

Using Soft Tissue Graft to Prevent Mid-facial Mucosal Recession Following Immediate Implant Placement

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Abstract

Background: With advances in dental technology, the placement of immediate implants has progressively gained popularity. However, a common complication that surfaced was mid-facial mucosal recession, which impaired esthetic outcomes. The use of soft tissue grafts has thus been introduced to manage and prevent this undesirable result. To date, no guidelines have been put forward for clinicians to identify the indications for a soft tissue graft during immediate implant placement. Therefore, this manuscript aimed to propose a decision-making model to prevent mid-facial mucosal recession following immediate implant placement. **Method:** An electronic search of the PubMed database for literature published in English on the occurrence and management of soft tissue alterations following immediate implant placement was performed. **Results:** Several factors, including implant position, buccal plate thickness, tissue thickness and width of keratinized mucosa, were found to influence the need for soft tissue grafting during immediate implant placement. For sockets with at least 2 mm of buccal plate thickness, a soft tissue graft was recommended for immediate implants placed at the incisal position. For sockets with less than 2 mm of buccal plate thickness, immediate implant placement in combination with bone or soft tissue augmentation was necessary. This was especially critical in scenarios with thin tissue biotypes or inadequate width of keratinized mucosa. **Conclusion:** Soft tissue grafts can maintain soft tissue stability following immediate implant placement.

Key words: : Immediate dental implant; tissue graft; peri-implant; recession.

Introduction

Since the discovery of osseointegration by Bränemark in 1952, massive developments in the field of implant dentistry have led to the dental implant becoming the preferred treatment option for tooth replacement (Albrektsson *et al.*, 1986; Bränemark, 1983). Unfortunately, patients generally have to wait for osseointegration to be completed before the prosthesis is installed and this healing period can range from 4 to 6 months. Therefore, in recent years, a push towards reducing treatment time has brought about the introduction of immediate implant placement.

Immediate implant placement, defined as the

“placement of a dental implant immediately following tooth extraction in the same procedure” (Hammerle *et al.*, 2004), enabled patients to enjoy a shortened overall treatment duration by reducing the number of surgical procedures. In addition, reduction of the period of edentulism allowed for the patient's esthetic, functional and psychological demands to be met in a shorter time.

Several post-operative complications have been reported with immediate implant placement, with the prevalence ranging from 4.2-36.7% (Chen and Buser, 2009). These complications included wound dehiscence or membrane exposure (Chen *et al.*, 2005; Zitzmann *et al.*, 1997), postoperative pain (Covani *et al.*, 2007) and bleeding (Nemcovsky *et al.*, 2000), and soft tissue alteration (Schropp *et al.*, 2003). Having a less favorable level of peri-implant marginal mucosa with immediate implant placement, compared to the immediate-delayed approach or delayed approach, has definitely negatively compromised esthetic outcomes (Esposito *et al.*, 2010). Despite that, comparable survival rates of dental implants have been shown with

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both immediate and delayed approaches, thus accounting for the increased popularity of immediate implant placement among clinicians (Chen *et al.*, 2004; Esposito *et al.*, 2010; Tealdo *et al.*, 2011).

For most clinicians, correction of the mid-facial recession on immediately placed dental implants is one of greatest esthetic challenges to deal with. Several strategies, such as soft tissue grafts, platform switching (Canullo and Rasperini, 2007) and biologic agents (Rosano *et al.*, 2011), have been used to minimize the risk of mid-facial mucosal recession following immediate implant placement. To date, soft tissue grafts have been advocated to manage the mid-facial gingival recession accompanying immediate implants. Although there might be donor site morbidity, tissue shrinkage and formation of scar tissue, the use of soft tissue grafts together with immediate implant placement could prevent and maintain peri-implant tissue levels and volume. Soft tissue grafts can also ameliorate the width and position of attached mucosa, create interproximal papillae (Rosenquist, 1997; Tarnow *et al.*, 1996) and compensate for possible tissue alteration following immediate implant placement (Kan *et al.*, 2011).

As there are no guidelines available to determine the need for soft tissue grafts in preventing mid-facial mucosal recession following immediate implant placement, this paper attempts to use available literature to recommend a clinical decision-making model examining the use of soft tissue grafts during immediate implant placement to achieve more predictable esthetic treatment outcomes. In addition, several important factors that may contribute to the occurrence of mid-facial gingival recession around immediate implants will be discussed.

