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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

Salaried Dentists & the Tax Act of '86

The much ballyhooed tax reform package recently enacted, known as "The Tax Reform Act of 1986," has been implemented and we shall all live with its consequences. Originally, the act was billed as an effort to simplify the tax laws and to eliminate many of the loopholes, felt by many to be unfair as some corporations and individuals were perceived as not paying their fair share of taxes under the previous tax laws of the land.

Will this new tax law accomplish what it was intended to do? Only time and the authors of the legislation can answer that, as we the people really cannot tell what the Congress had in mind. Some say the bill will make for a fairer tax structure, will lower taxes for most, and will "catch" those individuals and corporations that have been paying little if any taxes. Others say that the new bill will lower the total tax revenue and new taxes will have to be created. Only time will tell. However, a couple of obvious conclusions can be made now. Anyone completing the new Internal Revenue Form W-4 will readily attest to the fact that the new form is not simpler. Also, it seems apparent that most of the dental profession will pay more taxes and not less.

Many aspects of the Tax Reform Act of 1986 will affect all dentists, but *salaried* dentists are singled out by the elimination of deductions for many professional expenses, which creates a potential for catastrophic changes, particularly in regard to membership in professional organizations, attendance at professional meetings, and participation in continuing education courses.

Organized dentistry is having a difficult time maintaining membership, as noted by the efforts of the American Dental Association to recruit the newly graduated dentist. There is discord as a result of the perceived overproduction of dentists. In many areas there is dissent between practitioners and academicians as dental schools are viewed as the creators of those problems associated with the oversupply of dentists. In recent years, many state boards of dental examiners have been observed to fail more candidates each year. This conflict between state boards of examiners and dental schools is not new but is a point of serious concern in some regions. These factors, along with too many others to list, are making it difficult for organized dentistry to lead, to be the spokesman for those it represents, and to attract new members.

The Tax Reform Act of 1986 will contribute to the further fragmentation of our professional groups because of the elimination of deductions for professional expenses for salaried individuals. Recently, the American Association of Dental Schools informed its members of this provision and urged them to pay their dues several years in advance prior to the end of calendar year '86, while such deductions were still legal. The impact of this new provision will certainly be significant for full-time faculty members of dental schools, military dentists, those with Public Health and the Veterans Administration, and any other institutional type of practice as well as any other salaried dentists. The potential for a significant number of dentists in academics or other salaried positions to drop their membership in organized dentistry is very real. These dentists should remain part of our professional organizations and continue to contribute to the future of the profession.

The seriousness of this one change in the tax law will trouble us for many years to come, unless something is done to get the law amended. Why have we not heard a plea from the American Dental Association asking its members to contact their representatives and senators concerning this great injustice, and why has the ADA not pledged to its members a lobbying campaign to amend the law?

The alternative to getting the new tax law changed will do nothing but create additional fragmentation of our already divided profession. Let us do something about it. Certainly all salaried dentists need to be concerned and their voices heard.

DAVID J BALES

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ORIGINAL ARTICLES

Channel Depth and Diameter: Effects on Transverse Strength of Amalgapin-retained Restorations

WILLIAM C RODDY • LAWRENCE W BLANK
NELSON W RUPP • GEORGE B PELLEU, JR

Summary

The mechanical resistance of large amalgam restorations retained by amalgapins of different depths and diameters was evaluated. The findings indicate that amalgapins placed 1 mm into dentin are as resistant to fracture as are amalgapins of 2 and 3 mm in depth, and that four TMS Minim pins provide significantly greater resistance to fracture than four amalgapins prepared with a #1157 bur. The findings also indicate that 1 mm diameter amalgapins prepared with a #330 bur resist fracture as well as those prepared with a #1157 or #37 bur, and that beveling the entrance to the amalgapin channel does not increase the fracture strength of an amalgapin 1 mm deep prepared with a #1157 bur.

Naval Dental School, Naval Dental Clinic, Naval Medical Command National Capital Region, Bethesda, MD 20814-5077, USA

WILLIAM C RODDY, DDS, resident, Comprehensive Dentistry Department; Lieutenant Commander, Dental Corps, USN

LAWRENCE W BLANK, DDS, MS, Captain, Dental Corps, USN; director, Branch Dental Clinic, US Naval Activities, United Kingdom, London, England

NELSON W RUPP, DDS, MS, director, Paffenbarger Research Center, American Dental Association Health Foundation, National Bureau of Standards, Gaithersburg, MD 20234, USA

GEORGE B PELLEU, JR, PhD, Chairman, Research Department

INTRODUCTION

Providing adequate resistance and retention for extensive amalgam restorations can be challenging and time consuming. Self-threading pins are commonly used to provide both resistance and retention, but several disadvantages have been associated with their use: cracking and crazing of enamel and dentin (Birtcil & Venton, 1976; Dilts & others, 1970; Durkowski & others, 1982; Galindo, 1980; Going, 1966; Markley, 1966; Standlee, Collard & Caputo, 1970), pulpal encroachment and perforations (Birtcil & Venton, 1976; Schuchard & Reed, 1973), lateral perforations (Outhwaite, Garman & Pashley, 1979; Garman & others, 1983; Leach, Martinoff & Lee, 1983; Markley, 1966), weakened restorations (Dilts & others, 1970; Galindo, 1980; Going, 1966), inconsistent pin shearing and broken twist drills (Shavell, 1980), and increased time required for their placement (Seng & others, 1980; Garman & others, 1983).

Several authors advocate direct retention as an alternative to the self-threaded pin. Outhwaite and others (1979) use a circumferential slot prepared with a #33½ inverted cone bur, Seng and others (1980) recommend individual amalgam inserts 1.4 mm deep prepared with a #35 inverted cone bur, and Shavell (1980) suggests "amalgapin" channels 1.5 - 3 mm deep prepared with a #1156, #1157, or #1158 round-nose bur with a 0.5 mm bevel at the entrance to the amalgapin channel. Shavell feels that a bevel will increase the strength of the amalgapin; however, this has not been shown experimentally. These techniques are stated to have the following advantages when compared to self-threaded pins: less stress is imparted to dentin (Outhwaite & others, 1979, 1982; Garman & others, 1983; Davis & others, 1983), channels are rapidly placed (Shavell, 1980; Garman & others, 1983), no additional armamentarium is required (Shavell, 1980), the chance of pulpal or periodontal ligament perforation is reduced (Outhwaite & others, 1979, 1982; Garman & others, 1983; Davis & others, 1983), strength of the resultant amalgam restoration is not decreased (Shavell, 1980; Davis & others, 1983), and added occlusal reduction to accommodate pin height is not required (Davis & others, 1983).

