Introduction
Following tooth extraction, the alveolar ridge undergoes dimensional alterations. However, the fate of the buccal bone wall cannot be predicted easily and studies have demonstrated that extensive resorption of even intact buccal plates is a common phenomenon after extraction. A recent cone-beam computed tomography (CBCT) study on the thickness of buccal bone of maxillary central incisors showed that there is a prevalence of thin facial bone with less than 1mm thickness for most anterior maxillary incisors. A recent CBCT study on the thickness of facial bone for all six anterior maxillary teeth corroborated these findings. It was found that almost 50 percent of teeth in the anterior maxilla have less than 0.5mm thickness of buccal plate. These findings were corroborated by another CBCT study that showed that the facial bone wall thickness was very thin or missing in approximately 90 percent of the 125 patients under investigation.

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Immediate implant placement, with or without simultaneous implant provisionalization, has gained popularity due to the shortening of treatment time and reduction of surgical interventions.

Successful outcomes have been reported with immediate provisionalization of implants placed in fresh extraction sockets, especially in regard to interproximal papilla. On the other hand, midfacial recession is the most commonly encountered complication with this treatment approach. Case selection and accurate 3D implant positioning are of utmost importance, since there is a high risk for esthetic failures.

When part of the buccal bone is missing following extraction, early implant placement after a healing time of six to eight weeks has been suggested. The implant installation is performed with simultaneous guided bone regeneration (GBR) to restore facial contour.

A submerged approach is performed, followed by removable provisionalization during the osseointegration period. The long-term results of this contour augmentation have been encouraging clinically and esthetically after five to nine years of follow-up. The quality of the facial soft tissues and implant-prosthetic outcomes were satisfactory after application of pink (PES) and white esthetic scores (WES).

The key to an esthetically pleasing appearance lies in the clinician’s ability to properly manage the soft-tissue profile around dental implants. Hence, the objective of this clinical report is to illustrate the outcomes of immediate implant placement after an atraumatic extraction of a fractured tooth and the immediate fixed provisionalization with the same extracted tooth, followed by the definitive restoration and one-year clinical follow-up.

Case history
The patient, a healthy 55-year-old Caucasian female, presented to the practice with a chief complaint of, “My front
tooth hurts every time I bite down, and I have not liked the color and shape of the tooth for the past 15 years.” The patient’s medical history was non-contributory, and there were no contraindications to surgical treatment (Figs. 1 & 2).

Her main concern was to primarily alleviate the discomfort with mastication, and secondarily to correct the poor esthetics associated with tooth #9. Comprehensive clinical and radiographic examination was performed and a diagnosis of vertical root fracture with pulpal necrosis was done. Alginate impressions, interocclusal records and facebow registration were made.

Diagnostic waxing was performed and treatment planning was supplemented with a CBCT scan. The thickness of the buccal bone plate was measured to be about 1mm. After discussing the different treatment options with this patient, she decided to receive implant treatment to replace the non-restorable tooth.

**Surgical procedure**

One day prior to the surgical procedure, the patient began taking 500mg of Amoxicillin three times a day and continued this for a total of eight days. Before any surgical incisions were performed, the patient rinsed with a 0.2 percent chlorhexidine digluconate solution for one minute; this was continued twice daily for 14 days after the surgical procedure.

Postoperative pain control was achieved with 600mg of ibuprofen three times daily for a total of five days. After local anesthesia with articaine 4 percent with epinephrine (1:100,000), an intrasulcular incision around the tooth was completed, utilizing a No. 15C surgical blade. The tooth was atraumatically extracted without flap reflection, utilizing periotomes, a piezoelectric device, and micro elevators.

Careful examination of the extraction socket revealed an intact socket with no fenestrations or dehiscences. The buccal plate was ~1mm as measured with a periodontal probe and a Boley caliper gauge. After complete debridement of the extractions socket, the use of a povidone-iodine 10 percent gel (available iodine 1 percent) was placed into the socket for one minute.

Drilling of the prospective implant bed was then performed according to the standard protocol with the implant shoulder 3mm apical to the adjacent central incisor midpoint of the free gingival margin, and 1mm palatal to a reference line connecting the midcervical buccal surfaces of the adjacent teeth.

During the imaging and planning phases, a surgical template was fabricated so that the implant could be placed in a location that would allow for the proper relationship between the implant and the crown. A 14mm dental implant (Straumann Bone Level Ø4.1 mm RC, SLActive Roxolid with Loxim) was placed immediately into the extraction socket with excellent primary stability. After implant placement, the horizontal defect dimension (HDD) was about 1mm.

After the prosthetically-driven implant placement, in an attempt to
ameliorate potential apical recession of the buccal gingival tissues, a small connective tissue graft was harvested from the palate and placed into a minimally invasive pouch prepared under the buccal gingiva. The connective tissue graft was not sutured to the buccal tissue but instead was secured to the temporary plastic abutment with a single resorbable gut-sling suture. A provisional restoration was fabricated in the following manner. A pre-surgical jig fabricated from silicone putty was utilized as a positioning template for the provisional restoration.

