Simultaneous implant placement and provisionalization using a CATA in an avulsion site

Authors: Scott B. Ross, DDS, Gregory A. Pette, DMD, MS, and Bradley A. Ross, DMD

Abstract

As implant dentistry has continued to evolve, so have success parameters that now focus not only on implant survival but also esthetics, health and stability of the hard and soft peri-implant tissues. A novel approach utilizing a customized anatomic temporary abutment (CATA) for immediate implant placement and provisionalization procedures allows for a more traditional crown and bridge method for both the surgeon and restorative dentist in order to maintain peri-implant hard and soft tissues.

In addition, platform-shifting implant systems have proven to be superior to butt-joint connection implant systems for long-term maintenance of hard and soft peri-implant tissues.

This technique article shows an approach toward achieving superior esthetic outcomes by utilizing ideal tri-dimensional immediate implant positioning, proper tissue augmentations, a CATA with a cement-retained provisional crown, a platform-shifting implant system and a minor restoration on the contralateral tooth.

Key words

Dental implants, gingival recession, gingival biotype, immediate implant placement, immediate provisionalization, immediate loading, platform shifting

Introduction

Dental implant design and surface improvements have helped clinicians direct their treatment approach toward a more immediate timetable as well as a more esthetically driven one. Numerous reports on immediate implant placement and immediate provisionalization, as well as on early and immediate implant placement and loading protocols, have shown high degrees of success.1-4

Immediate implant placement and provisionalization protocols have been applied to the esthetic zone with the goal of maintaining and even enhancing the gingival architecture over time. Reports have shown excellent results with immediate implant placement and provisionalization by maintaining or developing the gingival contours and proper architecture in the

Figs. 1a, 1b Retracted view of patient (about two weeks after trauma causing tooth #8 to be avulsed) showing a buccal hard- and soft-tissue deficiency and space discrepancies. Note the thick gingival biotype. Ideally, orthodontics or restorative dentistry on adjacent teeth would be required for an esthetic outcome, but the patient declined either option at time of consultation and at time of surgery. (Photos/Provided by Drs. Ross, Pette and Ross)
In the anterior esthetic zone, recessions can occur on a significant number of sites over time. However, some studies have shown that marginal gingival recession does occur on a significant number of sites over time. With esthetic concerns being at the forefront, clinicians are now focusing on five key parameters that are related to the risk of recession following dental implant restoration in the anterior esthetic zone.

- The location of the immediate dental implant platform should be palatally positioned in an incisor extraction socket or edentulous site. When the implant is positioned toward the palate, the implant platform is at a farther distance from the buccal bone, resulting in a larger horizontal defect dimension (HDD). This larger HDD has been shown to better maintain the buccal bone and, thereby, reduce the risk of gingival recession.

- The buccal bone should be maintained near the implant platform and mid facial line angle. When the implant is positioned toward the palate, the implant platform is at a farther distance from the buccal bone, resulting in a larger horizontal defect dimension (HDD). This larger HDD has been shown to better maintain the buccal bone and, thereby, reduce the risk of gingival recession.

- The gingival biotype thickness plays a role in the potential recession that occurs; a lesser degree of recession has been associated with a thicker gingival biotype.

- Flapless surgery has been shown to result in better hard- and soft-tissue stability, and can minimize marginal gingival recession. However, despite this focus on reducing surgical manipulation and its correlation on changes in gingival margin heights, recent studies are now reporting that gingival recession can still occur even with a flapless approach.

- The implant-abutment final restoration interface and/or the temporary abutment and provisional restoration complex play a role. The shape, size and contour of the temporary abutment and provisional restoration complex can influence the development and management of the soft tissue. This then can determine the final emergence profile. Also by modifying the implant to abutment connection with an implant system that has the capability to platform shift, it has been shown to maintain long-term hard and soft peri-implant tissue stability.

