Editorial

To *accuracy...* and beyond!

Dr. Jerome **Lipowicz**

DDS, PhD

- Doctor of Dental Surgery at Université Paris VII
- Post-graduate Legal Medicine, Université Paris V
- Post-graduate Implantology, Université Paris V
- Post-graduate Esthetic Dentistry, Université Strasbourg
- French Guided Surgery Academy, President
- International College of Dentists, Fellow
- Digital Dentistry Society, Board of Directors
- Active member of many international organisations.
- Founder of Eugenol.com and Eugenol.us

DEAR FRIENDS AND COLLEAGUES,
The full rehabilitation of edentulous pThe full rehabilitation of edentulous patients continues to be a challenge. Consensus has remained fickle for decades due to the significant difficulties still arising, both from a therapeutic point of view for patients and from a technical point of view for practitioners and dental technicians. The digital revolution has not spared this area of dentistry, and implantology is, of course, one of the disciplines that is benefiting hugely from technological and computing advances.

I will not be the last editorial writer to remind readers of the memory of Per-Ingvar Brånemark: the primary goal of his scientific and humanist approach to modern implantology was the treatment of completely edentulous patients, and his first patient was treated almost 60 years ago, shortly after the discovery of osseointegration, another revolution that extends beyond simple oral medicine. This leads us to ask: what would have been the accomplishments of Prof. Brånemark if he had had at his disposal all the current digital tools, and what benefits would he have brought to his patients? Indeed, we can observe that this technology not only allows us to push the limits of the precision of our work but also puts itself at the service of biology, current knowledge of which requires greater predictability using planning. Finally, it improves the comfort of our patients, with less invasive, less painful and quicker procedures.

Of all these changes, one in particular has caught my attention. The quest for accuracy in taking implantology impressions is a true obsession, and many solutions have been proposed in the pages of DDS MAG and at global conferences held by our esteemed organisation. Photogrammetry is one such proposed solution. Used in the aeronautical industry to study aeroplane wing deformation, and in topography by land surveyors, it allows the exact positions of the implants to be measured with respect to one another and allows them to be positioned in a 3D space using photographs of optical targets placed on scanbodies taken by an extra-oral appliance that includes several cameras. In a few seconds, we can thus obtain a reliable, reproducible impression, used to design the most passive possible multi-unit restorations, for materials that can be demanding and mechanically have a low tolerance. Only the future will tell us whether intra-oral scanners will provide such performances to all practitioners, but in the meantime, one observes a very special interest in photogrammetry on the part of numerous industrial companies, especially those who have already developed this technology for other purposes such as dynamic navigation.

All these advances are truly exciting since they show that there is still some way to go. The Digital Dentistry Society, which is recognised internationally for its educational programmes and its clinical and fundamental research initiatives, is a key present-day scientific organisation trying to meet these challenges.

Therefore, please pencil the following dates in your diary. We cannot wait to meet you, our active members, and present to you our projects and results during the upcoming DDS International State of Art Meeting on October 18 and 19, 2024, in Florence, Italy.

Case Report

Full rehabilitation using digital All-on-X *therapy*: a case report

Dr. Jerome **Lipowicz**

DDS, PhD

- Doctor of Dental Surgery at Université Paris VII
- Post-graduate Legal Medicine, Université Paris V
- Post-graduate Implantology, Université Paris V
- Post-graduate Esthetic Dentistry, Université Strasbourg
- French Guided Surgery Academy, President
- International College of Dentists, Fellow
- Digital Dentistry Society, Board of Directors
- Active member of many international organisations.
- Founder of Eugenol.com and Eugenol.us

INTRODUCTION

#After a series of prosthetic failures, a 70-year-old woman presented to our dental practice for a comprehensive fixed prosthetic rehabilitation solution.

She had numerous residual teeth with an overdentured maxillary mobile prosthesis and a mandibular complete denture with two ball attachments on symphyseal implants (Fig. 1A-C).

After the removal of the maxillary roots containing the infection sites, integration of the cone-beam computed tomography (CBCT) data, intraoral impressions and current dentures respecting the vertical dimension (Fig. 2) allowed us to create an ideal wax-up as a basis for the implant treatment plan (Fig. 3).

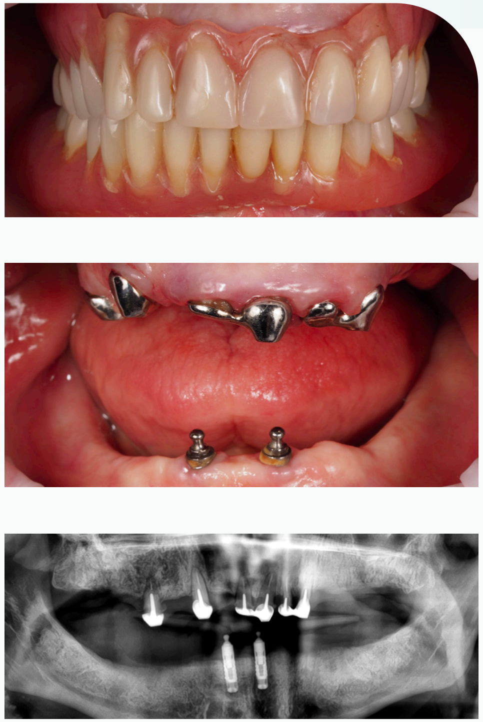

FIG. 1A-C *(A) Initial situation with dentures. (B) Initial situation with remaining teeth and implants. (C) Initial situation panoramic x-ray.*

