Title
A Novel Pontic-Designed Interface

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Publication Date
2015-10-01

DOI
10.1111/cid.12320

Peer reviewed

The Implant Biologic Pontic Designed Interface: Description of the Technique and Cone-Beam Computed Tomography Evaluation

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ABSTRACT

Purpose: The study aims to evaluate clinically the thickness of the alveolar ridge mucosa underneath a zirconia implant-supported restoration with a modified ovate pontic.

Materials and Methods: Sixty-five patients, 32 women and 33 men (mean age: 65.5 years; range 38–81), were included. A total of 383 implants (303 in the maxilla; 80 in the mandible), supporting 81 full or partial fixed dental prostheses (65 in the maxilla; 16 in the mandible), were either cement- or screw-retained. Three years after loading, a total of 219 pontic sites (153 in the maxilla; 66 in the mandible) were measured, and the thickness of the alveolar ridge mucosa between the prosthetic surface and the underlying bone crest were recorded.

Results: The overall implant and prosthesis survival rates at 3 years were 98.7% and 100%, respectively. No implant complications were reported, scoring a cumulative implant success rate of 100%. In the maxilla, the overall mean thickness of the alveolar ridge mucosa was 2.32 ± 0.57 mm. In the mandible, the overall mean thickness of the alveolar ridge mucosa was 2.20 ± 0.62 mm. There was no statistical difference between the overall mean values in the maxilla and mandible ($p = .471$).

Conclusion: This radiologic retrospective study suggests the existence of a physiological barrier, named prosthetic biological width, underneath a novel pontic-designed restoration.

KEY WORDS: biologic width, dental implants, pontic, soft tissue conditioning, zirconia

INTRODUCTION

Th maintenance of the alveolar bone width and height following tooth loss is essential to establish an adequate zone of keratinized mucosa surrounding the implants and underneath the prosthetic framework in the pontic area.[1] Once an implant is placed into the function, peri-implant mucosal changes had been postulated as an attempt of the mucosal tissue to establish a stable biological dimension.[2] The peri-implant bone undergoes early changes primarily because of the establishment of a biologic width similar to that around the natural dentition,[3–5] which may prevent oral bacteria and their by-products from penetrating into the body.[3,6] The dimension and stability of the dentogingival around implants,[7] as well as the changes due to surgical and restorative procedures,[4,6] have been extensively investigated. Nevertheless, there is still a lack of information regarding the soft tissue interface at the pontic sites underneath the implant-supported restorations. Initial gingival tissue thickness at the alveolar crest may be considered as a significant factor influencing marginal bone stability around implants.[8] Experimental studies have demonstrated that a minimum width of the peri-implant mucosa is required.[3] If the thickness of peri-implant mucosa is reduced, bone resorption occurs to reestablish the mucosal dimension that was required for protection of the underlying tissues.[3] Hence, clinicians should take into consideration gingival thickness and

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DOI 10.1111/cid.12320

bone availability in the esthetic zone to enable a satisfactory and predictable implant treatment.[9] The challenge is to ideally manipulate the soft tissue volume at the pontic site to avoid open gingival embrasures that might affect speech and esthetics, and that may contribute to food impaction as well as plaque accumulation.[10] The design of the supra-construction, providing access to the supporting implants for proper cleaning, is mandatory to improve oral hygiene performance and lower the risk for biological complications.[11] Nonhygienic overcontoured restorations may be associated with the occurrence of mucositis. Moreover, for optimum esthetics, the ridge form must house the pontics and the emergence profile of the adjacent implant-supported abutments, and the overall prosthetic framework has to match in terms of soft tissue profile, contours, shade, and texture to that of the natural dentition.[1,12] Currently, the focus of dentistry has shifted toward providing a restoration that is functionally stable and indistinguishable from the neighboring dentition over time.[11,13] Therefore, surgical hard and soft-tissue augmentation techniques have been documented in developing the soft-tissue architecture at the pontic sites with varying levels of predictability.[14–17] Wennström and Derks,[18] in a recent review of the literature, concluded that in well-maintained populations, no significant association between "inadequate" keratinized tissue and higher plaque scores and gingival inflammation existed. On the other hand, in less well-maintained populations, a significant association was reported. Many methods were proposed to measure soft tissue thickness. The term "periodontal biotype" was introduced by Seibert and Lindhe[19] to categorize the gingiva into "thick-flat" and "thin-scalloped" biotypes. Claffey and Shanley[20] defined the thin tissue biotype as a gingival thickness of ≤1.5 mm, and the thick tissue biotype was referred to as having a tissue thickness ≥2 mm.

