Tissue Preservation and Maintenance of Optimum Esthetics: A Clinical Report

Stephen L. Wheeler, DDS[1]/Robert E. Vogel, DDS[2]/Renzo Casellini, MDT[3]

Today, most tooth replacement in the esthetic zone is done using implants placed in a delayed surgical protocol. Unfortunately, this delay can result in loss of both hard and soft tissue during the healing period, necessitating guided tissue regeneration techniques at the time of implant placement. Recent developments with tapered implants have facilitated predictable immediate implant placement, preserving the osseous structure surrounding the socket. Further developments with custom healing abutments can preserve the crestal soft tissues, including the papillae. This article reviews techniques that provide for the preservation of both bone and soft tissue while enhancing the esthetic results around implants. (Int J Oral Maxillofac Implants 2000;15:265–271)

Key words: *custom healing abutment, immediate placement, tapered implant, tissue preservation*

The use of dental implants has revolutionized oral rehabilitation over the past 3 decades. Multiple studies have proven the efficacy and excellent long-term prognosis with dental implants.[1–4] While initial research and clinical use were directed primarily toward the edentulous patient, more recent studies have focused on the esthetic use of implants in the partially edentulous patient.[5] The most challenging area of modern implant dentistry remains the "esthetic zone" in the anterior maxilla. Replacing single or multiple anterior teeth in the otherwise dentate patient requires careful consideration of the location and volume of residual bone, soft tissue esthetics, and the conservation of both by the implant and prosthetic crown.

Since the integration of an implant to the surrounding bone is predicated on its initial mechanical anchorage, immediate placement of implants into extraction sockets has been difficult because of the incongruency between the shape of a standard cylindric implant and the alveolus. Therefore, most implants are placed in a delayed manner, allowing for both hard and soft tissue healing prior to implantation. Unfortunately, this allows for resorption of the alveolar ridge in both the buccolingual and apicocoronal dimensions. Studies have shown that as much as 3 to 4 mm of resorption can occur during the first 6 months postextraction without the intervention of tissue regeneration techniques.[6,7] This resorption can significantly affect the position and prognosis of a dental implant as well as the hard and soft tissue esthetics in the area. In most cases, delaying implant placement will necessitate guided tissue regeneration techniques to successfully replace a maxillary anterior tooth, both functionally and cosmetically.

Guided tissue regeneration techniques have provided the ability to regenerate lost bone in a predictable manner, but they necessitate primary wound closure to prevent membrane exposure. Crestal levels of bone regeneration have been shown to improve only when membrane exposure and subsequent infections are avoided.[8,9] Primary closure of an extraction site over a membrane is possible, but it requires a full-thickness flap that may permanently disfigure the soft tissue architecture and still may not predictably provide protection for the membrane. This concern also favors a delayed placement approach to allow for primary soft tissue healing facilitating closure over a membrane.

However, if ideal hard and soft tissues are present at the time of extraction, it seems feasible to

[1]Private Practice Limited to Oral and Maxillofacial Surgery, Encinitas, California.
[2]Private Practice, Rancho Santa Fe, California.
[3]Master Dental Technician, Los Angeles, California.

Reprint requests: Dr Stephen L. Wheeler, 310 Santa Fe Drive, Suite 112, Encinitas, CA 92024. Fax: (760) 942-0331. E-mail: Steve@WheelerDDS.com

preserve them, rather than delaying implant placement and allowing resorption to occur. Several case reports have shown that early implantation may allow preservation of the alveoli and surrounding structures.[10,11] Regeneration procedures require additional surgery, with more morbidity and greater cost to the patient. While excellent regenerative results can be obtained, when possible it is more practical and expedient to preserve hard and soft tissues through modification of normal implant placement protocols. Thus, it is clinically appropriate to first consider placing implants immediately after extraction. Several studies have shown that in the absence of infection, implants can be placed into fresh extraction sockets with good mechanical anchorage and yield success rates virtually identical to implants placed into the healed alveolar ridge.[12–15]

