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CLINICAL AID

Transillumination of the Beveled Root Surface: An Aid to Periradicular Surgery

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A technique utilizing fiberoptics to transilluminate a beveled root surface during periradicular surgery is described. This procedure when integrated with other standard endodontic surgical aids may help diagnose apical variations and vertical root fractures.

Fiberoptic transillumination has been used as a diagnostic and treatment aid in dentistry since the 1960s (1). Transillumination, especially of anterior teeth, has been successful in detecting caries (2) and diagnosing vertical root fractures (3, 4). When used as an adjunct to other diagnostic techniques, transillumination can confirm that a tooth has an incomplete crown fracture or vertical root fracture (5). Hill (6) concluded that transillumination is an adjunct to conventional methods in determining pulpal vitality in anterior teeth and in minimally restored posterior teeth. In periodontal therapy, fiberoptics can be useful in detecting subgingival calculus on root surfaces (7). When performing periradicular surgery, the surgical area can be effectively illuminated when a fiberoptic light source is attached to various aspirator tips, mouth mirrors, or retractors (8). Transilluminating the floor of a pulp chamber causes a canal orifice to appear as a dark spot surrounded by illuminated dentin which can be very helpful in locating calcified canals (9).

Periradicular surgery has become a routine yet demanding part of endodontic practice. Strategic anatomical structures, e.g. the mandibular canal, mental foramen, maxillary sinus, greater palatine foramen, and the incisive canal, can complicate access to the periapical area. Even with excellent surgical access, complex anatomical variations in canal systems add to the technical challenge of periradicular surgery (10).

In recent years, technological advances have aided in overcoming some of the more difficult aspects of periradicular surgery. The development of microhead handpieces and miniature amalgam carriers allows for more effective retrograde preparation and obturation. Bellizzi and Loushine (8) described the use of fiberoptics for illumination of the surgical field and special handpieces and optical magnification as adjuncts to posterior endodontic surgery. Cambruzzi et al. (11) demonstrated that methylene blue dye can be used to delineate root outlines and identify isthmuses between canals. Most recently, the introduction of surgical microscopes and ultrasonic root end preparation techniques has dramatically improved our ability to visualize, debride, and prepare the root end cavity.

The purpose of this article is to describe a periradicular surgical technique that utilizes a fiberoptic wand or handpiece to transilluminate the surgical site and improve the visualization and diagnosis of the resected root end.

CLINICAL TECHNIQUE

Prior to performing endodontic surgery, vertical root fractures and untreated canals must be considered in the differential diagnosis. To help detect these conditions during surgery, fiberoptic transillumination has become an indispensable part of our armamentarium. After the incision, the surgical reflection of soft tissues, osseous removal, and the curettage of any existing inflamed periapical tissues, the root end is

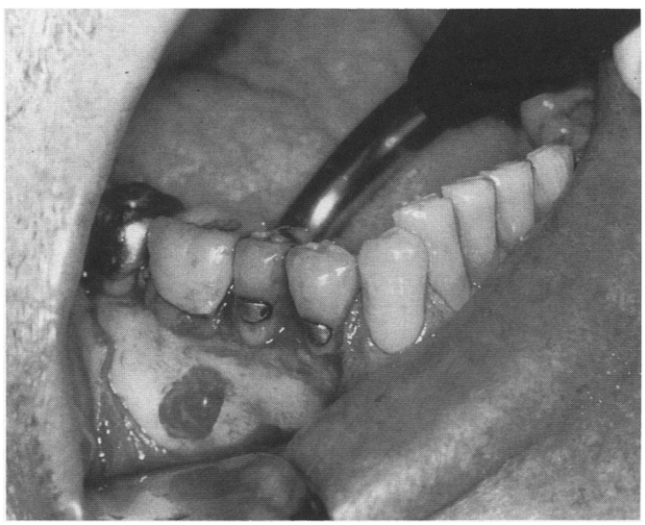

FIG 1. A lingually positioned fiberoptic wand illuminating the beveled root surface of a resected root.

FIG 2. The isthmus between the mesial canals of a mandibular first molar becomes apparent when the root is transilluminated (*arrow*).