Soft tissue alterations following immediate implant placement

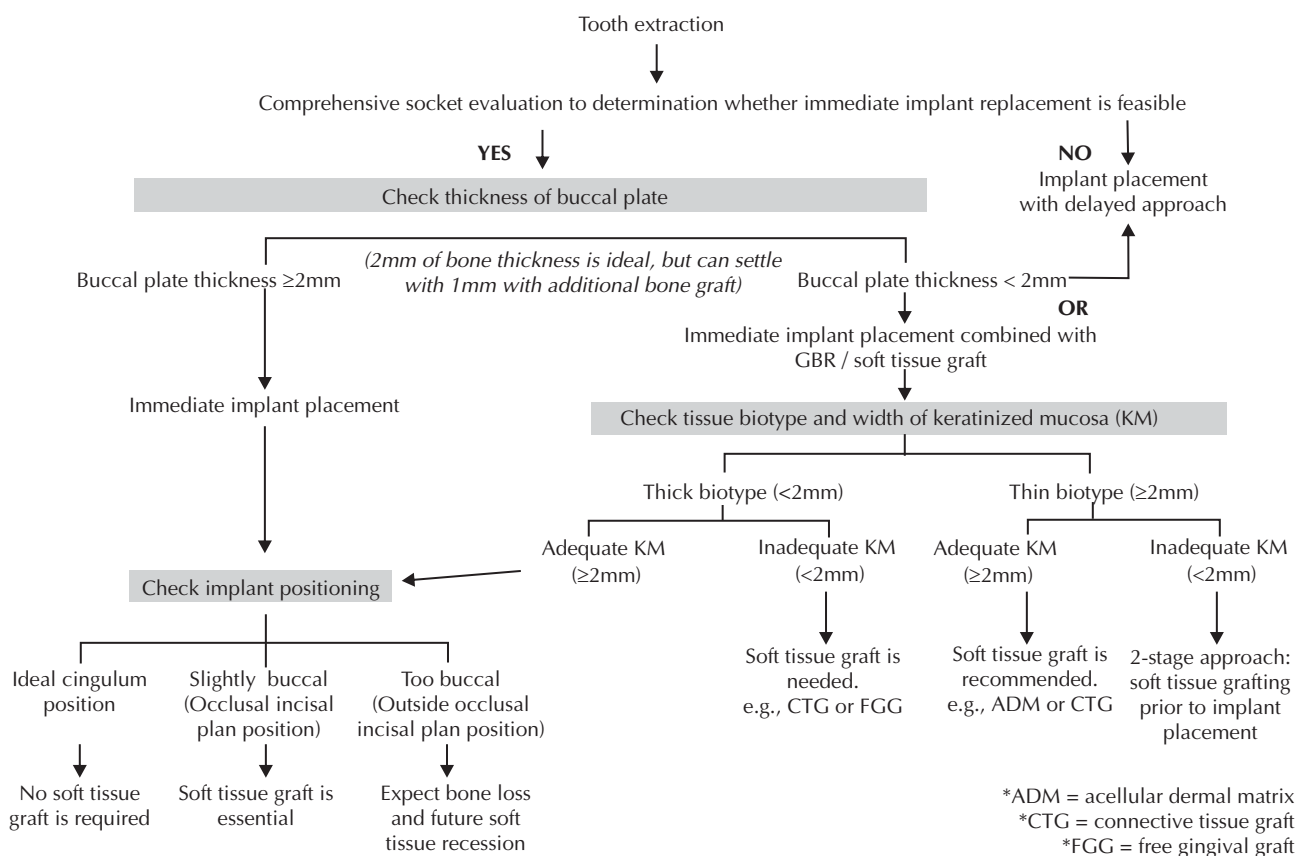
Following immediate implant placement, changes in peri-implant soft and hard tissue levels have been reported (Chen and Buser, 2009; Cosyn *et al.*, 2011; De Rouck *et al.*, 2008). In a meta-analysis, it was demonstrated that apical migration of the mid-facial free mucosal margin around dental implants was common in sites with immediate implants (Chen and Buser, 2009). This phenomenon was further confirmed in a longitudinal study (Crespi *et al.*, 2010). A recent study also reported that around one-third of patients receiving immediate implants might experience major bone remodeling and advanced mid-facial mucosal recession (> 1 mm; Cosyn *et al.*, 2012). In contrast, several studies showed a low incidence of mucosal recession (Covani *et al.*, 2012; Rompen *et al.*, 2007). Despite the heterogeneity of experimental and implant designs, it should be kept in mind that the slightest alteration in soft tissue might cause esthetic problems, e.g., exposure of the metal implant platform.