The ongoing research for aesthetic and biocompatible materials has favored the use of all-ceramic reconstructions for fixed dental prostheses as alternatives to conventional porcelain-fused-to-metal prostheses.[21] Zirconium oxide (ZrO_2 or zirconia) has gained increasing popularity in contemporary dentistry due to its high biocompatibility,[22] low plaque surface adhesion,[23] high flexural strength,[24] absence of mucosal discoloration,[25] and aesthetic properties.[26,27] Yttria-stabilized zirconium dioxide (Y-TZP) is more biocompatible compared with high-gold cast alloys, reducing bacterial and plaque adhesion as well as preventing soft tissue inflammation.[27–29]

In recent years, cone-beam computed tomography (CBCT) has been introduced for the image analyses of the maxillofacial region.[30] CBCT technology offers high-quality diagnostic images for the clinician and has become an essential tool in dentistry. The aim of this CBCT study was to radiologically evaluate in humans the thickness of the alveolar ridge mucosa underneath a zirconia implant-supported restoration (ZIBR) with a modified ovate pontic design named biological pontic design (BPD). In addition, this study compares thickness of the alveolar ridge mucosa in the maxillary and mandibular arches. The null hypothesis was that there would be no difference between measurements. This article was written following the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

MATERIALS AND METHODS

This retrospective cohort study evaluates in humans the distance between the pontic surface underneath a ZIBR with a BPD to the bone crest, in order to define the thickness of the alveolar ridge mucosa. A retrospective chart review and a CBCT scan evaluation of 78 consecutive implant patients, aged 18 and older, treated in the Department of Oral Rehabilitation, University of Rome Tor Vergata, Italy, between October 2007 and December 2009, were conducted by one independent examiner. The data were extracted in order to find partially and fully edentulous patients rehabilitated with an implant-supported zirconia-based restoration with at least one pontic site between two implants and 3 years of follow-up. The inclusion criteria were: (1) adequate bone height for the placement of implants with a minimum length of 8.5 mm; (2) full-mouth bleeding on probing (BoP) and full-mouth plaque index (PI) lower than 25%; (3) absence of active periodontal disease and/or periapical lesions on adjacent teeth before implant placement; (4) absence of active infection in the implant recipient sites; and (5) insertion torque ≥ 35 Ncm in case of immediate loading. Exclusion criteria were: (1) general medical (American Society of Anesthesiologist, ASA, class III or IV) and/or psychiatric contraindications; (2) pregnancy or nursing; (3) any interfering medication such as steroid therapy or bisphosphonate therapy; (4) alcohol or drug abuse; (5) heavy smoking (>10 cigarettes/day); (6) radiation therapy to head or neck region within 5 years; (7) high and moderate parafunctional activity; (8)

absence of teeth/denture in the opposite jaw; (9) untreated periodontitis; and (10) unavailability for regular follow-ups.

This study was a retrospective clinical and radiological analysis of data belonging from previously published prospective studies.[4,11,13] The study was conducted according to the principles of the Helsinki Declaration of 1964 for biomedical research involving human subjects, as amended in 2008 and monitored by the Tor Vergata University Human Subjects Review Committee. Patients were informed of the nature of the study, benefits, risks, and possible alternative treatments, and each participant gave written consent.

