Screw-retained solution for terminal dentition

Tissue-level implants and no multi-unit abutments

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Full-mouth rehabilitation of the terminal dentition with implant-supported screw-retained prostheses represents the gold standard of dental rehabilitation today.[1, 2] In the planning phase, once the patient's general medical condition has been evaluated, a multitude of aspects must be taken into consideration, involving the patient's hard and soft tissue and the morphology that the prosthetic frameworks will have to assume in order to comply with functional (mastication, deglutition and phonation) and aesthetic requirements.

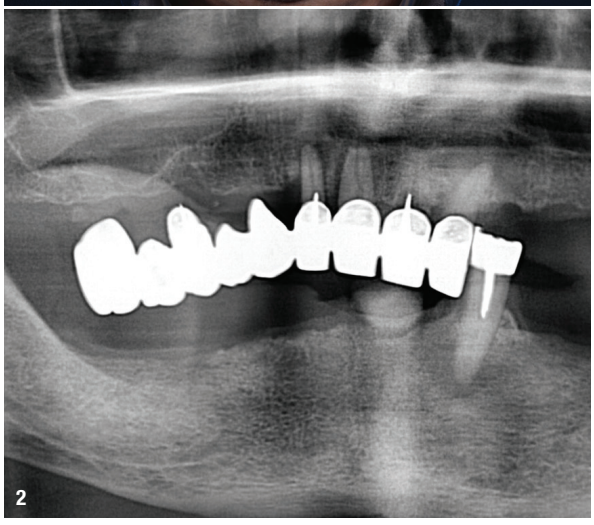


Fig. 1: Pre-op smile. **Fig. 2:** Pre-op panoramic radiograph.

In cases where many or all of the functional parameters (overjet, overbite, vertical dimension of occlusion, inclination of the occlusal plane, median and occlusal plane cant, etc.) are altered, it may be useful to precede guided surgery with a phase of rehabilitation, even a short one, through removable prostheses in order to be able to test our design and possibly correct it in the postoperative phase. To this end, sagittal skeletal assessment through orthognathic analysis is very useful in guiding the clinician towards the functionally and aesthetically ideal result.[3]

Furthermore, with regard to the possibility of performing immediate functional loading, it will be important to assess bone density through a CBCT examination and to choose an implant with a morphology suitable for obtaining an implant insertion torque sufficient for the purpose. The use of guided surgery will shorten the surgical time and minimise implant placement errors.[4]

Patient history

A non-smoker and systemically healthy 72-year-old male patient came to our clinic complaining of difficulty chewing owing to mobility of his maxillary fixed prosthesis (Fig. 1). On radiographic examination, the four incisors were found to be present in the maxillary arch, which clinically showed a high degree of periodontal and structural compromise (Fig. 2). In the mandibular arch, the patient had only the left canine remaining, to which a removable partial prosthesis was attached.

Treatment plan

The patient expressed a desire to receive a fixed prosthetic solution anchored on implants. We decided to initially construct a removable prosthesis (maxillary arch) to correct the anterior and sagittal parameters, and the mandibular canine would be left in place until guided surgery.

Fig. 3: Pre-op intra-oral scan. **Figs. 4a & b:** 2D digital smile planning, before **(a)** and after **(b)**.