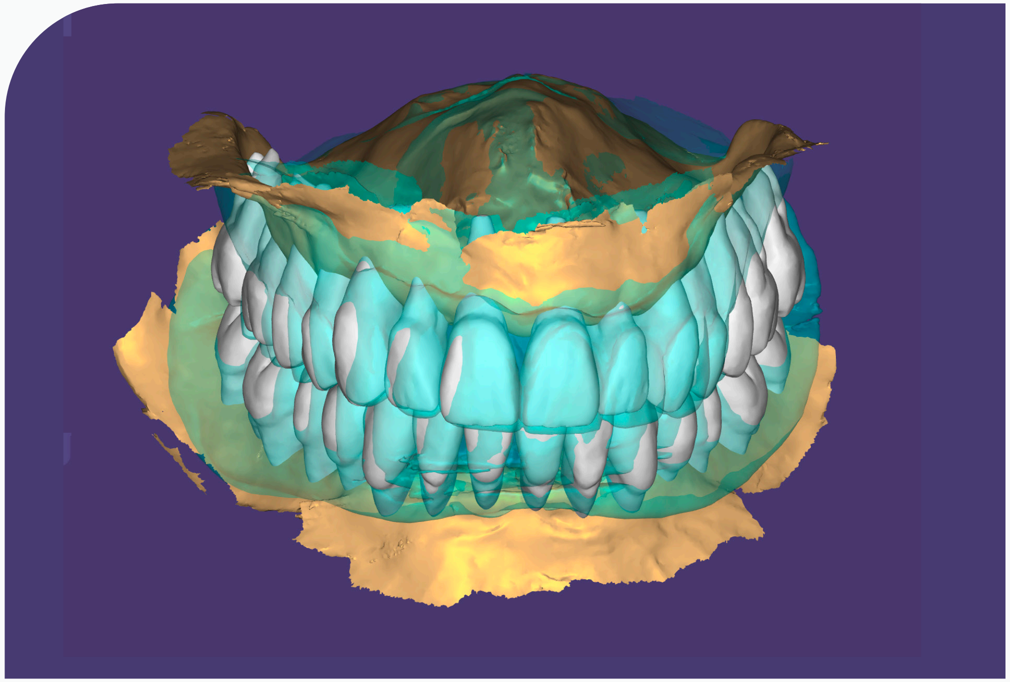

FIG. 2 *Ideal wax-up.*

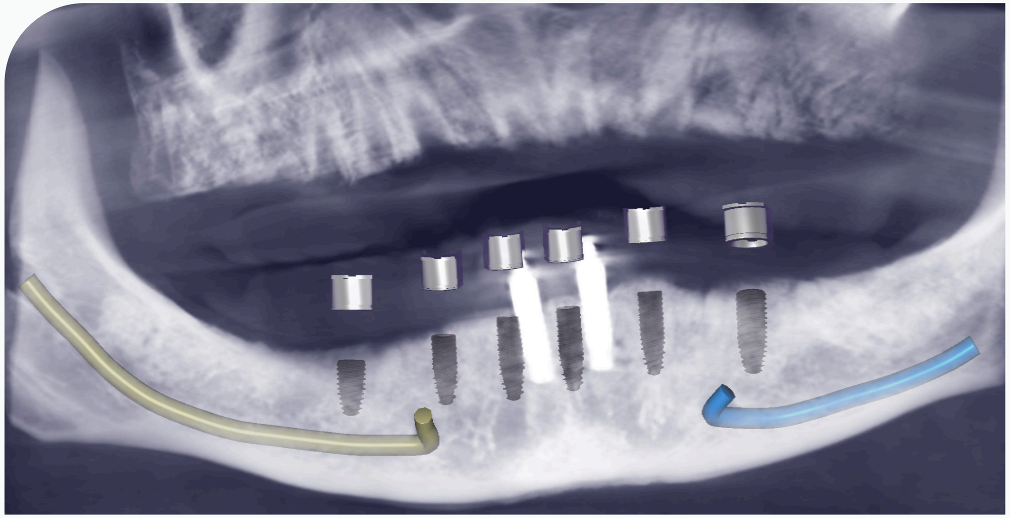

FIG. 3 *Mandibular implant planning.*

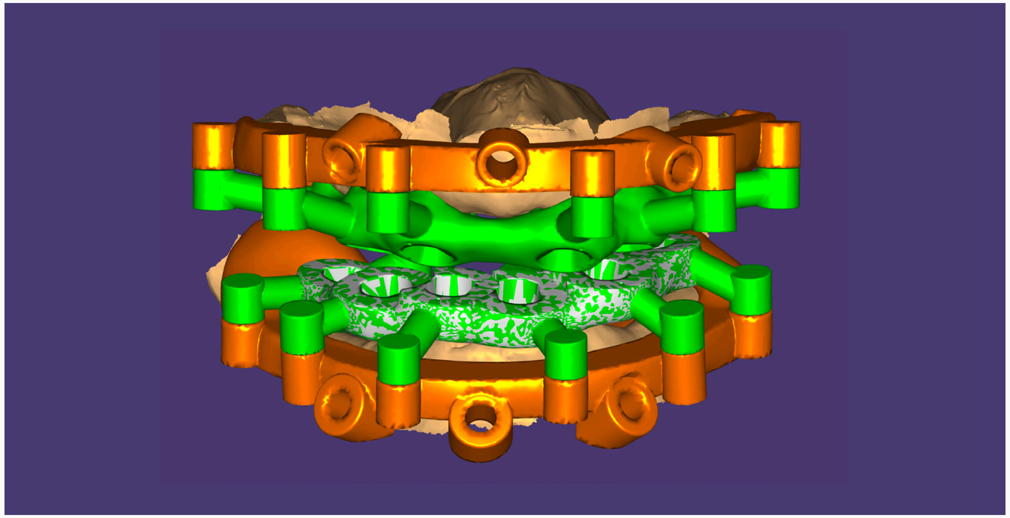

FIG. 4 *Stackable guide design.*

Since multi-unit restorations require the use of conical abutments, it was decided to use one-piece implants (Kontact MB, Biotech Dental, France), allowing standardisation with the choice of 4.6 multi-unit design. The surgical guides have a stackable design (Fig. 4) based on both magnets and male and female parts (dental technician: Joffrey Benon, Design4me, France). They are printed and consist of a base guide supported by pins (Fig. 5A), a positioning guide in contact with the antagonistic prosthetic arch (Fig. 5B), an implant positioning guide with metal sleeves (Fig. 5C), and a guide for controlling prosthetic emergencies, which many practitioners can use as a temporary bridge to be bonded directly in the mouth to abutments (Fig. 5D).

