Immediate implant with provisionalization and soft tissue grafting after 4-years follow-up

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Running Title: Implant with soft tissue graft: 4-year follow up

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A one-sentence summary describing the key finding: Immediate implant placement (IIP) with bone grafting and soft tissue augmentation led to less horizontal changes and stable mucosal margin, and

immediate provisionalization helped to maintain soft tissue architecture and proper case selection is key for clinical success.

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AUTHOR CONTRIBUTIONS

Conceptualization: GRCS, JRT, RFP, RACS, GVOF

Formal Analysis: GRCS, RACS, GVOF

Investigation: GRCS, RACS, GVOF

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ABSTRACT

Introduction: This paper presents a case report of immediate implant placement (IIP) with a provisionalization technique to restore function and esthetics with follow-up after 4 years.

Case presentation: Minimally traumatic extraction was performed with IIP, soft-tissue grafting, and immediate provisional crown. Six months after optimal healing, the patient was submitted to an esthetic restorative work through veneers in lithium disilicate. Fourteen months and 4-year follow-up visits revealed stability of the peri-implant soft-tissues with peri-implant health status, with the evaluation of the pink and white esthetic score, yielding to mean scores, respectively, in 14 months of 11.62 ± 2.07 (PES) and 18.25 ± 1.46 (PES/WES) and in 4 years of 11.0 ± 1.32 (PES) and 17.62 ± 0.65 (PES/WES). Intraoral digital radiographs showed minimal crestal bone level changes throughout the follow-up period. Thus, IIP is a sensitive technique procedure and a 3D implant position is crucial for success.

Conclusion: Immediate implant with grafting to fill the gap and soft tissue augmentation led to less horizontal changes and stable mucosal margin, and immediate provisionalization helped to maintain soft tissue architecture and proper case selection is key for clinical success.

Keywords: Esthetics; Tooth extraction; Dental implants; Immediate Dental Implant loading; Rehabilitation.

BACKGROUND

Immediate implant placement (IIP) following tooth extraction has been advocated as an advantageous option for the replacement of an anterior maxillary tooth, reducing the number of surgical procedures, treatment time, and provide immediate esthetics[1]. This surgical approach has gained popularity and acceptance, and it is combined with bone grafts[2,3] and soft tissue augmentation[4-6] to accomplish implant esthetics. However, several disadvantages and unsuccessful treatments have been linked to IIP, and the technique-sensitive feature has been described[7], with reports of lower survival rates for IIP[8,9].

Prosthetically-driven implant placement must be always the goal to perform IIP[10]. Its approach has been suggested[11] to reduce facial mucosa recession, especially when the implants were also immediately provisionalized. Additionally, gingival phenotype is one of the most important parameters to evaluate when planning for an IIP[7]. When applicable, connective tissue graft (CTG) should be considered to increase soft tissue thickness, keratinized mucosa width, improved esthetics, and stability of the soft tissue margin[2-4].

Hence, the proposal of this case report was to describe the IIP technique in the maxillary esthetic zone with immediate provisionalization and grafting of soft and hard tissues, exploring the key aspects for the maximum performance, showing the predictability after a 4-year follow-up, using the CARE statement[12] for standardizing the clinical case.

CLINICAL PRESENTATION

Diagnosis

A 22-year-old man with a dental history of perforation of the buccal aspect of the root of the maxillary right lateral incisor during endodontic treatment presented in a private clinic, in 2016,

seeking the restoration of a hopeless tooth by a dental implant (fig. 1). A patient consent statement was previously fulfilled. Medical history evaluation did not reveal any significant findings. Dental and periodontal examination showed a fistula at the buccal mucosal area of the tooth and probing pocket depths (PPD) did not exceed 4 mm in any of the 6 examined sites around the tooth. A cone-beam computed tomography (CBCT) scan confirmed an adequate amount of apical bone for implant installation, around 12.69 mm and 13.89 mm in height and 6.54 mm and 5,35 mm in thick. Also, CBCT was taken with lips retracted according to Januario *et al*.[13], and mucosa thickness of 1.03 mm was measured.

