Long-Term Peri-implant Health and Papilla Formation at Healed Sites with Chairside Provisionalization of Single-Tooth Implants: A Prospective Case Series

Jonas Lorenz, DMD
Department for Oral, Cranio-Maxillofacial, and Facial Plastic Surgery, Medical Center of the Goethe University Frankfurt, Frankfurt am Main, Germany.

Maximilian Blume, DMD
Private practice, Mainz, Germany.

Frank Schwarz, DMD, PhD
Department of Oral Surgery and Dental Implantology, Dental Clinic of the Goethe University Frankfurt, Frankfurt am Main, Germany.

Paul Weigl, DMD, PhD
Department of Prosthodontics/Postgraduate Education, Dental Clinic of the Goethe University Frankfurt, Frankfurt am Main, Germany.

Shahram Ghanaati, MD, DMD, PhD
Robert A. Sader, MD, DMD, PhD
Department for Oral, Cranio-Maxillofacial, and Facial Plastic Surgery, Medical Center of the Goethe University Frankfurt, Frankfurt am Main, Germany.

Purpose: To investigate the effect of immediate provisionalization of single-tooth implants at healed sites for peri-implant soft-tissue conditions, focusing on papilla formation around single implants. ***Materials and Methods:*** In total, 12 patients received a total of 12 implants in the incisor, canine, or premolar region of the maxilla or mandible at healed sites with immediate chairside provisionalization. After 4 months, the temporary crown was replaced with the permanent crown. After 40 ± 13.1 months, clinical follow-up was conducted, assessing probing pocket depth (PPD), bleeding on probing (BoP), mucosal recession (MR), and width of keratinized mucosa (KM). Papilla index (PI) was determined immediately after implant placement (t0), before removing the temporary crown (t1), 4 weeks after delivery of the definitive crown (t2), and at the final follow-up examination (t3) to evaluate papilla formation and its change over time. ***Results:*** None of the implants were lost. The mean PPD was 2.5 ± 0.39 mm, and BoP of 25% and 3.5 mm of KM were observed at the final follow-up. No implants showed MR. PI increased in all patients from 1.5 ± 0.45 at t0 to 2.4 ± 0.56 at t1, 2.6 ± 0.47 at t2, and 3.0 ± 0 at t3. The increase in PI between t0 and each individual timepoint from t1 to t3 showed statistical significance. ***Conclusions:*** The present results indicate the suitability and benefit of immediate provisionalization to achieve favorable peri-implant soft tissue conditions and papilla formation.
Int J Prosthodont 2025;38:27–34. doi: 10.11607/ijp.8719

Replacing missing teeth with implant-retained prosthetics is currently an accepted and reliable treatment. Significant advancements in implant geometry, surface technology, and design have resulted in high rates of implant survival.[1] Several factors, including the stability of peri-implant bone levels, determine implant success.[2,3] However, in the case of a single-tooth gap in the anterior region, esthetics play a pivotal role in determining implant success. Patient satisfaction is closely linked to the esthetic outcome of implant-retained prosthetics.

Correspondence to:
Dr Jonas Lorenz
jonas_lorenz@icloud.com

Submitted May 8, 2023;
accepted November 11, 2023.

Table 1 Patient Demographics and Implant Site Characteristics

Patients, n	
Female	6
Male	6
Age, y	47 (25–60)
Observation period, mo	40 (17–58; SD 13.1)
Smokers, n	2
Implants by length, n	
9 mm	4
11 mm	8
Implants by arch, n	
Maxilla	8
Mandible	4
Implants by site, n	
Incisor	1
Canine	3
Premolar	8

In general, achieving an appropriate balance between hard- and soft-tissue proportions, maintaining dimensional stability of the different involved tissues, and creating natural-looking prosthetic restorations are essential goals. In addition to an adequate quantity and quality of peri-implant bone, the peri-implant soft tissue significantly influences the esthetics of implant-retained restorations. The formation of a scalloped papilla filling the entire interproximal space contributes to an esthetically pleasing appearance to the overall restoration.

