

# Modern Treatment Solutions for the Immediate Esthetic Implant

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**Abstract:** Implant dentistry continues to evolve and improve, with technologies such as cone-beam scanners and guided surgery becoming routine adjuncts in the placement of implants. In addition, a wide array of restorative options are being used to dramatically enhance patient-specific results. This case presentation describes the provisional restoration of a fractured central incisor in a 19-year-old female patient, highlighting immediate placement and immediate restoration and loading in an emergency case.

**B**rånemark et al's pioneering article in 1969 discussed a two-staged implant placement approach with the use of a smooth-surfaced implant.<sup>1</sup> Some 50 years later implantology has evolved to become a significant field in dentistry, with a multitude of implants with varied surfaces, designs, and prosthetic configurations available. In 2018, Elani et al estimated that in 1999 dental implants represented 0.7% of patients treated and anticipated this percentage to be 5.7% by 2019.<sup>2</sup> The authors projected that this percentage may reach as high as 23% by 2026.

The basic principle of atraumatically creating an osteotomy and placing an implant has not changed much over the decades. What has changed is the collective knowledge of the dental profession generated by shared experiences through journals, education, implant manufacturers, and advances in technology. Methods, too, have changed, with cone-beam scanners and guided surgery having become routine adjuncts in implant placement, and, in addition, intraoral scanners, planning software, office-based printing and milling, and a vast armamentarium of restorative options are available.

Clinicians now can efficiently scan implant restorations and capture both the position of the fixture and the associated soft tissue. In 2015, SJ Lee showed that the accuracy of digital impressions as a general modality is comparable to impressions taken conventionally<sup>3</sup>; however, in 2019, JH Lee noted the potential difficulty in achieving accurate scans in areas of significant edentulous sites.<sup>4</sup>

The dental profession has long discussed the need for proper marginal integrity, fit of parts, and contour of the

restoration to promote soft- and hard-tissue healing. When clinically indicated, clinicians may elect to mill or fabricate an immediate provisional crown chairside at the time of implant placement or at uncovering. In 2016, de Medeiros Dantas compared different techniques of polymethyl methacrylate (PMMA) temporary fabrication and found significant differences in surface roughness and susceptibility to bacterial adhesion among the modalities studied.<sup>5</sup> In 2015, Rayyan evaluated the characteristics of CAD/CAM-produced provisional restorations versus those produced manually and found that CAD/CAM interim crowns presented lower water sorption, higher wear resistance, higher surface hardness, and significantly higher fracture resistance and may be used for long-term interim restorations.<sup>6</sup> This may be more significant in staged cases that require longer provisionalization than single-unit cases.

A key evolution in this area of dentistry has been changes in the design of the implants themselves, including surface characteristics, which has made osseointegration highly predictable and viable. Implants have emerged with thread designs that enable predictability, even in challenging immediate-load cases associated with bone grafting. The use of hydrophilic surfaces with microstructuring can reduce the time to final restoration placement to weeks instead of months. Di Felice confirmed up to 60% greater bone-to-implant contact and significantly higher unscrewing torques at 2 to 4 weeks with hydrophilic surfaces.<sup>7</sup>

## Case Presentation

The patient was a 19-year-old female college student who had gone to an otolaryngologist for a steroid shot in her

nose to treat a minor inflammatory condition. As she was leaving the office, she had a witnessed syncopal episode and fractured tooth No. 8. After going through a medical evaluation and receiving medical clearance, she was referred to the author's office for appropriate treatment.

Clinical and radiographic examination showed a fracture on tooth No. 8 that made it nonrestorable (Figure 1). No other facial trauma or fractures were noted. Taking into consideration the patient's noncontributory medical history and her clinical and radiographic examination, the clinician discussed with her and advised an extraction with an immediate implant and potentially an immediate-load prosthesis.