These five key parameters should be the foundation for the protocol for immediate implant placement and provisionalization in the anterior esthetic zone, with the goal of maintaining hard and soft peri-implant tissues over time.

**Case report**

The following case report focuses on a technique that, beyond achieving implant integration, aims to achieve proper emergence profile development with the goal of maintaining hard and soft peri-implant tissues in the esthetic zone. This case also highlights simple restorative procedures used to overcome esthetic challenges on a patient who declined ideal comprehensive treatment.

A 28-year-old male presented to the authors’ office after having tooth #8 traumatically avulsed eight days earlier while on his honeymoon. The residual edentulous ridge (post avulsion area) had a significant concavity on the buccal aspect, indicating a deficiency of the gingival complex and the esthetic outcome.

**Fig. 2**. Implant placement into the 2-week-old avulsion site. Excellent primary stability was achieved (over 35 Ncm). Implant positioning was based on proper tri-dimensional positioning. The exposed threads of the implant at the site of the buccal ridge defect.

**Figs. 3a, 3b**. The exposed buccal threads were grafted with autogenous coallugum and FDBA and a collagen barrier membrane was placed over the graft materials after proper seating of the CATA.

**Fig. 4**. Development of the CATA. An autocured composite was added to the PEEK Procera wax-up sleeve then customized, ensuring to under-contour the CATA and place the margins supragingival to allow for cement clean-up. Note the exposed threads of the implant at the site of the buccal ridge defect.

**Figs. 5a, 5b**. CATA in place and surgical site sutured; note the supragingival margin position for ease of cement clean-up. Provisional crown based on existing dimensions of edentulous space; note tooth shape and size discrepancy between #6 and #9 as the patient declined orthodontics, a diastema between #8i-9 or any restorative dentistry on adjacent teeth.
Upon presentation, the patient mentioned that he had a diastema between his front two teeth (teeth #8 and #9), which he never liked or wanted, and he did not want to have any space with the replacement of tooth #8 (Fig. 1). However, he stated adamantly he would not undergo orthodontic therapy to correct the spacing issue nor would he do anything irreversible to the adjacent teeth that would change the shape of the teeth, i.e. crowns or veneers. He understood this limitation could compromise and affect the final outcome.

With these limitations and existing clinical findings, this particular case is complex according to the International Team for Implantology classifications system. A team approach with the patient, surgeon, restorative dentist and ceramist is necessary for a successful and esthetic result.

The proposed treatment was to place a dental implant in the avulsion site (treat the recently avulsed tooth site as an immediate extraction socket) and a CATA with a cement-retained provisional crown, followed by a final implant-supported restoration.39

Surgical protocol

The patient was given 2 grams of amoxicillin one hour prior to surgery and instructed to take 500 mg t.i.d. for five days. For postoperative analgesia, Dolobid (500 mg) was utilized two times a day (b.i.d.) for two days following completion of surgery. Under local anesthesia, a full-thickness flap was elevated on the labial aspect for access to the entire alveolar ridge and associated labial defect.

Preparation of the implant site was then completed following NobelActive (www.nobelbiocare.com) surgical drilling protocol along with the use of a surgical guide for precise restoratively driven implant placement. The surgical guide was fabricated from an impression taken preoperatively. Implant placement location was based on the tri-dimensional implant protocol.8,11,30

The implant platform was placed 1 mm to 2 mm to the palate and was centered mesial distally and approximately 3 mm apical to the proposed cementoenamel junction (CEJ) of the final restoration as it relates to the existing gingival margin.40-43 Excellent initial implant stability was achieved (greater than 35 Ncm).8,12 The implant placed (Fig. 2) was a 4.3-mm x 13-mm NobelActive® (Nobel Biocare), with a significant portion of the implant body being exposed due to the deficiency on the labial dehiscence. The exposed threads of the implant were grafted with a freeze-dried bone allograft (FDBA) (Fig. 3) (Puros®, Zimmer Dental, www.zimmer.com) and a collagen resorbable barrier membrane (Fig. 3) (Ossix® Plus, OraPharma, Inc., www.orapharma.com).