Another strategy to minimize disruptions to peri-implant hard and soft tissue involves selecting the optimal timing for implant placement and prosthetic restoration. According to the philosophy that the earliest possible implant placement preserves peri-implant hard- and soft-tissue structures, immediate implant placement is considered a treatment option that not only reduces treatment duration but also minimizes manipulations of hard and soft tissue. However, there is an ongoing debate in the literature on this matter. On one hand, immediate implant placement appears to yield predictable results, similar to implants placed in fully healed bone.[4–6] On the other hand, there is a risk of unpredictable tissue healing in immediately placed implants, leading to recession of 1 to 2 mm, depending on the gingival phenotype.[7] Concerning the impact of restoration timing on clinical and esthetic outcomes, existing literature provides evidence that immediate restoration, whether at fresh extraction sites or healed sites,[8,9] positively influences esthetic appearance. In particular, papilla formation shows a slight increase when peri-implant tissue is immediately supported with provisional restoration.[10]

The aim of this study was to assess the impact of immediate provisionalization of single-tooth implants placed in healed sites on peri-implant health and papilla formation in a prospective case series. The null hypothesis was that conventional loading of single implants in healed sites would achieve favorable functional and esthetic results. The working hypothesis of the present study was that immediate provisionalization of single implants in healed sites would improve papilla formation.

MATERIALS AND METHODS

Study Design and Patient Population

In this prospective case series, 12 patients (6 women and 6 men) with a mean age of 47 ± 13 years (range: 25 to 60 years) were enrolled from the Department for Oral, Cranio-Maxillofacial, and Facial Plastic Surgery, Medical Center of Goethe University Frankfurt. Patients received a total of 12 dental implants with immediate chairside provisionalization without functional occlusion in the incisor, canine, or premolar region of the maxilla and mandible (detailed allocation in Table 1). No additional soft or connective tissue augmentation procedures were performed. After a mean provisional phase of 4 ± 0.67 months (3 to 5 months), the implants were restored with definitive single crowns. These implant-retained crowns were clinically evaluated following a mean loading period of 40 ± 13.1 months (range: 17 to 58 months).

The study was approved by the ethics commission of the medical department of Goethe University in Frankfurt am Main, Germany (213/13) and was conducted according to the Helsinki Declaration of 1975, as revised in 2013. All participants provided informed written consent to participate in this prospective study and for the publication of the obtained data.

Patient selection was performed for all individuals who presented at or were referred to the Department for Oral, Cranio-Maxillofacial and Facial Plastic Surgery, Medical Center of Goethe University Frankfurt during the years 2017 and 2018. Patients who met the inclusion criteria, outlined in Table 2, were included in the study. Prior to enrollment, all patients underwent clinical and radiologic examination by the same examiner (J.L.).

Exclusion criteria were defined as follows: uncontrolled diabetes (HbA1c > 7), use of bisphosphonate medication, a history of oral cancer disease, previous radiation in the head and neck area, ongoing or previous chemotherapy, inadequate oral hygiene, and an insufficient condition of teeth and jaws. Additionally, patients with significant horizonal or vertical defects of the alveolar crest, classified according to Seibert's criteria as I, II, and III, were also excluded.

Table 2 Inclusion Criteria

1	At least one missing single tooth in the incisor, canine, or premolar region of the maxilla or mandible
2	Natural neighboring teeth
3	Tooth extraction at least 6 weeks prior to implant placement
4	Sufficient bone volume in horizontal and vertical dimension for placement of an implant with 3.8-mm diameter and 9-mm length without additional augmentation procedures
5	No systemic diseases that could influence the outcome of therapy
6	No intake of medications that may affect bone turnover and mucosal healing
7	No pregnancy or breastfeeding
8	Nonsmoker or light smoking habits (< 10 cigarettes per day)
9	Adequate oral hygiene and no untreated periodontitis
10	No history of bruxism or clenching habits
11	No history of adverse reactions to the materials used in this study
12	No general contraindications for surgical interventions
13	No physical or mental handicaps that would interfere with the ability to perform adequate oral hygiene or understand the study and follow-up procedure

Implant Placement, Immediate Provisionalization, and Definitive Prosthetics

Implant therapy involved placing single implants in healed sites at least 6 weeks after tooth extraction.

Prior to surgical diagnostic casts, a direction template for pilot drilling made of surgical guide resin with a titanium alloy sleeve, a hollow provisional crown (VITA Physiodens) in nonocclusion, and a transfer key for the provisional crown were produced by a dental technician to align the implant to the planned position.

Using a midcrestal approach, the alveolar crest was exposed, and pilot drilling was performed following the direction template according to the desired prosthetic position and axis of the subsequently placed implant with a diameter of 3.8 mm (Camlog Screw Line Implant, Camlog Biotechnologies). Further implant site osteotomy was performed according to the standard drilling protocol recommended by the manufacturer. Implants were placed slightly subcrestally. Regarding sufficient primary stability, at least 30 Ncm insertion torque was measured with a torque wrench, and immediate chairside provisionalization was performed.

