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ITI International Team for Implantology

ITI Treatment Guide

Volume 10

Implant Therapy in the Esthetic Zone
Current Treatment Modalities and Materials for Single-tooth Replacements

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QUINTESSENCE PUBLISHING

7.1 Replacement of a Failing Upper Left Central Incisor: Immediate Placement of an RC Bone Level Implant and Provisionalization

E. R. Lorenzana, J. Gillespie

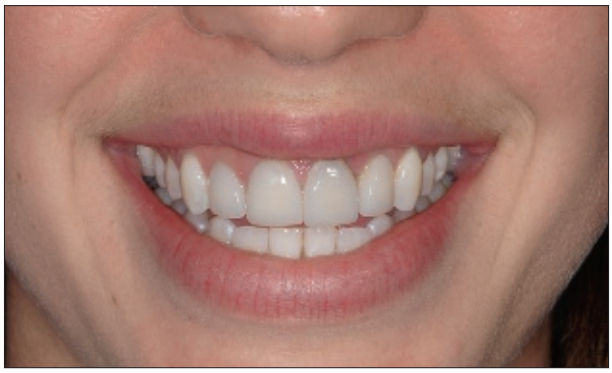


Fig 1 The patient presented with a medium to high lip line when smiling, exposing the papillae throughout the anterior sextant, but with the upper lip obscuring the gingival margins of the central incisors.

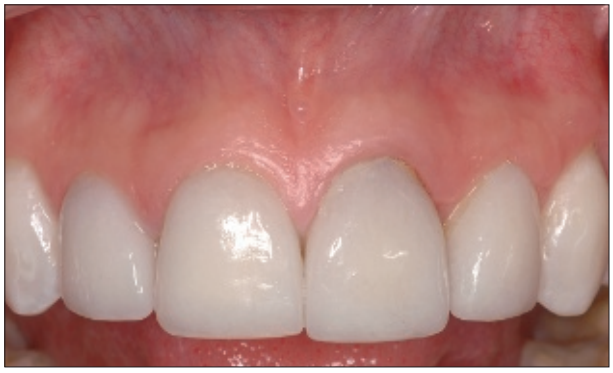


Fig 2 Retracted view. Medium to thick soft-tissue phenotype with symmetrical gingival margins.

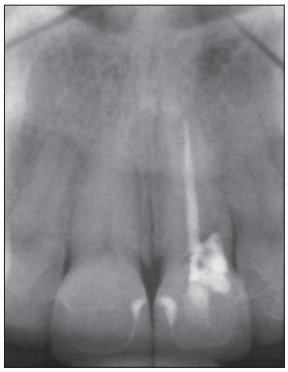


Fig 3 Periapical radiograph. Internal resorption defect coronally and result of previous endodontic treatment.

A healthy 23-year-old female patient was referred for a consultation on replacing tooth 21 with an implant-supported restoration. The patient had recently moved to the area and reported a history of endodontic and periodontal treatment for tooth 21. The tooth had been deemed non-restorable by her previous periodontist but since she was going to be moving, he recommended consulting to a dentist in her new city to continue her treatment. A review of her medical history yielded no significant findings and no known drug allergies.

The analysis of her smile revealed a medium to high symmetrical smile line and a slightly discolored tooth 21 (Fig 1).

Anterior retracted view revealed a medium to thick tissue phenotype and closely symmetrical gingival margins. A slight discoloration was noted at the cervical margin of tooth 21 (Fig 2). A wide band of attached gingiva was observed along the existing ceramic veneers on teeth 12 to 22.

The initial periapical radiograph was suggestive of internal root resorption with possible extension to the external aspect on the distal of tooth 21 (Fig 3). Postorthodontic root blunting was visible on teeth 12 and 22.

An esthetic risk assessment of the patient was completed and revealed a medium to high lip line and a medium scalloped phenotype. The adjacent teeth were restored and a horizontal bone deficiency was expected once the tooth was removed (Table 1).

Table 1 Esthetic Risk Assessment (ERA)

Esthetic risk factors	Level of risk		
	Low	**Medium**	**High**
Medical status	Healthy, uneventful healing		Compromised healing
Smoking habit	Non-smoker	Light smoker (≤ 10 cigs/day)	Heavy smoker (> 10 cigs/day)
Gingival display at full smile	Low	Medium	High
Width of edentulous span	1 tooth (≥ 7 mm)[1] 1 tooth (≥ 6 mm)[2]	1 tooth (< 7 mm)[1] 1 tooth (< 6 mm)[2]	2 teeth or more
Shape of tooth crowns	Rectangular		Triangular
Restorative status of neighboring teeth	Virgin		Restored
Gingival phenotype	Low-scalloped, thick	Medium-scalloped, medium-thick	High-scalloped, thin
Infection at implant site	None	Chronic	Acute
Soft-tissue anatomy	Soft tissue intact		Soft-tissue defects
Bone level at adjacent teeth	≤ 5 mm to contact point	5.5 to 6.5 mm to contact point	≥ 7 mm to contact point
Facial bone-wall phenotype*	Thick-wall phenotype ≥ 1 mm thickness		Thin-wall phenotype < 1 mm thickness
Bone anatomy of alveolar crest	No bone deficiency	Horizontal bone deficiency	Vertical bone deficiency
Patient's esthetic expectations	Realistic expectations	Moderate expectations	Unrealistic expectations

