

## CLINICAL ARTICLE

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# Copy-paste concept: Full digital approach in the management of gingival emergence profiles

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## Abstract

**Objective:** Obtaining a perfect integration of a prosthetic rehabilitation on natural teeth and implantys in the esthetic zone requires a deep knowledge of the biological processes and a clear understanding of the characteristics of the restorative materials. Once the soft tissue profile has been created with the placement of a temporary prosthesis, the ability to accurately transfer information about the tissue profile and the contour of the restoration for the fabrication of the definitive crowns can be challenging.

**Clinical Significance:** This paper illustrate the copy paste full digital workflow, a simple protocol that allows to create definitive restorations by making an exact copy of the temporary prosthesis that has been placed in function in the patient's mouth.

## KEYWORDS

digital quality control, digital workflow, emergence profile, intraoral scanning, restorative digital plan

## 1 | INTRODUCTION

The natural integration between the prosthetic restoration and the periodontal or peri-implant soft tissue has a key role in determine the esthetic result of the dental treatment. The creation of an harmonious profile of the restoration that contour the soft tissue around teeth and implants is of paramount importance for the final success, in particular in the esthetic area.<sup>1,2</sup>

The restorative dentist dedicates particular attention to the fabrication of the temporary prosthesis with the purpose of preserving, supporting, and sculpting the soft tissue while maintaining tissue health.<sup>3,4</sup> Once the soft tissue contour has been established and the ideal profile of the restoration has been identified, the critical part is the accurate transfer of those information to the dental technician.<sup>5,6</sup>

For many years, conventional impression techniques using elastomeric impression materials (polyvinylsiloxanes and polyethers) have been used in fixed prosthodontics for dental implants and natural teeth.<sup>7</sup>

On natural dentition, retraction cords or retraction paste have been placed into the sulcus to horizontally and vertically displace the marginal gingiva and allow the impression material to register

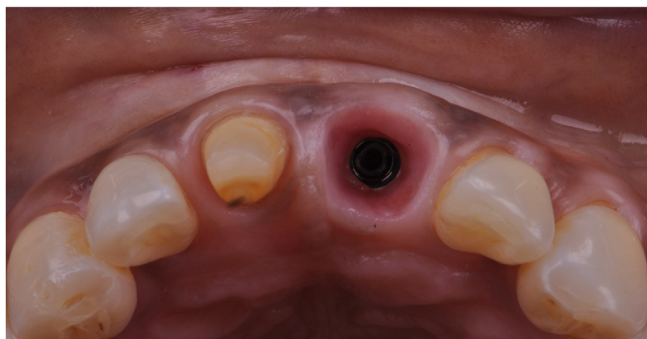
the entire finish line of the tooth preparation. In implant dentistry, in order to prevent the natural collapse of the peri-implant mucosa after removing the temporary restoration, impression copings have been customized intra-orally or extra-orally and used with an open or close tray technique.<sup>8</sup>

In the last decade digital technologies have radically changed the way we routinely practice dentistry and new tools such as intra-oral scanners, 3D printers, and milling machines are often present in our practices.<sup>9</sup> Evolution in the dental industry has allow to significantly improve trueness and precision of intra-oral scans and the accuracy of printed models to such a level that full digital workflows are commonly used to fabricate definitive restorations on teeth and implants.<sup>10</sup>

The purpose of this paper was to describe full digital workflows to transfer the definitive emergence profile and angle for fixed restoration on dental implants and natural teeth.

## 2 | CLINICAL TECHNIQUE

The copy-paste full digital workflow in implant prosthesis.



**FIGURE 1** Occlusal view highlighting the periodontal and peri-implant soft tissue of the maxillary central incisors.

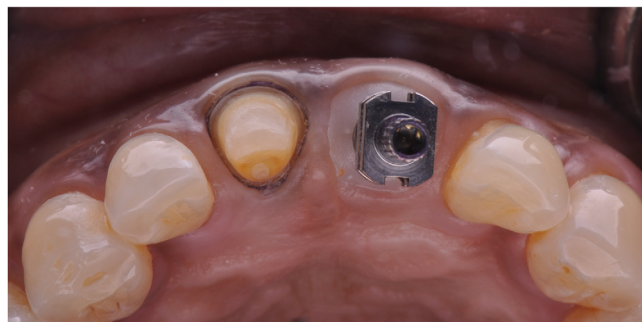


**FIGURE 3** Occlusal view of the final prostheses. Note the profiles of the restorations that contour the soft tissue.



**FIGURE 5** A partial extraction therapy approach was performed. The root was sectioned mesio-distally and a C-shape fragment of dentin was left facing the buccal site of the socket to maintain the supracrestal attached tissue. The coronal margin of the fragment was reduced until reaching the level of the facial bone crest.