Seng and others (1980), Garman and others (1983), Shavell (1980), and Barney, Croll and Castaldi (1984) report clinical success using amalgam inserts. However, there is little agreement among them concerning the minimum number, diameter, and depth of the inserts required to effectively retain extensive amalgam restorations. The purpose of this investigation was to compare the fracture strength of the restorations retained by amalgapins of different depths and diameters when loaded at a 45° angle. The study also evaluated the effect of bevel placement and the adaptation of mechanically and hand-condensed amalgapins to the preparation.

MATERIALS AND METHODS

Part I: The Effect of Channel Depth

Forty extracted human molars of similar size were selected and stored in a humidor (95% -100% relative humidity) at room temperature throughout the experiment. Forty cylindrical mounting rings were fabricated from aluminum stock 2.54 cm in diameter. The rings were faced to ± 0.05 mm, and a hole 20 mm deep and 16 mm in diameter was prepared to receive the tooth. A depression was milled in the same location on all mounting rings to standardize placement of the mounting rings in a machined holding block during later phases of the experiment (Fig 1). The roots of the teeth were

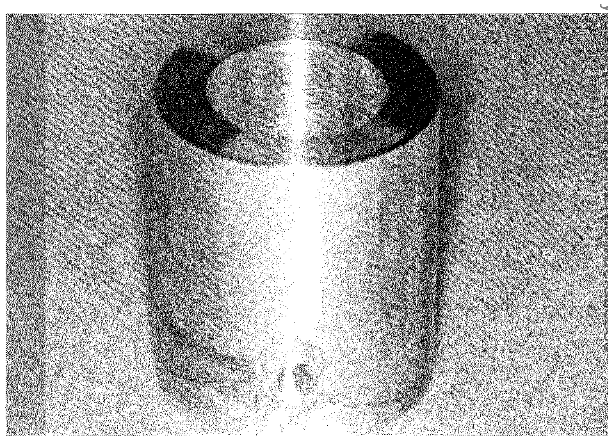

FIG 1. *Mounting ring to hold each specimen*

notched for retention, and the teeth were embedded in the mounting rings with a standardized mix of polymethyl methacrylate. A machined mounting jig was used to orient all teeth perpendicular to their long axes at a standard height in the center of the mounting ring (Fig 2).

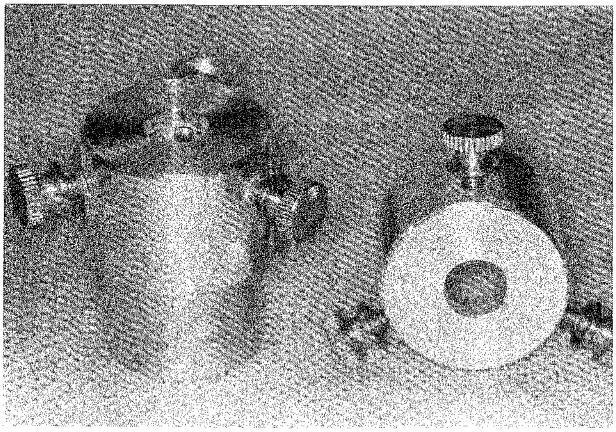

FIG 2. *Jig to orient teeth in mounting ring*

The teeth were divided arbitrarily into four groups of 10 teeth each, and the rings were consecutively numbered. The rings were chucked in a machinist's lathe, and all teeth were reduced to a diameter of 10 ± 0.05 mm and a height of 5 ± 0.05 mm with a high-speed grinder and water spray (Fig 3).

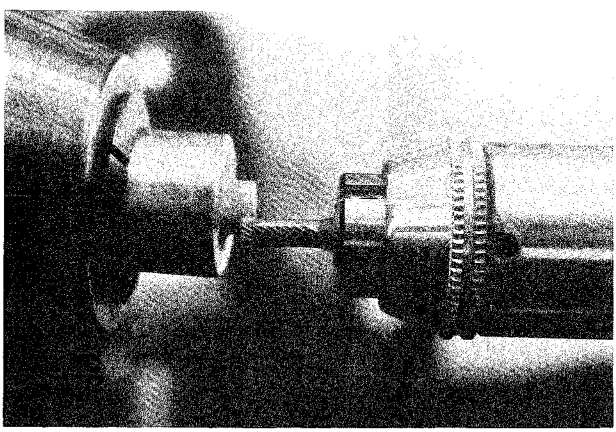

FIG 3. *Specimen chucked in lathe with attached high-speed grinder*

Amalgapin and TMS pin channels were placed in the following manner: A square block was fabricated to hold the cylindrical mounting ring. The holding block contained a spring-loaded ball that engaged the notch on the mounting ring so that all rings could be consistently and precisely oriented. The holding block was placed on a 6° inclined plane (Fig 4),

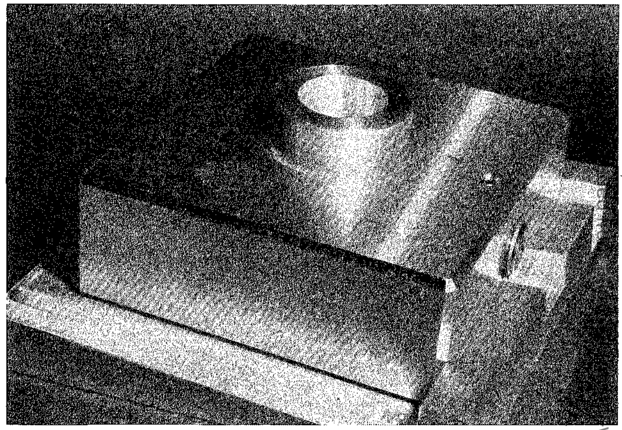

FIG 4. *Holding block on 6° inclined plane for channel and bevel placement*

which was anchored to the table of a precision drill press (Fig 5). This enabled the depth of the