* If three-dimensional imaging is available with the tooth in place
[1] Standard-diameter implant, regular connection
[2] Narrow-diameter implant, narrow connection

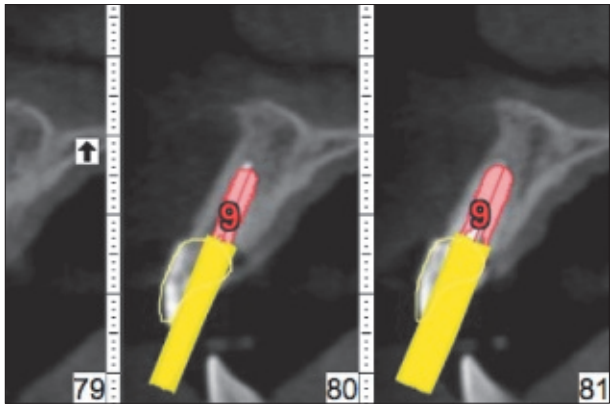


Fig 4 CBCT image with virtual implant placement showing the position of the natural tooth in relation to the proposed implant position. Adequate bone is available apically to support an immediately placed implant.

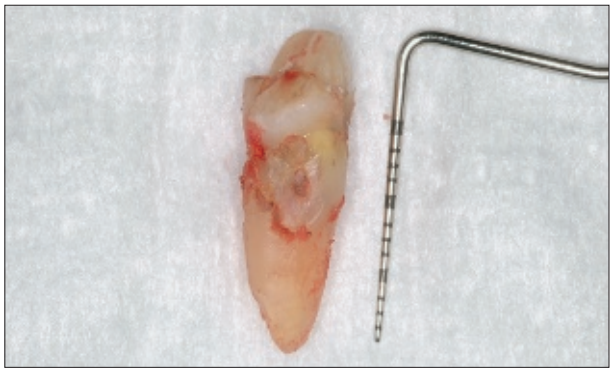


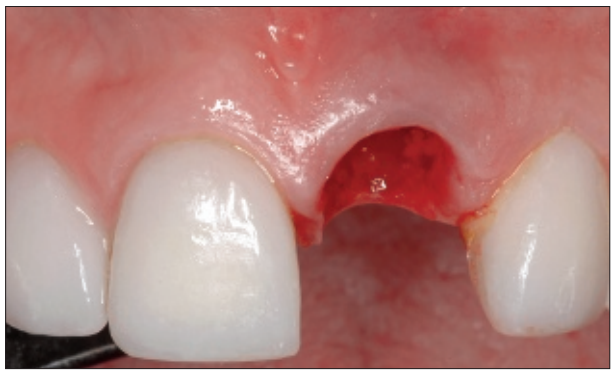
Fig 5 At the time of extraction, the extent of the perforation of the tooth root due to the internal resorption process became evident.

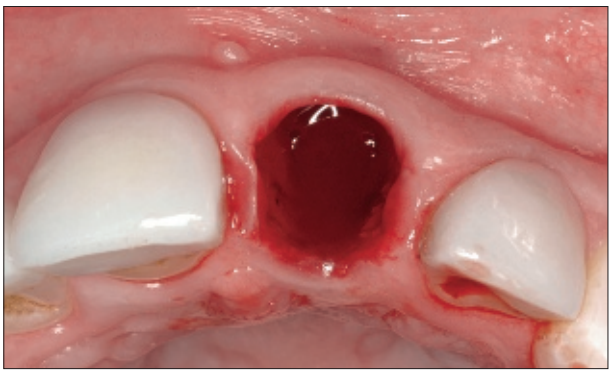
The patient was referred for a CBCT prior to the surgery. It documented adequate vertical bone height apically to allow engagement of the native alveolar bone by the implant following the extraction of the tooth. However, orthodontic extrusion was scheduled first, to be followed by immediate implant placement (Fig 4).

Unfortunately, the tooth became increasingly more uncomfortable, and it was decided that extrusion was not feasible, given the patient's level of discomfort. The revised treatment plan called for extraction, immediate implant placement and, if stability allowed, immediate provisionalization by the prosthodontist.

The tooth was carefully removed with a periotome without damaging the alveolar housing. Upon examination of the tooth, external root resorption was noticed on the distopalatal aspect of tooth 21. There was a concomitant probing depth at the location of the resorption, but it did not result in any significant bone loss that would have prevented treatment (Fig 5).

Figures 6 and 7 show the site following minimally traumatic extraction of tooth 21 (Figs 6 and 7). There was no incision, tissue trauma, or displacement following the extraction.





