OPERATIVE DENTISTRY

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Aim and Scope

Operative Dentistry publishes articles that advance the practice of operative dentistry. The scope of the journal includes conservation and restoration of teeth; the scientific foundation of operative dental therapy; dental materials; dental education; and the social, political, and economic aspects of dental practice. Review papers and letters also are published.

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EDITORIAL

Beware Third Party Power

For many years payment for dental service has been made directly to the dentist by the patient. This method of payment is being modified increasingly by the entry of a third party into the transaction. The third party may be a corporation organized by dentists or dental associations, an insurance company, or, in some countries, the government. The function of the third party is to contract with patients, usually groups of patients, to satisfy their demands for dental treatment and to pay directly the dentists that supply the treatment or, alternatively, to reimburse the patients for their costs. From the point of view of economics the entry of the third party changes the dental market drastically from one of many individual buyers and sellers to one of many sellers but few buyers—in some cases only one. This arrangement concentrates buying enormously.

Selling power can be concentrated also and most know such concentrations by the familiar name of monopoly. Though he does not always use it, a monopolist has the power to raise prices and restrict output so that he can make more by selling less. He has also the power to engage in price discrimination by charging different customers different prices, so that if he cannot sell all his stock at the highest price he can sell the remainder by lowering the price to selected buyers rather than having to lower the price to everyone as would happen in an open market.

The buyer's counterpart to the seller's monopoly is called a monopsony. Monopsony is exemplified by a sugar-beet refinery which draws its supplies of beets from farmers in the surrounding area. The distance between sugar-beet refineries is usually substantial so any farmer not satisfied with the price offered for his beets by the local refinery must contemplate additional transport charges if he wants to sell his produce to another refinery. Thus the monopsonist has the power to set prices lower than those that might prevail were another refinery nearby. The monopsonist has additional advantages in being able to set the terms of contracts and to specify types, quantity, and quality of produce.

Third party programs in dentistry have monopsony power if they pay the dentist directly rather than reimburse the patient. The power of a third party over a dentist grows directly as the proportion of his patients participating in the program increases. Some of the abuses of monopsony power are now evident, such as not paying the dentist his full fee, withholding payment, refusing to pay for certain types of treatment, notifying patients of the names of dentists that belong to third party corporations, as well as requiring a monumental and costly traffic in paper. Some of these practices border on unfair competition and restraint of trade, both of which are illegal and benefit neither patient nor dentist.

A classical example of the use of monopsony power against dentists is provided by the General Dental Services of the National Health Service of the United Kingdom. The health service began on July 5, 1948, at which time about 50 percent of the dentists were induced to participate. Within six months the proportion had risen to 85 percent. A month later the government began to lower fees.

Some dentists believe that third party programs can be controlled if dentists participate actively in establishing or managing them. This is as effective as setting the fox to guard the chickens. Fundamental principles of economics cannot be contravened with impunity. Dentists should insist on being paid by the patient, not by the third party. Third party power is dangerous. Beware!

A. Ian Hamilton

SHORT REPORT

Can You Believe Bitewings?

CHRISTOPHER T. HERRON

This is an exercise in interpreting bitewings. Test your skill.

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Mr. Herron is a dental student at the University of Washington School of Dentistry.

The author would like to thank Richard D. Tucker for the idea of sectioning the teeth.

Carious lesions are treated best when they are small. At this stage we can prepare a cavity with ideal depth and extension. The problem lies in detecting the lesions early. This is true especially of proximal lesions in posterior teeth where visibility and access with a probe are restricted.

The bite-wing radiograph (Raper, 1926) has become the standard tool in the detection of proximal caries. The carious lesion, however, is always more extensive than its portrayal by the radiograph. Despite common knowledge of this phenomenon, the tendency to equate the size of the lesion with that of its radiographic appearance is ever present. To reduce the amount of radiation to which patients are exposed, a faster emulsion requiring less exposure has been introduced. Unfortunately, the grains of this emulsion are larger than those of emulsion with slower speed resulting in less definition. Thus the gain in speed has been offset by a loss in definition and the discrepancy between radiographic appearance and actuality has increased. This raises the question of whether bite-wing radiographs remain an effective tool for detecting caries.

Here is an opportunity to test your skill in recognizing proximal carious lesions that should be restored.

The bite-wing radiograph in Figure 1 has been taken of extracted teeth mounted in normal alignment. The radiograph was taken on Kodak DF-57 ultraspeed film (Eastman Kodak Company, Rochester, NY, USA) at 90 KVP, 15 MA, and 1/3 second exposure. The film was developed and fixed in an Auveloper (S.S. White, Division of Penwalt, Philadelphia, PA 19102, USA) at 26.6°C (80°F). This technique,

REFERENCE

Raper, H. R. (1926) *Clinical Preventive Dentistry: Based on a New Type of X-Ray Examination.* Rochester, NY: Ritter Dental Manufacturing Company, Inc.

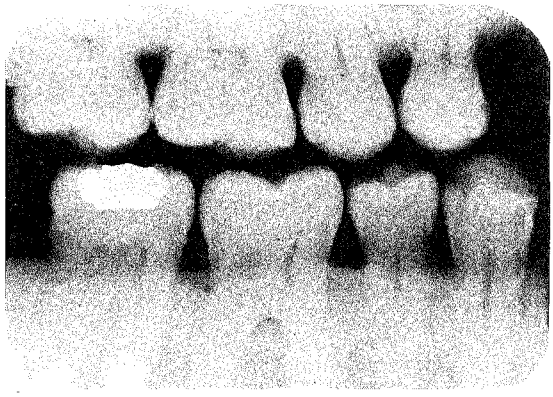
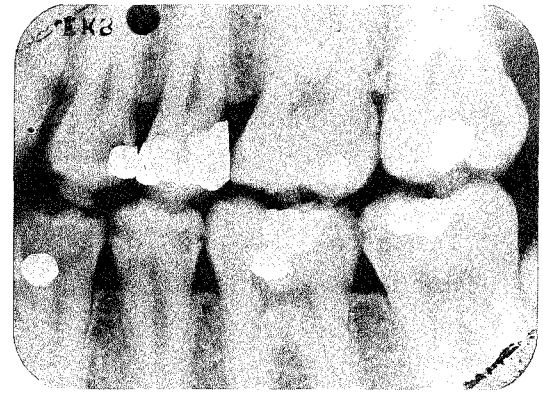


FIG. 1. Bite-wing radiograph: extracted teeth mounted in normal alignment.



Radiograph courtesy of Dr. F. L. Jacobson

FIG. 2. Compare photo on left with radiograph taken on Radia-tized film, above, at 65 KVP, 10 MA.

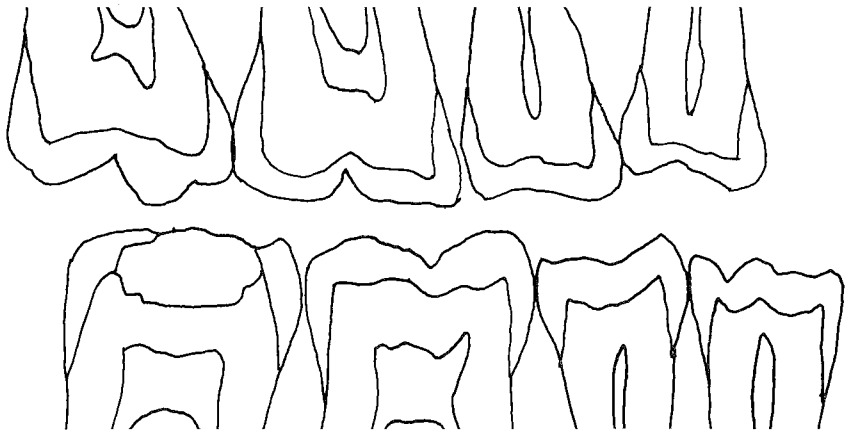


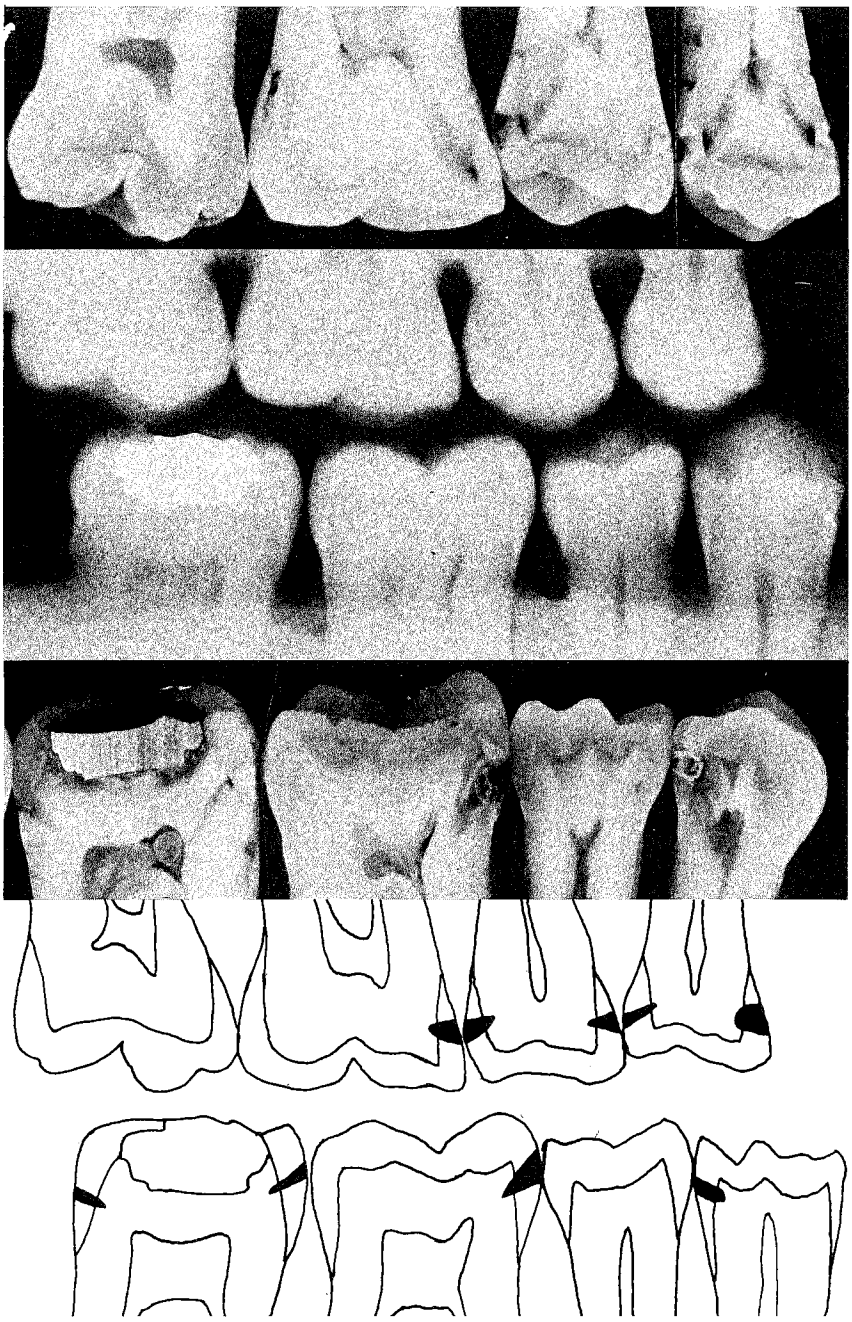
FIG. 3. On the diagram above, mark the surfaces which should be restored in Figure 1.

which is used at a dental school, may not produce the ultimate in definition. On the other hand, this radiograph was taken outside the oral cavity with no interposed soft tissue. The results compare favorably with most radiographs though some definition may be lost in the printing process. For comparison a radiograph taken on Radia-tized film (Eastman Kodak Company, Rochester, NY, USA) is shown in Figure 2.

After the radiograph was taken the teeth were sectioned mesiodistally with a diamond circular saw or by grinding on a model trimmer. The teeth were then aligned and photographed.

Examine Figure 1 and decide which surfaces should be restored. Mark these on the accompanying diagram in Figure 3.

Now turn the page to confirm your diagnosis (Fig. 4).



It is obvious that the teeth have been more deeply infiltrated by caries than was apparent on the radiographs. Without exception this has been the case in 20 teeth examined. Figure 5 indicates the surfaces that should be restored.

The bite-wing radiograph can be a valuable aid in diagnosing proximal caries. The dentist can derive the full benefit of this aid only when he interprets it correctly. Each time a radiograph is viewed it should be understood that the radiographic appearance is considerably smaller than the actual lesion. The appearance on the bitewing of initial penetration of the enamel by caries should indicate in your mind's eye that the dentin has already been penetrated.

The bitewing at its face value is not a satisfactory diagnostic tool.

ORIGINAL ARTICLE

A Class III Cavity Preparation for Direct Gold: Modified Loma Linda Design

HAROLD E. SCHNEPPER • ROBERT B. WOLCOTT

This cavity, designed for maxillary teeth with strong marginal ridges, is inconspicuous, conserves tooth structure, preserves the marginal ridge, has adequate convenience form, excellent retention, and confined walls that assist the operator in beginning condensation.

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The illustrations are provided by George Robbins, School of Dentistry, UCLA.

The direct gold restoration has encountered a measure of disfavor in the profession and among instructors in the schools. This unfortunate status is attributed to a gradually diminishing interest in the ability to perform a rather challenging procedure with skill and efficiency. Where direct gold restorations can be placed to the satisfaction of clinician and patient alike, it is difficult to justify the use of inferior restorative materials. In examining reasons for the disfavor of direct gold restorations among our colleagues, we find that the preparation of the cavity and the manipulation of the gold, from placement to finish, are so exacting, complicated, or tedious that the average dentist is discouraged. Instead of developing the knowledge and skill that would ensure confidence in creating a satisfactory gold restoration with aptitude and efficiency, he prefers procedures that are less demanding. The modern clinician, however, with concern for preventive dentistry, can understand that teeth with small lesions can be restored securely and permanently with direct gold, whereas the temporary nature of "esthetic" materials provides only limited assurance that the tooth has been treated and restored. The harmonious color of esthetic restorations is short-lived, and replacements lead eventually to more heroic measures to retain appearance and function.

New Designs of Cavities

To encourage broader use of direct gold restorations, efforts to simplify the direct gold techniques are constantly being made. Among the new approaches is a cavity designed with an inconspicuous or invisible facial margin, yet a cavity that meets all the basic criteria for acceptability. The conservative facial outline ensures a minimal display of gold and also ensures acceptance by the patient, especially when the operation can be completed with ease and dispatch. The approach to the preparation of this cavity is from the lingual aspect and several designs have been developed (True, 1943; Jeffery, 1957; Ingraham & Koser, 1961).