Factors contributing to mid-facial mucosal recession

The apical migration of peri-implant mucosa has been associated with several factors, e.g., the three-dimensional (3-D) bone-to-implant relationship regarding mesio-distal, bucco-lingual and apical-coronal position (Grunder *et al.*, 2005), and tissue thickness and width of keratinized mucosa (Chen *et al.*, 2009; Kan *et al.*, 2011; Redemagni *et al.*, 2009). A recent meta-analysis also demonstrated that position of the implant shoulder, tissue biotype and thickness of the facial bone wall were significant influencing factors (Chen and Buser, 2009).

The implant should be placed in an ideal 3-D position to achieve a long-lasting esthetic outcome. This is because most implant complications, especially esthetic failures, are because of improper implant positioning. With the implant in an ideal position, a good emergence profile and the maintenance of peri-implant soft tissue can be achieved. It was demonstrated that the risk of mid-facial mucosal recession was three times higher around immediate implants placed in a buccal shoulder position compared with those placed more palatally (Evans and Chen, 2008). Therefore, several investigators suggested having a distance of 1-4 mm from the external bone surface to implant shoulder to ensure stable esthetic results (Carrion and Barbosa, 2005; Grunder *et al.*, 2005). When the implant is positioned at the ideal bucco-lingual position (i.e., cingulum), a more significant horizontal gap is observed. Consequently, addition of bone grafts in sites with more than 1 mm of horizontal gap between the implant and socket walls was found to minimize soft tissue alterations around immediate implants (Ferrus *et al.*, 2010). Hence, "dimension of horizontal gap" should also be considered as a possible factor that influences the dimensional changes of alveolar crest following immediate implantation. However, it should be kept in mind that an implant which is placed i.e. too palatally, beyond the cingulum, may damage anatomic structures (Buser *et al.*, 2004) and create prosthetic complications. In other words, mucosal recession may occur if the implant shoulder is buccal to the cingulum, which is the reference point. Therefore, a soft tissue graft is highly recommended for immediate implants placed in an incisal position because this may trigger further bone loss resulting in mucosal recession and compromised esthetic results.

In order to compensate for dimensional changes of the residual ridge during wound healing and bone remodeling, having sufficient buccal plate thickness is a prerequisite for immediate implant placement. Sites with immediate implant placement were found to have marked apical displacement of the buccal plate with no vertical bone loss in the lingual aspect (Vignoletti *et al.*, 2009). It was demonstrated that the mean vertical

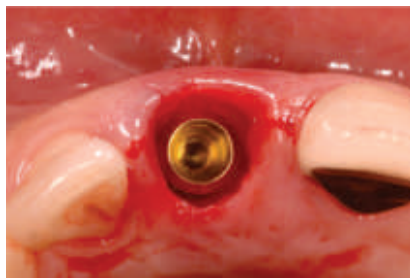
Figure 1. Decision tree for soft tissue grafting during immediate implant placement.

differences between buccal and lingual alveolar crest was approximately 1 mm (Vignoletti *et al.*, 2012). In a multi-center study of 2667 implants, minimal bone loss was shown in sites with more than 1.8-2.0 mm of facial bone (Spray *et al.*, 2000). This implied that buccal bone thickness was important in predicting the resorption of the buccal plate. Therefore, to compensate for bone loss during healing, a buccal plate thickness of at least 2 mm was preferred for immediate implant placement (Juodzbalsys *et al.*, 2008). However, it is rare to find sites in the esthetic zone with 2 mm or more buccal plate thickness (Huynh-Ba *et al.*, 2010).

