Trimestriel - ISSN 1771-3986 - Abonnement 199 €

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Change of paradigm
in anterior implant positioning

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TITANE 3/19
DENT IMPLANT & PARODONTE
QUINTESSENCE PUBLISHING
VOLUME 16 / ISSUE 3 / SEPTEMBER 2019

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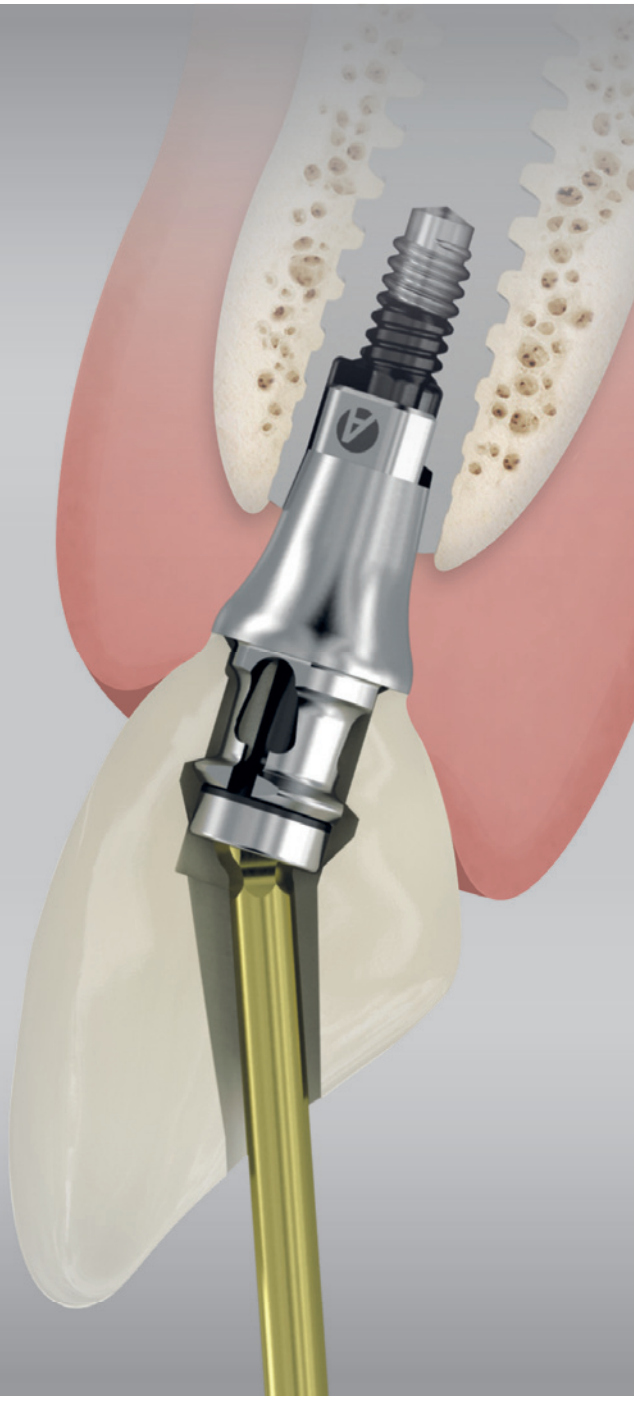

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Change of paradigm in anterior implant positioning

