AN INNOVATIVE STRATEGY FOR IMMEDIATE IMPLANT PLACEMENT REHABILITATION IN MOLAR SITES: THE SSA CONCEPT.

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SUMMARY

MOLAR REPLACEMENT is the most frequent therapeutic modality in implant dentistry. However, many different clincal protocols are proposed and utilized in order to maintain volume stability after tooth extraction (including early placement, socket preservation and immediate implant placement). From the patient´s perspective, immediate protocols provide satisfying experience, but surgical manipulation for closure obtention may generate invasiveness and unpredictability. In this perspective, the goal of this article is to describe a clinical workflow combining immediate implant placement on molar sites and prosthetic non invasive closure by the use of a customized healing abutment (SSA: Sealing Socket abutment). Based on the SSA (sealing socket abutment) Concept, the SSA Gingival Fit Abutment (Biotech Dental, France) is presented as a multi-functional anatomical abutment that has been developed to offer a highly biocompatible interface, integrate one time one abutment concept and allow for digital scanning.

INTRODUCTION

THE CLINICAL PROTOCOLS for implant placement and loading have substantially evolved since the initial concept described by Brånemark in the 80's (Brånemark 1983). Over the years, the technical advancements in 3D imaging, and CAD softwares allow us to plan, diagnose, and execute surgical procedures with higher precision and predictibility.

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Figure 1.
SSA workflows: a) Pre-operatively Labside, combined with guided implant surgery (CAD-CAM, Digital); b) Per-operatively, chairside, CAD / CAM milling system (CAD-CAM, Digital) 1; c) Per-operatively, chairside by adding photopolymerisable increments of composite (Flowable composite, Conventionnal).

In this context, the immediate post-extraction implant placement has been scientifically supported through numerous publication dealing with this clinical strategy (Vignoletti and Sanz 2014). It is, now widely accepted, that conducted with respect to the rules of a 3D positioning, this procedure can be predictably implemented. Since many years, immediacy is routinely utilized in dental implant practices as it allows to reduce number of surgeries, overall treatment time, and morbidity (Chen and Buser 2014; Bhola et al. 2008).

In the recent years, Implant timing Type 1 (immediacy) in the esthetic zone, have been presented as an attractive treatment (when conducted properly) alternative for the patient as well as for the dentist for the clinical benefits it offers:

reduction of number of surgeries, reduction of overall treatment time and reduction of morbidity.

In this region, (Immediate placement) is commonly associated with an immediate provisional prosthesis as this socially involved site requires an esthetic temporary solution (De Rouck et al. 2009; Chen et al. 2007).

Opposingly, in molar sites, the risk of failing osseointegration for an implant undergoing extensive masticatory load is not worth the benefit of receiving restoration on the day of the surgery.

Thus, although many studies reported similar implant survival rates when implantation is performed immediately after extraction (98.8%) or on healed sites (99%) at molar sites (Atieh 2010), hermetic primary closure around the healing abutment remains the major challenge.

For this reason, several authors have proposed to utilize a customized anatomical healing abutment (Akin 2016), also described as SSA (« Sealing Socket Abutment ») (Finelle 2015; Finelle and Lee 2017).

The aim of the technique is to mimick the benefits of the transmucosal tissue conditioning observed when immediate restoration is performed without taking the mechanical risks of the micromovements on a NON osseointegrated implant.

Moreover, the SSA allows to perform a physical barrier and serves to:

- Seal Mechanically the surgical site following the outline of the extraction socket with its anatomical design.
- Stabilize the blood clot in a confined and a favorable space for bone regeneration and substitute material (Retzepi 2010).
- Develop an ideal prosthetic emergence profile modeled on the anatomy of the existing tooth (Chu 2012).

Diverse manufacturing techniques (Figure 1) have been proposed previously, firstly through digital ways which appeared as the more appropriate workflow. Subsequently, in order to make this technique accessible to the greatest number of practitioners who are not digitally equiped this customized healing abutment has been adapted for conventional workflow with flowable composite.

To date, this customized healing abutment could be performed in different ways (digitally and by so-called traditional chairside technique) (Knafo and Finelle 2020).

The techniques below are described in the chronological order in which they were clinically developed:

1. Pre-operatively Labside, combined with guided implant surgery (CAD-CAM, Digital)
2. Per-operatively, chairside, CAD / CAM milling system (CAD-CAM, Digital)
3. Per-operatively, chairside by adding photopolymerisable increments of composite (Flowable composite, Conventional)

All of these techniques have the advantage of insuring an immediate placement combined with a rigid NON invasive alveolar closure. Nevertheless none of these offer the advantages of an industrially engineered abutment design and conceived with an ultimate biological and technical goal.