Figs 6 and 7 Soft-tissue contours following tooth removal and occlusal view of the socket following tooth removal.

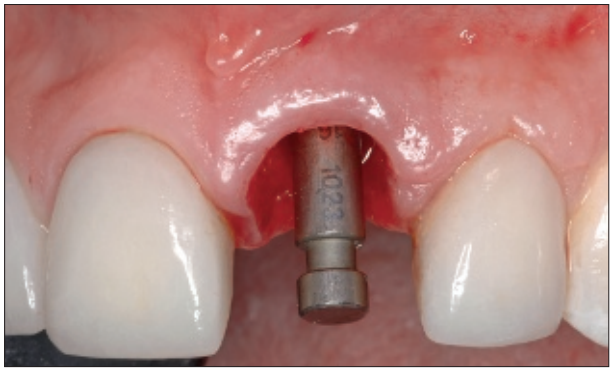


Fig 8 3.5-mm depth gauge in position following preparation of the implant site.

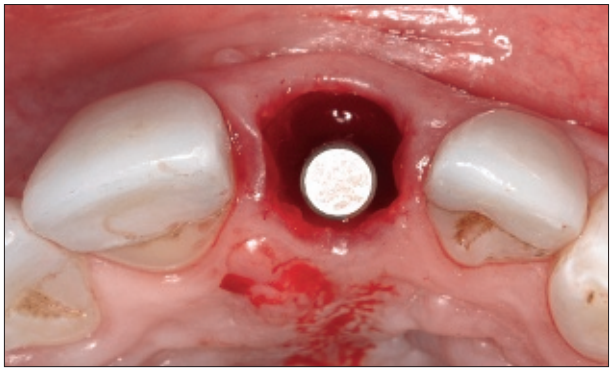


Fig 9 Occlusal view following site preparation. Note the palatal position of the proposed implant site.

Prior to implant placement, a depth gauge 3.5 mm in diameter was used to check the preparation depth, emergence profile, and the expected three-dimensional implant position (Fig 8). The occlusal view shows a site preparation shifted slightly palatally, engaging the palatal wall of the extraction socket (Fig 9).

A Bone Level implant (diameter 4.1 mm, length 14 mm; Institut Straumann AG, Basel, Switzerland) (Fig 10) was placed in the correct three-dimensional position as planned, with the implant shoulder positioned 3 mm away from the planned mucosal margin of the implant-supported restoration (Figs 11 and 12).

Fig 10 A Bone Level Regular CrossFit implant (diameter 4.1 mm, length 14 mm).

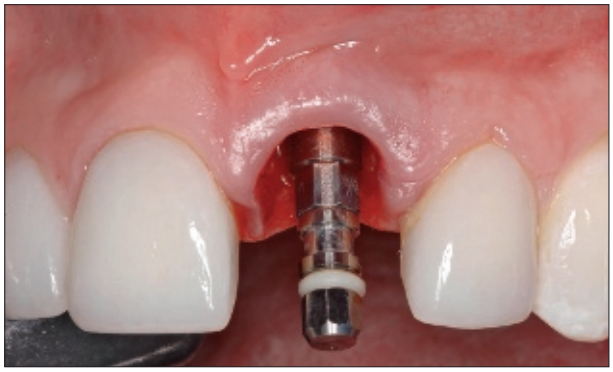


Fig 11 The Bone Level implant in position.

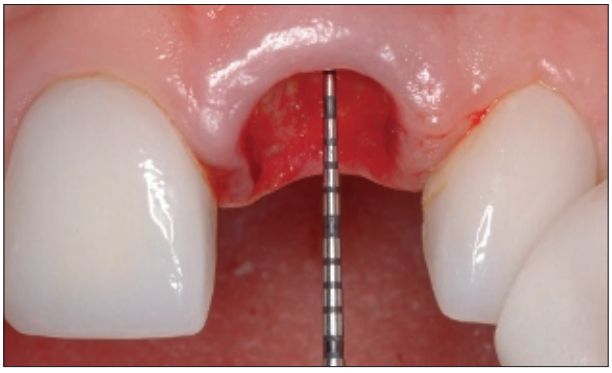


Fig 12 The periodontal probe is placed at the implant shoulder to demonstrate its position 3 mm apical of the proposed gingival margin.

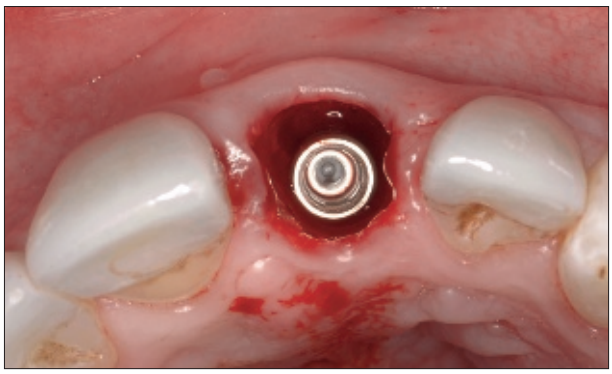


Fig 13 Occlusal view of the Bone level implant placed toward the palatal aspect of the alveolar socket.

