Central incisors with a history of past trauma are a common finding in dentistry today. Many of these incisors have been endodontically treated at the time of trauma or shortly post trauma.

However, failure of these teeth can occur at a later time as a result of fracture, internal resorption, external resorption, decay and other factors. Sources of trauma often include sports or automobile-related accidents.

Once it has been determined that an internally resorbed tooth is failing and non-restorable, a restorative treatment plan that is both functionally and esthetically acceptable must be determined and implemented.

The following are two case studies involving maxillary right central incisors that had sustained trauma, were endodontically treated and functioned for a number of years. Approximately 15 to 20 years later, the teeth in each case failed due to internal resorption.

Internal resorption

Dental root resorption involves the loss of hard tissues that compose the teeth (dentin, cementum and enamel). Resorption occurs primarily by osteoclasts, large multinucleated cells that originate from the bone marrow.

Osteoclasts aid in the process of bone loss by releasing demineralizing agents and degrading enzymes that function in the breakdown of a tooth’s hard tissues. Resorption of the teeth is often difficult to prognosticate, diagnose and care for.

In most cases, tooth resorption is the result of trauma or irritation to the periodontal ligament and/or tooth pulp. These conditions may occur because of injury, inflammation or chronic infection of the pulp, periodontal conditions, orthodontic tooth mobility or tooth eruption.

Internal inflammatory resorption, the type of resorption identified in the following cases, is characterized by progressive loss of hard tissue in the tooth root. This degeneration is typically found in the cervical region, but has been observed in all areas of the root canal system.

Internal resorption is generally asymptomatic and is discovered most frequently through radiographic examination. The loss of hard tissue is detected radiographically as uniform radiolucent expansion of the tooth canal. If internal root resorption is left to progress untreated, it may result in extension to the periodontal ligament through a crown or root perforation.

Immediately placed implants/immediate provisionalization

The clinician faces a great esthetic challenge in the replacement of single anterior teeth.

In the following cases of internally resorbed incisors with a poor prognosis, extraction followed by immediate placement of an implant is a desirable restorative option. The failing tooth is in the esthetic zone, and therefore an immediate and esthetic replacement is necessary following extraction.

In the past, the non-restorable tooth was extracted and 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 upward 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.3

Major cosmetic concerns in the fabrication of the immediately placed provisional are the retention of the interdental papilla and prevention of alveolar bone collapse.4

Research has suggested that immediate provisionalization following implantation allows for greater clinical control over the regeneration of tissue surrounding the site of extraction.5 This benefit offers an esthetic advantage of immediate loading of an implant with immediate provisionalization over alternative-staged therapy treatment options.

Unfavorable alterations to the alveolar bone structure must be avoided using ridge preservation techniques and precautions in terms of osseous exposure.6 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

Case study No. 1

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).

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

Fig. 1. Pre-op retracted view, 1:1 (case study No. 1). (Photos/Provided by Susan McMahon, DMD, and Jessica Forestier)

Fig. 2. Radiograph with implant in place (case study No. 1).
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 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. See the radiograph with implant in place (Fig. 2).

_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 insure 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).

_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 polyether 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 toothlike color and esthetic appeal, but for their tissue tolerability, high load strength and intrasulcular design enhancement.7

The extraordinary load strength of the oxide ceramics is not compromised by high bending and tensile strength, and fracture and chemical resistance.7
Zirconium abutments are mechanically equivalent to their metal counterparts, but boast greater biological compatibility.7

Results of a recent study provide evidence that 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.7

Because of 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.8 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 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 No. 2

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 that resulted in complete fracture of the crown (Fig. 7). The tooth was non-restorable. 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 later. 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 case study No. 1.

The right central incisor was removed and a NobelReplace Tapered Groovy (internal connection) 5 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 as the patient did in case No. 1.

Final restoration

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

The restoration was seated, 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**

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.⁹

In the cases cited above, both patients had sustained juries 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 the patients' 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._

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A list of references is available from the publisher.

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Fig. 8. Final restoration before insert (case study No. 2).

Fig. 9. Occlusal view showing slightly lingual implant placement (case study No. 2).

Fig. 10. Final restoration in place, day of insert (case study No. 2).