Single Tooth Immediate Provisional Restoration of Dental Implants: Technique and Early Results

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Purpose: Patients desire efficient restoration of missing teeth. Immediate provisionalization of implants at the time of placement can provide the patient with a tooth-like restoration. Our hypothesis is that preoperative fabrication of the implant abutment and provisional restoration can provide successful immediate provisionalization of implants, if specific diagnostic criteria are used for patient selection.

Patients and Methods: This hypothesis is evaluated by prospectively following 74 implants thus treated for 6 months to 2 years. A technique is presented to illustrate a simple and reliable method to provisionally restore a single tooth restoration. The method involves preoperative placement of an implant analog into a model, preparation of the abutment on the model, and fabrication of a provisional crown out of occlusion. At the time of surgery, the implant is placed according to the prescription of the restorative dentist, the surgeon places the abutment and provisional crown, and the final restoration is fabricated after the implant integrates.

Results: Seventy of 74 (94.6%) restorations have been successful with up to 2-year follow-up, which is similar to single tooth implants treated using a 2-stage protocol.

Conclusions: Single tooth immediate provisionalization implants are effective techniques when specific diagnostic criteria are used.

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Patients who receive implants may be candidates for immediate provisionalization at the time of implant placement. The restorative dentist can fabricate the provisional restoration at chairside or before implant placement. Chairtime for the dentist and patient is less when the provisional restoration is fabricated before implant placement. The provisional crown provides a reliable method for developing the soft tissue site of single tooth restorations. This report documents a reliable and simple method for fabricating a provisional restoration before surgical placement of the implant, used in consecutive cases that have been prospectively followed.

Review of the literature reveals multiple reports on successful fabrication of provisional restorations at the time of implant placements, using chairside techniques.1-10 The techniques use a modified or standard abutment that is adjusted at chairside with a provisional crown relined and left out of occlusion. The authors indicate their use of insertion torque as the method to use to decide if immediate provisionalization can be performed.5,9 The disadvantages of chairside techniques are increased chairside time for both the dentist and patient and increased manipulation of the implant by removing and replacing the abutment.

Gomes et al11 reported 1 case using a preoperative model to fabricate a provisional implant restoration out of occlusion. They placed an abutment into an analog on a model and fabricated a provisional crown similar to the technique described in this article. How-
ever, details on additional cases and site-specific modifications were not included.

Rocci et al.\textsuperscript{12} reported a technique using tissue thickness mapping to determine the location of the underlying bone. This information was transferred to a model and the tissue was replicated in silicone. Implant analogs were placed into the model and then the provisional restoration fabricated out of occlusion. Ninety-seven implants were placed in 46 patients with a 91\% success rate.

Petrungaro\textsuperscript{13} reported a larger, diverse series of implants immediately provisionalized out of occlusion. The cases included single edentulous sites, extraction sites, multiple implant restorations, and immediate provisionalization of implants immediately placed into sinus grafts. He reported a success rate of 97.8\% with minimal details on follow-up methods.

This team has followed 74 implants for 6 months to 2 years using the technique described later. The experiences indicate that with careful planning and an understanding of potential need for modification of the provisional crown at the time of surgery, preoperative fabrication of the provisional restoration can result in efficient treatment of the patient.\textsuperscript{14}

Based on these experiences, our team has established diagnostic criteria for selecting immediate provisionalization for the patient, which include:

1. Sufficient bone height, width, and density for stability of the implant at time of placement. The choices of implant length and width are similar to those considerations that would be used if the implant was used in a 2-stage method. This team uses 20 N-Cm implant insertion torque as the deciding factor for choice of using the implant for immediate provisionalization or using a 2-stage approach.
2. Sufficient mesial-distal, buccal-lingual, and interocclusal space for placement of an anatomic restoration. If the space is less than 6 mm or if the opposing occlusion interferes with the provisional restoration, then a 2-stage technique is used rather than the immediate provisionalization method.
3. The patient should have the expected compliance with the understanding to limiting chewing to only the softest foods, preferably liquids, for up to 8 weeks. In addition, patients with excessive parafunctional habits are not provisionally reconstructed.