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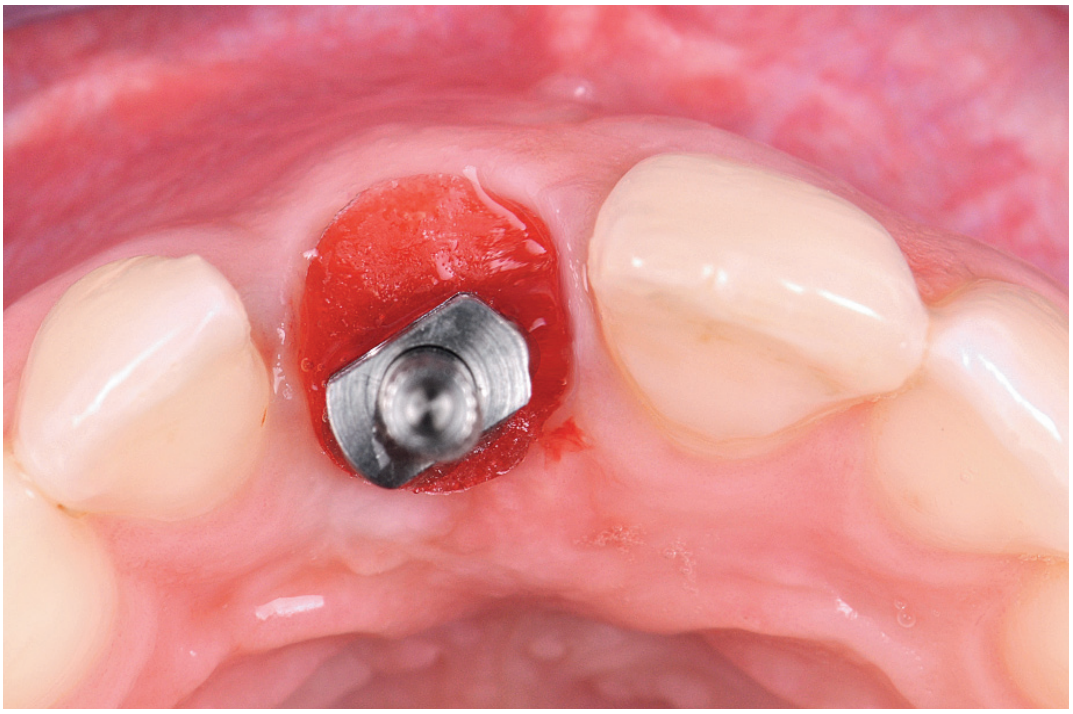

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INTRODUCTION

Due to its location, the anterior region represents a major esthetic challenge to implant placement. The objective is to restore an ideal and symmetric dentogingival composition to the contralateral teeth. Establishing a presurgical prosthetic project is necessary to compare the situation of the future implant with the volume of existing tissue[1,2] **(Fig. 1 a and b)**. In some clinical situation, this implies the reconstruction of the bone and gingival environment **(Fig. 2 a and b)**. Moreover, the placement of the implant, defined by its impact point, axis, and depth, is an element that will have a significant effect on the final result. Hence, many authors have defined this ideal placement[3,4]. The impact point is located opposite the cingulum of the future anterior tooth. The axis must emerge on the palatal side of the tooth. Finally, the implant plate must be 4 mm below the ideal gingival edge of the tooth. An incorrectly placed implant will result in a tissue reorganization of its biological space in the short or medium term. Following the bone reorganization, the soft tissues will reposition themselves and be most often responsible for vestibular recessions and loss of interdental papillae[5]. This specific implant placement in the maxillary anterior region, and notably the need for an emergence on the palatal side, sometimes makes its inclusion in the bone anatomy of the premaxillary bone difficult. In fact, in this position, the apex of the implant is adjacent to the external cortex, thereby increasing the risk of fenestration and the complications this implies **(Fig. 3)**.

AXIS ADAPTATION SOLUTIONS FOR A SCREW-RETAINED SINGLE-UNIT TOOTH

The introduction to the market of new adjustment solutions opens up new perspectives, both for permanent and temporary prostheses. These new solutions also allow a change of paradigm in the placement of anterior implants, while assuring better adaptation to the maxillary bone anatomy.

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Fig. 1 a and b Initial situation, following an injury with a marked horizontal bone defect.

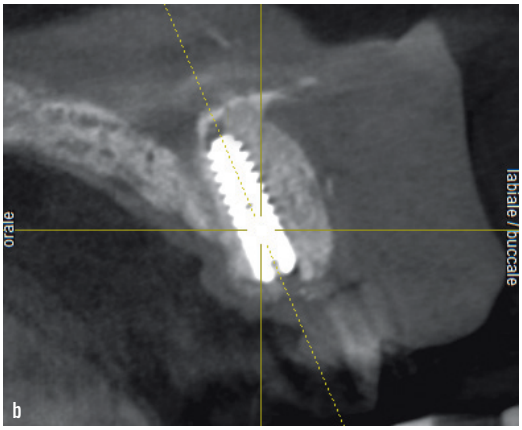

Fig. 2 a and b Placement of the implant (Anthogyr PX 3.4 X10) and performance of guided bone regeneration (GBR). Radiographic follow up 6 months postoperatively.

