be considered in relation to its medium- and long-term evolution, compared with the initial result. The efficacy of continuous tooth eruption and an analysis of different risk factors lead the authors to make clinical recommendations to minimize any negative effects.

Provisional prosthesis

A provisional prosthesis can be fabricated at different stages of treatment: when the implant is provided to place an immediate temporary solution, when the implant is uncovered, or once the soft tissues have healed. A temporary abutment can be utilized, or this will involve greater manipulation of the subgingival components (Figs. 1a & b).

One abutment, one time

The concept of the single abutment being seated early and definitively during implant treatment in order to preserve the attachment of soft tissues around the abutment is based on a study of 15 years ago by Abrahamsson et al.1 For these authors, the multiple connections and disconnections of healing screws resulted in apicalization of the periimplant bone. This study is now considered to be biased because of the cleaning of healing screws with alcohol (which destroys the attached fibroblast). Nevertheless, it provided the basis for the one-abutment-one-time concept (OAOT) put forward by Maurice and Henry Salama at conferences from 2007. At present, the medical literature is generally in favor of this concept, even though research results are mixed.

In dogs, the results of Ighaï et al.1 showed a highly negative outcome of connection and disconnection at four and six weeks, while in Alves et al.2 five such manipulations between 6 and 14 weeks had no negative consequences.

In humans, several reviews have concluded that there is a vertical advantage of 0.5 mm, horizontal advantage of 0.3 mm, and a non-statistical result for the OAOT protocol in different clinical situations.

In their 2014 review of the literature on factors influencing apicalization of periimplant tissues, Ighaï et al.1 documented interest in the concept of the single abutment and proposed recording the position of the implant at the time of placement. Thus, there is some evidence suggesting that it is desirable to limit the number of manipulations of the subgingival elements as much as possible, even though the literature is not unanimous in this regard.

The OAOT technique has a drawback pointed out by Pihy becomes and Tudor:3 however, the increased risk of cement overflow where the abutment-crown limit is deeply buried. Different clinical strategies make it possible to apply the OAOT concept.

The fabrication, using 3-D imaging, of a surgical guide and a machined abutment prepared during the implant surgery makes immediate placement possible, but it is also more risky, since any error in the guide or any lack of precision in the placement could result in a prepared abutment unusable.

The same technique, starting with an impression at time of implant placement, is less risky, since the position of the implant has already been finalized.

Since these two techniques involve the collaboration of the laboratory, a simplified protocol was used for the majority of the 120 NobelActive implants (Nobel Bio care: 3 mm) placed over the past three years:

- Preoperative cone computed tomography imaging is used to determine whether a straight abutment or a 15° angulated abutment is the best choice for the specific clinical case.
- Radiographic monitoring makes it possible to apply some pressure on the abutment, which is done to avoid, as far as possible, any adjustment to the abutment by grinding (Figs. 2a–c).

In order to respect the principle of OAOT during the fitting of the provisional crown, a provisional resin coping is prepared on a straight or angled abutment and provides the rest of the prosthetic chain.

Keep manipulations of the abutment to a minimum

Emergence profile

When putting the provisional tooth in place, it is preferable to give it an initial emergence profile that is conducive in order to allow healing of the papilla with the maximum space available. A convex profile or an overcontour encourages apicalization of the gingival margin, which is generally deleterious buccally (Figs. 4a–c). After stabilizing the soft-tissue margin, small amounts of resin placed mesially and distally with a brush on the temporary tooth allow some pressure to be placed on the papilla according to the cervical run tour concept of Bichhac and Landeged4 and, in this way, to optimize the filling of any gaps and the emergence profile. Buccally, the gingival level or the crown zygithon can be moved by modifying the temporary tooth (Figs. 6a & b). In order...
to reduce any excess cement and to allow it to escape during setting. A 0.75 mm hole can be drilled on the palatal side in the incisal half of the temporary crown.\(^{11}\)

**Optimize the emergence profile by progressive modification of the temporary crown**

Taking impression

In order to comply with OAO1T, the ideal, provided that the abutment has not been adjusted, is to take an impression of the abutment. A resin impression coping fabricated over an abutment identical to the one seated in the mouth makes it possible to transfer the position of the abutment without unscrewing it (Figs. 7a & b). An abutment and a laboratory copy are positioned in the impression and, if it is thought that the abutment is not suitable for the permanent prosthesis, one could opt for a NobelProcera abutment (Nobel Biocare) or a modified abutment (Fig. 7c).