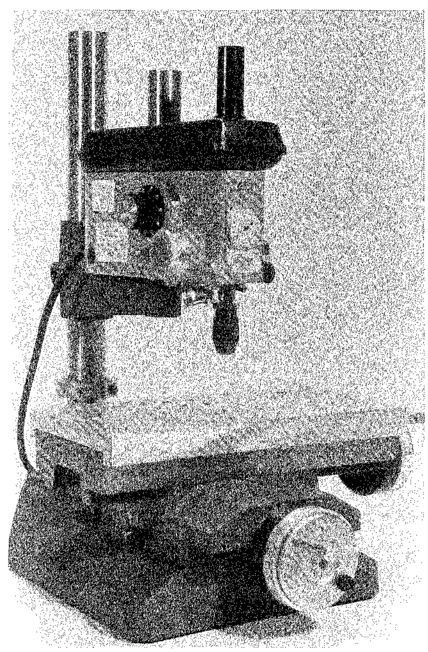

FIG 5. *Precision drill press with dial indicator (±0.001" tolerance)*

channel to be controlled to a tolerance of ± 0.05 mm. Four channels were placed in each tooth. All channels were prepared 1.5 mm from the external surface of the tooth equidistant from each other at a 6° angle converging toward the pulp chamber. A new bur or twist drill was used for each tooth.

Amalgapin channels were prepared for the specimens in the three experimental groups with a #1157 round-nose plain cylinder bur (S S White Dental Products International, Philadelphia, PA 19102, USA). S S White burs were used to prepare the amalgapin channels in both parts of this study. The amalgapin channels in the first experimental group were prepared to a depth of 1 mm, those in the second group to a depth of 2 mm, and those in the third group to a depth of 3 mm. The TMS pin channels in the control group were prepared in two stages. Using the drill press, a pilot channel was prepared with a TMS Minikin pin drill (.017 in) (Whaledent International, New York, NY 10001, USA). The channels were located in the same position and converging angle as the amalgapins in the experimental groups. Next, a slow-speed dental handpiece was used to place the TMS Minim pin channels (0.021 in) to the depth of the drill's self-limiting collar.

After all channels had been prepared, a uniform diameter base of Life (Kerr Mfg Co, Romulus, MI 48174) was placed in the pulpal area by filling a machined Teflon template positioned on each tooth (Fig 6). After the base was set, the

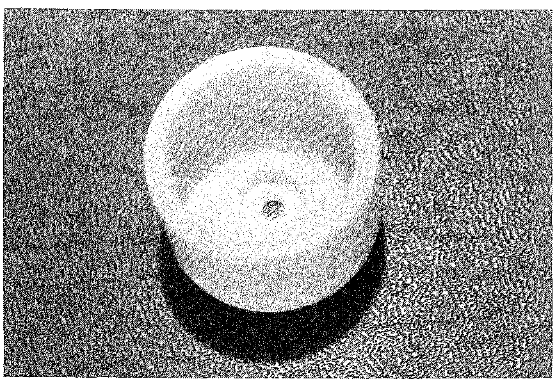

FIG 6. *Teflon template for Dycal placement*

mounted teeth were rechucked in the lathe, and the base material was trimmed to a height of 0.5 ± 0.05 mm. Two layers of Copalite varnish were then applied to all teeth.

Nonshearing TMS Minim pins (0.023 in) were placed with a hand wrench to a depth of 2 mm. The pins were first cut to a height of 2.5 mm with a pair of diagonal cutters modified with a polymethyl methacrylate shim. The pins were further reduced with a high-speed bur to a height of 2.0 mm using a standardized metal bushing embedded in an acrylic sleeve that was well adapted to the tooth. The bushing securely held the pin to prevent vibration and to give a uniform height.

Matrices were then fabricated. A tight-fitting copper band 3 mm wide was placed below the cavosurface margin (Fig 7), and the next size

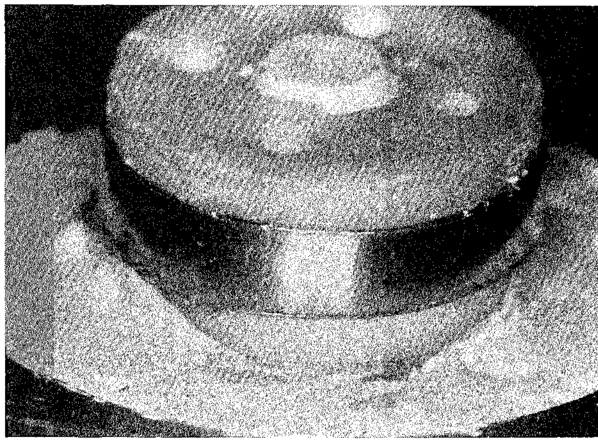

FIG 7. *Completed preparation with 3 mm copper-band spacer*

band was placed over the first. The matrix was reinforced with red modeling compound. A Hollenback pneumatic condenser (Clev-Dent, Cleveland, OH 44101) was used to condense four 800 mg capsules of Tytin (S S White) into each preparation. Amalgam was triturated in a Vari-Mix II amalgamator (L D Caulk Co, Milford, DE 19963), M setting, for 9 seconds. The amalgapin channels were hand condensed, and the pneumatic condenser was used to complete the restoration. Seventy-two hours later, the copper bands were cut with a high-speed handpiece and removed. The specimens were then returned to the lathe, and the restorations were reduced to a height of 5 ± 0.05 mm and a diameter of 10 ± 0.05 mm. A 45° bevel 1.0 mm wide was placed at the occlusal-axial line angle of the amalgam.

The holding block was mounted on an inclined plane so that the test load would be applied at an angle of 45° to the long axis of the tooth (Fig 8). The rings were oriented in the holding block so that the pin placement simulated placement at the four line angles and the test load simulated a buccal or lingual force. The samples were then mounted in an Instron Universal testing machine (Instron Corporation, Canton, MA 02021), and the test load was applied to each sample at a constant crosshead speed of 0.1 in/min until the sample fractured (Fig 9). For this experiment, fracture of the sample was assumed to have occurred once the pen of the recording chart on the Instron machine indicated a deviation toward the baseline. The highest force recorded before the first deflection toward baseline was termed the fracture force. The force necessary to cause fracture was recorded in pounds. The data were analyzed with the analysis of variance and Scheffé's test. Significance was determined at the α = 0.01 level.