CLINICAL MANAGEMENT AND OUTCOMES

Surgical and Immediate Prosthetic Procedures

Minimally invasive extraction was performed using an atraumatic tooth extractor, and the socket was gently curetted and irrigated with saline solution (fig. 2 a, b). The osteotomy was performed following the manufacturer's recommendation and a tapered internal connection implant was placed (Alvim Cone Morse 3.5 x 13 mm)[¶] (fig. 3 a). The abutment (CM Universal abutment)[¶] for a cemented provisional crown was chosen and placed with a torque of 32 N.cm (fig. 3 b). The provisional crown was fabricated using an acrylic denture tooth stock and adjusted intra- and extra-orally to establish an ideal critical and subcritical contour to create emergence profile (fig. 4). The socket was grafted with demineralized bovine bone mineral with 10% of collagen (Bio-Oss Collagen)[#]. A CTG was harvested from the palate between premolars and de-epithelized extraorally with the use of a 15c blade (fig. 5 a), following to be sutured at the buccal mucosa of the alveolar socket. The palatal donor site was covered with a collagen membrane to protect the wound and post-op instructions were given. After cementation of the provisional crown, the occlusal adjustment was performed to avoid any contact during excursive movements during the osseointegration period (fig. 5 b).

[¶] Neodent, Brazil

[¶] Neodent, Brazil

[#] Geistlich, Switzerland

Final Restorative Procedures

Six months after initial procedure, the patient undergoes an esthetic treatment planning for veneers anterior teeth and a mock-up was done to determine esthetic try-in and guide teeth preparation for veneers (fig. 6). Teeth were prepared approximately 0.3 to 0.5 mm for veneers and peri-implant soft-tissues presented healthy with adequate emergence profile before impression (fig. 7). After impression procedures with PVS, the lab technician customized an implant crown for the right lateral incisor to match with veneers fabricated in lithium disilicate (Emax)** (fig. 8). The idea of an implant crown prepared to receive the cementation of a veneer was to have an adequate shade balance with adjacent teeth that will receive veneers cementation. Implant crown and veneers were then cemented with a resin-based cement (fig. 9).

Follow-up visits

The patient presented 14 and 48 months with maintenance of the soft tissue architecture, and an intraoral digital radiograph was taken (fig. 10). Radiographic analysis at 48 months showed no significant changes in crestal bone levels (fig. 10 d). At both follow-up visits, the pink esthetic score (PES)[14] and white esthetic score (WES)[15] were performed (tables 1 and 2). Three separated examiners did the judgement performing two assessments with 7-day of interval, and the Kappa test was conducted. All data is encountered in table 2.

DISCUSSION

This case describes key factors for obtaining esthetic after 4-year outcomes with high success rates[16], although there is contradictory scientific evidence that IIP per se does not exert an influence on the local tissues[17]. Therefore, esthetic outcomes were objectively evaluated through PES and WES, yielding to mean scores in 14 months of 11.62 ± 2.07 (PES) and 18.25 ± 1.46 (PES/WES) and in 4 years of 11.0 ± 1.32 (PES) and 17.62 ± 0.65 (PES/WES). The esthetic success could have suffered the influence of multiple factors such as, but not limited to, the advantageous nature of the flapless procedure (preserving periosteum and supraperiostal plexus)[7], tridimensional implant position, gap

** Ivoclar Vivadent Co

filling between the implant and the buccal bone[2], simultaneous augmentation of soft tissues, and prosthetic procedures.

As the gingival thickness at the level of crestal bone was measured as 1.03 mm in the present case, concerning about the effect of immediate provisionalization on peri-implant soft tissues, there was decision to apply a CTG harvested from the palate to convert the phenotype into thick was taken at the time of surgery. A similar finding was also observed[4,6].

CONCLUSION

It was possible to conclude that IIP is a sensitive technique procedure and a 3D-implant position is crucial for success. When a thin phenotype is encountered, CTG could be leaded to fewer horizontal changes and stable mucosal margin. Immediate provisionalization helps to maintain soft tissue architecture and proper case selection is key for clinical success.

Summary

• Why is this case new information?	This case showed a 4-year follow-up stability of the tissues (hard and soft) the around implant, comparing WES and PES.
• What are the keys to successful management of this case?	Scientific base to support all steps performed; carefully treatment plan; and executability with all technique and excellence.
• What are the primary limitations to success in this case?	To control the biological behavior and the patient care after procedures.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest, associated with this study.

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Table 1. Parameters evaluated for PES[14] and (PES/WES)[15] that were examined by each author (five authors) in two time-points (14-months and 4-year follow-up).