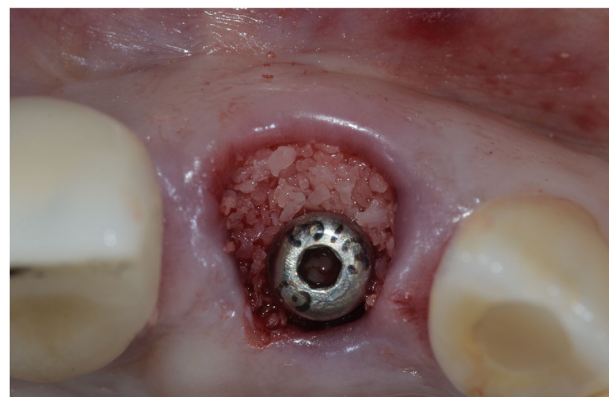
A detailed treatment planning, precise 3D position of the implant and adequate soft tissue volume facilitate the achievement of a final natural esthetics.<sup>11</sup> A screw retained temporary prosthesis is commonly used to support and condition the soft tissues by generating an emergence profile that replicates and mimics the tissue architecture of the adjacent dentition.<sup>12</sup>



**FIGURE 2** On the natural tooth a #000 retraction cord has been placed into the sulcus to horizontally and vertically displace the marginal gingiva, whether on the implant site an open tray impression coping has been customized extra-orally to support the peri-implant mucosa.



**FIGURE 4** Maxillary left central incisor broken at gum line and judged non-restorable due to a palatal fracture.



**FIGURE 6** A tall and narrow healing abutment was placed and the marginal gap was filled with small-particle bone graft. The dual-zone bone grafting (i.e., placement of the bone graft in the gap between the implant and the labial bone plate, as well as in the zone above the implant-abutment junction) provides support and volume to the hard and soft tissues

Significant amount of time is often required to optimize the morphology of the temporary restoration and waiting for tissue maturation, managing the critical and subcritical contour by adding or

trimming the acrylic material.<sup>13</sup> In order to fabricate the definitive restoration, all the information related to the prosthetic volume, the outline of the soft tissue and the clearance with the opposing arch need to be accurately transferred to the dental technician.<sup>10-14</sup>

One of the most popular technique included the use of a custom impression coping that will be embedded in a conventional impression taken with elastomeric materials.<sup>15</sup>

Afterwards, impression of the same arch with the restoration in place and the impression of the opposing dentition were taken (Figures 1-3).

The copy-paste full digital workflow allows to get those clinical information through the registration of six intraoral scans (Figures 4-10):

1. Scan of the arch with the temporary prosthesis in place
2. Scan of the opposing arch



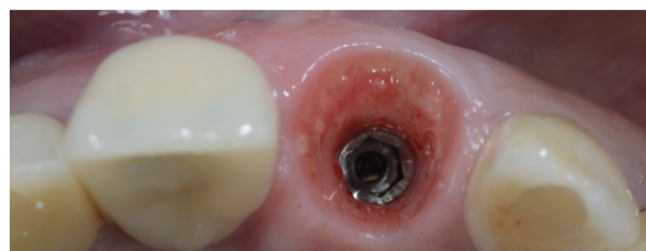
**FIGURE 7** Profile views of the screw-retained temporary prosthesis placed the day of surgery. The peri-implant tissue is adequately supported and it is in harmony with the soft tissue of the adjacent teeth

3. Bite scan in maximum intercuspation
4. Scan of the arch without the temporary prosthesis
5. Scan of the scan body in high definition
6. Scan of the temporary restoration connected to an analogue chair-side