Once the patient has been confirmed to be a candidate for immediate provisionalization, mandibular and maxillary impressions are made and a periapical radiograph is obtained at the implant site. The preoperative laboratory phase is completed and the patient is scheduled for surgery. At the time of implant placement surgery, the surgeon should have the abutment, retaining screw, provisional crown, and models with the analog in place.

Our hypothesis is that preoperative fabrication of the abutment and provisional restoration can provide successful immediate temporary restoration of implants. This hypothesis is evaluated by prospectively following 74 implants thus treated for 6 months to 2 years. Literature review indicates that single tooth restorations, with a delayed approach allowing for integration of the implant before placing the final restoration, have success rates between 94\% and 100\%, depending on specific implant protocols and the nature of the implant site.\textsuperscript{15-18}

**Report of a Case**

Our patient is a candidate for an immediate provisionalization of a second premolar restoration (Fig 1). Impressions were made of the maxilla and mandible, and a stone cast was poured. A wax-up of the missing tooth was made, and the cast was duplicated. A vacuum formed stent was made over the duplicated cast, and the missing tooth site was filled with resin and then returned to the master cast. The position of the implant to be placed was marked, and a hole was drilled through the stent and into the stone cast. The stone above the analog is shaped to allow for an emergence profile of the provisional restoration.

Delineation of the crestal level of the alveolar ridge in relation to the cementoenamel junction of the adjacent teeth was established from a periapical radiograph. The vertical position of the implant analog
in the model was then marked on the cast, anticipating approximately 1 to 2 mm of gingival thickness.

An analog of the implant to be placed is positioned in the hole, with its vertical position placing the top of the implant at the anticipated level of the bone (Fig 2). The analog is cemented with cyanoacrylate glue or can be secured to the model with stone or plaster. The analog should be positioned with its internal or external retentive feature, such as the flat surface of a hex, facing the labial. When the implant team maintains consistent orientation of the analog, there will be less variability of implant orientation, better positioning of the prepared abutment and temporary crown, and better communication between members of the implant team.

A prepable abutment is placed in the analog and prepared in the laboratory to allow for placement of a provisional crown. The abutment margins should be at the level of the gingiva to avoid deep subgingival margins and to allow for ease of cleaning after the implant and provisional crown are placed. In addition, a small groove or dot should be placed on the labial surface of the abutment to allow for accurate orientation of the abutment at the time of surgery. The labial groove will also provide additional retention of the provisional crown. The prepared fixed abutment should be left with a rough surface to allow for retention of the temporary cement to the provisional crown. The abutment preparation will result in a shorter abutment than the final abutment, to allow for 1 to 2 mm of interocclusal space between the provisional crown and the opposing restoration (Fig 3). This is important to avoid loading of the implant during the immediate healing period. These crowns are provisional and are not placed in occlusion.

After the abutment has been prepared, either a hollow denture tooth or a hollow shell crown is relined over the abutment with the use of the opposing model (Fig 4). The provisional crown is adjusted to avoid occlusion. It is useful to leave 0.5-mm to 1-mm space at the mesial and distal marginal ridges to...
allow for surgical flexibility at the time of the placement and to prevent micromotion on the implant due to movement of the adjacent teeth. The provisional crown margins are smoothed and polished to optimize the soft tissue response.

A hole is made in the occlusal aspect of the provisional crown to allow for access to the retaining screw, which secures the abutment to the implant, and to allow for excess cement to vent (Fig 5). This provides the restorative dentist the option of taking an impression of the provisional crown to avoid the use of transfer copings. The abutment retaining screw is removed, and the abutment and provisional crown are removed as 1 piece. The abutment and crown as 1 unit are placed onto an analog of the appropriate implant system. This is then placed in the impression, which is poured into stone. The transfer of the implant and the subgingival sulcus is very accurate and avoids the use of a transfer coping and resin placed into the gingival sulcus. Traditional techniques using transfer copings can also be used but lose 1 to 1.5 mm of buccal-lingual width.14

At the time of implant placement, the surgeon will have the prepared provisional abutment, provisional crown, and the screw to retain the abutment into the implant (Fig 6). In addition, the surgeon will receive a stent that will have full arch coverage to guide the surgeon at the time of placement (Fig 7). It is useful for the surgeon to also have the model of the analog

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**FIGURE 6.** Retaining screw, prepared abutment, and provisional crown as delivered to surgeon on day of implant placement.