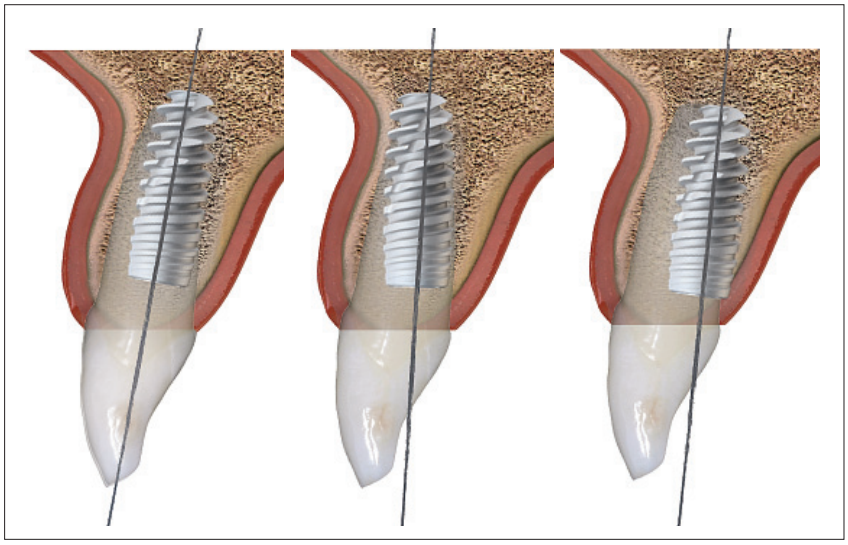

Fig. 3 Different options of implant positioning in the anterior region without axis adjustment. Position A respects the anatomy, but it emerges in the free edge, position B has an ideal cingular emergence, but it brings the apex of the implant very close to the external cortical bone, and position C significantly reduces the palatal bone thickness at the neck.

The major axis of a central incisor goes through its apex and its free edge. Its position and intrabone orientation depend on the skeletal class of the patient and the patient's periodontal biotype. Hence, an Angle Class II relationship makes implantation in the maxillary anterior region easier, thanks to a more vertical orientation of the alveolar bone volume; it is also easier to obtain an emergence on the palatal side of the tooth. Conversely, a Class III relationship, due to the natural anterior projection of the alveolar process, considerably increases the risk of apical perforation of the external cortex during implant drilling[6,7]. The use of temporary and permanent prosthetic parts to adjust the axis allows the access channels to be moved to the palatal side of the tooth. At the same time, this allows for the preservation of the esthetic results, and integrates the prosthesis and implant in the natural anatomy of the tooth it replaces, hence in its alveolar bone volume **(Fig. 4)**.

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As a result, this prosthetic innovation allows greater flexibility in implant placement by considerably reducing the risks of apical fenestration of the external cortical bone of the maxilla.

This new technical development makes the free edge the new ideal emergence reference for the axis of implants in the maxillary anterior region, as is the case with a natural tooth.

This paradigm change in implant placement considerably reduces the need for bone arrangements of the premaxillary by better adapting to the anatomy of the tooth and its bone environment.

However, it is essential for the implant axis not to emerge past the free edge, by tilting on the vestibular side. In the short term, this may result in the appearance of a gingival recession, the cause of which would be linked to suppression due to the size of the prosthetic parts in the transgingival area. The axis adjustment systems that use cardan screwdrivers allow a major move in the crown portion of the tooth and entail hardly any change nearer the neck of the implant in the transgingival area. Thus, the free edge becomes the new reference in order to remain in the general volume of the tooth to be replaced, including its transgingival portion.

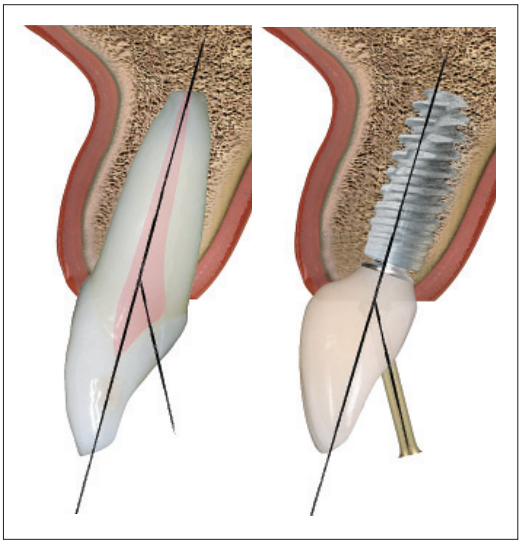

Fig. 4 Axis adjustment allows an ideal placement of the implant in the bone anatomy, while allowing an access in the cingulum in order to preserve the appearance of the vestibular area.

