

Immediate implantation and provisionalization: single-tooth restoration in the esthetic zone

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Anterior tooth loss and restoration in the esthetic zone is a common challenge in dentistry today. The prominent visibility of the area can be especially distressing to the patient and requires a timely and esthetically pleasing solution.

Immediate single-tooth implantation followed by immediate provisionalization is becoming an increasingly desirable treatment that offers numerous benefits over conventional delayed loading.

In the past, the non-restorable tooth was extracted and possibly grafted for site preservation. A removable partial denture (or flipper) was fabricated and placed for use during healing. After an adequate healing period, an implant was placed and buried under the gingiva and the patient continued to wear the flipper until the implant had osseointegrated and was ready to be uncovered and restored. The patient would therefore wear the removable partial denture for upwards of six to eight months.

This course of treatment often results in a less than desirable gingival architecture surrounding the final restoration. There are also clear indications that partial removable dentures are an important causative factor

in the alveolar bone resorption process.¹

Today, immediate treatment offers a better solution. Immediate implantation and same-day provisional replacement of single anterior teeth minimizes treatment time and cost while enhancing esthetic quality.² In addition to alleviating patient trauma, this technique decreases resorption of hard and soft tissue and results in better function.² Overall, this leads to greater patient satisfaction.

In this process, the implant is placed and a provisional is quickly loaded. A non-occluding, also known as non-occluding, provisional is used in a protected occlusal scheme.

The placement of the non-occluding restoration must occur within 48 hours to be considered immediate loading.³ Both of the following cases received same day provisionalization.

The clinician faces several challenges when restoring teeth in the esthetic zone. Major cosmetic concerns are the retention of the interdental papilla and prevention of alveolar bone collapse.⁴ Research has suggested that immediate provisionalization following implanta-



(Photos/Provided by Dr. Susan McMahon)



Fig. 3



Fig. 4

tion allows for greater clinical control over the regeneration of tissue surrounding the site of extraction.⁵

Unfavorable alterations to the alveolar bone structure must be avoided using ridge preservation techniques and precautions in terms of osseous exposure.⁵ Immediate placement of the implant into fresh extraction sockets prevents the post-extraction resorption that occurs commonly with alternate forms of treatment, preserving the integrity of the alveolar ridge.⁶

A compromised implantation site is also a concern when dealing with tooth loss. Bone resorption may leave insufficient bone for implantation. Furthermore, a deteriorated gingival architecture produces an inferior esthetic. Immediate implantation into the fresh extraction socket allows the clinician to maintain the gingival tissue and create a more esthetically pleasing restoration.²

Minimum criteria for implant placement have been established for successful immediate loading. Rough quantitative values for insertion torque and implant stability quotient (ISQ) as well as surgical assessment play a role. Values as low as 15N-cm for insertion torque and 50 ISQ both resulted in successful provisionalization.

Additionally, the surgeon must assess where there is adequate bone support at the apex, at least 3 mm of circumferential bone, and primary stability of the implant. Research has shown that "early loading of dental implants does not appear to interfere with osseous modeling of a developing osseointegration as long as significant micromovement does not occur".⁷

In addition to providing both esthetic and functional benefits, immediate implantation and loading of a nonfunctioning provisional has also been found to result in comparable implant survival outcomes to more traditional techniques.

A recent study measuring clinical success, survival, and satisfaction found the technique to be "not less favorable than conventional loading."³ In consideration of this, current literature is now purporting immediate implantation and non-occlusal loading to be the

"treatment of choice" in cases of single anterior tooth restoration.⁸

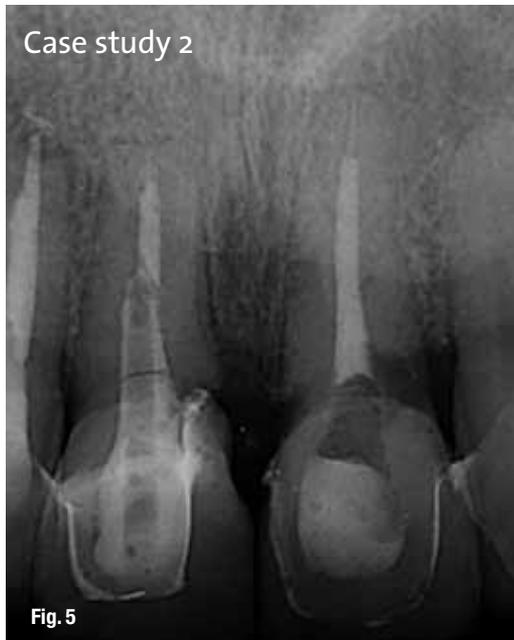
The following are two case studies involving immediate provisionalization. In both cases, the maxillary right central incisors had sustained trauma, were endodontically treated and functioned for a number of years. Approximately 15-20 years later, the teeth in each case failed due to internal resorption. The failing teeth were extracted and implants were inserted immediately and restored the same day with a non-functional provisional.

