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Methylene Blue Dye: An Aid to Endodontic Surgery

Tintura Azul de Metileno: Una Ayuda para la Cirugia Endodontica

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Methylene blue dye can be a useful aid in endodontic surgery. The differential staining of methylene blue outlines roots, delineates root dentin from bone, demarks isthmuses between two canals in a single root, and outlines cysts for enucleation.

La tintura azul de metileno puede ser una ayuda eficaz en cirugía endodóntica. El teñido diferente del azul de metileno delinea las raíces, delimita la dentina radicular del hueso, demarca los istmos entre dos conductos de una raíz y bosqueja los quistes para su enucleación.

In dentistry, methylene blue dye (injection USP 1%; American Quinine Co., Inc. Shirley, NY) is mainly used for laboratory research. In endodontics, it is used most often in marginal leakage studies to stain and locate those areas of the root canal system not sealed by the obturating material (1). It is also used to treat methemoglobenemia due to prilocaine toxicity (2, 3).

Methylene blue dye is often used in general medicine. It is injected intravenously to evaluate renal function. General surgeons inject the dye into sinus tracts that dissect through healthy tissues from a source of infection, making the outlined tracts easier to identify and remove.

Vital staining with methylene blue dye has been used previously by us to selectively stain tissue during molar surgery (4) when the ability to differentiate tooth from bone is hindered by poor visibility, excessive bleeding, or unusual root anatomy. Once the root has been located and the initial resection accomplished, methylene blue dye (Fig. 1) is dabbed onto the amputated root surface with a sterile cotton pellet for 1 to 2 min. The surgical area is then washed with sterile saline solution. The remaining dye will stain not only the internal root canal anatomy exposed by the resection but also the periodontal ligament (Fig. 2). Such differential staining outlines the root anatomy enhancing the operator's ability to complete the resection of the root and to expose any existing isthmuses (Fig. 3). If an isthmus of pulp tissue joining two canals in a single root is exposed by resection, the apical amalgam must be placed so that the two canals as well as the isthmus will be filled and sealed (4, 5).

Methylene blue dye has also been used in an earlier research study to determine the incidence of isthmuses connecting two canals in single roots (4). The study

FIG 1. One-milliliter ampule of methylene blue dye (sterile solution) used to stain vital tissues.

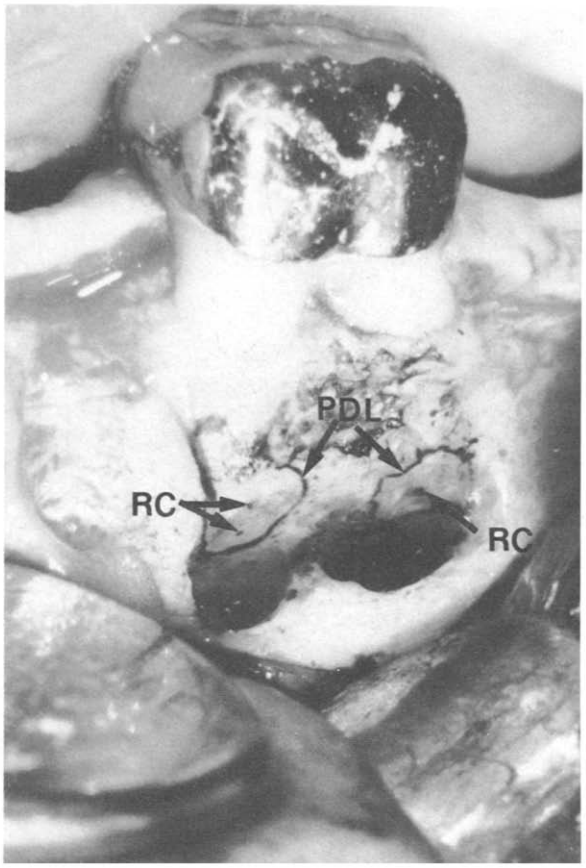


FIG 2. Resected mandibular molar stained with methylene blue dye. Note how easily the root canals (*RC*) and the periodontal ligament (*PDL*) can be visualized after staining.