Restorative protocol

Following the placement of the implant and completion of the surgical phase of the treatment, a stock polyether ether ketone (PEEK) temporary abutment (Nobel Biocare) was used with an auto-cured composite (Systemp®, Ivoclar Vivadent, www.ivoclarvivadent.com) to develop a CATA for a cement-retained provisional restoration (Fig. 4).39
The composite was added to extend over the entire length of the temporary abutment and allowed to auto-cure to a solid state.

The CATA was then contoured for the desired emergence profile as it was passively seated into the implant without encroaching on the osseous crest interproximally. With the desired contours established, along with the location of the gingival margin, the desired length for occlusal clearance and room for a provisional restoration in mind, the unfinished CATA was then removed and finished, exactly mimicking that of the tooth to be replaced or the normal physiologic shape at the CEJ area.

In establishing the desired emergence profile, the focus was to not over-contour the composite and thus compromise the gingival contours, as this could lead to future gingival recession and gingival changes.\(^{30,31,33,43}\) The facial contour of the CATA was either flat or under-contoured. The majority of the contouring was completed out of the mouth.

Once finished with the desired shape, the CATA was then hand-tightened to approximately 15 Ncm to the implant. Then, 5-0 chromic gut sutures were placed to adapt the surgical flap in the desired position against the CATA (Fig. 5). Using either a diamond or a fissure bur with copious water, the final preparation of the CATA was then completed, achieving gingival margin contour on the labial, interproximal and lingual for final restorative margin placement.

The composite margin was prepared to approximately 0.5 mm supragingival for the provisional crown margin access to ensure total removal of excess cement. Vinylpolysiloxane (VPS) impression material was then placed into the abutment chimney and covered with a composite material to create a solid abutment complex.

A provisional restoration was then fabricated and cemented using routine crown and bridge procedures. The radiograph of the implant, CATA and provisional restoration showed a radiolucent space at the implant–abutment connection. This radiolucent space at the implant–abutment interface was due to the lack of the PEEK material of the temporary cylinder (Fig. 6).

Cement was easily accessible, as the abutment margin–provisional interphase was supragingival, allowing excess cement to be readily removed. Special attention was given to verify that no occlusal contact with the opposing teeth existed either in intercuspal position or upon any excursive movements. Keeping within the patient’s instructions that the replacement tooth for #8 fills in all interproximal spaces, the provisional crown was over contoured mesial distally being in direct contact with the adjacent teeth #7 and #9 (Fig. 5). By doing so, the provisional restoration was not esthetically desirable but this was exactly what the patient initially wanted.

Follow-up and final restorative protocol

The patient was given oral hygiene instruction and was advised to avoid any function on this implant provisional restoration for approximately three to five weeks.\(^{49}\) At the first follow-up at 14 days, the patient stated that he was extremely unhappy with the esthetic appearance of the over-contoured crown and wanted a better solution without irreversibly changing or touching the adjacent teeth.

Therefore, the cemented immediate provisional crown was easily removed from the CATA. This left the CATA intact and connected to the immediately placed implant, not affecting or disturbing the healing of the gingival complex, bone grafting or compromising the stability of the implant during the initial phases of osseointegration (Fig. 7).\(^ {45,46}\)

With new consent from the patient, composite resin was bonded to the mesial of #9 to establish a more symmetrical and better shaped central incisor that could be matched with a new provisional crown on the implant #8. The new provisional crown was then cemented with a radiopaque provisional cement, and excess cement was easily removed due to the supragingival margins (Fig. 7).\(^ {47}\)

With the new provisional restoration, the patient was very satisfied. The patient then returned to the office for follow-up visits at four weeks, six weeks and at three months. At the three-month post-op visit, implant restorative procedures for the final implant crown were initiated. Waiting three months enabled the emergence profile to develop and achieve stability, ultimately allowing for excellent soft-tissue contours (Fig. 8).\(^ {38,46-51}\)