1st analysis (PES)	**2nd analysis (PES + WES)**	
1. mesial papilla	1. mesial papilla	1. tooth shape
2. distal papilla	2. distal papilla	2. tooth volume and curvature
3. level of the gingival margin	3. curvature of the facial mucosa	3. color (hue / value)
4. curvature of the facial mucosa	4. level of the facial mucosa	4. tooth texture
5. alveolar process	5. root convexity/color and texture of the soft tissue	5. translucency
6. color of the soft tissue		
7. soft tissue texture		

Table 2. PES and WES reported as mean ± SD, and agreement among investigators.

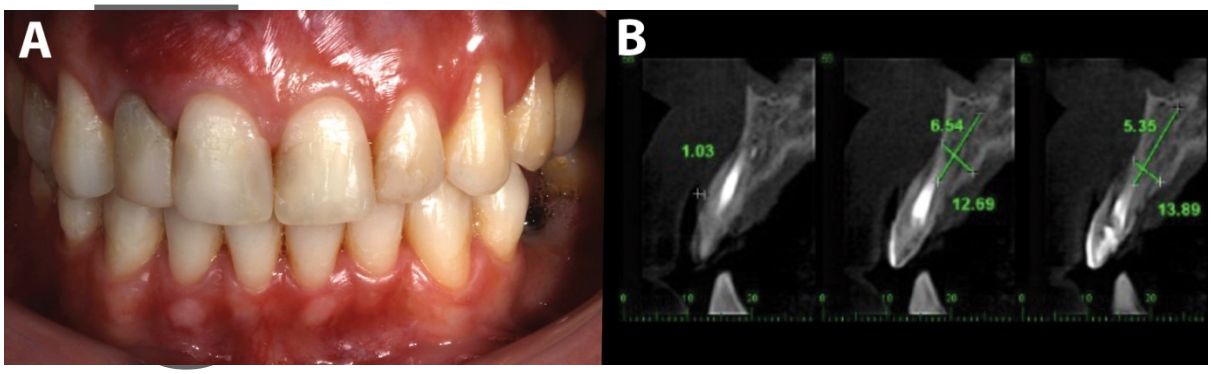
SCORE/ASSESSMENT		**14-MONTHS**	**4-YEARS**
PES	**1st assessment**	11.75 ± 2.06	11.75 ± 1.70
	2nd assessment	11.50 ± 2.08	10.25 ± 0.95
	Inter-examiner agreement	84%	79%
PES/WES	**1st assessment**	18.5 ± 1.29	18.25 ± 0.50
	2nd assessment	18.0 ± 1.63	17.0 ± 0.81

Inter-examiner agreement	85%	76%

A score was attributed for each item found in Table 1: 0 (zero) = absent/obviously different; 1 = incomplete/slightly/moderate difference; 2 = complete/without discrepancies/no difference. Maximum total PES = 14 and PES/WES = 20.

FIGURE LEGENDS

Fig. 1. (a) Initial preoperative clinical labial view of the maxillary right lateral incisor. (b) Sagittal view of Cone Beam computed tomography (CBCT) image showing remaining apical bone and measurement of gingival thickness. Image, in the right, is confirming the perforation existent in the root.



(BEFORE) Fig. 2. Minimally traumatic extraction: (a) extractor device engaged to the root during extraction exactly in the region perforated; (b) preservation of gingival architecture after tooth extraction.

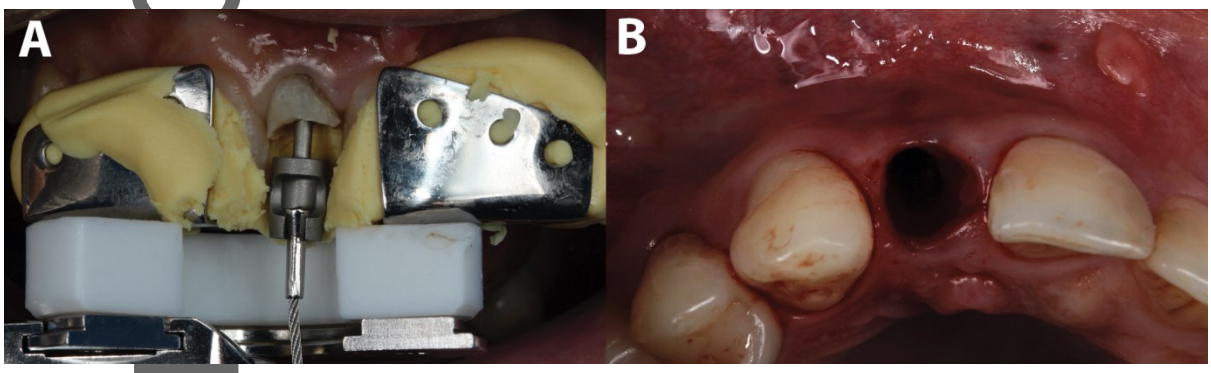


Fig. 3. (a) Occlusal view of implant placement in relation to surgical guide utilized during surgery. (b) Labial view of implant placement and prosthetic abutment installed.

