Decompression of large periapical cystic lesions

Elmer J. Neaverth, DDS, and Hans A. Burg, DDS, MS

The removal of extensive periapical cystic lesions by surgical enucleation frequently causes postsurgical sequelae, such as devitalization of adjacent teeth, patient apprehension and discomfort, loss of bony support and, on occasion, paresthesia. An alternative approach is presented, whereby a tube is inserted into the cystic cavity. This tube is then periodically reduced in length as the lesion heals.

Management of large periapical lesions that resist conventional therapy or that are interpreted as cystic in nature is somewhat questionable. When encountered, re-treatment, apicoectomy, tooth extraction, or some form of surgery to enucleate the lesion have been suggested.[1-3] Surgery with complete enucleation may be the most expeditious method of management. However, this approach may create certain undesirable complications that are detrimental to the well-being of the patient. Large radiolucent lesions often encroach on the apexes of adjacent vital teeth as well as other anatomic structures, such as the mandibular canal, maxillary sinus, floor of the nasal cavity, and the palatal vault. The surgical enucleation of these large lesions could compromise the vitality of adjacent teeth, seriously jeopardize their osseous support, or result in nerve damage. These complications can and should be avoided whenever possible. The ideal therapy, therefore, would be to first eliminate the lesion, or at least reduce the size of the lesion by decompression. Then, if enucleation was still considered necessary, there would be less danger of injury to adjacent vital structures. However, in most instances, enucleation of periapical lesions is not indicated because these lesions and the concomitant acute inflammation normally heal spontaneously after endodontic therapy. There is clinical evidence to support our theory that decompression enhances this biological response through the continuous elimination of the metabolic debris associated with the lesion.

The purpose of this article is to call attention to certain differences between the marsupialization and decompression as methods of therapy for the management of large cystic lesions; to discuss the pathogenesis of cysts and the potential for healing; to describe a technique of decompression; and to present several case reports that demonstrate this technique.

MARSUPIALIZATION

Marsupialization is synonymous with the term "Partsch operation." This procedure, named after Partsch,[4] one of the first individuals to describe a technique for reducing the size of large cystic lesions. Marsupialization (Partsch operation), as described in the literature,[2] consists of unroofing the outer wall of the cyst by making a surgical incision, evacuating its contents, and establishing a large permanent opening by suturing the remaining part of the cystic membrane to the mucosal surface around the periphery of the opening. This procedure relieves the pressure and allows the natural repair processes of the body to restore the original bony contour as the cyst is exteriozied. Although this conservative approach preserves the lining mucosa to prevent the exposure of bare bone to infection from the mouth, it has several disadvantages. When these large windows are established, they may be located in a position that is inconvenient for the patient to keep clean. Also, these large lesions that are marsupialized tend to heal more slowly than comparable lesions that are treated by other surgical means. Marsupialization lends itself well to the management of certain types of cysts, especially those that are large and those in which the most remote part of the cyst is surgically inaccessible. In our opinion, however, marsupialization is not particularly useful in treating radicular cysts.

DECOMPRESSION TECHNIQUE

Although this intubation technique has been referred to as marsupialization,[5] we think that there are enough differences to consider a more descriptive terminology and have, therefore, referred to it as a decompression technique. An attempt to exteriorize the lesion, as in marsupialization, is not made. Instead, the internal cystic pressure is relieved by decompressing the lesion and disrupting those conditions that favor cystic perpetuation and patient discomfort. Decompression is a minor surgical procedure whereby a small opening is made into a cystic cavity and maintained to relieve pressure and to ensure constant drainage. This opening is kept patent by using an indwelling catheter until the cystic perpetuating conditions have been altered sufficiently to anticipate uneventful healing. The altered conditions include the cessation of drainage, the elimination of metabolic debris from apical area, a reduction in size of the cystic space, and the alleviation of patient discomfort. Only then is the opening allowed to close. This technique of eliminating cystic lesions is based on the theory that given constant drainage a cystic cavity will gradually diminish in size.[6] The technique of decompression described in this paper is similar to those proposed in the literature,[3,5,6] but with certain modifications. By using this technique we anticipate aiding the normal biological responses that stimulate more rapid healing and eliminating the need for a more extensive surgical procedure.