Fig 14 Bovine-derived xenograft being hydrated with recombinant human PDGF.

Removal of the implant mount shows the implant positioned toward the palatal aspect, allowing for an adequate horizontal dimension of the defect for grafting and preservation of the buccal wall (Fig 13).

The horizontal dimension of the defect was grafted using a xenograft derived from bovine hydroxyapatite (Bio-Oss; Geistlich Pharma, Wolhusen, Switzerland) hydrated with recombinant human platelet-derived growth factor (rhPDGF) (Gem21; Osteohealth, Shirley, NY, USA) (Fig 14).

The bone-graft material was positioned along the buccal aspect of the implant (Fig 15), and a connective-tissue graft harvested from the distal aspect of tooth 27 was used as a biological barrier above the bone graft material (Fig 16). The buccal flap was not reflected; the tissue-graft dimensions matched the length, width, and depth of the void above the bone graft and alveolar crest.

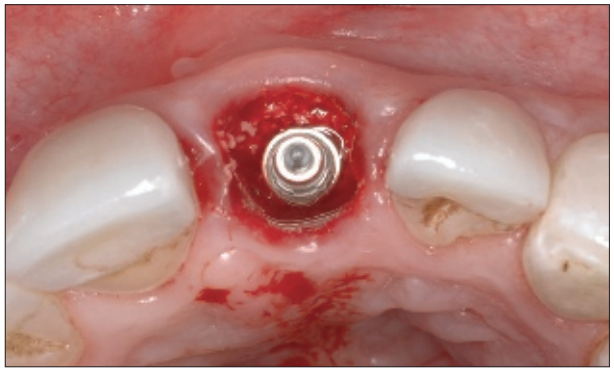


Fig 15 The xenograft in place to bridge the horizontal defect dimension.

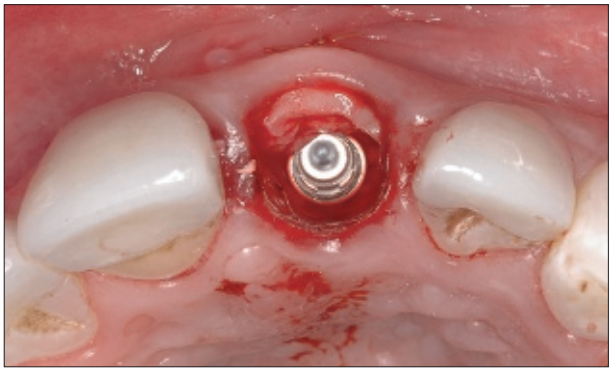


Fig 16 Connective-tissue graft in place acting as a biologic barrier over the xenograft.

A single 5-0 chromic gut horizontal mattress suture (Ethicon; Somerville, NJ, USA) was used to secure the soft-tissue graft (Fig 17). Finally, a customizable Regular CrossFit (RC) polymer healing cap (Institut Straumann AG) was placed for the patient to wear while in transit to her prosthodontist's office for fabrication of the immediate provisional (Fig 18). The postoperative radiograph confirmed the ideal positioning of the dental implant, away from the adjacent roots and any vital structures. (Fig 19).

When the patient had arrived at the prosthodontist's office, provisionalization began by removing the healing cap, placing a RC temporary abutment (RC PEEK abutment), and making marks to guide the reduction of the abutment (Fig 20).

The provisional abutment preparation was then completed (Fig 21). The finish lines were located just below the mucosal margin to facilitate access to the cement line for clean-up.

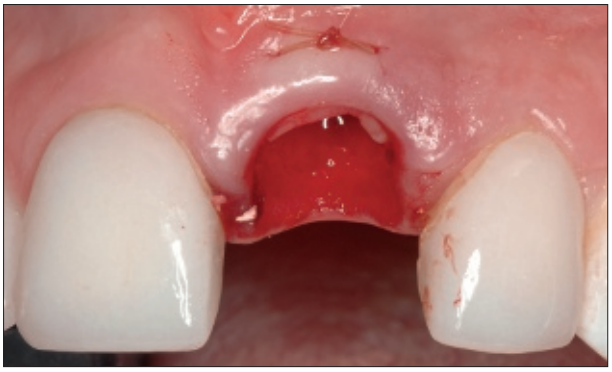


Fig 17 Facial view of the horizontal mattress suture securing the connective-tissue graft to the facial wall of the socket.