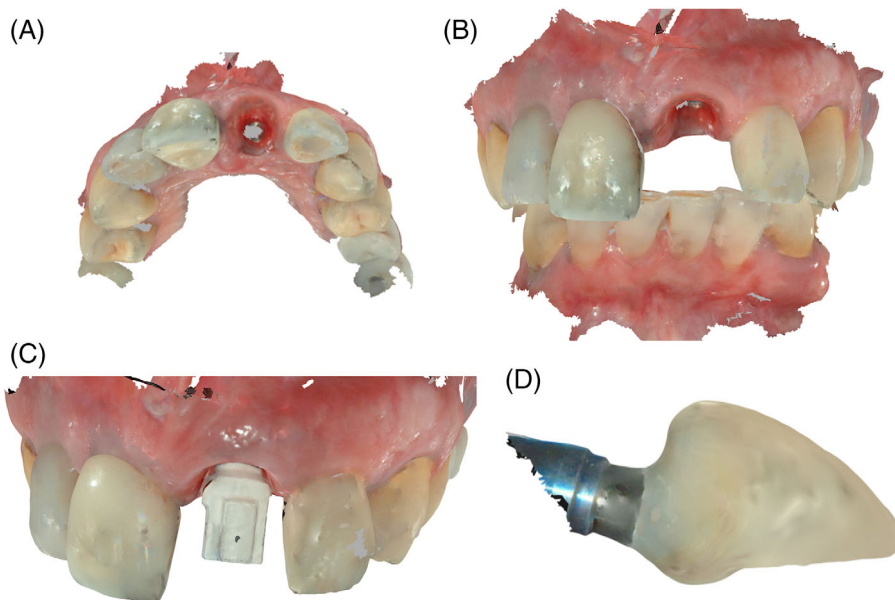
Scanning the arch without the temporary restoration in place do not provide accurate registration of the emergence profile due to the collapse of the soft tissue, but it is used to give information about the contact points of the adjacent teeth. The chair-side scan of the temporary restoration, on the other hand, allows to capture the subgingival component of the tissue outline. A CAD software combines all the scans and it generates a high-precision virtual model where the dental technician can identify the real profile of the soft tissue. If needed, a 3D printed model with removable gingival tissue can be fabricated and it can assist the technician during porcelain layering and finishing stages.

The copy-paste full digital workflow in natural dentition.

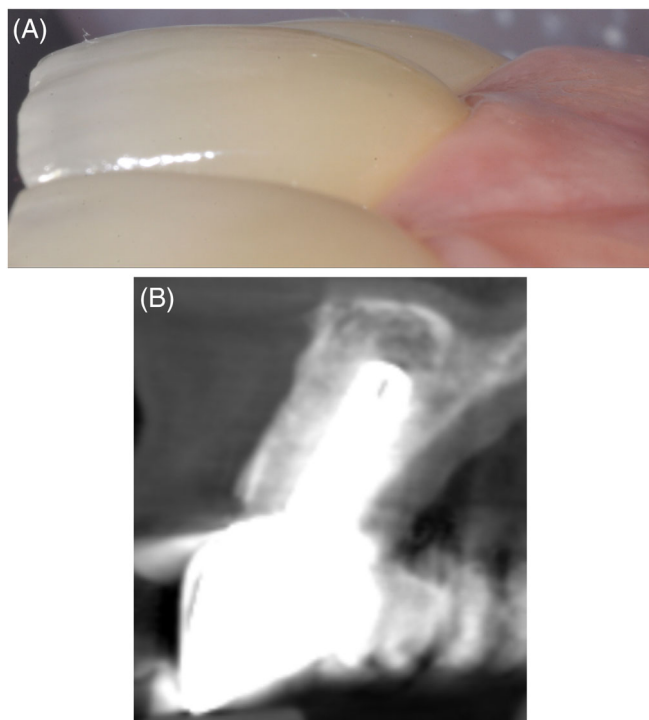
If one of the main aspect of fabricating implant prosthesis is the ability to transfer the tri-dimensional position of the implant and the orientation of the connection, the impression of natural dentition



**FIGURE 9** Occlusal view of the peri-implant soft tissue 5 months after the surgery. Note the excellent preservation of tissue volume and the proper balance between white and pink esthetics



**FIGURE 8** (a-d) Four of the six intra-oral scans (scan of the soft tissue, bite scan, scan with the scan body and extra-oral scan of the temporary prosthesis) that are included in the copy-paste full digital workflow for implant prosthesis



**FIGURE 10** (a) Lateral view of the definitive prosthesis, showing the transition between the peri-implant soft tissue and the screw-retained zirconia crown (master ceramist Simone Maffei). (b) The CBCT taken 24 months after the surgery demonstrating the stability of the hard tissue