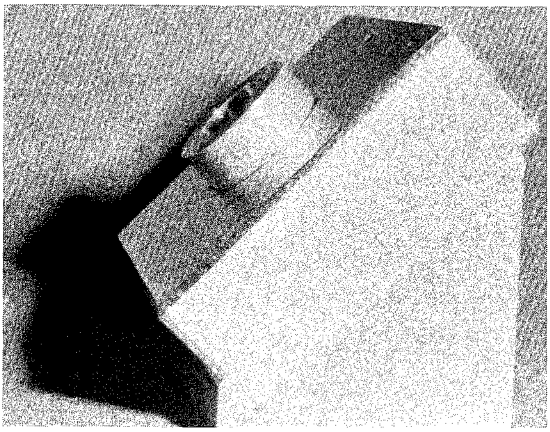

FIG 8. *Holding block on 45° inclined plane for sample orientation in the Instron testing machine*

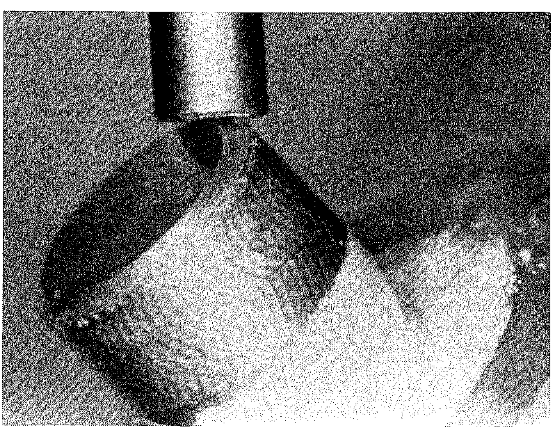

FIG 9. *Completed restoration oriented in the Instron testing machine just prior to fracture*

The specimens from the experimental groups were then sectioned 1 mm beyond the apex of the amalgapins. The sections were decalcified, dehydrated, and prepared according to a method described by Robertson and others (1980) (Fig 10). The amalgapins were subsequently evaluated under a stereomicroscope at a magnification of X25 for the presence of voids and adaptation of the amalgapins to the channel walls. Adaptation was judged to be either complete or not complete by a single observer.

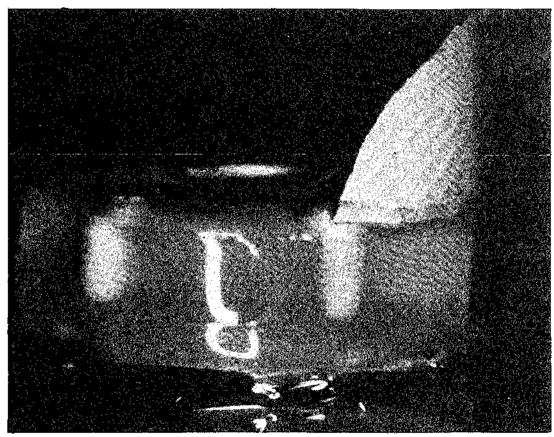

FIG 10. *Decalcified, dehydrated, and cleaned section of tooth after testing*

Part II: The Effect of Channel Diameter

The results of Part I indicated that increasing the depth of the amalgapin channel beyond 1 mm did not increase the fracture strength of the restorations; therefore, all channels in Part II were prepared to a depth of 1 mm. Standardized preparations were made in 30 teeth as described in Part I. The teeth were divided arbitrarily into groups of 10 teeth each and the amalgapin channels were prepared as before. The amalgapin channels in Group 1 were prepared with a #1157 bur; in Group 2, they were prepared with a #330 bur; and in Group 3, a #37 bur was used. A bevel (0.2 ± 0.05 mm) was placed perpendicular to the long axis of each amalgam channel with #4, #6, or #8 round burs, respectively, chucked in the precision drill press. The samples were restored as in Part I, except that the channels were not hand condensed before the pneumatic condenser was used. The 10 teeth with amalgapin channels prepared to a depth of 1 mm with the #1157 bur and no bevel, which had been used in Part I, served as the controls. The samples were tested and the data were analyzed as in Part I.

RESULTS

Part I

The mean force required to fracture each group of samples is shown in Table 1. All restorations failed before the teeth fractured. Examination of the amalgapins under the stereomicroscope at magnification of X25 showed that all the amalgapins were completely adapted to the entire amalgapin channel.

Table 1. Effect of Channel Depth on the Transverse Strength of Amalgapin-retained Restorations (n = 10)

Pin Type	Depth	Fracture Force (kg)		
	mm	mean		SD
TMS Minim pin (control)	2	141	±	12
Amalgapins	1	116	±	16 ⌶
Amalgapins	2	106	±	17 ⌶
Amalgapins	3	106	±	18 ⌶

⌶ Indicates no significant differences within the amalgapin group. There was a significant difference between the control and the amalgapin groups ($P < 0.01$ Sheffé's test).

Part II

The mean force required to fracture each group of samples is shown in Table 2. In all samples with amalgapin channels prepared with the #1157 and #330 burs the restorations failed before the tooth fractured. In the samples with the channels prepared with the #37 bur the tooth structure on the inferior side fractured for all samples. A mean and standard deviation force of 116 ± 16 kg was required to fracture the control restorations. Statistical analysis revealed no differences between the experimental and control groups ($P > .01$).

Table 2. Effect of Channel Diameter on the Transverse Strength of Amalgapin-retained Restorations

Amalgapin Type	Number	Fracture Force (kg)		
		mean		SD
#1157 (no bevel, control)	10	116	±	16 ⌶
#1157 (bevel)	7*	117	±	18 ⌶
# 330 (bevel)	7*	119	±	35 ⌶
# 37 (bevel)	10	131	±	20 ⌶

*Three of the 10 samples failed before testing.
⌶ Indicates no significant difference within sample groups or between amalgapin group and control.

Examination of the amalgapins under the stereomicroscope at a magnification of X25 showed that many of the amalgapins in all experimental groups were not completely adapted to the channel walls. This was most noticeable for the amalgapins prepared with a #330 bur and least noticeable for the amalgapins prepared with a #37 bur.

