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Aesthetic rehabilitation in a young patient using a minimally invasive approach. A multidisciplinary case report

ABSTRACT

Background *Optimal integration and long-term stability of oral rehabilitations require correct diagnostic approach, appropriate pre-prosthetic treatments and accurate therapeutic protocols. Technology provides devices to optimise therapeutic results, according to biologic constraints and aesthetic parameters.*
Case report *The present report describes a multidisciplinary management in a young patient affected by lateral incisor agenesis, including pre-prosthetic orthodontic treatment and restorative and implant-supported prosthetic rehabilitation. Minimally invasive clinical procedures with veneer restorations and flapless implant placement, followed by immediate prosthesis delivery, are carried out. Tridimensional diagnostic data and dedicated software were used for treatment planning, allowing to achieve optimal results.*

Keywords *Aesthetic rehabilitation; Flapless implant; Immediate crown; Lateral incisor agenesis, Pre-prosthetic orthodontics.*

Introduction

Optimal aesthetic, function, and periodontal health in patients with lateral agenesis require a complex decisional process, involving several dental specialties [Celli et al., 2014]. The treatment should be the least invasive option in order to achieve the expected functional and aesthetic outcomes [Pini et al., 2014; Zarow et al., 2015]. Since no evidence shows an ideal treatment for every situations, lateral incisor agenesis patients should be treated according to operator's clinical expertise, clinical condition of each patient and patient expectations [Pini et al., 2014; Andrade et al., 2013]. If agenesis of the maxillary lateral incisors leads to situations that are aesthetically unpleasant or unacceptable, therapeutic options should be orthodontic space closure or opening. Several factors such as molar relationship, degree of incisors protrusion, facial patterns, skeletal arches interrelation, dental arch configuration, dental inclination, tooth shape, incisal contact, gingival margins contour, black triangles smile line, lip shape, and other aesthetic factors should be considered in therapeutic options [Park et al., 2010; Monaco et al., 2013]. In the present case, according to the absence of major occlusion problems, orthodontic space opening followed by the placement of an endosseous implant was considered as first choice treatment. Correct assessment of qualitative and quantitative features of peri-implant tissues is essential in implant planning protocols and increases the likelihood of successful long-term therapeutic outcomes [Rossi et al., 2010]. Development of implant planning software and introduction of CBCT (Cone Beam Computed Tomography) scanning technology increases feasibility of tridimensional computer-based pre-surgical planning [Bedi et al., 2011]. Computer guided implant dentistry simplifies analysis of anatomic and prosthetic requirements, allowing to achieve predictable therapeutic solutions [Frascaria et al., 2013]. Moreover, CBCT devices expose the patient to lower radiation doses comparing to conventional CT (Computed Tomography) scanning technologies [De Vos et al., 2009; Miracle and Mukherji, 2009; Guerrero et al., 2006].

In the present report, the pre-surgical planning process was carried out using CAD (Computer Assisted Design) applications by referring to the integration of different maxillofacial imaging modalities: radiographic data, captured by a CBCT scanner, and surface anatomical data, acquired by a structured light scanner [Barone et al., 2014]. Integration of different scanning data guarantees an accurate assessment of crown shapes and oral soft tissues with respect to the CBCT alveolar bone structure, avoiding subjective visual perceptions during the reconstruction process [Frisardi et al., 2011].

Accurate reconstruction of oral surfaces improves outcome predictability of implant placement when flapless approaches and immediate provisional protocol are carried out [Barone et al., 2014].

Case report

The patient, a 17 year-old female, was not satisfied

with her aesthetic appearance, presenting a maxillary right lateral incisor agenesis and a left lateral incisor microdontia (Fig. 1).

A pre-prosthetic orthodontic therapy was planned. According to the absence of major occlusion problems, the first choice treatment was orthodontic space opening followed by placement of an endosseous implant. Since the right canine was in place of the lateral incisor, a canine substitution [Zachrisson et al., 2011] was planned as the most conservative alternative to satisfy the expected aesthetics and functional objectives. An adequate space for implant placing in site 3 was achieved through a straightwire orthodontic appliance with MBT bracket prescription. Space was gained using continuous and segmented arch mechanics (Figs. 2a, b, c). Moreover, central diastema closure was considered a therapeutic target.