Dental root resorption involves the loss of hard tissues that compose the teeth (dentin, cementum and enamel).⁹ In most cases, tooth resorption is the result of trauma or irritation to the periodontal ligament and/or tooth pulp.⁹ These conditions may occur as a result of injury, inflammation or chronic infection of the pulp, periodontal conditions, orthodontic tooth motility or tooth eruption.^{9,10} Internal resorption is generally asymptomatic and is discovered most frequently through radiographic examination.^{9,10} If internal root resorption is left to progress untreated, it may result in extension to the periodontal ligament through a crown or root perforation.⁹

Case study 1: failing maxillary right central incisor

The patient is a 30-year-old healthy male who was examined in our office for a failing maxillary right central incisor. His history involves a soccer accident in 1993 that resulted in an elbow to the face with trauma to the right maxillary central incisor. Approximately one week subsequent to the accident, the patient's tooth was treated endodontically. It eventually became discolored and grew increasingly out of alignment (Fig. 1). Radiographic examination revealed internal resorption (Fig. 2).

Clinically, all other maxillary and mandibular teeth were in good condition. Periodontal examination revealed healthy gingival tissue. The patient was con-



cerned that his anterior tooth would fracture unexpectedly and desired an immediate replacement.

Treatment options

Several treatment options were considered. The first was extraction of the maxillary right central incisor and fabrication and placement of a conventional fixed bridge of porcelain fused to metal or an all-ceramic system. The second option was extraction of the tooth followed by placement of a removable partial denture. The next option was extraction, provisionalization with a removable partial denture (flipper) followed by implant placement, healing while wearing the flipper and, finally, restoration of the implant.

The best alternative was extraction and immediate replacement of the extracted tooth with an implant, followed by immediate loading with a nonfunctioning provisional. After adequate osseointegration, a final restoration would be fabricated. Advantages and disadvantages of all options were explained to the patient. He decided to continue treatment with an immediate implant restoration. The patient was then referred to a periodontist for further evaluation and implant consultation.

Implant evaluation

Implant examination revealed adequate bone height and width for implant placement immediately following extraction of the failing tooth. A surgical date was scheduled with the periodontist for extraction of the tooth and placement of the implant. An appointment was coordinated with our office for the

patient directly following the surgical procedure for provisionalization of the implant.

Surgical protocol

The right central incisor was removed and a Nobel-Replace Tapered Groovy (internal connection) 5.0 mm x 13 mm implant was placed. An osseous graft of demineralized freeze-dried bone and a collagen membrane were utilized to augment the surgical site. The fixture received an emergence profile, healing abutment.

Provisionalization

The patient presented in our office after the implant placement with a healing abutment in place. The healing abutment was removed. A Nobel Biocare immediate temporary abutment was placed and a provisional was fabricated.

Care was taken to contour the emergence of the provisional as to best support the gingival architecture. The plastic coping for the immediate temporary abutment was roughened with a 56 carbide bur to enhance adherence of the integrity provisional material used.

The provisional was polished and placed on the immediate temporary abutment with a small amount of flowable composite to enhance retention. The provisional crown was fabricated to be completely out of occlusion and non-functional to ensure the implant adequate osseointegration time undisturbed by occlusal forces. The provisional restoration was observed periodically during the six-month healing process to monitor gingival adaptation (Fig. 3).



Fig. 7



Fig. 8

Final restoration

Six months post surgery, the patient was scheduled for placement of the final restoration. After removing the provisional crown and the immediate temporary abutment, an implant impression post was placed, radiographic verification was made to assure complete seating and a final impression was taken with a poly-ether system. Complex shade-mapping was carefully performed to match the existing contralateral natural teeth. The provisional was then reinserted.

