



Effectiveness of the Use of Simultaneous Connective Tissue Grafts and Immediate Post-Extraction Implant Placement: A Literature Review

Nicolás Solano^{1,2}, Dalmiro Ortega³, Arianny Peraza^{2,*}, Mari Solvey Vargas⁴, Mariela Fox⁵

¹Oral and Maxillofacial Surgery Unit, Hospital Coromoto, Maracaibo, Venezuela

²Oral Surgery Postgraduate Program, University of Zulia, Maracaibo, Venezuela

³Prosthodontics Unit, University of Zulia, Maracaibo, Venezuela

⁴Periodontics Postgraduate Program, University of Zulia, Maracaibo, Venezuela

⁵Research Institute of the School of Dentistry, University of Zulia, Maracaibo, Venezuela

Email address:

nicksolano@msn.com (N. Solano), integracamoruco@gmail.com (D. Ortega), ariperaza95@gmail.com (A. Peraza),

solvey2894@gmail.com (M. S. Vargas)

*Corresponding author

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Abstract: In recent decades, pink aesthetics represents a relevant factor when evaluating long-term results in implant rehabilitation, mainly in the anterior sector. Immediate implant placement after dental extraction is an alternative for the rehabilitation of edentulous patients, and despite its high success rate, the presence of associated peri-implant tissue recessions has been evidenced within its main complications, and the use of connective tissue grafts are a tool that could preserve the stability of the peri-implant mucosa. The objective of this literature review is to assess the use of simultaneous connective tissue grafts with implant placement immediately after extraction as an alternative to improve peri-implant stability. Good results have been evidenced by applying this technique measured in the pink aesthetic score in scientific studies, benefiting those cases with a fine gingival phenotype. Likewise, fewer recessions of the peri-implant mucosa have been observed, which causes fewer associated complications and constitutes an alternative to achieve long-term stability, improvement of peri-implant tissues and better clinical results. However, it is important to take into account that the gingival phenotype is not the only element to consider in post-extraction implants, since the thickness and integrity of the vestibular cortex, the jumping distance, as well as the design of the implant and the three-dimensional positioning must be evaluated.

Keywords: Connective Tissue Graft, Pink Aesthetics, Immediate Implant Placement, Aesthetic Sector

1. Introduction

Dental implants have been considered safe and predictable rehabilitation treatments that can be used to replace absent dental organs in partially or totally edentulous patients, where the survival range is greater than 90% [1] When there is a prior indication of tooth extraction in the anterior sector, the immediate insertion of implants has become a routine exercise in surgical practice where achieving an optimal aesthetic result through the similar appearance between peri-

implant tissues and tissues adjacent to natural dentition is one of the main objectives. If the parameters for the immediate placement of implants in a post-extraction socket are respected, the functional and aesthetic results are highly satisfactory, reducing consultation time and promoting a positive psychological impact on the patient [2, 3].

Despite the fact that immediate implant placement (IIP) is associated with a high success and survival rate, various

associated complications have been described, including: gingival recessions, inadequate amount of keratinized tissue bands, unacceptable aesthetics, implant failures due to surgical trauma, premature loading, implant design, and anatomical limitations, among others [4]. Thus, the way to achieve aesthetic success begins with an understanding of the elements involved: the reproduction of the natural characteristics of the tooth and the establishment of peri-implant soft tissues; through an adequate diagnosis and treatment plan, including clinical and radiographic evaluations, as well as the patient's expectations [5, 6].

Likewise, it has been identified that the presence of healthy peri-implant soft tissues is correlated with long-term success and aesthetic-functional stability, since not only the lack of keratinized tissue facilitates the accumulation of bacterial plaque but also leads to gingival recessions in the esthetic zone [7]. The long-term stability of the pink aesthetic around dental implants has been highly associated with the gingival phenotype, as well as the height of the papillae, amount of keratinized tissue, and oral cortical tissue. In the case of soft tissue deficits at the time of IIP, the use of connective tissue grafts (CTG) could be used simultaneously to achieve better aesthetic results and adequate gingival thickness [6]. The objective of this literature review is to describe the use of connective tissue grafts simultaneously with immediate post-extraction implant placement.