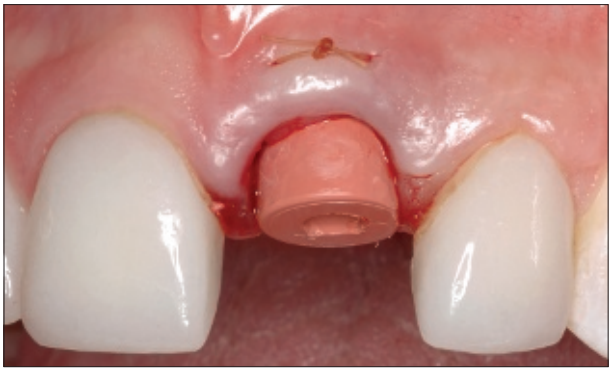


Fig 18 Customized Regular CrossFit polymer healing cap in position.

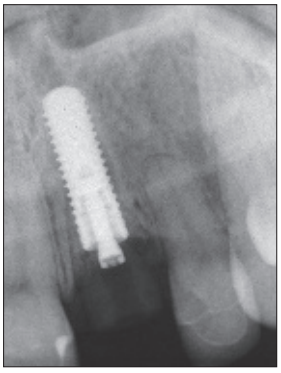


Fig 19 Radiograph taken on completion of the procedure, showing the implant position.

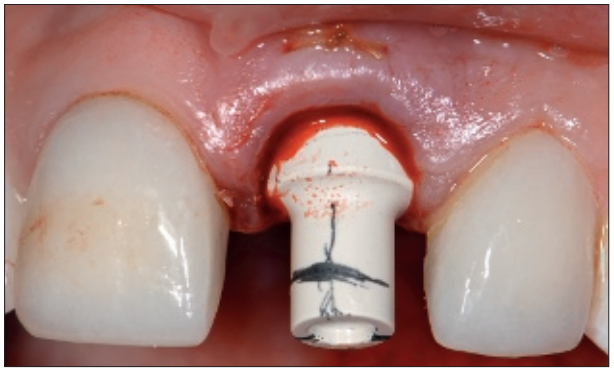


Fig 20 Regular CrossFit temporary abutment in place with reduction marks to guide customization.

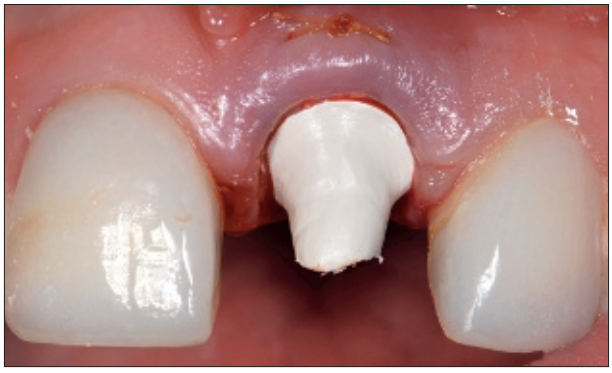


Fig 21 Provisional abutment preparation.

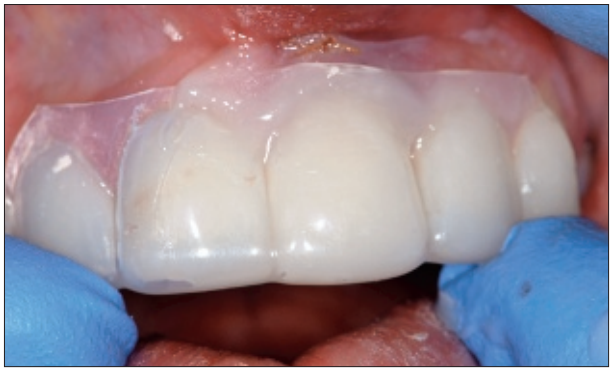


Fig 22 Vacuform template with autopolymerizing resin seated over the provisional abutment.

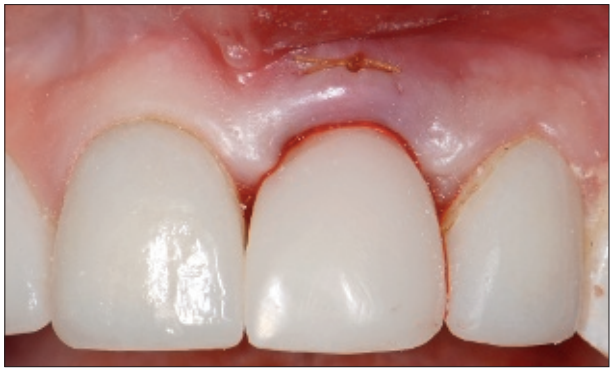


Fig 23 The completed provisional restoration.

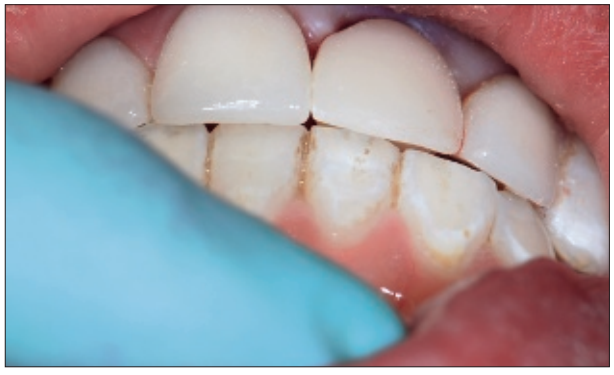


Fig 24 Occlusion check of the provisional restoration.