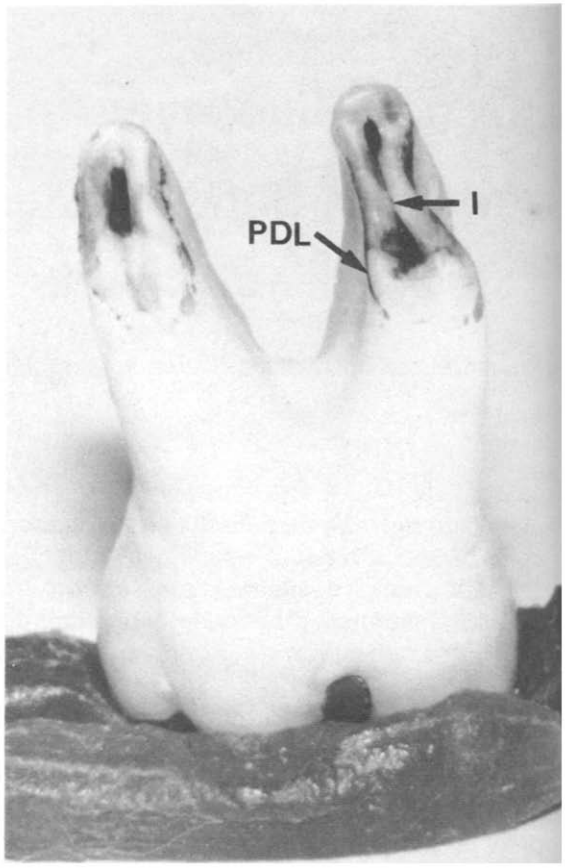


FIG 3. Extracted mandibular molar apically resected and stained with methylene blue dye. Note the presence of an isthmus (*I*) of pulp tissue joining the buccal and lingual canals in the mesial root. Note also the staining of the remaining periodontal ligament (*PDL*) on the mesial root.

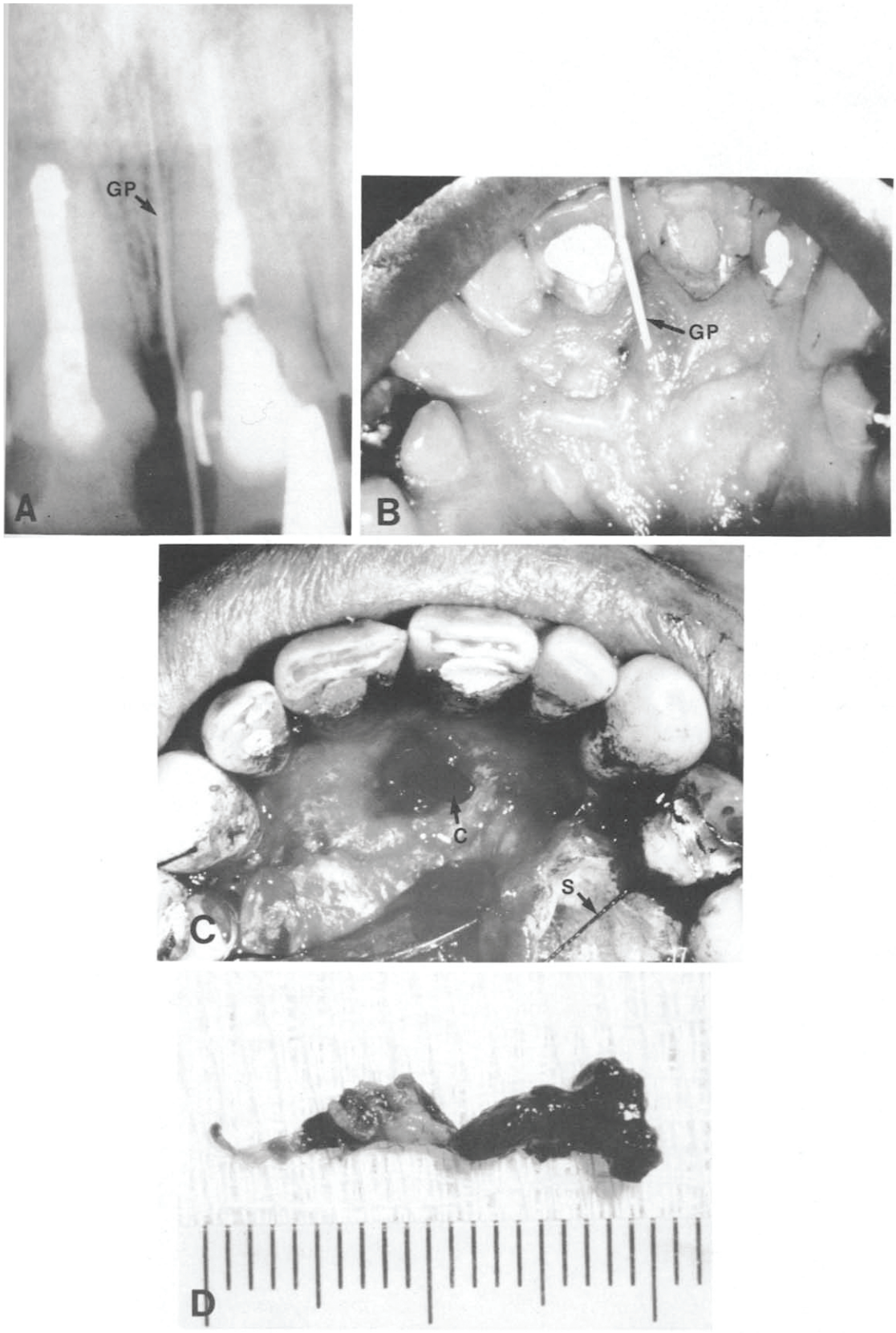
showed that isthmuses were present in 60% of the mesial roots and 15% of the distal roots of mandibular molars as well as in 30% of the mesiobuccal roots of maxillary molars. These results generated the interest in using the technique clinically. The dye can also be used to delineate apical (vertical) fractures, but such defects are usually defined by fiber-optic transillumination.

