IMMEDIATE IMPLANT PLACEMENT USING CUSTOMIZED HEALING ABUTMENTS AS A METHOD OF HARD AND SOFT TISSUE PRESERVATION. A REVIEW ARTICLE

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ABSTRACT

INTRODUCTION: Dental implant placement with its excellent and predictable results is becoming the treatment of choice after tooth removal. A key step in creating a proper environment and conditions for it is the process of tissue preservation after the extraction. Various ridge preservation procedures have been suggested and performed, one of which is the application of immediate implant protocol using customized healing abutments.

AIM: This review observes immediate implants not only as a definitive treatment after tooth extraction but also as a method for ridge preservation, especially in conjunction with customized healing abutments. We compared and evaluated the reports on their application and summarized their features, advantages, and limitations.

MATERIALS AND METHODS: The present article is based on 61 articles. A manual and electronic search using PubMed and Google Scholar databases was conducted until June 2022.

RESULTS: The majority of studies support the concept of immediate implant placement with customized healing abutments as a successful and reliable strategy for tissue preservation. It has numerous advantages, some of which are reduced healing time and post-operative discomfort, and excellent aesthetic results without the need for additional surgical stages.

CONCLUSION: Further investigation is still necessary to clarify the exact protocols and indications for this treatment, and to point out the conditions, which demand greater caution.

Keywords: *immediate implants, customized healing abutments, alveolar ridge preservation, sealing socket abutments, CAD/CAM*

INTRODUCTION

Tooth extraction is followed by the imminent loss of the tooth-related structures—periodontal ligament and bundle bone (1). This process eventually affects the surrounding hard and soft tissues and leads to their volumetric changes (2,3). A wide variety of alveolar ridge preservation (ARP) procedures have been suggested and there is still a growing demand for minimally invasive and predictable techniques with shorter treatment duration (4,5).

Implant dentistry has been rapidly developing and has provided the best treatment modalities for

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the replacement of missing teeth. Immediate implant placement has been in focus recently for its predictable aesthetic solutions and its properties to preserve the volume of hard and soft tissues (6–13). Furthermore, the approach has proven to be more acceptable to patients due to the shortened treatment duration and decreased morbidity.

The term "immediate implant placement" refers to a one-stage surgical protocol with implant insertion immediately after tooth extraction. The technique was first described by Schulte and Heimke in 1976 (14).

The reports on its advantages, drawbacks, and limitations in the literature are not univocal, especially when considering its ability to reduce post-extraction resorption. To improve the long-term functional and aesthetic outcomes when immediate loading is not indicated, the application of customized healing abutments has been suggested.

AIM

The present review aims to observe the application of immediate implant placement with customized healing abutments as a method for tissue preservation and optimization of peri-implant gingival contour. Considering the heterogeneity in studies, we aimed to determine and emphasize the key steps for successful results.

MATERIALS AND METHODS

Manual and electronic searches using PubMed, and Google Scholar were conducted up to June 2022. This article summarizes the collected data and identifies the advantages and disadvantages of the method, as well as some discrepancies which necessitate further assessment.

RESULTS

The benefits of immediate implant placement have been broadly discussed and still, there is some research heterogeneity. This can be explained by the different treatment protocols that the authors use to gain optimal functional and aesthetic results and to restrict the dimensional changes of the alveolar ridge.

The majority of studies have suggested that immediate implant placement is not superior to spontaneous wound healing and shows significant ridge reduction (1,15–22). However, if combined with ARP procedures, it gives satisfactory results and has a lot of advantages, such as reduced treatment time, number of dental appointments, and patient morbidity. In addition, it provides immediate aesthetics and is preferred by patients from a psychological point of view. Some authors have even claimed that the success rate of immediate implant placement is similar to that of conventional implantation (13, 23–26). However, it demands more precise surgical protocol and planning.

The basic requirements for immediate implant insertion are:

- an intact buccal plate > 1 mm;
- a thick gingival biotype (27);
- at least 2 mm distance between the implant and the inner surface of the buccal bone.

The abovementioned factors create an appropriate environment for bone formation between the implant and bone surfaces (28).

Prerequisites for good aesthetic results are the following criteria: 1. atraumatic tooth extraction; 2. bone grafting in the gap between the implant and the bone plate; 3. socket sealing with a screw-retained provisional restoration. These factors protect the bone contour from remodeling and preserve the soft tissue volume (29).

Some authors have reported on the use of anatomic abutments as a successful method for creating a natural soft tissue contour (30,31). However, they cannot correspond to all anatomic variations and then customized abutments are required (32,33).

In 2016 Richard Akin introduced the so-called anatomic harmony abutment, made of composite resin, for immediate implants, placed in the molar sites (34).

Chu et al. have suggested immediate implant placement with the use of a PMMA shell, replicating the cervical contours of the extracted tooth. The method aimed to promote tissue regeneration, prevent peri-implant soft tissues from collapsing, and improve aesthetic outcomes (35).

Stidenkin and Niftaliev (36) pointed out that round-profile standard gingiva formers do not correspond to the anatomical features of the peri-implant tissues and cannot meet the requirements of the definite constructions. Therefore, they suggested

the utilization of customized provisional abutments made of composite material. The authors reported that the method showed numerous advantages, such as the formation of an optimal gingival profile, reduced risk of microbial contamination, and accelerated tissue integration.

In 2020 Gamborena et al. (37) described an 8-step protocol for successful and predictable immediate implant placement, which includes the use of customized healing abutment, mimicking the morphology of the extracted tooth, sealing the socket, and protecting the soft-tissue graft they use.

Despite the statements of Proussaefs (38,39) that customized healing abutments are restricted to the non-aesthetic area, Ruares-Carrera et al. (40) have suggested that the method could be successfully applied in the aesthetic region, as well.