A vacuform matrix filled with cold-curing resin was used to fabricate the provisional crown (Fig 22).

The completed provisional (Fig 23) exhibited ideal contours, allowing for ideal prosthetic volume for the restorative materials and papillae to fill in during healing and maturation. The occlusion was carefully checked to ensure that no contact could occur during excursive or functional movements (Fig 24).

The two-week follow-up photograph illustrates an uneventful healing response, with tissue rapidly filling the papillary areas (Fig 25).

At two months, the peri-implant tissues were maturing nicely, maintaining the desired mucosal margin position (Fig 26). However, a distinct demarcation between the native tissue and the connective-tissue graft began to emerge.

At five months. although the tissue volume was ideal and the gingival margins were stable, this demarcation was even more prominent. Plans were made to perform dermabrasion to smooth the tissue contours (Fig 27). A follow-up radiograph was taken at this time to verify stable bone levels around the implant (Fig 28).

The fabrication of the custom impression coping began by removing the provisional and the abutment from the patient's mouth and placing it on a RC implant analog. Bite registration material was placed around the analog and provisional to obtain an outline of the crown contours (Fig 29).

With the facial position of the provisional marked in black, the provisional and the abutment were removed and a Bone Level RC impression post placed on the analog, leaving a void that reflected the ideal contours of the proposed restoration. Composite material was slowly added to fill the voids around the impression post and light-cured until set (Fig 30).

The custom impression post was seated in the patient's mouth and provided support for the tissues, as it had the same shape as the provisional. New crowns on teeth 12, 11, and 22 were also planned (Fig 31).

A RC CAD/CAM customized zirconia abutment (CARES) (Institut Straumann AG) was fabricated and delivered prior to cementation of the final crown (Fig 32).

Figure 33 shows the patient's final restorations on the day of delivery. The uneven tissue contact areas were recontoured with a fine diamond bur under copious irrigation.

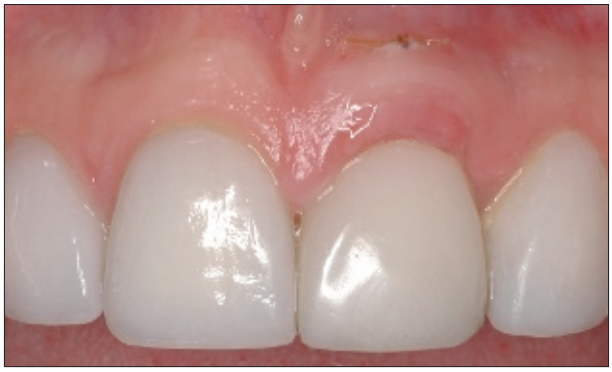


Fig 25 At two weeks. Excellent adaptation of the soft tissue.

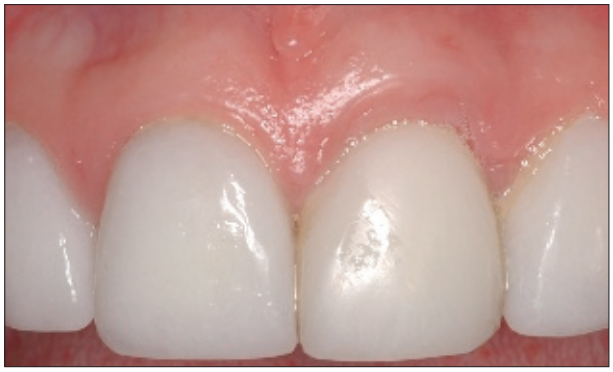


Fig 26 At two months.

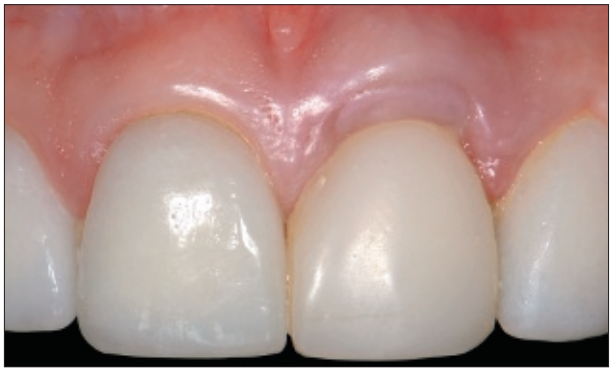


Fig 27 At five months. The tissue had matured and facilitated the start of final restorative process.

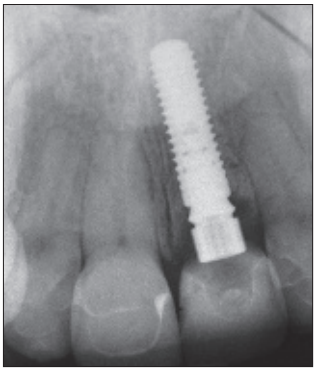


Fig 28 Radiograph of the implant and provisional at the start of the definitive restorative procedures.

