A novel technique for fabrication of immediate provisional restorations

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Prosthetic rehabilitation of the edentulous patient with implant-supported restorations is a commonly provided treatment modality. The original protocol prescribed a healing period of three to six months prior to loading. This meant that the total treatment time could be extensive and that patients were often required to wear removable prostheses during healing and treatment. The use of immediate implant loading protocols offers functional and psychological benefits to the patient and significantly reduces overall treatment time. New implant designs coupled with enhanced surfaces and new drilling guidelines provide an opportunity to successfully employ immediate loading protocols in clinical practice. Importantly, new prosthetic component technology allows for provisional prostheses to be fabricated in a simple chairside procedure, thus offering a predictable and economic means of providing this valuable service to patients.

Key Words: dental implants, edentulism, provisional restorations, immediate placement

Introduction

Edentulism is a major public health problem. The World Health Organization (WHO) defines edentulism as a physical impairment because important body parts have been lost. Tooth loss may limit the ability to perform two essential tasks in life – speaking and eating. It thus can be categorized as a disability. Edentulism is also defined as a handicap because significant changes are needed in order to compensate for the deficiencies. Further, elderly patients are at risk of malnutrition as they often have age-related diseases or conditions that can negatively affect the oral cavity. These may include neurologic impairment associated with Parkinson’s disease, Alzheimer’s disease, and stroke, all of which may affect parafunction, mastication, and the ability to swallow. Additionally, these same individuals often take multiple commonly prescribed medications for which xerostomia is a known side effect. For many of these patients, the reduction in saliva flow leads to an increase in cariogenic and perio-pathogenic bacteria and an inability to function with a removable denture.

From a psychological perspective, patients with an oral handicap often silently endure the embarrassment and may withdraw from social situations. In a controlled study, Blomberg et al. examined 26 patients before insertion of an implant-supported fixed partial denture and then three months and two years post-operatively. The majority of the patients stated that their quality of life had significantly improved, that they had regained confidence in themselves, and that, in contrast to a conventional denture, they accepted the fixed prosthesis as part of their body.

Our goal as clinicians is to reduce the disability, handicap, and negative psychological impacts of edentulism on our patients’ lives by providing them with well-fitting, functional, aesthetic prostheses. Today, treatment plans that provide patients with immediate function via implant-supported prostheses with minimal downtime are those that are most accepted. Such immediate function is obtainable in a chairside procedure that incorporates new restorative components in immediate fixed-provisional restorations supported by dental implants. Enhanced implant surfaces coupled with macrogeometric designs aimed at increasing initial bone-to-implant contact, may provide the necessary foundation for employing immediate loading protocols.

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Prosthetic Considerations

Different approaches to providing patients with provisional prostheses have been presented. Most of these techniques require dental technicians to convert existing dentures and fabricate acrylic resin, fixed partial dentures. Procedures for doing this in the laboratory are well controlled and may offer better margins, polish, and aesthetics than those provided chairside. On the other hand, laboratory-fabricated provisional prostheses require extended logistics, tend to be more expensive, and may take more time to fabricate. Advantages of fabricating provisional restorations chairside may include immediate reduction of the handicap, immediate splinting, and cost effectiveness. Moreover, a provisional restoration made chairside can be delivered while the patient is still anesthetized from the implant-placement surgery. Potential risks include compromised aesthetics and contamination of the newly operated site by provisional restorative materials.

Fabrication of Provisional Prostheses with a Chairside Technique

The chairside provisional concept aims to fabricate a cement-retained provisional prosthesis on abutments that will ultimately be used for a screw-retained definitive prosthesis.

Surgical Treatment

Clinical and radiographic examination revealed sufficient bone volume in both arches for implant placement (Figures 1.1 and 1.2). Full-thickness mucoperiosteal flaps were raised. Preparation of the osteotomies began with an ACT® Pointed Starter Drill (BIOMET 3i) (Figure 1.3), followed by a 2mm diameter Twist Drill (Figure 1.4).
The bone quality was deemed to be Type IV (soft bone). Preparation of the osteotomies continued with a Pilot Drill (Figure 1.5) and a 2.75mm Twist Drill, employed according to the recommended drilling guidelines for soft bone (Figure 1.6). The final drill used was a Countersink Drill (Figure 1.7). NanoTite™ PREVAI L® Implants (BIOMET 3i) were placed (Figure 1.8) into tooth sites 19, 21, 27, and 30 [34, 36, 43, and 46]. The insertion torque of the implants reached the limit preset on the drilling unit (50 Ncm). Implant Stability Quotient (ISQ) readings indicated a high level of initial implant stability (greater than 70). These numbers exceeded the minimum recommendation for employing an immediate loading protocol. QuickBridge® Provisional Components (BIOMET 3i) were chosen for fabrication of immediate fixed-provisional prostheses (Figure 1.9). Conical Screw-Retained Abutments were placed and tightened to 20 Ncm (Figure 1.10). QuickBridge Titanium Cylinders were mounted onto the abutments and hand tightened (Figure 1.11). Impression copings were snapped onto the titanium cylinders, and the soft-tissue flaps were closed with intermittent sutures. An impression was taken with polyvinylsiloxane impression material. The impression was removed, and the QuickBridge Caps were then snapped onto the titanium cylinders (Figure 1.12).
Provisionalization

An occlusal registration was made with polyvinylsiloxane occlusal registration material (Figure 2.1). On the master cast (Figure 2.2), laboratory-processed provisional restorations that incorporated the QuickBridge® Caps were fabricated (Figure 2.3). In the operatory, the intaglio surfaces of the QuickBridge Caps were filled with chlorhexidine gel, and the provisional restorations were snapped onto the Titanium Cylinders (Figure 2.4). Occlusal equilibration was done, and the patient was instructed in proper oral hygiene.