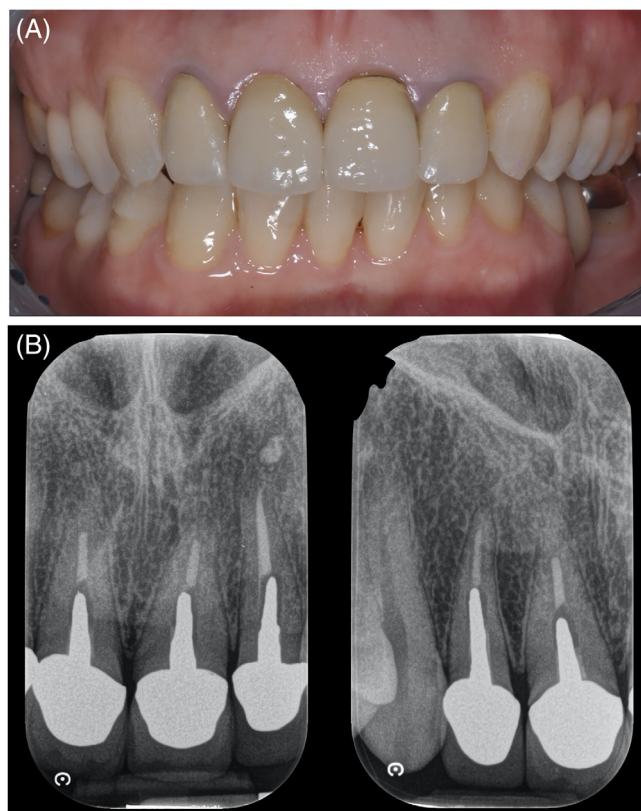


**FIGURE 12** Each tooth received endodontic re-treatment, glass fiber post and composite direct core build up. The four abutments have been prepared with a vertical finish line and a temporary restoration have been placed

must register clearly the finish line of the teeth preparation. Mechanical means consisting of retraction cords and paste can be used to displace the soft tissue and allow the impression material or the light of an intra-oral scanner to capture the entire surfaces of the prepared teeth.<sup>16</sup>

The copy-paste full digital workflow on natural dentition consists of five different scans (Figures 11–20):

1. Scan of the arch with the temporary prosthesis in place
2. Scan of the opposing arch
3. Bite scan in maximum intercuspation



**FIGURE 11** (a) A 41-year-old female patient presented at the first visit complaining about the esthetic of four metal-ceramic restorations, with discolorations at the gingival margin, altered tooth proportions and soft tissue asymmetries. (b) The peri-apical radiographs evidenced metal post and inadequate endodontic treatments

