

Esthetic Outcomes of Immediately Loaded Locking Taper Implants in the Anterior Maxilla: A Case Series Study

Giorgio Lombardo, MD, DDS^{1*}
 Giovanni Corrocher, DDS¹
 Jacopo Pighi, DDS¹
 Anna Mascellaro, DDS¹
 Mauro Marincola, MD, DDS²
 Per Francesco Nocini, MD, DMD, DDS¹

The purpose of this study was to evaluate the esthetic outcome of single-tooth locking taper connection implants placed in the anterior maxilla following a postextractive nonfunctional loading protocol. This preliminary clinical study involving 16 patients evaluated the results of 21 implants placed in areas with high esthetic value. For each implant the pink esthetic score, white esthetic score, cumulative survival rate, and health status of peri-implant tissues were evaluated. The cumulative survival rate was 100% 2 years after prosthetic loading, and the mean total pink esthetic score/white esthetic score was 16.9 ± 1.14 on a maximum value of 20. There was excellent plaque control in all patients, and inflammation indices were within the norm. Within the limits of this study, this immediate nonfunctional loading protocol seems to be a successful procedure esthetically and for the maintenance of peri-implant soft tissues.

Key Words: *single-tooth locking taper implants, pink esthetic score, white esthetic score, immediate loading protocol*

INTRODUCTION

Implant therapy in partially edentulous patients has become a well-established treatment method even in esthetic areas where predictability levels have been achieved that are comparable with those for implants placed in other jaw areas.¹⁻⁶ To shorten rehabilitation times, protocols have been constantly evolving in recent decades, with the literature focusing on the evaluation of postextraction implant placement with or without immediate loading. Continuous improvements to materials and methods means that now these protocols achieve implant survival rates comparable with those of traditional biphasic techniques.^{7,8} Most of the studies, however, have concentrated on implant survival, radiographic bone loss, sulcus probing depth, peri-implant hygiene, and prosthetic complications rather than esthetics. However, in esthetic areas complications such as the appearance of subgingival gray-wash transparency^{9,10} or abutment or implant collar exposure may have serious implications for the patient's social life as well as the patient-therapist relationship even if good osseointegration has been achieved. Some authors¹¹⁻²⁴ therefore believe that to be able to properly evaluate a therapeutic protocol aimed at the rehabilitation of esthetic areas it is also essential to consider the results from the esthetics standpoint. Few studies have used indices that can be objectively reused for comparative esthetic appraisal. In this

regard, three authors have proposed their protocols of esthetic evaluation. In 1997, Jemt²⁴ focused on the presence or absence of interproximal papilla after implant; in 2005, Fürhauser et al²⁵ proposed the pink esthetic score (PES), which assigns particular importance to the anatomy of peri-implant soft tissues; and in 2005, Meijer et al²⁶ proposed an index evaluating the properties of the prosthetic crown. Belser et al²⁷ recently proposed an index to integrate soft tissue assessment with that of the prosthetic crown. The aim of this study was to evaluate implant survival, peri-implant tissue health, and esthetic outcomes in implant-prosthetic rehabilitation of anterior maxilla areas according to an immediate postextractive nonfunctional loading protocol.

MATERIALS AND METHODS

Patient population

Patients were selected from those who had been treated with a postextractive single implant according to an immediate nonfunctional loading protocol in the esthetic areas of the maxilla between October 2009 and November 2011 in the periodontology department of the dental and maxillofacial surgery clinic of Policlinico GB Rossi at the University of Verona. For enrollment in the study all patients had to have a natural teeth both mesially and distally to the implant. Exclusion criteria were uncontrolled diabetes, bone disease, poor oral hygiene, bruxism, and a heavy smoking habit (more than 10 cigarettes per day). Sixteen patients (11 women and 5 men) aged between 28 and 71 years (mean age = 44 years) were selected.

¹ Clinic of Dentistry and Maxillofacial Surgery, Department of Surgery, University of Verona, Verona, Italy.

² School of Dentistry, Universidad de Cartagena, Cartagena, Colombia.