In this perspective, very recently, an innovative solution entitled « SSA Gingival Fit» (Biotech Dental) (Figure 2) abutment has been introduced into the market to meet clinicians in need for simplification and optimal tissue integration.

The objective of this article is to discuss the technical and digital features behind this novel immediate abutment solution and illustrate the SSA implant workflow for single molar restoration.

Figure 2.
SSA Gingival Fit structure showing screw retained «omnipost» one time one abutment final abutment and SSA Cap Suprastructure.

CASE DESCRIPTION

A 38-YEARS OLD WOMAN, presented in our clinic for implant and prosthetic restoration of a lower left hopeless first molar (#36). The patient's medical history revealed no contraindications to dental implant therapy and restorative treatment.

Treatment planning

Tooth #36 was diagnosed as untreatable due to deep root decay and lack of ferrule (Figure 3). The tooth was previously endodontically treated and slightly sensitive to percussion. Moreover, the soft tissues are intact. No sign of acute infection was noted at the time of clinical examination.

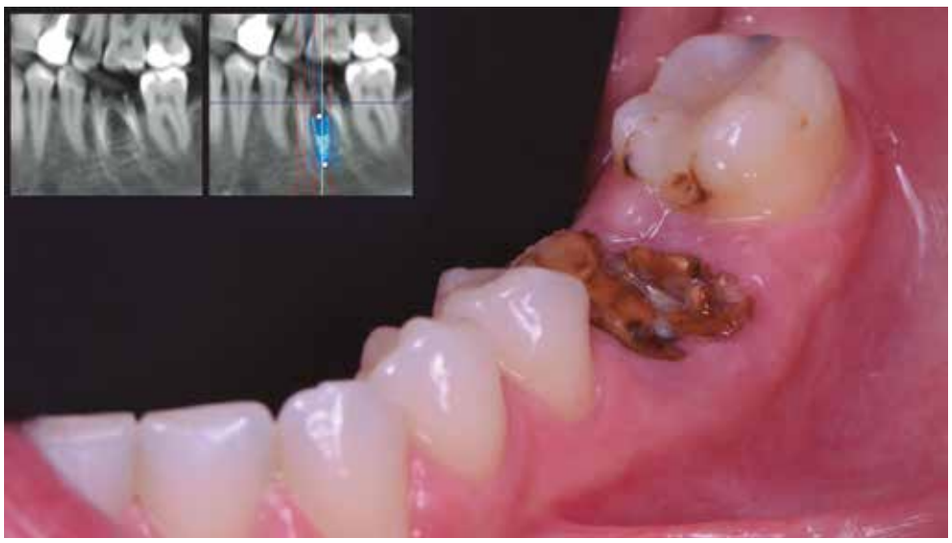

Figure 3.
Initial clinical situation of hopeless first lower molar and corresponding Radiograph exhibiting suitable septum for immediate placement.

Based on radiographic examination (Cone Beam Computerized Tomography), the class A septum configuration (Smith and Tarnow 2013) and apical bone volume was favorable and compatible with:

1. a predictible and adequate insertion torque
2. perfect 3 dimensional prosthetic position.

Immediate implant placement after extraction of #36 was planned to reduce treatment time and number of surgeries in comparison with the delayed approach. The implant selected for this procedure was a Biotech Dental® Implant Kontact N 4.2 X10.

Surgical procedure

Atraumatic flapless tooth extraction was performed by sectioning the existing roots (Figure 4) and separating the supracrestal gingival fibers with periotomes. After extraction, the alveolar socket was generously irrigated with sterile saline solution and cleaned with curettes to remove granulation tissue. The osteotomy was prepared in the middle of the septum as virtually planned in the diagnostic stage (Figure 5). A Biotech Dental® Implant Kontact N 4.2 X10 was placed following manufacturer's instructions (Figure 6). The insertion torque was recorded during the placement and reached at 38N/cm. Xenograft bone substitute (Bio-oss Collagene, 250mg Geistlisch) was packed to fill the alveolar socket surrounding the implant (Figure 7).

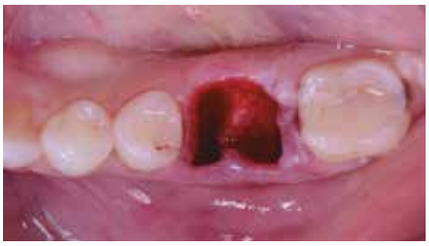

Figure 4.
Occlusal view after tooth extraction.

