

Implant in the anterior area: A real esthetic challenge

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Abstract

Introduction: The aesthetic success of the implant is essentially based on the natural integration of the prosthesis. Implant placement in the anterior sector is a real challenge for the dental surgeon. The challenge is about: The timing of implant placement, the accurate 3D position of the implant and the hard and soft tissue management.

Case report: A 24-year-old patient in good general health attended the Department of Periodontology, complaining of an unsightly smile. Intraoral examination showed the presence of dyschromia of the 21, fracture and fistula. Radiographic examination showed apical reaction associated with cervical root resorption. After several attempts of endodontic treatment, the decision was to replace 21 by an implant. The procedure relied on a guided bone regeneration (GBR) with a bovine bone and a resorbable collagen membrane has been done.

Conclusion: The evaluation of the esthetic risk of the patient allows to establish an accurate diagnosis and a detailed and a personalized treatment plan. The purpose of the present report is to expose, through a clinical case, the management of a case of implantation in the anterior sector with a vertical bone defect.

Keywords: Aesthetics; anterior maxilla; dental implants; single-tooth implants; papilla; bone grafting; soft tissue augmentation; guided tissue regeneration; bone substitutes; pink esthetic score; white esthetic score; clinical guidelines; implant placement/timing; keratinized mucosa.

Introduction

Nowadays, the replacement of a single tooth in an esthetic area using an implant has become a common indication. It is a real challenge for clinicians due to lack of surrounding soft tissue and hard tissue as a result of bone resorption. Indeed, bone resorption after avulsion is a natural and

inevitable phenomenon that is carried out according to a well-defined scheme. The width of the alveolar crest is reduced by 50% 1 year after extraction, as two thirds of this reduction occurs in the first 3 months after the extraction. (1) The challenge also lies in the implant supported restoration of an esthetic zone with gingival architecture that harmonizes with the adjacent dentition.

Today, several options can be used for implant rehabilitation. Immediate or early placement with soft tissue or partial bone healing, and late implant placement. The latter is not an attractive option for the patient as it requires a post extraction healing period of 6 months or more. However, it can be indicated in specific situations. These can be classified into patient-specific indications or site-specific indications. Patient-specific reason most often includes adolescent patients, too young for implant therapy (age < 20 years). Site-specific reason include extended bone lesions and ankylosed root. (2)

Case report

A 24-year-old patient in good general health attended the Department of Periodontology, complaining of an unsightly smile. Intraoral examination showed the presence of dyschromia of the 21, fracture and fistula (Figure.1). Radiographic examination showed apical reaction associated with cervical root resorption (Figure.2). After several attempts of endodontic treatment, the decision was to replace 21 by an implant.



Fig. 1: Initial clinical situation with dyschromia + fracture + fistula at the level of the 21



Fig. 2: Apical reaction + Cervical root resorption

First we evaluate the esthetic risk of the patient in order to establish an accurate diagnosis and a detailed and a personalized treatment plan (necessity of: guided bone regeneration, connective tissue graft) for this specific case. Risk assessment includes medical status, smoking, esthetic expectations, lip line position, periodontal biotype and shape of tooth crowns. The infection at implant site, bone anatomy of alveolar crest and finally the width of edentulous span must be evaluated. (3) In this case, the esthetic risk level was somewhere between medium and high. (Table 1)

| Esthetic risk factors | Low | Medium | High |
|--------------------------------|-------------------------|------------------------------|--------------------------|
| Medical status | Healthy | | Reduced immune system |
| Smoking habit | Non-Smoker | < 10 cig/day | > 10 cig/day |
| Attentes esthetiques | Low | Medium | High |
| Lip line | Low | Medium | High |
| Gingival biotype | thick | Medium | Thin |
| Shape of tooth crows | Rectangular | | Triangular |
| Infection at implant site | | Chronic | Acute |
| Bone level at adjacent teeth | ≤ 5 mm to contact point | 5,5- 6,5 mm to contact point | ≥ 7 mm to contact point |
| With of edentulous span | 1 tooth ≥ 7 mm | 1 tooth ≤ 7 mm | |
| Soft tissue anatomy | Intact | | Soft tissue defects |
| Bone anatomy of alveolar crest | - | Horizontal bone deficiency | Vertical bone deficiency |

Table 1: Esthetic risk assessment

Eight weeks after the tooth extraction, the implant site was reconstructed as shown in the following figures of the surgical steps (figure 3 to 7). The procedure relied on a

guided bone regeneration (GBR) with a bovine bone and a resorbable collagen membrane has been done.