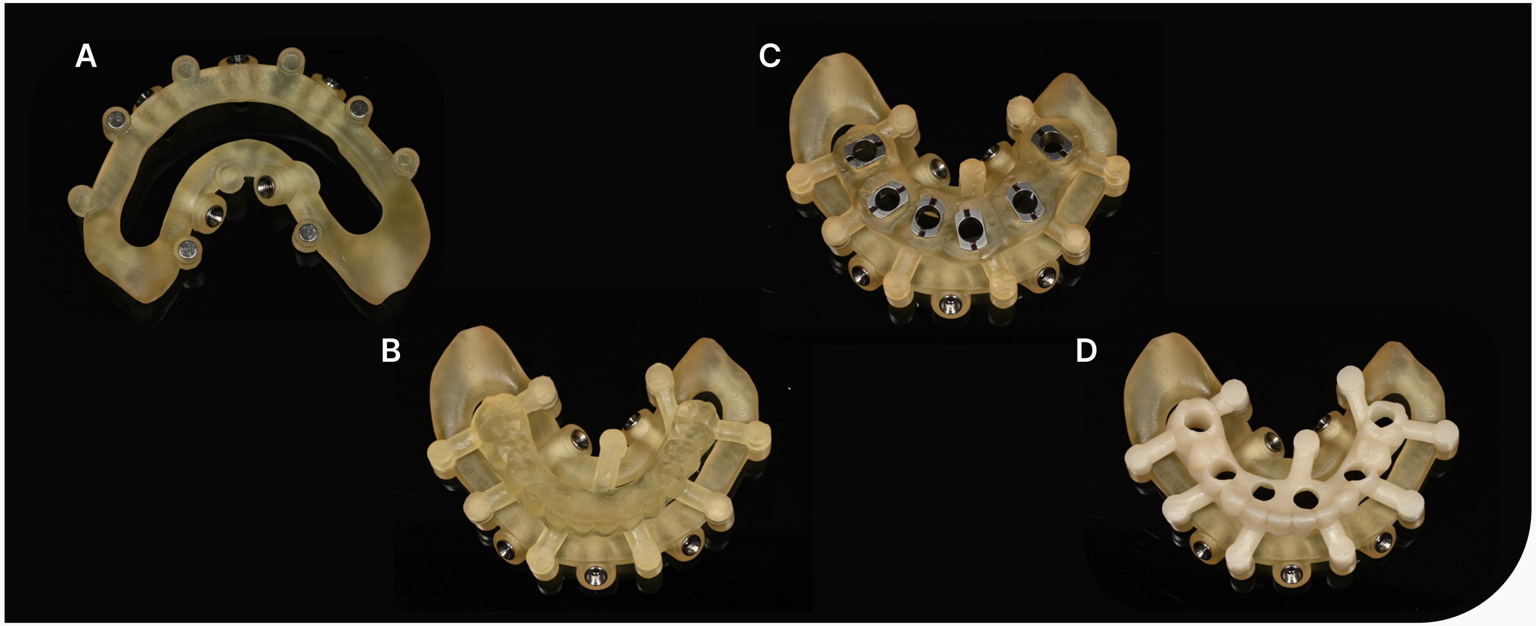

FIG. 5A-D *(A) Printed base stack. (B) Assembled positioning guide. (C) Assembled implant guide. (D) Assembled control guide.*

Two old mandibular implants were removed, for which no implant abutments were available, and no existing CADCAM library (Fig. 6). The sufficient amount of keratinised tissue and the absence of any indication for bone remodelling enabled flapless surgery in the maxilla (Fig. 7) and mandible with mini-incisions after observation using guided epithelial-conjunctive shallow punches (Fig. 8). This was performed in two stages for patient comfort (Fig. 9A-B).

The implants were placed manually to control the burial of the multi-unit stage. These monolithic implants were chosen for the All-on-X protocol because of the advantage of not having to screw in an abutment at $35Ncm^2$ if the torque is slightly lower than when the implants are placed (Fig. 10).

Control stages assess correct implant positioning according to planning (Fig. 11).

The insertion torques were greater than 35Ncm, and the RFA indicated ISQ scores of greater than 70 on each implant, authorising immediate loading (Smartpeg 25 for MUA, Osstell, Sweden; Fig. 12).