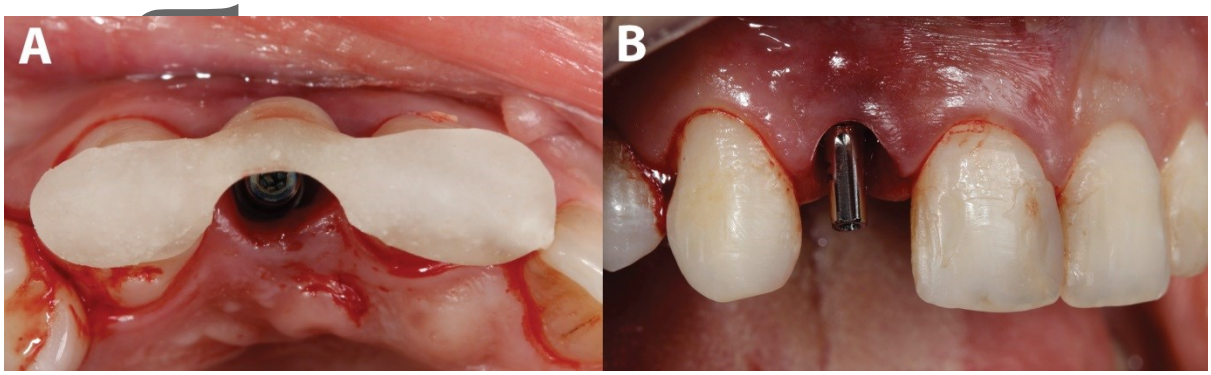


Fig. 4. Provisional crown with critical and subcritical contour established to support peri-implant soft tissues.

Fig. 5. (a) Free CTG was harvested from the right palate in the area between premolars and de epithelized extra-orally with the use of a 15c blade. (b) View from the surgical site after suturing CTG, cementation of the provisional crown, and occlusal adjustment.

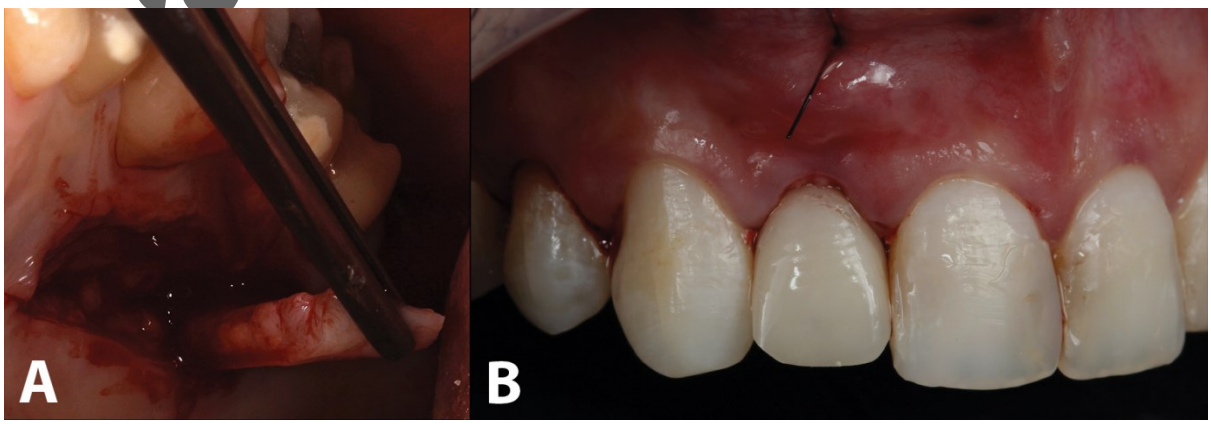


Fig. 6. Mock-up with bis-acryl[††] was used for esthetic and functional try-in, and to guide teeth preparation for veneers. (a) lateral view; (b) frontal view.