To accomplish this decompression, many types of devices have been used to maintain the patency of the opening. Sommer and associates[3] used a rubber dam "I" wick; Thomas,[6] a metal tube; and Freeland,[5] polyethylene or polyvinyl tubing. The polyvinyl tube possessed the more ideal qualities for this study and we used this kind of tubing in the past. It was, however, brought to our attention that, if the tube was inadvertently swallowed, aspirated, or otherwise dislodged from its position, it then might not be readily located within the body by examination radiographically. Realizing the possibility of aspiration, and other associated complications, we now recommend using only radiopaque tubing in the decompression management of large cysts. Used in various medical treatments, radiopaque tubing is available as urethral, percutaneous, and angiographic catheters (Fig 1). The type of tubing we found most advantageous is an umbilical artery catheter, size 8 FR (French scale), (Fig 1D), which gives a lumen diameter of approximately 1.5 mm (Argyle umbilical artery catheter, Sherwood Medical Industries Inc, St. Louis). The tubing can be precut into 2-inch lengths, sterilized according to the type of material used, and packaged ready for use.

TECHNIQUE

Realizing the inadequacy of accurately determining the type of radiolucent lesion that is seen in a radiograph, we established certain requirements for the tentative diagnosis of cysts in this study. When the periapical lesion met these requirements, it was provisionally classified a periapical cyst: a large radiolucent lesion (200 mm^2)[7]; nonvital tooth or teeth associated with the lesion; copious drainage from the canal during root canal therapy; a cystic cavity encountered during

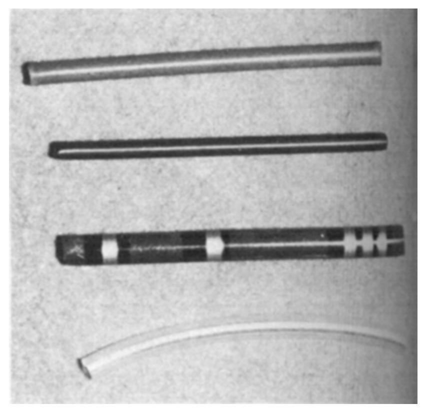

Fig 1—Various sizes and types of radiopaque tubing; A, angiographic catheter; B, percutaneous catheter; C, urethral catheter; D, umbilical artery catheter.

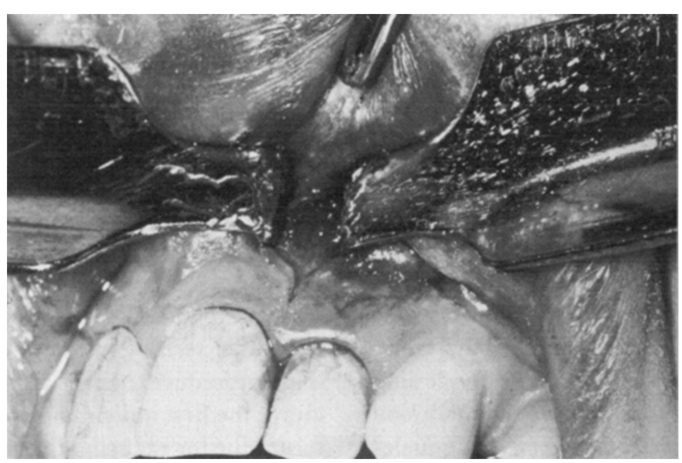

Fig 2—Tissues retracted to expose intact labial cortical plate of bone.

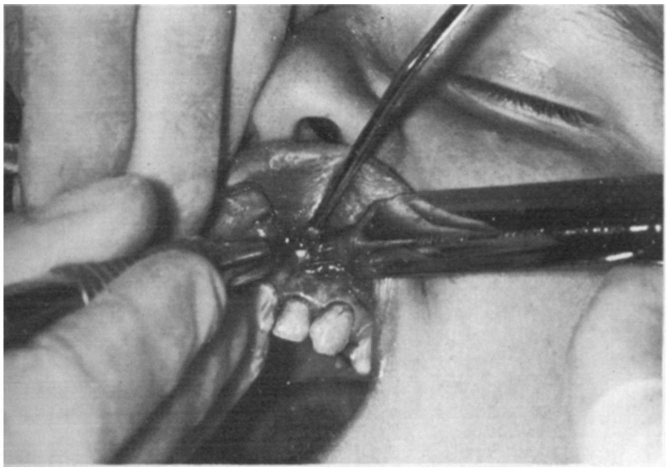

Fig 3—Cortical plate of bone is penetrated with round bur.