USE OF SCREW-RETAINED TEMPORARY PARTS

Whether during the activation of an implant placed in two surgical sessions or during an immediate implantation extraction protocol, timing is a key factor in obtaining an anatomical gingival cavity. Similarly, the provision of sutured connective tissue in the vestibular area is essential in these protocols on the anterior teeth **(Fig. 5 a and b)**. Through the dynamics of healing, the temporary tooth will guide the soft tissue shaping. The use of angulated (10, 15, and 25 degrees) temporary parts allows the same axis adjustments on the temporary tooth as those allowed by computer-aided design/computer-aided manufacturing (CAD/CAM) on the permanent tooth **(Fig. 6)**. Hence, it is possible to have an implant axis that goes through the free edge of the tooth while at the same time ensuring its access in the cingulum **(Fig. 7)**.

Fig. 5 a and b Gingival development by tunnelling of a connective graft of tuberous origin.

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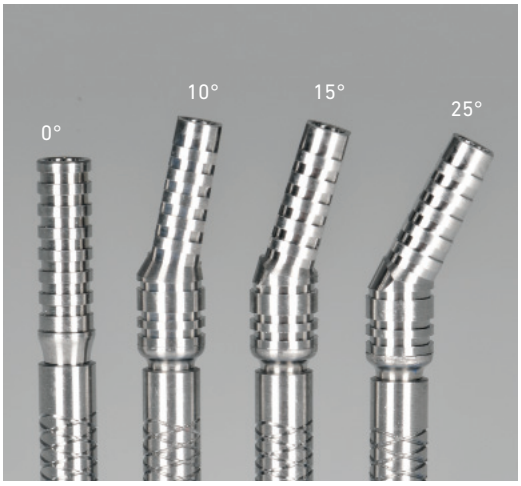

Fig. 6 Temporary angulated AxIN part, 0, 10, 15, and 25 degrees on its base.

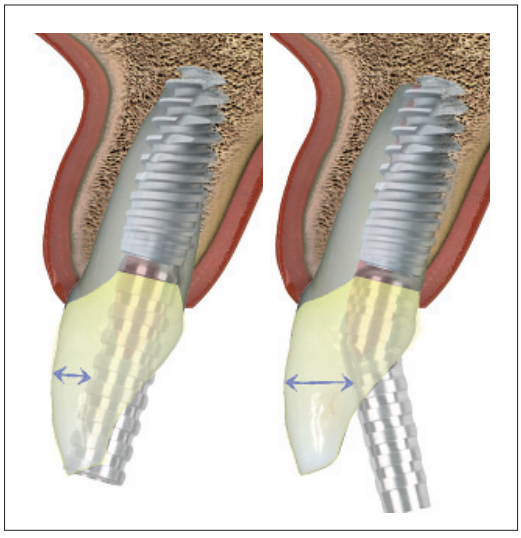

Fig. 7 The temporary angulated AxIN solution allows a cingular access when the implant is integrated in the natural anatomy and bone cavity of the tooth it replaces.

The advantage is two-fold: esthetically, the vestibular side of the tooth is preserved; and anatomically, the implant is integrated in the bone cavity **(Fig. 8 a and b)**.

This component (AxIN, Anthogyr) consists of three parts: a base, a screw, and a temporary crown/coping, with the axis adjustable at various angulations (10, 15, and 25 degrees).

The innovative aspect of this system is that the screw is inserted in the base prior to placing the temporary titanium crown/coping over it. This approach has the major advantage of reducing the diameter of the lumen of the part to that of the screwdriver. Indeed, as the screw no longer passes through the cap, it does not need a curved channel that would require a wider diameter[8]. Here, the channel is practically cylindrical, with a small opening, which considerably contains its volume on the palatal side and facilitates functional adjustments.

