

IMPACT OF IMMEDIATE AND NON-IMMEDIATE PROVISIONALIZATION ON THE SOFT TISSUE ESTHETICS OF FINAL RESTORATIONS ON IMMEDIATELY PLACED IMPLANTS

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INTRODUCTION

In recent years, soft tissue esthetics has been one of the major issues in implant dentistry.¹⁻⁵ The main influencing factors in soft tissue esthetics are the height of interproximal papilla and the level of facial gingiva.⁶ The level of facial gingiva is influenced by several factors such as thickness of labial bony wall, the position and orientation of implant, the gingival biotypes⁶⁻⁹ whereas the height of interproximal papilla around a single implant restoration is mainly dependent on the bone level of adjacent teeth.¹⁰

Recently, excellent soft tissue esthetic outcomes were reported by delivering a provisional restoration on the day of immediate implant placement.^{11,12} In the esthetic point of view, the greatest benefit of immediate provisionalization following immediate implant placement is that the interproximal soft tissue height could be maintained by supporting the overlying soft tissue during healing period.^{12,13} As the presence and height of the interproximal papilla is attributable to the presence of adjacent teeth attachment and the size of the gingival embrasure formed

by these teeth,¹⁴ immediate support of interproximal papilla by provisional restoration could minimize the collapse of interproximal soft tissue following the extraction of a tooth.^{13,15-17}

Instead of delivering a provisional restoration, connecting a healing abutment still can be an option following an immediate implant placement. By gradually increasing the diameter of the healing abutment, clinicians can manipulate soft tissue around the implants.¹⁸ In such cases, however, clinicians may be concerned about the loss of papilla height due to the absence of immediate papilla support. Numerous studies have been performed to assess the soft tissue esthetics around implant restorations.^{19,20} However, still less information is available on the soft tissue esthetics of single implant restorations which were immediately placed and immediately provisionalized.

The purpose of the current study was to evaluate and compare the soft tissue esthetic outcomes of immediately placed single tooth implant restorations with or without immediate provisional restorations.

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MATERIALS AND METHODS

A total of 10 patients, each with a hopeless maxillary anterior tooth, were selected between Sep 2005 and Oct 2006. The patients were comprised of 6 women and 4 men, aged between 30 to 68 (mean 42.2). The hopeless teeth included 6 central incisors, 2 lateral incisors and 2 canines. Under specific patient inclusion/exclusion criteria, the placement of implant into fresh extraction socket was selected as a treatment plan for each patient.

Inclusion criteria were as follows

1. a hopeless single maxillary anterior tooth with adequate and similar level of the gingival and underlying bony architecture as the contralateral natural tooth
2. reasons of extractions were root fractures and endodontic failures.
3. good oral hygiene
4. adequate bone volume to place an implant with a minimum dimension of 4.3×11.5 mm without necessity of bone grafting.
5. primary stability with 35 Ncm of insertion torque.



Fig. 1. Initial frontal view of the hopeless left maxillary central incisor.



Fig. 2. An immediate implant was placed without flap elevation.



Fig. 3. A screw retained provisional restoration was delivered on the day of implant placement (picture was taken at 2 weeks after surgery).

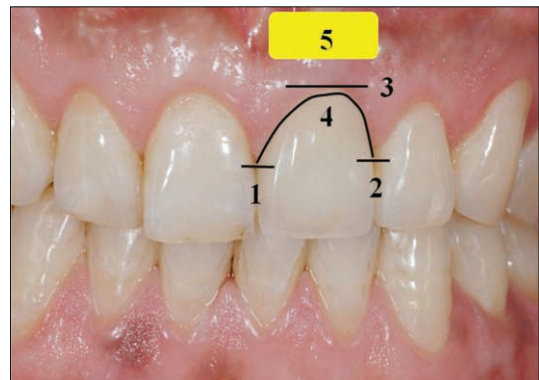


Fig. 4. Frontal view of the final restoration. Five soft tissue esthetic variables. 1; mesial papilla, 2; distal papilla, 3; soft tissue level, 4; soft tissue contour, 5; facial soft tissue prominence.



Fig. 5. A hopeless maxillary right lateral incisor due to endodontic failure.