FIG. 6 *Removed mandibular implants.*

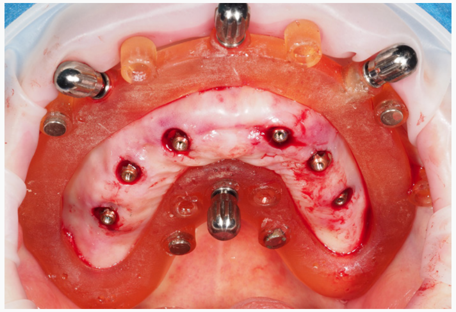

FIG. 7 *Maxillary implants final position.*

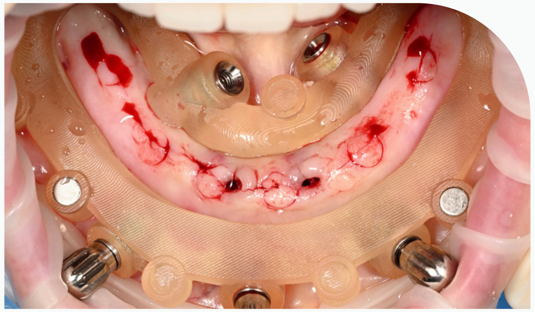

FIG. 8 *Mini-incisions after assessing the lack of keratinized tissues.*

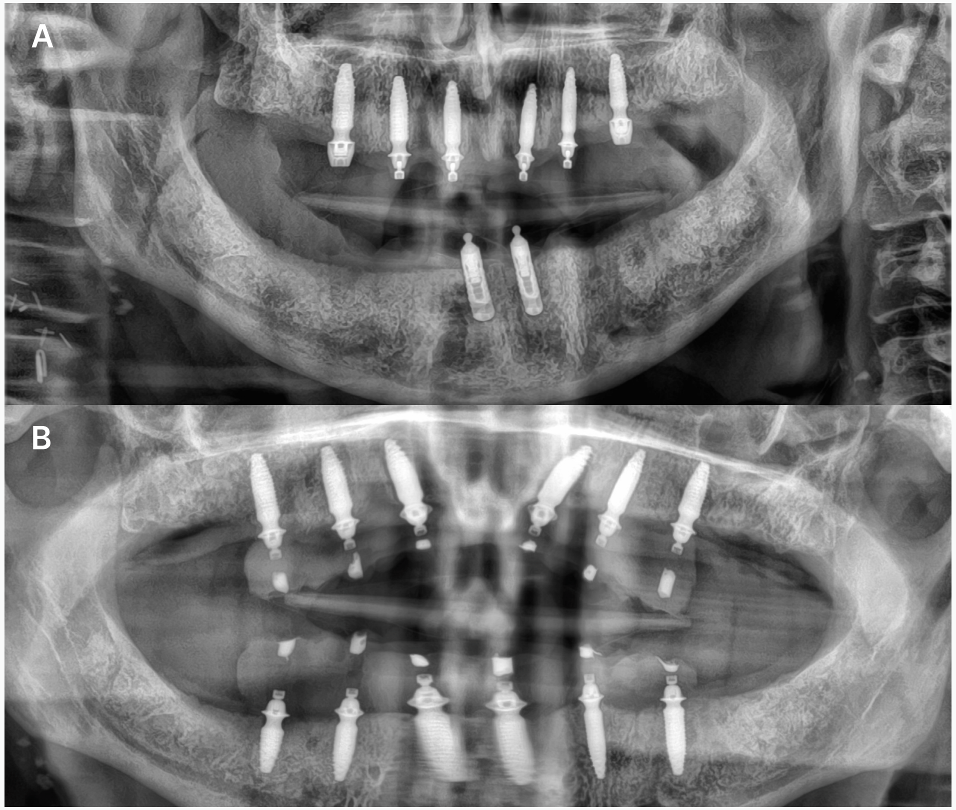

FIG. 9A-B *(A) Pan with maxillary implants. (B) Pan with all implants.*

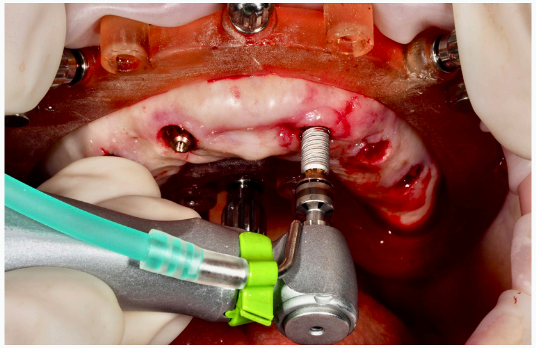

FIG. 10 *Free-hand insertion of KMB implant to control the MUA stage.*

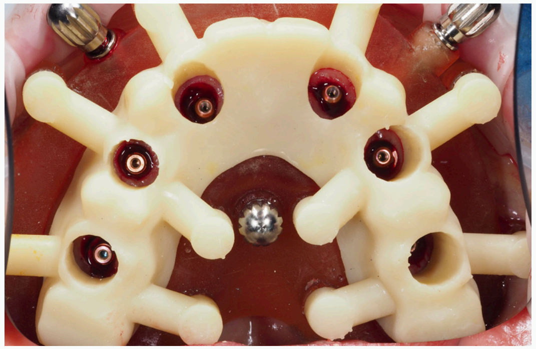

FIG. 11 *Control guide.*

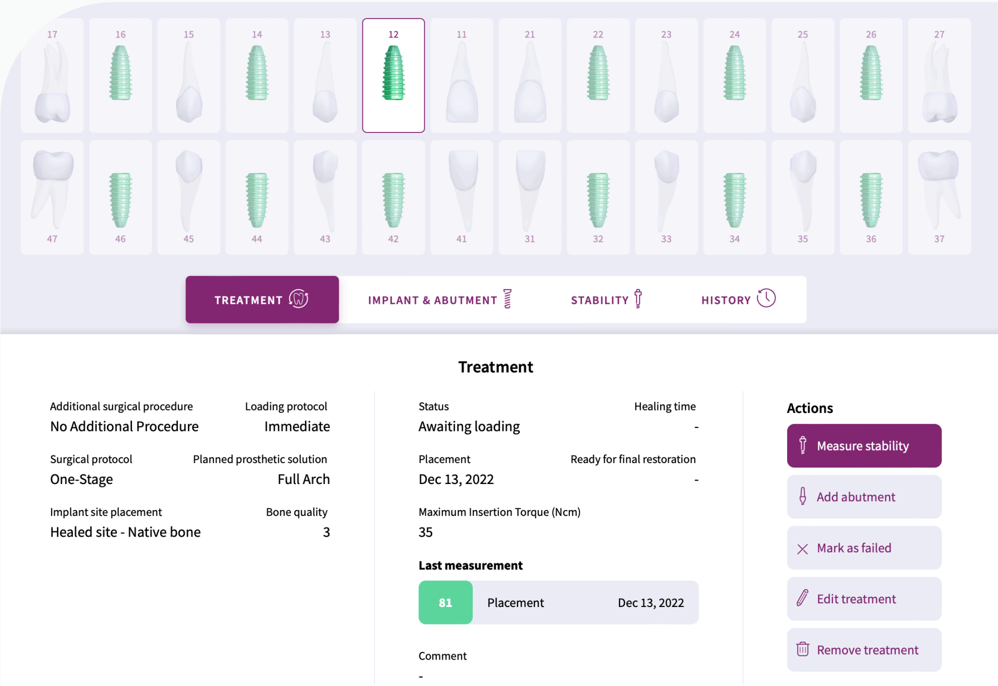

FIG. 12 *Patient dashboard on Osstell Connect software.*

> **"The impressions were supplemented by extra-oral photogrammetric recordings."**

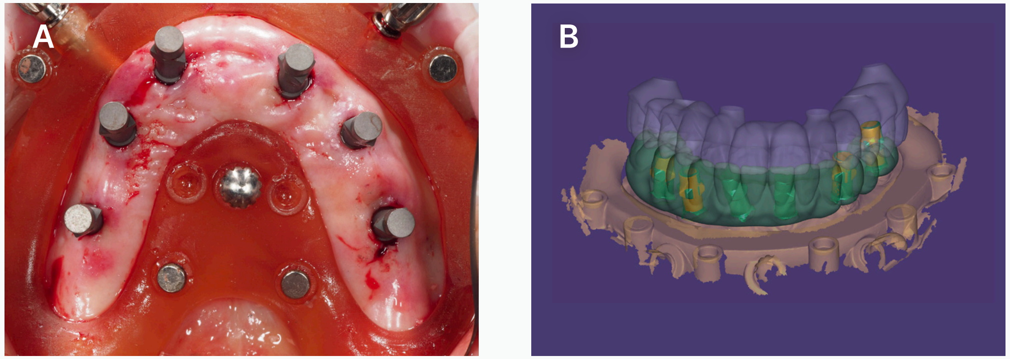

FIG. 13A-B *(A) Scanbodies with base guide still in place. (B) Matching elements on CAD software.*

Postoperative impressions were taken using scanbodies (52.007, DESS, Spain) in the presence of the base guide to help the laboratory reposition the impressions in the 3D space used for implant planning and thus preserve the recorded vertical dimension (Fig. 13A-B). The impressions were supplemented by extra-oral photogrammetric recordings (Icam4D, Imetric, Switzerland) to ensure exact positioning between each implant and subsequent passive insertion of the prosthesis (Fig. 14A-B).