Several indications have been suggested for the IIP, within them, the rehabilitation of a single dental piece that does not present periapical processes or associated root fractures, with adjacent teeth in good condition, presence of adequate and harmonious gingival architecture, as well as sufficient bone volume for implant placement [4]. A review of the literature revealed an atraumatic extraction protocol and immediate placement of the implant in the palatalized position, leaving a gap between the implant surface and the vestibular cortex [8-14] Elian and colleagues. [15] described a facial-palatal socket classification where risks could be potentially assessed in regard to potential midfacial recession depending upon the existing socket condition. Thus, the classification consisted of: Type 1 sockets were classified as having the labial bone plate and soft tissues completely; Type 2 where the soft tissue was present but a dehiscence bony defect existed, indicating the partial or complete absence of the labial bone plate and Type 3 where a midfacial recession defect occurred, indicative of loss of the labial bone plate and soft tissues. The use of IIP would be indicated in type 1 defects, in the case of type 2 it should be considered in conjunction with a regeneration treatment; in type 3, the placement of IIP would be totally contraindicated.

2. Surgical Considerations

Buccal plate thickness and intactness are vital for immediate implant placement. Gluckman *et al.* [16] studied a total of 150 CBCTs resulting in a sample size of 591 anterior teeth; they found that most patients included in this

study had thin facial bone (<1 mm) at crestal point A (83% of all teeth) and at mid-root point B (92% of all teeth). Most of the palatal walls (63%) were thin (<1 mm) at point A and thick (1 mm) at points B (98%) and C (99%). Cheng *et al.* [17] determined an intact buccal plate to be a more critical feature than thickness. Based on available literature, buccal plate evaluation can be summarized as thick when is > 1 mm and intact buccal plate is better than thin and intact, which, in turn, is better than buccal dehiscence socket morphology.

As a way to preserve the cortical or buccal wall, the palatinized position of the implant, a gap of at least 2 mm, and an adequate thickness (at least 1 mm) of the buccal wall are desirable. In a study by Groenendijk *et al.* [18] 16 patients underwent IIP as a replacement for upper central incisors. The osteotomy was directed palato-apically in relation to the original apex, with an average torque reached of 65 ncm. All underwent the placement of bone grafts (bone substitute with grain size 0.25-1.0 mm within the gap, with average measurements of 0.9 mm of the vestibular cortex and an immediate postoperative period of 2.4 mm (gain of 1.5 mm). After the remodeling phase, a total thickness of 1.8 mm was obtained (0.6 mm of reduction). However, a gain of twice the initial one (+0.9 mm) could be observed with a good PES in all patients. Therefore, it was evident that the use of IIP + bone grafts in the gap allows to reduce the expected horizontal changes, where in a gap of 2 mm or more in conjunction with bone grafts, good results are obtained at the level of hard and therefore soft tissues. [18]

Ideally, the bone-grafting material should include a slower resorbing material that will maintain the space to allow for bone regeneration (e.g., demineralized/mineralized allograft, allograft + autograft, or xenograft). The most widely used bone grafts described in IIP have been autologous bone of the mandibular ramus [8, 9], autologous bone + xenograft in a ratio of 1: 1 [10, 11]; and single use of xenograft [12-14].

Although the use of guided bone regeneration allows correcting peri-implant bone defects, changes may still occur at the soft tissue level, especially in the presence of thin gingival biotypes or inadequate width of keratinized tissues. Hence, the use of CTG has become popular in recent times in conjunction with IIP.

The most widely used CTG donor site has been the hard palate [8, 9, 12] and the maxillary tuberosity [10, 11], and the most used techniques for the placement of graft in the receiving area are the tunneling technique [8, 9, 12] and the enveloping technique [13, 14]. Gamborena *et al.* [19] recommended soft tissue augmentation with subepithelial CTGs for all implant procedures, especially IIP, even for thick tissue biotypes. In fact, they described CTG placement as the final step of the IIP protocol. The donor site of the CTG in their protocol is maxillary tuberosity, which is placed in two different ways: a circular CTG in all cases, or a buccal and circular CTG in situations of thin tissue or buccal plate dehiscence. When the buccal plate is 1 mm or thicker, a circular TCTG is sufficient.