Fig. 6. A healing abutment was placed on the day of surgery (picture was taken at 1 month after surgery).



Fig. 7. A provisional restoration was delivered about 3 month after implant placement.



Fig. 8. Final restoration.

Exclusion criteria were as follows

1. active or acute infection around the hopeless tooth.
2. uncontrolled diabetes, coagulation disorders, psychologic disorders.
3. alcohol or drug abuse.
4. parafunctional habit.
5. heavy smoker (more than 10 cigarettes a day)
6. perforation, dehiscence or loss of labial bony plate following tooth extraction or implant osteotomy.

Five patients were randomly assigned to the immediate provisionalization group (IP), and screw retained fixed provisional restorations were delivered on the day of implant surgery. The mean provisionalization period until delivery of final restorations for IP group was 155 days.

The remaining 5 patients were designated as the non-

immediate provisionalization group (NIP). Healing abutments were connected to the implants on the day of implant surgery and were maintained for 75 to 154 (mean 100) days. The healing abutments were replaced with screw retained fixed provisional restorations and were maintained for an additional 61 to 86 days (mean 77 days) until delivery of final restorations.

The implants placed were nine 4.3 mm diameter implants (FIT43115, Warantec, Seoul, Korea) and one 5.3 mm diameter implant (FIT53115, Warantec, Seoul, Korea). The abutments used for the final restorations were 7 castable gold abutments (IOCA37GE, Warantec, Seoul, Korea) and 3 preparable titanium abutments (IOTA4536, Warantec, Seoul, Korea). Intraoral photographs of the restoration and their contralateral tooth were taken with a digital SLR

camera (FinePix S2Pro, Fujifilm, Japan) on the delivery of the final restoration.

A total of 20 dentists (5 prosthodontists, 5 periodontists, 5 orthodontists and 5 dental students) were chosen to assess five soft tissue variables around implants in comparison with their contralateral teeth. The variables assessed were the height of mesial papilla (MP), the height of distal papilla (DP), the level of facial gingival margin (Level), the contour of facial gingival margin (Contour), and the facial soft tissue prominence of alveolar process (Prominence). Frontal view photographs of each final restoration and its contralateral tooth were shown to each dentist in randomized order, and five esthetic variables were scored. The scores were rated in numbers 0 (lack of esthetics), 1 (esthetic but incomplete), and 2 (perfect esthetic match to the contralateral tooth). The scores were not the absolute values but the relative values compared to the contralateral natural tooth.

Student t-test was used in order to evaluate the statistic significance of the scores rated for IP and NIP. To evaluate

the statistic significance of the five esthetic variables and the specialty of the four dentist groups, one-way ANOVA was used. Tukey grouping was chosen for post hoc test in both analyses ($\alpha = 0.05$).

RESULTS

Table I presented the soft tissue esthetic scores of IP and NIP

The assessment resulted in significantly higher esthetic scores of the IP group in two variables; Level and Prominence.

Table II presents the esthetic scores rated by each dentist group.

Considering different specialty areas in dentistry, there was no notable disagreement among the dentists groups in assessing the esthetic variables.

Table I. Means and standard deviations of esthetic scores of IP and NIP

	MP	DP	Level	Contour	Prominence
IP	1.56 ± 0.52	1.56 ± 0.52	1.41 ± 0.55	1.49 ± 0.56	1.60 ± 0.59
NIP	1.51 ± 0.56	1.44 ± 0.56	1.23 ± 0.71	1.38 ± 0.69	1.40 ± 0.67
<i>P</i> value	0.459	0.064	0.046*	0.146	0.002*

IP; immediate provisionalization group, NIP; non-immediate provisionalization group, MP; the height of mesial papilla, DP; the height of distal papilla, Level; the level of facial gingival margin, Contour; the contour of facial gingival margin, Prominence; the facial soft tissue prominence of alveolar process. *: statistical significance was noted between immediate and non-immediate provisionalization groups.