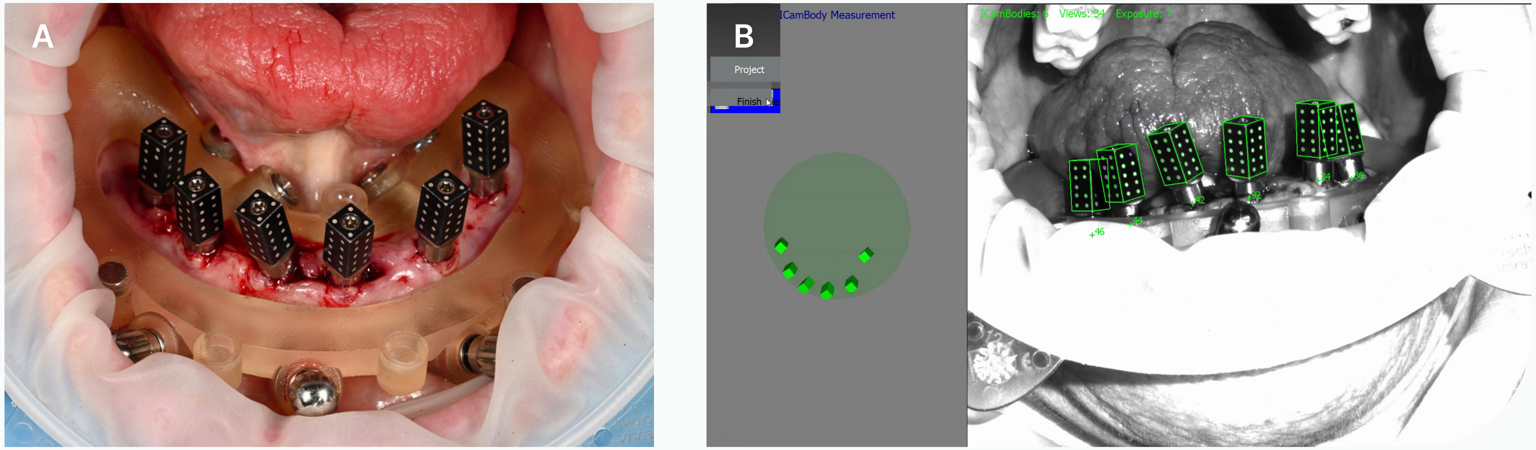

FIG. 14A-B *(A) ICamBodies for photogrammetric measurements. (B) ICamBodies registration on IMetric software.*

FIG. 15 *PMMA provisional bridge with no Ti-Base.*

FIG. 16 *Provisional brodges.*

PMMA bridges were machined and prepared without a titanium base (Fig. 15) for 24-hour loading for each arch (Fig. 16), with manual screwing.

After 3 months of osseointegration and healing (Fig. 17A-B), new impressions were taken, taking into account the new soft tissue position and the patient's aesthetic and functional requirements. The use of intra-oral impressions to record provisional bridges in occlusion, soft tissues, implant emergences, and scanbodies (Fig. 18A-B), followed by photogrammetry (Fig. 19), highlights the value of this double impression because inconstant deviations between the measurements taken were noted (Fig. 20).

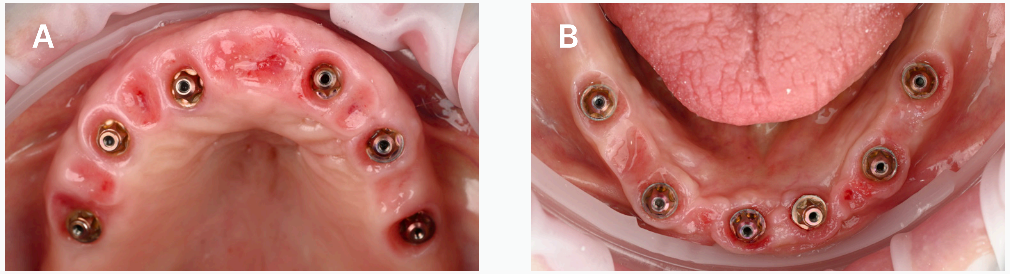

FIG. 17A-B *(A) Healed maxilla. (B) Healed mandibula.*

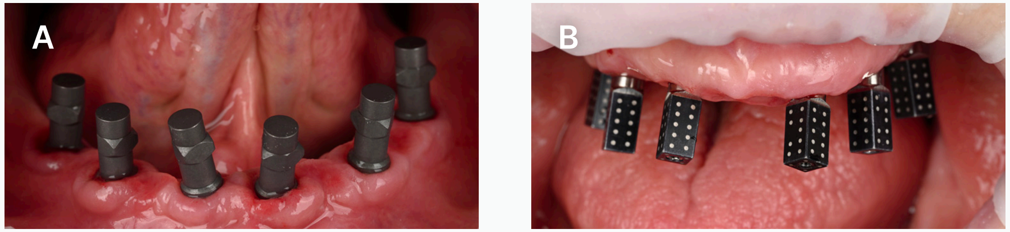

FIG. 18A-B *(A) Regular scanbodies for MUAs. (B) ICamBodies with up to 20 optical marks each.*