DISCUSSION

Little experimental data are available in the literature to indicate the minimum amalgapin depth required to effectively resist occlusal forces directed to large restorations on teeth with minimal supporting structure. Shavell (1980) has reported many years of clinical success with mechanically condensed 2 mm and 3 mm amalgapins prepared with a #1157 bur. The results of our study indicate that a 1 mm amalgapin provides as much resistance as 2 mm and 3 mm amalgapins.

Leach and others (1983) found that 91% of the mechanically condensed 2 mm amalgapins prepared with a #1157 bur failed to reach the bottom of the preparation but that the hand-condensed amalgapins were well adapted. Our findings support the Leach study. Hand-condensed amalgapins, regardless of their length, were densely compacted and well adapted to the channel walls, whereas the mechanically condensed 1 mm amalgapins varied in density and were not as well adapted to the apical portions of the channel. This was most evident with the amalgapins prepared with a #330 bur. In contrast to the Leach study, we found no difference in the fracture strength between the hand condensed and mechanically condensed groups. Nevertheless, we agree with Garman and others (1983), Birtcil and Venton (1976), and Wacker and Baum (1985), who feel that amalgam inserts should be hand condensed to ensure intimate adaptation to the preparation. This is especially important for amalgapin channels prepared with smaller diameter burs, such as the #330.

In this study, the amalgapins were found to be less resistant to fracture than the TMS Minim pins. Davis and others (1983) found that four Minim pins were significantly weaker than four 3 mm amalgapins prepared with a #1157 bur; however, the fracture force for the Minim pins was similar to that in our study. There are several differences between our study and the Davis protocol, which may account for the marked difference in the strength of the amalgapins. In the Davis study, the direction of the applied force with respect to the pattern of pin placement was not noted, a base and Copalite were not used, a different amalgam was used, and a 0.5 mm bevel at the entrance to the amalgapin channel was employed.

Shavell (1980), Davis and others (1983), and Outhwaite and others (1979) report that a bevel at the entrance to the amalgapin channel should be employed to increase the bulk and therefore the strength of the amalgapin. The results of our study indicate that increasing the size of the amalgam insert by beveling the entrance to the channel or by moderately increasing the size of the bur used to prepare the channel does not increase the fracture strength of the restoration to forces applied at a 45° angle.

The rather large variation in the fracture strength in the #330 group of amalgapins and the avulsion of three samples during machining probably resulted from inconsistent condensation of the amalgapins. The highest and lowest fracture forces for all 70 samples were from this group. Therefore, we feel that the #330 bur is an excellent choice for amalgapin preparation if the channels are hand condensed before mechanical condensation. The fracture strength of the amalgapins prepared with a #37 bur was limited by fracture of the tooth for every sample, certainly in part due to excess tooth structure removal. Clinically, this may be a disadvantage because fracture of the tooth structure may render it unrestorable, necessitating removal of the tooth.

Regardless of the method of retention employed, all samples in this study will likely resist the forces normally found in the oral cavity. This assumption is supported by the articles of Shavell (1980), Seng and others (1980), Garman and others (1983), and Barney and others (1984) reporting clinical success with restorations retained with amalgam inserts. In this study, only four amalgapins were used to retain the large amalgam restorations on a flat surface. Seng and others (1980) have shown the fracture force of the restorations retained with amalgam inserts increases with the number of inserts. Boxes, grooves, parallel walls, dovetails, and sharpened line angles will also increase the retention and resistance of large amalgam restorations (Birtcil & Venton, 1976). Because the precision drill press used in this study had minimal eccentric movement, and there was a single path of withdrawal of the bur, the amalgapin channels that resulted were tapered toward the apex. Channels prepared intraorally can be prepared more parallel in the apical regions or undercut. Further research is necessary to determine whether these factors have a clinical effect.

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References

BARNEY, J I, CROLL, T P & CASTALDI, C R (1984) The slot-retained complex amalgam restoration *ASDC Journal of Dentistry for Children* **51** 184–189.

BIRTCIL, R F JR & VENTON, E A (1976) Extra-coronal amalgam restorations utilizing available tooth structure for retention *Journal of Prosthetic Dentistry* **35** 171–178.

DAVIS, S P, SUMMITT, J B, MAYHEW, R B & HAWLEY, R J (1983) Self-threading pins and amalgapins compared in resistance form for compex amalgam restorations *Operative Dentistry* **8** 88–93.

DILTS, W E, WELK, D A, LASWELL, H R & GEORGE, L (1970) Crazing of tooth structure associated with placement of pins for amalgam restorations *Journal of the American Dental Association* **81** 387–391.

DURKOWSKI, J S, HARRIS, R K, PELLEU, G B & HARPER, R H (1982) Effect of diameters of self-threading pins and channel locations on enamel crazing *Operative Dentistry* **7** 86–91.

GALINDO, Y (1980) Stress-induced effects of retentive pins: a review of the literature *Journal of Prosthetic Dentistry* **44** 183–186.

GARMAN, T A, OUTHWAITE, W C, HAWKINS, I K & SMITH, C D (1983) A clinical comparison of dentinal slot retention with metallic pin retention *Journal of the American Dental Association* **107** 762–763.

GOING, R E (1966) Pin-retained amalgam *Journal of the American Dental Association* **73** 619–624.

LEACH, C D, MARTINOFF, J T & LEE, C V (1983) A second look at the amalgapin technique *Journal of the California Dental Association* **11**(4) 43–49.

MARKLEY, M R (1966) Pin-retained and pin-reinforced amalgam *Journal of the American Dental Association* **73** 1295–1300.

OUTHWAITE, W C, GARMAN, T A & PASHLEY, D H (1979) Pin vs slot retention in extensive amalgam restorations *Journal of Prosthetic Dentistry* **41** 396–400.

OUTHWAITE, W C, TWIGGS, S W, FAIRHURST, C W & KING, G E (1982) Slot vs pins: a comparison of retention under simulated chewing stresses *Journal of Dental Research* **61** 400–402.

ROBERTSON, D, LEEB, I J, McKEE, M & BREWER, E (1980) A clearing technique for the study of root canal systems *Journal of Endodontics* **6** 421–424.