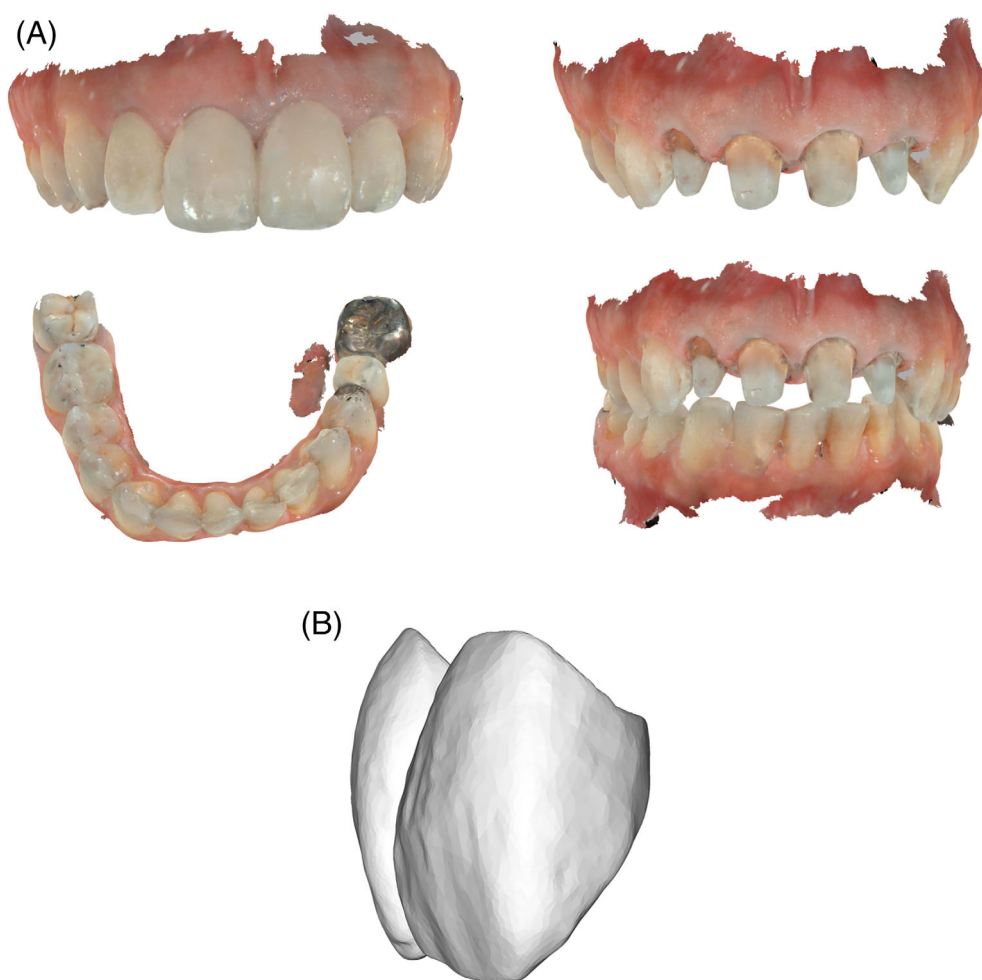


**FIGURE 13** After the soft tissue maturation, the gingival phenotype was mapped with a periodontal probe to decide which diameter of retraction cord to use. Retraction cord #000 was placed first, followed by a #00 cord. The use of intra-oral scanner allows to register the impression of one tooth at the time, thus allowing to keep the retraction cord around the adjacent teeth until the last moment.

4. Scan of the teeth abutments
5. Scan of the temporary restoration chair-side

The dental technician will align the different files and recreate in a virtual environment (the CAD software) the clinical scenario that

**FIGURE 14** (a, b) The copy–paste full digital workflow on natural dentition includes five intra-oral scans (a) and one extra-oral scan of the existing temporary prosthesis (b). The extra-oral scan of the provisional crowns allows to register the supra gingival and sub gingival components of the restorations, capturing the profile of the crowns that have supported the soft tissue.



includes the soft tissue profile, the shape of the temporary restoration and the morphology of the abutments. Moreover, by setting different values of transparencies, he is able to visualize the position and the extension of the margins of the temporary prosthesis in relation to the gingival margin and the sulcus.

The definitive restoration is designed as an exact copy of the temporary prosthesis and it will contain all the information that have been tested clinically in terms of tissue support, esthetics, phonetics, and function.

### 3 | DISCUSSION

Nowadays, achieving and maintaining an harmonic soft tissue architecture and tissue stability in the long-term is of paramount importance for the esthetic outcome. The outline or the emergence profile of the restoration determines the natural transition between the prosthesis and the soft tissue with the purpose of achieving a natural integration between the white esthetics with the pink esthetics.<sup>17,18</sup>