Tissue biotype is a significant factor that influences the progression of soft tissue recession around teeth and dental implants. Thin and thick tissue biotypes were previously defined as < 1.5 mm and > 2 mm tissue thickness (Claffey and Shanley, 1986). Patients with thin tissue biotype were believed to have long and narrow teeth and greater susceptibilities to gingival recession compared to patients with thick biotype (Olsson and Lindhe, 1991). Over the past decades, human trials have demonstrated that a thin tissue biotype increased the risk of mucosal recession around dental implants (Chen and Buser, 2009; Chen *et al.*, 2009; Evans and Chen, 2008; Kan *et al.*, 2011). In a longitudinal study, changes in facial soft tissue levels were -0.56 ± 0.46 mm and -1.50 ± 0.88 mm in sites with

thick and thin biotype, respectively, thereby demonstrating a positive correlation between tissue biotype and gingival recession (Kan *et al.*, 2011). However, because of the scarcity of available comparable data, more longitudinal randomized controlled trials to support the association between gingival biotype and soft tissue alteration following immediate implant placement are needed.

The width of keratinized mucosa (KM) in the implant sites may also influence the esthetic outcome. A study of 164 implants was conducted to evaluate the soft tissue outcome of immediate implants over four years. Implants with a wide zone of KM (≥ 2 mm, group A) exhibited greater modified bleeding index, modified plaque index and gingival index implants compared to those with a narrow zone of KM (< 2 mm, group B). At the 4-year follow-up, mean mucosal changes were 0.24 ± 0.16 mm and 1.30 ± 0.80 mm in groups A and B respectively. It was concluded that lack of KM was a critical factor influencing mucosal recession, plaque accumulation and peri-implant inflammation (Crespi *et al.*, 2010). Although the association between width of KM and maintenance of peri-implant tissue health remained controversial, it is generally accepted that adequate KM might be essential in preventing the apical migration of peri-implant mucosa (Chung *et al.*, 2006; Kim *et al.*, 2009; Schrott *et*

Figure 2. Case 1**(a) An immediate implant in incisal edge position.****(b) Connective tissue graft was performed three months after immediate implant placement.****(c) The provisional crown was delivered.****(d) During the healing process.****(e) The final crown was fabricated.****(f) Favorable esthetic outcomes were maintained 3.5 years after crown delivery.****(g) Radiograph taken 3.5 years after crown delivery**

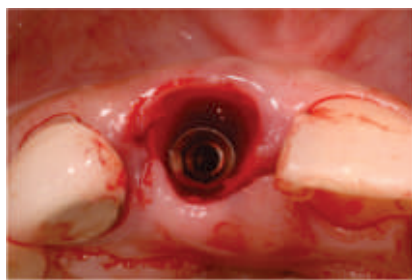
al., 2009). Therefore, immediate implants with a thin tissue biotype and/or a narrow width of KM have a higher risk of facial mucosal recession.

Soft tissue grafting for prevention of peri-implant mucosal recession

Several techniques have been introduced to either improve the soft tissue contours or maintain the stability of soft tissue around immediately placed implants. They include autologous gingival/connective tissue graft (Chung *et al.*, 2011; El-Askary, 2002; Grunder, 2011; Shibli *et al.*, 2004; Simons *et al.*, 1993), and allogenic soft tissue graft (Griffin *et al.*, 2004; Park, 2006). For the past two decades, the use of free gingival grafts (FGG) and connective tissue grafts (CTG) were

recommended to increase the amount of KM (El-Askary, 2002; Price and Price, 1999; Shibli *et al.*, 2004) and manage mucosal recession around implants (Simons *et al.*, 1993). Recently, acellular dermal matrix (ADM), used alone or in combination with bone grafts, was found to be another feasible approach to correct esthetic deficiencies around implants (Griffin *et al.*, 2004; Park, 2006). Its main advantages over FGG or CTG are the elimination of a donor site and its associated morbidity; thus slowly gaining popularity among clinicians and patients.

Performing soft tissue grafting at sites with immediate implant placement could be done simultaneously with or after implant placement. It was reported that securing a soft tissue graft in conjunction with immediate implant placement not only maintained soft tissue levels, but also gained a greater amount of tissue thickness and KM. In addition, immediate implant sites with simultaneous soft tissue grafting had a greater increase in KM compared to non-grafted sites (Bianchi and Sanfilippo, 2004). The effect of a connective tissue graft on dimensional changes of the alveolar bone after immediate implant placement was examined and prominent differences were reported six months after surgery. In the non-grafted group, a mean horizontal resorption of labial tissue volume of 1.063 mm was found. In contrast, the grafted sites had a mean gain in labial tissue volume of 0.34 mm (Grunder, 2011). It is thus worth mentioning that implants placed at the incisal position would significantly benefit from

Figure 3. Case 2**(a) An immediate implant placed in gingulum position.****(b) Immediate provisional restoration with non-functional loading.****(c) During the healing process.****(d) Final outcome****(e) Radiographs were taken after delivery of final crown.**

having a soft tissue graft to compensate for tissue changes over time. Moreover, it was shown that facial tissue stability, in terms of marginal bone level and peri-implant papilla, could be achieved with the use of CTG at the same time of immediate implant placement regardless of the initial gingival biotypes (Kan *et al.*, 2009). In short, increasing tissue volume with grafting procedures is beneficial in preventing facial mucosal recession in implant sites with thin tissue biotype or inadequate width of KM.