* Corresponding author, e-mail: prof.giorgiolombardo@gmail.com

DOI: 10.1563/aaidd-joi-D-14-00282

Implant system

In this study we used a locking-taper implant System (Bicon Dental Implant, Boston, Mass). The fixture has a plateau design and a sloping shoulder collar. The implant-abutment connection was screwless. When the conical shape abutment (1.5° angle) is activated a locking taper occurs: the 2 surfaces of the same metal (Ti V 6 A14) rub together in such a way that the metals enter into intimate contact to create an airtight seal.^{28,29}

Surgical procedure

Preoperative orthopantomography and intraoperative X rays were used to determine implant site dimensions. Drilling depth was determined on the basis of available bone and implant length so as to permit the implant placement 1.0–3.0 mm below the bone crest. Surgery was performed with local anesthesia by the infiltration of articaine 4% containing 1:100 000 adrenaline (Artin 4%, Omniapharma, Omnia Spa, Fidenza, Italy). The tooth extraction was carried out avoiding damage to either the buccal or palatal bone plates (Figures 1 through 3). Once the tooth was extracted, the socket was debrided with curettes and irrigated with sterile saline. A pilot drill of 2.0-mm diameter mounted on contra-angle 1:18 at 1000 rpm with external irrigation (Pilot Drill 2.0 mm, surgical steel, Bicon Dental Implant System) was used to prepare for the reamers and to determine implant insertion depth. The depth of drilling was 2.0–3.0 mm deeper than that of the chosen implant. Initially, the palatal wall of the socket was drilled in a more perpendicular approach than the proposed trajectory of the intended restoration. As soon as the pilot drill was engaged in the bone, the drill's trajectory was changed to be more parallel to adjacent teeth and the proposed restoration in accordance with suggestions in the literature.³⁰ The socket was expanded with reamers of increasing diameter beginning with a 2.5-mm diameter without irrigation at a maximum of 50 rpm until the desired diameter was reached. The implant was positioned by tapping on the healing plug or directly into the implant well; the healing plug was replaced with an appropriate temporary abutment. (Figures 4 through 6). Autogenous bone removed from the reamer burs and beta-tricalcium phosphate granules (SynthoGraft Pure Phase Beta-Tricalcium Phosphate, Bicon Dental Implant) were used to fill the gaps between the implant and the residual bony walls.

All patients received oral antibiotics (Augmentin, Glaxo-Smithkline Beecham, Brentford, UK) 2 g per day for 6 days and painkillers as required. Detailed instruction was given on oral hygiene, including mouth rinsing with 0.12% chlorhexidine (ChlorexidineR, OralB, Boston, Mass) for 7 days and abstention from brushing of the surgical site for the same period.

Prosthetic procedure

After implant placement the temporary abutment was inserted. The diameter of the abutment was dictated by the anatomy of the interdental papillae as it would have to support the papillae without encroaching upon them. All patients received a temporary acrylic resin crown made by designing wax-up. The temporary crown was also splinted with cold resin to adjacent elements to reduce micromovements at the bone-

implant interface (Figures 7 and 8). The final restoration with a porcelain crown was placed after 4 months (Figures 9 and 10). Extraoral cementation was carried out with adhesive resin (3M ESPE RelyX Unicem Self-Adhesive Universal Resin Cement, Milan, Italy). This provided for control of any cement overflow; any excess was removed before placement of the crown-abutment complex. All crowns were inserted with a custom silicone jig to avoid any crown fracture with tipping.