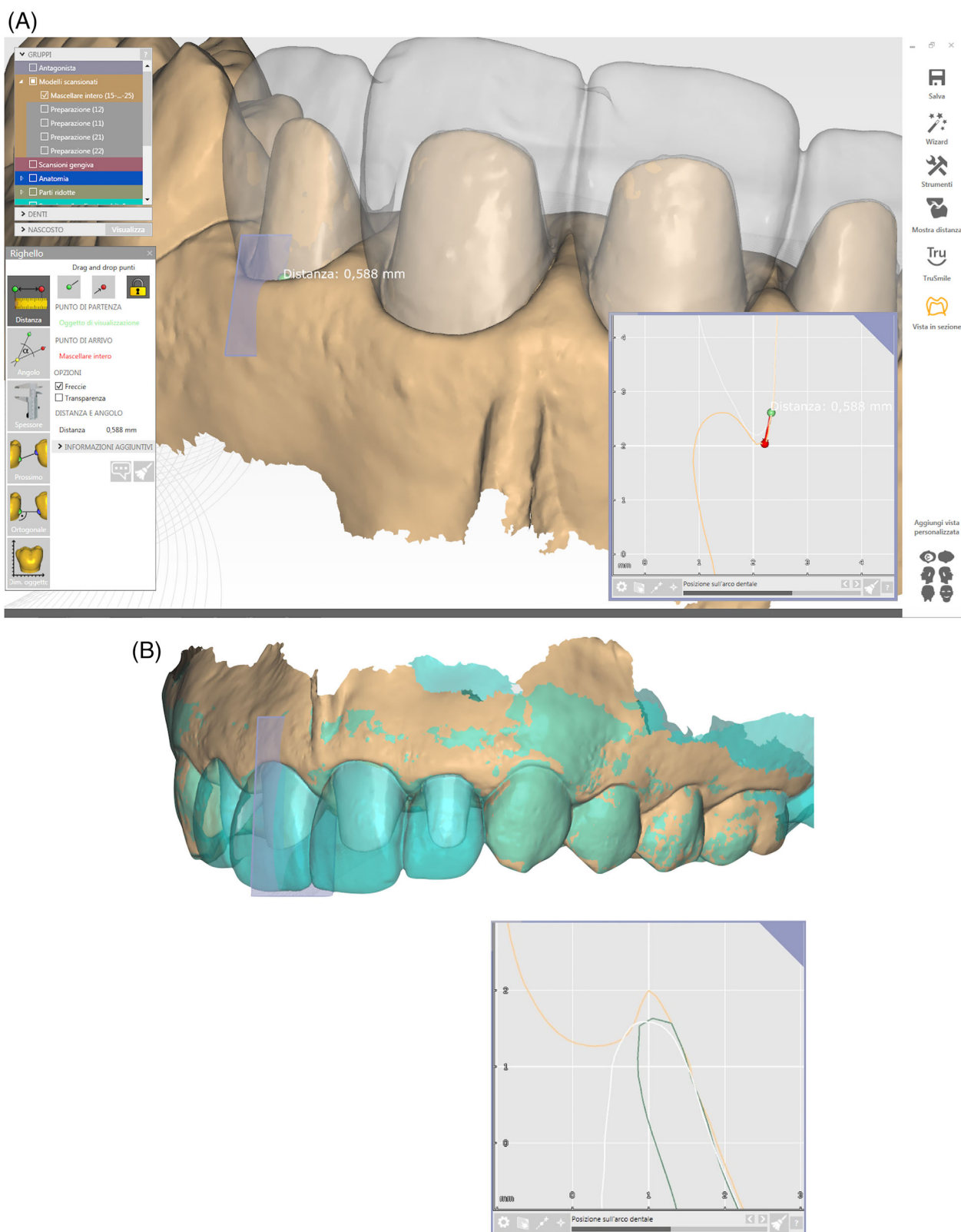
In restorative dentistry, the function of the temporary prosthesis is not only to protect the teeth during the phases that precede the manufacturing and delivery of the final prosthesis. The

temporary is used as a test drive to restore dento-facial esthetics and it must guarantee proper phonetics, tissue health and adequate masticatory function. Only when the temporary prosthesis has fulfilled all its functions is it possible to fabricate the definitive restoration, which in the ideal conditions should be the exact copy of the provisional, with the exception of the material with which it is made.<sup>19</sup>

The fundamental step in this process is the accurate transfer of all the information contained in the provisional to the dental technician. In this regards, digital technologies have radically changed the way we do dentistry, bringing several advantages for the clinician and the patient.<sup>20</sup>

The IOS can improve the communication between the dentist and the technician, eliminating stone models and reducing working time. Moreover, taking an intra-oral scan is faster than a conventional impression, resulting in improved patient comfort and experience.<sup>10,21</sup> Clinical studies and systematic reviews have also demonstrated that IOS are able to provide reliable outcomes when restoring natural teeth and dental implants.<sup>22</sup>

Despite the aforementioned advantages offered by digital dentistry, clinician should have the ability to formulate a correct treatment plan, to pursue precision in teeth preparation or in implant placement and have a clear understanding of the



**FIGURE 15** (a) After aligning the five scans into a CAD software and setting different level of transparencies, the dental technician is able to visualize the profiles of the soft tissue and the abutment (yellow line) and their relation with the temporary prosthesis (white line). It is also possible to measure the extension of the provisional crown inside the sulcus. (b) A different cross section showing the profile of the zirconia core (green line). Thanks to the copy–paste technique, the technician knows exactly where to extend the finish line of the zirconia crown in the apico-coronal direction as well as the thickness of the restoration in the sub-gingival and supra-gingival compartments.