For immediate provisionalization, a provisional PEEK abutment (Camlog Biotechnologies) was mounted and subsequently trimmed to match the antagonistic teeth.

Afterward, the prepared provisional crown was tried with the previously prepared transfer key, allowing the crown to be placed on the provisional abutment as planned with the cast prior to implant placement. Thus, a tension-free fit of the provisional crown on the abutment was achieved. Additionally, the crown and the transfer cast were accessible in the occlusal portion for subsequent filling and polymerization. After fitting and adjustment, both the provisional abutment and the provisional crown were abraded and cleaned in alcohol. Following the mounting the provisional abutment, the provisional crown was filled with a provisional self-curing composite (Protemp, 3M ESPE) and placed on the provisional abutment using the transfer key. If required, additional composite was injected from the occlusal access. Importantly, it was ensured that the screw channel of the provisional abutment was accessible at all times. Consequently, the screwdriver for the abutment screw remained in the screw channel during polymerization. After curing, the provisional crown was removed from the mouth and further filled, finished, and polished extraorally. Lastly, the provisional chairside abutment crown was screw-retained, eliminating the risk of cement residue interfering with the implant's healing. Nonocclusion was ensured to prevent undesired loading forces. Subsequently, wound closure was achieved with 5-0 monofilament sutures (Prolene, Ethicon).

After a mean provisional period of 4 months, definitive prosthetic rehabilitation was performed. Implant impressions were taken conventionally using an anatomically adapted impression post to prevent collapse of the emergence profile. The impression post was customized according to the initially prepared provisional crown by the dental technician before the impression. Afterward, an individual CAD/CAM-based titanium abutment was fabricated (Dedicam, Camlog Implant System) with subgingival abutment-crown margins of 2 mm to prevent

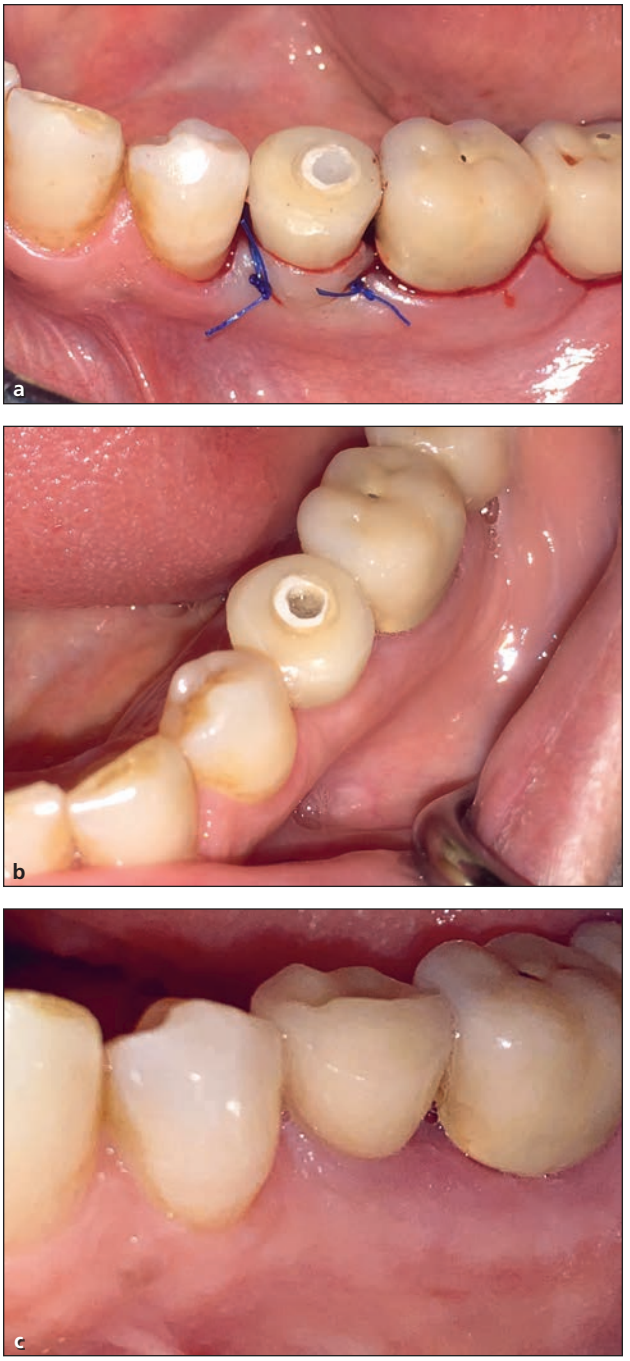

Fig 1 Clinical situation of the mandibular left second molar in patient 6: *(a)* immediately after implant placement and provisionalization (t0); *(b)* immediately before definitive prosthetic procedure (t1); and *(c)* at the final follow-up (t3).