Evaluation of peri-implant tissue health

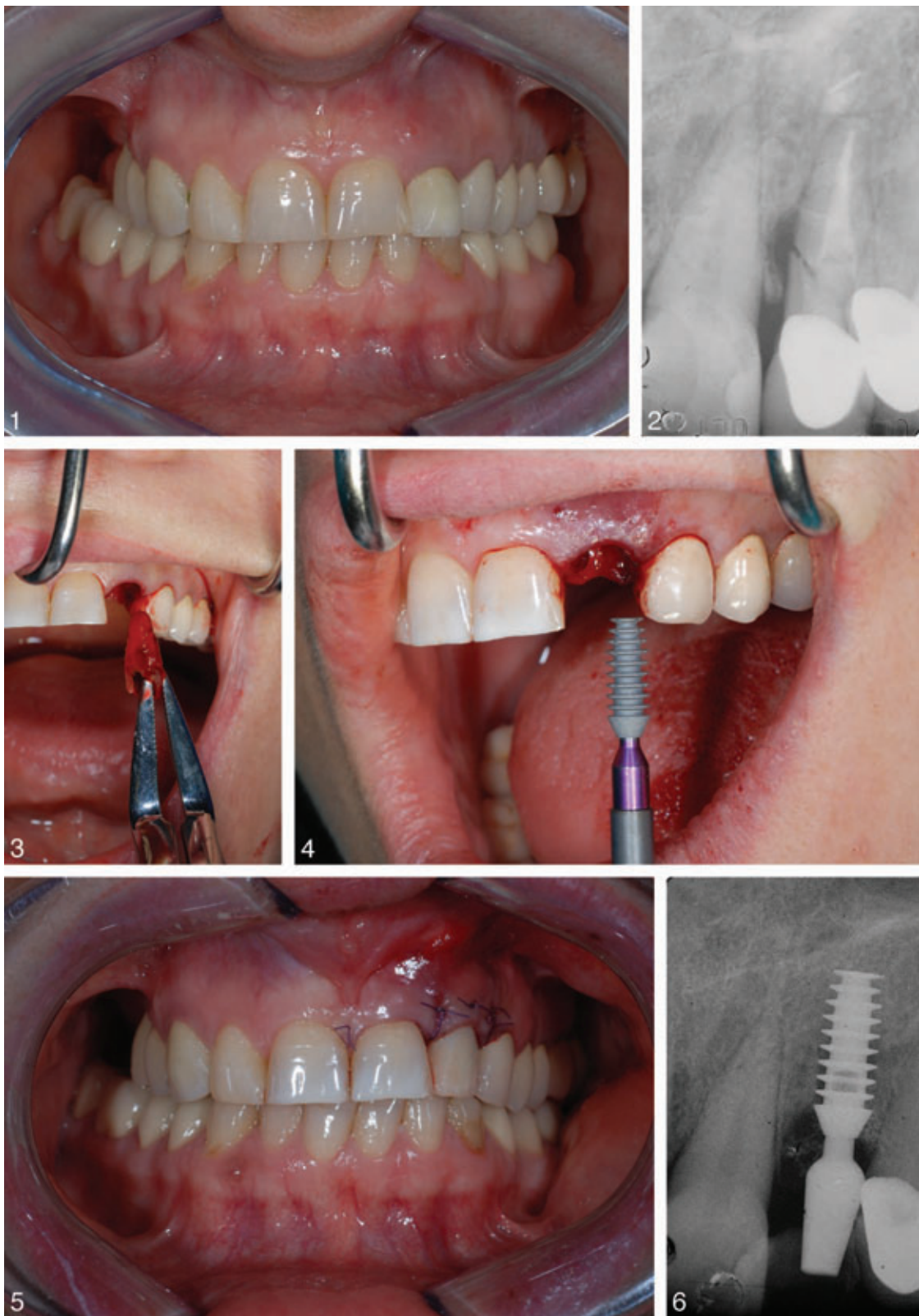
Peri-implant tissues were evaluated using the modified bleeding index, modified plaque index, probing depth, amount of keratinized tissue, and mesial and distal bone resorption (bone level). The same operator, who was not involved in the implant-prosthetic rehabilitation, performed all clinical and radiographic evaluations. Peri-implant tissues were assessed using a periodontal probe to probe 4 sites per implant: buccal, palatal, mesial, and distal. The amount of keratinized tissue was evaluated by measuring the distance between the buccal gingival margin zenith and the mucogingival line; the measurement was then compared with that performed before extraction. The interproximal marginal bone level was measured with a standardized periapical X ray using a customized Rinn film holder (Rinn XCP Anterior Aiming Ring-Blue; Dentsply, Elgin, Ill) and a computerized measurement technique (Rulers 2011, Omnidea srl, Venice, Italy). Mesial and distal bone peak height was evaluated by calculating the distance between implant shoulder to bone peaks. To correct radiographic distortion of the image, the apparent size of each implant was compared with the actual length to precisely determine any vertical bone loss.