**FIGURE 7.** Surgical guide stent with full arch coverage.

**FIGURE 8.** Surgical guide pin placed into implant preparation site to confirm accurate implant placement.

**FIGURE 9.** The implant has been placed flush to the bone.
in place to help guide implant placement and orientation.

The design of the incision takes into consideration the need to transpose keratinized gingiva to the labial surface of the implant restoration. In sites with an excess of 6 mm of keratinized gingival present, a tissue punch can be used to place the implant and provisional restoration. In most molar sites or in sites that have had prior surgery with loss of some keratinized gingiva, the incision is made across the crest combined with anterior and posterior releasing incisions (Fig 8). A full-thickness mucoperiosteal reflection is made. The tissue punch technique is useful for anterior sites.

The stent is placed and the initial preparation drills are used. A guide pin is placed through the guide stent to indicate an accurate implant position (Figure 8). The implant preparation is completed, and the implant is placed with the orientation of the internal or external retentive features matching the orientation of the analog in the model. The implant should be flush or slightly supracrestal (Fig 9). The abutment should be placed passively without interference with soft or hard tissue (Fig 10). If present, bony interferences will need to be removed from the platform of the implant to allow for the passive placement of the abutment into the implant. If the abutment is not placed passively, excessive pressure can be transferred to the threads, increasing the chance of im-

FIGURE 10. The previously prepared abutment is placed passively. After the occlusal space is confirmed, a small piece of cotton is placed before cementation of the crown.


FIGURE 11. After the crown has been tried in place and the lack of occlusion has been confirmed, the crown is cemented with temporary cement.


FIGURE 12. The gingiva is sutured to transpose the keratinized gingiva to the labial surface of the provisional restoration.


FIGURE 13. This photograph shows the excellent soft tissue response within 2 weeks of implant placement.

plant failure. The interocclusal distance is confirmed at this time. If the abutment has not been shortened sufficiently on the model or if the implant is placed more superficially than planned, the abutment may have to be adjusted with a high-speed drill out of the mouth. Then the corresponding provisional crown may need a reline at time of insertion. With accurate model preparation, the incidence is less than 10%.

The abutment screw is hand tightened rather than torqued because it is difficult to place countertorque pressure on the abutments while a torque procedure is performed. The provisional crown is tried in position (Fig 11), and after the margins are confirmed to be acceptable, the crown is cemented after placement of a small piece of cotton into the abutment to protect the screw from being clogged with temporary cement. After the provisional crown is cemented and the cement is cleaned from the margins, the gingiva is sutured (Fig 12). The keratinized gingival tissue that was previously on the crest is against the labial surface of the provisional crown. Resorbable sutures are used both interproximally and along the vertical incisions.

**POSTOPERATIVE MANAGEMENT**

Patients are instructed to avoid chewing solid, textured food for 8 weeks. They are advised to chew on the opposite side of the mouth and avoid loading of the implant restoration. Postoperative antibiotics and pain medication are prescribed. Diluted chlorhexidine solution is started 1 week after implant placement.

The gingiva heals quickly and facilitates the efficient restoration of the patient (Figs 13, 14). After an appropriate time for integration of the implant, the final impression is taken using either the provisional crown or transfer coping method. The final abutment is prepared to place the final crown margins to within 1 to 0.5 mm of the gingival margin (Fig 15). At this point, the final crown is fabricated and cemented (Fig 16).

**Patients and Methods**

Using the diagnostic criteria given earlier, 63 patients have had the described provisionalization protocol used for 74 implants placed in locations described in Table 1. Three implant systems were used in this prospectively followed series of patients: Centerpulse (Carlsbad, CA)—Spline (hydroxyapatite-
coated threaded) and Tapered Screw Vent; and Implant Innovations (Palm Beach Gardens, FL)—internal connection Osseotite surface. All data for the 3 systems are summed.