A total of 65 (32 women and 33 men) out of 78 patients, aged from 38 to 81 years (mean 65.5), were identified on the medical records as matching the aforementioned inclusion and exclusion criteria. The same independent examiner, conducting the chart review, recalled all the included patients in order to clinically assess the relation between the pontic outline and the soft tissue architecture. A total of 227 pontic sites (153 in the maxilla and 66 in the mandible) were clinically evaluated through a gentle flossing (Super Floss, Oral-B, The Procter & Gamble Company, Cincinnati, OH, USA) underneath the prosthetic surface in order to assess their embedding in the soft tissue with a tight but noncompressive contact. Two hundred nineteen out of 227 pontic sites were considered eligible to measure the soft tissue thickness of the pontic recipient site on the CBCT scans (SCANORA® 3D, Soredex, Tuusula, Finland). The remaining eight pontic sites showed soft tissue recession underneath the prosthetic framework and were excluded from the radiological analysis.

Before implant placement, each patient underwent a CT scan (LightSpeed VCT, GE Healthcare, Waukesha, WI, USA) or a CBCT (SCANORA 3D; Soredex) with a double-scan protocol, to accurately plan implant positioning according to the biomechanical, biological, and aesthetic demands of the prosthetic restoration in a minimally invasive fashion. Following the digital treatment planning, a total of 383 implants (303 in the maxilla and 80 in the mandible), supporting 81 fully or partial fixed dental prostheses (65 in the maxilla and 16 in the mandible), were placed into extraction sockets (34) or healed ridges (346) according to previously published protocols.[4,11,13] Prefabricated metal-reinforced, screw-retained, acrylic resin, interim restorations were delivered immediately in all patients if an insertion torque of 35 Ncm was obtained. Following an uneventful healing period of 3 and 4 months in the mandible and the maxilla, respectively, definitive impressions were taken. Finally, 4 to 6 months after implant placement, the definitive zirconia bridges were cemented[4] or screw-retained.[11,13] All prosthetic restorations were fabricated using a zirconium dioxide framework, veneered with feldspatic porcelain (63) or restored with single monolithic lithium disilicate full-contour crowns bonded on the surface (18). The pontic surface was modeled with two convexities tightly in contact with the underlying soft tissue. The main convexity approaches the buccal and interproximal area, supporting the ideal shape of the gingival parabola and interproximal papilla, roughly mirroring the contours of the osseous ridge crest. This convexity echoes the facial appearance of a natural tooth as it emerges from the soft tissue (longer in the mid-cervical area and shorter at the interproximal junctions). The inner bucco-lingual convexity is oriented perpendicular to the main one and slopes toward the lingual side of the pontic, tightly in contact with the mesial-to-distal contours of the BPD (Figure 1). One expert clinician performed all surgical and prosthetic procedures.

The primary outcome measures were the cumulative implant and prosthetic survival and success rates. The secondary outcome measures were the thickness of the alveolar ridge mucosa underneath a zirconia implant-supported restoration with a modified ovate pontic, and the soft tissue parameters.

Regarding the implants, the success and survival criteria used in this study were modifications of the

Figure 1 Main pontic buccal convexity mesio-distal extending (red) and inner convexity sloping from the buccal to the lingual (black). The BPD has a broader mucosal surface contact compared with the conventional ovate pontic.

success criteria suggested by van Steenberghe.[31] According to the above criteria, a "successful implant" was an implant that: (1) did not cause allergic, toxic, or gross infectious reactions, either locally or systematically; (2) offered anchorage to a functional prosthesis; (3) did not show any sign of fracture; and (4) did not show any sign of radiolucency on intraoral radiography using a paralleling technique, strictly perpendicular to the implant-bone interface. A surviving implant was defined as an implant remaining in the jaw and that was stable, although all the individual success criteria were not fulfilled, while a failed implant was an implant that had been removed. A "surviving prosthesis" was a prosthetic reconstruction that was stable and in good function. Prosthesis success was evaluated following a modification of the evaluation criteria, as suggested by the California Dental Association (CDA).[32]