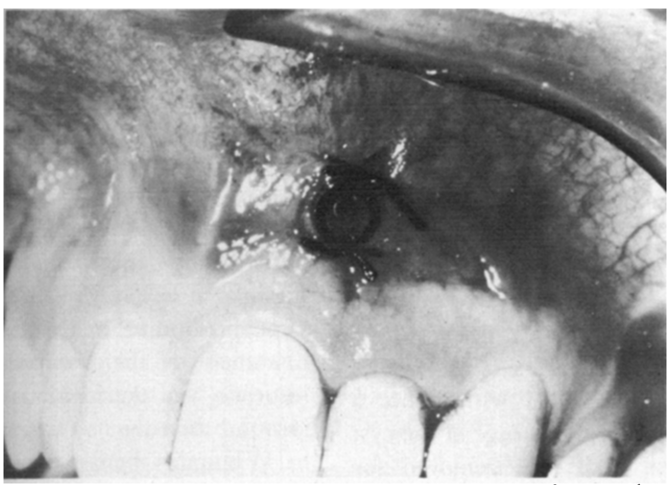

Fig 4—Tissue incision is sutured to form collar around exposed end of tube.

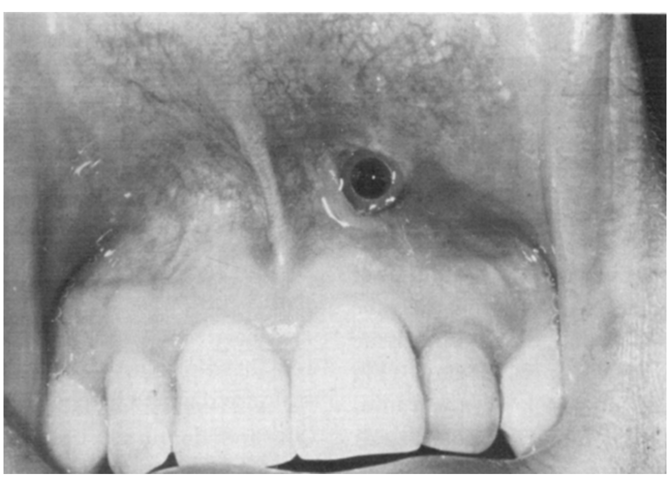

Fig 5—One week after suture removal. Note excellent tissue adaptation around plastic tube.

decompression, through the center of which a tube could freely pass.

The procedure of decompression is performed with the patient under local anesthesia. The technique consists of making a small vertical incision through the mucoperiosteum, above or midway between the roots and overlying the cystic lesion. The edges of the incision are separated to expose the labial or buccal bone (Fig 2). If an intact cortex is encountered, an opening is made through the bone into the cystic cavity with a small chisel or round bur (Fig 3). This opening should be made as far coronally as the cavity will permit to afford optimal soft tissue adaptation. Where feasible, a small piece of tissue should be taken for biopsy examination. Often, however, it is difficult to obtain a representative biopsy sample through a small opening. There is also evidence in the literature that suggests that cysts frequently do not have an intact epithelial lining.[8] In such cases, biopsy examinations would be inconclusive. The contents of the lesion are aspirated, and the cavity is then gently irrigated. A short piece (2 inches) of sterile radiopaque tubing is gently inserted to the depth of the cavity. The tube is then trimmed to fit so that the protruded end is flush with the labial mucosa with just sufficient elevation to prevent the mucosa from closing over its edges. The base of the tube should rest in the depth of the cavity to prevent slippage into the lesion. The tissue incision is sutured to form a collar around the exposed end of the tube (Fig 4). The sutures should be removed in several days. The patient is then shown how to irrigate the cavity with a small syringe using water. The patient should be seen every 10 days for an adjustment of the tube as it is forced out by the resolution of the cystic cavity (Fig 5). The root canal obtura-

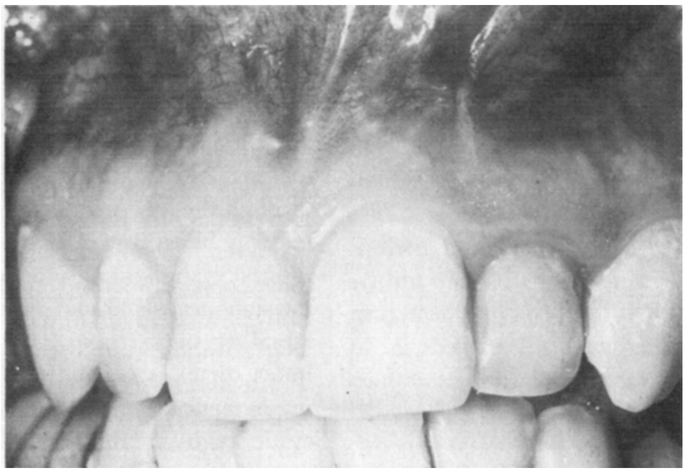

Fig 6—Tissue orifice healed three days after tube removal.

tion is accomplished at any time during therapy when the canal is dry.