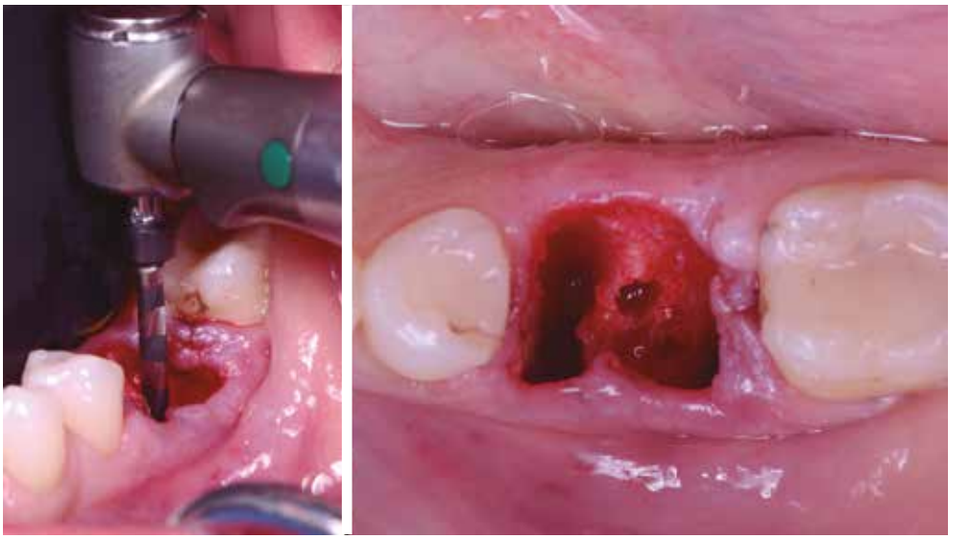

Figure 5.
Intraseptal pilot Drilling.

Figure 6.
Immediate implant placement in the septum area (4.2x10 Kontact N, Biotech Dental).

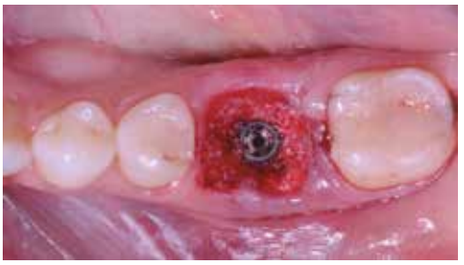

Figure 7.
Occlusal view after immediate implant placement and socket preservation with xenograft material.

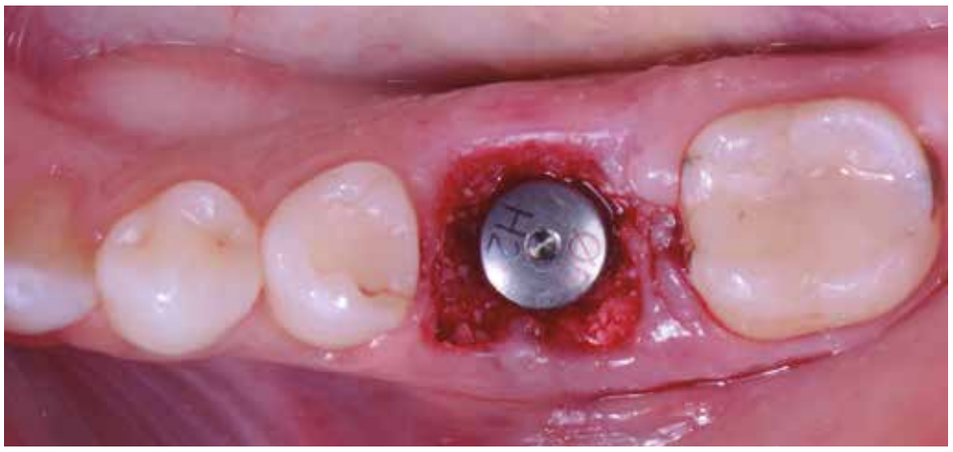

Figure 8.
Occlusal view showing discrepancy between regular healing abutment and morphology of the post extraction socket.