True Cavity Preparation

True (1943) described a Class III preparation with a lingual approach that is instrumented from the linguoincisal direction. The preparation has a partial lingual wall that preserves a portion of the marginal ridge above the gingival wall. Convenience form is achieved by an exaggerated incisal turn on the lingual surface and a slight concavity to the axial wall. These two features permit adequate access for preparing the walls, the retention, and the remote line angles within the preparation; they also facilitate condensation of the gold.

Powdered Golds and the Loma Linda Cavity Preparation

The advent of the powdered golds, Goldent and Electraloy (Williams Gold Refining Company Inc., Buffalo, NY 14214, USA), has led to a modified design of Class III cavity (Lund & Baum, 1965). This preparation has a facial outline with minimal extension, complemented by a lingual approach that facilitates the preparation of the cavity and the condensation and finish of the restoration. Most of the instrumentation is carried out from the lingual direction.

Modified Loma Linda Cavity Preparation

Consistent with True we recognize the value of preserving a portion of the lingual surface if the maxillary anterior tooth is wide enough faciolingually where the gingival wall is to be located. The sacrifice of the valuable structure of the marginal ridge is usually unnecessary since convenience form may be achieved from the linguoincisal direction. Preserving the strong marginal ridge on the lingual surface adds to the retention of the restoration and expedites condensation of gold by confining the area of the cavity to which the gold is introduced and positioned for compaction (Fig. 1).

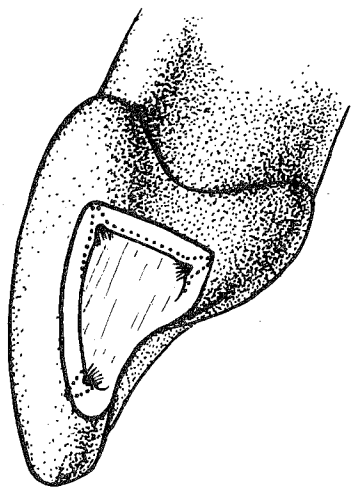


FIG. 1. Modified Loma Linda Class III cavity preparation with lingual access and preserved portion of the marginal ridge.

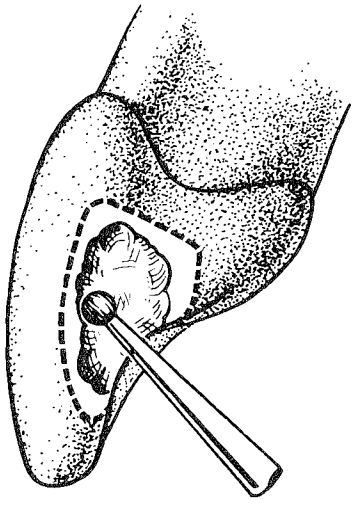


FIG. 2. Outline form is roughed out with a No. 2 round or No. 699 fissure bur.

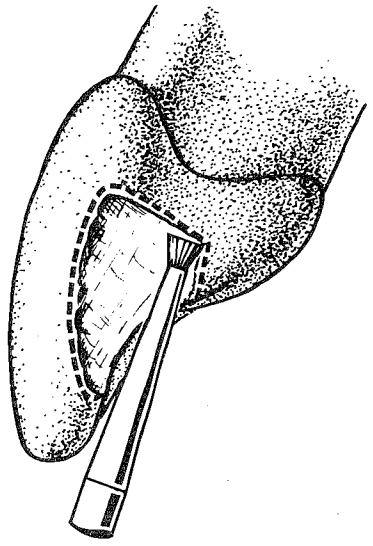


FIG. 3. Establishing the gingival wall with a No. 34 bur.

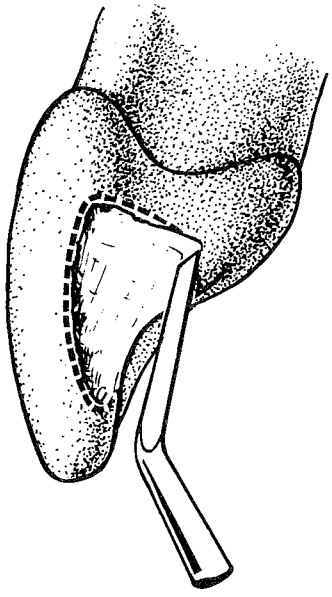


FIG. 4. Refining the gingival wall with a binangle chisel.

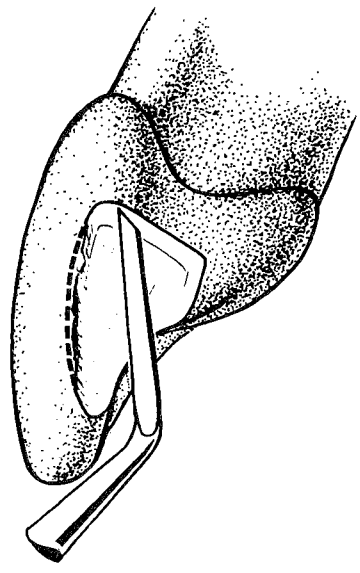


FIG. 5. Refining the lingual wall with a hoe or binangle chisel.

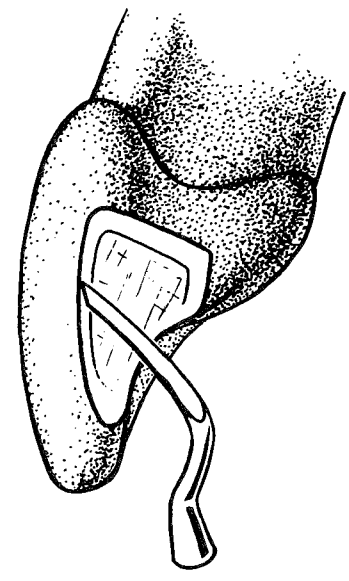


FIG. 6. Extending and refining the facial and incisal wall with Jeffery instruments.

Preparing the Cavity

Outline Form. Establish a rough outline form. Begin in the preparation with a 2 round bur or a 699 fissure bur (Fig. 2). Introduce the bur from the lingual surface toward the carious lesion. When this area is reached, extend the preparation with short "painting" strokes until a rough outline form with cavity walls has been achieved. The axial depth is limited because the removal of dentin is dictated only by the access needed to create the basic outline. Removal of caries is ignored at this stage of the preparation. The caries should influence only the extension of the gingival, facial, or lingual cavity walls to ensure adequate dentinal support. Caries on the axial wall is removed after the balance of the preparation has been completed.

Cavity Walls. Establish the gingival wall with a 34 inverted cone bur; make the wall perpendicular to the long axis of the tooth (Fig. 3). Be careful not to extend the gingival wall to the facial and lingual surfaces of the tooth. Establish the lingual wall within the gingival third of the lingual marginal ridge. Extend and refine the wall with a 6½-2½-9 hoe or a 10-8-8 binangle chisel (Fig. 4). Sharpen the junction of this wall with the gingival floor and join this wall to the lingual access opening with a sharp but less abrupt angle. If necessary, flare the lingual wall slightly to ensure that no unsupported enamel prisms remain, and extend the cavosurface margin lingually to facilitate condensation and to aid in finishing the compacted gold. Prepare the facial portion of the gingival wall with the same hoe used for the lingual wall (Fig. 5).

The facial and incisal walls are considered as one wall. Extend it facially to break the contact and form a line in harmony with the facial contours of the crown. Continue the incisal extension of the facial wall to the lingual margin, then turn the wall abruptly and merge it with the margin of the access opening. Wherever possible, include the contact by the incisal extension of the wall. Establish definite line angles concomitantly with refining the facial wall by using the Jeffery 13, 14, and 15 hatchets (Fig. 6). Gingival margin trimmers also may be used for this procedure.

The lingual cavosurface margin forms the lingual border of the axial wall in the region of the access opening. Straighten and refine this margin with a hoe or the small Wedelstaedt chisel (Fig. 7).

Retention Form. Begin retention with a ¼ round bur. Place the gingival retentions in dentin at the facial and lingual extremities of the gingival floor. Direct these retentions as

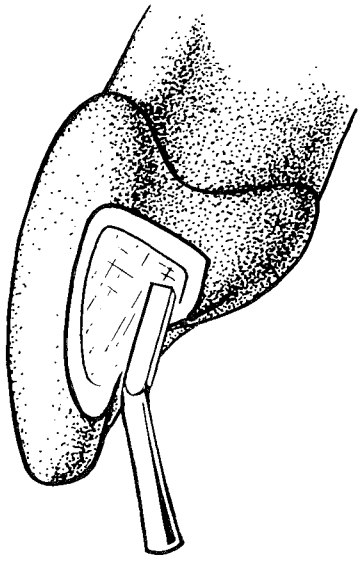


FIG. 7. Straightening and refining the lingual cavosurface margin with the Wedelstaedt or binangle chisel.

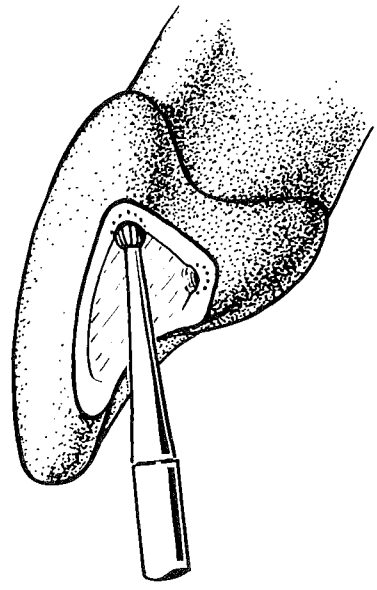


FIG. 8. Positioning the gingival retentions with a No. 1/4 round bur.

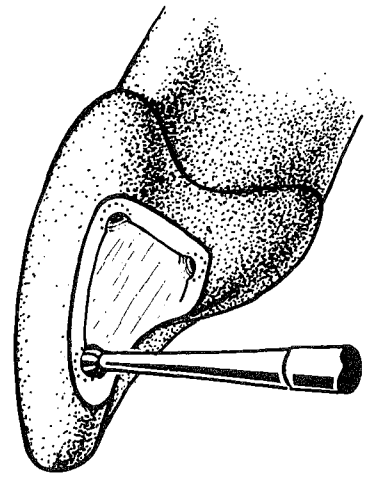
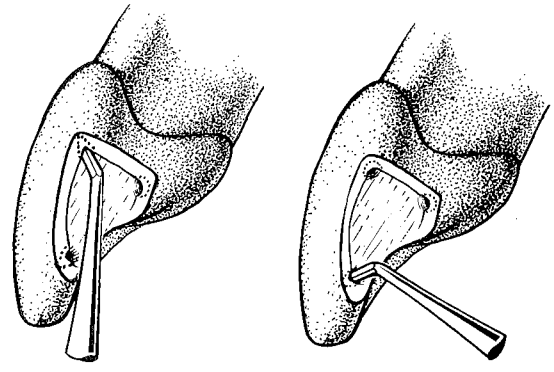


FIG. 9. Positioning the incisal retention.

much toward the long axis of the tooth as access or convenience form allows (Fig. 8). Begin the incisal retention on the axial wall and extend it under the incisal wall in a labioincisoaxial direction. This direction carries the retention into an area under the lobe of the labial surface (Fig. 9). Then use angle formers (Fig. 10) and incisal hatchets (Fig. 11) to transform the "pot holes" created by the bur into retentions that have a more sharply defined base (Fig. 12). This gives greater strength to the gold in the retentive pits.

Caries Removal. Now remove caries and clean the cavity.

The cavity is now ready for the insertion of the gold.



FIGS. 10 and 11. Opening the linguogingival retention with a bayonet or regular angle former (at left); extending and defining the incisal retention with an incisal hatchet (at right).

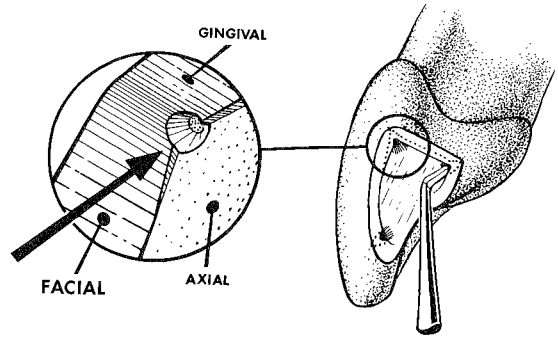


FIG. 12. The instrumentation of the gingival retentions gives them a more defined base as seen in the enlargement. Note also the accentuated axiogingival line angle.

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DENTAL PRACTICE

Cleansing Cavities and Sealing Cavity Walls

JOSEPH EVANS • ZACK KASLOFF

Careful cleansing and treatment of prepared cavity surfaces prior to insertion of a restoration are essential to success in restorative dentistry. Superficial dust produced during the grinding of enamel and dentin must be removed, otherwise the layer of debris will interfere with proper cementation of inlays or prevent close approximation of amalgam to cavity walls. A resultant gap, 4-10 μm, could be responsible for subsequent marginal leakage. Scrubbing with a 3 percent solution of hydrogen peroxide, followed by application of a lining agent appropriate for the restoration are not only desirable but also essential components of good restorative procedures.

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Restorations fail for various reasons. The two cited most commonly are improper manipulation of restorative materials and lack of attention to detail in cavity preparation. One of the more important factors contributing to failure is the presence of undetected debris at the base of the cavity, debris that has accumulated during the preparation. Many dentists are uncertain about the proper method of cleansing the cavity of this debris. Sometimes they ignore this important procedure. The purpose of this article is to review the origin of cavity dust and debris and to suggest effective methods for cleansing and treating surfaces of the prepared cavity before inserting the restoration.

ORIGIN OF CAVITY DEBRIS

Most of the debris that collects in cavities during their preparation consists of a mixture of enamel crystals and dentin dust loosened during grinding (Provenza & Sardana, 1966; Scott & O'Neil, 1961) (Fig. 1). Debris in cavity preparations may also arise from saliva or from "smearing" of odontoblast processes, but this type of debris consists of large particles easily removed by washing and is thus of minor importance compared to dentin dust.

Enamel Crystals and Shattered Enamel Prisms

Rotary cutting instruments, especially those used at ultra high speeds, may crack or craze enamel during cavity preparation; of these instruments, diamond stones are less severe than carbide burs (Kasloff, Swartz & Phillips, 1962). An eccentric bur or stone acts like a high-speed pounding instrument to fragment the crystalline enamel prisms, even at the

occlusal level (Boyde & Knight, 1970). The shattering effect of burs and stones is most severe on the enamel margins, especially at the cervical level where the enamel prisms are very short. Such shattered prisms may soon be lost, leaving a gap between tooth and restoration. Leakage at the gingival margin almost always results from subsequent loss of the shattered enamel prisms (Going, 1959). Cracking, shattering, and the resulting gaps may, in part, be the reason we frequently see ditching of amalgam restorations, and open margins on inlay and gold foil restorations.

