Managing congenitally missing lateral incisors with implants

The key factors to reach an excellent result

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Congenital missing teeth is a highly prevalent dental anomaly, with a 5.5% prevalence in permanent teeth, excluding third molars[1]. Maxillary lateral incisors are one of the most affected teeth with agenesis. Besides an unfavourable appearance, patients with missing teeth in the anterior zone may suffer from malocclusion, periodontal damage, insufficient alveolar bone growth, reduced chewing ability and other problems[2].

Implant-supported single tooth restoration in the aesthetic area is currently a well-documented and predictable treatment option to replace a missing single tooth in this zone[3]. Cases of dental agenesis of anterior teeth are challenging, and many specific aspects have to be carefully evaluated. Patients usually need orthodontic treatment in order to correct the malocclusion resulting from this absence. A correct and meticulous diagnosis is mandatory to decide whether spaces closure and canine substitution[4], or space

opening to create enough width for the restoration[5], is the appropriate treatment plan. Biological aspects are also very important. Usually the present bone is poor in quality and quantity, and both have to be improved and corrected in the surgical phase. All the issues of an aesthetic case are also important to consider when restoring missing teeth: smile line, shape and size of adjacent teeth, soft tissue volume, periodontal biotype, need for temporisation, importance of flap design and surgical technique, aesthetic materials… always with a global vision on patient´s health, function and smile.
The case presented brings together all this aspects, using the Aadva Implant System (GC Tech) and a milled zirconium abutment (GC Tech Milling Centre, Leuven, Belgium) covered with Initial ceramic (GC), highlighting the importance of a correct diagnosis, a careful and minimally invasive surgical approach, and a correct selection of materials.

CASE REPORT

A 29-year old male patient presented with agenesis of the right upper lateral incisor. Orthodontists decided to open the space to replace this missing tooth, and when the mesio-distal and inter-occlusal spaces were adequate to replace it (Figures 1-2), the patient was referred to us.

After clinical, and radiographic examination (CBCT and periapical) and diagnostic assessment (including casts), the therapeutic plan was drawn up including placement of a narrow diameter implant with delayed loading, a provisional implant-supported restoration after second-stage surgery, and a metal-free screw-retained esthetic implant definitive single crown. The CBCT diagnosis found enough bone availability in the coronal part of the future implant, but a concavity in the middle and apical zone of the buccal plate (Figure 3).

The patient had a low smile line and a thick periodontal biotype.

Implant surgery began with a crestal incision slightly deviating towards palatal, including intrasulcular in the distal part of the right upper central and mesial of the right upper canine, and avoiding vertical releasing incisions.

Bone was prepared carefully with a drilling sequence adapted to bone quantity and quality, with a non-

Figures 1-2. Preoperative frontal and occlusal view. Agenesis of the right upper lateral incisor.

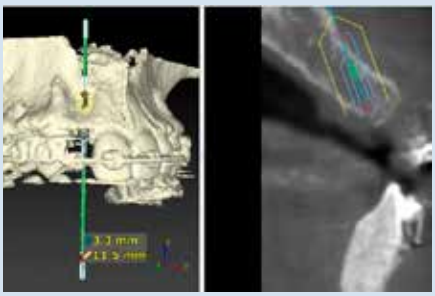

Figure 3. CBCT: Sufficient bone in the coronal part, and a concavity in the middle and apical part.

Figure 4. Drilling sequence:
a) Initial bur;
b) 2 mm twist drill up to 7 mm length;
c) 2 mm osteotome up to working length;
d) 3 mm osteotome up to working length;
e) Tapered implant drill narrow up to 12 mm.

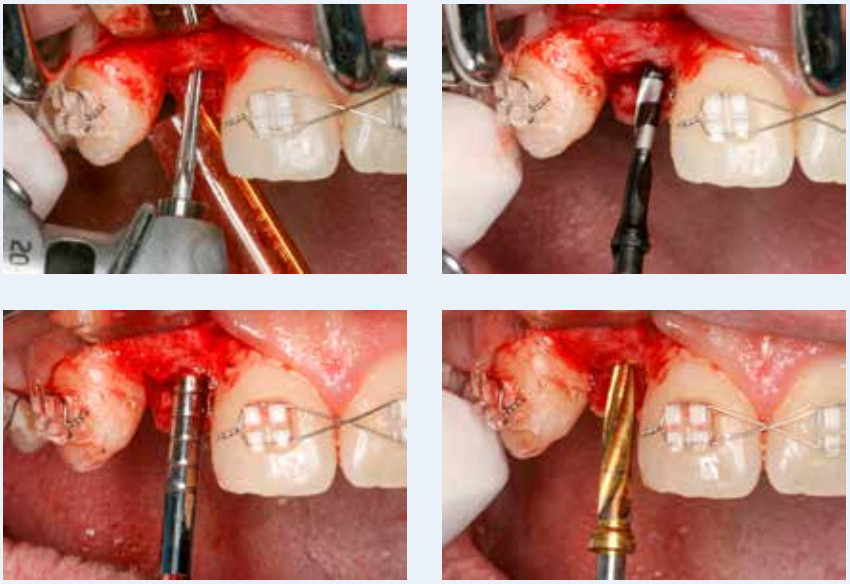

Figure 5. Checking three-dimensional position of the future implant.