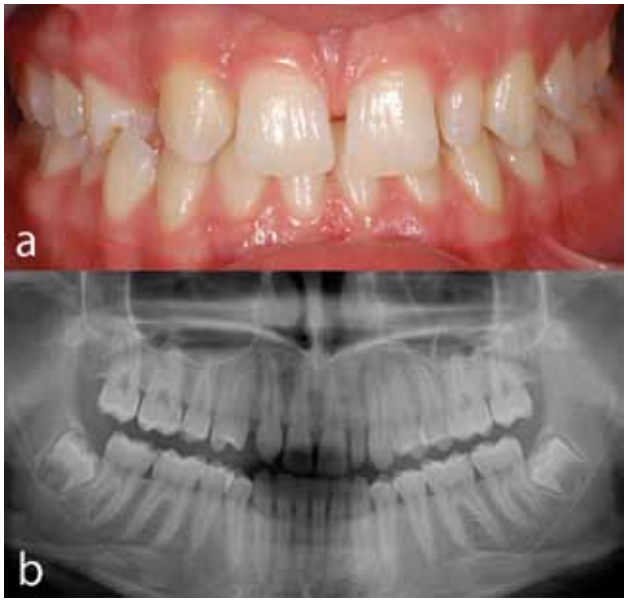

FIG. 1 Pre-treatment clinical (a) and radiographic (b) views.

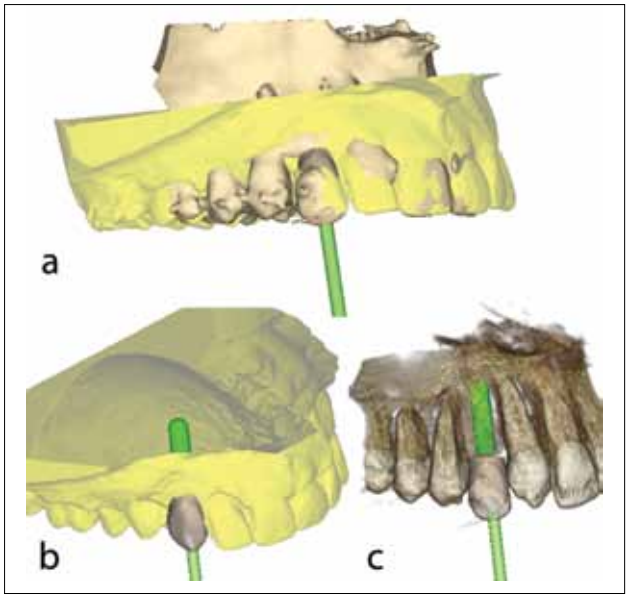

FIG. 3 Implant planning on integrated 3D model (a), obtained merging CBCT (b) and optical images (c).

FIG. 2 Pre-prosthetic orthodontic treatment (a, b, c). Eights months after an adequate space for implant positioning was achieved (d).

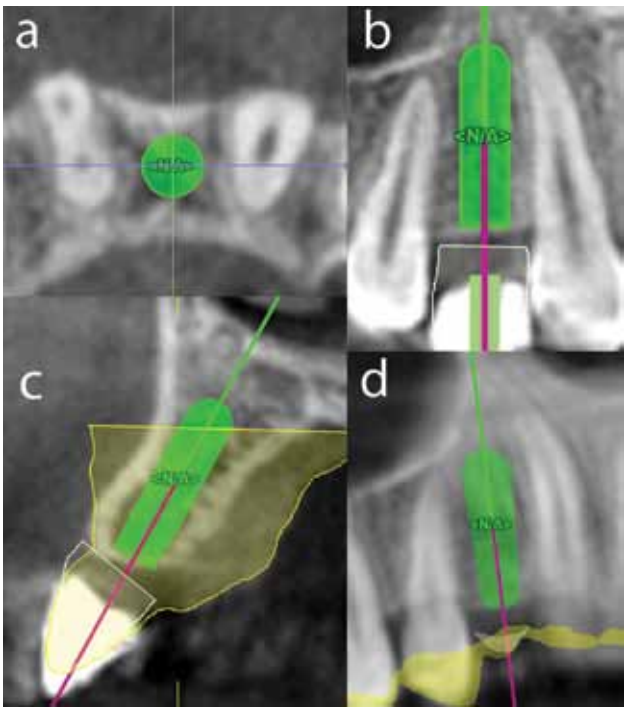

FIG. 4 Different sectional views of 3D implant planning position.