The development of stepped-tapered root analog implants has encouraged immediate placement in the anterior maxilla. Available in multiple lengths and widths of up to 6.5 mm in diameter, these designs make immediate implant placement far more predictable than with the use of standard cylinder implants with parallel sides. Wider implant diameters will fill the extraction socket (elimination of any dead space), preventing soft tissue growth into the socket and eliminating the need for guided bone regeneration and membrane techniques. This also eliminates the need to place the implant into bone apical to the extraction socket, allowing immediate placement near the sinus floor or other vital structures.

The purpose of this clinical report was to present a technique for support of both the hard and soft tissues surrounding an extraction socket based on an immediate 1-stage surgical protocol.

MATERIALS AND METHODS

A custom healing abutment (EsthetiCap) based on the ProTec abutment (Friadent America, Irvine, CA) has been designed to facilitate the support of hard and soft tissues in this procedure. This abutment is prefabricated from a stone cast of the patient's teeth to mimic the natural tooth emergence contours. The cap is fabricated so that it extends no more than 1 mm through the soft tissue.

The custom-made EsthetiCap is designed to support the hard and soft tissues of the socket in the same fashion as the tooth that is being extracted. On the second pour of the initial diagnostic cast impression, the tooth to be removed is sectioned from the cast, leaving a clear view of a cross section of the tooth at the gingival crest. This provides accurate information relative to the dimensions necessary to support the tissue.

From the preoperative periapical radiograph, it is possible to approximate the location of the cemento-enamel junction relative to the gingival crest. This depth is usually 2 to 3 mm. Measurement of the width of the root provides an accurate guide to the final diameter of the implant body. A hole is made in the cast at the same inclination as the long axis of the root of the tooth. An implant analog of the probable diameter of the implant to be used is inserted into the cast, with a flat surface of the internal hexagon placed directly to the labial or buccal aspect (Fig 1). An ovate shape is created from the top of the implant analog to the outline of the gingival crest. A ProTec abutment is placed on the analog, and light-cured composite resin is added to fill the area that would be created by extraction of the tooth (Fig 2). The composite is glazed for tissue compatibility. The labial or buccal aspect of the healing abutment is marked, and the chimney of the ProTec abutment is left to facilitate handling.

Patient Selection and Presurgical Treatment Planning

Two of 9 patients who have been successfully treated are presented in this article. Age and gender did not enter into the consideration of candidates for treatment. All candidates were non-smokers and were selected for immediate implant placement with ideal hard and soft tissues around the tooth to be removed. The sites were required to be free from infection. The labial or buccal plates must have been intact, with no fracture or fenestration. Utilization of the Frialit-2 system (Friadent, Irvine, CA) provided secure anchorage of the implant within the walls of the socket without the need to drill apically into virgin or non-existent bone. This allowed the inclusion of patients with maxillary teeth where the root apices were at or near the sinus floor. Patients were also screened for any possible contraindications for implant placement and advised as to the risks, benefits, and alternatives to the proposed treatment plan.

During the prosthodontic consultation, impressions were made to fabricate a surgical guide, a custom healing provisional restoration, and an interim prosthesis. The guide was fabricated from a generic 0.060 vacuum-formed temporary splint material. It was used to accurately position the implant and make an immediate record of this position after placement using a technique described by Hochwald.[16]

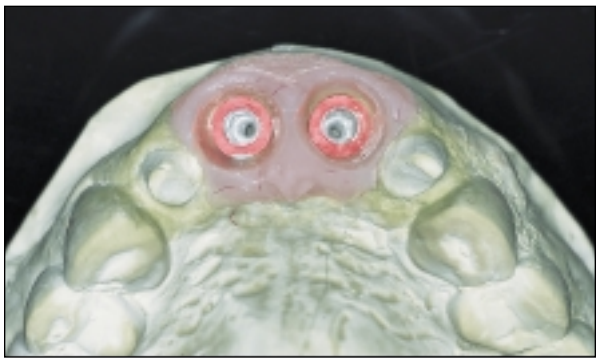


Fig 1 Two 5.5-mm Frialit-2 analogs are placed in the master cast in ideal positions.