The thickness of the alveolar ridge mucosa underneath a zirconia implant-supported restoration with a modified ovate pontic was assessed radiologically 3 years after loading. A second CBCT (SCANORA 3D; Soredex) examination was performed for each patient with the following setting parameters: scan dimensions: of 75×100 mm; voxel size: 0.2 mm; gray scale; 14 bits; focal spot: 0.5 mm; image detector: amorphous silicon flat panel; image acquisition: single 360° rotation; time: 20 seconds; 90 kV; 12 mA according to patient size. The data were exported as Digital Imaging and Communication in Medicine (DICOM) and opened using the InVivoDental Application software Version 5.3.1 (Anatomage Inc, San Jose, CA, USA) to perform all measurements. The thickness of the alveolar ridge mucosa adjacent to a ZIBR with a BPD was recorded. The following parameters were used:

(1) Scanner orientation was adjusted, making the patient's occlusal plane as horizontal as possible.
(2) The reslice curve was adjusted and resized in the axial view, manipulating the existing tooth control points at the occlusal plane, in order to match the curvature of the dental arch.
(3) The 2D cross-sectional view was rotated bucco-lingually and tilted mesio-distally in order to orientate it to split the vestibular face of the dental pontic in two symmetric parts, matching the long axis of the tooth. Then three measurements were taken between the pontic surface convexity and the bone crest at the highest magnification (full screen view). The first measurement was at the center of the bucco-crestal pontic convexity and the other two measurements were at the facial and palatal/lingual aspects (Figure 2).
(4) After 90°clockwise rotation of the 2D cross-sectional view, three new measurements were taken along the mesial and distal axis of the dental unit between the pontic convexity and the bone crest at the highest magnification (full screen view). The first measurement was at the tip of the mesa-distal pontic convexity and the other two on the most mesial and distal aspects (Figure 3).

Soft tissue parameters were around the implants (BoP, PI, and gingival index [GI]) and underneath the pontic sites. BoP was assessed at the restoration level and reported at the 3-year examinations using a plastic periodontal probe (Plast-o-Probe, Dentsply Maillefer, Ballaigues, Switzerland) on four sites around each implant according to the Mombelli Index.[33] PI, defined as the presence of plaque (yes/no), was scored by running a periodontal probe (PCP15, Hu-Friedy, Chicago, IL, USA) around the implant, parallel to the abutment surfaces, and calculated in percent on the basis of the total measurement points. GI was defined as follow: 0 = normal gingiva; 1 = mild inflammation, slight change in color, slight edema, no BoP; 2 = moderate inflammation, redness, edema, and glazing, BoP; 3 = severe inflammation, marked redness and edema, ulceration, tendency to spontaneous bleeding. Soft tissue interface at the pontic sites was evaluated through a gentle flossing (Super Floss, Oral-B, The Procter & Gamble Company) underneath the prosthetic surface in order to assess the presence (yes/no) of bleeding on flossing (BoF).

No sample size was calculated as reliable figures on which to base a sample size calculation were lacking in the literature. A biostatistician with expertise in dentistry analyzed the data using IBM® SPSS® Statistics for Mac OS X release 22.0.0.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was performed using mean and standard deviation (median and 95% confidence interval [CI]). The patient was used as the statistical unit of the analysis. Comparisons between maxillary and mandible measurements were made by independent sample *t*-tests.

RESULTS

The overall implant and prosthesis survival rates at 3 years were 98.7% and 100%, respectively. No implant