SCHUCHARD, A & REED, O M (1973) Pulpal response to pin placement *Journal of Prosthetic Dentistry* **29** 292–300.

SENG, G F, RUPELL, O L, NANCE, G L & POMPURA, J P (1980) Placement of retentive amalgam inserts in tooth structure for supplemental retention *General Dentistry* **28**(6) 62–66.

SHAVELL, H M (1980) The amalgapin technique for complex amalgam restorations *Journal of the California Dental Association* **8**(4) 48–55.

STANDLEE, J P, COLLARD, E W & CAPUTO, A A (1970) Dentinal defects caused by some twist drills and retentive pins *Journal of Prosthetic Dentistry* **24** 185–192.

WACKER, D R & BAUM, L (1985) Retentive pins: their use and misuse *Dental Clinics of North America* **29** 327–340.

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Visible-Light-Curing Devices: A Potential Source of Disease Transmission

W FRANK CAUGHMAN • R P O'CONNOR
K R VOLKMANN • G S SCHUSTER
G B CAUGHMAN

Summary

Ten composite resin light-curing units from different clinical environments were evaluated for microbial contamination. Although the lights were considered by the practitioners to be ready for use, cultures of the handles and the light tips of all 10 units exhibited bacterial growth. These findings indicate that these light-curing devices could serve as unrecognized vehicles for the transmission of infectious agents in the dental office.

Medical College of Georgia School of Dentistry, Augusta, GA 30912-0200

W F CAUGHMAN, DMD, MEd, assistant professor, Department of Restorative Dentistry

R P O'CONNOR, DMD, associate professor, Department of Restorative Dentistry

K R VOLKMANN, DMD, PhD, associate professor, Department of Oral Biology/Microbiology

G S SCHUSTER, DDS, PhD, Ione and Arthur Merritt Professor, Department of Oral Biology/Microbiology

G B CAUGHMAN, PhD, assistant professor, Department of Oral Biology/Microbiology

Introduction

The dental office is well recognized as a potential site for transmission of infectious diseases caused by a variety of micro-organisms (Autio & others, 1980; Gross, Devine & Cutright, 1976). Recent guidelines (see *Morbidity and Mortality Weekly Reports*, 1986) stress the multitude of ways these organisms can be passed from individual to individual and the need to break this chain of sepsis.

While hepatitis and AIDS are the current focus, we must always keep in mind that there are a number of potential pathogens in the oral cavity, and indeed, even micro-organisms that are native to one patient may be pathogenic to another. Many of the instruments used routinely in dentistry are potential fomites. While any instruments that penetrate the skin or mucosal barrier, such as scalers, can obviously serve as vehicles for transfer of microbes, there are numerous other devices that are not as obvious. One such instrument is the dental radiographic unit. White and Glaze (1978) found that micro-organisms can be transferred from the patient's mouth via the operator's hands to the radiographic equipment and subsequently to other patients. These microbes can remain viable on the equipment for 48 hours, increasing the potential for cross-contamination. Contaminated water lines, dental impressions, and laboratory pumice also have been implicated as sources of infectious agents (Scheid & others, 1982; Fitzgibbon & others, 1984; Rowe & Forrest, 1978; and Williams & others, 1985).

The advent of new dental treatments, materials, and their associated delivery devices presents a spectrum of new sources of transmission which needs to be included in office disinfection protocols. One such device is the resin-curing light. Results of the present study indicate that, although the curing procedure is noninvasive, the light tip nonetheless routinely becomes contaminated with oral organisms. The handle also becomes contaminated, probably via saliva transferred from the hands or gloves of the operator. Inadequate disinfection procedures allow the contaminating micro-organisms to persist in a viable state and thus visible-light-curing devices may serve as a source of potentially pathogenic agents.

Materials and Methods

A total of 10 light-curing devices were evaluated. Eight from five private practice offices in this geographic area and two from separate treatment areas in the Medical College of Georgia School of Dentistry were evaluated for microbial contamination. These lights were of both the pencil and pistol type. Selection of the private practices was based on the practitioner's willingness to participate and the busy restorative nature of the practices. Several weeks after first contacting the practitioners, the investigators arrived unannounced at the offices to obtain microbiologic cultures from the visible-light-curing devices. Only lights that were considered ready for immediate use by the practitioner (that is, cleaned and prepared by whatever method was typical for each office) and that had been used in the past 36 hours were cultured.

Two independent cultures, one from the light tip and one from the handle, were obtained from each light by swabbing those surfaces with sterile cotton swabs moistened with sterile distilled water. After sampling, swabs were submerged immediately in Todd-Hewitt broth containing 0.5% lactalbumin hydrolysate in culture tubes and transported to the laboratory. Upon arrival, which was not more than two hours after the first sample was obtained, the tubes were vortexed, and an aliquot was removed by bacteriological loop, transferred to Todd-Hewitt agar, and incubated anaerobically in an atmosphere of 95% nitrogen-5% carbon dioxide at 37 °C for three days. The transport tubes containing the swabs were incubated overnight under aerobic conditions at 37 °C. An aliquot of each transport broth was then transferred to Todd-Hewitt agar and incubated aerobically at 37 °C for two days. All positive cultures were evaluated as to the morphology and number of different colony types, and cells from each colony type were examined microscopically after gram staining.

Results

All 20 samples (corresponding to the handles and the tips from 10 different lights) exhibited bacterial growth under aerobic conditions, and four of the 10 tips exhibited growth under the anaerobic conditions employed. No handles were positive for anaerobic growth. A total of 13 different colony types (designated as A-M) were observed. Brief descriptions of each colonial type and of the organism associated

Table 1. Characteristics of Isolated Micro-organisms (n = 10)

	Description of Macroscopic Colony	Description of Microscopic Cellular Morphology	Culture Conditions		Lights Positive	
			Aerobic	Anaerobic	Tips	Handles
A	Large, spreading, irregular, matte white	gram + large bacillus	+		4	5
B	Raised, irregular, shiny yellow	gram + small/medium coccus	+		3	1
C	Raised, round, shiny yellow	gram + large coccus	+		2	2
D	Flat, round, shiny cream	gram + small coccus	+		1	1
E	Flat, round, shiny white	gram + small/medium coccus	+		1	3
F	Pinpoint, translucent white	gram + small coccus	+	+	4	2
G	Flat, irregular, matte cream	gram + medium coccus	+		1	0
H	Raised, round, shiny white	gram + varied size coccus	+		1	0
I	Irregular, granular, yellow-white	gram + club-shaped rod		+	1	0
J	Small, irregular, semi-glossy gray-white	fusiform		+	1	0
K	Flat, irregular, shiny gray-white	gram + granular, filamentous		+	1	0
L	Flat, scalloped, shiny gray-white	gram + medium/large coccus		+	1	0
M	Flat, round, shiny white	gram + small coccus		+	1	0

with it are given in Table 1. Seven colony types (G-M), including five types (I-M) unique to the anaerobic cultures, were found only in light tip samples, while six colony types (A-F) were found in both handle and tip samples (Table 1).