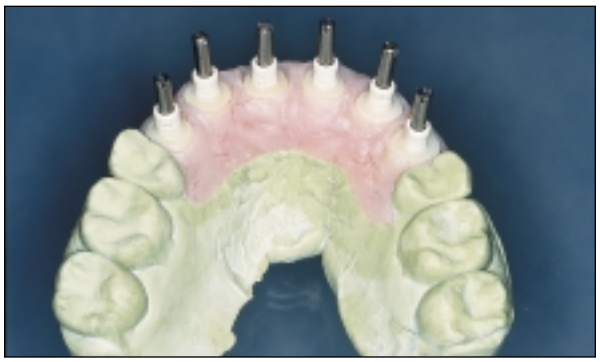


Fig 2 Composite resin buildup on ProTec abutments mimics natural tooth contours and fills soft tissue voids.

Surgery

An atraumatic extraction was accomplished using routine surgical extraction techniques and/or a Periotom (Friadent), ideally without laying a flap. Schulte developed the Periotom for the purpose of removing teeth without damage to the surrounding bone.[17] The Periotom was worked firmly into the periodontal ligament space until the root became mobile and was lifted out of the socket. Once the extraction was complete, the integrity of the socket was evaluated and the area was debrided. If the walls of the socket were intact, a tapered implant was placed without incising the soft tissues or elevating a flap. This alone helped to significantly preserve the tissues around the socket. It is known that stripping the periosteum off of the bony plate will cause resorption. In the maxillary incisor region, implant site preparation is begun in the palatal aspect of the socket to prevent labial perforation. The site was enlarged until preparation filled the extraction socket up to the labial plate. The stepped drills were taken to a final depth that was indicated by a colored ring on the shaft (Fig 3). When this ring was at the soft tissue crest, the implant would be at an ideal depth, 3 mm deeper.

If fenestration was detected, a labial flap was raised to allow for guided tissue regeneration techniques over the fenestration after implant placement. If the bone surrounding the prepared implant site remained intact, a Frialit-2 implant of appropriate diameter was placed without reflecting the soft tissues. Care was taken to assure that the internal hex alignment was accurate so that a preangled MH-6 abutment (Friadent) could be used for a final restoration without the need for preparation of a custom abutment. There is a groove on the press-fit implant design, or a dot on the ratchet extension used to place the threaded implant, that indicates

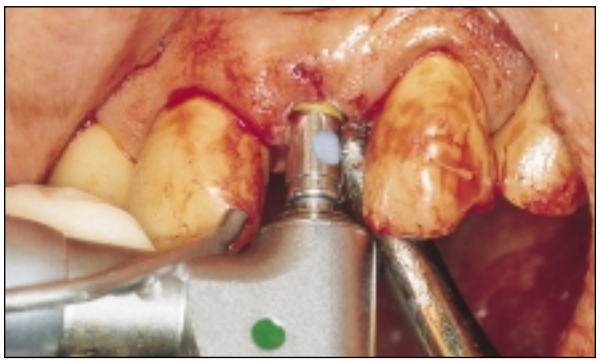


Fig 3 A 3.8 × 15-mm drill is taken to the proper depth, as indicated by the colored band on the drill, aligning with the labial soft tissues without reflecting a flap.

the position of a flat surface on the internal hex so that it can be properly positioned relative to the labial plate (Fig 4). When an infrequent gap was noted with a probe around any part of the implant that was wider than 1.0 mm, it was filled with BioGran (Orthovita, Malvern, PA) to prevent soft tissue invagination.