Fig. 3 A :21 extracted



Fig. 3 B: Bone defect after extraction



Fig. 4 A: Clinical situation Eight weeks after the extraction



Fig. 4 B: Eight weeks after the extraction significant bone loss is observed radiologically



Fig. 4 C: Buccal bone defect observed at the time of implant surgery



Fig. 5 B: Application of the collagen membrane



Fig. 5 A: Application of the bovine bone



Fig. 6 A: Surgical site after suturing



Fig. 6 B: Removable partial prosthesis, without false gums with ovoid pontic set up during periods of healing



Fig. 7: Radiographic view after GBR showing bone filling



Fig. 8 A: Nine months post op, vertical bone volume stability



Fig. 8 B: Nine months post, horizontal bone gain

The Cone Beam Computed Tomography (CBCT) evaluation after nine months shows the reconstruction of the buccal bone (figure 9 B) which allows optimal conditions for implant placement. A 3-D guided surgery was chosen rather than free-hand surgery for the implant placement in order to achieve immediate esthetic outcome. (Figure 9 C)



Fig. 9A: Radiographic view nine months after GBR showing bone filling

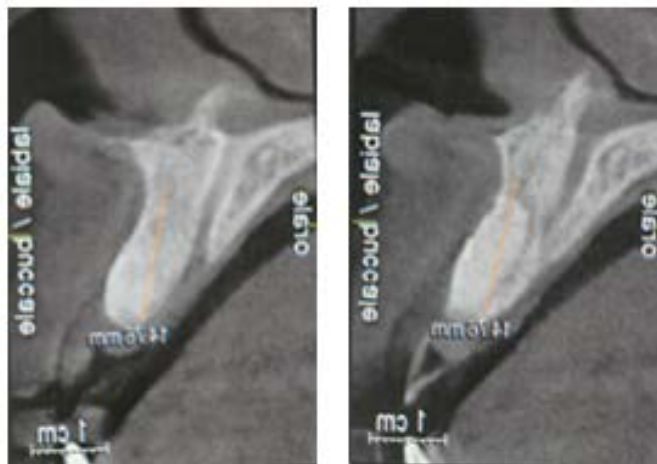


Fig. 9 B: Cone beam computed tomography evaluation after nine month showing reconstitution of buccal bone

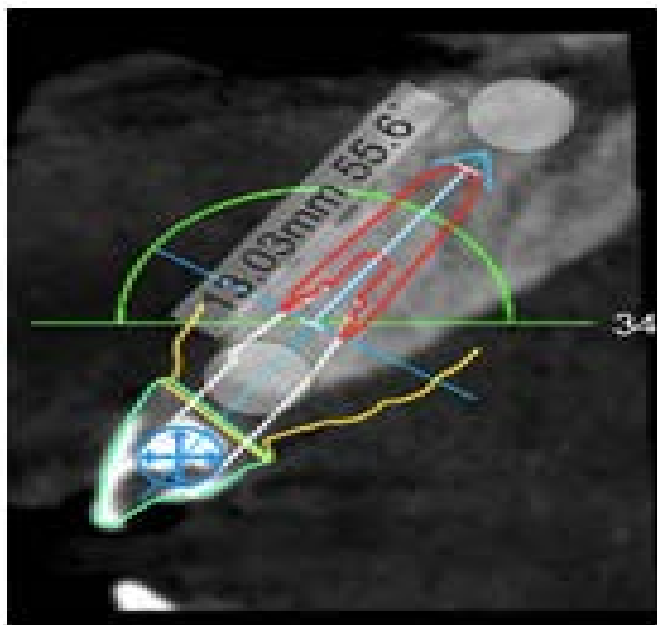


Fig. 9 C: Digital plan for guided surgery

After flap elevation (figure 10), we noted that the bone volume is suitable for implant placement. An implant of 3,5mm in diameter and 13mm length was placed through the surgical guide obtained from the 3D digital treatment plan (Figure 11). A torque of 40Nm and ISQ (Implant Stability Quotient) of 75 was obtained, which was suitable for immediate loading (Figure 12).



Fig.10: Flap elevation



Fig 11: Pre surgical guide



Figure 12

18 months post op clinically pleasing esthetic outcome is observed. X-ray examination revealed stable marginal bone level around the implant. (Figure 13: A, B, C)



Fig. 13: A: 24th September 2019/ B: 4th June 2019/ C: 3rd March 2020

Discussion

One of the most challenging treatment in implantology, is the one to be placed in the esthetic area, for it has to fulfill many criteria for optimal outcomes.

The challenge is about:

- The timing of implant placement
- The accurate 3D position of the implant
- The interdental papilla

The timing of the implant placement

A study by Hof and al compared five different implant treatment protocols in the anterior maxilla, including immediate, early, and delayed implant placement, as well as implant placement in conjunction with simultaneous guided bone regeneration and implant placement 3 months following horizontal autologous bone block grafting. (4) This study revealed that comparable clinical, radiological, and esthetic results can be achieved with all treatment protocols. (4) The immediate implant placement (type I) is indicated in case with intact facial bone wall, a thick soft tissue biotype, no acute infection in the socket and finally

the presence of a sufficient bone volume apically. Early implant placement (4-8 weeks) (type II) with soft tissue healing is indicated in case of thin or damaged facial bone wall. Early implant placement (12 to 16 weeks) with partial bone healing is indicated in case of large apical bone lesion which does not allow type I or II placement. Late implant placement is an option that is generally indicated for young patients (<20 years), especially those with extended apical bone lesion. This implant placement procedure was chosen for our patient in order to obtain optimum implant stability. (2)

The 3D implant position

Buser and colleagues have identified a «comfort zone» where the implant must be placed.