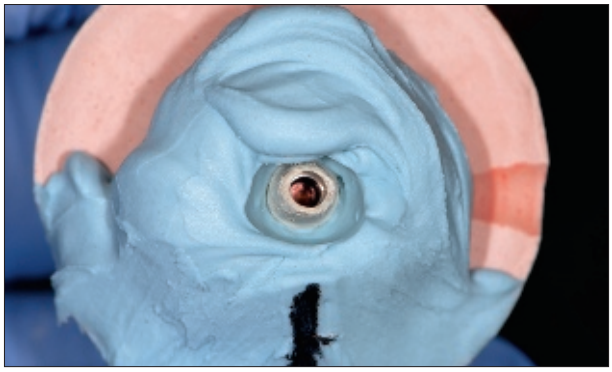


Fig 29 Duplication of the provisional crown contours to create the customized impression coping.

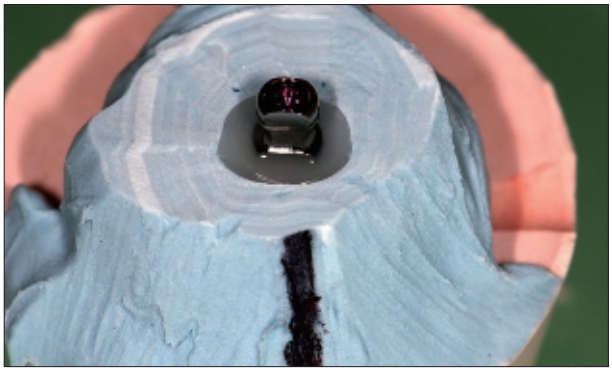


Fig 30 Composite resin placed around the impression post to capture the provisional contours.

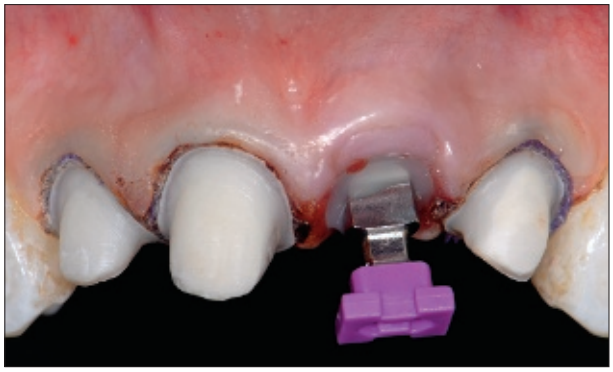


Fig 31 Customized impression post in position prior to taking an impression of the implant and adjacent preparations.

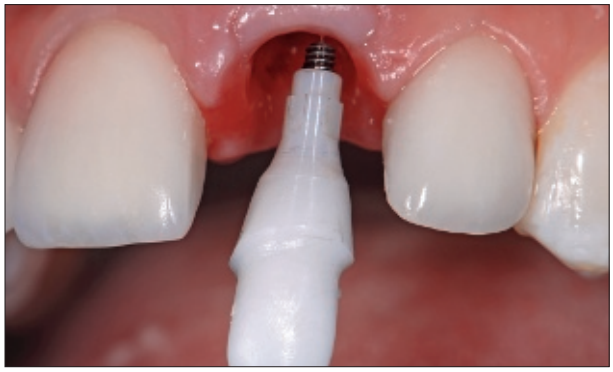


Fig 32 Custom zirconium abutment prior to seating.

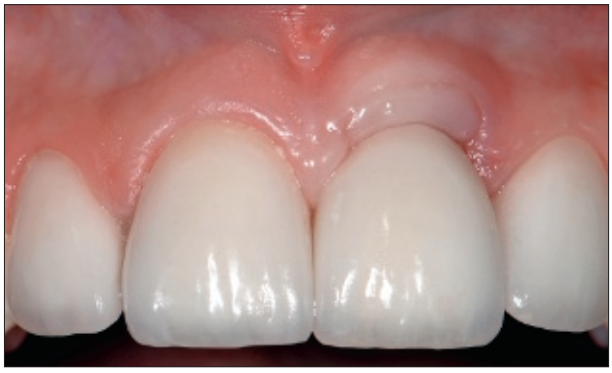


Fig 33 Final restorations in place on the day of delivery.

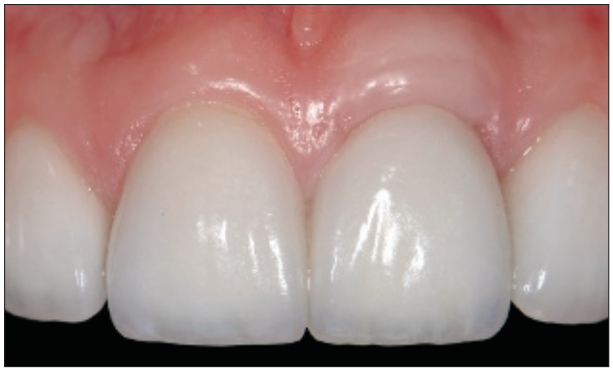


Fig 34 One year after treatment.