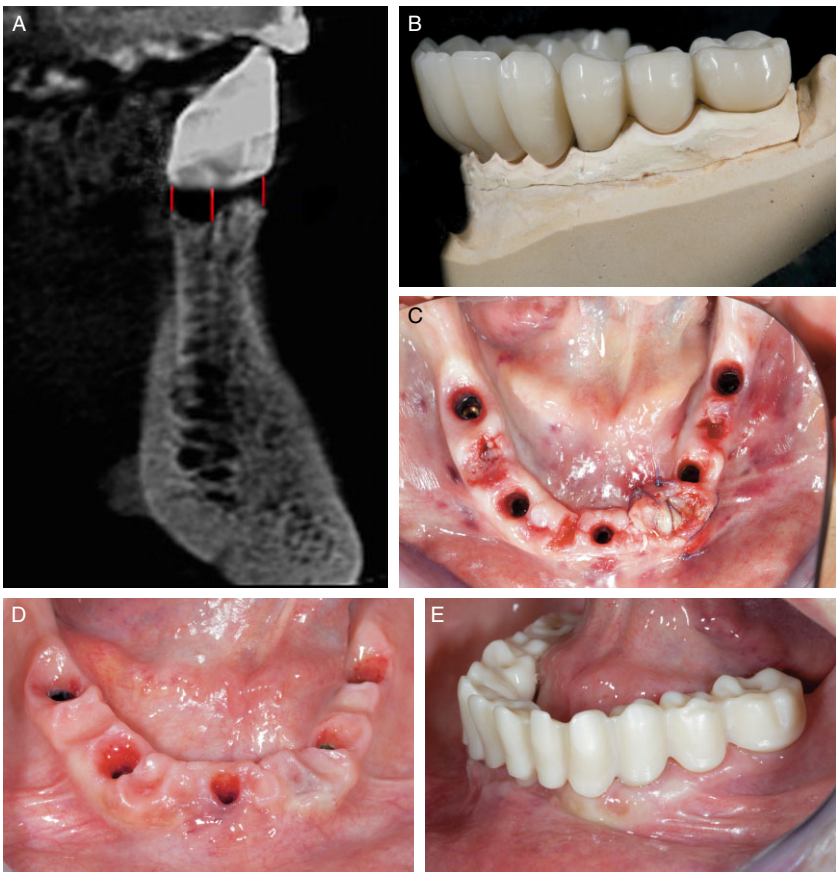

Figure 2 A: 2CBCT 2D cross-sectional view at the mid-pontic unit with the three measurements taken at the facial and palatal/lingual aspects. CBCT=cone-beam computed tomography. B: Temporary restoration contoured with BPD concepts. C: The recipient sites were reconfigured in order to house properly the pontic contour leaving 2 mm of clearance between the provisional and the underneath bone tissue; the lack of keratinized tissue has been compensated with a connective tissue graft. D: The soft tissue reshaping after 3 months of healing. E: The anatomic contoured ZIBR with the pontic sites embedded in the anatomically reshaped soft tissue.

complications were reported scoring a cumulative implant success rate of 100%. Seven out of 81 restorations (8.6%) showed a chip-off fracture of the veneering ceramic scoring a cumulative prosthetic success rate of 93.4%, according to the CDA index.

In the maxilla, the overall mean thickness of the alveolar ridge mucosa adjacent to a ZIBR with a BPD was 2.32 ± 0.57 mm (range 3.75–1.22 mm; median 2.31 mm; 95% CI 2.13–2.49 mm). Particularly, the mean thickness of the alveolar ridge mucosa was 2.15 ± 0.55 mm at the center of the pontic tip; 2.42 ± 0.64 mm at the mesial side; 2.47 ± 0.71 mm at the distal side; 2.31 ± 0.67 at the buccal aspect; and 2.27 ± 0.70 at the palatal aspect. In the mandible, the overall mean thickness of the alveolar ridge mucosa was 2.20 ± 0.62 mm (range 3.28–1.25 mm; median 2.24 mm; 95% CI 2.04–2.44 mm). Particularly, the mean thickness of the alveolar ridge mucosa was 2.13 ± 0.61 mm at the center of the pontic tip; 2.27 ± 0.65 mm at the mesial side; 2.31 ± 0.70 mm at the distal side; 2.12 ± 0.63 at the buccal aspect; and 2.25 ± 0.70 at the palatal aspect. There was no statistical difference between the overall mean maxillary (2.21 ± 0.62) and mandible (2.32 ± 0.57) values ($p = .421$) (Table 1, Figure 4).

At the 3-year follow-up visit, the BoP was reported on 14 implant/abutment complexes of six restorations (8.5%). The cumulative plaque score was 2.1%. The GI was reported as 91.8% with normal gingiva, 3.4% with mild inflammation, and 4.8% with moderate inflammation (Figure 5).