Esthetic analysis

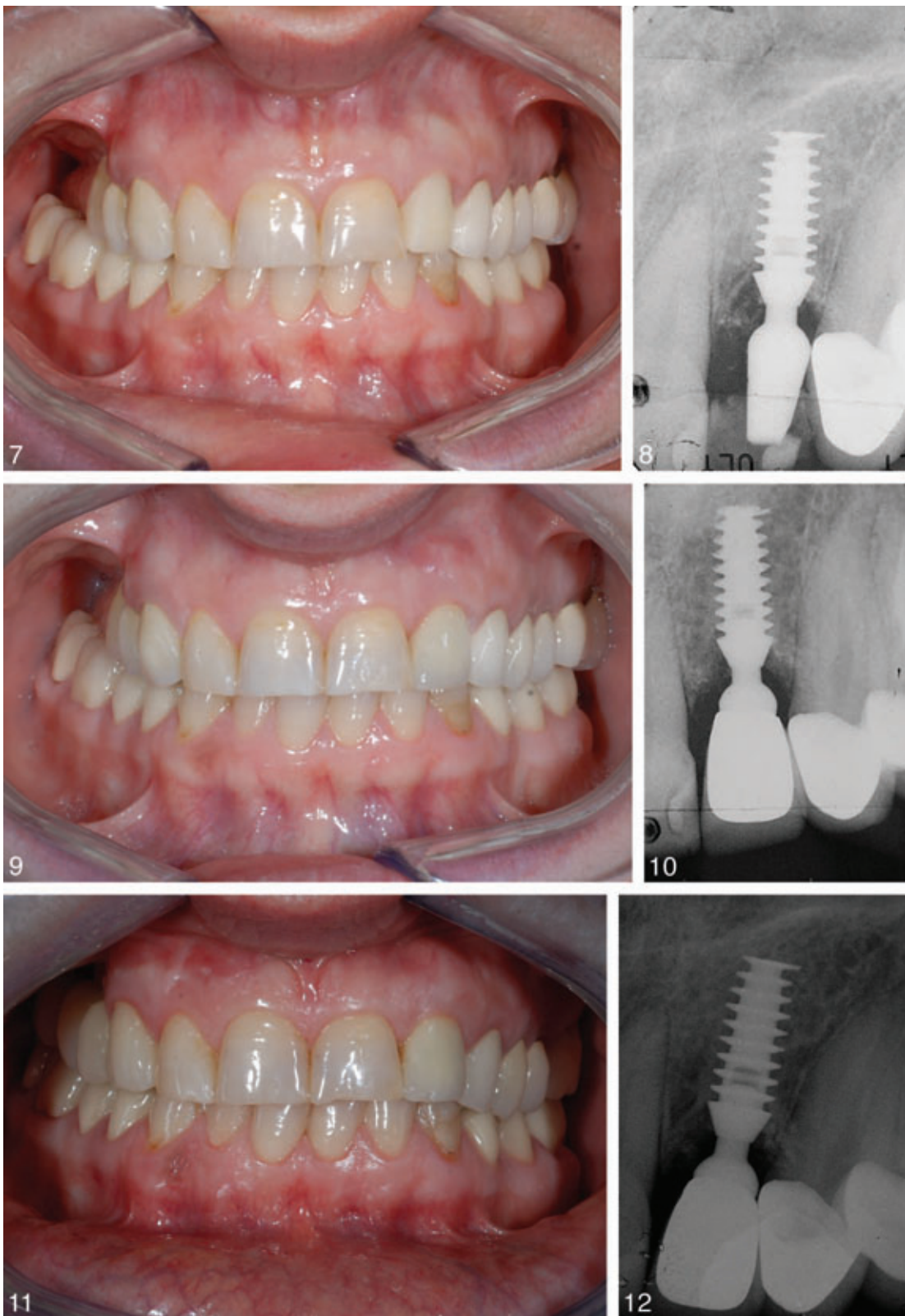
The esthetic examination was performed by a second observer. To objectively examine the esthetic outcome of the implants, intraoral photographs were critically analyzed using the PES and the white esthetic score (WES), setting these as suggested by Belser et al²⁷ in 2009. All implant crowns were photographed with a digital camera (Nikon D100R, Nikon, Tokyo, Japan) and a 105-mm lens (AF micro Nikkor 105 mm 1:2.8D, Nikon) with ring flash (Nikon Macro Speedlight SB-29S, Nikon). To ensure comparability, the contralateral reference tooth had to be completely and symmetrically represented.

The PES comprises the following 5 variables: mesial papilla, distal papilla, curvature of the facial mucosa, level of the facial mucosa, and root convexity/soft tissue color and texture at the facial aspect of the implant site.