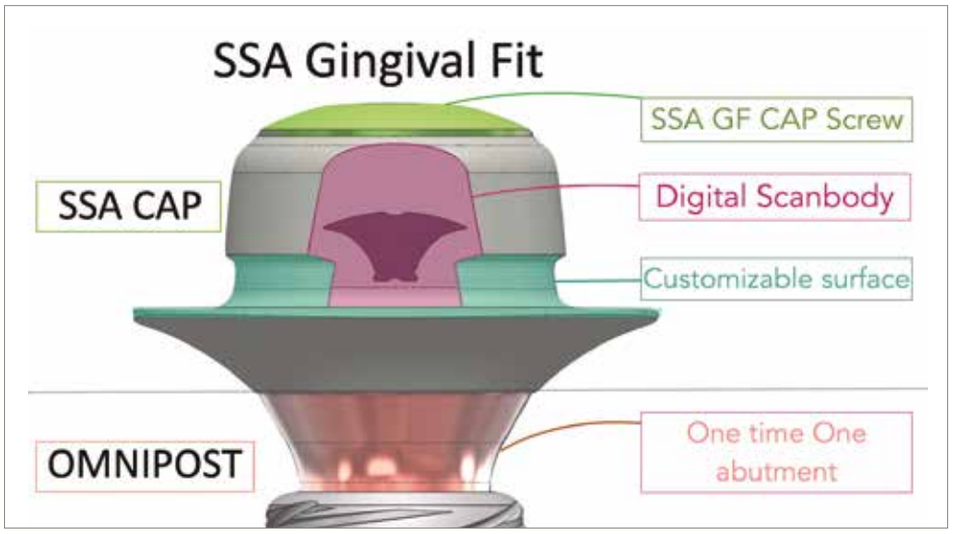

Figure 9.
Technical features and composition of SSA Gingival Fit abutment (Biotech Dental).

As a regular healing abutment is not fitting with the alveolar morphology (Figure 8) and doesn't allow for proper closure of the socket at the time of extraction, the « Sealing Socket Concept » was applied through a novel customizable abutment system (SSA Gingival Fit : SSA GF) specifically developed for this immediate indication. Thus, the abutment system called SSA Gingival Fit has been utilized to simplify the obtention of alveolar closure and optimize biological response.

The SSA Gingival Fit complex (Figure 9 and Figure 2) is a customizable healing abutment dedicated for immediacy and made of two transmucosal components:

1. Omnipost: a narrow prosthetic abutment (Titanium) internally connected into the implant following «one time one abutment » as it is finally delivered on the day of surgery.
2. SSA CAP: A highly biocompatible, anatomical, customizable, scannable suprastructure (PEEK material) connected and indexed externally onto the Omnipost that can be selected for 3 shapes (maxillary molars, mandibular molars, Universal) to initiate the socket sealing process.

Figure 10.
Insertion of omnipost abutment onto the implant connection.

Figure 11.
Buccal view of SSA CAP try in, connected onto the omnipost abutment.

Figure 12.
Occlusal view of SSA CAP try in, connected onto the omnipost abutment.

Figure 13.
SSA CAP customization to fit the cervical socket outline.

As the site involved here is a #36, an SSA CAP matching with a lower molar shape component is preselected.

According to the vertical position of the implant, the appropriate gingival height is chosen for the omnipost abutment.

The omnipost is screwed into the implant at a final torque of 20 N/cm as recommended by the manufacturer (Figure 10). This abutment will not be removed anymore to follow the one abutment one time protocol.

SSA CAP is manually inserted on the omnipost (Figure 11 and Figure 12), and can be customized by adding increments of flowable composite on the extension margin of the component which is sandblasted for improved adhesion (Figure 13).

Once customization is finalized, the SSA CAP is manually polished in the areas where composite has been added (Figure 14a).

Finally, SSA CAP is finally tighted into the omnipost at a torque of 15 N/Cm to support surrounding soft tissues and provide a barrier to bone substitute material without the use of a biological membrane as described by previous authors in the situation of immediate provisionalisation in the esthetic zone (Figure 14b) (Chu et al. 2012). Immediately after the surgery, post-operative peri-apical radiographs (Figure 15a) were taken to verify the proper position of the implant and the full seating of the SSA CAP onto the omnipost. At the one week follow up, the patient reported an uneventful post-operative recovery The clinical examination at two weeks showed a favorable soft tissue healing with minor inflammation noted (Figure 15b).