All restorations were fabricated under the supervision of the prosthodontic authors, and all surgical procedures were supervised by the surgical author. All patients were prospectively followed every 4 weeks after implant placement until the final impression was taken, and then every 6 months after delivery of the final restoration, with standardized radiographs taken serially. Bone level data will be reported in a separate study. For this report, success is achieved if the implant received a functional restoration, with crestal bone loss less than 2 mm beyond the first thread of the implant, and no evidence of pain during function.

Results

Four implants (3.1%) failed before placement of the final restoration. One central incisor was not left out of occlusion and the patient did not comply by wearing her bite opening device; thus she occluded on the central incisor provisional restoration. The implant loosened within 1 week and was eventually removed. One lateral incisor implant was placed immediately after extraction of a tooth, became infected, and was removed 10 days after placement. The lateral incisor implant was replaced with another implant after the infection resolved. One molar implant did not integrate, and one molar implant became infected and was removed. The site with the previous infection had a second implant successfully placed using a 2-stage protocol. No implants failed after final restoration. Follow-up ranges from 1 to 5 years postprovisionalization with no cases lost to follow-up through the present time period. Because of the small sample size, a cumulative survival table analysis was not performed since the sample size was not sufficient to achieve 95% power and no concurrent controls (2-stage protocol) were included in this series of patients.

At the time of implant placement, several situations were encountered.

1. The implant was placed with a different labial flare than anticipated because of variations of bone morphology (5 of 74, or 6.67%). The provisional restoration required revision at chairside by adjusting the contour and resulted in an adequate restoration.

2. The abutment was too close to the opposing occlusion, requiring adjustment of the abutment (2 of 74, or 2.7%). This occurred if the implant analog was placed too deep into the model, and the implant was then placed flush with the bone, resulting in the abutment needing adjustment. This was accomplished at chairside after removing the abutment from the implant.

3. The provisional crown needed occlusal adjustment to keep it out of occlusion (21 of 74, or 28.3%).

4. The provisional crown needed removal of a contact to allow for passive placement (15 of 74, or 20.2%).

5. The provisional crown became loosened and required recementation (15 of 74, or 20.2%). This occurred because of the lack of ideal retention by an abutment, which often was shorter than the final restoration. By placing a labial groove and leaving the abutment surface rough, cement retention was improved.
Discussion

The decision to immediately provisionalize a dental implant involves excellent cooperation of the surgeon and restorative dentist. Using the described technique, the team should communicate to ensure proper patient selection, proper placement of the analog in the model, and delivery of a modified abutment and provisional that can be efficiently placed by the surgeon.

For many cases, the surgeon may need to drill the hole into the diagnostic model until the method has been well experienced by the team. If the implant is placed at the wrong depth, interference with the opposing occlusion can occur or the implant restoration may be extremely short. If the restoration is too short and is an aesthetic problem, the provisional will need a reline at the time of abutment insertion.

The restorative dentist or laboratory technician may provide a refined, “ideal” type of preparation. The ideal abutment preparation, especially if highly polished, will limit flexibility if the implant is angled slightly different than planned. Angulation alterations by the surgeon may occur to avoid exposing the implant through bony undercuts or unknown angulations of the cortical plates. To avoid the problem of lack of flexibility, this team suggests that the abutment be slightly overprepared with labial grooves and the surface of the abutment left in a roughened state. The presence of the grooves and roughened surface will enhance retention of the provisional crown.

If the implant angulation results in an unaesthetic situation, the provisional crown may need to be adjusted by the restorative dentist by selective grinding, polishing, and, in rare cases, relining of the provisional restoration. To anticipate the need to have access to the margins of the abutment, it is suggested to have the margins of the provisional within 0.5 mm of the gingival margin, avoiding deep margins.

The surgeon should be prepared to adjust the mesial and distal contact of the provisional crown if necessary to avoid direct contact and inadvertent loading of the implant from the adjacent teeth. The surgeon should always check the occlusion of the restoration and as necessary reduce the occlusal surface to keep the provisional restoration free from occlusal load from the opposing dentition.

One advantage of using this provisional restoration technique is the development of the gingival sulcus. The provisional restoration will shape the gingival sulcus, providing the restorative dentist with less needed manipulation of the implant site’s soft tissue morphology. The maturation of the soft tissue allows for immediate placement of the final restoration after the implant has integrated. The soft tissues have appeared stable in form after they have healed from the implant surgery.

References