As the base is indexed in the implant connector, it is essential to orientate the latter correctly when placing the implant. For the Anthogyr system, one of the three sides of the implant platform trilobe must be in the vestibular area. The second characteristic of this system is that the base is available in different heights and diameters.

The choice of height (1 or 2 mm) allows, at certain depths, the flat joint to be kept between the temporary part and the base, away from the bone. At the same time, the choice of diameter (4 or 5 mm) for the base improves its adaptation to the size of the tooth to be replaced.

The temporary restoration will therefore be performed directly in the chair by solidifying a resin tooth with the temporary part. This direct technique has two advantages: first, it allows an ideal placement of the tooth with reference to facial esthetics; second, and most importantly, it

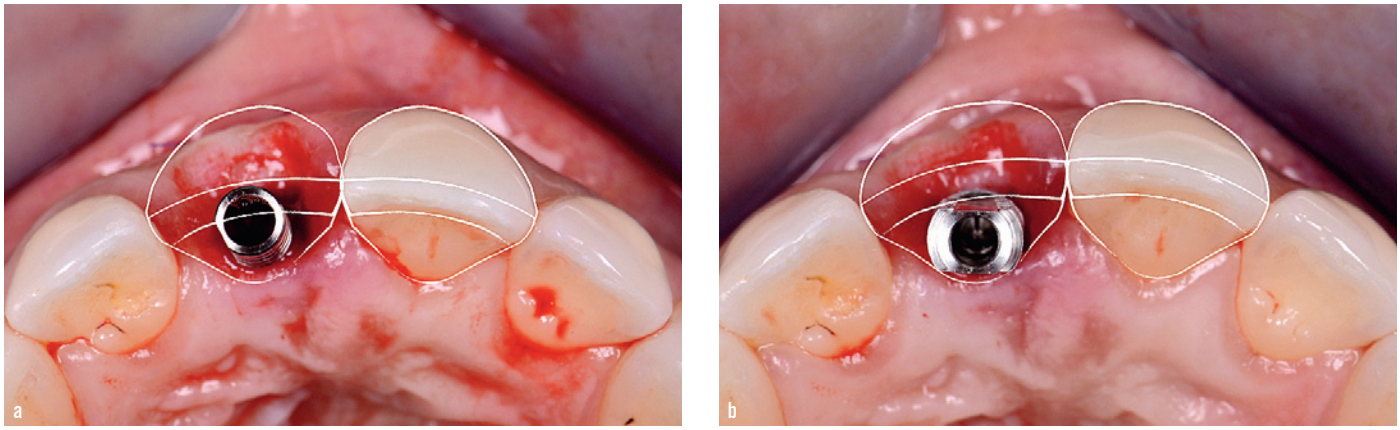

Fig. 8 a and b Clinical comparison of a straight temporary part emerging in the free edge of the tooth, and of a temporary AxIN component angulated at 10 degrees that leads the emergence to the cingulum.

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allows the shape of the transgingival contour to be tested around the temporary restoration. The transgingival design of the temporary restoration has the dual purpose of preserving the gingival architecture present in the case of extraction implantation and immediate esthetic use, while at the same time guiding the soft tissue healing during prosthetic use. The concave shape in the vestibular area will stabilize the cervical area with minimal compression, and the proximal convex areas will support the interdental papillae[9] **(Fig. 9)**.

This axis adjustment solution (AxIN, Anthogyr) on the temporary prosthesis includes all these advantages: screw retention (no cement), axis correction (0 to 25 degrees), choice of base height, and diameter. Moreover, as the retention between the cap and the base is purely mechanical, no cytotoxic adhesive will be used in the subgingival area. After adopting this approach and allowing 2 months of tissue stabilization, a practically ideal repositioning of the soft tissues around the temporary restoration is often observed **(Fig. 10 a and b)**.

Fig. 9 Temporary restoration with AxIN at 10 degrees on its titanium base. Work of the transgingival emergence profile on the shapes of the edge of the temporary restoration that will ensure a perfect placement of the gingival line.

Fig. 10 a and b Positive progress of tissue stabilization over two months of healing following the placement of the temporary restoration and gingival development.