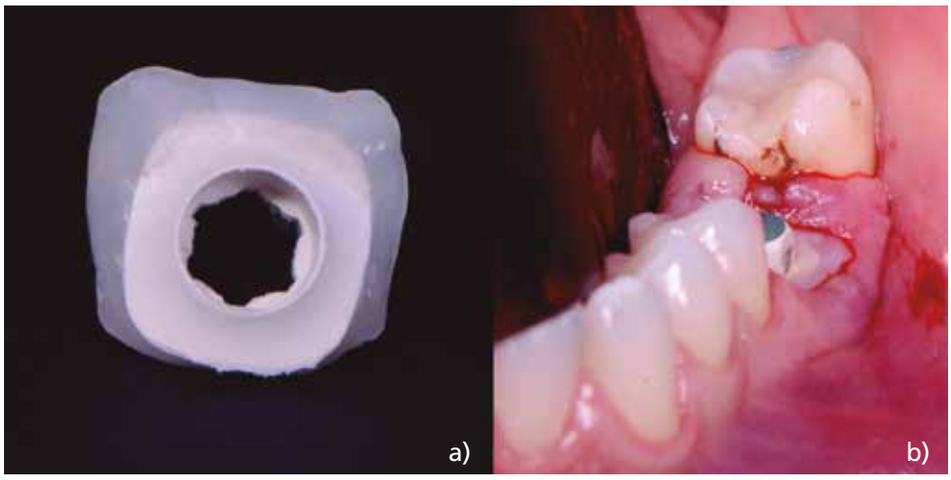

Figure 14.
a) SSA CAP customization before being screwed onto the «omnipost» abutment; b) SSA GF screwed into the implant after final customization.

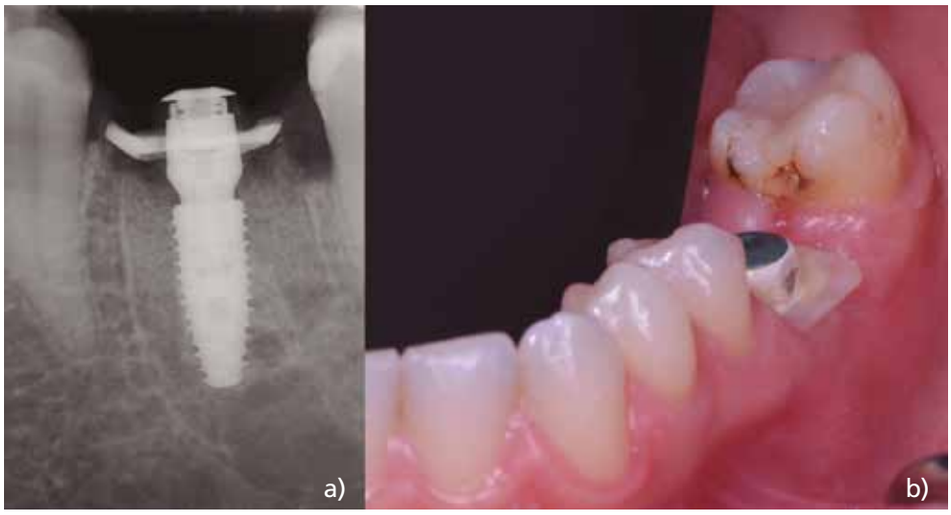

Figure 15.
a) Post operatory radiograph of the implant and SSA GF; b) Buccal view of the SSA GF complex at 2 weeks Follow up

Figure 16.
Buccal view of the SSA GF complex at 4 months Follow up.

After 4 months of osseointegration, soft tissues around the SSA abutment were healthy and the clinical buccal contour adequately maintained (Figure 16). Nevertheless, it can be observed that some of the initial composite increments were partially lacking on the abutment surface. The patient explained she ate accidentally on the abutment in the late stage of osseointegration which caused its breakage. No further complications were reported.

As described on Figure 9, the SSA GF device contains an integrated scanbody with a scannable coding part (Flat area). Final Digital impression for implant restoration can be performed directly on the abutment without any need of abutment removal or additional components. Alternatively, if the digital geometry is not accessible (Adhesive resin extension) or damaged, a digital impression can be also taken after removal of the SSA cap, on the underlying omnipost abutment on which a scanbody is connected. This action would not compromise the «one-time, one-abutment» protocol as the biological width remains stable and untouched.

In the present case, implant impression was taken directly on the SSA GF, without taking it out from the omnipost abutment, as it behaves also as a scanbody at this stage (Figure 17).

The prosthetic emergence profile is replicated from a digital library containing the specific anatomical shapes matching with the SSA GF abutment utilized and the prosthetic emergence profile can be reproduced in consequence.