Dentin Dust and Bacteria

The debris that accumulates during cavity preparation is composed largely of dentin dust. This debris can contain microorganisms capable of surviving and growing in the space between the filling material and the wall of the cavity, even though the entire procedure is performed under rubber dam; practically no bacteria are found, however, when the cavity is cleansed adequately and measures are instituted to prevent leakage (Brännström & Nyborg, 1973).

The diameter of these particles of dentin varies from 50 micrometers (μm) (microns) to less than 2 μm. It is the very small particles of dentin dust less than 2 μm in diameter that clog and partly seal the cut dentinal tubules (Fig. 2A). This clogging helps seal the tubules against penetration by acids (Brännström & Johnson, 1974). However, medium-size particles of dentin powder, 5-20 μm in diameter, do not lie within the tubules, but on the surface of the dentin where they interfere with cementation (Brännström & Nyborg, 1973; Brännström & Johnson, 1974). This can be compared with laying adhesive tile on concrete that is covered with dust; the tile will not adhere to a dusty surface. Dentin particles can likewise interfere with the close adaptation of silver amalgam to tooth structure. In patients whose oral environ-

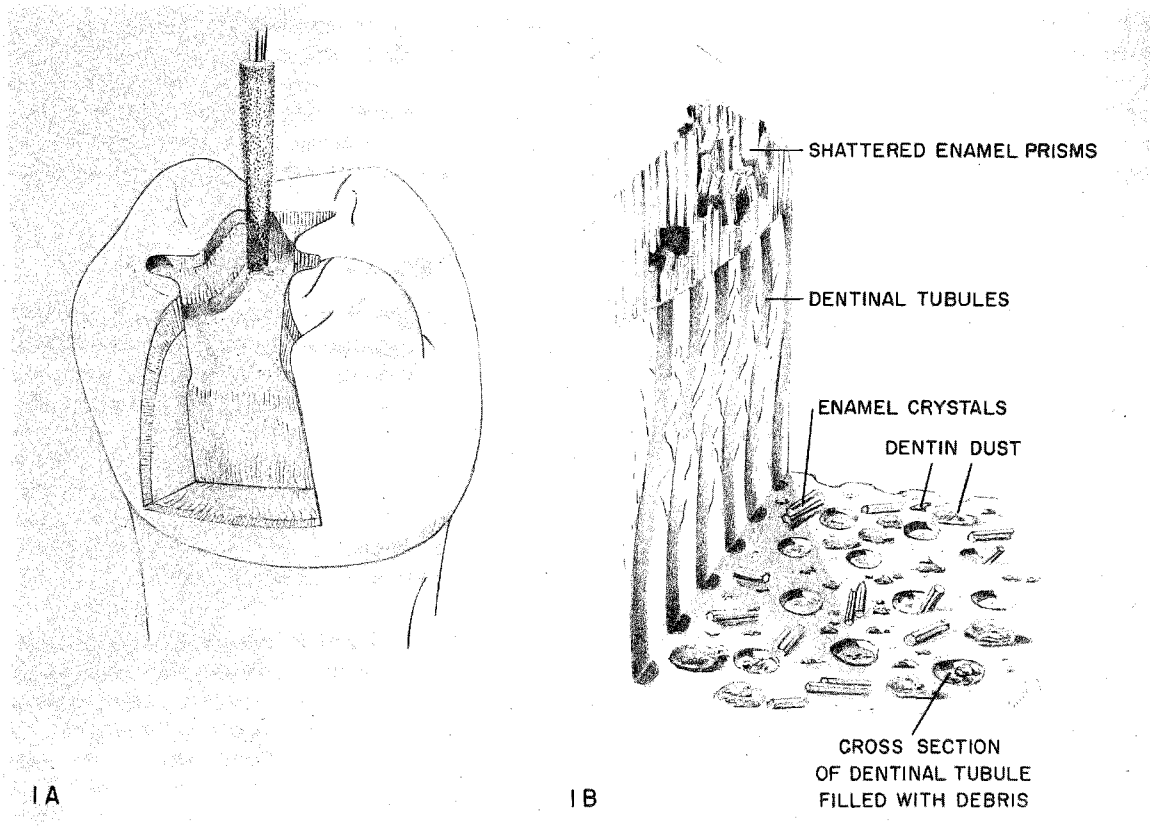

FIG. 1. Debris resulting from cavity preparation: (a) grinding procedure; (b) grinding debris.

ment is highly cariogenic, failure to close the margins of the restoration can lead to the formation of plaque with surviving microorganisms and recurrent decay.

CLEANSING AGENTS

Acid Cleansers

Cleansing agents containing acid, such as phosphoric or citric acid, remove dust particles from the surface of the dentin (Brännström & Johnson, 1974). Unfortunately, these acids also remove the fine particles of dust that fill the opening of the dentinal tubules. This opens the tubules and widens the cut ends, creating funnels which facilitate penetration of bacteria into these openings (Brännström & Johnson, 1974) (Fig. 2B). Many commercial cavity cleansers contain acids of this nature. It is therefore questionable if such acids are suitable for cleansing dentin.

Application of acid etchants and demineralizing agents to dentin is contraindicated for another reason. Ordinarily, due to capillary action, fluid is always present at the outer ends of the cut tubules. Because pressure is higher in the pulp than at the outer aperture of the tubule, a continuous outward flow through the tubules produces increased moisture on the dentin surface (Berggren & Brännström, 1965; Brännström & Åström, 1972). Such demineralizing solutions, by widening tubule apertures, increase the area of fluid on the dentin surface and create a condition which tends to inhibit adhesion of restorative materials and cements to dentin. Therefore it is necessary to dry a cavity before placing the restoration or luting agent. Prolonged use of warm air, however, may dehydrate the tubules, causing their contents to shrink excessively, and may even lead to aspiration of odontoblast nuclei (Brännström & Åström, 1972), as illustrated in Figure 3.

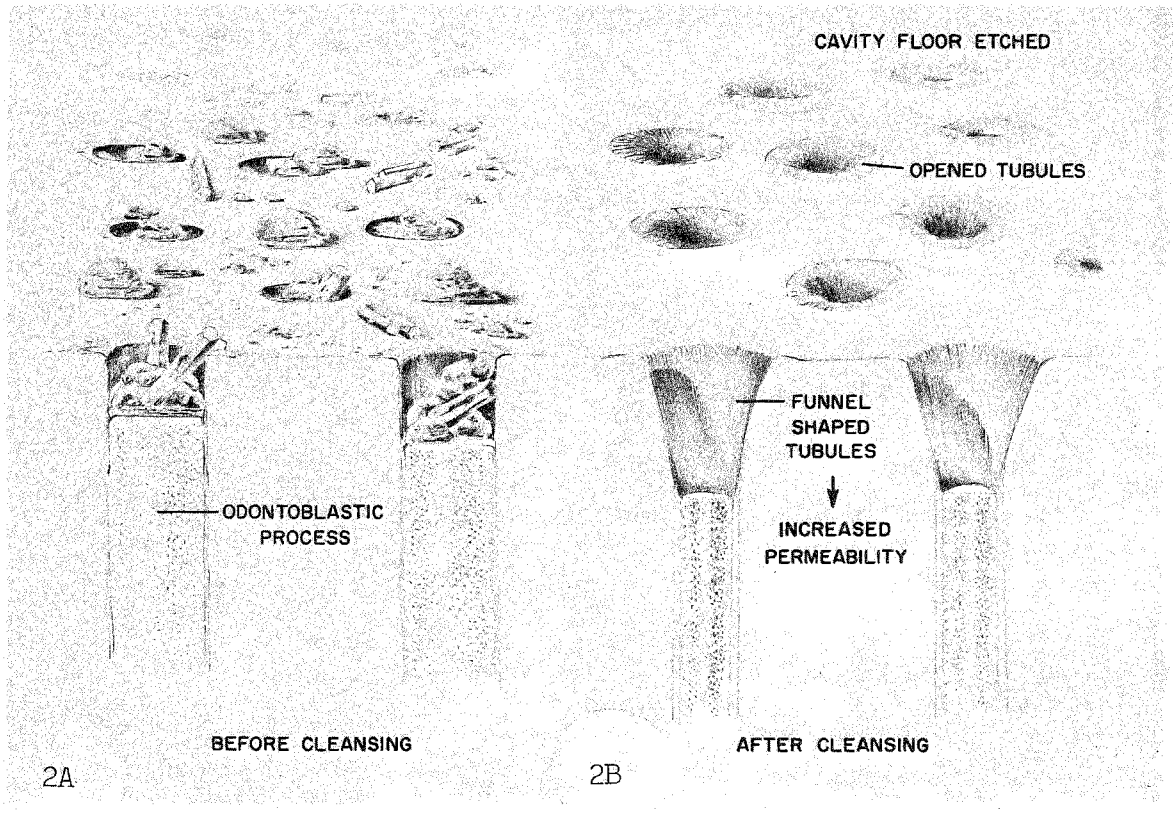

FIG. 2. Effects of acid cleansers: (a) dentin dust in orifices of dentinal tubules and on surface of dentin; (b) effect of acids on tubules.

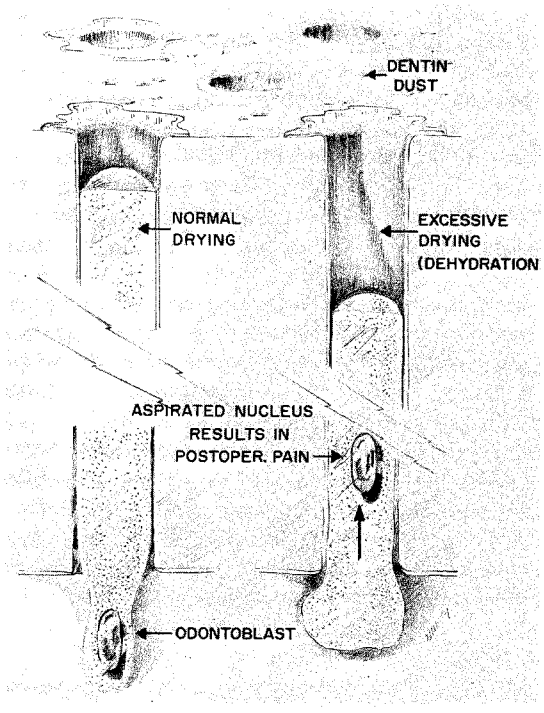

FIG. 3. Effects of dehydration on tubules.

Hydrogen Peroxide

Another approach to the cleansing of cavities should be considered. Brännström & Johnson (1974) have shown that a prepared cavity, cleansed only with water spray, remains covered with small particles of grinding debris. They have shown that cleansing for five seconds with a pellet soaked in 3% or 30% hydrogen peroxide followed with 95% alcohol for an equal period, is much more effective in removing the dust from the cavity. The surface of the dentin appears much cleaner and most of the openings of the tubules remain filled. The nature of this action is illustrated in Figure 4. Others have also recommended hydrogen peroxide as an effective cleansing agent (Gilmore & Lund, 1973; Bell & Grainger, 1971).

Alcohol

The use of alcohol is questionable. The reason commonly offered for its use is to neutralize the action of the peroxide and to dissolve some of the debris. However, desiccation can result from the prolonged application of

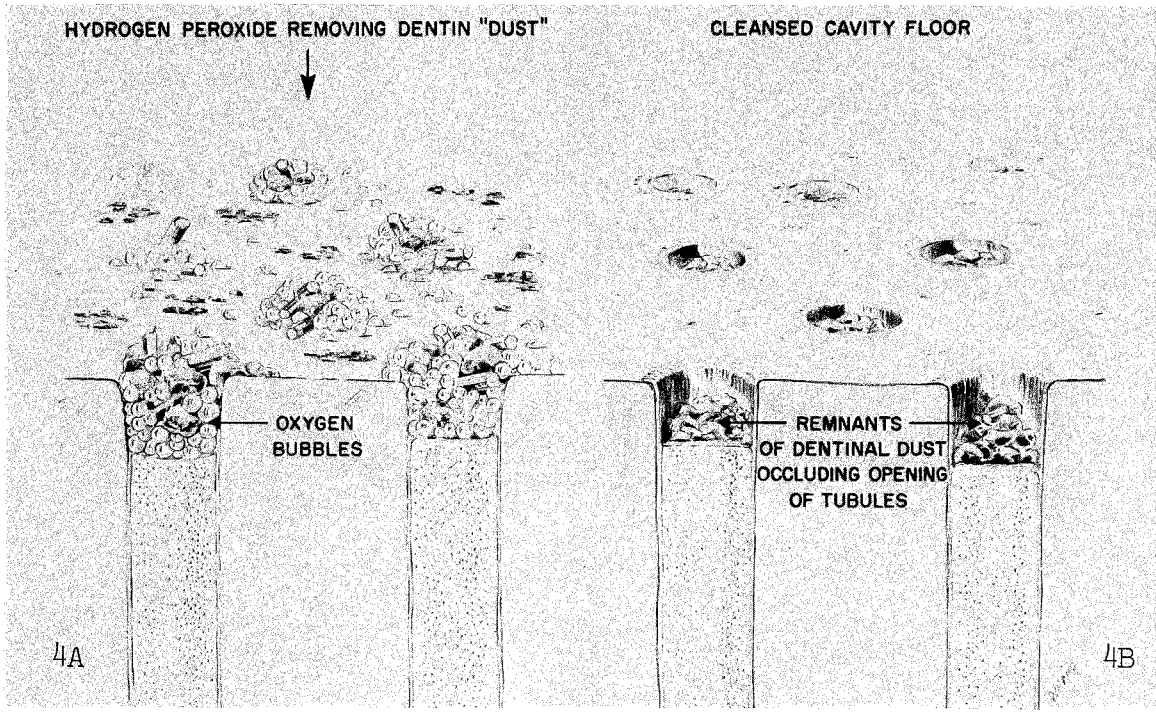

FIG. 4. (a) Cleansing action of hydrogen peroxide; (b) effect of cleansing on dentin surface and tubular openings.

alcohol. Experimental evidence to support its use is still lacking. Warm water, followed by drying with a cotton pellet, is much less dehydrating.