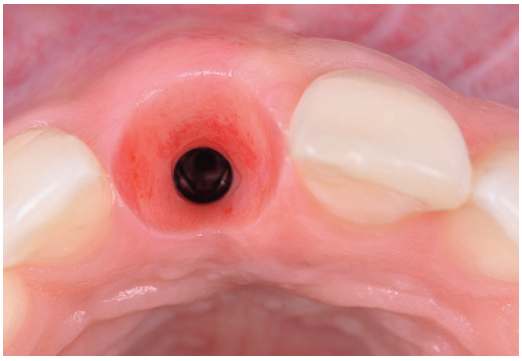

Fig. 11 Peri-implant gingival cavity.

PRODUCTION OF PERMANENT RESTORATION

At the end of tissue and bone stabilization, the permanent restoration can be produced. At the same time, the impression will allow the indexing of the implant position with the rest of the arch and record the transgingival profile shaped by the temporary restoration **(Fig. 11)**. Thanks to the customized coping technique, this information can be provided to the laboratory by moulding

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the shape of the transgingival profile of the temporary restoration[10] **(Fig. 12 a to c)**.

The customized coping perfectly supports the tissues and will provide a working model that reflects clinical reality **(Fig. 13 a to c)**. The model thus obtained will be scanned in the laboratory and the zirconia frame will be modelled. If the temporary restoration is satisfactory, a *cut-back*, starting from its external shape, will allow a more rapid design of the ideal frame to be obtained in order to ensure a perfect support for the ceramic of enamelling.

Fig. 12 a to c Production of a customised coping by moulding the shape of the transgingival contour of the temporary restoration.

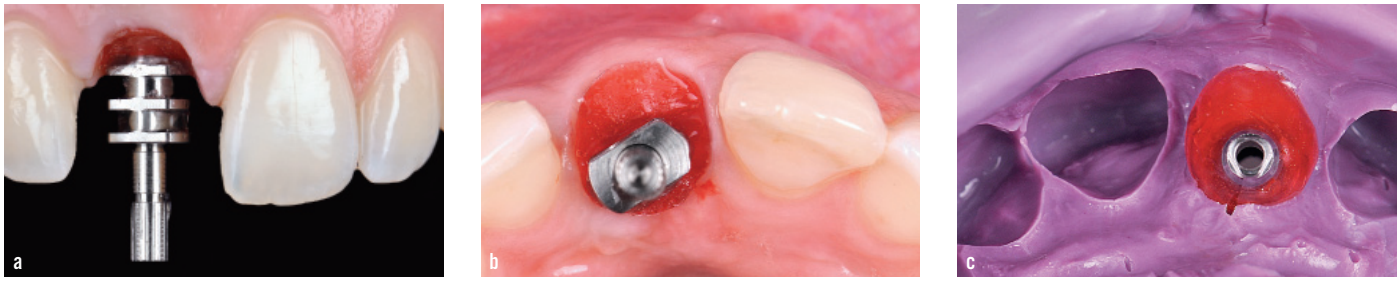

Fig. 13 a to c Clinical placement of the impression transfer and perfect soft tissue support.

Fig. 14 a to d Permanent restoration in ceramic layered on zirconia, assembled on AxIN titanium base. Special screw for axis correction.

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The screwdriver access point is placed optimally on the palatal side according to occlusal, mechanical, and esthetic constraints **(Fig. 14 a to d)**.

The axis can be adjusted here from 0 to 25 degrees, thanks to CAD/CAM technology (Siméda). As for the temporary restoration, the screw is inserted in the base before placing the ceramic coping on top.

This technique avoids creating a curved access channel that significantly destroys the ceramic to ensure the passage of the screw[11], as is the case with other systems.

This innovation thus allows the maximum ceramic preservation thanks to the screw retention lumen being reduced to a minimum, with major esthetic advantages. The presence of more coping material decreases the vestibular zirconia layer to a minimum, leaving more room for cosmetic ceramic layering in order to optimize esthetic results **(Fig. 15)**.

In the anterior sector, zirconia is the material of choice due to its high mechanical strength. Additionally, the choice of a multilayer colored zirconia ensures optimal esthetic results thanks to its degree of translucence.