Decision tree

A decision tree to prevent mid-facial mucosal recession on immediate implants is proposed (*Figure 1*). This guide serves to demonstrate the application of different soft tissue grafts during immediate implant placement in attempt to minimize the occurrence of mid-facial mucosal recession. By adopting this decision-making process, a compromised esthetic outcome due to apical migration of facial mucosa and loss of buccal bone during or after immediate implant placement could be avoided.

A careful examination of the socket after tooth extraction is the first step in achieving a successful treatment outcome. Several classifications on socket morphology have been proposed to determine the method of implant placement (Caplanis *et al.*, 2005; Juodzbalys *et al.*, 2008). For example, in an intact socket, the thickness of buccal plate is used to determine if an immediate implant placement approach is indicated. If the facial bone thickness is less than 2 mm, a delayed approach or immediate implant placement with simultaneous correction of soft and/or hard tissue

deficiencies would be preferred. During immediate implant placement, soft tissue grafts can be used to remedy improper implant positioning, e.g., buccal positioning of the implant shoulder. Furthermore, tissue biotype and width of keratinized tissue should be checked before immediate implant placement. In sites displaying a thin tissue thickness and/or a narrow zone of keratinized tissue, the use of soft tissue grafts can prevent possible mucosal recession, ensuring desirable and stable long-term esthetic outcomes.

Case reports

Based on the decision tree described above, two cases with satisfied esthetic outcomes were reported.

Case 1

A 53-year-old healthy female presented with a decemented post and a fractured prosthesis on an endodontically treated maxillary right central incisor (#8). A fracture line extending subgingivally was detected; thus, it was suggested that #8 be replaced with an implant. An intact and thick buccal plate was observed following tooth extraction and immediate implant placement was indicated. A 4.1 x 13 mm implant (Mega Gen ExFeel, Korea) was placed at the incisal edge position (*Figure 2a*) and a provisional restoration with non-functional loading was delivered simultaneously. Even though the horizontal gap between the implant and socket wall was filled with non-absorbable hydroxyapatite bone graft, facial mucosal recession was noticed three months after surgery. Possible therapeutic strategies to correct the esthetic complication included guided bone

regeneration, coronally advanced flap, and the use of soft tissue graft. A soft tissue graft with an envelope flap was used to correct the tissue level and increase tissue volume. Emergence profile of the provisional restoration was modified to sculpt the peri-implant soft tissue (Figure 2b, 2c). The final prosthesis was delivered two months afterwards (Figure 2d, 2e). A favorable esthetic outcome was maintained for 3.5 years after delivery of the final prosthesis (Figure 2f, 2g).

Case 2

A 32-year-old female non-smoker presented with a fractured endodontically treated maxillary right central incisor (#8). As the long-term prognosis of the tooth was questionable, replacing it with an implant became a more viable option. During surgery, the wall of the extraction socket was seen to be intact and thick. A 3.75 x 13 mm implant (MIS Seven, Israel) was placed immediately into the extraction socket at the cingulum position (Figure 3a). Buccal bone augmentation was not performed. A provisional restoration was subsequently placed to create the emergence profile and fulfill the patient's esthetic demands (Figure 3b). At the 6-month follow-up, the peri-implant soft tissue had healed uneventfully (Figure 3c) and remained stable. The implant was later restored with a full ceramic crown (Figure 3d).

Conclusion

Despite the high success rate, immediate implant placements have been challenged with unfavorable esthetic results because of the high prevalence of mid-facial mucosal recession. With the proposed guideline, potential mucosal changes could be prevented by comprehensive assessment and management. Soft tissue grafts could be used successfully to prevent or correct mid-facial mucosal recession following immediate implant placement, achieving predictable esthetic outcomes.

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