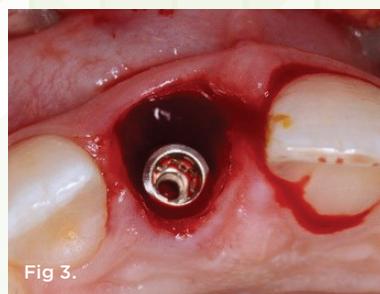
Ideally, during treatment planning, if the luxury of time is available to schedule this type of case, alternative plans for replacement, such as a flipper or resin-bonded bridge, should be developed in case the criterion for immediate load cannot be met. During consultation patients should be made aware that different thresholds and benchmarks need to be achieved to allow the clinician to be confident in placing an immediate implant, and that there are additional criteria for immediate loading. These include torque, implant stability quotient (ISQ), grafting, and the clinician's subjective feeling about the case based on his or her experience. In this case the patient presented as an emergency and there was no time to plan for alternative replacement options. The clinician informed the patient of the possible need to create a transitional prosthesis if required benchmarks were not met.

With the patient under intravenous sedation utilizing midazolam and propofol, tooth No. 8 was atraumatically extracted with the use of periostomes (Figure 2). A 4.5 mm x

12 mm implant (Straumann® BLX, Straumann, straumann.com) was placed to 45 Ncm with an ISQ of 76 (Figure 3). With consideration given to these torque and ISQ values along with the preservation of the buccal plate, it was decided to proceed with an immediate temporization. Particulate corticocancellous bone graft was used in the buccal gap, and the implant was profiled to prevent any impingement when seated with the temporary restoration after fabrication (Figure 4). In the author's experience, when the buccal plate is intact, this type of bone graft has provided excellent results when filling the buccal gap. Implant positioning was chosen based on the patient's local anatomy, with effort made to place the implant toward the palatal aspect and just below the mid-facial crest as described by Buser et al.<sup>8</sup>

Like many emergency cases, this case did not afford the luxury of milling a temporary restoration for an angled screw base locally; often in such cases, as in this one, the screw hole will be toward the incisal in the provisional. The final restoration, however, can be milled for an angled screw abutment (Straumann® Variobase, Straumann) and provide the esthetics needed with a screw-retained abutment.

With the use of an intraoral scanner (TRIOS®, 3Shape, 3shape.com) the implant with a scanbody (Straumann® CARES, Straumann) was scanned. The maxilla was captured, including the implant site both with the scanbody and without to aid the clinician in determining the proper emergence and contours when fabricating the provisional. The mandible and an occlusal registration was scanned to allow for the design of the crown in the occlusion needed. A healing cap was placed, and the patient was allowed to wait in the



**Fig 1.** The patient's initial presentation with fractured tooth No. 8. **Fig 2.** Tooth No. 8 atraumatically extracted. **Fig 3.** Implant placed toward palatal aspect. **Fig 4.** Particulate corticocancellous bone graft used in the buccal gap. **Fig 5.** Postoperative x-ray at the time of implant placement.

recovery room while the temporary was created (Figure 5).

Utilizing the CAD/CAM software (TRIOS) a provisional crown was designed and a standard tessellation language (STL) file was produced (Figure 6 and Figure 7). The crown was then milled and luted to a Variobase abutment. Current CAD/CAM software programs allow the contralateral tooth to be mirrored, the proximal contacts designed and adjusted, and, as in this case, the crown created out of occlusion.

The provisional crown was inserted and the occlusion was adjusted (Figure 8). A matching shade of composite was placed over the screw hole. In this case, the crown was able to be placed within 60 minutes of the intraoral scanning.

One week after the procedure a postoperative evaluation showed that the gingiva was healing well with presence of papilla and a pink appearance (Figure 9). The crown had been designed to be undercontoured in a buccolingual dimension to prevent apical gingival migration. The appearance of excessive gingiva at the postoperative visit was favorable.