Microbicidal Fluoride Solution

Brännström & Johnson (1974) have reported that scrubbing the dentin surface for five seconds with a pellet soaked in a preparation consisting of a microbicidal solution mixed with 3% sodium fluoride, followed by a static application of the same mixture for 60 seconds, results in a cleaner surface than that obtained from the application of 3% peroxide followed by alcohol. They claimed that their solution did not remove the plugs within the tubular apertures, but did cleanse the intertubular dentin. It has been suggested that 3% sodium fluoride has a remineralizing effect, thus increasing the resistance of dentin and enamel to the action of acids (Selrig, 1968). A 3% solution of sodium fluoride does not irritate the pulp (Weiss & Massler, 1969; Daugherty & Taylor, 1972).

SEALING CAVITY WALLS

Marginal Penetration by Bacteria

Removal of particulate matter from the dentin surface is not the only important procedure to be performed prior to inserting a restorative material; of equal importance is an adequate seal to prevent bacterial invasion from the oral environment. Copal resin varnish is an effective agent for obtaining such a marginal, as well as tubular, seal.

The manner of applying copal varnish depends on the type of restorative material being used. Figure 5 illustrates the way in which varnish forms a seal. To assure a continuous protective film, it is suggested that, under amalgam, the varnish be applied in three successive thin layers, each layer being allowed to dry thoroughly before applying the succeeding one. A wire loop, or cotton wound tightly on a root canal reamer, is among the popular devices recommended for the application of varnish (Phillips, 1973). The first thin layer of varnish is sucked into the open ends of the dentinal tubules and combines with the fine dentin

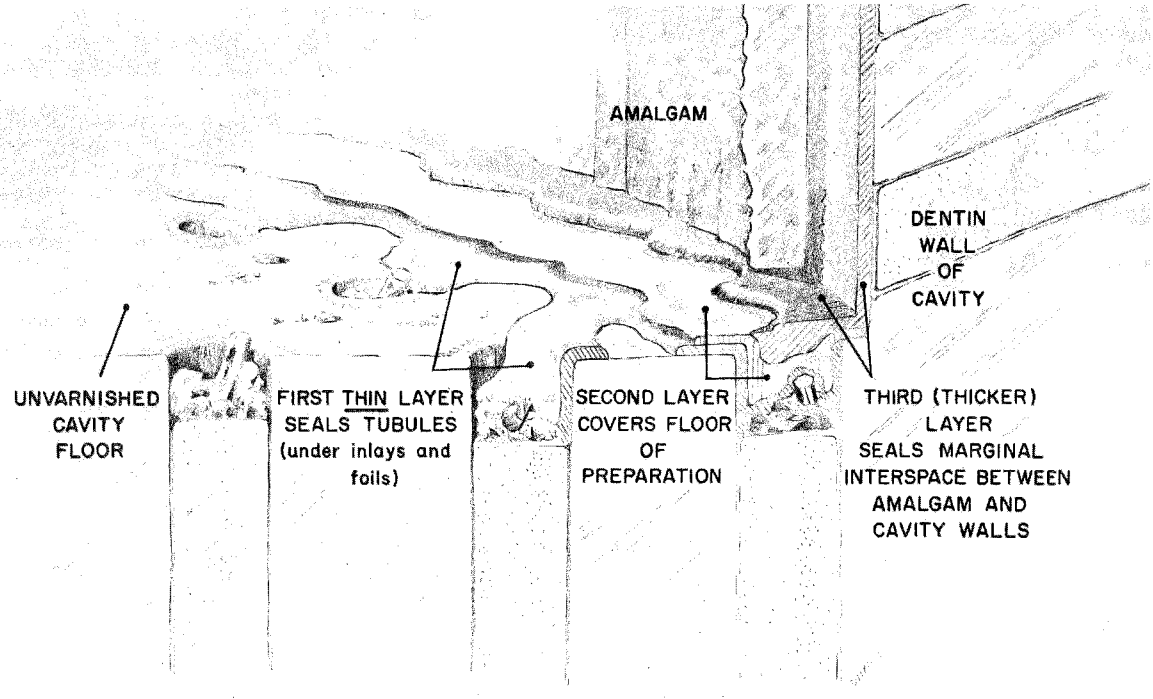

FIG. 5. Postulated action of cavity varnish.

dust within to seal the tubules firmly. The succeeding layers obliterate micropores usually present in the first layer. With the exception of cavities for amalgam, the varnish should be confined to the dentin surface. For amalgam, varnish should cover, as well, all the enamel walls of the cavity. This will reduce microleakage effectively, improve adaptation of the amalgam to the enamel wall, and reduce discoloration of the tooth from by-products of corrosion. Where resin restorative materials are used, varnish is contraindicated because the solvent in the varnish may react with the resin (Phillips, 1973).

Copal varnish is contraindicated as an intermediary film when carboxylate cements are used. The luting quality of these cements depnds on their ability to form a chelate with the calcium in the tooth. Varnish prevents this action. Carboxylate cements do not irritate the pulp, therefore additional sealing of the dentinal tubules is not needed (Beagrie, Main & Smith, 1972; Beagrie, Main, Smith & Walshaw, 1974). Adequate cleansing of the cavity is particularly important when using carboxylate cements so that dentin dust and other debris do not prevent chemical bonding between the polyacrylic cement and the surfaces of the cavity.

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Treatment of the Pulpless Tooth During Post and Core Construction

RICHARD H. HARPER • MELVIN R. LUND

Pulpless teeth should be strengthened with posts and cores during restoration if fractures of the teeth are to be avoided.

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The opinions or assertions contained herein are the private ones of the author and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

This article was written while Dr. Harper was a graduate student in the Department of Operative Dentistry at Indiana University School of Dentistry.

Improved techniques have made endodontic treatment highly successful and as a result more teeth are being retained. Restoring these teeth to full function often challenges the ingenuity of the dentist. The various methods of restoring endodontically treated teeth rely on the principle of providing an adequate foundation within the teeth to support the required restorations. This presentation deals with several methods of constructing posts and cores.

Need for Strengthening Teeth

Endodontic treatment weakens teeth because dentin is lost, both in the removal of the roof of the pulp chamber whose arched shape resists stress, and in obtaining further access to root canals. The teeth are weakened further because the remaining dentin becomes brittle as a result of dehydration from loss of nourishment from the blood supply of the pulp (Helfer, Melnick & Schilder, 1972).

The supporting structures of the tooth, on the other hand, are not usually affected by endodontic therapy. Thus if the tooth can be strengthened it can usually be retained as a functioning member of the dental arch.

Not every tooth needs extensive restoration after endodontic treatment. Occasionally an intact anterior tooth requires removal of the pulp due to the trauma of an accident. If endodontic therapy is conservative and there is no unnecessary removal of dentin, the lingual opening may be sealed with direct gold or composite resin. The conservative preparations for posterior teeth should include the occlusal table to support the cusps, though in many cases the severity of the problem dictates the use of a crown.

A casting should not be placed on an endodontically treated tooth without first providing support to resist fracture from longitudinal, or vertical, and transverse, or horizontal,

forces (Herschman & Weine, 1972). The restoration of choice to protect against vertical fracture is an onlay or crown. The potential for horizontal fracture is especially evident in anterior teeth and premolars due to the intensified transverse stresses placed upon the teeth in the anterior part of the mouth. Therefore vertical support should be placed within the pulpless tooth so that it will be strong enough to resist horizontal fracture. Vertical support is obtained by using a post or dowel permanently cemented within the tooth.

Filling the Root Canal

Gutta percha is the material preferred for filling the root canal if a post is to be used. After filling the canal the operator should remove the coronal part of the filling material and place a cotton pellet in this area before the opening is sealed temporarily. If silver points are used, the twist-off technique is recommended. In both these situations a post may be placed subsequently without disturbing the apical seal of the root canal filling. Courtade & Timmermans (1971) describe a technique to be used if a full-length silver point is encountered, but this method allows no means of determining if the cement seal at the apex has been damaged. A more reliable restoration is obtained by removing the silver point and refilling the canal with gutta percha.

A cast restoration can seldom be placed immediately on completion of endodontic treatment, therefore a temporary restoration should be placed to protect the tooth from fracture until a permanent restoration is constructed. A band is often applied around a pulpless tooth to help prevent fracture. The band may be of copper or stainless steel or, less desirably, prefabricated aluminum.

Undue stress on the weakened tooth may also be avoided by reducing the cusps at least 1 mm. Since the tooth is to be restored by a crown or onlay, reduction of cusps is not contraindicated. Once a tooth has been reduced occlusally, however, it should be restored as soon as possible.

Interval between Filling Canal and Constructing Post

There is disagreement about the optimum time to begin construction of the post and core after root canal filling. Herschman & Weine (1972) state that the post should be prepared at the same appointment at which the canal is finished. They reason that the angle and length of the canal are well known at this time and the correct length for the post is easily determined. However, there is a risk of dislodging the freshly placed root canal filling. A period of 24 to 48 hours is necessary for the permanent setting of some root canal cements (Hiffinbotham, 1964) and preparation of the post hole is often delayed until after this time.

Grossman (1965) suggests that a week is long enough to wait before beginning routine restorative procedures. When periapical pathosis is obvious, treatment requiring complicated restorations should be delayed for a few months so as to validate the healing process.

Preparing Root Canal for Post

The preparation of the root canal to receive the post must be done carefully to ensure that the remaining tooth structure is not left unsupported and also that the root is not perforated (Fig. 1). Wherever possible a remnant of 3-5 mm of root canal filling is left in the apex of the canal, but in exceptional circumstances —for example, teeth with very short roots—2 mm suffices.

Single-Rooted Teeth

Burs are not needed to remove the surplus gutta percha root canal filling or to enlarge the opening of the canal. A conservative technique is to place a warmed, 60-70° C (140-160° F), lateral condenser in the canal to soften the gutta percha. Hand reamers are then used to enlarge the canal sufficiently to accept a post of the desired size. A warmed endodontic file may also be used to remove the surplus gutta percha. Increasingly larger files are used to prepare a canal of the required size. Gates Glidden root canal drills (Union Broach Co., Div. of Health-Chem Corp., Long Island City, NY 11101, USA) are useful in preparing canals. The drills are available in various diameters and have flexible shafts that allow the drill to follow the root canal without danger of perforating the root. Peeso reamers (Union Broach Co., Div. of Health-Chem Corp., Long Island City, NY 11101, USA) can also be used to remove gutta percha. The tip of this reamer is blunt and will not readily cut dentin.

After space for the desired length and width of post has been obtained, and undercuts removed from the pulp chamber, a flame-

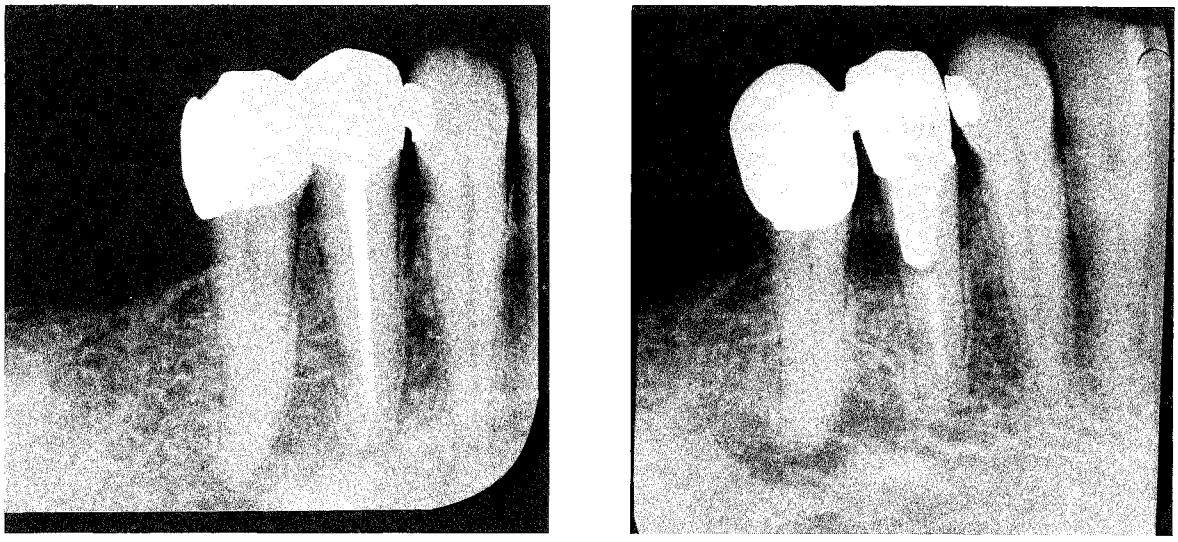

FIG. 1. (a) Follow-up radiographs after the completion of endodontic treatment, January 1972. (b) Six-months recall radiograph which includes a post and core.

shaped diamond is used to place a prominent contrabevel around the periphery of the occlusal of the preparation. This provides for a gold collar that helps retain the post and core and prevents fracture of the root (Rosen, 1964). A key or groove prepared in the occlusal aspect of the root prevents turning or dislodgment of the post and core and acts as a guide in cementation.

Multirooted Teeth

In teeth having more than one root there is a question as to where the post should be placed. Mandibular anterior teeth sometimes divide in the middle third and reunite at the apical third. If two canals are present the straighter one is selected for the post. Mandibular molar teeth have a large distal canal which can be used for a post and, if needed, a shorter auxiliary post can be placed in the mesial canal (Kapsimalis, 1965).

Maxillary first premolars have two distinct canals that usually diverge. If the canals are large enough, two parallel posts should be made. Successively larger Peeso reamers should be used until number 4 has been reached. If the canals are too small, a common core can be made using both canals with one post being longer than the other. The smaller post, or key, gives no retention, but aids in seating and prevents rotation. Due to the

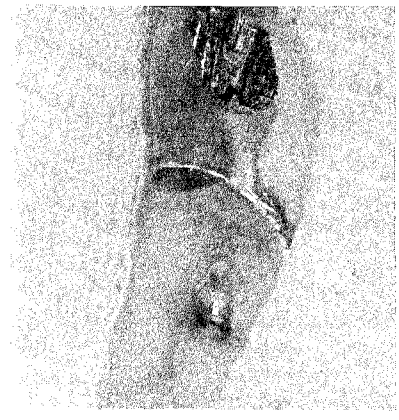

FIG. 1c. February 1974: bone loss, pain, bleeding, and mobility are associated with first premolar. Treated by extraction; perforation is obvious.

closeness of the divergent canals no attempt at parallelism should be made as perforation may result. The second canal is enlarged and tapered to a depth of 2 mm using a 700 tapered fissure bur in the low-speed handpiece. This should be done carefully to prevent perforation of the root. The canals are connected with a slot which acts as a guide in seating and prevents rotation. Upper molars have a large straight palatal root for the insertion of a post. Occasionally the facial root is usable and permits the insertion of two parallel posts—one

FIG. 2. Directional pressure of cylindrical posts with slight taper as compared to the wedging action of highly tapered post.

facial and one palatal. There should be no undercuts in the pulp chamber and a flame-shaped diamond should be used to place a prominent contrabevel around the external periphery of the occlusal of the preparation to provide a gold collar which helps to prevent fracture of the root.