Table II. The means and standard deviations of esthetic scores rated according to each dentist group

		MP	DP	Level	Contour	Prominence
IP	Prosthodontists	1.60 ± 0.50 ^a	1.60 ± 0.50 ^a	1.48 ± 0.59 ^a	1.52 ± 0.51 ^a	1.72 ± 0.46 ^a
	Students	1.64 ± 0.57 ^a	1.56 ± 0.51 ^a	1.44 ± 0.51 ^a	1.64 ± 0.49 ^a	1.68 ± 0.63 ^a
	Orthodontists	1.56 ± 0.51 ^a	1.6 ± 0.58 ^a	1.52 ± 0.51 ^a	1.56 ± 0.51 ^a	1.64 ± 0.57 ^a
	Periodontists	1.44 ± 0.51 ^a	1.48 ± 0.51 ^a	1.2 ± 0.58 ^a	1.24 ± 0.66 ^a	1.36 ± 0.64 ^a
	<i>P</i> value	0.562	0.832	0.166	0.062	0.119
NIP	Prosthodontists	1.48 ± 0.59 ^a	1.44 ± 0.58 ^a	1.32 ± 0.69 ^a	1.48 ± 0.71 ^a	1.56 ± 0.51 ^a
	Students	1.68 ± 0.56 ^a	1.52 ± 0.59 ^a	1.2 ± 0.71 ^a	1.52 ± 0.65 ^a	1.44 ± 0.65 ^a
	Orthodontists	1.44 ± 0.51 ^a	1.44 ± 0.51 ^a	1.24 ± 0.72 ^a	1.32 ± 0.63 ^a	1.36 ± 0.76 ^a
	Periodontists	1.44 ± 0.58 ^a	1.36 ± 0.57 ^a	1.16 ± 0.75 ^a	1.2 ± 0.76 ^a	1.24 ± 0.72 ^a
	<i>P</i> value	0.372	0.798	0.877	0.336	0.387

Students; dental students. Within the same column, means with the same greek superscript letters are not statistically different

DISCUSSION

Successful clinical results were achieved by submerging an immediate implant or connecting a healing abutment following immediate implant placement.^{18,21,22} Along with these approaches, excellent esthetic outcomes were reported with immediate provisional restorations following immediate implant placements.^{11,12,23} One of the advantages of immediate provisionalization following immediate implant placement is that it better maintains the interproximal soft tissue height around the implant restorations.^{13,24} It is reported that 3 mm was measured in the facial dimension of normal dentogingival complex whereas 5 mm was measured in the interproximal dimension.²³ Only when the interproximal soft tissue was supported by adjacent teeth, the interproximal dimension of 5 mm could be maintained.²⁵ Once the tooth is extracted, the interproximal soft tissue would lose its support from the tooth, resulting in decrease of soft tissue dimension to 3 mm, consequently compromising the gingival esthetics. Therefore, immediate support by a provisional restoration is essential to maintain the height of interproximal soft tissue and eventually produce desired esthetic outcome.^{11,14,25}

Few studies have investigated the soft tissue change around immediate implant restorations. Schropp *et al.*¹⁹ reported that no significant difference was noted between the early and delayed placement groups at either final restorations delivery or 1.5 year follow up. However, the risk of negative or no papilla at final restorations delivery was 7 times greater in the delayed placement group.¹⁹ Cornelini and co-workers²⁶ evaluated the soft tissue changes of 22 single implant restorations which were placed into fresh extraction socket and provisionalized within 24 hours. They reported that the mean recession of midfacial gingiva was 0.75 mm at 1 year follow up. As immediate provisional restorations were delivered to support the interproximal soft tissue, 100% of subjects showed esthetically acceptable papilla height (Jem t papilla index 2 or 3).²⁶ Kan and colleagues¹² assessed the soft tissue changes around single implant restorations which were immediately placed and provisionalized following extraction of hopeless teeth. They reported that the mean amount of recession for midfacial, mesial and distal soft tissue were 0.55, 0.53 and 0.39 mm, respectively.¹² Groisman *et al.*²⁷ evaluated 2 year results of

soft tissue changes on single implant restorations, which were immediately placed and immediately provisionalized, and thereby reported complete fill of papilla in 82 out of 86 implants.²⁷ One notable finding was recently published by Evans and Chen²⁸. They reported that the bucco-lingual position of implant head influenced significantly on the level of facial gingiva. The mean recession of midfacial gingiva was 3 times greater the implants with a buccally positioned implant head rather than a lingually placed implant head.²⁸ In the current study, however, each screw hole of provisional restoration was around the cingulum, therefore, the influence of implant head position was not a critical factor for the level of facial gingiva.