BoF was reported on 26 out of 227 pontic sites (11.5%) of 15 restorations (18.5%).

DISCUSSION

In this radiologic human study, the mean thickness of the alveolar ridge mucosa underneath ZIBRs with a BPD, named as "prosthetic biological width," is 2.32 mm and 2.2 mm in the maxilla and in the

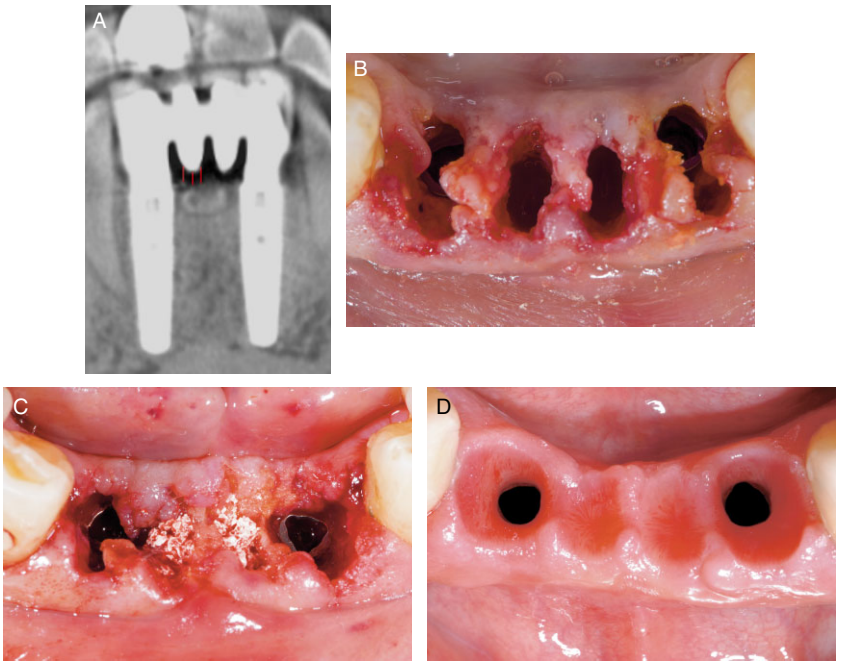

Figure 3 A: CBCT 2D coronal view of the pontic with the three measurements taken at the mesio-distal aspects. CBCT=cone-beam computed tomography. B: Fresh extractive sites management according with the BPD concepts. C: Socket preservation. D: The soft tissue reshaping at the implant and pontic sites after 3 months of healing.

mandible, respectively. The mean of all the maxillary and mandibular measurements is 2.26 ± 0.60 mm. Furthermore, this study failed to find any statistically significant difference between maxillary and mandible measurements. Thus, the null hypothesis that the thickness of the mucosa underneath anatomical pontic-designed restorations in the maxilla and mandible would not differ between the two arches was accepted.

The main limitations of the present investigation are its retrospective nature that may have unidentified differences and the relative small sample size limiting generalization of the results. Additional trials are needed to confirm these preliminary results.

The establishment and maintenance of an efficient soft tissue seal around a dental implant as well as around a prosthetic framework are hallmarks for implant success.[34] To the best of our knowledge, at the time of writing this article, there were no other published radiographic studies measuring the dimensions of human alveolar ridge mucosa underneath the pontic areas of an implant-supported restoration. This makes difficult to evaluate and discuss how the present results fit with other comparable studies. In this radiological study, the founded "prosthetic biological width" is slightly lower than the corresponding dimensions of the dentogingival complex reported by Gargiulo and colleagues,[5] as well as to the mean facial dimension that develops in humans around implants at the time of abutment connection.[7]

Pontics of fixed partial or complete dentures have to fulfill hygienic, functional, and esthetic demands in

TABLE 1 The Overall Mean Thickness of the Alveolar Ridge Mucosa Adjacent to a ZIBR with a BPD in the Maxilla and Mandible (Data are Reported in Millimeters [mm])

	Center	Mesial	Distal	Buccal	Palatal	Mean
Maxilla	2.15 ± 0.55	2.42 ± 0.64	2.47 ± 0.71	2.31 ± 0.67	2.27 ± 0.70	2.32 ± 0.57
Mandible	2.13 ± 0.61	2.27 ± 0.65	2.31 ± 0.70	2.12 ± 0.63	2.25 ± 0.70	2.20 ± 0.62
						(p = .421*)

*The difference was not statistically significant.