The final implant screw retained crown was designed using a design dental Software (Exocad) and milled out of a block of Zirconia (ZirCAD Prime, Ivoclar Vivadent). The emergence of the implant screw axis allowed for a screw retained prosthesis (Figure 18). The crown was stained, and occlusal grooves were readjusted to improve the occlusal anatomy. The implant crown was bonded in the lab onto a titanium base abutment adapted for the omnipost final abutment. At the time of final crown delivery (Figure 19a), the SSA CAP is unscrewed and removed and the final implant crown is inserted. Final insertion torque (35N/cm) was applied and the access hole was covered with restorative composite (Gænial A2, GC). We can notice the adequate emergence profile of the peri-implant soft tissues precisely fitting with the transmucosal anatomy of the ceramic crown. A post-operative periapical radiograph was taken to verify the seating and marginal integrity after insertion (Figure 19b).

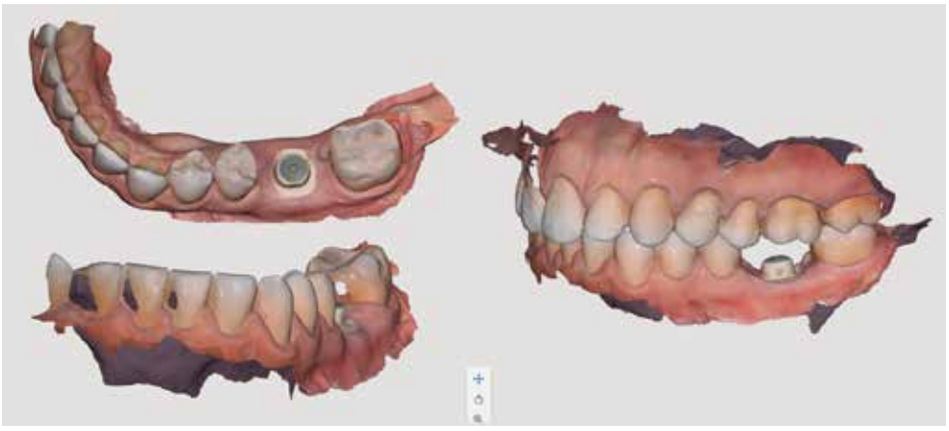

Figure 17.
Digital Files after intra-oral scanning of the SSA GF complex.

Figure 18.
Occlusal view after SSA CAP removal at the time of implant supported rehabilitation try in.

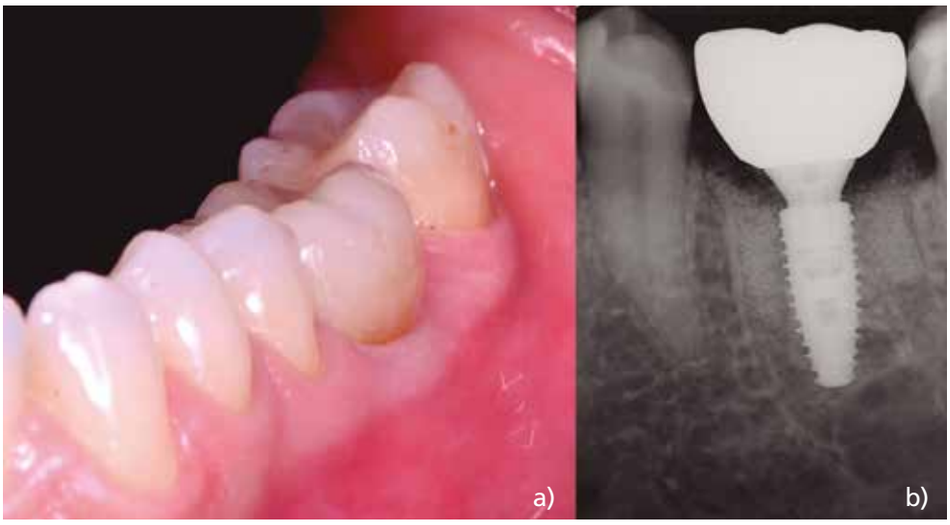

Figure 19.
a) Monolithic Zirconia screw retained crown at time of final delivery; b) Final Peri-apical Xray at time of final Delivery.

DISCUSSION

THE PRESENT ARTICLE, DISCUSSES A CLINICAL PROTOCOL focusing on minimally invasive surgery in molar sites, combining immediate implant placement and a chairside manufactured customized abutment that has been previously approached in several articles.

Immediate implant therapy in molar sites shows comparable survival rates with implants placed in healed sites and includes highly valuable potential benefits for the patient, including a reduction of morbidity (one surgery) (Atieh et al. 2013), reduction of treatment time, a possible flapless procedure and reduced treatment costs.