Restorative Treatment

Three months following soft-tissue maturation, the patient was seen for fabrication of the definitive restorations, which were to consist of two implant-supported CAM StructSURE® Copy Milled Frameworks (BIOMET 3i) and all-ceramic restorations for the natural dentition (Figures 2.5 and 2.6). The framework masters, along with a new maxillary tooth set-up, were fabricated (Figure 2.7). The framework masters were spraypainted white for optimal scanning (Figure 2.8).
The master casts and the framework master were sent to the BIOMET 3i PSR® Department for scanning and milling of the definitive CAD/CAM frameworks. These were returned to the dental laboratory for porcelain application and completion of the restorations (Figures 2.9 and 2.10). The patient returned to the dental clinic. The provisional restorations were removed, and the two CAM StructSURE Copy Milled Prostheses along with the all-ceramic restorations for the natural dentition were placed (Figures 2.11 and 2.12). The implant-supported, screw-retained prostheses were placed with 10Ncm, and the screw access openings were restored with composite resin.

Surgical Treatment in the Maxilla
Rehabilitation of the patient continued a month later with implant therapy in the maxillary arch. A full-thickness mucoperiosteal flap was elevated, and an ACT® Pointed Starter Drill was used to mark the planned implant positions and pierce the cortical plate (Figure 3.1). Preparation of the osteotomies continued with a 2mm diameter Twist Drill (Figure 3.2). The bone quality was judged to be Type IV (soft bone). Guide Pins were placed into the osteotomies to verify the optimal position for the implants (Figure 3.3). A 3.25mm x 15mm QSD Drill was advanced into the osteotomies (Figure 3.4), followed by a
4mm x 10mm QSD Drill, to widen the cortical aspect of the osteotomies (Figure 3.5). A combination of NanoTite™ Tapered and NanoTite Tapered PREVAIL® Implants were placed into tooth sites 3, 6, 8, 9, 11, and 13 [16, 13, 11, 21, 23 and 26] (Figure 3.6). The insertion torque of the implants reached the limit preset on the drilling unit (50 Ncm), and ISQ readings were greater than 70. Conical Screw-Retained Abutments were placed and tightened to 20Ncm (Fig. 3.7). QuickBridge® Titanium Cylinders were mounted onto the abutments and hand tightened (Figure 3.8). QuickBridge Caps were snapped onto the titanium cylinders (Figure 3.9), and intermittent sutures were placed to close the soft-tissue flaps (Figure 3.10). From the maxillary tooth set-up, a vacuum-formed template was made (Figure 3.11). The template was filled with ProTemp™ (3M ESPE, St. Paul, Minnesota, USA) and seated onto the QuickBridge Caps. The material was allowed to set per the manufacturer’s instructions, incorporating the QuickBridge Caps into the provisional restoration. The restoration was then snapped off, trimmed, and polished, and replaced with chlorhexidine gel (Figure 3.12).
Restorative Treatment

Following three months of soft-tissue maturation, the provisional restoration and QuickBridge® Titanium Cylinders were removed (Figure 4.1). Pick-up impression copings were placed onto the abutments and hand tightened. An open-tray impression was made with polyvinylsiloxane impression material (Figure 4.2). The QuickBridge Titanium Cylinders were replaced, and the vacuumformed template was reused to make an occlusal registration by filling the template with polyvinylsiloxane occlusal registration material (Figure 4.3). With this technique, information about the interocclusal height, midline, shape of the teeth, etc., is provided to the dental technician for fabrication of the framework master.

In the laboratory, a tooth set-up was fabricated onto the master cast (Figure 4.4). From the tooth set-up, the framework master was constructed by a cut-back technique (Figures 4.5 and 4.6). This was sent to the BIOMET 3i PSR® Department for fabrication of a CAM StructSURE® Copy Milled Framework. CAD/CAM frameworks offer advantages as compared to cement-retained conventional cast frameworks, including a passive fit and the precision of CAD/CAM technology. The copy-milled framework was returned to the dental laboratory (Figure 4.7). Three layers of opaque porcelain were baked onto the titanium framework prior to application of body and incisal porcelains (Figure 4.8).
The definitive full-arch screw-retained prosthesis was completed (Figure 4.9). The patient returned to the dental clinic. The provisional prosthesis was removed, and the definitive implant-supported, screw-retained prosthesis was placed with 10Ncm of torque applied to the retaining screws. Occlusal equilibration was done, followed by restoration of the screw-access openings with composite resin (Figures 4.10-4.12). The patient received oral hygiene instructions and was released.

Follow-Up and Maintenance
When fabricating a provisional restoration according to this protocol, follow-up visits are scheduled for two weeks postoperatively and then once a month. At each visit, oral hygiene status, soft-tissue healing, stability of the provisional prosthesis, and implant status are evaluated. Following placement of the definitive prosthesis, the frequency of follow-up visits is determined based on the health of the soft tissue and the patient’s ability to properly maintain the prosthesis.

Clinical Relevance
Patients are more likely to accept implant treatment plans that provide them with immediate function. Patients often present with missing dentition, ill-fitting removable prostheses, and the inability to speak and eat comfortably. The goal of treatment is to limit the disability, the handicap, and the negative psychological impacts of edentulism by providing patients with well fitting, functional, and aesthetic prostheses. While different approaches to providing patients with immediate provisional prostheses have been explored, the simple, chairside procedure presented in this article may offer advantages including reduction of edentulism, immediate splinting, and cost effectiveness.

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References

*BIOMET 3i® OSSEOTITE® and NanoTite Dental Implants are intended for immediate function on single-tooth and/or multiple-tooth applications when good primary stability is achieved with appropriate occlusal loading, in order to restore masticatory function.