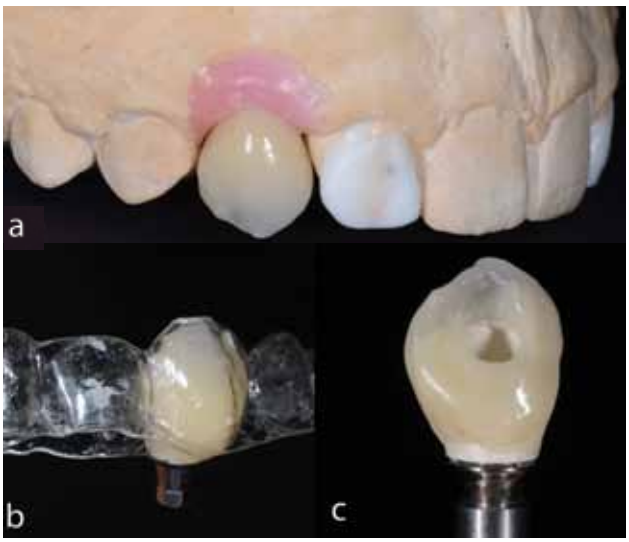

FIG. 5 Surgical model with prefabricated prosthesis (a). The provisional prosthesis into a thermoformed position index (b). Palatal view of the prosthesis with the screw access hole (c).

After eight months, when the planned orthodontic movement was completed (Fig. 2d), the patient underwent a CBCT scan, wearing a radiographic guide. At the same time a virtual model was created, scanning the plaster cast model by optical impression [Kalhara et al., 2014]. The different scanning data were imported into a dedicated CAD design software and integrated by matching reference surfaces from the existing dentition structure. The plaster cast provides wax-up information for final prosthetic result [Garcia Lopes et al., 2014]. Composite veneer restorations [Vadini et al., 2012] were designed for the right cuspid, in order to change it into a lateral incisor, and for the left microdontic incisor [Re et al., 2015]. Implant insertion was planned to replace the right cuspid (Fig. 3, 4) and a surgical guide was created according to planning data. After fitting check, the surgical guide was used to manufacture a resin pre-fabricated prosthesis, supported by a provisional abutment, for immediate provisionalisation (Fig. 5a-c).

Mucosa and dentition optical scan data permits the accurate construction of a surgical guide that will be placed on the implant site during transmucosal drilling in a unique and stable way.

The surgical guide was positioned on the maxillary dentition, and the implant (Astra Tech, OsseoSpeed TX 3.5-11 mm, Dentsply Implants) was inserted through the guide using a totally guided flapless surgery approach (Fig. 6, 7). Immediately after surgery, the temporary restoration was screwed to the fixture using a thermoformed guide (Fig. 8, 9).

The prosthesis was manufactured in order to remodel the peri-implant soft tissues, according to planning design, obtaining an optimal emergence profile and avoiding grafting surgery procedures (Fig. 10, 11). The provisional tooth was out of any occlusal contact.

After two months of healing time a definitive

FIG. 6 Detail of surgical drilling guide positioned on the maxillary dentition, after implant insertion.

FIG. 7 Site after guide removal.

FIG. 8 Provisional prefabricated prosthesis placed after surgery.

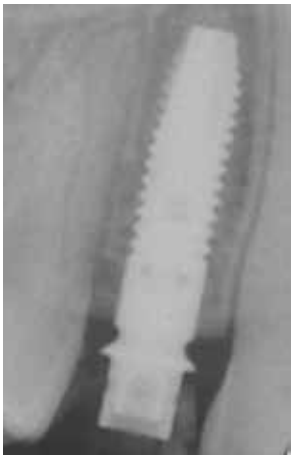

FIG. 9 Post-operative radiographic image.

FIG. 10 Clinical image two weeks after surgery.

FIG. 11 Re-modeled emergence profile two months after surgery, before delivering of the definitive crown and composite veneer restorations.

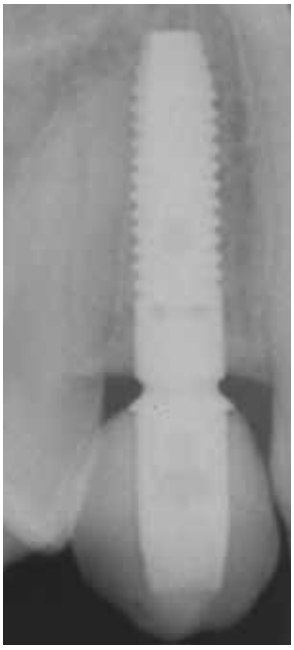

FIG. 12 Radiographic two-year follow-up shows optimal peri-implant bone stability.

restoration was screwed to the implant. Radiographic and clinical two-year follow-ups show the optimal soft tissue remodeled profile and peri-implant bone stability (Fig. 12–14).