Nevertheless, due to the anatomical morphology of the intra-alveolar socket in the molar area, this technique remains highly challenging and relatively invasive, especially when primary closure of the soft tissue is intended. Thus, it could be assumed that immediate provisionalization (similar to the technique described for the esthetic area) is an interesting alternative, behaving as a mechanical barrier, by stabilizing a freshly constituted blood clot, and maintaining a favorable confined space for bone regeneration. Moreover, it is commonly accepted that immediate restoration in the esthetic area provides optimal soft tissue support for the papillae and buccal soft tissue margins (Schwartz-Arad et al. 1998; Kan et al. 2011).

However, immediate provisionalization in the molar area is poorly documented and cannot be recommended as a safe procedure with regards to the unfavorable risk/benefit ratio of such a procedure in a molar area.

The use of a customized healing abutment allows for the optimization of the biological response of the transmucosal portion area without compromising the immobilization of the fixture during healing. Recently, industrialized semi-anatomical abutments or 'gingival formers' have been introduced to the market in order to guide peri-implant tissues towards a more natural emerging shape. These standardized anatomical abutments fit well with the indication of healed sites that exhibit a collapsed anatomy which occurred following tooth removal; however, they lack the possibility of being fully customized. In the case of immediate placement, a fully customized healing abutment seems to be a predictable approach to ensure proper sealing of the socket and intimate tissue closure, which has significant biological benefits, among which are the mechanical stability of the blood clot in a confined space, the dimensional stabilization of the mucogingival architecture, and guidance of a proper emergence.

The SSA concept, previously described in the literature, is utilized to ensure soft tissue support, to avoid tissue collapse, and reduce treatment times. In a case series involving 29 patients with at least 2 years follow up, the results demonstrated uneventful postoperative recovery and showed positive treatment outcomes with regard to implant survival and tissue appearance (Finelle 2019).

Some recent studies have investigated the impact of customized healing abutment on the peri-implant hard and soft tissue environment. Interestingly enough, the articles dealing with bone volume variation showed that significantly less shrinkage was observed after at least 3 years when a customized healing abutment is utilized in comparison with a standard healing abutment. (Menchini-Fabris et al. 2020; Alexoupoulou 2021).

Indeed, loss of bone width appeared negligible, with values ranging between 0.2 and 0.4 mm in the customized group, whereas in the conventional group all tooth sites underwent wide shrinkage.

In a recent prospective case series, the authors have evaluated the soft tissue contours and the radiographic bone levels of 17 patients who received immediate implants in molar sites and a digitally customized CAD-CAM sealing socket abutment. At the 2 years follow-up, the overall ridge resorption calculated on the soft tissue contours at the most coronal portion were reduced horizontally in an average of 1mm at 1,2,3 and 4mm below the gingival margin. These results showing minimal ridge resorption are consistent with the results observed on the bone changes articles described previously in the text (Menchini-Fabris et al. 2020; Alexoupoulou 2021) .

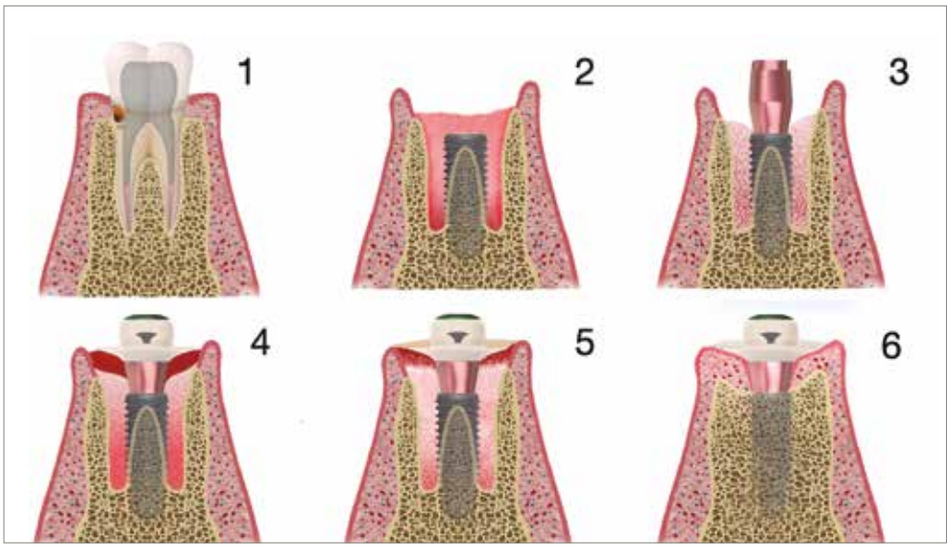

Figure 20.
Step by step overview of SSA GF protocol:
1) Hopeless molar to be extracted; 2) Atraumatic extraction and immediate implant placement; 3) Omnipost abutment insertion, and Socket preservation; 4) Insertion of SSA Cap before customization; 5) Customization of SSA Cap after adhesive composite increments for socket sealing; 6) Hard and soft tissue healing around SSA GF complex after osseointegration is completed (around 3-4 months).