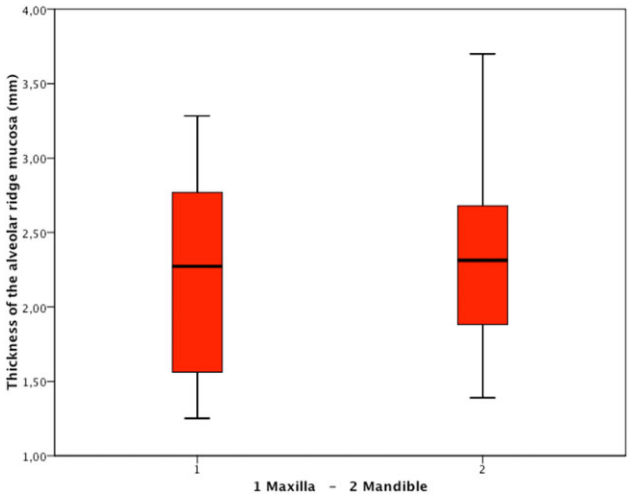

Figure 4 Box plots of the mean thickness of the maxilla and the mandibular alveolar ridge mucosa adjacent to a ZIBR with a BPD at the 3-year follow-up examination. BPD = biological pontic design; ZIBR = zirconia implant-supported restoration.

restorative dentistry, avoiding any compression of the soft tissue that might result in blanching, blood-supply compromises, and necrosis of the compressed tissues.[35] The soft tissue contacting pontics were associated with clinical signs of inflammation such as swelling, edema, and histologic changes.[36] However, in the presence of proper and regular oral hygiene procedures, clinically healthy conditions can be established and maintained at pontic sites,[37] irrespective of the pontic material used.[38] All patients evaluated in this study presented with healthy peri-implant soft tissue at the 3-year follow-up examination. This results suggest that positive results in terms of soft tissue maintenance in the medium-term follow-up are to be expected when using biologic pontic-designed ZIBRs and when proper oral hygiene is maintained by the patient. The ovate pontic design is commonly used in restorative dentistry.[39] It was originally created with a convex shape to overcome the disadvantage of the former concave ridge lap or modified ridge lap pontic designs.[40] The advantages of the ovate pontic lie in its ability to achieve maximum esthetics and hygiene maintenance compared with the ridge lap designs.[41] The tip of the ovate pontic contour is commonly designed close to the center of the prosthetic convexity, in the deeper and middle portions of the recipient site. Thus, the ovate pontic design may be associated with an increased risk of mucosal swelling and ulceration due to poor oral hygienic maintenance or erroneous flossing, especially in thin-scalloped periodontium.[37] Furthermore, the ovate pontic design requires adequate thickness of the edentulous ridge to be housed within the soft tissue properly.[1,12]

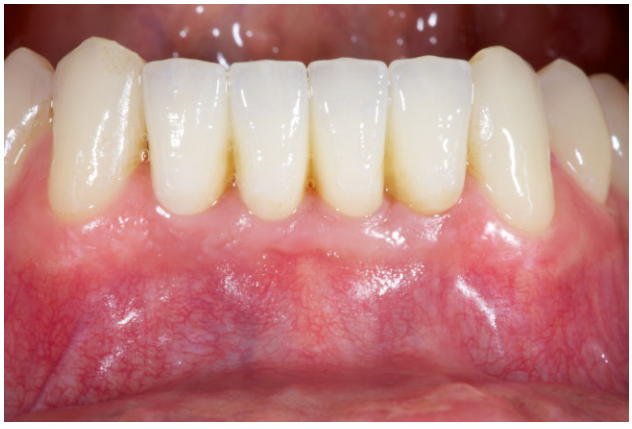

Figure 5 Clinical view at the 3-year follow-up visit.