The treatment of decompression can last more than a year, depending on the size of the lesion and the rate of healing[5]; however, leaving the tube in for only several weeks has proved equally effective. A study is currently under investigation to determine the optimum time for removal of the tube. At present, the time of removal of the tube is left to the discretion of the operator, once there is clinical evidence that the potential problems of the cystic lesion have been eliminated. After the tube has been removed, the aperature can close uneventfully within several days (Fig 6).

CASE REPORTS

Case 1

A 22-year-old white woman had a moderately symptomatic swelling of the left anterior maxillary vestibule. She related a history of trauma that had occurred two years before. Radiographs showed a large radiolucent lesion (Fig 7, left). The left central and lateral incisors were pulpless and were treated with root canal therapy (Fig 7, middle). During root canal treatment, copious amounts of fluid were removed through the root canals. A vertical incision was made between the root eminences of the two pulpless teeth, and the tissues retracted to expose the intact cortex (Fig 2). The cortex was penetrated with a no. 6 round bur (Fig 3). A wedge of the cyst capsule and wall was removed for biopsy to verify the nature of the lesion histologically. A polyvinyl tube was inserted into the lumen of the lesion and sutured superiorly and inferiorly after the maximum depth of the cystic space had been ascertained (Fig 4). One week after the suture had been removed, there was excellent tissue adaptation, and the plastic tube could be removed with ease by the patient for cleaning. Five weeks after initiation of the decompression procedure, the tube was removed permanently. The tissue orifice healed within three days (Fig 6). Thirteen months later, the radiograph showed complete osseous repair (Fig 7, right).

Case 2

A 32-year-old man was referred to the endodontic service for evaluation and treatment of the maxillary lateral incisor. Intraoral examination showed a tender swelling of alveolar mucosa between the roots of the lateral incisor and canine. The lateral incisor failed to respond to electrical or thermal pulp testing. All other teeth in the area tested vital although several defective restorations were seen (Fig 8, left).

After the pulp chamber of the maxillary lateral incisor, was opened, a copious amount of exudate flowed from the tooth. After the patient was given a local anesthetic, a small opening was established in the periapical lesion through a simple vertical incision. Limited surgical access prevented the collection of a biopsy sample. A small radiopaque tube was inserted into the opening to the depth of the periapical lesion through the incision. The protruding end of the tube was trimmed to the level of the labial mucosa, and the incision was sutured around the tube.

Within 24 hours, the swelling had subsided, and the patient was comfortable. The sutures were removed on the following day. The tube was checked at two-week intervals and adjusted as the lesion decreased in size, forcing the tube from the bony cavity. The tube was removed four months after the decompression procedure was initiated. The aperture closed within three days, and healing continued uneventfully (Fig 8, right).

Case 3

A 21-year old man was referred to the endodontic service for re-treatment of a painful maxillary lateral incisor before placement of crowns. Intraoral examination disclosed that the mucosa