Not all endodontically treated teeth are indications for post core therapy. Some teeth, with difficult access to canals or with small roots, will require a core of amalgam retained with pins or a core of composite resin (Shillingburg, Fisher & Dewhirst, 1970; Lund, 1974). The core of pin-retained amalgam allows rapid construction of coronal form, but does not offer the reinforcement of post cores (Lovdahl & Dumont, 1972).

Fabricating Posts

In fabricating posts the following principles of post support should be observed (Courtade & Timmermans, 1971).

(1) The length of the post should equal the length of the restored crown or engage two-thirds of the remaining root. The retention of the post is proportional to the area of contact between the circumference of the post and the boundary of the canal. For this reason the length of the post is more important than its width (Herschman & Weine, 1972). A short post may increase the possibility of root fracture because, as stress is applied to the superstructure, the post is forced against the root. A long post distributes the stress through the root which it contacts and which is well supported by bone. If the post is very wide, but short, the root segment which has been weakened by the wide preparation will be even more likely to fail.

(2) Cylindrical posts are more retentive than tapered posts of similar size. The most retentive post is parallel-sided with serrations or roughening of the surface to give added retention (Colley, Hampson & Lehman, 1968). Cylindrical posts, with slight taper, transmit forces in line with the long axis of the tooth, whereas a noticeably tapered post transmits forces to the walls of the root canal producing wedging which may split the root (Figs. 2, 3).

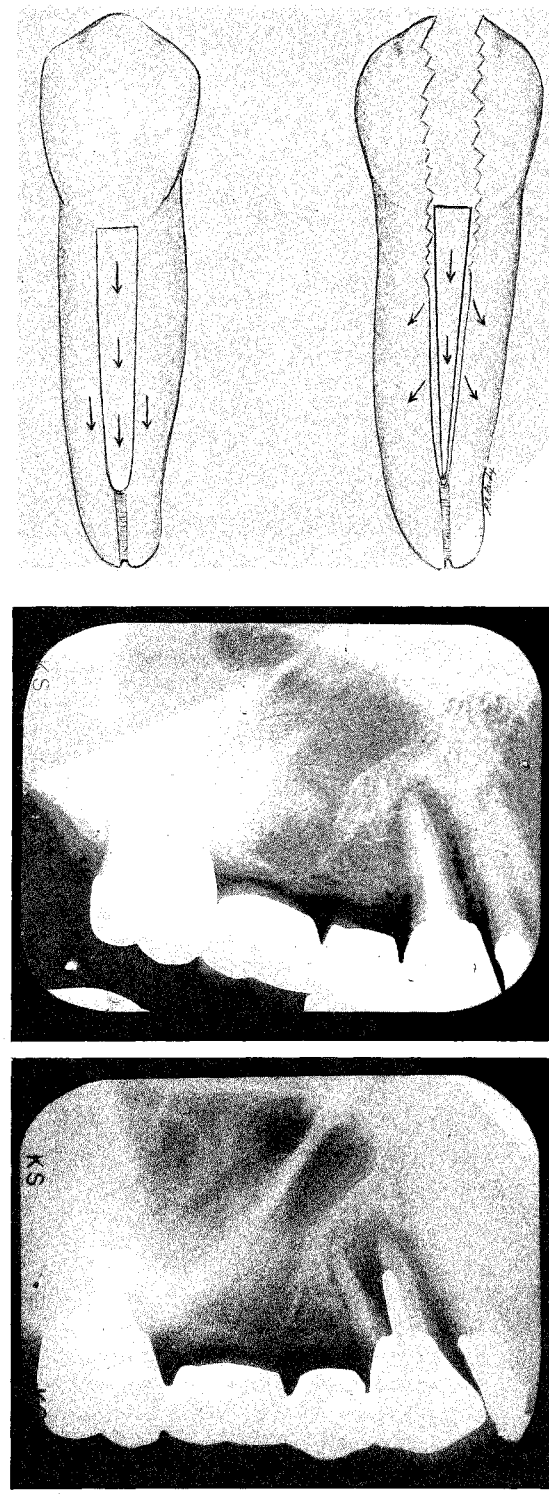

FIG. 3. Radiographic sequence which indicates: (a) post and core under function; (b) subsequent root fracture.

(3) Venting the post with a groove or channel permits cement to escape, resulting in complete seating during cementation and a closer fit of the post in the canal.

(4) Short auxiliary pins attached to the post core provide a guide to seating, prevent rotation of the post in the root canal, and offer increased retention and lateral stability.

Direct Technique

Various materials are available for fabrication of posts. Although several of these materials are supposedly correlated in size with endodontic instruments, slight adjustments may be necessary for adequate fit.

Endopost (Kerr Mfg. Co., Romulus, MI 48174, USA) is made of high-fusing, precious alloy in sizes corresponding to endodontic instruments from size 70 to 140. Wax or acrylic may be added to form the core and then cast to form a well-adapted post and core. Endowel (Star Dental Mfg. Co., Inc., Conshohocken, PA 19428, USA) is a plastic pin available in sizes 80 to 140. It is also used with a wax or acrylic core. Parapost (Whaledent International, New York, NY 10001, USA) is a plastic post that is not calibrated to endodontic instruments. Rotary instruments are needed to prepare the canal if the Parapost system is to be used.

Indirect Technique

Although an accurate reproduction of the post hole can be obtained with the rubber base technique, reproducing a post of proper length in gold poses a difficult challenge to the laboratory technician. If the dentist is confident that the laboratory can make a post that will fit the post hole accurately, the indirect method can be quick and precise with a technique using an impression material of polysulfide rubber.

After the post hole has been prepared, a paper clip is cut, bent, and scored as shown in Figure 4. The clip must not be so long that it impinges on the custom tray used for the impression. The post hole is lubricated and the polysulfide material is spun into it using a lentulo spiral. The paper clip is placed in the post hole and a rubber base impression taken of the entire preparation. The laboratory can fabricate the post, the core, and the clinical crown from this one impression, or a separate impression for the restoration can be taken after the post and core has been cemented.

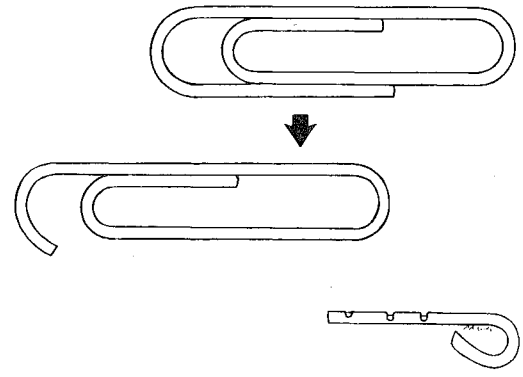

FIG. 4. A segment of a paper clip used to stabilize the post portion of a rubber base impression.

Temporaries

Temporary coverage for anterior teeth is accomplished quickly by using preformed crowns and quick-curing acrylic. Several small cotton pellets are placed in the post hole to prevent any cementing material from penetrating deep into the root and causing problems when seating the cast post and core.

The plastic crown is shaped to fit the preparation and then filled with quick-curing acrylic, with enough excess that some of the acrylic enters the post hole. This usually provides enough retention for the temporary crown. If added retention is sought, preformed plastic and aluminum pins are available (Parapost system). Endowels can also be used with quick-curing acrylic for temporary coverage. After the acrylic post and crown have cured, it is cemented with temporary cement; Cavitec or Tempbond (Kerr Mfg. Co., Romulus, MI 48174, USA) is recommended because it has adequate retention and is quickly removed from the preparation when the casting is to be placed. The patient should be cautioned that the temporary restoration may become dislodged if undue pressure is placed upon it.

Temporary coverage for posterior teeth is accomplished most easily by using preformed aluminum crowns.

Cementation of Post and Core

The casting should have a precise fit prior to cementation. If needed, adjustments are made on the casting to allow for a proper fit.

The post should be vented to allow excess cement to be removed from the root canal. A Parapost is already vented. If no vent is pres-

ent, a longitudinal slit is placed in the post with a disk. The post is then fitted to a positive seat and cemented with zinc phosphate cement. This should be mixed to a thin consistency and in a manner that will provide a slow set. The post should be seated slowly with finger pressure because rapid forcing of the post into the canal could fracture the root. After cementation has been completed, the preparation is finalized to receive the eventual restoration.

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SPECIAL ARTICLES

Skinner Memorial Lecture

Eugene Skinner: His Contribution to the Science of Dental Materials

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Dr. Phillips is associate dean for research, research professor of dental materials, and director of the Oral Health Research Institute at Indiana University School of Dentistry. He is chairman of the Biomaterials Research Advisory Committee of the National Institute for Dental Research and is a past president of the International Association of Dental Research.

This first lecture, dedicated to the memory of Dr. Eugene W. Skinner, was presented on April 30, 1975, at Northwestern University, Chicago, Illinois.

I want to express my gratitude in being chosen to present the first Eugene Skinner Memorial Lecture. Many who would have welcomed this rare privilege surely deserve it more. The challenge has been a humbling one. Because of my years of close association with Gene as colleague, counselor, and friend, reminiscences would be colored by personal experience and fail to provide insight into Dr. Skinner's continuing influence on current biomaterials science and dental practice. In preparing my remarks, I also have before me Gene's trademark as a scientist and author—his constant search for excellence within the capabilities of each individual.

His name has become identified principally with his textbook. While time does not permit a review of his many honors and accomplishments, and even more important, as Gene was most modest and would reject undue adulation, I shall cite only a few of the more outstanding.

Dr. Skinner was the recipient of the Wilmer Souder Award from the International Association for Dental Research, the highest honor bestowed by that group upon a scientist in this discipline. He was an honorary member of the Chicago Dental Society, Swedish Dental Society, and the Brazilian Dental Materials Group. He served on the Dental Study Section of the National Institute of Dental Research and was an honorary lecturer for a year at the University of Edinburgh in Scotland. The memorial Plaque that hangs outside the library of Northwestern Dental School records the professional honor that he cherished most—an

honorary degree of Doctor of Odontology from the Royal School of Dentistry in Stockholm.

As certain members of the faculty well recall, Dr. Skinner served for thirteen years as chairman of the Committee on Dental Graduate Study and for eleven years as director of Graduate and Postgraduate Study. In those positions he contributed substantially to the development of one of the truly exemplary graduate programs in dentistry. He personally directed 57 master's theses and it is of interest to note that many of these graduate students are now teaching in the United States and abroad.

Because of Gene's unusual empathy with students and scholars from other countries, he was able to establish a unique fellowship here at Northwestern. He brought foreign scientists, whose names read as a virtual *Who's Who* in dental materials, to this campus, enabling faculty and students to share their knowledge and expertise.

Gene was ever willing and eager to share his experiences and fund of information with others. With me, he cosponsored annual teacher workshops on dental materials at Indiana for twelve successive years. In terms of longevity and productivity, these conferences, now continued under the sponsorship of Dr. E. H. Greener and myself, were milestones in dental education.

The name of Eugene Skinner is most often associated with his text, *The Science of Dental Materials*. It was the publication of that first edition in 1936 that led to an evolutionary change in the way of thinking about the significance and conduct of this subject within the dental curriculum. The problem, as it existed then, and the goal of Dr. Skinner's book, is best summarized in the preface to that first edition: "One of the obstacles to be overcome in adapting such a course to the dental curriculum is the proper organization of the necessary knowledge. The fundamental background material for this course is scattered throughout the literature of engineering and chemistry, as well as of dentistry. If this book is of help in overcoming this particular obstacle, the author will feel amply repaid for his efforts." And so it did—and much more—as the book soon became a legend.

In my own career I suppose the one single event that I recall more distinctly than any other occurred during an afternoon in a hotel room in French Lick at an annual meeting of the International Association for Dental Research when Dr. Skinner asked me if I would consider being a coauthor of the next edition of that text—the fifth. In about two seconds I had locked the door, gotten the agreement down on paper, and signed—before Gene could change his mind.

During the years we worked on the fifth and six editions I learned much from Gene. He stressed an orderly presentation of facts and his manuscripts were structured accordingly. He adhered to a philosophy that it is as important to know what information should *not* be placed in a text as what *should* be. Lastly, and more importantly, he demanded exactness in the written word and precise accuracy in the concepts and the data presented.

One of the nice fallouts resulting from the preparation for this lecture has been the excuse to go back and reread Gene's papers and the earlier editions of his text. I searched specifically for certain trends in his mode of thinking or in his philosophy that might have previously eluded me. Not surprisingly, I found many, but in the interest of brevity I have selected only two. I would like to identify two currents of thought that run throughout his writings and use them as a backdrop against which to illustrate certain changes now occurring in the practice of restorative dentistry. These two characteristics are his exceptional foresight and his recognition of the importance of clinical tests of the evaluation of restorative materials.

Foresight

If one examines the dental literature on materials during the 1930s and '40s, it is readily apparent that investigators were preoccupied with laboratory test methodology and the niceties of the numbers derived from those tests. Furthermore, there was a definite aura of dogmatism, with restraint against any position that diverged from that which was accepted as true. Empiricisms were common, yet often considered sacred and not to be questioned. However, I find many instances that indicate Gene was gifted with rare intuition and often was somewhat of a maverick. More importantly, his subtle suggestions, or research, frequently proved to be prophetic when viewed in the light of 1975. Some examples follow.

Dental Amalgam. In the 1930s the classical work of Dr. Marie L. V. Gayler led to the first real understanding of the setting reaction in amalgam. Coincident with this was the acceptance by the research community of a rigidly fixed composition for the alloy. Any deviation from the established silver-tin-copper relationship was considered virtual heresy. Conservatism was the golden rule in dental materials. Yet, note the following two sentences from the first edition of the *Science of Dental Materials* (1936): "In the opinion of Gayler, the tin content is the composition factor which determines whether or not an amalgam is suitable for use as a filling material. She places the desirable tin content, irrespective of the silver and copper content, at not less than 25 per cent and not greater than 26.8 per cent by weight. However, the assumptions upon which Gayler bases these statements are somewhat restricted, and it is doubtful whether a complete generalization should be made in this respect."

Subsequent editions of the text re-emphasized that the inflexible limits on the composition of amalgam, and, I might add, other materials, were not all that untouchable. Now—forty years later—sound relationships between the structure and properties of amalgam are being documented for the first time. That knowledge has led to the introduction of commercial alloys demonstrating superior clinical performance, especially in maintaining marginal integrity. And by what mechanism? Precisely by dramatic changes in composition—as suggested by Skinner four decades ago.