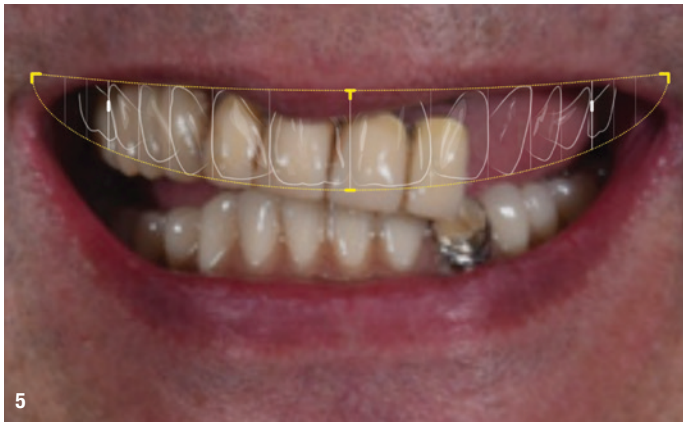
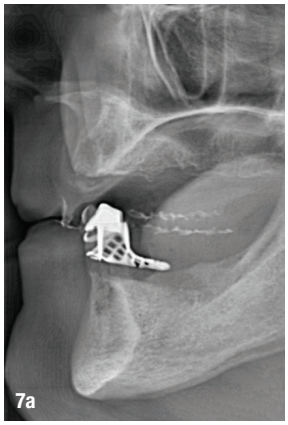
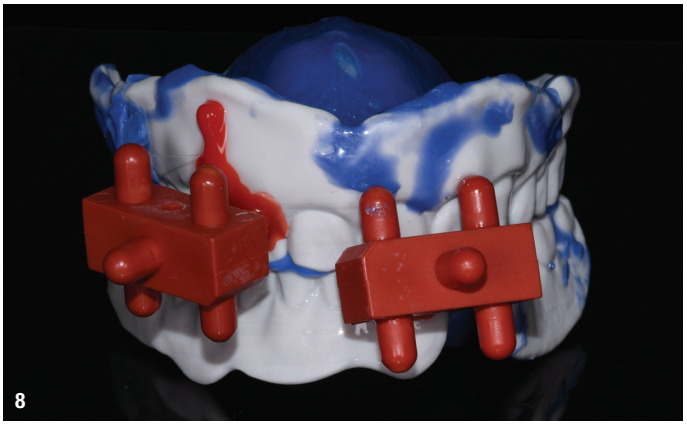
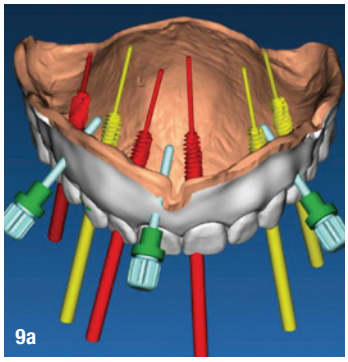


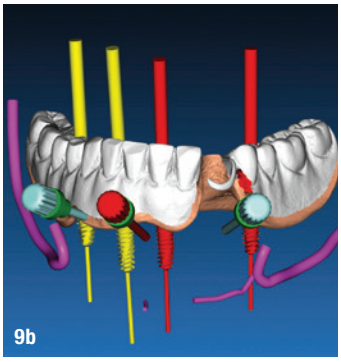
Fig. 5: 2D digital smile planning, close-up. **Fig. 6:** Appearance of the maxillary removable prosthesis.

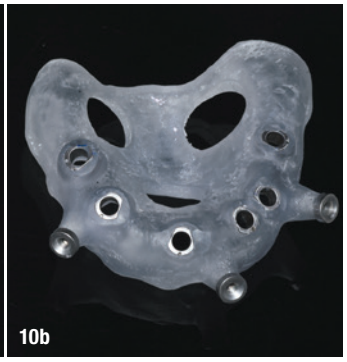




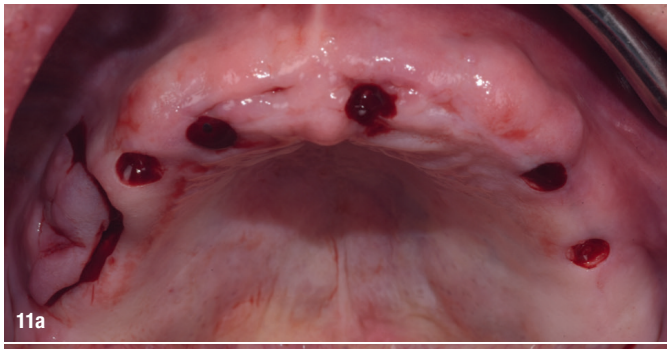
Figs. 7a–c: Lateral profile radiograph **(a)** and radiopaque cement applied to the removable prosthesis **(b & c)**. **Fig. 8:** 3D markers applied to the maxillary and mandibular prototypes.