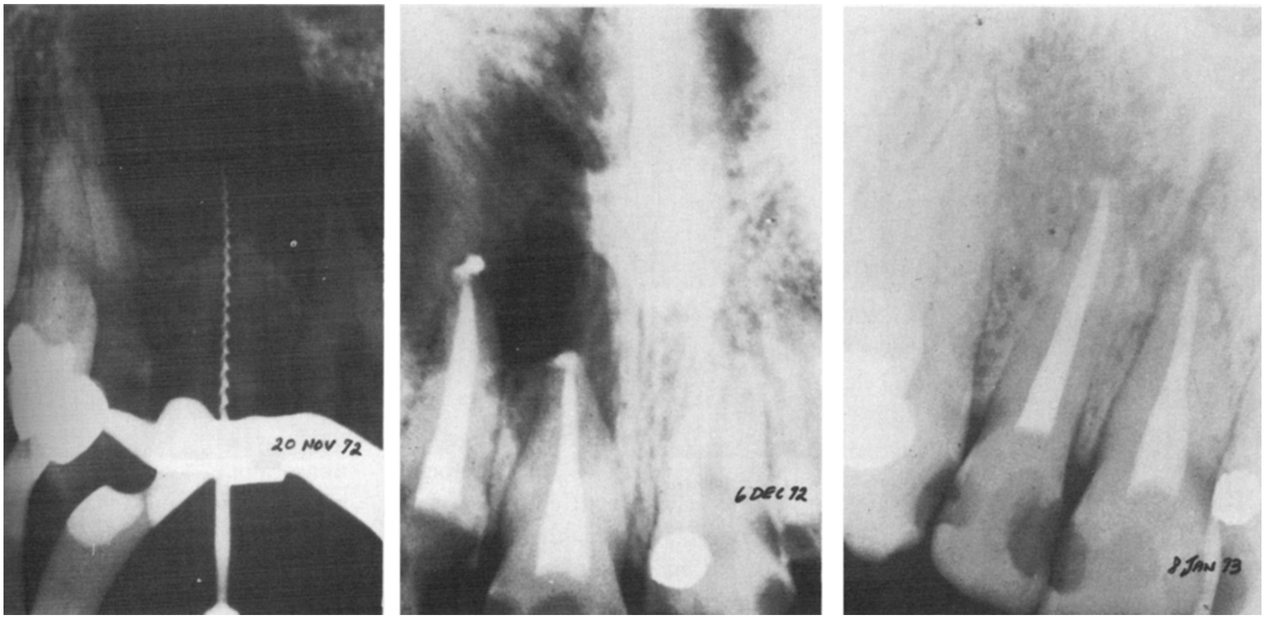

Fig 7—Left, preoperative radiograph. Note extensive rarefaction. Middle, endodontic therapy completed. Decompression tubing present but very difficult to visualize. Right, follow-up radiograph at 13 months shows complete osseous healing.

overlying the lateral incisor was slightly distended and tender to touch. The lateral incisor was open, but there was no apparent drainage. An old root canal filling had been removed during a previous emergency dental visit without relief of symptoms. The radiograph showed a large radiolucent area of approximately 2 cm in width. Also a bayonet-shaped root tip had apparently been filled short of the apex (Fig 9 left).

The area was anesthetized, and an attempt was made to negotiate the apical curvature but with little success. The patent part of the canal was biomechanically prepared and temporarily sealed. Drainage was then established with the placement of a radiopaque tube through the labial mucosa into the depth of the periapical lesion (Fig 9, middle). The protruding end of the tube was adjusted level with the labial mucosa. The patient was checked at two-week intervals, and the root canal was completed at a subsequent visit. The tube was removed permanently approximately a year later. The aperture closed uneventfully in five days. Recall in three months showed no recurrence of clinical swelling or symptoms, and the radiograph taken at that time showed good osseous repair of the defect (Fig 9, right).

Case 4

A 52-year-old white man, a periodontal maintenance patient, was referred for evaluation of a soft, compressible swelling in the left posterior maxilla associated with the first molar. The lesion (Fig 10, left) was asymptomatic, and the patient was unaware of its presence. During root canal therapy, large quantities of fluid were again draining through the root canals. On the subsequent visit, the root canals were obturated with gutta-percha (Fig 10, top right), and a superficial vertical incision was made through the buccal mucosa. No osseous tissue was encountered. A biopsy of the lesion disclosed an epithelial-lined cavity; the lesion was intubed with a plastic tube. The tube was permanently removed six weeks after the initial decompression, and the orifice closed within a week. A three-month postoperative X ray showed initial osseous healing (Fig 10, bottom right).

DISCUSSION

The maxilla and mandible are uniquely involved with a variety of epithelial-lined cysts, both odontogenic and nonodontogenic in origin. The nonodontgenic cysts develop from epithelial linings of the facial processes. After fusion of the bony processes occurs, epithelial rests may remain embedded in bone along the suture lines, which when stimulated may develop into epithelial-lined cystic

