

CASE REPORT

Multidisciplinary Approach to the Repair of Vertically Fractured Teeth

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This case report describes the treatment of a vertically fractured upper left second molar. The two segments were extracted separately. The periodontal ligament was protected from damage extraorally by soaking it with Hanks' balanced salt solution. The two segments were bonded with the use of a bio-compatible glass ionomer bone cement and re-planted in conjunction with an expanded polytetrafluoroethylene (gore-tex) membrane. After 1 yr the tooth functions normally and is clinically and radiographically within normal limits.

Vertical root fracture results in serious complications and presently is invariably followed by extraction of all or a segment of the tooth. Attempts to treat this problem are numerous in the literature but as yet a predictable treatment with a long-term successful prognosis has not been reported (1-7).

Predictably successful treatment would involve sterilizing the fractured segments, bonding the segments with a biocompatible material to an acceptable clinical strength, maintaining the health of existing periodontal tissues, and promoting healing with new periodontal attachment over the bonded fracture site. Most previous attempts at treatment have addressed some but not all of these requirements (1-7).

Recent advances in dental fields such as the storage media for the maintenance of the periodontal health of avulsed teeth (8-10), tooth bonding agents which have strength and are relatively biocompatible (11), and barrier techniques for the establishment of new attachment over denuded root surfaces (12) make the treatment of these vertically fractured teeth theoretically feasible.

The following case report describes a multidisciplinary approach to treat a tooth with a mesiodistal vertical root fracture. An attempt has been made to address the theoretical requirements for predictable success.

CASE REPORT

A 22-yr-old Oriental female was referred to the office by a general dentist. She complained of pain in the upper left

second molar which had recently been endodontically treated. Her medical history was noncontributory.

Clinically, all teeth except the tooth in question were non-carious or adequately restored. There were areas of marginal gingivitis. The upper left second molar was restored with an IRM temporary (Caulk Co., Milford, DE) filling placed after completion of root canal treatment. A wide mesiodistal vertical fracture through the tooth was obvious (Fig. 1) and a mesial periodontal pocket of 10 mm was present. Radiographically, the tooth appeared to be adequately endodontically treated. A diffuse radiolucency surrounded the length of all roots (Fig. 2). The tooth was extremely sensitive to percussion and palpation. All surrounding teeth reacted normally to sensitivity testing, percussion, and palpation.

The treatment plan comprised removal of the two fractured segments separately, bonding the segments with a glass ionomer bone cement, and reimplanting the bonded tooth in conjunction with an expanded polytetrafluoroethylene Gore-tex membrane (W. L. Gore & Associates, Inc., Flagstaff, AZ). The Gore-tex membrane would be removed at 6 wk, at which time extracoronary support would be afforded by the placement of a temporary crown. Clinical and radiographic follow-up would be undertaken for 1 year, at which time if the treatment was considered to be successful a permanent crown would be placed.

Adequate anesthesia was obtained with lidocaine with 1:100,000 epinephrine injected buccally and palatally. After removal of the IRM, the buccal and palatal segments and roots were extracted separately and the sockets enlarged with a #6 round bur to facilitate reimplantation of the bonded tooth (Fig. 3). The extracted roots were placed in a 4- × 4-inch gauze soaked with Hanks' balanced salt solution (Fig. 4) and the periodontal ligament was washed continually with the same medium. All internal aspects of the tooth not covered with a periodontal ligament were cleaned with a sterile bur and acid etched. A glass ionomer bone cement (ESPE GmbH, Seefeld, Oberbay, Germany) was evenly spread over the fractured segments and the two segments digitally pressed together for 1 min without touching the periodontal ligament (Fig. 5). The tooth was then replanted after less than 5 min in conjunction with a gore-tex membrane (Fig. 6). Sling sutures were placed to act as a functional splint for the replanted tooth.

At 6 wk healing appeared to be normal and the Gore-tex membrane was removed. At that time a temporary crown



FIG 1. Photograph of maxillary left second molar. A wide mesiodistal fracture through the tooth can readily be seen.



FIG 2. Preoperative radiograph of maxillary left second molar. The endodontic treatment appears to be adequate. A diffuse radiolucency is present around the length of all roots.

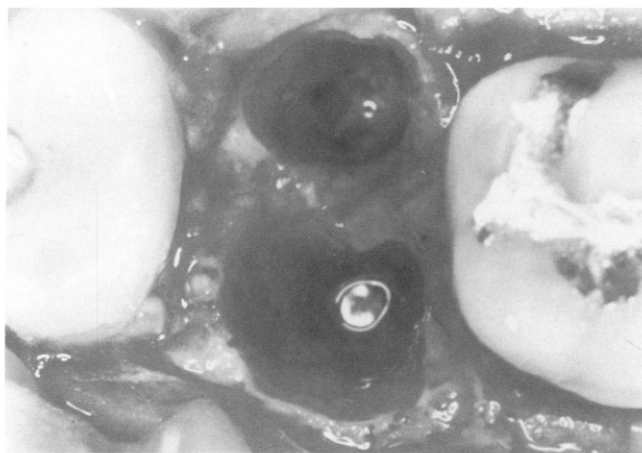


FIG 3. Photograph of extraction sockets after removal of the roots separately. The sockets have been enlarged with a #6 round bur to facilitate reimplantation of the bonded tooth.