Figure 6. Aadva tapered implant narrow.

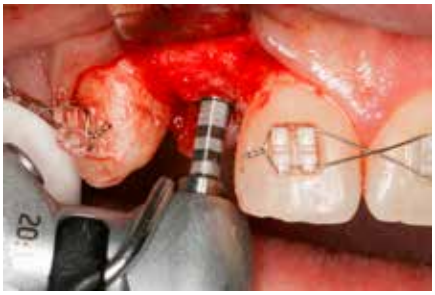

Figure 7. Implant insertion.

irrigation low-speed technique (50 rpm) and including the use of manual osteotomes between the uses of drills (Figure 4). Using osteotomes, the aim was to preserve as much as possible the low-density bone, compact it, and expand the buccal ridge in the middle and apical part[6].

Implant site was slightly underprepared to ensure high implant stability, avoiding countersinking in order to engage as much of the crestal bone as possible and to avoid damaging of the cortical bone. When the bone was prepared and the three-dimensional position of the future implant was checked with a direction and depth indicator (Figure 5), one rough-surfaced grade 5 titanium implant (12 mm tapered implant narrow, GC Implant Aadva) (Figure 6) was placed, according to the treatment planning with 35 N of torque (Figure 7). Adequate apico-coronal position was achieved and confirmed with a manual insertion torque wrench (Figure 8), leaving as much width as possible in the buccal plate (Figure 9).

Figures 8. Adjustment of implant depth position with a manual insertion torque wrench: Apically there is 3 mm space between the implant platform and the cemento enamel junction of adjacent teeth.

Figure 9. Occlusal view of the placed implant. Width of the buccal bone is 2.5 mm, which is important for long-term peri-implant tissues stability.

Figure 10. Wound sutures. a) Occlusal view; b) Buccal view

After suturing (Figure 10), an acrylic resin tooth was attached to the orthodontic wire as a provisional. After healing and a 3-month uneventful osseointegration period (Figure 11),

Figure 11. One-week postop. a) Occlusal view; b) Buccal view.

Figure 12. Second-stage surgery with a minimally invasive approach. a) Incision; b) Occlusal view with healing abutment; c) Buccal view.

the implant was uncovered with a minimally invasive incision (Figure 12), and one day later, a screw-retained acrylic provisional was connected to the implant (Provi Abutment Hexed Narrow, GC Implant Aadva; Figure 13).

Subgingival emergency profile had a concave design in order to allow the soft tissue to adapt to it without pressure (Figure 14).
The width of this provisional was the same as that of the upper left lateral

Figures 13. Screw-retained acrylic provisional crown. Concave emergency profile design.

Figures 14. After placement of the acrylic provisional crown.

incisor, and mesio-distal small remaining spaces were closed with orthodontic treatment (Figure 15).

Soft tissues were healing and adapting to the provisional and the brackets were removed (Figure 16). The teeth were whitened by home bleaching during three weeks (Figure 17).

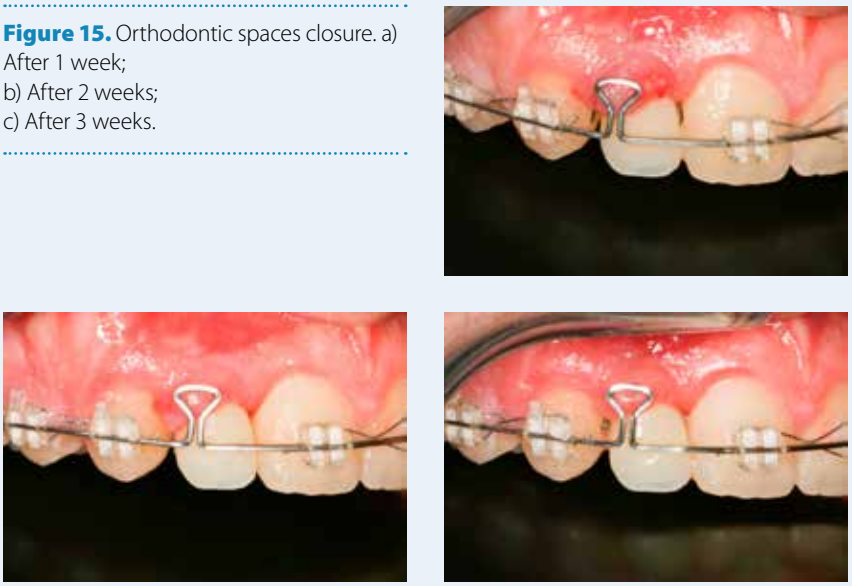

Figure 15. Orthodontic spaces closure. a) After 1 week;
b) After 2 weeks;
c) After 3 weeks.