Once the implant was placed, a transfer coping was inserted, and GC Unifast (GC America, Lake Zurich, IL) was used to lute the coping to the surgical guide (Fig 5). To date, this has been found to be the only material that will chemically bond to the vacuum-formed surgical guide instead of mechanically locking to it. This was removed, and an EsthetiCap was then placed onto the implant to fill the soft tissue defect left from the extraction and to support the surrounding hard and soft tissues, eliminating the need for any sutures. If required, an interim prosthesis was placed, making certain to relieve it over the EsthetiCap. The patients were

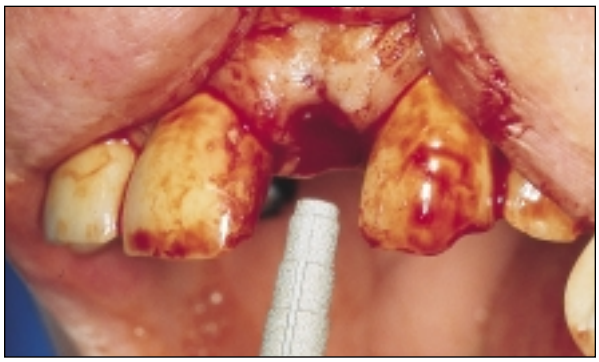


Fig 4 A groove on the press-fit Frialit-2 indicates the alignment of the internal hexagon for proper positioning to allow the use of a preangled abutment.

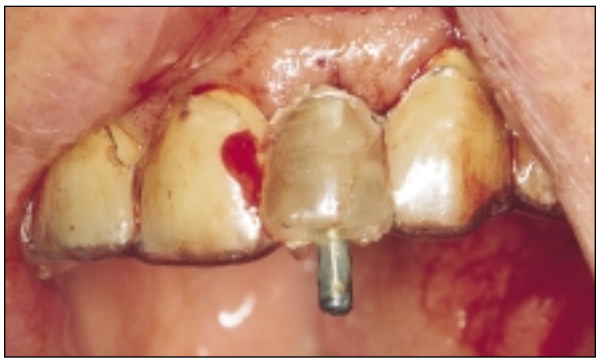


Fig 5 GC Unifast is used to lute the transfer coping placed on a Frialit-2 implant to the surgical guide for transfer to the master cast.

placed on oral antibiotics, an analgesic, and Peridex rinses (Zila Pharmaceuticals Inc, Phoenix, AZ). The implants were allowed to integrate for 4 to 6 months, depending on bone density.

Second-Stage Surgery

Following integration of the implant, the patient returned to the restoring dentist rather than the surgeon. The custom healing abutment was removed with a standard screwdriver without any need for an anesthetic. If progressive loading of the implant body was desired, a composite provisional restoration fabricated on a ProTec abutment was placed. If no progressive loading was deemed necessary, the definitive restoration was seated.

RESULTS

Patient 1

A 49-year-old healthy male patient presented with a fractured and nonrestorable maxillary right second premolar. A panoramic radiograph indicated a 10-mm root with the sinus floor at the apex. The site was free from infection, with normal hard and soft tissue contours. Immediate implant placement using cylindric implants would have been difficult. Anchorage could not have been achieved apical to the existing root socket. A delayed approach to implant placement may have allowed for pneumatization of the sinus, necessitating placement of a short implant or sinus graft procedures. If the bone remained intact following extraction without reflecting a flap, a custom EsthetiCap healing abutment would be placed to preserve the hard and soft tissues.

At surgery, the maxillary premolar was extracted using a Periotom without damaging the surrounding bone (Fig 6a). The extraction socket was debrided and a 4.5 × 10-mm stepped drill was used to reshape the extraction socket in preparation for placing a Frialit-2 implant (Fig 6b). The socket was widened without damaging the buccal plate. Since the buccal plate was at an ideal height, approximately 2 mm below the soft tissue crest, the stepped drill was taken to the depth indicated by the color band on the shaft. The drilling was stopped when this band was aligned with the soft tissue on the buccal aspect of the socket. A 4.5 × 10-mm stepped-threaded Frialit-2 implant was then placed and ratcheted into final position.