Figs. 9a & b: 3D view of the implant planning, maxilla **(a)** and mandible **(b)**. **Figs. 10a & b:** Mandibular **(a)** and maxillary surgical guides **(b)**.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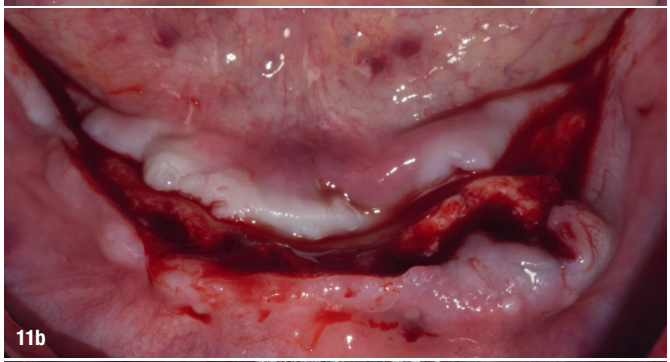
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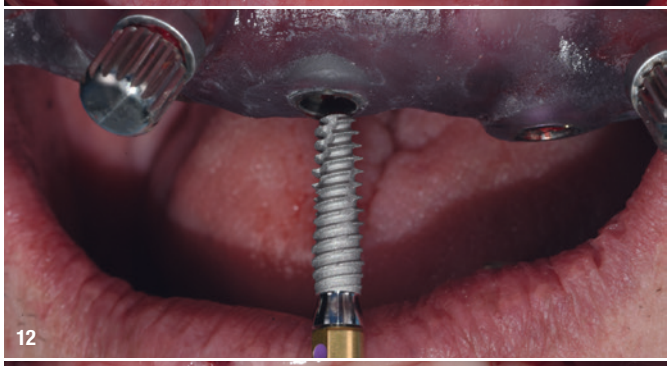
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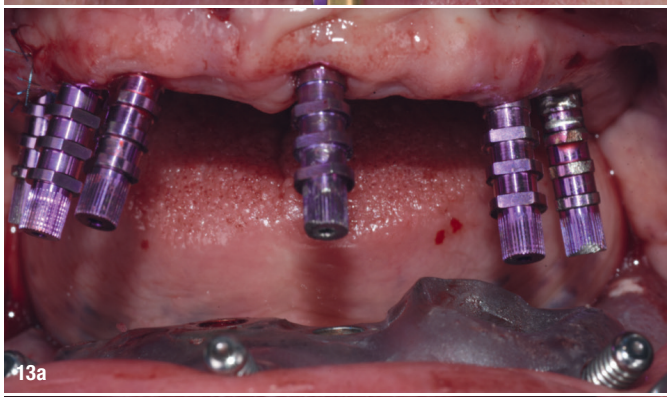
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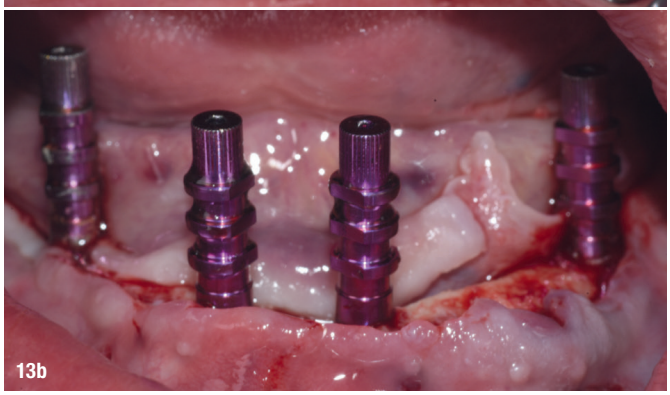

13b

An intra-oral scan (TRIOS 3, 3Shape; Fig. 3) and a 2D digital smile design were then performed (Smilecloud, Straumann; Figs. 4 & 5). With this data, the laboratory (Nuova Eliodent) constructed the maxillary removable prosthesis with a fully digital flow.