Even though, increasing promising data are continuously published providing positive information, it remains unclear which is the most adequate technique to proceed with SSA workflow fabrication.

In this context, the present case report described the overall immediate workflow for implant molar rehabilitation using a novel fully customizable abutment conceived for the specific indication of immediate implant rehabilitation entitled «SSA Gingival Fit» (Biotech Dental) (Figure 20).

Previous techniques were presented in the literature : In 2017, Finelle and Lee (Finelle and Lee 2017) described a CAD/CAM generated SSA prepared before navigated surgery based on virtual implant planning. This technique implies the use of a computer-guided surgery system that allows for pre-milled prosthetic components in accordance with the expected 3D implant position. This workflow presents few disadvantages as it is technique-sensitive and associated with a high cost due to the outsourcing and labside fabrication. Additionnally, possible misfit may occur in case of deviation of the implant, which would translate to increased laboratory costs.

A more conventional technique was described in a recently published case report in which adhesive resin composite was placed directly into the socket area.

One of the main issues of this procedure is due to the technique sensitivity and time allocated for it. Some authors (Olabisi Arigbede et al. 2017) have also reported a cytotoxicity effect into the deep peri-implant area, due to monomers released after the composite is directly inserted into the wound.

The implementation of an industrialized SSA abutment (SSA GF) described in the present investigation demonstrates a more autonomous, cost-efficient, and biologically oriented approach, since a highly biocompatible and prefabricated anatomical abutment is utilized in order to cover a significant majority of the emerging alveolar socket surface.

Subsequently, the SSA GF complex can be fully customized and molded with adhesive resin onto the SSA CAP in accordance with the shape of the cervical outline of the freshly extracted tooth.

In order, to respond to the biological challenge of this highly demanding transmucosal portion, the 'one time one abutment' feature allows the clinician to prevent from connection/disconnection of the abutment in the biological area. Additionnally, the transmucosal profile is conducted with a narrow platform switched component (Finelle et al. 2015) in highly biocompatible materials (Titanium and Peek). The composite customization is only occupying the superficial outline of the alveolar socket which involves monomers release in a limited extent compared to the previously described technique.

From a technical and digital stand point, the SSA GF aims to improves the automatization of the the customization process by reducing the time of fabrication and the quantity of intra-oral manipulation, as the abutment is already preshaped anatomically and digitally scannable.

This techniques, and in particularly the SSA Gingival Fit abutment present significant advantages regarding patient-centered outcomes because they reduce:

i) The overall morbidity by diminishing the length of treatment compared with conventional approaches;
ii) the number of surgical procedure;
iii) the prosthetic manipulations and
iv) the potential cost by reducing chairside treatment time.

CONCLUSION

THE PRESENT ARTICLE REPORTS on a clinical workflow of a case report. he outcomes observed need to be confirmed and further evaluated in well-designed controlled clinical trials that evaluate qualitative and quantitative clinical parameters.

CLINICAL RELEVANCE

THE PROTOCOL DESCRIBED IN THIS ARTICLE provides clinical information about a novel integrated workflow for immediate posterior implant rehabilitation. The clinical benefit that we can foresee through this protocol are both intended to be beneficial for the patient and the clinician.

From the patient´s point of view, we observe one single surgical appointment, reduction of overall length of treatment and minimally post operative recovery.

From the clinician´s side, this protocols allow to reinforce blood clot stabilization, soft tissue support leading eventually to reduced peri-implant remodeling.

RESEARCH IMPLICATIONS

EVEN THOUGH, THE FIELD OF CUSTOMIZED HEALING ABUTMENT in molar extraction sites is a newly explored area, it appears from the literature analysis to raise an increased interest from the scientific community. The early conclusions reports very interesting and promising results which need to be confirmed and further evaluated in well-designed controlled clinical trials evaluating qualitative and quantitative clinical parameters.

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