**FIGURE 16** (a, b) During the framework try-in appointment the dentist checks the fit and the marginal accuracy of the zirconia core with the use of silicone paste. It is also possible to verify the occlusion of the monolithic portion against the opposing dentition

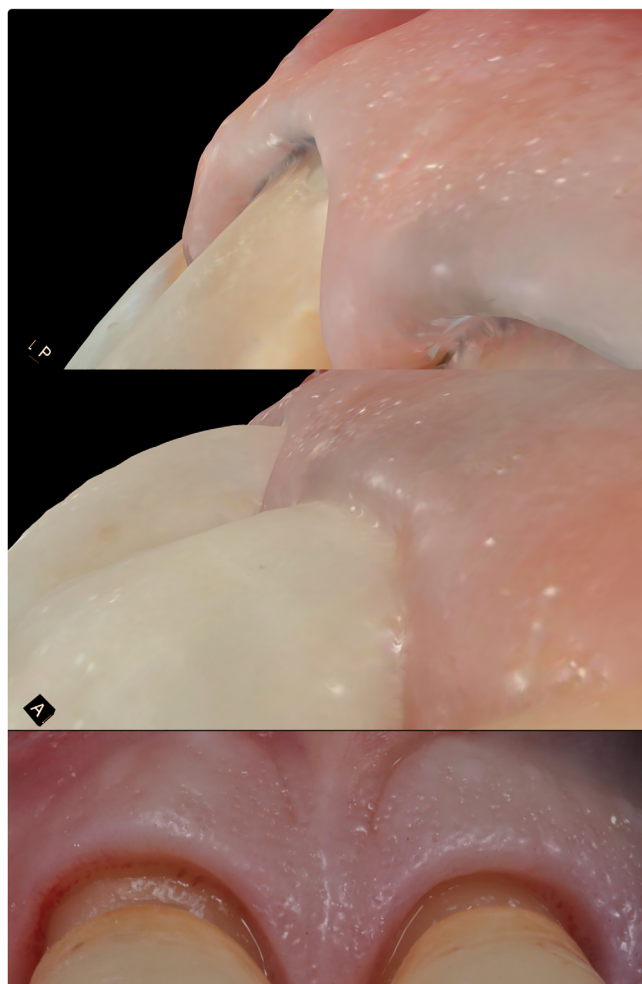


**FIGURE 18** Frontal view of the four veneered zirconia crowns

biological principles and the characteristics of the restorative materials.<sup>23</sup>

Soft tissue management using temporary prosthesis has always been an artisan process that involved a fair amount of chair time and manual skills.<sup>24</sup> Before digital workflows were available, replicating the subgingival contour of the temporary prosthesis into the final restoration through a conventional workflows was associated with a variable degree of accuracy than relied on the quality of the impression and the ability of the dental technician to read that impression. The position of the gingival margin captured by the impression did not correspond to the real position of the tissue because of the displacement produced by the retraction cords. This implies that, in the traditional workflow for feather edge preparation, the clinician should always check the framework to identify any excessive compression of the prosthetic margins into the gingival sulcus.<sup>25</sup>

Using the copy-paste full digital workflow, the technician does not have to arbitrarily decide the emergence profile of the restoration or where to place its margins in apico-coronal direction (particularly with feather edge preparation), because by superimposing the different files and playing with the transparencies, he is able to visualize the volume occupied by the temporary prosthesis as well as the position of the soft tissue. At this point, the design of a zirconia core or a monolithic restoration is straightforward.



**FIGURE 17** Soft tissue profile the day of the impression, with the temporary prosthesis in place and before delivering the definitive crowns. Not the stable contour of the soft tissue



**FIGURE 19** Peri-apical radiograph taken at 1 year recall



**FIGURE 20** Detail of tissue stability 3 years after cementation (master ceramist Luca Dondi)

## 4 | CONCLUSIONS

The copy-paste full digital workflow simplifies the fabrication of the definitive prosthesis, allowing a precise replica of the emergence profile and angle of the temporary prosthesis. The dental technician can simply copy the morphology of the temporary prosthesis and the subgingival contour that has been established by the dentist and he will be able to fabricate a definitive prosthesis in few steps.

## PATIENT CONSENT

All treated patients signed an informed consent to their treatments.

## DISCLOSURE

Authors disclose that this article is based on private practice clinical experience and no company supported the project.

## DATA AVAILABILITY STATEMENT

The data sets used and analyzed during the current study are available from the corresponding author on reasonable request.

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