A score of 2, 1, or 0 was assigned to each of the 5 parameters. The 2 papillary scores (mesial and distal) were assessed for complete presence (score = 2), incomplete presence (score = 1), or absence (score = 0) of papillary tissue. The curvature of the facial soft tissue line, also defined as the line of emergence of the implant restoration from the soft tissues, was scored as being identical (score = 2), slightly different (score = 1), or markedly different (score = 0) compared with the natural control tooth, therefore providing a natural and symmetrical or disharmonious appearance. The level of the facial peri-implant mucoasa was scored by comparison with the



FIGURES 1–6. **FIGURE 1.** Clinical situation before surgery. **FIGURE 2.** Preoperative x ray showing the root fracture on lateral incisor. **FIGURE 3.** The atraumatic tooth extraction. **FIGURE 4.** The implant positioning immediately after tooth extraction (4 × 11 mm Bicon dental implant). **FIGURE 5.** The provisional acrylic crown in situ and the suture. **FIGURE 6.** Postoperative x ray showing the correct implant-prosthetic position.



FIGURES 7–12. FIGURES 7 AND 8. Clinical and radiographic view at 3 months. FIGURES 9 AND 10. Clinical and radiographic control of the final restoration after 4 months. FIGURES 11 AND 12. Clinical and radiographic control at the 2-year follow-up.

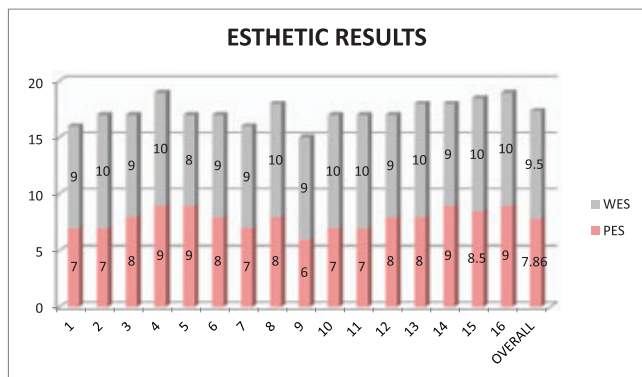


FIGURE 13. The esthetic results of our study according to the parameters described by Belser²⁷: insufficient esthetic results = pink esthetic score (PES)/white esthetic score (WES) < 12; adequate esthetic results = 13 > PES/WES < 18; excellent esthetic results = PES/WES > 18.

contralateral tooth in terms of its identical vertical level (score =2), slight (≤ 1 mm) discrepancy (score = 1), or major (≥ 1 mm) discrepancy (score =0). Finally, the proposed index combines 3 additional specific soft tissue parameters as one variable: the presence, partial presence, or absence of a convex profile (in analogy to a root eminence) on the facial aspect, as well as the related mucosal color and surface texture. The latter 2 qualities basically reflect the presence or absence of an inflammatory process, which may in turn adversely affect the appearance of an anterior single-tooth implant restoration. To obtain a score of 2 for this composite variable, all 3 parameters have to be more or less identical compared with the control tooth. A score of 1 is assigned if 2 criteria are fulfilled, whereas a score of 0 is assigned if none or only one parameter matches the control site.

The WES is based on the following 5 qualities: general tooth form; outline and volume of the clinical crown; color, which includes assessment of the dimension's hue and value; surface texture; and translucency and characterization. A score of 2, 1, or 0 was assigned to all 5 parameters. All parameters were assessed by direct comparison with the natural, contralateral reference tooth, estimating the degree of match or any mismatch.

The highest possible combined PES/WES score is 20, which represents a close match of the peri-implant soft tissue conditions and the clinical single-tooth crown compared with the respective features present at the contralateral natural tooth site. A score <6 in the individual parameters and <12 total (PES/WES) corresponds to a nonacceptable esthetic result; an individual score between 6 and 8 or a total score between 13 and 18 corresponds to a satisfactory esthetic result; a PES and WES score >9 or a total score >18 indicates excellent esthetics.

Data analyses

In the peri-implant hard and soft tissue assessment and for the purposes of the PES/WES evaluation, such statistics as mean values, SDs, medians, and range were included in the analyses.