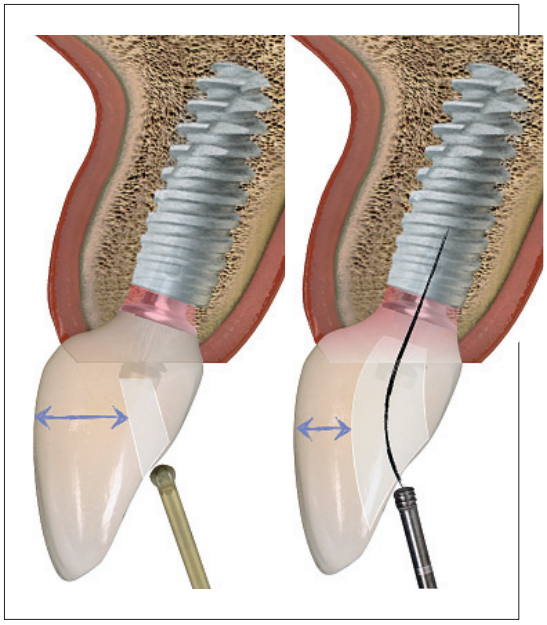


Fig. 15 Illustration of the key differences in the design of two options of axis adjustment. The AxIN system on the left allows, among others, a preservation of material that ensures more room for layering in the vestibular area, and better esthetic results.

The communication of esthetic data with the laboratory occurs via intra- and extraoral photographs and the marking of the model with the Ditramax system[12] **(Fig. 16 a and b)**. The shade is taken with both a conventional and digital method directly by the ceramist **(Fig. 17 a and b)**.

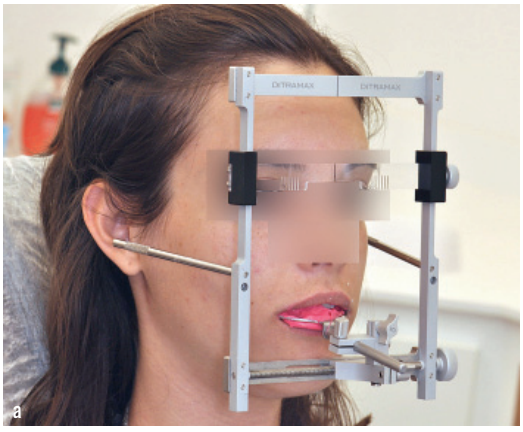
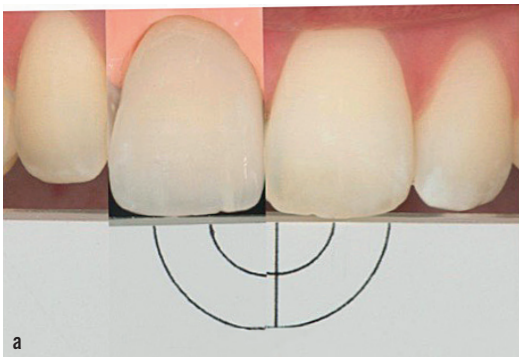


Fig. 16 a and b Thanks to recording with the Ditramax system, the working model is directly marked by the esthetic reference axes. Thus, the ceramist has a viewer to optimize esthetic integration.



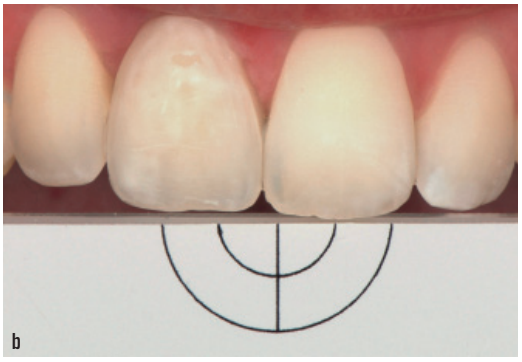


Fig. 17 a and b Digital shade recording thanks to the eLAB calibration protocol.

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Fig. 18 a and b Clinical view of the permanent restoration.

However, only layering allows the perfect reproduction of the shapes and colors of the adjacent teeth to ensure optimal biologic, esthetic, and functional results **(Fig. 18 a and b)**. These latest advances in axis adjustment have made cemented designs obsolete.

CONCLUSION

Permanent innovation in implantology has ensured optimal results beyond simple prosthetic evolution, introducing a paradigm change for anterior implant placement ready to be adopted to meet anatomical and biologic needs.

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