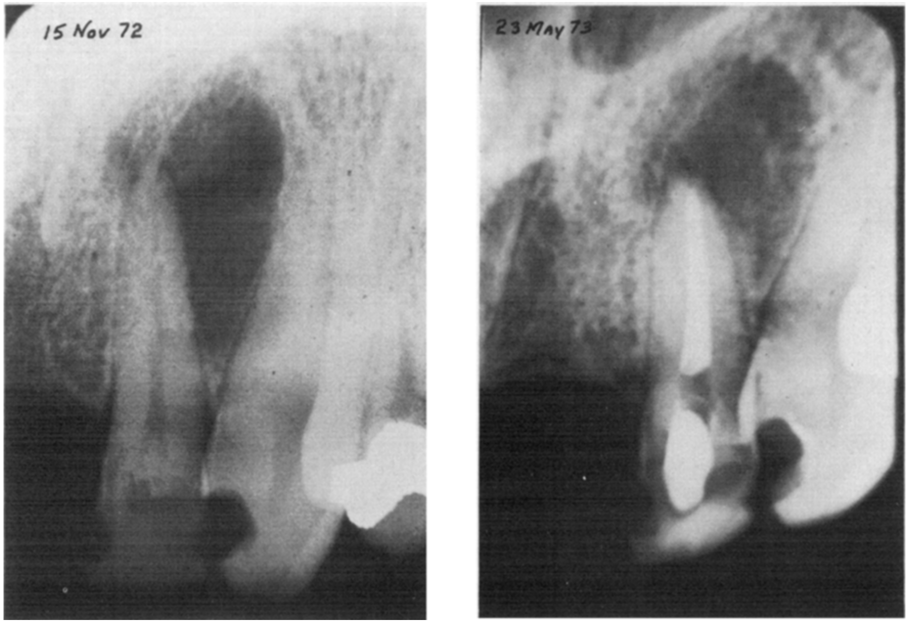

Fig 8—Left, preoperative radiographs. Note extensive rarefaction and root displacement of lateral incisor. Right, follow-up radiograph six months after initiation of treatment.

spaces. The odontogenic cysts are derived from either undifferentiated epithelial residues of the dental lamina (primordial cysts), or from differentiated epithelial rests of malassez (radicular cysts) normally found in connective tissue around the roots of teeth; and they are also in granulomatous tissue masses near the apex or lateral aspect of a root.[8]

Toller[9] suggests a genetic process, whereby epithelial remnants are either suppressed or disposed of after the formative stage of development. Unfortunately, not all epithelial rests are eliminated, and these may be "switched on" again to proliferate anew under certain conditions.

Ten Cate[10] has demonstrated that these apparently inactive epithelial cell remnants (rests of Malassez) are able to remain dormant, using an intracellular chemical reaction known as the Pentose shunt for low-energy glycolysis. Reactivation of these dormant cells appears to be initiated by an inflammatory reaction.

Two mechanisms of epithelial proliferation are described in the literature.[11] One possible mechanism is when a pathological space, such as an apical abscess, may already exist and epithelial cells proliferate along the walls of the space until it is totally lined with epithelial tissue. Another possibility may occur when no previous pathologic cavity exists, and epithelial cells proliferate in all directions, along connective tissue cords, eventually forming a mass of epithelial cells. Shear[12] describes the typical arcading and ringing effect of proliferating epithelial tissue around cores of vascularized connective tissue when viewed histologically. He also points out that epithelium relies on diffusion from the connective tissue for nutrition and elimination of metabolic waste. As the epithelial mass enlarges, the inner-