The BPD used in this study was developed to reshape the underlying soft tissue into the pontic areas in such a way as to reproduce a natural looking tooth-emergence profile, while maintaining tissue health. In contrast with the original ovate pontic, which suggests the importance of an active-pressure contact over a small area, in the BPD the ovate pontic tip has been replaced with a large convex surface supporting the pontic shape up to 1.5 mm underneath the gingival margin. This area comes in contact with a larger area of the underlying soft tissue in a light and uniform compressive manner, allowing cleaning between the mucosa and the pontic. The pontic surface is carefully adjusted for an adequate mucosal contact at the recipient site mostly located in the vestibular and interproximal aspects of the recipient site. There is a slight convexity of arched smooth surface, compared with the original pontic design the tip of the egg-shaped pontic is moved toward the facial, in order to create a convex parabola and support in the ideal way the gingival margin. Accordingly with Zitzmann and colleagues,[42] a well-polished, smooth acrylic material of the temporary was not associated with overt clinical signs of inflammation and it can work like a scaffold guiding the regeneration of the epithelium that will grow around the pontic contour. Highly polished, smooth, and homogenous surface seems to be more important than the restorative material used, when dental floss was used regularly.[38] In contrast, human histology showed that the residual ridge gingival tissue under low-fusing ceramic prosthetic interface appeared less inflamed than the tissue

under the acrylic resin pontic, which more frequently reported ulceration, granulation tissue, and inflammatory cells.[43] Yttria-stabilized zirconium dioxide (Y-TZP), reducing bacterial and plaque adhesion, prevents soft tissue inflammation.[28,44] Thus, Y-TZP contributes to achieving healthy soft tissue integration of implant-supported restorations, thus improving long-term stability of the marginal bone.[44,45] On the contrary, nonhygienic inaccessible restorations are significantly associated with implant loss and a high rate of peri-implantitis.[46] We customized the construction of the pontics with a tight but noncompressive contact with the soft tissue to allow easy hygienic access to the supporting implants to improve oral hygiene maintenance and reduce the risk of biological complications. The cumulative plaque score was extremely low (2.1%), and 91.8% of patients experienced no gingivitis throughout follow-up. In our study, scheduling follow-up visits every 4 months undoubtedly improved patient compliance with hygiene recommendations.

In postextraction sites conditioned with ovate pontics, as well as in ovate pontic-prepared soft tissue sites, a period of at least 3 months is needed for healing.[47] After healing, it will be possible to create a compressive force that displaces the soft tissue toward the entire periphery of the pontic in the labial, palatal, and proximal directions. However, "excessive pressure" exerted from an ovate pontic resulted in a thinning of the epithelium and changing in the composition of the connective tissue compartment subjacent to the epithelium itself.[42,48]

The main clinical hypothesis of this study may be the existence of a "prosthetic biological width" underneath the pontic-designed prosthetic interface, whose dimension (2.26 ± 0.60 mm) may affect the health and the dimensional stability of the pontic soft tissue interface. The prosthetic violation of such physiological barrier may result in inflammation, ulceration, and thinning of the epithelium, jeopardizing the bone crest stability.[10,18,46] On the contrary, a gap between the pontic and the gingiva could provide a food trap and may produce clinical signs of inflammation.[10] Although the ovate pontic design has been used in posterior or anterior quadrants with equal success, it is essential to determine the proper dimensions according to the area of the mouth and the related functional, hygienic, and aesthetic needs. A try-in period of 3 to 6 months, using a provisional restoration with a convex ovate shape that acts as a template, may be recommended to condition the gingival tissue underlying the pontics, customizing the ideal prosthetic shape.

CONCLUSION

This radiological retrospective study may suggest the existence of a physiological barrier underneath a novel pontic-designed zirconia implant-supported bridge restoration. These dimensions, as measured in this study, support the concept that the clinician may prepare the pontic recipient site in order to ensure an adequate mucosal thickness of 2.26 ± 0.60 mm and properly house the prosthetic interface.

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