Bioactive Material Treatment

A double case study examining internal and external root resorption
xtensive internal or external root resorption and deep caries may present treatment challenges. Often, we remove these compromised teeth and replace them with implants or bridges. A lower-cost option is a removable prosthetic. If the neighboring teeth are seriously damaged, a bridge may be a good solution because the prosthetic can also reinforce the adjacent teeth.

However, we prefer not to place a bridge when the adjacent teeth are young and healthy and an incisor is involved. Now, with the right materials in our practices, we have a greater ability to successfully save teeth. If the attempt fails, there is always the option to extract. All you need is a good idea, some time and the proper materials. The following two cases demonstrate how to treat internal and external resorption using bioactive materials.

Resorption review

Resorption is a process by which a number of physiological and pathological factors lead to the loss of hard tissue of the tooth and, quite often, the bone of the alveolar ridge. Roots of primary teeth are subject to natural resorption—it is a physiological process related to the transition from primary to permanent dentition.

Both primary and permanent teeth can be subject to pathological resorption, which leads to the development of pathologies in teeth and periodontal tissues. When pathological resorption occurs within the confines of the tooth, it is internal resorption. When it appears on the surface of the root cementum, it is external resorption. Differentiating internal resorption from external resorption is not always easy; it depends on which occurs first. However, proper diagnosis is very important because implementing the correct treatment depends on it.

Root caries most often develops in cases where cervical areas are exposed to periodontal disease. Initially, the root cementum, which constitutes the external layer covering the root, is attacked. Once caries settles in the cementum layer, it progressively attacks deeper layers composed of dentin.

Caries of the root significantly decreases tooth strength and viability, which can result in extraction if not diagnosed in time. Resorptions often develop without symptoms and are only discovered in the patient’s radiograph.
Case 1: External Resorption

A 25-year-old patient came to the office requesting that we save her upper left central incisor, #21. She had visited three other offices that had recommended a bridge, an implant and extraction.

A radiograph indicated significant root caries on the distal of #21, which could have been caused by external resorption in deeper parts of the root (Fig. 1). External resorption is triggered by persistent inflammation of the tissues in the apical region, tooth trauma, cysts in dental tissues that put pressure on the teeth, or overly aggressive orthodontic therapy and whitening. Inflammatory resorptions require antiseptic endodontic treatment and sometimes the intervention of an oral surgeon. Untreated or insufficiently treated external resorption can lead to loss of the tooth.

The patient arrived for her first visit with swollen tissue around teeth #21 and #22 (Fig. 2). Her tooth was not responding to thermal stimulus. An examination with a pulp tester confirmed pulpal necrosis. Many offices still use ethyl chloride to test pulp vitality; however, experience has taught us that ethyl chloride does not always provide accurate results because periodontosis (the exposed cervix) of an adjacent tooth can cause inaccurate readings. A pulp tester is a practical and more reliable device that precisely determines the level of pain in a particular tooth.

An endodontic procedure was performed on #21 (Fig. 3), and the canal was mechanically and chemically prepared to a length of 24mm. As usual, 5.25% sodium hypochlorite was used along with chlorhexidine, citric acid, ethylenediaminetetraacetic acid (EDTA, Pulpdent) and sodium chloride (NaCl). Because the pulp was necrotic, the canals were filled with TempCanal Enhanced, a provisional nonsetting, nonhardening calcium hydroxide paste from Pulpdent that can be easily removed with file and irrigation at a later visit. The access cavity was temporarily closed with HardCore (Pulpdent).

At the two-week follow-up visit, the patient reported that she had not experienced any pain or sensitivity. TempCanal Enhanced was removed with NaCl, chlorhexidine and citric acid. The canals were filled to a working depth with AH Plus Root Canal Sealer (Dentsply) and gutta-percha points, and the cavity was sealed with a temporary filling, Coltene, for the next 24 hours (Fig. 4).

The following day, the tooth was reinforced with a fiber post cemented with Activa Bioactive Cement (Pulpdent). To accomplish this, the gutta-percha and sealer were removed from the root canal to two-thirds of the length of the root (Fig. 5).

Fig. 1: Preoperative radiograph shows external resorption.
Fig. 2: Patient presents with swelling of soft tissues around teeth #21 and #22. There is no thermal response, and a pulp tester confirms that #21 is nonvital.
Fig. 3: Shows diagnostic radiograph to determine the working length.
Fig. 4: Radiograph shows AH Plus Paste and gutta-percha points.
Fig. 5: Radiograph with metal matrix strip cut to size and stabilized with a wedge (#21 and #22). Two-thirds of the length of gutta-percha was removed from the root canal to make space for the cementation of a fiber post.
To isolate the tooth, a metal matrix was cut to size, placed between #21 and #22 and stabilized with a wedge. The process was difficult and required some improvisation; a customized metal matrix was a perfect solution. The canal was etched using Etch-Rite for 20 seconds, and the canal was dried with paper points. Dentastic Uno-Duo, a simplified fifth-generation dual-cure bonding system from Pulpdent, was applied to the walls of the root canal. A previously fitted post was treated with silane, cemented with Activa Bioactive Cement A2 shade, and cured with an LED lamp (Figs. 6 and 7). The mesial periodontal pocket on tooth #21 was measured at 5mm.