**Take an impression of the abutment without removing it**

Abutment

**Material**

According to several publications, \(^{12,13}\) titanium and aluminum and zirconium oxides are the only materials that allow attachment of soft tissues on the abutment. For Van Brakel et al.\(^{14}\), in a study on human maxilla, there is no difference between titanium and zirconia regarding biology, with just a slight advantage in favor of zirconia for several depths after three months. Gold alloys cause apicalization of the formation to the titanium\(^{14}\) of the implant, but this conclusion has been contested by Linkevicius and Apse.\(^{15}\) A gold alloy supports less dental plaque after 4 hours in vitro but more than titanium or zirconia does after four days in vivo.\(^{16}\) Thus, there is no consensus yet in the medical literature concerning the superiority of one material over another in terms of biology.

Zirconia and gold alloys have superior esthetic qualities when the abutment supports a glass-ceramic crown in vitro\(^{17}\) or in vivo\(^{18}\), compared with titanium. When the implant site of the lateral incisor is wide \((>6.5 \text{ mm})\), selecting a 3.3 or 3.5 mm diameter implant makes it possible to use zirconia abutments. However, the majority of small-diameter implants on the market do not allow the use of zirconia abutments. The 3.5 mm diameter implant makes it possible to use zirconia crowns only when the tooth is thick, this type of all-ceramic crown can sometimes result in more disadvantages than advantages from an esthetic perspective. In such a case, for the coping in lithium disilicate, one has to use high-opaque-ceramic of significant thickness in order to hide the titanium abutment as much as possible. This has the effect of reducing the thickness of the cosmetic ceramic and thus reduces its ability to mimic the appearance of adjacent teeth (Figs. 10a–d).

**Metal-ceramic crowns**

Conversely, using metal fused to-porcelain on narrow and small teeth makes it possible to reproduce the thickness of the copings made from precious alloys or palladium \((0.3 \text{ mm or } 0.4 \text{ mm})\) and in this way to increase stratification (Figs. 11a–c & Figs. 12a–d). However, the transversal area remains the weak point in this type of restoration with a risk of the grey color of the titanium abutment showing through when the porcelain mu-crown is thin (see Figs. 33 in Russe & Linkevicius).\(^{19}\)

**Do not hesitate to use metal-ceramic crowns for small lateral incisors**

Monoblock screwed zirconia crown

The use of hexagonal implants means that external or with an internal connection measuring 3.5 mm makes it possible to use zirconia abutments. In these circumstances, two options are possible, depending on the emerging position of the abutment screw: either a two-stage solution of a zirconia abutment supporting a cemented ceramic crown (Figs. 13a–d) or a monoblock crown screwed directly to the implant (Figs. 14a & b). In these situations, the semitranslucent character of zirconia makes it possible to ensure optical continuity in both the coronal and gingival section, resulting in better esthetic integration.

**Cement**

In order to reduce the visibility of titanium showing through when a glass-ceramic crown is used, an opaque white cement should be employed according to Dede et al.\(^{14}\).

This involves a polycarboxylate ce-ment \((\text{Polycarboxylate Cement, PCC})\), selected initially for its theoretical ability to potentially allow detachment of the crown. Recent studies have demonstrated that polycarboxylate has greater tensile strength than does zinc oxide-porcelain or glass-ionomer.\(^{20}\) At the time of ce-menting, the cement-coated crown is placed on a replica abutment; any excess is removed before placing the crown in the mouth.\(^{21}\) This clinical technique has been proven beneficial for both its qualities of retainment and reducing excess ce-ment.\(^{22}\)

If standard abutments are used, the use of zirconia abutments is consider-ably subgingival and it is then vi-tal to use a minimum amount of cement to prevent it from being displaced. The washable nature of polycarboxylate cement immedi-ately after placement can be an advan-tage for its removal.

**Continuous eruption**

Since the 1990s, authors such as Lueers and Darling\(^{23}\) have described the phenomenon of continuous erup-tion, which results in a verticalization of the maxillary incisors. The con-tinuation of implants prevents them from following this migration and, over time, the lateral incisors can end up in a more apical and buccal position than the central incisors. This phenomenon is sometimes parogni-tic after some years have passed, whatever the age when the implants were placed (Figs. 18a & b). Thus, the organization of anterior guidance be-comes particularly important, since rapid movement of the central inci-sors can occur if these are not occluded when the implants are placed. During orthodontic treat-
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