discoloration of the marginal mucosa. Finally, all-ceramic crowns with a zirconia framework and individual ceramic veneering were cemented using a semipermanent zinc oxide-based cement (Temp-Bond, Kerr Dental) using the extraoral cementum technique, thereby preventing cement residue.

Analyzed Implant System

In this prospective study, Camlog screw-line implants (Camlog Biotechnologies) with a diameter of 3.8 mm and lengths of 9 mm or 11 mm were used. The implant system has a morse-locking implant-abutment connection with three-point indexing. The Promote surface of the implant system is manufactured using grit blasting and acid etching.

Clinical Follow-up Investigation

Patients were clinically assessed at the Department for Oral, Cranio-Maxillofacial, and Facial Plastic Surgery of the Medical Center of Goethe University Frankfurt according to previously published methods.[12,13]

The following parameters were evaluated at the follow-up visit to assess peri-implant health and the impact of immediate provisionalization on soft-tissue conditions and papilla formation:

- Implant being in situ and restored with a crown
- Probing pocket depth (PPD): measured at four sites per implant (mesiobuccal, distobuccal, mesiolingual, distolingual) from the mucosal margin to the pocket depth.
- Bleeding on probing (BoP)
- Mucosal recession (MR): measured from the crown margin to the mucosal margin
- Width of keratinized mucosa (KM)
- Papilla Index (PI) according to Jemt[14]

PPD, BoP, MR, and KM were assessed during the final follow-up. PI was assessed at various time points: immediately after implant placement (t0), just before removal of the temporary crown (t1), 4 weeks after delivery of the definitive crown (t2), and at the final follow-up (t3). These evaluations were standardized through consistent measurement, and all assessments at different time points were performed by the same examiner (J.L.). To ensure examiner calibration, prior to the follow-up, the examiner (J.L.) assessed the clinical parameters of this study in five patients, with a total of five implants, who were not part of the study. Three rounds of evaluation of the assessed parameters were conducted at 5-minute intervals. Calibration was acceptable when the repeated measurements were similar (> 95% level).

According to the 84/466/EURATOM directive, radiographs for the longitudinal assessment of interproximal bone level changes were deemed unnecessary. According to clinical standard procedures, additional radiographs were taken based on clinical indications, such as signs of biologic or technical complications. Biologic complications were defined as PPD larger than 5 mm, presence of marginal recession in combination with BoP, suppuration, or mucosa proliferation. Technical