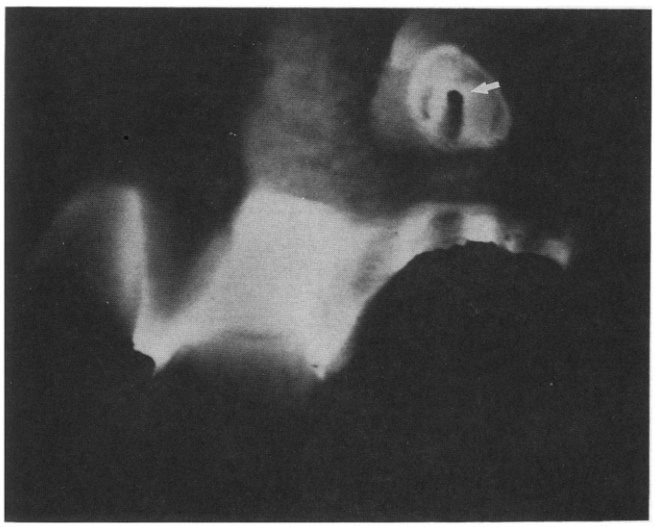

FIG 3. The resected mesial buccal root of a maxillary first molar is transilluminated to evaluate the debridement and obturation of the canal and for the presence of anatomical variations (*arrow*).

beveled on an angle that is appropriate for the individual case. If a retrofill exists, it is completely removed. The fiberoptic wand or fiberoptic handpiece is then positioned to the lingual or palatal aspect of the root that has been resected (Fig. 1). The room lights and the patient treatment lights are dimmed or turned off to better observe the transilluminated root surface. The fiberoptic wand is moved along the arch until the light penetrates the palatal or lingual gingiva and bone and illuminates the beveled root surface and bone surrounding the root. Subtle changes in the direction of the light beam produce significant changes in illumination. Vertical root fractures, seen as dark lines, are more clearly identifiable both on the beveled root surface and on the facial root surface when cortical plate dehiscences exist. Because excessive hemorrhage in the surgical field may give a false indication of anatomical variations or other root defects, adequate hemostasis is critical. If the fiberoptic light source is adjustable, the intensity of the light may need to be varied to give an optimal view of the beveled root surface. When the beveled root surface is transilluminated untreated calcified canals or isthmuses will appear as dark spots or lines between canals. Upon completing the retrofilling preparation, the root end is again transilluminated and if the cavity preparation is considered to be adequate the retrofilling material is placed.

DISCUSSION

Transillumination of the beveled root surface during periradicular surgery offers many potential benefits. These include detection of vertical root fractures (12); location of calcified, undebrided canals (13); evaluation of complete circumferential resection of the root end; detection of unusual apical anatomy; detection of extra canals; location of fins and isthmuses between canals (Fig. 2); and the evaluation of the quality of debridement and obturation of the root canal (Fig. 3). As an operator's visibility improves, his or her diagnostic and technical skills also improve. When coupled with some form of surgical magnification (8), transilluminating a beveled root surface from the lingual or palatal area dramatically increases an operator's ability to visualize the entire surgical field.

There are a number of fiberoptic systems on the market that can be used for this transillumination technique. These systems vary in price depending on their sophistication. A most important feature to be aware of is the intensity of the light source. To illuminate the beveled root surface, the light source must have sufficient power to penetrate soft tissue and bone. In addition, it is advantageous to select a system that offers a variable intensity control that allows one to make adjustments to compensate for the lingual to buccal thickness of the gingiva, bone, and root.

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The Way it Was

Surely one of the most crucial discoveries of this century in the basic sciences was Hodgkin and Huxley's demonstration of the transmembrane ionic currents which underlie the action potential. They achieved initial experimental success in August 1939. World War II started 3 weeks later, and it was not until 1947 that work continued.

Had the two scientists not survived military service, the advances in pain control and understanding of neurological disease which are based on their work may not have occurred.

Who can know what great—or monstrous—deeds were lost with those less lucky in the war.

P. Bernstein