RESULTS

In total, we examined 21 implants—14 upper central incisors and 7 upper lateral incisors. The average loading period was 23.3 ± 14.8 months (Figures 11 and 12). The cumulative survival rate after 2 years of loading was 100%. Most of the patients exhibited good oral hygiene during the follow-up period, presenting with a visible modified plaque index of 0.9 ± 0.77 and a modified bleeding index of 0.81 ± 0.81 . The average probing depth was 2.4 ± 0.77 mm, while total bone resorption was 0.45 ± 0.39 mm. The average amount of peri-implant keratinized tissue was 3.1 ± 0.63 mm. The overall mean PES/WES score was 16.9 ± 1.14 (Figure 13). Analyzing the single parameters as regards the PES, the mesial and distal papilla scored 1.62 ± 0.5 and 1.24 ± 0.44 , respectively; the curvature and level of facial mucosa were 1.71 ± 0.46 and 1.62 ± 0.5 , respectively; and the root convexity/soft tissue color and texture at the facial aspect was 1.67 ± 0.48 . The mean PES was 7.86 ± 0.8 . Taking into consideration the parameters of the WES, we observed that both the general tooth form and the outline and volume of the clinical crown scored 1.67 ± 0.48 ; the color and surface texture of the prosthesis scored 1.76 ± 0.44 and 1.95 ± 0.22 , respectively, and the translucency and characterization scored 2. The total WES value obtained was 9.5 ± 0.8 .

Biological and prosthetic complications

One implant failed osseointegration due to a fracture of the splint of the provisional restoration that was not immediately detected, which led to rotational instability 4 months after surgery; the implant was removed and substituted with one with a larger diameter, which healed uneventfully. In another 5 patients fracture of the splinting was found, but thanks to the early detection, no complication occurred. In 3 patients we observed decoupling of the final restoration after 2 weeks, so the patients had a second recurrence and needed to be tapped twice; no further detachments were observed.

DISCUSSION

Osseointegrated implants began 40 years ago with the pioneering work of Branemark et al.³⁰ Since then developments in implant dentistry have focused on such matters as dental materials, micro-characteristics of the implant surface, macro-characteristics of the implant system, and soft and hard tissue biology.

According to many authors, however, in areas of high esthetic value it is not sufficient to rely on such criteria as survival and osseointegration when assessing implant-prosthetic protocols; an esthetic evaluation is also required. This preliminary clinical study presents the esthetic results of 21 single implants placed in the anterior maxilla using post-extractive immediate nonfunctional loading implant placement. We encountered cumulative survival rates of 100% after about 2 years of loading. All patients had good plaque control (modified plaque index = 0.9) and the modified bleeding index of 0.81 was wholly compatible with peri-implant health (modified bleeding index <1). The average probing depth (2.4 mm) and peri-implant bone resorption (total bone

resorption = 0.45 ± 0.39 mm) confirmed peri-implant health. In this study we considered it appropriate to subject our results to an esthetic evaluation that would be as objective as possible using the PES/WES, a recent esthetic index.²⁷ Applying this index, the treated patients had a mean PES of 7.9, a mean WES of 9, and a total PES/WES of 17. In the literature, several studies have recently appeared focused on the same protocol to evaluate the esthetic of postextraction implants and immediate loading in the anterior maxilla. However, these studies make a distinction between the intact or not alveolar bony walls. We did not consider this parameter in our preliminary clinical study, but it will surely be examined in further studies with a longer follow-up. In 2011, Mangano et al³¹ evaluated results obtained in 26 patients with intact alveolar wall and thick biotype and found a PES/WES equal to 14.3 ± 2.78 after 2 years of loading. The PES and WES medium were 7.30 ± 1.78 and 7 ± 1.35 , respectively. Also in 2011, Cosyn et al³² evaluated 30 subjects with the same characteristics described earlier and found a PES of 10.58, a WES of 8.17, and a PES/WES of 15.76 after 3 years. In 2012, Paul and Held evaluated the 5-year esthetic results of 31 immediately loading implants placed 1.5 mm supracrestal in extraction sockets and found mean PES and WES of 8.38 ± 1.33 and 9.5 ± 0.65 , respectively.³³ By comparing our results with those of the studies regarding the intact postextraction sites, it is possible to consider our protocol comparable, good, and reliable. In another study, Cosyn et al³⁴ evaluated the esthetic results of 4 different treatment modalities—traditional dental implant protocol, immediate postextraction implant protocol, implant placement associated with guided bone regeneration (GBR), and implant placement after bone block graft—and concluded that the reconstructive surgical procedures, such a GBR and especially bone graft, in the esthetic areas increased the risk of complications and poor esthetic outcomes. The same conclusions had already published in 2004 by Buser et al,¹¹ who later proposed³⁵ the protocol of early implant placement to resolve cases of nonpreserved socket in esthetic areas. This protocol requires the patient to wait about 6 months before completing the therapeutic procedure but results in high levels of outcome predictability in terms of survival and esthetics. In 2009, Belser et al²⁷ evaluated 45 implants placed in accordance with this protocol and reported a mean PES of 7.8 ± 0.88 , a mean WES of 6.9 ± 1.47 , and a PES/WES of 14.7 after 2–4 years. Also in 2009, Buser et al³⁶ evaluated the esthetic results obtained 1 year after the early placement protocol (4–8 weeks after extraction) associated with GBR of 20 implants placed in the anterior maxilla; they reported a PES of 8.1, a WES of 8.6, and a PES/WES of 16.7. In comparison with the results reported by Buser et al²⁶ and Belser et al,²⁷ our PES/WES values ranks as satisfactory and confirm the reliability of this technique from an esthetic point of view. From the esthetics analysis of soft tissues, the PES we report is slightly lower than that obtained by protocols that recommend operating on soft tissues already healed but forcing patients to a temporary removable or bonded prosthesis for 6 or 7 months.