Also, in the 1940s and '50s amalgam technics used relatively high mercury-alloy ratios. Then a dentist from Colorado, Dr. Wilmer Eames, came to Dr. Skinner with a technic that he had been using in practice and that appeared to provide better clinical results. Although this contradicted all of the existing theories of amalgam technology, Gene invited Dr. Eames to study in his laboratory and subsequently a paper was published validating the concept. Now the Eames, or minimal mercury, technic is recognized as an essential component in the correct manipulation of amalgam. Incidentally, through that experience, Dr. Eames was lured into dental research and education, where he has since enjoyed an international reputation on the faculty here at Northwestern and now at Emory University.

Adhesive Materials. In the 1930s it was believed, apparently, that certain types of restorative materials were truly adhesive, whereas others were not. In that first edition of *The Science of Dental Materials* one finds the following comment: "It is generally conceded that zinc phosphate cements are adhesive, whereas the silicate cements are not. If the physical definition of adhesion, as being the attraction between unlike molecules, is strictly adhered to, there is *no* adhesion between the set cements and the structures involved."

That controversial statement was challenged in the literature and tested by the methodology available at that time for measuring the adhesive characteristics of dental restoratives. Now it is well established, as he stated, that none of the currently used cements or restorative materials, with the possible exception of the polycarboxylate cement system, produce true adhesion to enamel or dentin. And Dr. Skinner's subsequent plea, in a paper written way back in 1942, that the development of a truly adhesive system would provide a major breakthrough in the quality and nature of dental health care has at last been heeded. At present no other area of biomaterials research enjoys a higher priority.

Restorative Resins. The first self-curing restorative resins were introduced to the profession in the late 1940s. Widely acclaimed as the answer for the esthetic anterior restoration, they were warmly embraced by most dentists —only to reveal that in a short time many of the restorations exhibited severe color change, while secondary caries and pulp pathosis were common. Actually, these dyscrasia were caused not only by inadequacies in the acrylic resin systems available but also by a lack of appreciation of certain principles of manipulation that were essential to success. Nevertheless, by 1951 resin had been virtually abandoned as a restorative material. Now I shall quote from a paper by Dr. Skinner in 1951: "The subject of the so-called 'self-curing' resins, especially as applied for use in operative dentistry, appears to be of considerable interest to the dental profession. According to our present knowledge, the direct acrylic resin restoration should give service, provided that its limitations are recognized, and that the proper technic of manipulation has been followed."

Very few agreed with that judgment and those that did seldom had the courage to admit it. Yet Gene had the vision to see the potential in this system, and a deeper appreciation than most for the relationship of properties to clinical behavior. Now the composite resin is a material in the armamentarium of every practicing dentist, a documentation of the prediction rising out of the chaos of that particular era.

Handpieces. The use of ultra high-speed handpieces for the removal of tooth structure is now routine. This was not always true. Before 1955 bur speeds of less than 20,000 rpm were in use. But shortly after the introduction of the first high-speed cutting tools, a cry arose that they were less efficient, pulp damage from thermal shock was reported, and bur lifetime questioned. In the first comprehensive evaluation of the devices and technics then available, Dr. Skinner summarized: "The studies indicated that instruments which produced the ultra-high speeds, 225,000 rpm and above, resulted in maximum cutting effectiveness, minimal pulpal trauma, reduced operator fatigue, and increased life of the cutting instrument."

This statement coming from such a respected investigator cleared the air for further development of the present high-speed instrumentation which has revolutionized operative procedures. One further comment in that paper bears citation: "These instruments require a copious stream of water for coolant purposes."

Importance of Clinical Research

Let me turn to the other facet. As mentioned previously, Dr. Skinner emerged from an age when attention centered on laboratory methodology. Data were accumulated as a sort of capital investment with little attempt to relate them to dental practice. In fact, any such effort was usually interpreted as an adulteration of the discipline. However, those of us who knew Gene remember his concern for, and interest in, *clinical* research. As a matter of fact, he frequently pleaded with practitioners to make meaningful observations and to publish such data. Examples are countless. In a paper in 1942 related to the use of acrylic resins for denture bases was the following comment: "However, all of this discussion of properties should be followed by diligent and accurate clinical research. Every one of the readers of this paper has it within his power to carry on valuable research and therefore contribute to the general knowledge of the profession, and more important, to the general health of our nation."

In a tape recording made in 1960 by Dr. Eames, Gene said: "I would give a lot to have a good patient file—patient histories well kept, and classified. If I could get hold of something like that, [files] which had been kept for five or ten years, and could take the time to sit down and do a real statistical analysis, I think we would probably get more information out of that file on dental materials than we could get here in the same length of time. The final testing laboratory is the patient's mouth."

Finally, in a paper presented to the American Association of Dental Schools back in 1940, he succinctly suggested: "In the last analysis, the practitioner does possess the basic tools for research, namely, the patient and the clinical records. Many times the basic science research worker sits amongst the extensive research equipment to which he has access and longs to trade all of it for the training of a dentist, and accurate records of dental practice, in order to determine whether his ideas are merely academic, or of practical value. If the dentist has kept accurate records, they are potentially more practical tools of research then all of the microscopes, test tubes, and testing machines in the world."

If time permitted, one could use the foregoing excerpts from Gene's writings and comments to illustrate how certain of these threads have been woven into the changing practice of restorative dentistry. For example, current research programs in dental biomaterials place particular emphasis on clinical studies designed to establish the practical significance of laboratory data. This has resulted in the reasonable hypothesis that creep and the presence or absence of the gamma-two phase in amalgam are better related to marginal deterioration than other properties, such as compressive or tensile strength.

On the other hand, the clinical observations on Class II composite restorations clearly document the lack of validity of using the conventional laboratory test of abrasion to predict clinical performance of a given material. The

long-term clinical evaluations in progress on base metal alloys as substitutes for gold alloys are essential before an accurate comparison can be made between the two, in matters such as corrosion resistance and the strength of the porcelain-metal bond.

The need for the development of dental adhesive molecules, as suggested by Gene decades ago, has been heeded. A direct result, or a fallout, of such research has been the introduction of the polycarboxylate and glass ionomer cement systems, acid etching technics, and pit and fissure sealants.

"The Normally Great Minds . . ."

This lecture should be dedicated not to the past but as a continuing living memorial to Dr. Skinner's remarkable insight and particularly his sensitivity. Knowing Gene as I did, I consider the following sentence from the Memorial Plaque to be especially appropriate: "He understood and appreciated the arts, classical music, his garden, his wife Rosamond, his children, and a group of close friends from around the world who constituted the well from which flowed his greatest joys."

Possibly the best image of the real nature of the man is the following quote from a paper he wrote in 1940 on the philosophy of investigation, which so nicely places research and its importance in the proper perspective. "Lastly, but not the least benefit to accrue to the man who practices research methods, is the possible cultural values involved. Is it not true that a mind disciplined to collect the facts and to draw accurate conclusions from such facts, will be able to adapt itself better to its environment? The possessor of such a trained mind should be in a position to be a better family man and a more intelligent citizen, since in his weighing of the facts, he must take into consideration and appreciation the viewpoint of the other fellow. He must never allow his thinking to be destructive, but always constructive. Destructive criticism is seldom intellectual; rather it appeals to the emotions. The normally great minds of history have been constructive in their thinking, and the applications of their conclusions are the reasons why they are remembered in history."

Better than most, Gene appreciated the danger in glorifying science but forgetting the scientist, magnifying government but ignoring those who discharge its function. As knowledge pushes back even further the parameters of the unknown, the responsibility of the profession to maintain excellence in its practice and research becomes greater. For as John Gardner (1962) has said, "An excellent plumber is infinitely more admirable than an incompetent philosopher. The society which scorns excellence in plumbing because plumbing is a humble activity and tolerates shoddiness in philosophy because it is an exalted activity, will have neither good plumbing nor good philosophy. Neither its pipes nor its theories will hold water."

Because of the Gene Skinners, the science of dental materials forms a pillar for the foundation of this profession as strong as that of any other discipline. However, the continuing discharge of its responsibilities can be realized only if it accepts a critical, reflective attitude capable of envisioning and reacting to the new challenges which a changing profession will offer. The future is an exciting one but its rewards depend on a virtuous use of the tools and skills with which the scientific community is now blessed.

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OPERATIVE DENTISTRY, 1976, 1, 66-69.

Writing for *Operative Dentistry*

A. IAN HAMILTON

The reader, not the author, communicates. The reader's needs are parallel with the importance of the information.

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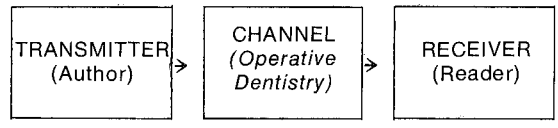
Instructions to contributors on the preparation of a manuscript for a journal deal mainly with technicalities that are essential to the editorial process. These instructions may be more intimidating than encouraging but, in any event, they need not be the primary concern of the author when he sits down to write. He should have the reader in mind. Our purpose here is to describe the types of article we think are wanted by the readers of *Operative Dentistry* and to address prospective contributors on the importance of communicating effectively.

Importance of the Reader

Communication requires a transmitter, a receiver, and a channel connecting the two. For our purpose the transmitter is the author, the receiver the reader, and the channel of communication *Operative Dentistry*.



All three elements of the process of communication are essential, but we tend to forget that without a reader there can be no communication. In a sense we can say that the reader, not the writer, communicates (Drucker, 1970). Accordingly, we must attend to the needs of the reader by providing information that interests him and by presenting it in a form that is easy to apprehend. Care should be taken not that the reader may understand, if he will, but that he must understand, whether he will or not (Quintilian, 1892 ed.). Too often the interests of the reader are disregarded. Some maintain that a high standard of writing is unnecessary because the reader, if he is interested enough, will struggle through an article even if it is badly written. But such writing is discourteous. Moreover, imprecise and woolly writing may

lead to misunderstandings. The reader is distracted when he has to ponder over a statement to decide which of alternative meanings is the least unlikely (Allbutt, 1923). In *Operative Dentistry,* we intend to give the reader prime consideration.

Types of Article

Most of the subscribers to *Operative Dentistry* are practicing dentists or teachers in dental schools. We expect all who read the Journal are interested in improving the service they provide to patients, in operative dentistry in particular, and in dentistry as a whole. The readers are interested especially in information that enables them to improve techniques, select better materials, and learn more about the fundamental principles, both physical and biologic, on which operative dentistry depends. The readers are not interested, on the other hand, in procedures which, though saving time, do not maintain quality. Improvement is what is wanted.

Original Articles. Articles that report new findings are the lifeblood of any journal engaged seriously in trying to raise standards. One difficulty with this kind of article is that it may use specialty terms, particularly in statistics, that may not be readily comprehensible to the practicing dentist. In writing for our Journal, scientists have an obligation to present their work in terms that its particular readers can easily understand. The example set by *Scientific American* shows that this is possible. Another difficulty is that often the descriptions of materials and methods and the reviews of the literature can be unduly long and soporific —on a par with reading a telephone directory or a catalog. Of course, enough information must be given to satisfy the reader as to the credibility of the results and to enable another investigator to repeat the study if he wishes. Often the details, unless they are critical to the exposition, are best obtained by personal communication with the author. The *result* of the study is of greatest interest to the dental practitioner.

Research of all types, from fundamental to clinical, is important and we seek articles from the broad spectrum of research activity. A vast and scarcely tapped source of valuable information lies dormant in the experiences of practicing dentists. Clinicians use techniques and materials daily and are admirably situated to assess their effectiveness. We hope, in a future article in *Operative Dentistry,* to say more about the ways in which practicing dentists can contribute to the Journal the valuable information they have gleaned from years of clinical experience. A dentist may find that a slight modification in a well-known procedure, such as a change in the method of applying a matrix for amalgam, may improve his results markedly, but he may think that the change is not great enough to warrant a full-blown article. Such topics, however, are well suited to short reports and as such can be effective because their brevity enhances their chance of being read. We encourage the submission of brief reports that describe and illustrate new techniques, or modifications of existing techniques, that lead to better and more durable service.

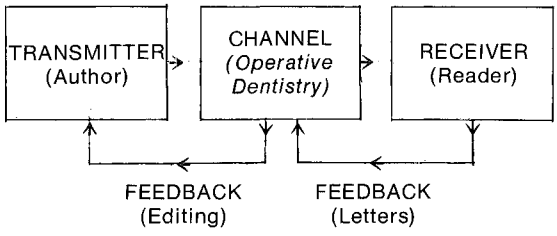
Review Articles. The publication of new information does not in itself create knowledge (Ziman, 1969). The bits of information must first be incorporated into the structure of a larger pattern. Thus not only do we need articles that provide new data by analysis but also articles of an entirely different kind that synthesize the data into a body of knowledge. The best type of article for this purpose is a review article. Review articles sift and evaluate the data and reappraise the state of affairs in the light of new discoveries. These articles need not be all-encompassing but rather should be directed to limited topics to keep the reports from being overly long. A review of polishing amalgams, for instance, need not extend to other aspects of amalgam. Review articles are as valuable as original articles and usually very popular with readers.

Theses. A wealth of useful information lies buried in theses which often remain unpublished. This is because, on the one hand, the thesis as such is usually much too long to be published in a journal and, on the other hand, the author may believe that the results would not constitute an adequate article unless accompanied by excessive padding. However, many of the studies on which theses are based are well planned and produce valid data. The results of these studies should have an outlet and, in an abridged form, should be made available to the profession. Anyone interested in further details of a study can get them from the thesis, a copy of which is usually obtain-

able from the institute that awarded the higher degree. We urge graduate students to select the essential features of their investigations and prepare them in a form suitable for publication.

Points of View. We need articles that present a point of view or an opinion that is not necessarily substantiated by research or scientific evidence. Intuition can be valuable. Many good opinions do not see the light of day because the originator believes they should not be published without the benefit of scientific justification, which might take years of study and be beyond the resources of the author. The *Point of View* section provides an outlet for sage comments on any aspect of operative dentistry.

Letters to the Editor. We encourage you to write to the editor about *Operative Dentistry* and operative dentistry. Short letters are preferred to long ones. Readers are interested particularly in comments about the articles published in the Journal. Confirmation of results, their modification, or even rejection, all help to clarify contentious topics. A reader with specialized knowledge can sometimes, by an astute observation, put matters in their proper perspective and so enhance our understanding of a subject. The editorial staff welcomes advice or criticism that will help the Journal to fulfill its function of advancing operative dentistry. Letters constitute the feedback component of our system of communication. They complete the loop to close the system and thus subject it to a measure of control. The reader is the consumer; his views should be respected.



Who knows what gems we may unearth; after all, work that gained a Nobel Prize for the authors was published as a letter to an editor (Watson & Crick, 1953).