3. Peri-implant Mucosa Architecture

One of the frequently described complications during IIP is the presence of gingival recessions associated with the gingival phenotype, inadequate hygiene or decreased amount of a keratinized tissue band, which would additionally lead to bone loss, plaque accumulation poor peri-implant health and finally, implant failure. Thus, the simultaneous use of soft tissue grafts has been used to avoid such recessions and ensure greater stability of the peri-implant tissues in the long term [4, 6]. In patients treated with IIP in conjunction with CTG, better results have been obtained regarding the architecture of the peri-implant mucosa. Likewise, the gain in the band width of keratinized mucosa has been up to 1 mm in those patients treated with CTG [9]. Regarding the vestibular gingival level, in areas with thick phenotypes there have been fewer changes associated, contrary to the areas with fine phenotype where greater changes have occurred; in addition to this, greater recessions have been described in those cases without the CTG application [9-12, 14, 20, 21]. The gingival phenotype plays a critical role in peri-implant health and long-term stability. For this reason, the simultaneous placement of CTG is a good alternative to achieve a better prognosis, especially in those cases where the gingival phenotype requires it and where the width of the keratinized gingiva prior to implantation is not favorable.

4. Pink Esthetic Score (PES)

Despite the fact that the success rates in IIP are high, the main focus of the study has been aimed at achieving optimal long-term aesthetic results, with the intention of imitating a natural tooth, taking into account important factors such as a suitable position and inclination of the implant [10, 14]. Furhauser et al [22] created a score to evaluate dental aesthetics called PES, a peri-implant soft tissue evaluation tool that takes into account the mesial and distal papillae, as well as the level, contour, color and texture of the soft tissue, with a maximum score of 14 points. The purpose of the score is to determine the aesthetic success of soft tissues associated with implant rehabilitation in the aesthetic sector. Similarly, Belser et al [23] proposed an evaluation alternative called PES / White Esthetic Score (WES), where they added the assessment of the implant crown, based on the shape of the tooth, its emergence, volume, color, texture, translucency and characterization, with a total result of 20 points (10 for PES and 10 for WES), allowing a comprehensive evaluation in implant rehabilitation in the anterior sector.

In those patients who have undergone IIP simultaneously with CTG, improvements of up to 3 points in the PES have been evidenced, reaching values greater than 12 [9]. In contrast, although in other scientific investigations there have been no statistically significant differences, an acceptable level of PES in 78.7% of cases has been reported [10]. When applying the PES / WES, 66.6% of patients with CTG achieved a score of 8 points or higher, compared to groups of patients without CTG in which approximately 48.5%

achieved an acceptable aesthetic result with a score of 6 [12].

5. Marginal Bone Level (MBL)

The dimensions of the alveolar ridge allow the configuration of the soft tissue contour around the implants, presenting more apical gingival mucosa levels in defects of the vestibular cortex than in those implants with intact cortices [24]. For this reason, another key factor to consider for the long-term success of implant rehabilitation is keeping the MBL as coronal as possible. Previously, the loss of up to 1 mm of bone was considered acceptable within the first year after implant placement, and subsequently the loss of up to 0.2 mm annually. However, current protocols through the use of Morse Cone and reduced platform connections have reduced levels of bone loss and provide additional space for the development and maintenance of soft tissues in the long term. [25]

On the other hand, the alveolar ridge undergoes clinical and biological modifications after an extraction resulting in a loss of hard and soft tissue. Bone tissue grafts can reduce this loss by 5-15% but cannot maintain the alveolar ridge volume by themselves. Although no statistically significant differences have been found between study groups and control groups with the concomitant use of CTG and IIP [10, 13, 14], soft tissue grafts can be used to achieve better clinical results, compensating for bone loss and providing a more stable peri-implant mucosa that allows to achieve optimal long-term results [26].

6. Success Rate

The clinical results of IIP have been evaluated, reporting similar short and long-term survival ranges of approximately 97.9 to 99%. However, the complications associated with soft tissues do not escape this reality [4]. Regarding the associated use of CTG in these patients, success rates of 96.7% to 100% of cases have been reported, with evident clinical improvements in terms of the pink aesthetic in the anterior sector [9, 10, 21].

7. Conclusion

Obtaining adequate results in the pink aesthetic associated with IIP represents a current clinical challenge. This review was able to show that the simultaneous use of CTG provides better aesthetic results from a clinical point of view. The scientific literature shows that IIP with CTG reduces recessions of the peri-implant mucosa and allows a more adequate gingival architecture, which leads to fewer associated complications. However, it is important to take into account that the gingival phenotype is not the only element to consider in IIP, since the thickness and integrity of the vestibular cortex, the jumping distance or gap, as well as the design of the implant and the three-dimensional positioning must be evaluated. Further research on this is necessary with larger sample sizes to determine its efficacy.

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