CONCLUSIONS

Based on these data, our protocol seems to give good results in terms of survival rate, peri-implant tissue health, and esthetics.

In our opinion, given the good results we have obtained, further studies would be appropriate to assess a larger sample with a longer follow-up so that more definitive conclusions can be achieved.

ABBREVIATIONS

GBR: guided bone regeneration
 PES: pink esthetic score
 WES: white esthetic score

NOTE

This article was presented in the poster session of the 21st Società Italiana di Osteointegrazione (SIO) Congress, February 8–9, 2013 in Milan, Italy.

REFERENCES

- Eckert SE, Wollan PC. Retrospective review of 1170 endosseous implants placed in partially edentulous jaws. *J Prosthet Dent*. 1998;79:415–421.
- Lindh T, Gunne J, Tillberg A, Molin M. A meta-analysis of implants in partial edentulism. *Clin Oral Implants Res*. 1998;9:80–90.
- Wyatt CC, Zarb GA. Treatment outcomes of patients with implant-supported fixed partial prostheses. *Int J Oral Maxillofac Implants*. 1998;13:204–211.
- Noack N, Willer J, Hoffmann J. Long-term results after placement of dental implants: longitudinal study of 1,964 implants over 16 years. *Int J Oral Maxillofac Implants*. 1999;14:748–755.
- Naert I, Koutsikakis G, Duyck J, Quirynen M, Jacobs R, van Steenberghe D. Biologic outcome of implant-supported restorations in the treatment of partial edentulism. Part I: a longitudinal clinical evaluation. *Clin Oral Implants Res*. 2002;13:381–389.
- Creugers NH, Kreulen CM, Snoek PA, de Kanter RJ. A systematic review of single-tooth restorations supported by implants. *J Dent*. 2000;28:209–217.
- Chen ST, Darby IB, Reynolds EC. A prospective clinical study of non-submerged immediate implants: clinical outcomes and esthetic results. *Clin Oral Implants Res*. 2007;18:552–562.
- Evans CD, Chen ST. Esthetic outcomes of immediate implant placements. *Clin Oral Implants Res*. 2008;19:73–80.
- Juodzbalys G, Wang HL. Soft and hard tissue assessment of immediate implant placement: a case series. *Clin Oral Implants Res*. 2007;18:237–243.
- Benagazi F, Wennstrom JL, Lekholm U. Recession of the soft tissue margin at oral implants. A 2-year longitudinal prospective study. *Clin Oral Implants Res*. 1996;7:303–310.
- Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. *Int J Oral Maxillofac Implants*. 2004;19(suppl):43–61.
- Grunder U, Gracis S, Capelli M. Influence of the 3-D bone-to-implant relationship on esthetics. *Int J Periodontics Restorative Dent*. 2005;25:113–119.
- Kan JY, Rungcharassaeng K, Umezu K, Kois JC. Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. *J Periodontol*. 2003;74:557–562.
- Belser UC, Buser D, Hess D, et al. Aesthetic implant restorations in partially edentulous patients—a critical appraisal. *Periodontol 2000*. 1998;17:132–150.
- Choquet V, Hermans M, Adriaenssens P, Daelemans P, Tarnow DP, Malevez C. Clinical and radiographic evaluation of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. *J Periodontol*. 2001;72:1364–1371.
- Kois JC. Predictable single-tooth peri-implant esthetics: five diagnostic keys. *Compend Contin Educ Dent*. 2004;25:895–896, 898, 900 passim; quiz 6–7.