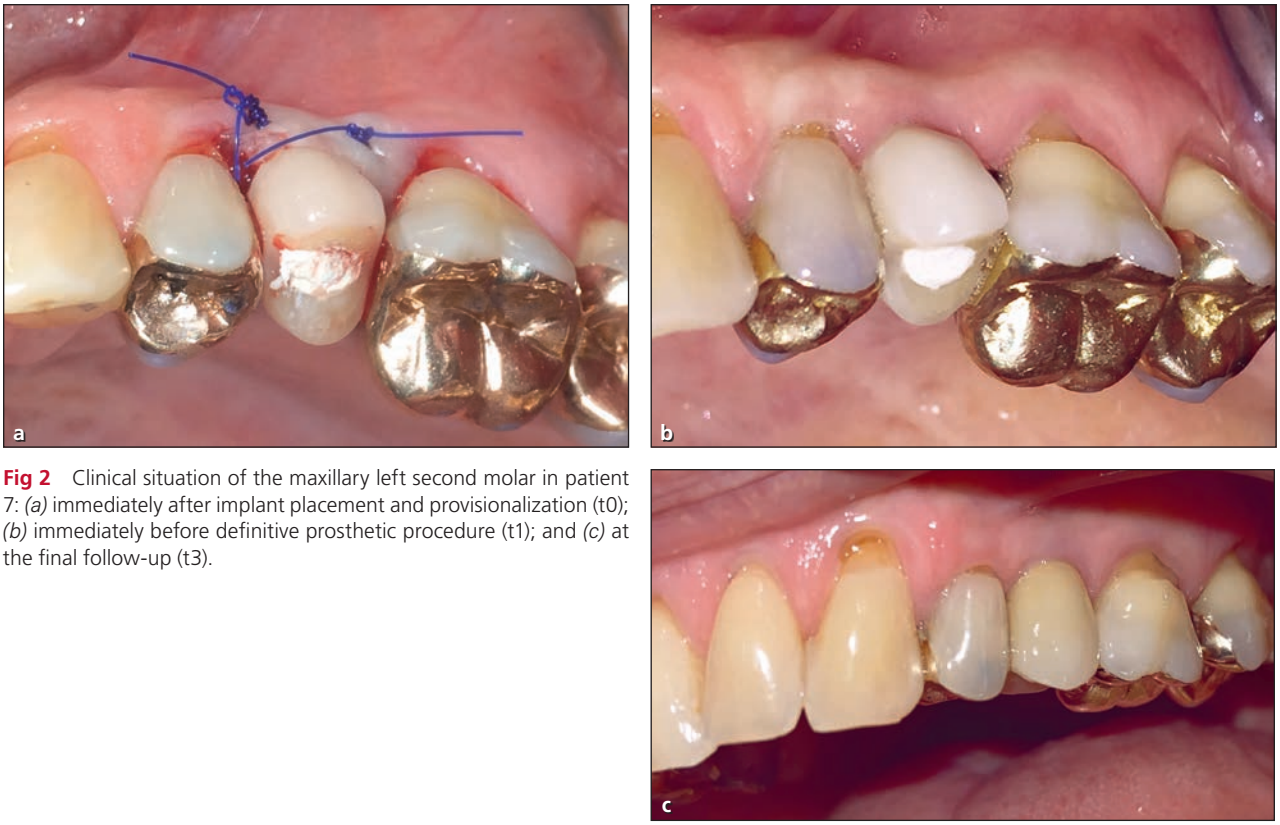

Fig 2 Clinical situation of the maxillary left second molar in patient 7: *(a)* immediately after implant placement and provisionalization (t0); *(b)* immediately before definitive prosthetic procedure (t1); and *(c)* at the final follow-up (t3).

complications included screw loosening, abutment fracture, and chipping.

Table 1 presents an overview of patient information, implant localization, and implant data. Figures 1 and 2 illustrate the clinical process of implant placement, provisionalization, and final prosthetics of two patients.

Statistics

Quantitative data are presented as the mean ± SD. Friedman test was used to compare groups (t0 to t3) using SPSS version 16.0.1 software (IBM). Mesial and distal PI values were averaged for statistical analysis. Differences were considered significant at $P \leq .05$ and highly significant at $P \leq .01$ and $P \leq .001$.

RESULTS

Clinical Results

A total of 12 patients met the inclusion criteria and were clinically followed up according to the study protocol. Sufficient primary stability for immediate chairside provisionalization was achieved intraoperatively, during implant placement for all implants. There were no implant failures, and all implants were successfully restored with all-ceramic single crowns cemented onto individual titanium-based abutments after a mean provisionalization period of 4 ± 0.67 months (range: 3 to 5 months). The final follow-up assessment was conducted in all patients after a mean loading period of the final prosthetics of 40 ± 13.1 months (range: 17 to 58 months). No implants presented biologic or technical complications, as defined in previously.

Soft Tissue Parameters

Table 3 shows the detailed results of PPD, BoP, MR, and KM at the final follow-up investigation. The mean PPD, measured at four sites per implant, was 2.5 ± 0.39 mm (range: 2 to 4 mm) with a BoP of 25%. No MR was observed at any of the implant sites. The measurement of the buccal peri-implant keratinized gingiva width at the final follow-up revealed a mean of 3.540 ± 0.79 mm (range: 3 to 5 mm).