Under local anaesthesia, the four maxillary incisors were extracted, and the removable maxillary prosthesis was delivered. The prosthesis still showed some cant in the frontal plane (Fig. 6) probably due to the mandibular occlusal plane; therefore, a lateral profile radiograph was taken after applying radiopaque temporary cement (TempBond, Kerr) on the maxillary prosthesis to highlight the course of the occlusal plane and the position of the incisors (Fig. 7). Orthognathic analysis revealed the need to raise the occlusal plane posteriorly and revealed the tilt of the occlusal plane on the frontal plane (adjusting the two lines).

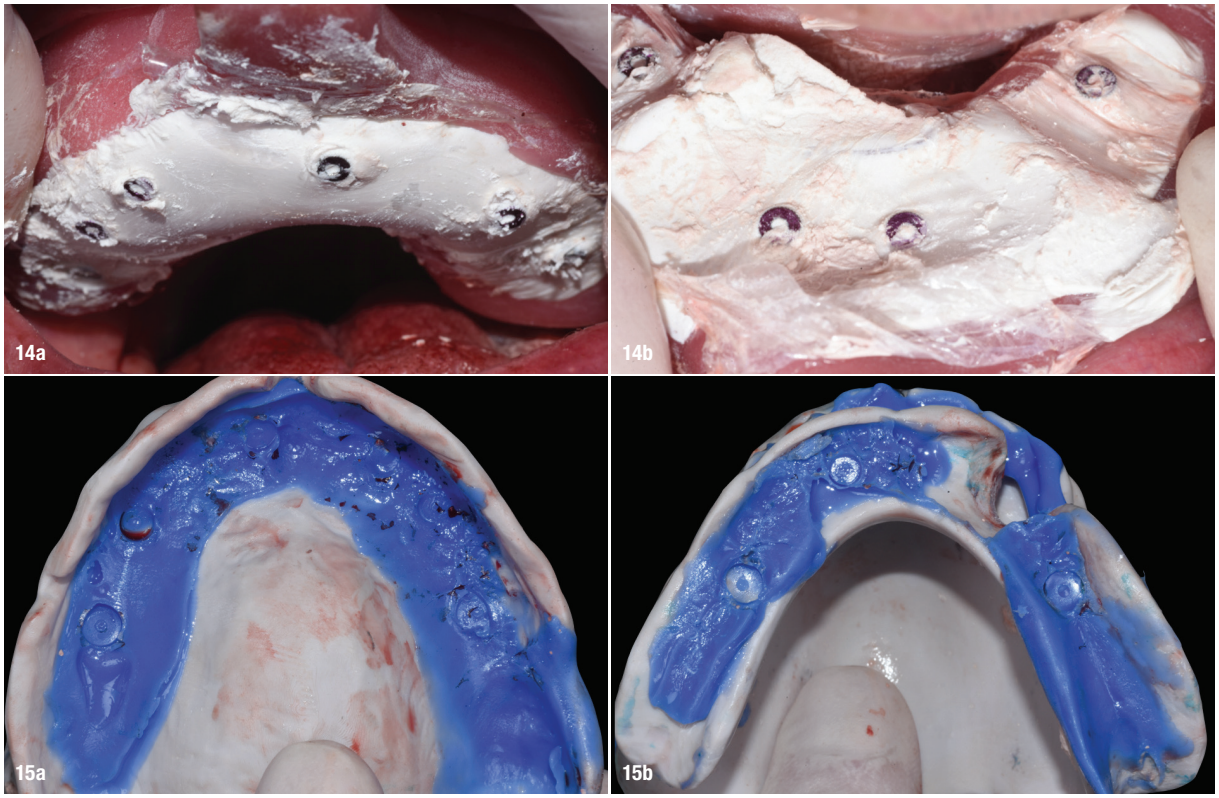
The prostheses were then scanned in the clinic and duplicated in the laboratory and the necessary corrections effected digitally using two extra-oral 3D markers (3DIEMME). The two resin prototypes were relined, and the intermaxillary relationship was determined (Fig. 8). Next, a CBCT scan was performed, and the files were sent to the laboratory, which performed CBCT and STL matching within the guided surgery software (RealGUIDE, 3DIEMME).