Composition. Writing for scientific journals does not lend itself to elegance; a simple and direct style is adequate. There are several good books on writing to aid authors seeking improvement. Among the best are Gowers (1975); Strunk & White (1972); O'Connor & Woodford (1975); Woodford (1968); Trelease (1970); Dixon (1973). Here we comment on just a few of the important elements of composition that are often disregarded.

Structure is as important to a written article as to a living organism. We can reveal structure and emphasize it by using headings to indicate subdivisions within the text and thus guide the reader on his way. A solid page or two of unrelieved prose intimidates many readers and may discourage them from beginning at all. On the other hand, short sections, well delineated by headings, invite the reader because he can see in advance where he may pause, if necessary, and begin again.

Resist the temptation to digress from the main topic. Unnecessary information, or too much information, produces a 'noisy channel', as it is called in the theory of communication, and creates confusion.

Writing is more lively and enjoyable if we use the personal pronouns 'I' and 'we', and the active rather than the passive voice.

Avoid chains of modifiers, especially nouns, such as 'ultraviolet-polymerized fissure sealant' in which there is some ambiguity as to whether the fissure or the sealant is polymerized; prefer instead 'the fissure sealant polymerized by ultraviolet'. This problem of "high polymer adjective synthesis" is discussed at length by Dean (1951) and Woodford (1968).

Illustrations

An illustration often saves many words of explanation and facilitates comprehension. Illustrations may be either photographs or drawings.

Photographs are very useful in illustrating clinical conditions both before and after treatment. The oral cavity is not easy to photograph because there is little contrast in the color of teeth and because the area is difficult to illuminate if proper modeling is to be recorded. Often the quality of photographs is inferior because of the arrangement of the subject in the viewfinder, because the subject is out of focus, or because of inadequate equipment. At their best clinical photographs are effective, but all too often they are disappointing and fail to show clearly what is intended. Proper equipment is needed if good results are to be

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POINT OF VIEW

Prevention in Perspective

MARVIN A. JOHNSON

The great emphasis on a part of preventive dentistry has tended to obscure its broader and more important functions in preventing the loss of the dentition.

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Dr. Johnson conducts a private practice and is an assistant professor part-time at the University of Washington School of Dentistry. He is a member of the American Academy of Crown and Bridge Prosthodontics and the Tacoma Operative Seminar.

Preventive dentistry in the last ten years has risen to prominence in the lecture circuits on the premise that brushing and flossing can solve 90 percent of the patients' dental problems. Thousands in our profession travel to the recreation capitals of the world to hear young specialists in communication give their ideas on patient motivation, plaque control, and how to get paid for these services. The main attraction, other than a deductible trip, seems to be the discovery of another way to extract a fee from the patient for services rendered with attractive auxiliaries or videotape and for urging the patient to assume more responsibility for his own dental health.

I have no quarrel with deductible trips; I believe plaque control to be absolutely essential; I believe in honest fees for services rendered; and I believe in patient responsibility. So why am I concerned? To call flossing, brushing, and fleecing preventive dentistry is one of the greatest overstatements in the history of our profession—like renaming Bunker Hill Mt. Everest. To build this limited concept of prevention into a specialty is unthinkable.

Preventive dentistry has changed little since the days of G. V. Black. It requires a complete diagnosis of the patient's dental problems and a program of dental treatment and maintenance designed to obtain the greatest possible service from his existing dentition, whether his age is six or sixty, and whether he has a normal dentition or is edentulous.

The goal of all dental treatment should be preventive in the sense that it should be designed to preserve the dental apparatus against the ravages of wear, age, and disease. This principle should apply in every phase of

achieved. An excellent combination of camera and accessories has been selected by our consultant on photography (Freehe, 1976, 1972). Anyone contemplating writing for *Operative Dentistry* is urged to acquire the suggested, or similar, equipment, or consult Mr. Freehe about modifying equipment already available.

Supplements

Longer contributions such as monographs or theses may be published as supplements to *Operative Dentistry*. The cost of publishing a supplement would have to be borne by the author.

Conclusion

The foregoing comments are general and should not be interpreted as applying to every contribution to *Operative Dentistry*. Each article will be treated individually. The editorial staff is willing to do all it can to help authors arrange their material in the best possible form for the reader. We hope in this way to enlarge the readership of each article and thus contribute to the advance of operative dentistry, ultimately to the benefit of the patient.

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dentistry from pedodontics to prosthetics. Nowhere is it more important than in the office of the family dentist where the patient may start at three years of age and remain to bring in his or her children twenty-five years later.

The true preventive dentist not only gives diet counseling, provides fluoride treatment, and insists on the patient controlling plaque, but also makes prompt specialty referrals when indicated. He monitors occlusal function, corrects occlusal form and patterns of wear, and gives counsel on destructive habits. He intercepts developing periodontal disease by correcting the problem himself or by proper referral. The preventive dentist diagnoses early carious lesions and makes conservative meticulous restorations that will best preserve and protect the remaining tooth structure and *prevent* recurrence of the disease.

I have heard many leaders in periodontics and restorative dentistry say that a large portion of the dental disease in our middle-aged population is iatrogenic. These statements along with my years of clinical experience have led me to believe that the restorative procedures used and abused today must be a major focus of our concern. The preventive aspect of correct, conservative, restorative treatment of incipient caries could mean countless savings both in dental manpower for the profession and in suffering and expense for the patient. Prevention of iatrogenic dental disease should be the prime consideration of every member of the dental profession.

Because of overwhelming demands of the public for dental treatment and the physical stress placed on the dentist by careful exacting operative procedures, efforts are always made to do it quicker and easier. In the past, such shortcuts have resulted in failures, retreatment, and further retreatment as long as the tooth was in place, and replacement after its demise. One sage of the dental profession has said, "If you can't take the time to restore a tooth properly the first time, what makes you think you'll have time to do it correctly the next time?" Because many in the profession have given up the field of operative dentistry as too perverse, unproductive, or mundane, they are trying to relegate it to an auxiliary function not worthy of their time or effort. The position of operative dentistry in dental schools is deteriorating. Procedures requiring self-discipline, ability, and skill are being dropped from the curriculum and, in many areas, state boards are giving absolution.

Moore and Stewart (1967) have concluded that more than one-third of the effort of operative dentistry is spent replacing defective restorations. If this was true in 1967, and our standards of education are diminishing, the future appears chaotic.

For the last ten years, I have observed a growing concern at every level of organized dentistry from local to national about this apparent trend in operative dentistry. I urge the deans of our dental schools and other curriculum planners and visionaries to come out of their offices, look into our clinics, and talk to dentists whom they might choose for their personal dental treatment.

Thinking, conscientious practitioners who perform preventive procedures in every phase of their practice, though less vocal than I, are worried. Common sense would seem to dictate that the trend to condone sloppy, restorative procedures must be reversed. We can't afford to do otherwise. Iatrogenic dental disease is already an epidemic.

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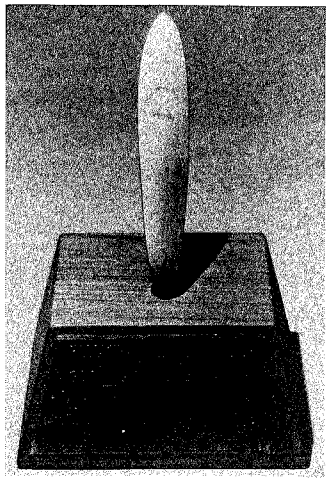
Hollenback Prize



The 1976 Hollenback Memorial Research Prize has been awarded to Dr. George C. Paffenbarger. The prize is given annually by the Academy of Operative Dentistry to recognize excellence in research that has contributed substantially to the advancement of operative dentistry.

The prize was won by Dr. Paffenbarger in recognition of his outstanding contributions to operative dentistry, particularly for his research on precision casting, amalgams, and direct filling composites and for his effective promotion of standards for dental materials.

At the present time Dr. Paffenbarger is active in research on dental materials at the National Bureau of Standards where he began his research career almost fifty years ago as a research associate of the American Dental Association. His early efforts, directed toward perfecting the precision casting technique, included studies of gold alloys, waxes, investment materials, and the casting procedure. Since then his work for the operative dentist has ranged from the zinc phosphate cements, silicate cements, direct filling resins, impression materials, and dental amalgam to the clinical evaluation of composite restorative materials. In 1941 he published an article concerning the pulp response to filling materials and in 1952 with Nelsen and Wolcott reported on microleakage, or fluid exchange, at the margins of dental restorations. Not only has he been effective in dental research but his persistent efforts have contributed in a major degree to the development of the American Dental Association and International Standardization Organization specification programs.

The quality, quantity, variety, and clinical relevance of the research Dr. Paffenbarger has completed and continues to do make him most worthy of this honor.

Dr. Paffenbarger graduated from Ohio State University, and in 1924-25 was associated with his father in practice of dentistry at McArthur, Ohio. Following this he was an extern at the Palama Settlement Dental Clinic, Honolulu, Hawaii, 1925-26; instructor in the College of Dentistry, Ohio State University, 1927-28; and research associate of the American Dental Association at the National Bureau of Standards, 1929-41, and since 1946. He directed the work of the American Dental Association Research Division from 1931 to 1967. The American Dental Association gave him a leave of absence from 1942-46 to serve in the Dental Corps of the United States Navy at the Naval Medical Supply Depot, Brooklyn, New York. During this five-year period, Dr. Paffenbarger advanced from lieutenant commander to commodore. He now holds the rank of rear admiral (retired) in the U.S. Naval Reserve. In 1959 Dr. Paffenbarger was the Praelector in Dentistry on the Faculty of Medicine, St. Andrews University (Scotland). He holds both an honorary M.D.Sc. degree (1959) and a D.Sc. degree (1961) from Nihon University (Tokyo). Dr. Paffenbarger was awarded the degree of Doctor of Science at the time he was a visiting professor in dentistry at Nihon University.

He is an honorary member of dental associations in Japan, Germany, France, Brazil, and the United States and is on the List of Honor of the Federation Dentaire Internationale. He has also been made an honorary member of the American Dental Association.

DEPARTMENTS

Press Digest

Should I be using amalgam or composite restorative materials? Phillips, R. W. (1975) *International Dental Journal* (25), 236-241.

Compressive strength of composite resins commonly reaches 45,000 psi compared with amalgam at 55-60,000 psi. Tensile strengths are comparable at 7,000 psi, as are coefficients of thermal expansion. Amalgam, however, is substantially harder.

Observations up to 4 years indicate the marginal integrity of each is similar. With amalgam, however, microleakage decreases with time. Composite resins are decidedly inferior to amalgam in resistance to wear. Composite resins tend to become yellow with time and there is likely to be marginal percolation. Amalgam is preferable to composite resins for Class I and Class II cavities.

Clinical aspects of composite restorative materials. Jacobsen, P. H. (1975) *British Dental Journal* (139), 276-280.

The best adaptation is obtained when the composite resin is inserted immediately after mixing. Only one cavity should be filled from each mix. To secure good adaptation a matrix should be used. Bis-GMA composite resins shrink about 3% in 30 minutes. Shrinkage is compensated by expansion in water but the gap between filling and cavity wall did not close. Compensation does not begin until 4-6 hours after insertion, therefore finishing should be delayed. Margins are improved if filling is delayed a week.

Setting shrinkage allows microleakage which may cause pulpal sensitivity, staining of the margins, and recurring caries. The high thermal coefficient of composite resin compared with that of the tooth leads to a breakdown of mechanical adhesion and thus increases the gap between filling and cavity. Temperature changes stress the bond between filler and resin and this may result in more surface staining. The future of tooth-colored restorative materials is in the development of chemical adhesion and monomers of low shrinkage.

Bases for gold inlays and crown restorations. Bryant, R. W. and Wing, G. (1975) *Australian Dental Journal* (20), 392-396.

This article reports an investigation of the strength of the bond between various cements used as luting agents and a number of materials for bases. Zinc phosphate cement does not bond as well to calcium hydroxide or zinc oxide-eugenol cement as to a base of zinc phosphate cement. Polycarboxylate cement does not bond to calcium hydroxide or zinc oxide-eugenol cement. It is recommended that if zinc phosphate cement is used for luting, any calcium hydroxide or zinc oxide-eugenol used as a sedative base should be covered with zinc phosphate cement retained by undercuts in the cavity.

Principles of occlusion in periodontics and general dentistry. Basaraba, N. (1975) *Journal of the Canadian Dental Association* (12), 660-663.

Occlusal trauma is believed not to initiate gingivitis or periodontitis but may aggravate pre-existing lesions. The intensity, frequency, duration, and direction of the occlusal load may exceed the capacity of the tissue to adapt. Occlusal trauma leads to resorption of circumferential alveolar bone and its replacement by a thicker ligament. This in turn predisposes the periodontium to disease. Although it is generally believed that occlusal relationships should not be altered in the absence of positive symptoms, occlusal therapy eliminates or decreases

wear, mobility, fracture, pain, temporomandibular joint sounds, restricted opening, muscle spasm, and related headaches. The undesirable influences, therefore, should be eliminated.

Tooth positions cannot be maintained after orthodontic treatment if the teeth are deflected by contacts on slopes. Restorations are often built to a centric occlusion that does not coincide with centric relation. Every effort should be made to eliminate occlusal stresses that are deleterious.

Ultrastructural gingival reactions to gold foil restorations. Frank, R. M., Brion, M. & De Rouffignac, M. (1975) *Journal of Periodontology* (46), 614-624.

Restorations of gold foil were placed in Class V cavities in four beagle dogs. After three weeks the gingiva was examined with an electron microscope. The sulcular epithelium was inflamed. The inflammation was attributed to the plaque which covered the restorations, not to the gold foil.

D is for dodo. Will, G. F. (1976) *Newsweek* (February 9), p. 84.

Since the mid-1960s the grades of undergraduates have risen substantially. In 1974 at Harvard 82% of the class graduated cum laude or better; recently at Stanford the average grade was A−; at Vassar 81% of all grades were As and Bs; at Amherst more than 85%; in a decade at the University of North Carolina the percentage of A students doubled; and at the University of Wisconsin the average grade rose from C+ to B+.

Some attribute the higher grades not to inflation but to smarter students. However, for the twelfth year in succession there has been a steep decline in the average scores of high school students on the Scholastic Aptitude Test.

Grades are inflated in some cases to lure large enrollments and justify large budgets, in others as a response to student evaluations of faculty. Inflation of grades is caused primarily by rejection of the elite for the egalitarian. But if everyone is supremely gifted then almost everyone is above average.

Letters

Dear Sir:

On behalf of the officers and members of the Associated Ferrier Gold Foil Study Clubs, I would like to add my best wishes and our compliments to you and your staff for the outstanding new journal *Operative Dentistry*.