To obtain an immediate record of the implant position, a transfer coping was attached to the implant with a long transfer coping screw. The screw, not the transfer coping, was lubricated, and the surgical guide was repositioned over it. GC Unifast was used to lute the transfer coping to the surgical guide. Care was taken to ensure that none of the light-cure resin material was engaged in any adjacent undercuts prior to curing. The long transfer coping screw was loosened, and the guide was removed with its transfer coping. This guide was sent to the laboratory for incorporation into the master cast. During the patient's healing period, the definitive prosthesis was fabricated.

A prefabricated EsthetiCap was then placed into the implant, and the height of the chimney was adjusted to avoid any possibility of occlusal contact. It was secured by an abutment-retaining screw (Fig 6c). This effectively provided closure of the soft tissues without the need for sutures and supported the surrounding soft tissue contours. Four days later, the chimney was removed and sealed. The patient elected to have no provisional restoration placed.

After 4 months of uneventful healing, the EsthetiCap was removed to reveal healthy soft tissues with the ideal architecture and an osseointegrated implant. The procedure was done in the restorative dentist's office without the need for anesthetic. The

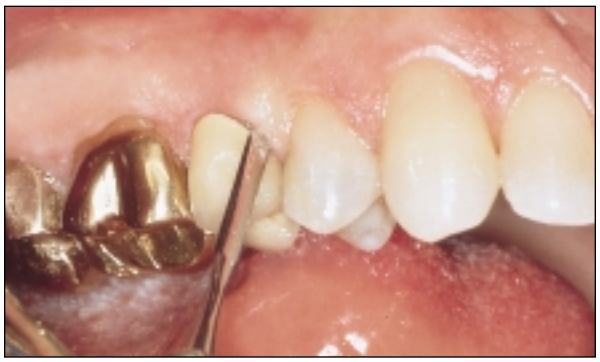


Fig 6a The maxillary right second premolar is removed using the Periotom.

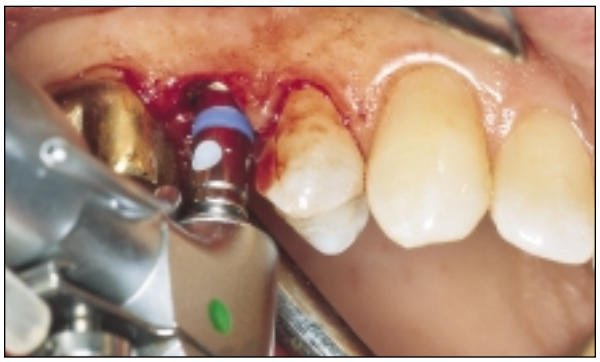


Fig 6b The implant site is prepared using a 4.5 × 10-mm stepped drill.

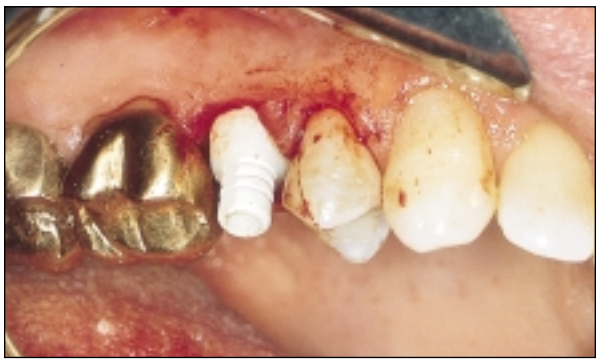


Fig 6c The EsthetiCap is placed onto the implant after immediate placement and registration. Note the absence of incisions or flaps.