## Discussion

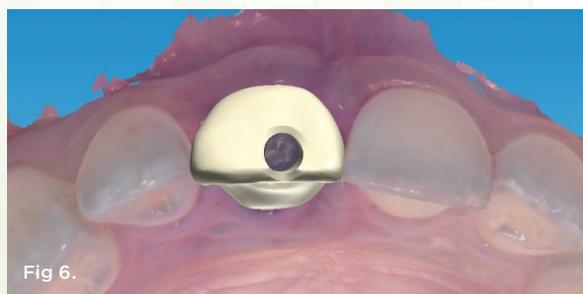
Although dental implant placement may be easy to understand theoretically, delivering the highest level of care possible can be challenging in many cases. Often, clinicians encounter situations that were unforeseen in their diagnosis and evaluation, such as an ankylosed tooth, the presence of infection, or the loss of surrounding bone. Along with the best materials available, discretion and good judgment are needed to achieve optimum results routinely and consistently. The International Team for Implantology consensus on dental implant placement and loading protocols state that immediate placement

and immediate restoration and loading is a complex surgical and prosthodontic procedure and should be performed only by clinicians with a high level of clinical skill and experience.<sup>9</sup>

When considering immediate loading as a potential treatment option, there are clinically objective and subjective criteria that must be achieved to enhance the chances of success. These include torque, ISQ, presence of buccal plate, occlusion, past medical history, and smoking, to name some. Patient compliance with prescribed instructions and the need for follow-up examinations must be emphasized with the patient. Torque and ISQ have been discussed extensively in the literature with regard to their clinical significance and importance as prognostic indications.<sup>9-13</sup> Viewpoints range from torque being acceptable from as low as 20 Ncm to up to 45 Ncm for immediate placement, and that similar outcomes may be achievable for implants inserted with low or high torque. Generally, though, the data is thought to be still inconclusive.

Buser, among other respected clinicians, has identified criteria necessary to achieve success in immediate placement with immediate loading.<sup>8</sup> These include presence of an intact buccal wall, atraumatic extraction technique, and placement of the fixture 1 mm to 2 mm lingually to the buccal plate and apically to the mid-facial crest. Bone grafting to fill the gap between the implant and buccal plate is done almost universally in these cases.

The author's practice utilizes a full lab software suite (3Shape) and a five-axis mill (Ceramill<sup>®</sup> Motion 2, Amann Girrbach, amanngirrbach.us) in-house, which enables these restorations to be designed and fabricated quickly. However, dental practices can also attain these results in a day or two without significant investment in digital equipment by working



**Fig 6 and Fig 7.** CAD/CAM design of provisional crown, occlusal view (Fig 6) and frontal view (Fig 7). **Fig 8.** Insertion of provisional crown. **Fig 9.** One-week postoperative photograph.

with a capable dental laboratory. Utilizing a fully digital laboratory workflow with milling offers exceptional accuracy and allows for the delivery of a polished surface that is “kinder” to the tissues than many conventional chairside procedures. This workflow saves chairtime and also can be done in conjunction with a dental lab to complete a temporary restoration, with the return for insertion requiring no time spent on chairside fabrication. Digital integration has become a routine part of many dental offices and most dental laboratories. In 2017, the American College of Prosthodontists established a framework for education in dental institutions.<sup>14</sup> Today in the post-COVID-19 era, digital protocols may be an even more essential, efficient, and hygienic modality in many instances.

Implant dentistry has progressed significantly since Brånemark’s writing in 1969. Immediate implant placement, one-stage implants, and immediate loading were not even considerations when the modern era was born, but now they are performed routinely.<sup>15-17</sup> Through experience and education, clinicians have learned that these treatments are often possible and predictable. Placement of an anatomically contoured provisional restoration may even provide a platform to promote peri-implant soft-tissue healing and minimize remodeling of the buccolingual ridge dimension.<sup>18</sup> Peri-implant tissues, although similar, are different than those of natural teeth, and they need to be addressed differently to obtain optimum results.<sup>19</sup>

## Conclusion

With the utilization of proper techniques and appropriate tools clinicians can deliver an esthetic restoration rapidly that promotes hard- and soft-tissue healing. Being able to offer the aforementioned services to referring doctors and patients can elevate the quality of care for a referral-based practice and increase patient satisfaction. Discretion and judgment together with quality dental materials, along with collaboration with knowledgeable and experienced dental labs and dental implant companies that offer versatile and complete solutions for a wide range of indications, can help practitioners achieve desired results with regularity.

### DISCLOSURE

This article was commercially supported by Straumann.

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