Once the tooth was extracted, the patient’s own clinical crown was hollowed out and shaped into a veneer. This veneer was then placed into the putty jig and relined with acrylic resin material, which was transferred to the patient’s mouth and allowed to set over the temporary plastic abutment.

The provisional crown was then finished to allow for proper soft-tissue contours, and to help shape healthy gingival tissues that would serve as a guide for the final restoration (Figs. 3-8). The provisional crown was put out of occlusion, and adequate clearance during excursive movements was achieved. At the three-week recall, the soft tissues around the implant provisional crown were healthy. Discoloration of the screw-retained provisional crown was observed but it did not affect patient satisfaction (Fig. 9).

Prosthodontic procedure

Eight weeks after implant placement, an implant-level impression was made using a customized impression coping and polyether impression material loaded on a custom tray. This was done in order to capture the morphology of the emergence profile created with the provisional crown. Shade selection was carried out as well, and photos were taken to aid in communication with the laboratory.

Additionally, the patient was sent to the laboratory for custom shade selection with a spectrophotometer (Crystal Eye).

After the master cast fabrication, a zirconia abutment was fabricated with CAD/CAM technology and was tried
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in the mouth. The buccal finishing line of the abutment had been placed 0.5mm subgingivally for esthetics. After the gingival margins were confirmed facially and interproximally, it was sent back to laboratory for the fabrication of a pressed lithium disilicate (IPS e.max) single all-ceramic crown.

At the final appointment, the zirconia abutment was torqued at 35Ncm and then the e.max crown was tried in. After minor occlusal adjustment and polishing, the e.max all-ceramic crown was cemented with resin (Variolink) cement (Fig. 10). At the one-year follow-up appointment, the patient was extremely satisfied with the esthetic and functional outcome (Figs. 11 & 12).

Discussion
The definition of immediate loading of dental implants is when the prosthesis is connected to the dental implants within one week following implant placement. For the present case, immediate loading was performed for an immediately placed implant. In general, there is a high level of short-term comparative evidence in terms of implant survival and marginal bone-level stability that supports the use of both immediate and conventional loading.19

Based on the scientific literature, the most common inclusion/exclusion criteria included minimal insertion torque in the range of 20-45 Ncm, a minimal implant stability quotient (ISQ) in the range of 60-65, and the need for simultaneous bone augmentation. There is limited data comparing immediate and conventional loading in terms of stability of the papilla height and of the facial mucosal margin.

Esthetics and patient satisfaction were measured in only a few trials that compared immediate and conventional loading, rendering insufficient data to draw conclusions.

Specifically for immediate loading with single-implant crowns, the following prerequisites are necessary:19
1. Postdoctoral training, clinical skills and experience
2. Proper patient selection, adequate bone volume and density
3. Primary stability, measured with Insertion torque >20 Ncm and RFA values >60 ISQ
4. Implant length>10mm
5. Absence of systemic or local contraindications (large bone defects in need for structural bone augmentation, poor bone volume and density, parafunctional activities, need for sinus-floor elevation, systemic health).

For the anterior maxillary and mandibular regions, immediate loading of single-implant crowns are predictable procedures in terms of implant survival and stability of the marginal bone. However, data regarding soft-tissue aspects is not conclusive enough to recommend immediate loading of single-implant crowns in the esthetically demanding sites as a routine procedure. Immediate loading in such sites should be approached with caution and by experienced clinicians.19
Conventional implant loading is predictable in all clinical situations and is particularly recommended in the presence of treatment modifiers such as poor primary implant stability, substantial bone augmentation, reduced implant dimensions, and compromised host conditions. For the present case, high primary stability was achieved, allowing for immediate loading. The use of the patient’s own natural tooth for the provisional implant restoration contributed to develop soft-tissue architecture that is almost identical to the patient’s original, immediately after tooth extraction.

Esthetically pleasing anterior implant restorations rely heavily on correct 3D implant placement and management of the soft-tissue profile around dental implants. This clinical report illustrates the short-term favorable outcomes of immediate implant placement afteratraumatic extraction and the simultaneous fixed provisionalization with the same extracted tooth.

**References**


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**Dr. Panos Papaspyridakos** holds a DDS and a PhD from the National and Kapodistrian University of Athens, Greece. He received a certificate of specialty in prosthodontics as well as an MS degree in prosthodontics with honorary distinction from Columbia University College of Dental Medicine, and a certificate of fellowship in implant dentistry from Harvard University School of Dental Medicine. He also holds a DDS from the University of Detroit Mercy School of Dentistry. Papaspyridakos has published more than 30 articles in international, peer-reviewed journals, and has authored chapters in two implant-dentistry textbooks. He serves as assistant professor of postgraduate prosthodontics at Tufts University School of Dental Medicine, and is a visiting assistant professor at the University of Rochester. His clinical expertise covers all aspects of implant, esthetic and reconstructive dentistry.

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