Until now, immediate support of interproximal soft tissue was considered as a prerequisite in maintaining the preexisting papilla height.^{11-13,16,24} However, current study showed that the preexisting papilla height can be also achieved by connecting a healing abutment following immediate implant placement. Immediate or early implant placement resulted early papilla regeneration on final restoration delivery even though the implants were submerged following implant surgery. It is assumed that the interproximal soft tissue around immediate implant might have more potential to regenerate the papilla.

Contrast to the level of papilla, significant difference was noted in the level of facial gingiva between IP and NIP groups. The difference in the level of facial gingiva between IP and NIP groups could be due to the following reason; immediate provisional restorations give support not only to the interproximal papillae but also to the facial soft tissue. The dimension of healing abutments used was smaller than the dimension of corresponding extracted tooth whereas the dimension of provisional restoration was similar to the extracted tooth. Furthermore, the implant system used in current study has a so-called narrow neck design. The diameter of abutment is about 1 mm narrower than that of implant platform at abutment/implant interface. The narrow healing abutment alone may not provide adequate support for the maintenance of facial soft tissue and eventually result in slight collapse of the facial soft tissue. Once the healing abutment was replaced with a provisional restoration, the greater facial-lingual dimension of provisional restoration would push the immature facial soft tissue, and eventually result in the recession of facial

gingival margin. The difference in facial soft tissue prominence between IP and NIP may come from the same reason. Considering the result of the current study, achieving esthetic facial gingival margin is more demanding rather than restoring the height of the papilla and the level of facial gingiva can be better maintained when facial soft tissue is immediately supported. However, clinicians should bear in mind that greater risk of failure is present when immediate provisional restorations are delivered on immediately placed implants. Careful patient selection and higher level of surgical and restorative skills are required for successful outcomes.

Four dentist groups with different specialties have participated in the current study to assess the esthetic variables. These dental specialties were selected based on previous studies.²⁹ In the previous report, orthodontists were more critical than other dentist groups. In the current study, however, the overall scores showed no significant differences in opinion between the dentist groups. The special characteristic of the current study was that the soft tissue esthetic variables of implant restoration were compared to those of the contralateral natural tooth and this guideline for esthetic assessment may have diluted the esthetic concerns of different specialties.

CONCLUSION

Within the limitation of this study, immediate provisionalization on immediately placed implants could be a superior treatment option to non-immediate provisionalization approaches to achieve more esthetic facial gingival margin and facial soft tissue prominence.

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STATEMENT OF PROBLEM: Interproximal papilla could be re-established without immediate support with a provisional restoration following an immediate implant placement. **PURPOSE:** Successful esthetic outcomes were reported utilizing immediate provisionalization following immediate implant placements. The aim of this study was to evaluate the soft tissue esthetics around immediately placed single tooth implant restorations with or without immediate provisional restorations. **METHODS:** A total of ten patients, who had a hopeless maxillary anterior tooth, were enrolled in this study. Screw retained provisional restorations were delivered to the randomly chosen 5 patients (immediate provisionalization group) on the day of immediate implant placement and maintained for about 5 months. For the remaining five patients (non-immediate provisionalization group), healing abutments were delivered on the day of surgery, replaced with screw retained provisional restorations approximately 3 months afterwards, and the provisional restorations were maintained for about 3 months. Digital photographs were taken at the delivery of final restorations in order to assess following variables; mesial papilla, distal papilla, soft tissue level, soft tissue contour and facial soft tissue prominence. The variables were compared to those of the contralateral natural tooth and scored by prosthodontists, periodontists, orthodontists and dental students. **RESULTS:** The immediate provisionalization group marked significantly higher scores on the following variables; soft tissue level and facial soft tissue prominence. In evaluating each variable, there were no notable differences in opinion between four dentist groups. **CONCLUSION:** Immediate provisionalization can be a treatment option to achieve superior soft tissue esthetics around immediately placed single implant restorations rather than non-immediate provisionalization approaches.

KEY WORDS: Soft tissue esthetics, Immediate implant, Immediate provisionalization

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