The placement of ten implants (Axiom X3 Tissue Level, Anthogyr) with a narrow (4 mm) prosthetic platform was planned, six in the maxillary arch and four in the mandibular arch (Fig. 9). The laboratory constructed two surgical guides (INTEGRAL fully guided surgery, Anthogyr; Fig. 10), the corresponding silicone splints for guide placement and two open trays for plaster impression taking with the pick-up technique. The two prototypes already used for CBCT scanning were used to determine the intermaxillary relationship.

Surgical procedures

Two months after delivery of the removable maxillary prosthesis, bimaxillary guided surgery under venous sedation was performed. The osteotomies in the maxillary arch were performed flapless

Figs. 11a & b: Maxillary **(a)** and mandibular arches before osteotomy preparation **(b)**. **Fig. 12:** Axiom X3 Tissue Level implant before its placement. **Figs. 13a & b:** Maxillary **(a)** and mandibular arch pick-up impression copings placed **(b)**.



Figs. 14a & b: Maxillary **(a)** and mandibular arch plaster impressions **(b)**. **Figs. 15a & b:** Adaptation of the prototypes to the healing screws.

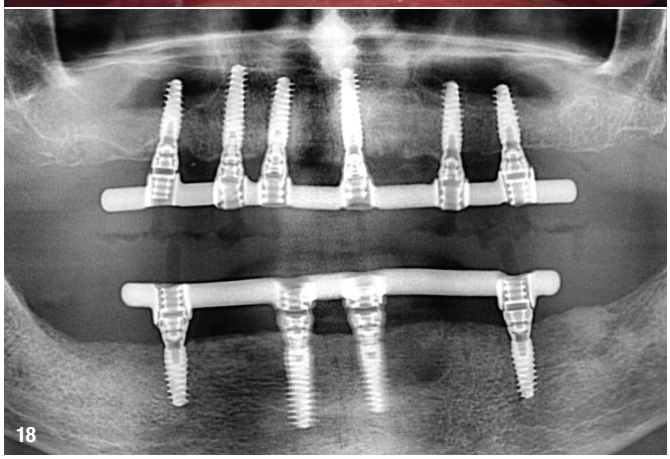


Fig. 16: Screw-retained maxillary and mandibular temporary prostheses. **Fig. 17:** Post-op view 24 hours after implant placement. **Fig. 18:** Post-op panoramic radiograph 24 hours after implant placement.