Discussion and conclusions

The present report deals with the aesthetic rehabilitation of a young patient, starting from pre-prosthetic orthodontic therapy, ending with veneer restorations and implant insertion, using minimally invasive surgical technique and positioning an immediate pre-fabricated fixed prosthesis [Saha and Malik, 2012].

Multidisciplinary diagnosis and planning is essential to define therapeutic options in case of lateral incisor agenesis, providing best individual outcomes for patients.

Options available to clinicians are: i) space closure with mesial repositioning of canines, followed by teeth recontouring; ii) a combination of space opening and prosthetic replacement of missing lateral incisor [Pini et al., 2014; Marchi et al., 2012; Kokich and Kinzer, 2005; Kinzer and Kokich, 2005]. Different restorative approaches can be used in the agenesis area: resin-bonded fixed partial denture (FPD), cantilever FPDs, conventional full-coverage FPD, and single-tooth implants with implant-supported crowns [Antonarakis et al., 2014].

Placement of an intraosseous implant in the edentulous area, followed by placement of a crown should be the first therapeutic option in case of orthodontic space opening in post growth patients [Zarone et al., 2006]. Special attention should be paid to hygienic prevention according to the complexity of the case in order to gain optimal orthodontic and prosthetic outcomes and avoid complications [Ortu et al., 2014; Mummolo et al., 2014]. Diagnosis and treatment of growing children with missing lateral incisors can be a problem because implants cannot be placed until facial growth is complete [Kokich, 2002]. Females mature faster than males, and their adolescent growth spurt occurs earlier.

In the case reported, facial growth has been considered completed, by means of patient growth curves analysis and observation of secondary sexual characteristics.

In lateral agenesis, an ideal height of bone for implant positioning is often not available, increasing the risk of soft tissue recession after prosthetic restoration placement [Grunder et al., 2005].

Since the patient had a Class I molar relationship and the right cuspid was in a Class II relationship, having a favourable morphology to be changed into a lateral incisor, the first treatment choice proposed was to reposition the cuspid in the agenesis area and open the proximal distal space in order to place an implant in site 3.

The available bone was assessed after orthodontic treatment by means of CBCT 3D radiographic analysis, endorsing the edentulous site for safe implant positioning, without surgical augmentation procedures.

Modern implant dentistry provides patients with function, aesthetics and comfort using minimally invasive restorative approaches [Vercruyssen et al., 2008; Azari and Nikzad, 2008].

An appropriate pre-surgical planning should always be performed by combining anatomical and prosthetic considerations in order to guarantee a successful placement and a predictable treatment outcome [Barone et al., 2014]. The widespread of computer-guided methodologies provides reliable tools for virtual preoperative assessment of implant placement [Rossi et al., 2010; Abboud and Orentlicher, 2011]. Maxillofacial digital data can be processed by interactive software in order to plan implant position, taking into account both anatomical and restorative demands [Meloni et al., 2010; Retzepi and Donos, 2010].

Virtual implant placement is transferred to patients through customised surgical templates, designed according to final implant project within the CAD software.

Digital workflow, based on reliable 3D image data, makes flapless implant positioning a useful and predictable procedure facilitating the management of immediate implant provisionalisation [Azari and Nikzad, 2008; Frascaria et al., 2013; Malo et al., 2007;

FIG. 13 Clinical two-year follow-up. Composite veneer restorations in sites 1.2 and 2.2 result in good aesthetic smile integration. The peri-implant gingival contour is well preserved.

FIG. 14 The final aesthetic result achieved.

D'haese et al., 2012; Tardieu et al., 2007; Sclar, 2007].

Geometrical matching optical model with CBCT images results in better fit of surgical guide and more accurate pre-fabricated provisional prosthesis than radiographic data alone [Barone et al., 2014; Frisardi et al., 2011; Neugebauer et al., 2011; van der Meer et al., 2012].

Immediate prosthesis with a natural crown emergence profile, allows preservation and shaping of the gingival morphology for adequate aesthetics, often avoiding additional surgery [Frascaria et al., 2013; Meloni et al., 2010].

The described implant protocol improves patient care with a minimally invasive surgical approach, offering shorter healing times and immediate satisfactory aesthetic results.

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