A Procera zirconia custom implant abutment was chosen. Zirconium implant abutments have not only been noted for their tooth-like color and esthetic appeal but also for tissue tolerability, high load strength and intrasulcular design enhancement.¹¹

The extraordinary load strength of the oxide ceramics is not compromised by high bending and tensile strength, and fracture and chemical resistance.¹¹

Zirconium abutments are mechanically equivalent to their metal counterparts but boast greater biological compatibility.¹¹

Results of a recent study provide evidence that the ceramic oxide abutments can be safely utilized in the incisor region of both the maxilla and mandible as determined by maximal bite forces in the esthetic zone.¹¹ Due to excellent restorative properties in terms of strength and color conformity, the zirconium implant-abutment is becoming increasingly favored by clinicians for esthetically pleasing anterior implant restorations.¹² A Procera zirconia crown was fabricated for this patient with Noritake CZR porcelain (Fig. 4).

At the time of insert, the provisional crown and immediate temporary abutment were removed. The Procera zirconia custom abutment was seated, the screw was hand tightened and the screw was torqued to 35 Ncm with the manual torque wrench. The access was filled with a small cotton pellet and topped with a thin layer of flowable composite.

The Procera zirconia crown was then seated; margins, contacts and occlusion were confirmed; and the

crown was cemented in place with 3M ESPE RelyX luting cement (Fig. 5).

Case study 2: fractured maxillary right central incisor

This patient, a healthy male in his late 30s, was examined in my office for a fractured maxillary right central incisor. The patient had Feldspathic porcelain restorations on his upper central and upper lateral incisors that were placed several years ago. He had a history of trauma to the anterior teeth from a sports injury and subsequent endodontic treatment.

Recent periapical radiographs showed internal resorption in the upper incisors (Fig. 6). The patient sustained additional trauma to the maxillary right central incisor through a fall, which resulted in complete fracture of the crown (Fig. 7). The tooth was nonrestorable.

After reviewing the different treatment options, the patient decided on an immediate implant restoration. Although the maxillary left central incisor also exhibited signs of internal resorption, it was decided that treatment of that tooth would be performed at a later date. Consideration was given to the poor gingival architecture that results from placing adjacent implants in the esthetic zone. He was then evaluated by the periodontist for the surgical placement of the immediate implant for the maxillary right central incisor. The patient's treatment was similar to that of the patient in the first case study.

The right central incisor was removed and a Nobel-Replace Tapered Groovy (internal connection) 5 mm x 13 mm implant was placed. An osseous graft of demineralized freeze-dried bone was utilized to augment the surgical site. The fixture received an emergence profile, healing abutment. The patient then received an immediate non-functioning provisional.

Final restoration

After the six-month healing period the final res-



Fig. 9

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toration was fabricated. In this case, a one-piece screw-through abutment made from a Nobel Biocare GoldAdapt Engaging NobelReplace (Fig. 8) was fabricated in order to obtain a correct emergence profile of the restoration due to the slightly lingual placement of the implant (Fig. 9).

The restoration was seated, and the screw was hand tightened and then torqued to 35 Ncm with the manual torque wrench. The lingual screw access was filled with a cotton pellet and composite restoration (Fig. 10).

_Conclusion

In the cases cited above, both patients had sustained injuries to their anterior teeth as young adults while engaging in sports. Each of the patients had been treated endodontically and experienced internal resorption of the traumatized teeth approximately 15 years later. Both of their careers and lifestyles demanded immediate replacements that were non-removable and esthetically pleasing.

The failing teeth were extracted and implants were inserted immediately and restored the same day with a non-functional loaded provisional. Immediate placement and restoration of a single implant offers a highly esthetic and timely treatment option in the case of internal resorption and tooth failure in the maxillary central incisors.

Furthermore, this treatment eliminates the need for a removable partial denture while maintaining the gingival architecture and preventing alveolar bone loss in the extraction site.

As esthetic expectations of patients and the desire for a convenient and timely treatment continue to increase, instantaneous replacement of failing teeth is becoming more routine.¹³ Not only does placing the implant immediately following extraction maintain the alveolar architecture and retain the interdental papillas, placing the provisional immediately there-

after refines the level of treatment the clinician can offer the patient. Esthetic quality is enhanced without comprising long-term implant stability. Immediately placing and loading implants is both functionally and cosmetically beneficial.

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