Papilla Index

At baseline, immediately after implant placement the PI, according to Jemt,[14] showed a mean value of 1.5 ± 0.45 (range: 1 to 2). This value increased to 2.4 ± 0.56 (range: 1 to 3) immediately before removing the temporary crown (t1) and 2.6 ± 0.47 (range: 2 to 3) 4 weeks after definitive restoration (t2). At the final follow-up investigation (t3), a PI score of 3 could be observed in all 12 implants, indicating a continuous increase in papilla

Table 3 Clinical Parameters at the Final Follow-up (t3)

Patient no.	Implant survival	PPD (mb, db, ml, dl; mm)	BoP (±)	MR (mm)	KM (mm)
1	+	2, 2, 2, 3	–	0	4
2	+	3, 3, 2, 2	+	0	3
3	+	3, 3, 4, 2	–	0	4
4	+	3, 3, 2, 3	+	0	3
5	+	3, 4, 3, 2	–	0	2
6	+	3, 3, 3, 3	+	0	3
7	+	3, 3, 2, 2	–	0	3
8	+	2, 3, 3, 2	–	0	5
9	+	2, 1, 3, 2	–	0	4
10	+	2, 2, 2, 2	–	0	4
11	+	2, 2, 2, 2	–	0	3
12	+	3, 2, 2, 2	–	0	4
Total	100%	2.5 ± 3.9 mm (1–4 mm)	3/12 (25%)	0	3.5 ± 0.79 mm (2–5 mm)

mb = mesiobuccal; db = distobuccal; ml = mesiolingual; dl = distolingual;
Implant survival: + = survived; – = did not survive. BoP = + = present; – = absent.

Table 4 Detailed Results of Papilla Index

	t0		t1		t2		t3	
Patient no.	Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
1	1	1	3	3	3	3	3	3
2	2	2	3	3	3	3	3	3
3	2	1	2	2	3	2	3	3
4	1	2	2	2	2	2	3	3
5	1	1	2	2	2	2	3	3
6	1	1	2	2	2	2	3	3
7	2	2	2	2	3	3	3	3
8	1	2	2	2	2	3	3	3
9	2	2	3	3	3	3	3	3
10	2	2	3	3	3	3	3	3
11	1	1	1	2	2	2	3	3
12	1	1	3	3	3	3	3	3
Average	1.5 ± 0.45 mm (1–2 mm)		2.4 ± 0.56 mm (1–3 mm)		2.6 ± 0.47 (2–3 mm)		3.0	

Table 5 Friedman Test for P1 Differences Between Time Points

Compared time points	*P*
t0 vs t1	.034*
t0 vs t2	.002**
t0 vs t3	< .001***
t1 vs t2	1.000
t1 vs t3	.289
t2 vs t3	1.000

*$P < .05$.
**$P < .01$.
***$P < .001$.

formation, resulting in a complete fill of the interproximal space. Statistical analysis revealed a significant increase in PI from t0 to timepoints t1 ($P = .034$), t2 ($P = .002$) and t3 ($P < .001$). However, differences in PI between t1 and t2, t1 and t3, and t2 and t3 did not show statistical significance. Tables 4 and 5 provide an overview of PI development from t0 to t3.

DISCUSSION

In recent years, significant advancements in dental implantology have accelerated treatment options, resulting in reduced treatment durations, decreased patient

burden, and earlier rehabilitation. One such option, immediate prosthetic loading can accelerate oral rehabilitation and influence peri-implant soft tissue. A systematic review by Pigozzo et al[15] compared the efficacy of immediate loading to early loading in single dental implants, assessing factors like marginal bone loss and survival rate. The review found that immediate loading achieved comparable implant survival rates and marginal bone level changes without statistically significant differences. Another meta-analysis, focused on confirming the noninferiority of immediate loading compared to nonimmediate loading (early or conventional loading) in clinical and radiographic outcomes, also found no significant differences in implant failure rates. Additionally, immediate loading showed significantly less marginal bone loss than nonimmediate loading.[16]

In a clinical study, 45 implants were in placed in healed single edentulous sites in the maxillary esthetic region and immediately restored with provisional crowns to preserve soft tissue. All implant sites met success criteria in terms of function and esthetics, with particularly promising results seen after adjustments to the provisional restorations to preserve interdental papillae.[17]

The primary aim of the present study was to assess the impact of immediate restoration on a specific aspect of implant esthetics: papilla formation. Our findings revealed a statistically significant increase in papilla formation from implant placement and immediate provisionalization (t0) to the delivery of definitive prosthetics (t2) and notably, this positive impact was sustained during the mid-term follow-up of over 3 years of loading (t3). This result aligns with those from a retrospective study comparing immediately restored implants to delayed restoration and underlines the positive impact of provisionalization and the stability of the papillae over more than three years. The evaluation of riming's impact on clinical and esthetic outcomes showed no significant differences in the Pink Esthetic Score (PES). However, concerning individual PES variables, it is interesting to note that the distal papillae exhibited significantly better outcomes in the immediate restoration group.[10]