Vital staining with methylene blue is also helpful when surgically enucleating cysts. For these cases, the dye is injected into the cyst prior to the surgery, sometimes through an existing sinus tract.

The case presented in Fig. 4 is representative of this technique and shows the dissection and removal of an incisive canal cyst that was not clearly visible on radiographic examination. The treatment need was determined following an evaluation of the history and clinical examination. The patient's chief complaint had been a sensation of tightness and pressure in the anterior palate accompanied by a bad taste and bad breath. Close scrutiny and careful drying of the incisive papilla area showed a small bead of moisture associated with a sinus tract stoma in the center of the papilla. This stoma readily accepted a gutta-percha point as an indicator. The tract is shown clinically and radiographically (Fig. 4, *A* and *B*). After the involved tissues were anesthetized, methylene blue dye was injected directly into the cyst cavity via the sinus tract until the cyst cavity was overflowing. Once the flap was retracted, the inner cyst wall was observed to be stained blue and the cyst sac was clearly delineated from the surrounding normal tissues, greatly facilitating the cyst's removal.

Microscopically (Fig. 5), the specimen was found to consist of fibrous connective tissue surrounding a compressed central lumen lined incompletely with respiratory epithelium and modified stratified squamous epithelium. Large nerve trunks and clusters of muccous acini were also identifiable. Some fibrosis, lymphocytes, and plasma cells were noted. A diagnosis of incisive canal cyst was made (6). The patient healed uneventfully and there has been no recurrence of his complaint for over 2 yr.

Methylene blue dye staining has been especially useful for difficult cases of apical surgery that require maximum visualization and delineation of the surgical field. As a teaching aid, vital staining may be beneficial for students during the initial stages of clinical exposure



g 4. *A* and *B*, Radiographic (*A*) and clinical (*B*) appearance of an incisive canal cyst. The gutta-percha (*GP*) cone delineates the sinus tract diographically. *C*, Palatal flap reflected (first bicuspid to first bicuspid) exposes stained cystic tissue (*C*). Note lack of bleeding in general. Suture) tied to bicuspid to aid in flap extraction. *D*, Resected cyst with the inner lining, stained blue, shining through the cyst wall. Stain does not erfere with histopathological examination.

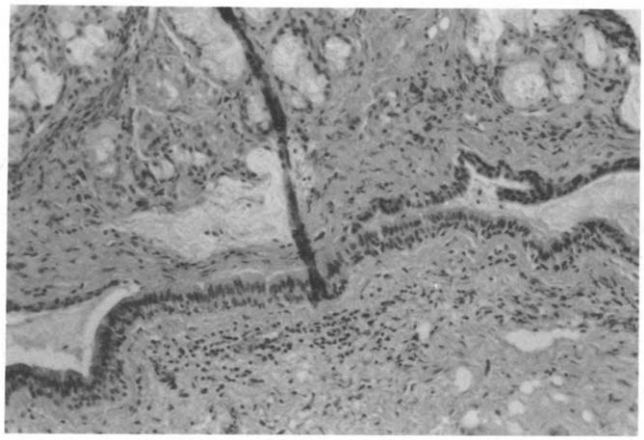


FIG 5. High-power view of the lesion. Note the respiratory epithelium and also the inflammatory infiltrate. Original magnification ×30.

to surgery because of its ability to outline normal anatomy to the inexperienced operator.

Several uses of methylene blue dye in the clinical practice of endodontic surgery have been outlined. The differential staining of methylene blue outlines roots, delineates root dentin from bone, demarks isthmuses between two canals in a single root, and outlines cysts for enucleation.

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