Although the isolated organisms were not conclusively identified but rather were characterized on the basis of growth conditions and morphology, they were types of organisms commonly found in the oral cavity. The bacteria observed following growth under anaerobic conditions were particularly suggestive of contamination from the oral cavity since their morphology was typical of the facultative streptococci and diphtheroids, common oral organisms, which favor anaerobic growth conditions. Also, they were isolated exclusively from the tips of the lights. Those organisms which grew under aerobic conditions also were typical of oral aerobes, although some similar forms may be found on the skin. There was a greater variety of organisms isolated from the tips, that is, every colony type was found on tips but not all were present on handles. Nine of 10 lights sampled exhibited contamination with more than one type of organism (Table 2) and two lights were positive for five different organisms by the culturing techniques employed in this study. In seven instances cultures of the handle and the tip of a light were positive for the same colony type. There were no organism types that were exclusively found on the handles. This finding may indicate cross-contamination between the two locations and is discussed further below.

Table 2. Colony Types of Micro-organisms and Source of Culture

Light	Colony type	Location: Tip	Location: Handle
1	C	+	
	F	+	+
	I*	+	
	J*	+	
2	A	+	+
3	A	+	+
	C	+	
	K*	+	
4	A	+	+
	E	+	
5	A	+	+
	C		
6	B	+	
	D	+	
	F	+	+
	G	+	
	H	+	
7	B	+	
	E		+
	F*	+	
	L*	+	
8	C	+	
	E	+	+
9	A		+
	B		+
	F	+	
	H	+	
	M*	+	
10	B	+	
	D		+

*Designates an anaerobic colony

Discussion

Results from this study suggest that the light-curing device can act as a source of transmission for micro-organisms. Although all of the lights were considered ready for use in the practice, each of the units tested was contaminated on the tip and handle, or both, with organisms typical to the oral flora. It should be noted that the number of types of isolates is conservative since some of the lights had not been used since the previous day and the more labile organisms might not have remained viable. Also, although a general growth medium was employed, neither it nor the culture environments employed were necessarily conducive to the growth of more fastidious organisms. The organisms isolated in this study are not so much of interest in themselves, but rather serve as sentinels for the contamination by serious pathogens which could occur during procedures involving an infected patient. Such pathogens could persist on the light's surfaces and be transferred between patients; the more frequent the use of the light, the more likely the transfer of organisms.

Variations in the design of different visible-light-curing devices should make some lights easier to disinfect than others, but in this study both the handle and tip of each light were contaminated with micro-organisms, irrespective of design. Theoretically, the tip should not touch the oral structures, but in reality contact is virtually unavoidable when working in some areas of the oral cavity. The protective sheath found on the tip of some lights may act as a trap and hold micro-organisms. Many of the new lights possess tips that are removable and autoclavable, but the handles are still potential sources of contamination. The handles or grip areas of any light-curing device may become contaminated with saliva from the clinician's hands/gloves, and may be transferred to subsequent patients. The pistol grip of the hand-held unit can be a particular problem since the handle is more difficult to clean than the holding area of the smooth, pen-type. While future designs may obviate some of these problems, we currently must deal with those available and include them in our disinfection procedures. Further research is under way to develop a protocol for disinfection of visible-light-curing units which is efficient and effective, yet does not alter the curing ability of the light.

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References

AUTIO, K L, ROSEN, S, REYNOLDS, N J & BRIGHT, J S (1980) Studies on cross-contamination in the dental clinic *Journal of the American Dental Association* **100** 358–361.

FITZGIBBON, E J, BARTZOKAS, C A, MARTIN, M V, GIBSON, M F & GRAHAM, R (1984) The source frequency and extent of bacterial contamination of dental unit water systems *British Dental Journal* **157** 98–101.

GROSS, A, DEVINE, M J & CUTRIGHT, D E (1976) Microbial contamination of dental units and ultrasonic scalers *Journal of Periodontology* **47** 670–673.

Morbidity and Mortality Weekly Reports (1986) Recommended infection-control practices for dentistry **35** 237–242.

ROWE, A H R & FORREST, J O (1978) Dental impressions: the probability of contamination and a method of disinfection *British Dental Journal* **145** 184–186.

SCHEID, R C, KIM, C K, BRIGHT, J S, WHITLEY, M S & ROSEN, S (1982) Reduction of microbes in handpieces by flushing before use *Journal of the American Dental Association* **105** 658–660.

WHITE, S C & GLAZE, S (1978) Interpatient microbiological cross-contamination after dental radiographic examination *Journal of the American Dental Association* **96** 801–804.

WILLIAMS, H, FALKLER, W A JR, HASLER, J & ROMBERG, E (1985) The persistence of contaminant bacteria in dental laboratory pumice *Journal Dental Research* **64** 258.

Retentive Properties of Dowel Post Systems

J DAROLD BROWN • JOHN C MITCHEM

Summary

The retentive strength of seven combinations of posts, cementing agents, and canal treatments was determined in recently extracted human anterior teeth. The Flexi-Post displayed twice the retention of the other systems evaluated.