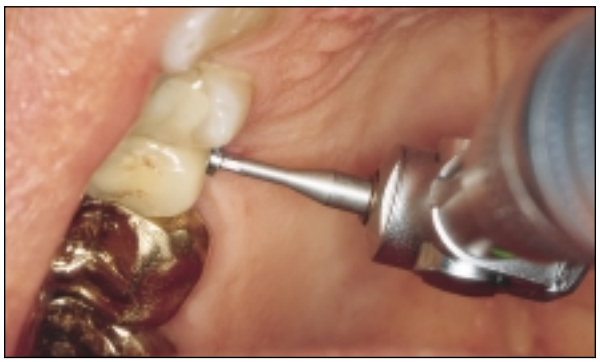


Fig 6d The final crown is placed on the implant abutment using a palatal screw.

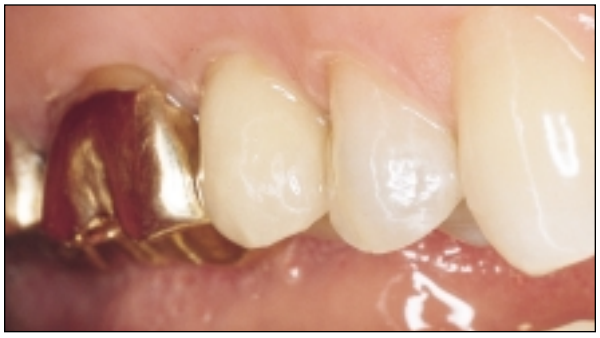
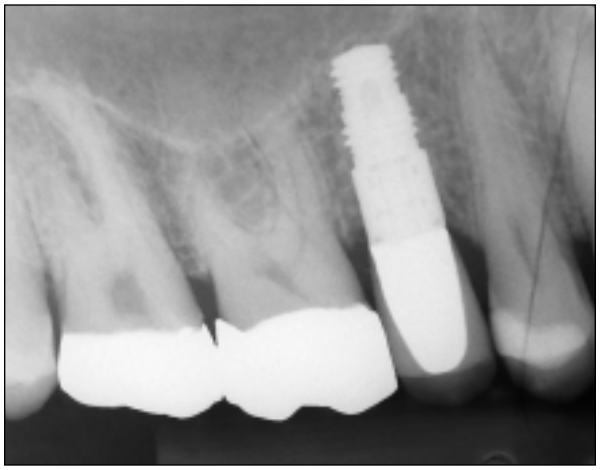


Fig 6e *(Above)* The hard and soft tissues have been maintained after final reconstruction.

Fig 6f *(Right)* Postoperative radiograph of 4.5 × 10-mm Frialit-2 implant with definitive restoration 18 months after surgery.



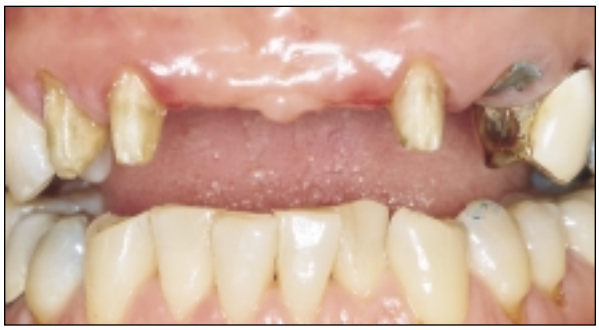


Fig 7a Preoperative clinical view of missing central incisors and fractured left canine.

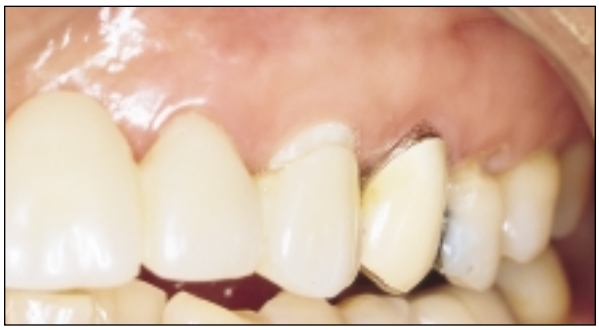


Fig 7b Postoperative view of EsthetiCap in maxillary left canine area following cementation of provisional prosthesis.