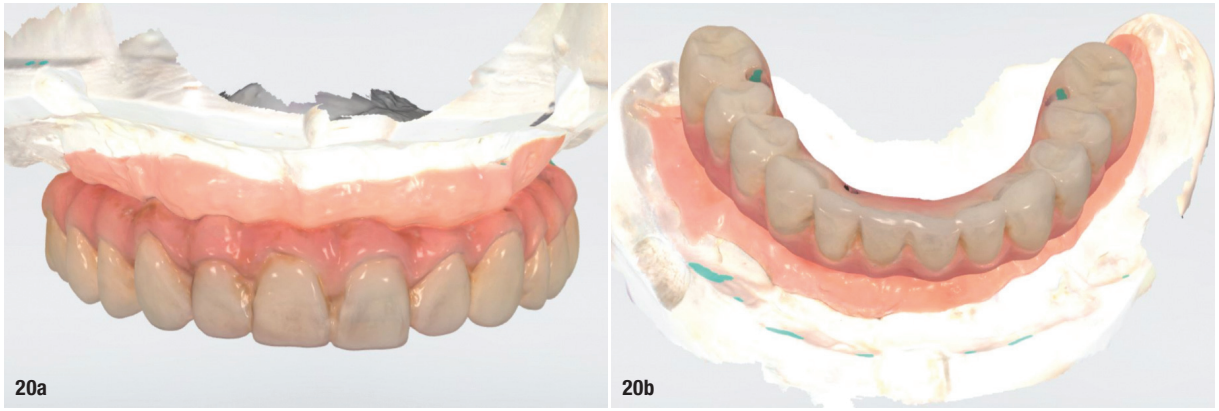
with the exception of position #16, since it required a small guided bone regeneration procedure (Figs. 11a), in addition to a transcrestal sinus lift using the Osteo Safe system (Anthogyr). The osteotomies in the mandibular arch were performed after raising a mucoperiosteal flap to allow for osteoplasty in the area of position #33 and to preserve keratinised soft tissue (Fig. 11b).

Implant insertion torques ranged from 35 Ncm to 50 Ncm (Fig 12). Pick-up impression copings were then connected directly to the heads of the implants, without the interposition of multi-unit abutments (Fig. 13), and plaster impressions were taken (Fig. 14). Two prostheses screwed directly to the heads of the implants were planned to be fabricated using the inLink prosthetic connection system (Anthogyr). Then, after connecting the healing screws, the intermaxillary relationship was recorded by relining the two prototypes on to the healing screws (Fig. 15).

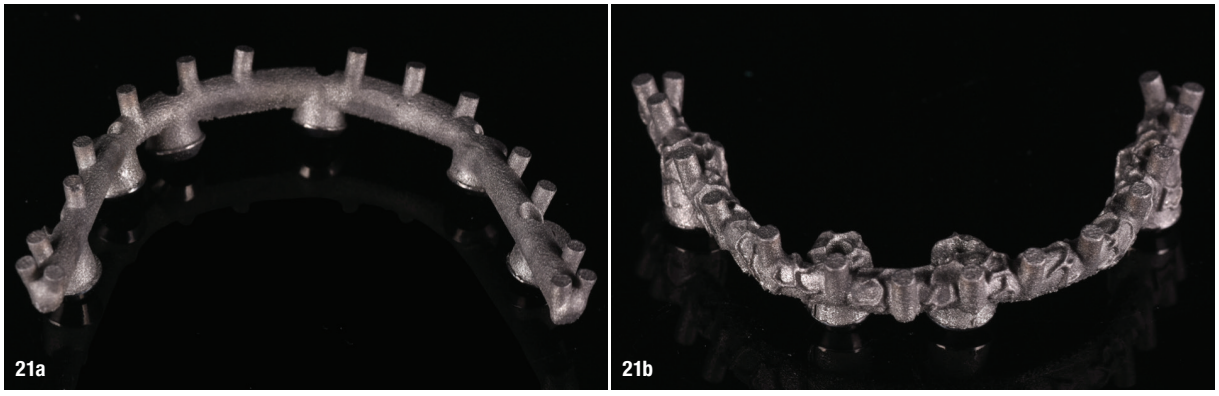
The laboratory then constructed two screw-retained prostheses by making two milled titanium bars that were bonded to the inLink (stock) abutments (Fig. 16). The prostheses were delivered to the patient without local anaesthesia 24 hours after the guided surgery (Fig. 17). Occlusal adjustments were performed to optimise the static and dynamic intermaxillary relationship. A dental panoramic X-ray (or radiograph) was then performed, and it showed the perfect connection of the prosthetic structures (Fig. 18).