At the two-month follow-up visit, the soft tissue appeared in very good condition. An examination with a periodontal probe revealed that the pocket was 2mm smaller than at the time of treatment, indicating tissue attachment. The radiograph did not show any negative changes. Radiographs taken at the one-year and two-year follow-up visits showed a healthy tooth (Figs. 8–10). The patient was comfortable and extremely pleased with the outcome.

Case 2: Internal Resorption

Another situation where bioactive cement is useful is with internal resorption, a process that is not entirely understood. It usually proceeds with no symptoms and is discovered only when a routine radiograph is taken. Often described as “internal granuloma,” it usually appears in the front teeth, and often in just one tooth. Some of the possible causes are trauma, systemic diseases and chronic inflammation of the pulp, and may happen after using whitening materials. Its treatment can pose a challenge for the dentist.

Internal resorption is often detected at an advanced stage, when pain develops and severe inflammation occurs from bacterial penetration. For the diagnosis of internal granuloma, a radiograph is helpful and reveals a bubblelike space in the affected tooth. Treatment involves complete removal of the infected tissue, the use of endodontic solutions as well as ultrasound, and final obturation of the root canal.

The essence of treating resorptions, regardless of location and severity, is the radical removal of the pulp and the resorptive granule to facilitate the proper treatment of the resorptive cavity. A prerequisite for endodontic treatment is the preparation of the canal walls so that the obturation material can completely fill and intimately adapt to the canal space.

Depending on the degree of advancement of the internal resorption process, endodontic, prosthetic or surgical treatment is applied.

Internal resorption can be divided into three types:

• **Type A**: A resorptive cavity in the crown of the tooth.
• **Type B**: A resorptive cavity in the root canal.
• **Type C**: A resorption process that leads to perforation of the wall in the root canal.

In addition, resorption can be divided into inflammatory and replacement resorptions. Inflammatory resorption is the development of grainy tissue that leads to the formation of a circular or oval resorptive cavity. Its size depends on the length and dynamics of the decay process.
Replacement resorption leads to the resorption of dentin, with the simultaneous deposition of mineralized tissues in the cavity of the tooth, which histologically resembles bone or root cementum. Ultimately, this can lead to partial and sometimes complete obliteration of the tooth cavity.

A 53-year-old patient came to the office for a comprehensive treatment. There was discoloration of the upper left lateral incisor, #22. The tooth had not been treated endodontically. A radiograph showed resorption in the upper left central incisor, #21 (Fig. 11). Teeth #21 and #22 were checked with a pulp tester, which confirmed that both teeth were nonvital. Endodontic treatment was started.

Root canal treatment was performed on #21 and #22 using standard endodontic solutions: sodium hypochlorite, chlorhexidine, citric acid, EDTA, NaCl and isopropyl alcohol. At the first visit, the entry to the canal was opened to a #40 file. To completely remove the granulation from the resorptive cavity, an ultrasound was also used to activate the NaOCl 5.25% solution. Dexadent with metronidazole was applied for 14 days. At the next visit, the canal was shaped mechanically and chemically, and TempCalaEnhanced was applied for a period of three weeks. After the calcium hydroxide paste treatments, the root canal was obturated with AH Plus Root Canal Sealer and gutta-percha points to the working length as indicated by an apex locator.

At the following visit, both root canals were prepared for fiberglass posts (Fig. 12). Biolorenc posts were cemented with Activa Bioactive Cement (Fig. 13), which is nontoxic, well tolerated by apical tissues, and stimulates the regeneration of root tissues.

Follow-up radiographs were taken 6, 12, 17 and 35 months after the initial treatment (Figs. 14 and 15). The radiographs did not show any changes in the treated teeth. The patient experienced no discomfort, and there were no issues or complications.

**Conclusion**

This technique for treating internal resorption is both efficient and effective and emphasizes the importance of radiographic examination. Panographic images should be made every three or four years as a standard practice. Only through regular visits and radiographic examinations can we effectively find inflammations and resorptions and implement appropriate treatments, including endodontic treatment, before the development of clinical symptoms. With the proper diagnostic tools and materials and the right ideas, we will be ready for these challenges and have everything in place to effectively treat our patients.