FIG. 19 *Scanbodies with the registered vertical dimension.*

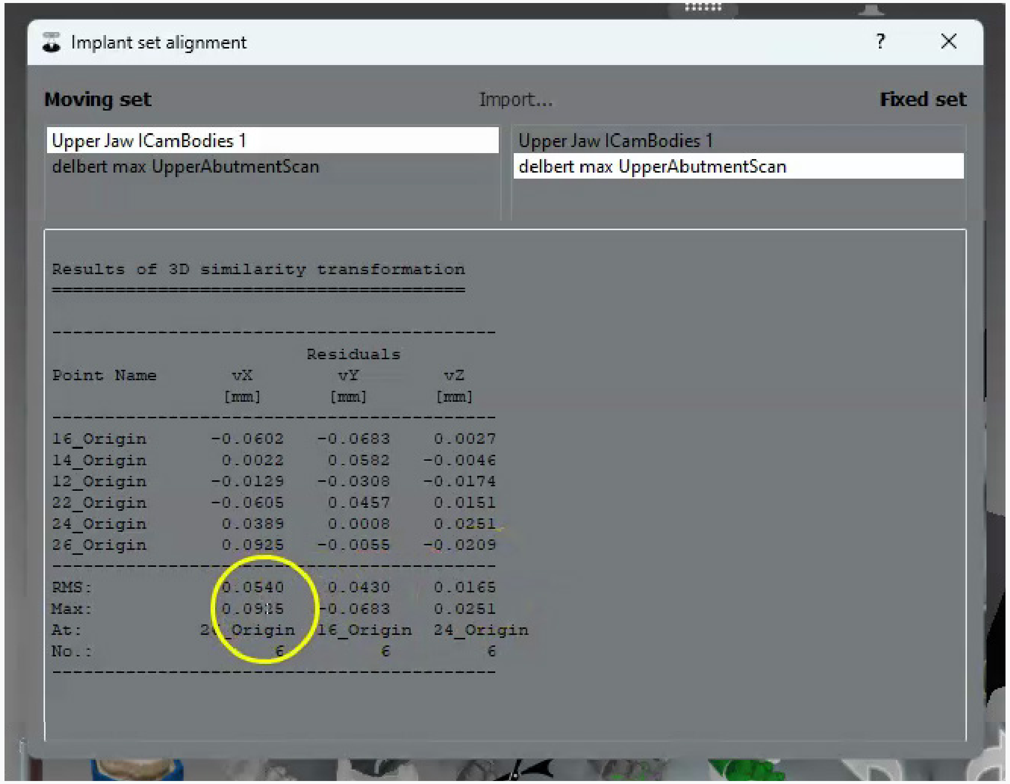

FIG. 20 *Deviation measurements between scanbodies and IcamBodies.*

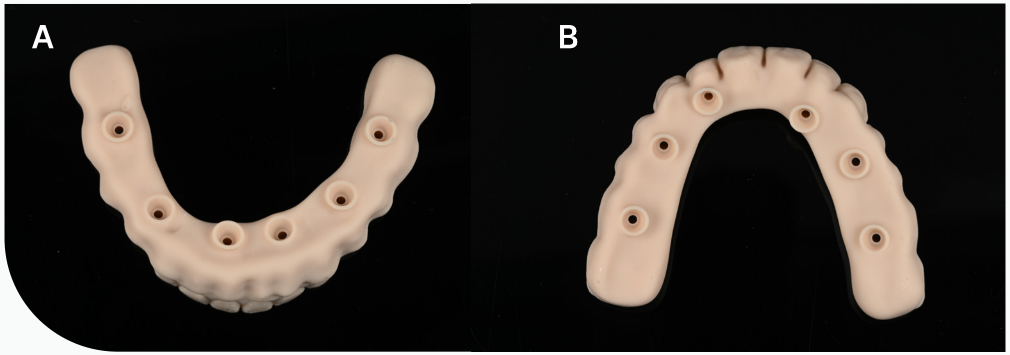

FIG. 21A-B *(A) Printed test mandibular bridge. (B) Printed test maxillary bridge.*

"The production of models using a 3D printer enabled us to check the insertion and seating of the final bridge."

The production of models using a 3D printer (Pro55S, Sprintray, USA; Fig. 21A-B) enabled us to check the insertion and seating of the final bridge, as well as the occlusion. It helped us to discover that an error had been made in the impression, resulting in a significant lack of left occlusion (Fig. 22A-B).