After five months, the prostheses were unscrewed and mounted on to the master models. The appearance of the peri-implant soft tissue was satisfactory (Fig. 19). Scans (TRIOS 3) of the prostheses on the models were taken (Fig. 20), and the intermaxillary relationship was then determined in the mouth. The laboratory then produced two new prototypes incorporating a 1 mm reduction

Figs. 19a & b: Soft-tissue healing at five months, maxilla **(a)** and mandible **(b)**.



Figs. 20a & b: Extra-oral scans of the maxillary **(a)** and mandibular temporary prostheses **(b)**.



Figs. 21a & b: Cobalt–chromium CAD/CAM structures (Simeda, Anthogyr), complete maxillary **(a)** and complete mandibular structures **(b)**.

Figs. 22a & b: Mandibular final screw-retained prosthesis, occlusal **(a)** and intaglio surfaces **(b)**.

Figs. 23a & b: Maxillary final screw-retained prosthesis, occlusal **(a)** and intaglio surfaces **(b)**.

Fig. 24: Intra-oral view of the final fixed restorations. **Fig. 25:** Final smile.

in the vertical dimension of occlusion at the mandibular arch (the exposure of the mandibular incisors was excessive, and the patient exhibited slight difficulty swallowing). The two prototypes were tested in the mouth and relined with elastomer to take the soft-tissue impression. The laboratory then designed the final prostheses, and the files were sent to the Simeda manufacturing centre (Anthogyr) to make two inLink milled bars in cobalt–chromium (Fig. 21). The material chosen for the final prostheses, for both the gingival and tooth portions, was PMMA (Figs. 22 & 23). The patient was informed of the need for tooth replacement every five to eight years, depending on the degree of wear found during periodic controls. The two screw-retained prostheses were then delivered, and the screws were tightened to 25 Ncm as prescribed by the manufacturer (Figs. 24 & 25). Finally, a radiographic check was performed (Fig. 26).

Conclusion

The treatment performed did not lead to any surgical or prosthetic complications. The use of the INTEGRAL guided surgery system reduced the surgical time and avoided implant placement errors. The morphology of the chosen implant allowed for rapid and accurate implant placement and provided adequate torque for immediate functional loading. In addition, Anthogyr's inLink connection reduced the surgical time and the rehabilitation costs because no multi-unit abutments were used. Overall, both the clinical team and the patient expressed a high degree of satisfaction with the result achieved.

Literature

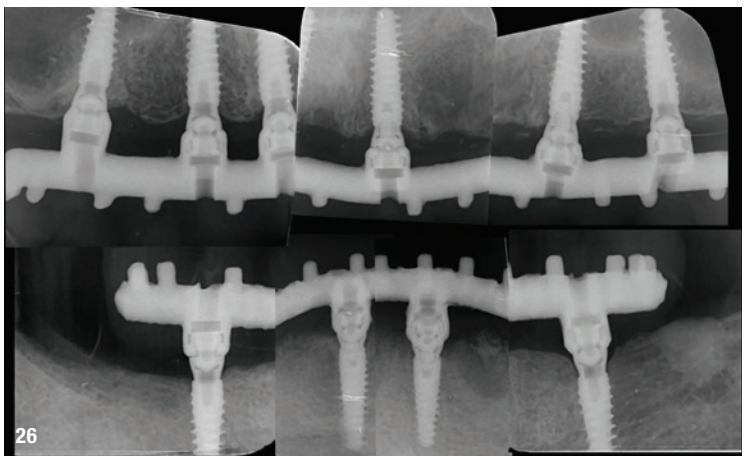


Fig. 26: Control radiograph.

about the author

Dr Gian Battista Greco graduated in dentistry and dental prosthetics from the University of Trieste in Italy in 2000. He completed a biennial course in prosthetics and implant prosthetics with Dr Stefano Gracis, Milan, Italy in 2008 and a biennial course in periodontal and peri-implant plastic surgery with Prof. Giovanni Zucchelli, Bologna, Italy in 2017. He is in private practice in Milan and has a main focus on implant-supported prosthetic therapy, periodontal plastic surgery and cosmetic dentistry.

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