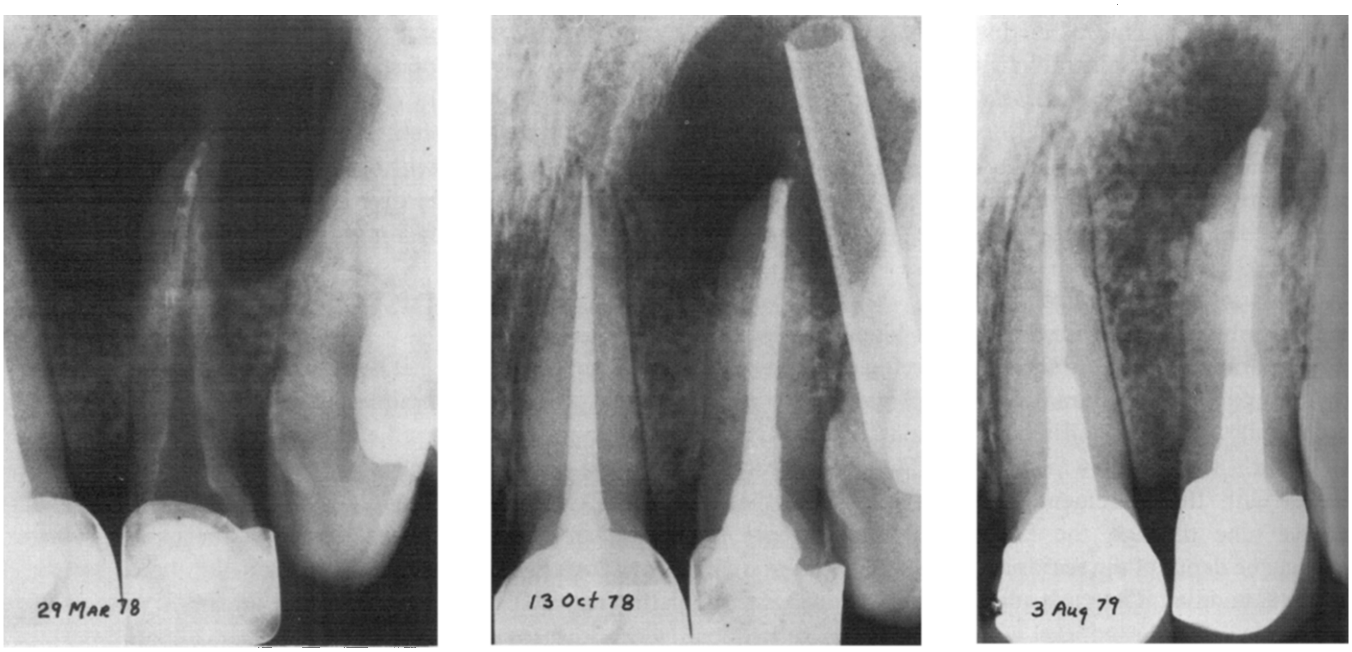

Fig 9—Left, preoperative radiograph. Note extensive rarefaction and a bayonet-shaped root tip, which was unfilled. Middle, radiograph showing radiopaque tube in place. Right, three-month recall radiograph. Note good osseous repair.

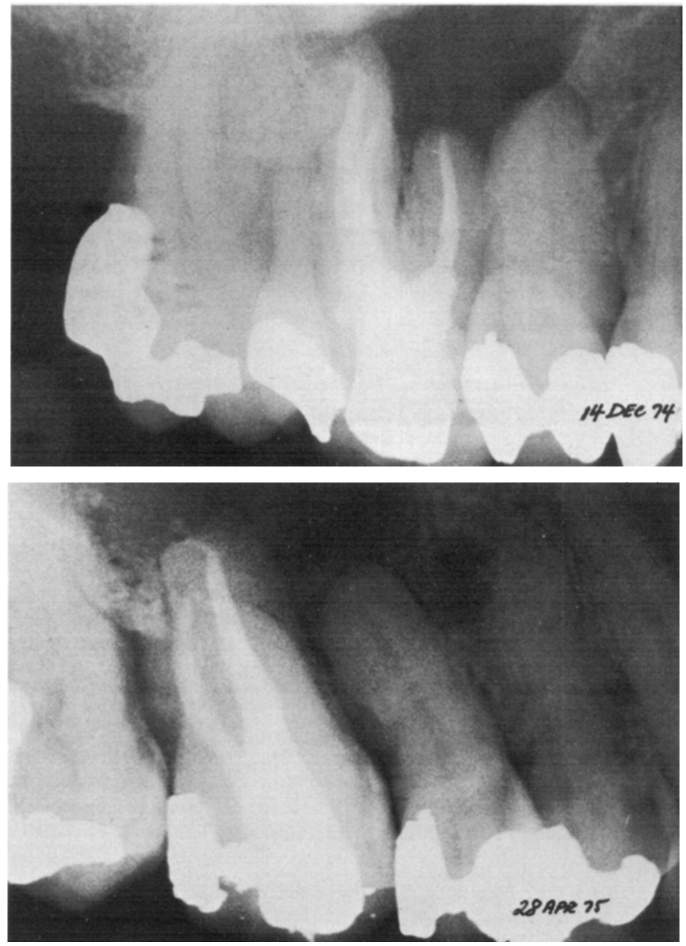

Fig 10—Left, preoperative radiograph, extensive rarefaction had caused overlying soft, compressible swelling. Right top, radiograph after root canal therapy. Right bottom, radiograph of decompressed area three months after tube removal.

most cells are deprived of adequate nutrition and succumb. Thus, an epithelial-lined cavity develops, with continued epithelial proliferation, until the source of inflammation is eliminated.

After a cystic epithelial-lined cavity has formed, cellular debris from dying cells is responsible for attracting fluid into the lumen, creating an osmotic pressure inside the cyst that is greater than that of the surrounding tissue fluid.[13] Pressure is exerted on the surrounding tissue, resulting in ischemia, and the cyst expands at the expense of the tissue around it. Expansion, therefore, takes place not only through epithelial cell proliferation, but also by pressure from within the lesion.