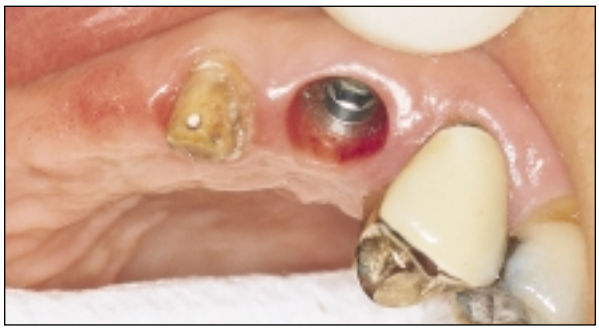


Fig 7c Soft tissues after removal of the EsthetiCap in the left canine area 5 months postoperatively.

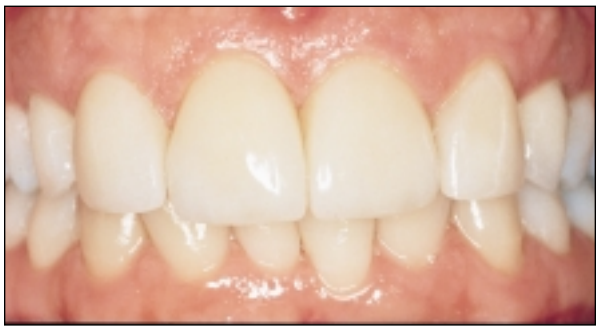


Fig 7d View of the final definitive restorations, with all anterior and posterior treatment completed.

final abutment was placed, and a prosthetic crown was secured with a single horizontal palatal screw (Figs 6d and 6e). An 18-month postoperative radiograph (Fig 6f) demonstrated virtually no hard or soft tissue changes.

Patient 2

This 48-year-old healthy female lost her 6-unit anterior fixed prosthesis when an endodontically treated left canine suffered a vertical root fracture (Fig 7a). No infection was present. The central incisors had been missing for 31 years. Treatment consisted of removing the canine atraumatically with no flap reflection. This was followed by immediate implantation of a 5.5 × 13-mm Frialit-2 stepped-threaded implant. The central incisor sites received two 3.8 × 15-mm Frialit-2 implants using guided tissue regeneration techniques to restore the long-lost labial contours. Immediate registration of all implants was made at the time of implantation for the purpose of fabricating custom provisional healing restorations.

An EsthetiCap was placed on the implant in the canine site and a provisional restoration was cemented on the remaining abutment teeth (right canine, right lateral incisor, and left lateral incisor). Care was taken to relieve the underside of the provisional restoration such that no contact could be made between the healing abutment and the cemented provisional prosthesis (Fig 7b). After 5 months of healing, the hard and soft tissues in the canine site were maintained perfectly (Fig 7c). The EsthetiCap was removed, and a ProTec provisional abutment was attached to the implant. The custom-made provisional crown supported the tissue in a manner that has made it almost impossible to detect that the tooth has been replaced by an implant-supported restoration.

An esthetic result was also obtained in the central incisor sites using customized ProTec abutments and provisional crowns. To achieve the final result, additional soft tissue plastic surgery was required, along with months of manipulation with the provisional crowns (Fig 7d). This patient example has demonstrated the ease with which the hard and soft tissue architecture can be maintained utilizing a custom-made healing abutment and the difficulty in reconstructing esthetic soft tissue structures once they have been lost.