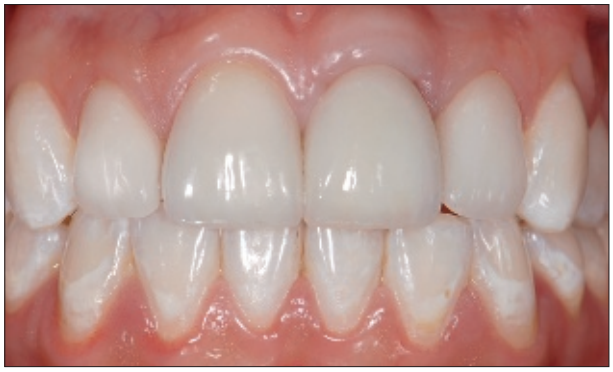


Fig 35 Retracted anterior view at one year.

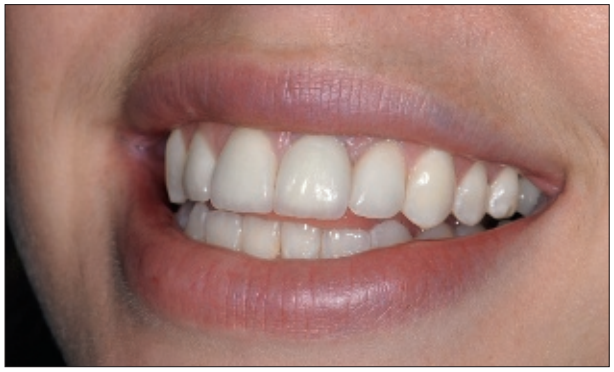


Fig 36 The patient's smile at one year.

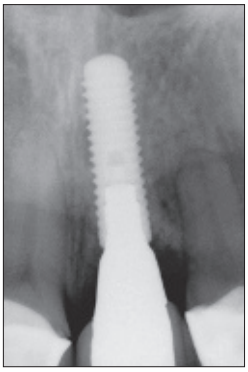


Fig 37 One-year radiograph.

The photograph taken at one year post-treatment demonstrated stable and symmetrical tissue contours (Fig 34).

The anterior retracted view at the same visit again showed excellent results, with harmonious tissue contours that were free of inflammation or other complications (Fig 35).

The one-year photo of the patient's smile illustrated the patient's satisfaction with the final esthetic result (Fig 36).

Stable bone levels were evident around the implant. The emergence profile of the final restoration was in harmony with the bone profile at the implant site (Fig 37).

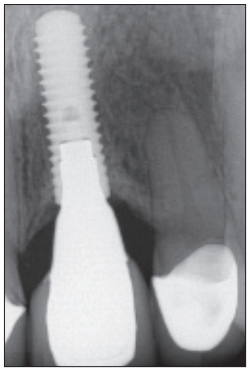


Fig 38 Periapical radiograph taken seven years postoperatively. Long-term stability of the peri-implant alveolar bone.

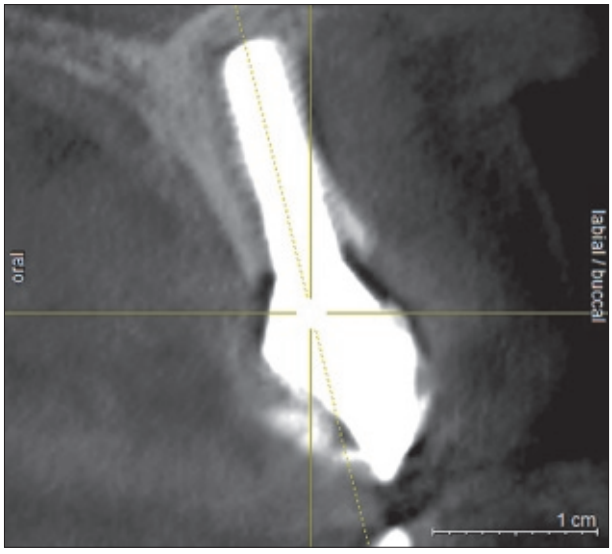


Fig 39 CBCT scan taken at seven years documenting the long-term stability of the buccal plate.

The patient moved to a new city due to work commitments, but her new dentist shared the seven-year periapical radiograph, which shows continued bone-level stability around the entire length of the implant and especially around the implant shoulder (Fig 38).

In consultation with her new dentist, a cone-beam computed tomography (CBCT) scan was taken at the seven-year mark that illustrated the presence of a stable buccal plate around the implant. This validated the long-term result and reassured the patient of the implant's ability to continue functioning well into the future (Fig 39).

Acknowledgments

Laboratory procedures
Nuance Dental Ceramics – Mansfield, TX, USA

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