Although advancements in guided surgery and the potential use of CAD/CAM-based prefabricated implant-prosthetic components might suggest questioning the presented chairside provisionalization approach, certain factors support its continued use. While guided surgery and CAD/CAM approaches allow precise preoperatively planned implant placement with final abutments and prefabricated provisional crowns, and can avoid repeated abutment changes that have been shown to provoke slightly but significantly increased bone loss,[18] they lack intraoperative adaptability. In contrast, the presented chairside approach permits easy compensation for deviations during implant placement by positioning the crown on the provisional abutment intraoperatively. Furthermore, the chairside approach is cost-effective, making it a valuable alternative to fully guided protocols, which can be more time-and cost-consuming.

Several limitations of our study must be acknowledged. These include the relatively small patient sample and the absence of a control group such as conventional prosthetic loading, which should be considered in future research. Additionally, the distribution of implants sites across incisor, canines, and bicuspids is not uniform and presents anatomical variations in tissue thickness and biotype. Limiting the study to a specific site and arch could enhance its validity and warrants further investigation. Despite these limitations, our study highlights the cost-effectiveness and flexibility of the chairside approach to immediate restoration, considering its manageable costs and materials, which can be advantageous over fully guided protocols, albeit with slightly longer treatment times.

CONCLUSIONS

The current prospective case series assessed the clinical and esthetic outcomes of single-tooth implants immediately restored with chairside provisionals. The main focus of the study was set on the papilla formation at different time points. Papilla formation increased incremental during the observed time points, ultimately achieving complete papilla formation in all patients at the final follow-up. Thus, a clinical conclusion of the present study is that, in terms when implant placement procedure allows, immediate provisionalization should be considered as alternative to transmucosal or submerged healing to increase papilla formation and thus esthetics of the implant-prosthetic-complex.

ACKNOWLEDGMENTS

The study was approved by the ethics commission of the medical department of Goethe University in Frankfurt am Main, Germany (213/13). All participating patients gave informed written consent to participate in the study and for publication of the obtained data and gave written consent for publication of the results of the study. The datasets used and analyzed during the current study are available from the corresponding author on reasonable request. The authors declare that they have no conflicts of interest. This study was supported by a grant from the former Camlog Foundation, now known as the Oral Reconstruction Foundation. The authors would like to thank Dr Alica Kubesch and Prof Eva Herrmann for the excellent statistical support.

Author contributions: concept and design of the study and final approval of the version to be published (J.L., M.B., F.S., P.W., S.G., R.S.); drafting the paper and revising it critically (J.L., F.S., P.W., S.G., R.S.); analysis and interpretation of data for the work (J.L., M.B., F.S.); securing funding (M.B., P.W., S.G.); acquisition and patient treatment (J.L.); agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any parts of the work are appropriately investigated and resolved (R.S.).