FIG. 22A-B *Bridges show lack of contacts, (A) lateral view & (B) front view.*

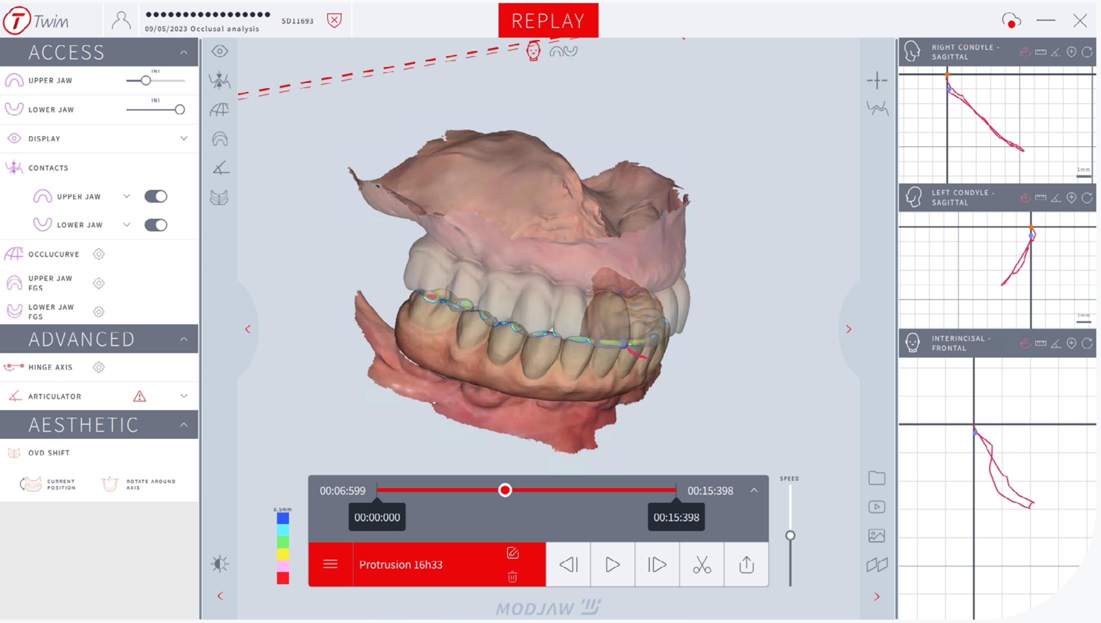

FIG. 23 *Jaw motion registration.*

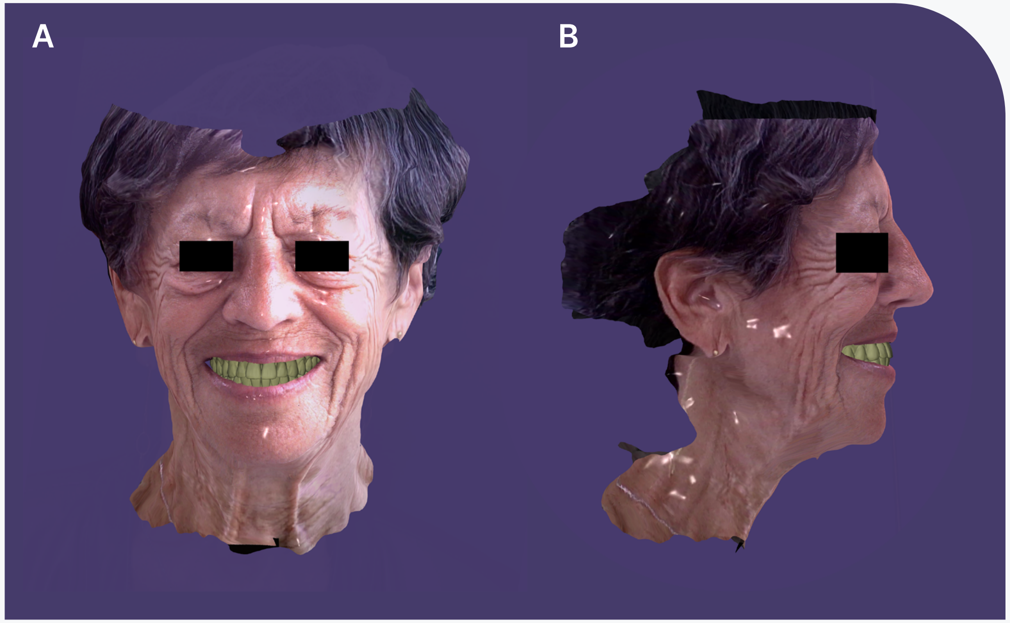

FIG. 24A-B *Facescan with final bridge design.*

A dynamic recording of mandibular kinematics (Twim, Modjaw, France; Fig. 23) combined with a facial scanner (RAYFace, Ray, South Korea) enabled the defects in the first design to be corrected (Fig. 24A-B), validated by new models (Fig. 25A-B).

FINAL WORK

The final work was based on a homothetic titanium bar machined with a high-strength composite suprastructure (breCAM.HIPC, Bredent, Germany; Fig. 26A-B; Dental technician: Romain Barret, France).

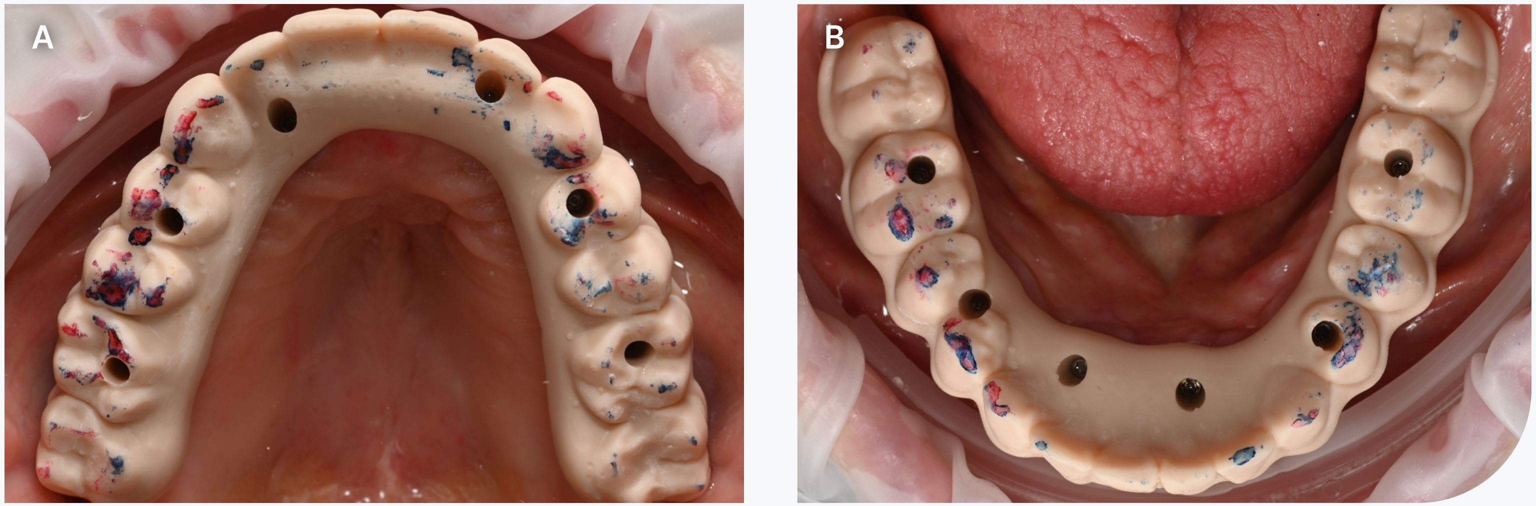

FIG. 25A-B *New printed bridges show acceptable contacts.*

FIG. 26A-B *(A) Titanium bar with HIPC teeth (maxilla). (B) Titanium bar with HIPC teeth (mandibula).*

Retroalveolar radiographic checks showed excellent adaptation of the bar on each of the conical abutments (Fig. 27), and follow-up of the bridges at 1 year already testifies to remarkable comfort for our patient (Fig. 28A-F).

"The final work was based on a homothetic titanium bar machined with a high-strength composite suprastructure."