Studies have reported that customized healing abutments allow immediate modeling of the gingival contour, eliminate the need for 2-stage surgery and reduce the risk of premature implant loading (39,41,42). Cellular adhesion to the abutments supports the peri-implant soft tissues and maintains their architecture (43,44).

Customized healing abutments, also referred to as sealing socket abutments (SSAs), could be easily and precisely fabricated by CAD/CAM technology and have the following advantages (30,34,42,45–47):

1. They mechanically seal the socket and mimic the peri-implant area.
2. They stabilize the clot and promote guided bone regeneration.
3. They recreate the emergence profile of the natural tooth.
4. They preserve the soft tissue volume, the level of the mucogingival junction, and the amount of the attached gingiva.
5. They reduce treatment duration, the number of surgical procedures, and the need for conventional laboratory stages.
6. They reduce postoperative discomfort and overall patient morbidity.

Stock abutments do not match the shape of the dental socket after extraction (48). When such healing abutments are used, especially in the molar area, flap elevation is mandatory to ensure primary wound closure (49). Customized healing abutments preserve the soft tissues during the osseointegration phase and even allow their modeling.

Teślak et al. (50) applied a method where prefabricated anatomic abutments were designed for maxillary incisors, canines, first premolars, and molars. For this purpose, CBCT scans of 51 patients were studied and cross-sections of the abovementioned groups of teeth were obtained. The authors claimed that this technique allowed for modeling of the desired emergence profile and reduced treatment duration.

Alexoupoulou has evaluated the long-term prognosis after immediate implant insertion in the molar sites, using customized healing abutments. The assessments of the horizontal and vertical bone remodeling showed 4.94% bone resorption and proved the effectiveness of this technique (51).

Mihali et al. compared the effect on soft tissue preservation around implants when stock and customized healing abutments were used. The research included 24 patients, separated into two groups. Digital impressions before extraction, during implant placement, and 6 months following the implantation and definite restoration showed that soft tissue remodeling occurred in the group with conventional abutments (52).

In 2016 Proussaefs described a novel technique for the fabrication of PMMA customized abutments by the CAD/CAM technology. The greatest advantage of the method was that the soft tissue contour, that it created, resembled the exact profile of the definite restoration (39).

The same year Joda et al. introduced the Digitally Flip Technique where an intraoral optical scan captured the definite 3D position of the implant and a customized abutment was then fabricated by digitally mirroring the contralateral tooth and replicating its emergence profile (53).

Menchini-Fabris et al. (2019) conducted retrospective research on immediate implant placement in the aesthetic zone without a guided bone regeneration (GBR) procedure. Their study aimed to compare bone resorption when customized and stock abutments were used. There was a statistically significant difference—2.18 ± 0.59 mm horizontal bone loss in the group with stock abutments, and—0.08 ± 0.27 mm horizontal bone loss in the group with custom-

ized healing abutments (28). The authors' conclusion was that customized healing abutments successfully preserve soft tissue, prevent the buccal bone from resorption during the osseointegration phase, and recreate the emergence profile of the natural teeth.

Finelle G and Lee SJ have suggested a novel technique, which combines the application of a 3D-printed surgical template for immediate implant placement and CAD/CAM-fabricated SSA. Excellent results with optimal tissue healing were registered (42).

Sealing socket abutments serve as a mechanical barrier that isolates and protects the clot and the bone grafting material. They also protect the wounds from contamination and reduce the risk of premature loading during the osseointegration phase. CAD/CAM manufactured SSAs recreate the exact soft tissue profile of the natural teeth. Thus they successfully prevent soft-tissue ingrowth without a need for a barrier membrane (42).

In 2019 Finelle G et al. (46) published results from a 2-year follow-up of 30 immediate implants with CAD/CAM-fabricated SSA. They reported a 100% success rate without any biological or prosthetic complications and stable peri-implant soft tissues. The authors concluded that this method is a promising alternative to the conventional treatment procedures and suggested further randomized trials to confirm their reports.

Alexopoulou et al. (54) conducted a retrospective 3D radiographic assessment of the volumetric hard tissue alterations in the molar region after immediate implant placement in conjunction with ARP procedures and installation of customized SSA. The analysis showed horizontal bone loss of less than 1 mm, while vertical bone changes were not registered.

As Valsan et al. (55) stated, the individualization of implant abutments, using CAD/CAM, allows for biologically compatible prosthetic restorations, which meet the high functional and aesthetic demands.

DISCUSSION

Several authors have suggested that immediate implant placement cannot counteract bone remodeling following tooth removal as previously described (15,17,18,56,57). On the other hand, ARP procedures with bone grafting materials have proven to significantly reduce post-extraction bone resorption (58) and have a long-term effect (59,60). Therefore, ARP should be considered in cases of immediate implant placement (61).

Immediate implant placement with customized healing abutments has been recently in focus. The technique was reported to prevent successfully the alveolar ridge from post-extraction bone loss and soft tissue collapse (9–13). They mimic the emergence profile of the natural tooth and preserve the mucogingival junction and the amount of attached gingiva. Furthermore, by the integration of the CAD/CAM technologies, the conventional laboratory stages are eliminated and the whole treatment cost and duration are reduced. The method gives excellent results with reduced patient morbidity, optimal hygiene, and aesthetics (45).

Therefore, these abutments could be considered a promising ARP procedure and an alternative to conventional ARP techniques with delayed implant placement. Further research should be conducted to prove or disclaim this statement.

CONCLUSION

Customized healing abutments successfully seal the sockets and stabilize the clot and the surrounding soft tissues, create a desirable emergence profile, provide minimally invasive healing without flap elevation, and preserve the soft tissue volume. Additional evidence is necessary to prove their qualities and whether they could be regarded as a superior method to the conventional treatment.

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