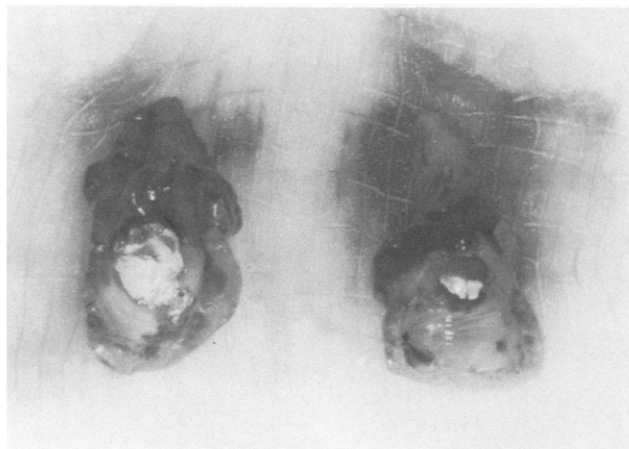


FIG 4. Photograph of the extracted roots. The roots are immediately placed on a 4- × 4-inch gauze and continually soaked with Hanks' balanced salt solution until bonding and reimplantation.



FIG 5. Photograph of tooth segments during the bonded procedure. The bone cement was evenly spread over the fractured segments and the two segments are digitally pressed together for 1 min. The periodontal ligament is not touched during bonding.

was placed on the tooth to allow additional extracoronary support.

At 6 months clinical and radiographic follow-up were within normal limits, periodontal probing revealed that the



Fig 6. Photograph of reimplanted tooth. A Gore-texR (expanded polytetrafluoroethylene) membrane has been sutured over the fracture lines to inhibit epithelial downgrowth and allow new attachment to form over the denuded root surface.



Fig 7. Radiograph at the 1-yr follow-up examination. Healing appears to be normal.

mesial 10-mm pocket had disappeared, and all probings around the tooth were 2 or 3 mm. At 1 yr the tooth functioned normally, and probings around the tooth were all within normal limits. Radiographically healing appeared to be normal (Fig. 7). At this time a permanent crown is planned.

DISCUSSION

In this treatment method, recent advances in different fields of dentistry have been incorporated in an attempt to solve the problems of previous treatment methods for vertical root fractures.

In 1984 Oliet (5) used a similar treatment technique with disappointing results. He extracted the separated segments, completed the endodontics extraorally, bonded the teeth with a cyanoacrylate cement, and reimplanted the teeth in approximately 30 min. One tooth refractured and in the other two deep pocketing and resorption was seen.

In our case the segments were similarly extracted but the periodontal ligament was immediately soaked with Hanks' balanced salt solution which has been found to maintain the

viability of periodontal ligament cells for extended periods (9). In our case because the root canal treatment was adequate quick replantation was possible. Had this not been the case, an attempt would have been made to treat each root intraorally before extraction. However, since the storage medium used has been shown to maintain periodontal cell viability for an extended period of time, the root canal treatment including an apicoectomy could safely have been completed extraorally if necessary. The bonding material in our case was a glass ionomer bone cement (11). This cement is used extensively in plastic and orthopedic surgery and has been shown to be extremely well tolerated by the bone (11). As yet the bond strength of this material is unknown and tests are currently being performed to test its strength relative to other materials including the cyanoacrylate used by Oliet (5). Because we do not know the strength of bond, we placed a temporary crown at 6 wk in order to provide additional extracoronary support.

The technique used in this case, which we feel is of critical importance for long-term success, is replantation in conjunction with the expanded polytetrafluoroethylene (Gore-tex) membrane. This membrane stops epithelial downgrowth along the fracture line and the connective tissue is kept away from the root surface long enough for the periodontal ligament to repopulate the fracture site (12). Thus, the pocketing associated with these fractures is eliminated. In Oliet's report (5) the membrane barrier technique had not been developed, and in the two cases that were retained in the mouth a deep pocket and lateral resorption was reported.

Stewart (6) has reported some success in vertical fracture treatment with the use of glass ionomer cement used within the root canal. Presumably, the cement flows into the fracture line and bonds the root segments. It has also been shown that the use of glass ionomer root canal sealer strengthens the tooth against fracture (13). However, it is unlikely that Stewart's technique (6) would be successful when the two fractured halves are completely separated as they were in this case. The technique proposed by Stewart (6) seems to be appropriate, therefore, in incomplete fractures where the cement could possibly flow into the fracture line.

Ideally, we would want many more cases with long follow-ups before a claim could be made that the treatment method is predictably successful. This one case is presented somewhat prematurely because of its theoretical correctness and most importantly because of the lack of alternate treatment methods for vertically fractured teeth.

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You Might Like to Know

A prospective study (*J Clin Epid* 44:355) of a large class of persons who never smoke or drink and many of whom are vegetarians found that 1 in 8 lived to be 91 years or older and that moderate to heavy physical activity was maintained until 95.6 years of age. Some would view this as a cautionary tale for those who live "la dolce vita." Others might say it depends on how you define being alive.

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