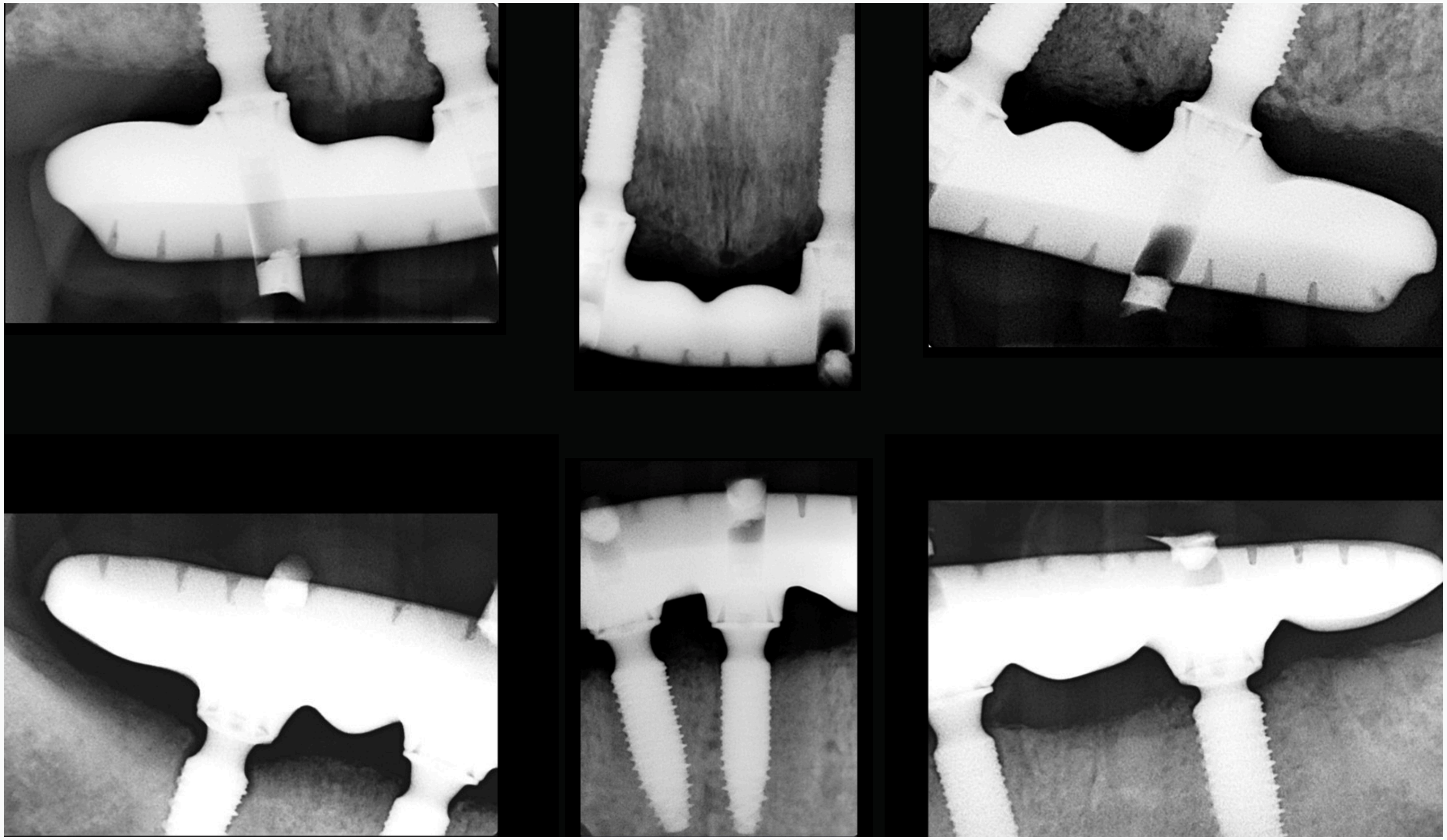

FIG. 27 *X-ray control of the fitting.*

CONCLUSION

Undeniably, digital technology facilitates all the steps involved in these complex restorations. It has enabled us, as practitioners and dental technicians, to reduce treatment times and better analyse, understand and resolve complaints. Using these interoperable tools is also less invasive and more comfortable for our patients.

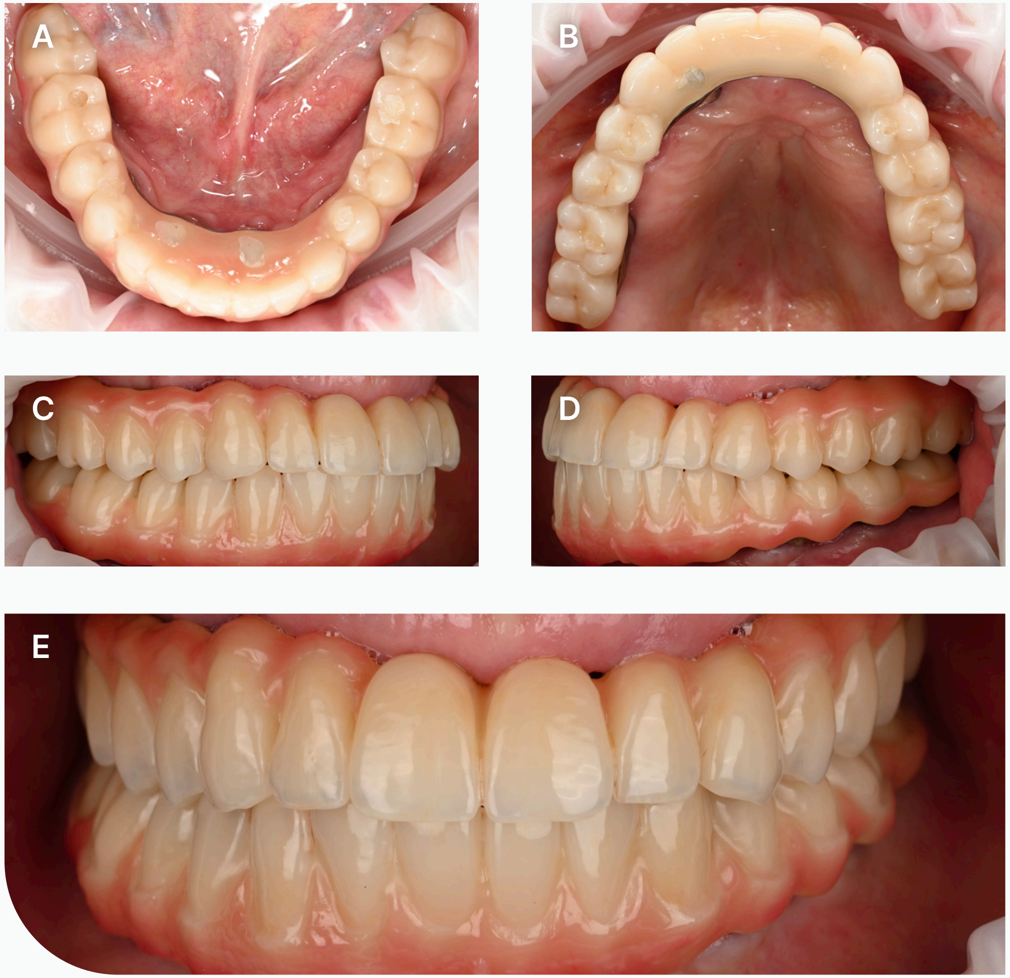

FIG. 28A-E *Final bridge in place.*

FIG. 29 *Final result.*