SUMMARY

A technique has been presented that is based on scientifically proven modifications to conventional implant protocols. By placing stepped-tapered implants immediately into extraction sockets where normal hard and soft tissue contours were found, and then attaching custom healing abutments that replicate the emergence profiles of the teeth being replaced, it has been possible to preserve both the hard and soft tissues surrounding the extraction sites. Not only is this procedure more predictable than trying to regenerate these tissues in a delayed implant placement protocol, but it involves less surgery for the patient. The result is less potential morbidity, lower cost to the patient, and significantly reduced overall treatment time. This has been found to be an advantageous addition to available treatment protocols for patients who present with ideal hard and soft tissues surrounding nonrestorable teeth to be replaced with dental implants.

REFERENCES

1. Adell R, Lekholm U, Rockler B, Brånemark P-I. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1981;10(6):387–416.
2. Brånemark P-I, Zarb GA, Albrektsson T (eds). Tissue-Integrated Prostheses. Osseointegration in Clinical Dentistry. Carol Stream, IL: Quintessence, 1985.
3. Lindquist LW, Carlsson GE, Glantz PO. Rehabilitation of the edentulous mandible with a tissue-integrated fixed prosthesis: A 6-year longitundinal study. Quintessence Int 1987; 18:89–96.
4. Laney WR, Tolman D, Keller EE, Desjardins RP, Van Roekel NB, Brånemark P-I. Dental implants: Tissue integrated prosthesis utilizing the osseointegration concept. Mayo Clin Proc 1986;61(2):91–97.
5. Chiche GJ, Block MS, Pinault A. Implant surgical template for partially edentulous patients. Int J Oral Maxillofac Implants 1989;4:289–292.
6. Atwood DA, Coy DA. Clinical, cephalometric and densitometric study of reduction of residual ridges. J Prosthet Dent 1971;26:280–293.
7. Johnson K. A study of the dimensional changes occurring in the maxilla after tooth extraction. Part I: Normal healing. Aust Dent J 1963;8:428–433.
8. Warrer K, Gotfredsen K, Hjørting-Hansen E, Karring T. Guided tissue regeneration ensures osseointegration of dental implants placed into extraction sockets. An experimental study in monkeys. Clin Oral Implants Res 1991;2(4): 166–171.
9. Becker W, Becker B, Handelsman M, Ochsenbein C, Albrektsson T. Guided tissue regeneration for implants placed into extraction sockets. A study in dogs. J Periodontol 1991;62(11):703–709.
10. Dennisen HW, Kalk W, Veldhuis HAH, Van Waas MAJ. Anatomic consideration for preventive implantation. Int J Oral Maxillofac Implants 1993;8:191–196.
11. Sclar AG. Ridge preservation for optimum esthetics and function: The "Bio-Col" technique. Postgrad Dent 1999; 6(1):3–11.
12. Mensdorff-Pouilly N, Haas R, Mailath G, Watzek G. The immediate implant: A retrospective study comparing the different types of immediate implantation. Int J Oral Maxillofac Implants 1994;9:571–578.
13. Watzek G, Haider R, Mensdorff-Pouilly N, Haas R. Immediate and delayed implantation for complete restoration of the jaw following extraction of all residual teeth: A retrospective study comparing different types of serial immediate implantation. Int J Oral Maxillofac Implants 1995;10: 561–567.
14. Esposito M, Hirsch J-M, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants. (II). Etiopathogenesis. Eur J Oral Sci 1998;106: 721–764.
15. Rosenquist B, Grenthe B. Immediate placement of implants into extraction sockets: Implant survival. Int J Oral Maxillofac Implants 1996;11:205–209.
16. Hochwald DA. Surgical template impression during stage 1 surgery for fabrication of a provisional restoration to be placed at second stage surgery. J Prosthet Dent 1991;66(6): 796–798.
17. Quayle AA. Atraumatic removal of teeth and root fragments in dental implantology. Int J Oral Maxillofac Implants 1990; 5:293–296.