The scholarly, scientific reports are excellent and well written by men who are most authoritative. The printing and format are clear and concise, making for easy reading.

The magazine has supplied "that extra something" to both the American Academy of Gold Foil Operators and the Academy of Operative Dentistry to give them a national reputation for excellence.

The Journal itself certainly should be recommended to be used as a reference source, for it is not only a splendid contribution to dental science, but a noble tribute to dentistry.

Many thanks for such superior efforts. It will inspire us all to greater accomplishments.

Fraternally,

Harold L. Sondheim
Secretary-Treasurer, Associated Gold Foil Study Clubs of Washington and British Columbia
1532 Medical & Dental Building
Seattle, WA 98101

Dear Sir:

I enjoyed the first issue of *Operative Dentistry* and am looking forward to subsequent issues. It is a journal which was greatly needed in this age of specialization.

Being an East Coast dentist, as the saying goes, I find that use of gold foil is virtually unknown here and I personally feel this is unfortunate. While in the Air Force I was stationed

—continued

with dentists who were educated on the West Coast, and their knowledge of golds was quite competent. I regret that there are so few, if any, opportunities to re-learn use of gold in this area. Perhaps the journal will cause rebirth of interest in gold foils here and study clubs may be formed. Until such time as that occurs, could you perhaps give me the titles of a few texts or articles that are current on the subject?

Thank you for your attention.

Very truly yours,
Charles S. Liebowitz
Smith Haven Mall
Lake Grove, NY 11755

Dear Sir:

Just finished reading Dr. Phillips' article in the first number of *Operative Dentistry.* If more articles were written and condensed like this one it would sure make reading dental literature a lot more enjoyable.

Sincerely,
Jerry H. Leer
445 North Pennsylvania Suite 904
Indianapolis, IN 46204

Dear Sir:

Just a short note of congratulations for a brilliant effort with regard to the new journal *Operative Dentistry.* I have always loved my operative dentistry in general and gold foil in particular. You've really done a marvelous job! Bravo! I simply can't say enough about how enthusiastically my friends have received your journal.

I hope there will be more articles concerning dental materials, particularly the new amalgams that are being marketed.

Dr. Stibbs' article and photographs concerning gold foil were most interesting and what magnificently done gold foils! Those Class II foils were superb. I'm green with envy.

I hope you will continue your book reviews also; as I am always purchasing and interested in the newest restorative dentistry textbooks.

Sincerely,
Vaughn I. Ikemura
370 West Sierra Madre Boulevard
Sierra Madre, CA 91024

Dear Sir:

I received my copy of *Operative Dentistry* last week and have gone through it from cover to cover.

I feel that I must write you a short note to tell you that your first copy is great—even the cover is striking.

I like the sections into which you have divided the Journal.

We now have a journal in which everything is of deep interest to me, cover to cover.

Of course, I totally agree with Dean Terkla's article and also the letter by George Ellsperman.

Sincerely,
R. Terrace
Professor and Chairman, Section, Operative Dentistry
Fairleigh Dickinson University
School of Dentistry
Hackensack, NJ 07601

Dear Sir:

I wish to congratulate you on your first edition of *Operative Dentistry.* It contained some excellent pertinent articles. It was easy to read, well laid out, and attractive.

Sincerely,
G. H. Gibb
Professor and Chairman, Department of Operative Dentistry
University of Alberta
Faculty of Dentistry
Edmonton, Alberta, Canada T6G 2E1

Dear Sir:

Congratulations to you and your Editorial Board for the excellent job on the journal. The layout and choice of articles are excellent; I shall have our staff review each article for discussion at our weekly conference. Thank you on behalf of all of us.

Sincerely,
Robert B. Wolcott
Professor and Chairman, Section of Operative Dentistry
University of California
School of Dentistry
Los Angeles, CA 90024

Dear Sir:

Just a note to tell you how much I enjoyed the first issue of *Operative Dentistry.* I think it is a real winner and I will look forward to it making a significant contribution to the profession. I particularly enjoyed Dr. Stibbs' article on gold foil.

Sincerely,
David O. Moline
President, Academy of General Dentistry
2304 Lemon Street
Metairie, LA 70001

Dear Sir:

I just wanted to drop you a note and congratulate you on the first issue of *Operative Dentistry.* If this issue is any indication of what is to follow, we can expect to have an excellent publication.

Again let me congratulate you and wish you well.

Sincerely,
R. J. Aylen
305 East Pioneer
Puyallup, WA 98371

Book Review

OCCLUSION

By Hamish Thomson
FDS RCS (EDIN) LDS RFPS (GLAS) DDS (NU)
Honorary Senior Lecturer, Department of Prosthetics, Institute of Dental Surgery; Consultant, Eastman Dental Hospital, London

Publisher: John Wright & Sons Ltd., Bristol, 1975. 276 pages, illustrated, glossary, appendix, and indexed. Price $27.00

Foreword by Sir E. Wilfred Fish

"This book is the record of a diligent search for the rules that govern the achievement of perfect occlusion. The inquiry is not confined to the natural dentition, with or without the provision of fillings, inlays or bridges, but extends also to the design of occlusal surfaces of dentures, whether partial or full. It is clearly the account of a comprehensive inquiry, the report of an unusually thorough example of purely clinical dental research, and therefore it has a special significance . . . direct practical value."

The book attempts to present some aspects of occlusion not already covered by such acknowledged authorities as Ramfjord and Ash, Posselt, Kraus, Abrams and Jordan, Schweitzer, Krough-Paulson, Beyron, Boucher, Brower, and Lauritzen, and by gnathologists McCollum, Stuart, Granger, Thomas, Lucia, and their successors. The result has been an absorption of these men's work and teaching with some extensions and changes of emphasis.

Chapter 1, "Terms, Influences and Concepts," addresses an area of incontrovertible difficulty with most students of occlusion. The adjective *centric* does not appear in the text and neither does *model.* The reader, however, is not left standing downcast with mania all around him, nor is he left in a kind of purgatory, unable to take the final step into a paradise of do's and don't's. Definitions and explanations are manifest throughout the text and

the author acknowledges the North American influence in equal measure with that of Britain and Scandinavia.

Chapters 2 through 8 review important literature in these areas: muscles, joints, and teeth; neuromuscular function; positions and movements; occlusion and articulation; functions of the masticatory system; articulators; disturbances and disorders. The author annotates each chapter. In Chapter 9, "Analysis and Diagnosis," the author offers an interesting reference list for assessing occlusal problems that can lead to more comprehensive functional, gnathosonic and articulator investigations. This background portion of the text brings the reader to four chapters of discussion in specific areas of clinical treatment—fixed restorative procedures; complete and partial dentures; adjustment of natural teeth; and treatment of disturbances and disorders. The text concludes with a summary and an exhortation.

The line drawings in this text are good; however, many of the photographs are poorly cropped and the quality of many is mediocre. The last four chapters could be more instructive if illustrations of clinical cases and presentations of specific treatment were available to the reader. Nonetheless, when an author is presented with a Grand Canyon of an occasion and a mere eyecupful of consensus, he must tacitly concede that limitations are necessary.

J. Martin Anderson

Announcements

NOTICE OF MEETINGS

American Academy of Gold Foil Operators
Annual Meeting: November 11 and 12, 1976
Loma Linda University
Loma Linda, California

Academy of Operative Dentistry
Annual Meeting: February 17-18, 1977
Chicago, Illinois

NEWS OF THE ACADEMIES

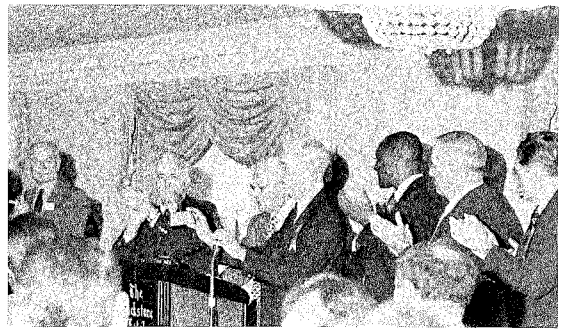
Academy of Operative Dentistry

The annual meeting was held February 13, 1976, at the Blackstone Hotel in Chicago. Morning table clinics were attended by some 170 participants. The luncheon speaker, Dr. Clifton Dummett (USC), urged quality dentistry for greater numbers, with ideas for implementing this goal. The afternoon panelists reviewed the uses of amalgams, cements, and resins.

Officers for 1976 are: H. W. Gilmore, president; D. Jackson Freese, president-elect; Donald Welk, vice president; R. J. Werner, secretary-treasurer; Robert Kinzer and Harold Laswell, councilmen.

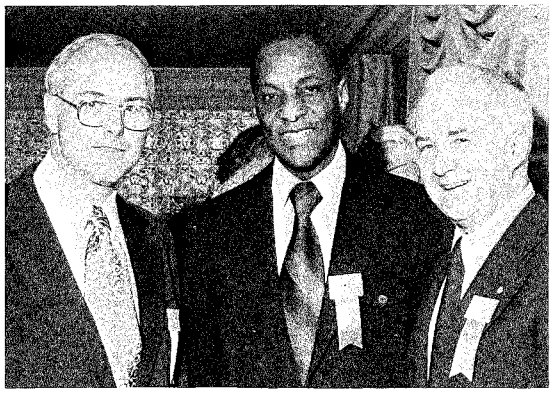
Tentative dates and place for 1977 are the Hyatt Regency hotel in Chicago February 17-18.

George Paffenbarger responding to his being presented with the Hollenback Prize.

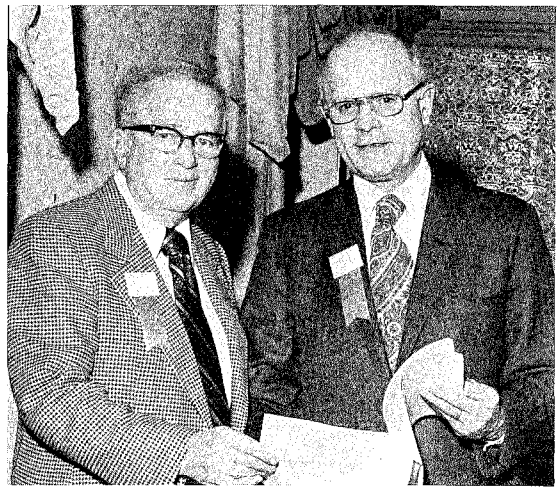


Applause for George Paffenbarger on presentation of the Hollenback Prize. From left: Ralph Werner, Ian Hamilton, Cliff Sturdevant, George Paffenbarger, Nelson Rupp, Clifton Dummett, Bill Gilmore, and Bruce Smith.

Cliff Sturdevant accepting a plaque in recognition of his services as president.

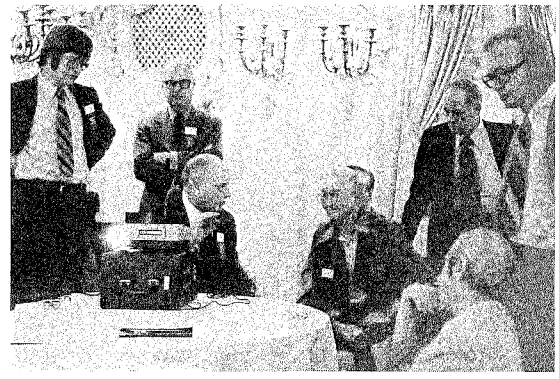


Bill Gilmore, president-elect (left), Clifton Dummett, guest speaker (center), and Cliff Sturdevant, president (right).



Marty Dionne and Jack Freese conferring on Academy affairs.

Scenes from the annual meeting at the Blackstone Hotel in Chicago February 13.



George Brass discussing dispersed phase amalgams with Paul Dawson and others.

Gary Hill describing a technique of restoring a hemisected tooth.

Steve Jepson demonstrating the manipulation of wax to Marty McIntyre.

INSTRUCTIONS TO CONTRIBUTORS

Correspondence

Send manuscripts and correspondence about manuscripts to the Editor, Professor A. Ian Hamilton, at the editorial office: OPERATIVE DENTISTRY, University of Washington, School of Dentistry SM-57, Seattle, Washington 98195, U.S.A.

Exclusive Publication

It is assumed that all material submitted for publication is submitted exclusively to *Operative Dentistry.*

Manuscripts

Submit the original manuscript and one copy; authors should keep another copy for reference. Type double spaced and leave margins of at least 3 cm (one inch). Supply a short title for running headlines. Spelling should conform to *Webster's Third New International Dictionary,* unabridged edition, 1971. Nomenclature used in descriptive human anatomy should conform to *Nomina Anatomica,* 3rd ed., 1966, and *Nomina Histologica,* 1975; the terms 'canine', 'premolar', and 'facial' are preferred but 'cuspid', 'bicuspid', and 'labial' and 'buccal' are acceptable. SI (Système International) units are preferred for scientific measurement but traditional units are acceptable. Proprietary names of equipment, instruments, and materials should be followed by the name and address of the source or manufacturer, in parentheses. The Editor reserves the right to make literary corrections.

Tables

Submit two copies of tables typed on sheets separate from the text. Number the tables with arabic numerals.

Illustrations

Submit two copies of each illustration. Line drawings should be in india ink or its equivalent on heavy white paper, card, or tracing vellum; any labeling should be on an extra copy or on an overleaf of tracing paper securely attached to the illustration, not on the illustration itself. Type legends on separate sheets. Photographs should be on glossy paper and should be cropped to remove redundant areas. For best reproduction a print should be one-third larger than its reproduced size. Maximum figure size is 15x20 cm (6 x 8 inches). The cost of color plates must be met in full by the author. On the back of each illustration, near the edge, indicate lightly in pencil the top, the author's name, and the figure number. Type legends on a separate sheet. Where relevant, state staining techniques and the magnification of prints. Obtain written consent from copyright holders to republish any illustrations published elsewhere.

References

Arrange references in alphabetical order of the authors' names at the end of the article, the date being placed in parentheses immediately after the author's name. Do not abbreviate titles of journals—write them out in full. Give full subject titles and first and last pages. In the text cite references by giving the author, and, in parentheses, the date, thus: Smith (1975) found . . .; or, by placing both name and date in parentheses, thus: It was found . . . (Smith & Brown, 1975; Jones, 1974). When an article cited has three authors, include the names of all of the authors the first time the article is cited; subsequently use the form (Brown *et al.,* 1975). Four or more authors should always be cited thus: (Jones *et al.,* 1975). If reference is made to more than one article by the same author and published in the same year, the articles should be identified by a letter (a, b) following the date, both in the text and in the list of references. Book titles should be followed by the names of the place of publication and the name of the publisher.

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