REFERENCES

1. Angkaew C, Serichetaphongse P, Krisdapong S, Dart MM, Pimkhaokham A. Oral health-related quality of life and esthetic outcome in single anterior maxillary implants. Clin Oral Implants Res 2017;28:1089–1096.
2. Lang NP, Pun L, Lau KY, Li KY, Wong M. A systematic review on survival and success rates of implants placed immediately into fresh extraction sockets after at least 1 year. Clin Oral Implants Res 2012;23:39–66.
3. Belser UC, Schmid B, Higginbottom F, Buser D. Outcome analysis of implant restorations located in the anterior maxilla: A review of the recent literature. Int J Oral Maxillofac Imp 2004;19:30–42.
4. Bianchi A, Sanfilippo F. Single-tooth replacement by immediate implant and connective tissue graft: A 1–9 year clinical evaluation. Clin Oral Implants Res 2004;15:269–277.
5. Norton M. A short-term clinical evaluation of immediately restored maxillary TiOblast single-tooth implants. Int J Oral Maxillofac Implants 2004;19:274–281.
6. Lang N, Tonneti M, Suvan J, et al. Immediate implant placement with transmucosal healing in areas of aesthetic priority. A multicentre randomized-controlled clinical trial. I. Surgical outcomes. Clin Oral Implants Res 2007; 19:188–196.
7. Bittner N, Schulze-Späte U, Silva C, et al. Changes of the alveolar ridge dimension and gingival recession associated with implant position and tissue phenotype with immediate implant placement: A randomised controlled clinical trial. Int J Oral Implantol 2019;12:469–480
8. Barone A, Toti P, Quaranta A, Derchi G, Covani U. The clinical outcomes of immediate versus delayed restoration procedures on immediate implants: A comparative cohort study for single-tooth replacement. Clin Implant Dent Relat Res 2015;17:1114–1126
9. Mangano FG, Mastrangelo P, Luongo F, Blay A, Tunchel S, Mangano C. Aesthetic outcome of immediately restored single implants placed in extraction sockets and healed sites of the anterior maxilla: A retrospective study on 103 patients with 3 years of follow-up. Clin Oral Implants Res 2017;28:272–282
10. Arora H, Ivanovski S. Clinical and aesthetic outcomes of immediately placed single-tooth implants with immediate vs. delayed restoration in the anterior maxilla: A retrospective cohort study. Clin Oral Implants Res 2018;29:346–352.
11. Frisch E, Ratka-Krüger P, Weigl P, Woelber J. Extraoral cementation technique to minimize cement-associated peri-implant marginal bone loss: Can a thin layer of zinc oxide cement provide sufficient Retention? Int J Prosthodont 2016;29:360–362.
12. Lorenz J, Lerner H, Sader R, Ghanaati S. Investigation of peri-implant tissue conditions and peri-implant tissue stability in implants placed with simultaneous augmentation procedure: A 3-year retrospective follow-up analysis of a newly developed bone level implant system. Int J of Impl Dent 2017;5,3:41
13. Lorenz J, Blume M, Korzinskas T, Ghanaati S, Sader R. Short implants in the posterior maxilla to avoid sinus augmentation procedure: 5-year results from a retrospective cohort study. Int J Implant Dent 2019;5:3
14. Jemt T. Regeneration of gingival papillae after single-implant treatment. Int J Periodontics Restorative Dent 1997;17:326–333.
15. Pigozzo MN, Rebelo da Costa T, Sesma N, Laganá DC. Immediate versus early loading of single dental implants: A systematic review and meta-analysis. J Prosthet Dent 2018;120:25–34
16. Zhang S, Wang S, Song Y. Immediate loading for implant restoration compared with early or conventional loading: A meta-analysis. J Cranio-Maxillo-Facial Surgery 2017;45:793–803.
17. Di Alberti L, Donnini F, Di Alberti C, Camerino M, Sgaramella N, Lo Muzio L. Clinical and radiologic evaluation of 70 immediately loaded single implants in the maxillary esthetic zone: Preliminary results after 1 year of functional loading. Int J Oral Maxillofac Implants 2012;27:181–186.
18. Esposito M, Bressan E, Grusovin MG, et al. Do repeated changes of abutments have any influence on the stability of peri-implant tissues? One-year post-loading results from a multicentre randomised controlled trial. Eur J Oral Implantol 2017;10:57–72.

Highlighted Literature

Comparison of the Success Rate and Marginal Bone Loss of Implants Placed Simultaneously with Either Bone Expansion or Ridge Splitting in Maxillary Sites: A Prospective Non-randomized Study

This study was performed to compare the amount of marginal bone loss (MBL) and the success rate of implants placed following maxillary ridge expansion with two surgical techniques. A nonrandomized prospective study was designed. The patients underwent either bone expansion or ridge splitting, and simultaneous implant placement. The implants were loaded according to the delayed loading protocol with single crowns. Each study group included 35 implants placed in 31 patients. One year after loading, the implant success rate was 100% in both groups. The median MBL was 1.00 mm in both groups (interquartile range 0.10 mm in the bone expansion group and 0.30 mm in the ridge splitting group) (no significant difference, P = .749). The median MBL around implants placed in sites with D2, D3, and D4 density bone was 1.40 mm, 1.00 mm, and 0.80 mm in the expansion group and 1.50 mm, 1.00 mm, and 0.85 mm in the splitting group, respectively. There was a significant difference in MBL between the different bone density types within both groups (P < .001). In conclusion, no significant difference in the amount of MBL or the success rate was observed between implants placed simultaneously with ridge splitting and those placed simultaneously with bone expansion, in the maxilla.

Tabrizi R, Aboul-Hosn Centenero S, Hazrati P, Azadi A. *Int J Oral Maxillofac Surg* 2024;53:787–794. **References:** 30. **Reprints:** Azadi A: azadiali1377@gmail.com—*Tony Pogrel, USA*