17. Kan JY, Rungcharassaeng K, Sclar A, Lozada JL. Effects of the facial osseous defect morphology on gingival dynamics after immediate tooth replacement and guided bone regeneration: 1-year results. *J Oral Maxillofac Surg.* 2007;65(7 suppl 1):13–19.
18. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. *Int J Periodontics Restorative Dent.* 2003;23:313–323.
19. Thomas JL, Hayes C, Zawaideh S. The effect of axial midline angulation on dental esthetics. *Angle Orthod.* 2003;73:359–364.
20. 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 Implants.* 2004;19(suppl):30–42.
21. Cardaropoli G, Lekholm U, Wennstrom JL. Tissue alterations at implant-supported single-tooth replacements: a 1-year prospective clinical study. *Clin Oral Implants Res.* 2006;17:165–171.
22. Meijndert L, Meijer HJ, Stellingsma K, Stegenga B, Raghoobar GM. Evaluation of aesthetics of implant-supported single-tooth replacements using different bone augmentation procedures: a prospective randomized clinical study. *Clin Oral Implants Res.* 2007;18:715–719.
23. Charruel S, Perez C, Foti B, Camps J, Monnet-Corti V. Gingival contour assessment: clinical parameters useful for esthetic diagnosis and treatment. *J Periodontol.* 2008;79:795–801.
24. Jemt T. Regeneration of gingival papillae after single-implant treatment. *Int J Periodontics Restorative Dent.* 1997;17:326–333.
25. Fürhauser R, Florescu D, Benesch T, Haas R, Mailath G, Watzek G. Evaluation of soft tissue around single-tooth implant crowns: the pink esthetic score. *Clin Oral Implants Res.* 2005;16:639–644.
26. Meijer HJ, Stellingsma K, Meijndert L, Raghoobar GM. A new index for rating aesthetics of implant-supported single crowns and adjacent soft tissues—the Implant Crown Aesthetic Index. *Clin Oral Implants Res.* 2005;16:645–649.
27. Belser UC, Grutter L, Vailati F, Bornstein MM, Weber HP, Buser D. Outcome evaluation of early placed maxillary anterior single-tooth implants using objective esthetic criteria: a cross-sectional, retrospective study in 45 patients with a 2- to 4-year follow-up using pink and white esthetic scores. *J Periodontol.* 2009;80:140–151.
28. Merz BR, Hunenbart S, Belser UC. Mechanics of the implant-abutment connection: an 8-degree taper compared to a butt joint connection. *Int J Oral Maxillofac Implants.* 2000;15:519–526.
29. Bozkaya D, Muftu S. Mechanics of the tapered interference fit in dental implants. *J Biomech.* 2003;36:1649–1658.
30. Branemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A. Intra-osseous anchorage of dental prostheses. I. Experimental studies. *Scand J Plast Reconstr Surg.* 1969;3:81–100.
31. Mangano F, Mangano C, Ricci M, Sammons RL, Shibli JA, Piattelli A. Single-tooth Morse taper connection implants placed in fresh extraction sockets of the anterior maxilla: an aesthetic evaluation. *Clin Oral Implants Res.* 2012;23:1302–1307.
32. Cosyn J, Eghbali A, De Bruyn H, Collys K, Cleymaet R, De Rouck T. Immediate single-tooth implants in the anterior maxilla: 3-year results of a case series on hard and soft tissue response and aesthetics. *J Clin Periodontol.* 2011;38:746–753.
33. Paul S, Held U. Immediate supracrestal implant placement with immediate temporization in the anterior dentition: a retrospective study of 31 implants in 26 patients with up to 5.5-years follow-up. *Clin Oral Implants Res.* 2013;24:710–717.
34. Cosyn J, Eghbali A, Hanselaer L, et al. Four modalities of single implant treatment in the anterior maxilla: a clinical, radiographic, and aesthetic evaluation. *Clin Implant Dent Relat Res.* 2013;15:517–530.
35. Buser D, Chen ST, Weber HP, Belser UC. Early implant placement following single-tooth extraction in the esthetic zone: biologic rationale and surgical procedures. *Int J Periodontics Restorative Dent.* 2008;28:441–451.
36. Buser D, Halbritter S, Hart C, et al. Early implant placement with simultaneous guided bone regeneration following single-tooth extraction in the esthetic zone: 12-month results of a prospective study with 20 consecutive patients. *J Periodontol.* 2009;80:152–162.