At this time the CATA and provisional crown were removed, revealing excellent soft-tissue development. A fixture level impression technique was used to capture the emergence profile developed with the CATA; this was the first time that the CATA and provisional restoration were removed. This allowed for maximum stability and maturation of the gingival complex and emergence profile.\(^ {48-51}\)

A closed-tray fixture level impression coping (Nobel Biocare, NobelActive) was then passively placed into the fixture without compressing, expanding or changing the emergence profile created in any way, capturing the exact shape of the emergence profile created for duplication in the laboratory phase. If significant space between the emergence profile and the impression coping exists, then placing light-cured flowable composite in the gap between the impression coping and the gingival
complex or the subgingival contours of the provisional were replicated and transferred to the impression post. The laboratory was given an impression that exactly matches the developed emergence profile. A patient-specific Procera® Zirconia abutment (Nobel Biocare) was then fabricated to exactly replicate the specific emergence profile. The abutment was then placed and torqued into the implant (35 Ncm) without putting pressure on and compromising the gingival complex. An optimally contoured ceramic crown was fabricated and cemented. The four-year follow-up showed excellent stability of the hard- and soft-tissue complex with no gingival recession (Fig. 9) and maintenance of crestal bone levels (Fig. 10). The immediate functional and esthetic result was beyond satisfactory to the patient.

**_Discussion_**

Success of implant dentistry in the esthetic zone is now judged by the integration of the restoration with the gingival complex, along with the development of the soft-tissue emergence profile and sustaining it over time. Various techniques, both surgically and restoratively, are being developed to accomplish this goal. Strong consideration should be given to the implant–abutment–restoration interphases. This aspect can greatly alter the shape of the emergence profile and ultimately affect the esthetic outcome.

The purpose of this article was to present a technique utilizing a platform-shifting implant and a CATA to enhance proper subgingival contours with immediately placed implants in the anterior esthetic zone. By doing so, the proper emergence profile can be developed and sustained in the peri-implant gingival complex. This technique has a significant clinical effect when an implant is immediately placed with an immediate provisional in a fresh extraction site.

This provisionalization technique can also be applied to most anterior implant cases even when the implant protocol is delayed. The exact shape of the pre-existing emergence profile (extraction site), or the proposed emergence profile desired can be optimally contoured with the use of a CATA, and ultimately transferred into the final abutment. This stability of the peri-implant hard- and soft-tissue complex then increases the potential for a more acceptable and desirable esthetic outcomes.

**_Conclusions/outcomes_**

This technique of utilizing an immediate cement-retained provisional restoration and a platform shifting implant also resembles a more traditional crown and bridge approach, which is user-friendly to most restorative dentists. The success of this case is not only related to the proposed restorative techniques but also proper case selection for immediate placement/provisionalization in the anterior esthetic zone. Certain clinical situations, including inadequate primary implant stability, hard- or soft-tissue deficiencies requiring extensive augmentation procedures and poor patient compliance, may not be appropriate for this technique and must be recognized during treatment planning._

References are available upon request from the publisher.

**_about the authors_**

Scott B. Ross, DDS, is adjunct professor in the graduate department of periodontology at Nova Southeastern University, College of Dental Medicine in Ft. Lauderdale, Fla. He is in private practice specializing in periodontics in Miami. He may be contacted at rossgums@aol.com.

Gregory A. Pette, DMD, MS, is a diplomate of the American Board of Periodontology. He is adjunct professor in the graduate department of periodontology at Nova Southeastern University, College of Dental Medicine in Ft. Lauderdale, Fla. He is in private practice specializing in periodontics in Miami. He may be contacted at greg.pette@gmail.com.

Bradley A. Ross, DMD, is a diplomate of the American Board of Periodontology. He is in private practice, specializing in periodontics in Miami. He may be contacted at rossgums@aol.com.