It has been shown that, unlike other closed physiological body cavities, cystic spaces are not in communication with the lymphatic system, which regulates their fluid balance. Therefore, drainage does not take place, and expansion of the cystic lesion is assured as long as the integrity of the cyst linings remains intact. After disruption of the cyst lining occurs, it can be theorized that destruction of the cyst will follow. There is some evidence[14] that some cystic lesions may not heal after routine endodontic therapy, and a subsequent surgical approach may be required. Tube decompression could provide an alternative therapy in these situations.

Contrary to general belief, approximately a third of apical cysts have an intact epithelial lining. Although these cysts are apparently expanding, Toller[9] showed that as long as the cyst wall as a whole remains a semipermeable membrane, expansion of the lesions, caused by pressure from within, does take place. An intact epithelial lining is apparently not necessary to maintain the integrity of the cystic space.

The odontogenic apical cyst has its origin in a previously existing inflammatory lesion, such as a granulomatous tissue mass. As the cyst expands, remnants of this inflammatory tissue remain, covering the epithelium. This tissue may also be present in response to a possible immunological reaction, the epithelium being its antigen. Inducing an acute inflammatory reaction by overinstrumentation[15] or by decompression will often disrupt the epithelium or the cyst wall as a whole. Drainage from the cavity will then take place preventing hyperosmotic pressure to form in the lumen of the lesion. Keeping the opening patent initially, by decompression, appears to have a major role in removing those conditions that favor cystic perpetuation.

SUMMARY

When confronted with extensive periapical rarefactions, the frequency of lesions showing characteristics of cysts is common. Although the literature implies that these lesions heal after conventional endodontic therapy, a surgical approach is often used when these lesions do not heal as anticipated. This approach is not always in the patient's best interest because of the possibility of injury to adjacent vital structures. The technique of decompression eliminates these undesirable complications, and, at the same time, promotes healing. A method of decompression using radiopaque tubing has been presented and illustrated with case histories. This method of reducing extensive periapical cystic lesions offers an alternative to surgical enucleation.

The opinions or assertions contained herein are the private ones of the authors and are not to be construed as official or as reflecting the views of the US Army.

Dr. Neaverth is chief, endodontics, Hospital Dental Clinic, USA DENTAC, Walter Reed, Washington, DC. Dr. Burg is assistant chief, endodontics, US Army DENTAC, Ft Gordon, Ga. Requests for reprints should be directed to Dr. Neaverth, Hospital Dental Clinic, USA DENTAC, Walter Reed, Washington, DC 20012.

References

1. Ingle, J.I. Endodontics. Philadelphia, Lea & Febiger, 1965.
2. Archer, W.H. Oral and maxillofacial surgery, ed 5. Philadelphia, W. B. Saunders, Co, 1975.
3. Sommer, R.F.; Ostrander, F.D.; and Crowley, M.C. Clinical endodontics, ed 2. Philadelphia, W. B. Saunders, Co, 1961.
4. Partsch, C. Bericht der Poliklinik fuer Zahnheilkunde. Leipzig, Deutsche Verlag. 1899.
5. Freedland, J.B. Conservative reduction of large periapical lesions. J Oral Surg 29:455-464, 1970.
6. Thomas, E.H. Cyst of the jaws, saving involved vital teeth by tube drainage. J Oral Surg 5:1-9, 1947.
7. Bhaskar, S.N. Synopsis of oral pathology, ed 5. St. Louis, C. V. Mosby Co, 1977.
8. Toller, P. Newer concepts of odontogenic cysts. Int J Oral Surg 1:3-36, 1972.
9. Toller, P. Origins and growth of cysts of the jaws. Ann Roy Coll Surg Engl 40:306-336, 1966.
10. Ten Cate, A. Histochemical demonstration of specific oxidative enzymes and glycogen in epithelial rests of Malassez. Arch Oral Biol 10:207-213, 1965.
11. Main, D. The enlargement of epithelial jaw cysts. Odontol Rev 21:29-49, 1970.
12. Shear, M. The histogenesis of the dental cyst. Dental Pract 13:238-243, 1963.
13. Toller, P. Permeability of cyst walls in vivo: investigation with radioactive tracers. Proc R Soc Med 59:724-729, 1966.
14. Seltzer, S. Endodontology of oral pathology: biologic considerations in endodontic procedures. New York, McGraw-Hill and Co, 1971.
15. Bhaskar, S.N. Nonsurgical resolution of radicular cysts. Oral Surg 34:458-468, 1972.