Figure 16. Soft tissues healing 3 months after second-stage surgery.

Figure 17. Home whitening treatment. a) Preoperative; b) Postoperative.

An individualised impression post copying the subgingival part of the provisional was prepared (Figure 18), and the final impression was made (Figures 19 to 21).

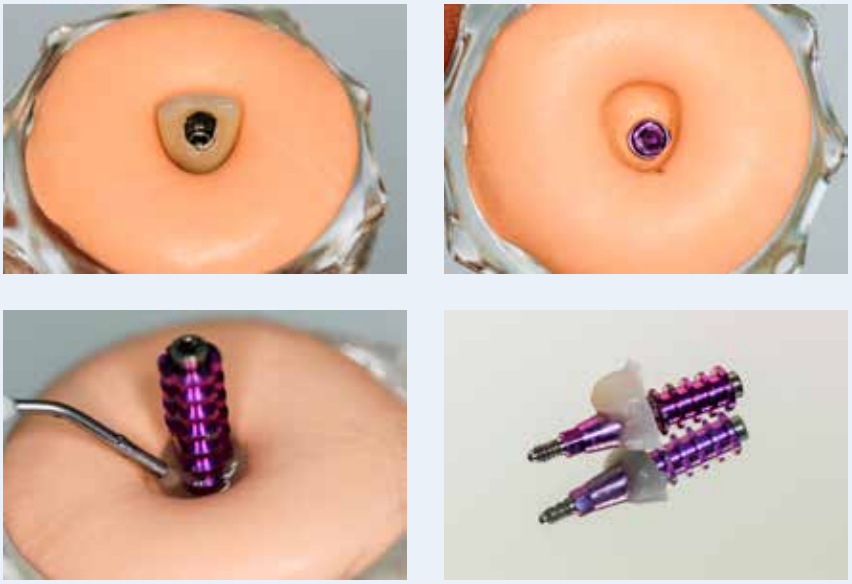

Figure 18 a-d. Preparation of an individualised impression post copying subgingival part of the provisional.

Figure 19. Emergency profile. Occlusal view prior final impression.

Figure 20. Individualised impression coping in place.

Figure 21. Final pick-up impression.

Figures 22-23. Screw-retained single-unit final restoration: individual zirconium CAD-CAM abutment covered with ceramic and cemented to a metallic base.

An individual zirconium CAD-CAM abutment (GC Tech Milling Centre) was covered with ceramic (Initial Ceramics, GC) and luted with a resin cement to a metallic base (Blend-/ Hybridabutment, GC Tech), providing a metal-free restoration that could perfectly integrate in the smile (Figures 22 and 23).

This final restoration was screwed on the implant (Figure 24).

The final restoration demonstrated excellent aesthetics and improved integration, shape and shade at the 3-year follow-up appointment (Figure 25).

Figure 24. Final restoration screwed on the implant.

Figure 25. Frontal views in occlusion. a) Preoperative; b) Postoperative; c) 3-year follow-up.

DISCUSSION

A correct diagnosis is crucial when restoring missing teeth in the aesthetic zone with implant-supported restorations. Analysing carefully and managing properly orthodontic, biologic and aesthetic aspects may lead to successful results. In this case some of these aspects were not favourable, like bone volume and quality. As the bone width was wide enough in the coronal part of the implant, and the patient had a low lip line and thick periodontal biotype, no bone volume augmentation was needed, and the use of osteotomes and a careful surgical technique were enough to solve it.

A minimally invasive surgical approach is mandatory in the anterior region, using conservative incisions in surgeries. Also low speed drilling sequence, infra-preparation and osteotomes were used in order to avoid over-preparation, overheating and to minimise the destruction of the cancellous bone. To achieve implant stability, a proper implant design and minimal and precise manipulation is required.

The implant was placed while the patient was in orthodontic treatment, allowing attaching the immediate provisional to the wire, and facilitating the space closure when implant-retained provisional was connected. Evaluating the case as a whole is mandatory, because sometimes patients with dental agenesis have other dental anomalies in adjacent teeth. Those were not present in this case. Nevertheless, from the aesthetic point of view there was an unfavourable teeth colour, which was improved by tooth whitening treatment.

The use and selection of the adequate materials for the restoration, and a meticulous work by the lab technician are essential points to achieve excellence. Computer aided design and manufacturing of the zirconia custom abutment, with the proper use of a ceramic coating worked with care, let the clinician get a successful and perfectly integrated metal-free restoration.

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