In the apicocoronal direction, it should be inserted 3 to 4 mm apically to the gingival margin of the future restoration. (5)

For the replacement of the maxillary central incisor, the implant has to be placed 1.5 to 2mm palatal to the incisal edge of the adjacent incisor, preserving 2mm of the buccal cortical bone, in order to obtain harmonious emergence profile of the final restoration. (6-7)

In the mesiodistal direction the implant should be at least, 1.5 mm away from the adjacent teeth. This distance is necessary for the preservation of the inter-proximal bone and thus ensure the achievement of the interdental papilla and a good emergence profile. The mesiodistal implant position determines the sustaining bone and the blood supply that allows papilla preservation, a fundamental factor in defining a good esthetic outcome. (7)

Interdental papilla and soft tissue management:

Fu and al suggest a management triad to increase soft tissue thickness around implants, PDP management triad.

- Implant position (P): more palatal and more apical;
- Implant position (P) and angulation are key determinants in ensuring that an implant-supported

restoration has functional and esthetic success through an ideal emergence profile.

- Implant design (D): small diameter and platform switching can help prevent crestal bone resorption, which is a great asset in preserving esthetics.
- Prosthetic design (P): concave abutment profile, concave crown profile. The prosthetic design (P) can provide the additional space for soft tissue ingrowth to create a fuller soft tissue profile. (8)

The authors also conclude that to have a papilla, the vertical distance between the point of contact and the bone crest must be 5 mm. (8, 9)

The choice of the implant diameter determines the esthetic result. The appropriate implant diameter depends on the width of the alveolar ridge and the size of the tooth to be restored. It is recommended to maintain a palatine bone wall of at least 1-2 mm thick, giving a minimum peak width of 5.5-6 mm for small diameter implants. In the anterior tooth region the authors agree on the use of small diameter implant. (10)

In addition to the implant placement timing, its position and diameter, hard and soft tissue regeneration is much often needed for the implant treatment in the esthetic area. Guided bone regeneration (GBR) has been shown to be effective to increase the crest volume in the vertical and horizontal direction (10).

The Consensus Report of the Guided Bone Regeneration (Cucchi and al) suggests that GBR employing non resorbable membranes or titanium meshes should be used for horizontal augmentation of large defects and for vertical augmentation. GBR is a predictable technique for bone augmentation. Clinicians should always consider the key factors for success in GBR, including patient and defect analysis, blood supply, flap passivation, membrane fixation, and primary closure. There is no clear evidence showing that any specific bone graft combination is

superior to others in terms of vertical or horizontal augmentation. (11)

Considering soft tissue augmentation would be based on the quantity and thickness of the keratinized mucosa, which may be reflected as a thin or thick gingival biotype. Based on the biologic width around dental implant, a minimum 3 mm width with 2 mm thickness of keratinized gingiva is recommended.(12) The case above exposed a vertical bone defect, though the keratinized gingiva width was 3mm which oriented our choice to use bovine bone and resorbable collagen membrane for the GBR procedure.

Conclusion

Esthetics is a subjective notion but there are scores to objectify it, especially the Pink Esthetic Score (PES) and White Esthetic Score (WES).

The PES includes five parameters: mesial papilla, distal papilla, curvature of facial mucosa, level of facial mucosa, root convexity / soft tissue color and texture. A score of 2, 1 or 0 is assigned to the five PES parameters.

The five described parameters (5 × 2) add up, under optimum conditions, to a score of 10 the threshold of clinical acceptability was set at 6.

WES focuses on the part of the implant crown that emerges from the implant. It is based on the following five parameters: Tooth form, Outline and volume of the clinical crown, Color,

Surface texture and Translucency / Characterization. A score of 2, 1, or 0 is assigned to all five parameters. Thus, in case of an optimum implant restoration, a maximum total WES of 10 is reached. Again, the threshold of clinical acceptance was set at a score of 6. (13)

The PES for this case is 8: (Mesial papilla: 2/ Distal papilla: 2/ Curvature of facial mucosa: 2/

Level of facial mucosa: 2 / Root convexity/ Soft Tissue color and texture: 1). The WES is 9 (Tooth form:1 /

Outline and volume of the clinical crown:2 / Color:2 / Surface texture and Translucency:2/ Characterization:2).

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List of abbreviation

GBR: guided bone regeneration.
CBCT: The Cone Beam Computed Tomography.
ISQ: Implant Stability Quotient.
PES: Pink Esthetic Score.
PI: Papilla Index.
SES: Subjective Esthetics Score.
VAS: Visual Analogue Scale.
PES: Pink Esthetic Score.
WES: White Esthetic Score.