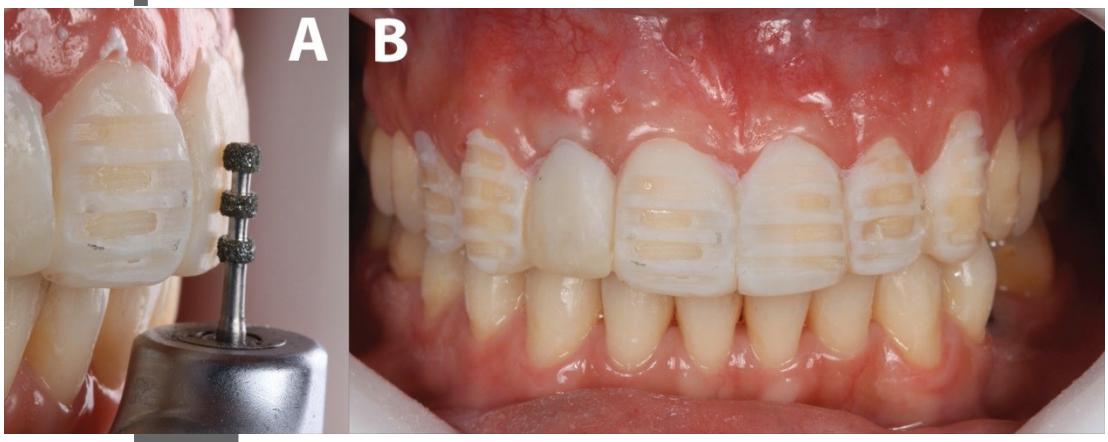
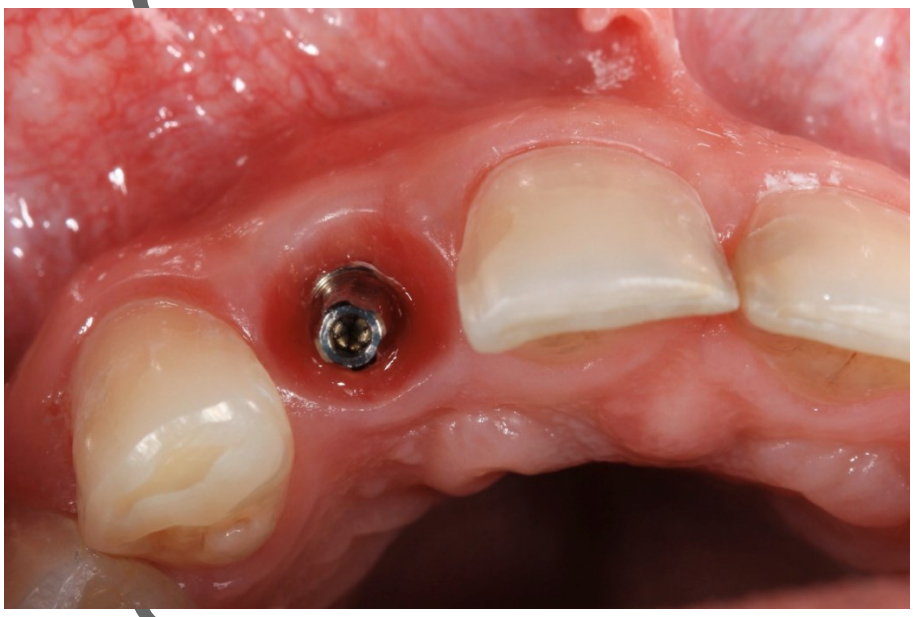


Fig. 7. Occlusal aspect of the peri-implant soft-tissues 6-months after IIP



[††] Protemp, 3M, USA

Fig. 8. Veneers and implant crown prepared to receive the cementation of a veneer on top.

Fig. 9. (a) Implant crown prepared to receive the cementation of a veneer in place showing adequate shade balance with adjacent teeth that will receive veneers cementation. (b) Immediate final aspect after cementation of implant crown and veneers.

(AFTER) Fig. 10. (a) Intraoral view 14 months after implant placement. Note the maintenance of the soft tissue architecture. (b) The intraoral digital radiograph was taken 14 months after the procedure and showing no significant changes in the crestal bone level. (c) Intraoral view 48 months after implant placement; (d) Intraoral digital radiograph showing preserved crestal bone levels.