Introduction

Dowel post retention in endodontically treated teeth has long been a topic of interest to dentists. Numerous studies have evaluated the influence of dowel design (Kurer & others, 1977; Standlee, Caputo & Hanson, 1978; Deutsch & others, 1985), length and diameter of post (Standlee & others, 1978; Deutsch & others, 1985; Zillich & Corcoran, 1984), canal preparation (Maryniuk, Shen & Young, 1984; Goldman, DeVitre & Pier, 1984), and cementing media (Standlee & others, 1978; Hanson & Caputo, 1974; Young, Shen & Maryniuk, 1985). In general, these researchers have concluded that threaded and parallel-sided posts are most retentive. However, many of the earlier threaded posts created internal stresses on the remaining root structure (Deutsch & others, 1985). Most investigators agreed that increased retention was achieved with longer posts (Zillich & Corcoran, 1984). A post length of 8 mm seems to be appropriate in most clinical applications (Standlee & others, 1978; Zillich & Corcoran, 1984). The effect of post diameter is not as clear; however, diameters above 1.5 mm appear to have little advantage (Standlee & others, 1978; Krupp & others, 1979).

Selection of a luting media is not as well defined as the mechanical features of post systems. Previous workers have not agreed upon a single material that exhibits outstanding char-

Oregon Health Sciences University, School of Dentistry, 611 Southwest Campus Drive, Portland, OR 97201

J DAROLD BROWN, DMD, associate professor, Department of Fixed Prosthodontics

JOHN C MITCHEM, DMD, MS, professor, Department of Dental Materials Science

Post Systems Tested and Retentive Strengths

Test	Dimensions (mm) Post	Post and Threads	Canal	Luting Agent	Mix Ratio	Canal Treatment (in seconds)	Retentive Strength (lbs) Mean ± SD
#1: Para-Post No 6 (control)	1.5		1.6	zinc phosphate cement (Flecks, Mizzy Inc Clifton Forge, VA 24422)	0.5 cc/1.0 gm	H_2O rinse 15 NaCl rinse 15 H_2O rinse 30 Dry 15	71.4 ± 7.8
#2: Para-Post No 6	1.5		1.6	composite resin —Concise "A" liquid and "B" paste (3M Co, Dental Products St Paul, MN 55144)	2 drops/0.212 gm	Same as #1 plus 37% phosphoric acid rinse 15 H_2O rinse 30 Dry 15	84.1 ± 14.1
#3: Para-Post No 6	1.5		1.6	glass-ionomer cement (Ketac-Cem ESPE-Premier Corp Norristown, PA 19401)	0.063 gm L/0.313 gm P	Same as #1 plus polyacrylic acid rinse 30 H_2O rinse 30 Dry 15	106.1 ± 13.2
#4: Brasseler Post No 4054	1.4	1.7	1.6	glass-ionomer cement (Ketac-Cem ESPE-Premier)	0.063 gm L/0.313 gm P	Same as #3	111.9 ± 15.4
#5: Para-Post No 6	1.5		1.6	composite resin —Concise "A" liquid and "B" paste (3M Co)	2 drops/0.212 gm	Same as #2 plus two applications of Scotchbond (autopolymerizing) applied with a paper point (3M)	115.5 ± 28.1
#6: Flexi-Post No 2	1.25	1.65	1.45	composite resin —EDS Composite Liquid and Paste (EDS Inc New York, NY 10019)	2 drops/0.212 gm	Same as #1	260.1 ± 34.3
#7: Flexi-Post No 2	1.25	1.65	1.45	glass-ionomer cement (Ketac-Cem ESPE-Premier)	0.063 gm L/0.313 gm P	Same as #1 plus polyacrylic acid rinse 30 H_2O rinse 30	270.2 ± 43.4

acteristics. Some reports have indicated that cement type has little influence on retentive capacity of the cemented post (Standlee & others, 1978; Hanson & Caputo, 1974; Krupp & others, 1979). There are, however, some newer materials in the areas of glass ionomers and resin systems that claim to have advantages over some of the previously available products. Even when the luting material is evenly distributed, the bond strength between the cement and the dentin seems to be the weak link (Young, Shen & Maryniuk, 1985; Goldman, DeVitre & Tenca, 1984). The objective of this investigation was to evaluate the retentive ability of six different dowel systems against a clinically established system.

Methods and Materials

The table lists the seven conditions evaluated. Four luting agents were used (zinc phosphate, glass ionomer, and two resin systems). Three post systems of equivalent diameter and length were included: Para-Post by Whaledent (Whaledent International, New York, NY 10001, USA), Brasseler's Post (Brasseler Inc, Savannah, GA 31419), and two posts of equivalent diameter and length, Flexi-Post by Essential Dental Systems (EDS Inc, New York, NY 10019). In addition various canal treatments were performed.

Freshly extracted maxillary anterior teeth were utilized. The teeth were stored in phosphate-buffered saline solution prior to use. The coronal portion of the teeth was removed at the cementoenamel junction, the pulpal tissue removed, and the teeth mounted in acrylic rings. The canals were then prepared with twist drills as supplied by the manufacturers to a depth of 8 mm. All luting agents were evenly distributed in the prepared canal with a lentulo spiral and the posts were also coated prior to seating. The para-posts were held under a force of 11 lbs for 7 minutes (Fig 1) following seating. The excess cement was removed and the specimens stored in distilled water at 37° for a minimum of 24 hours before testing. Each condition was replicated eight times. The retentive strength was determined in tension on an Instron testing machine (Fig 2) at a head rate of 5 mm/min.

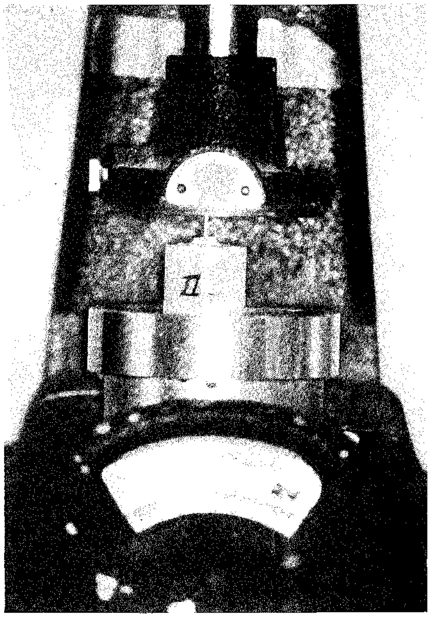

FIG 1. *Applying 11 lbs of force for seven minutes to the Para-Post systems*

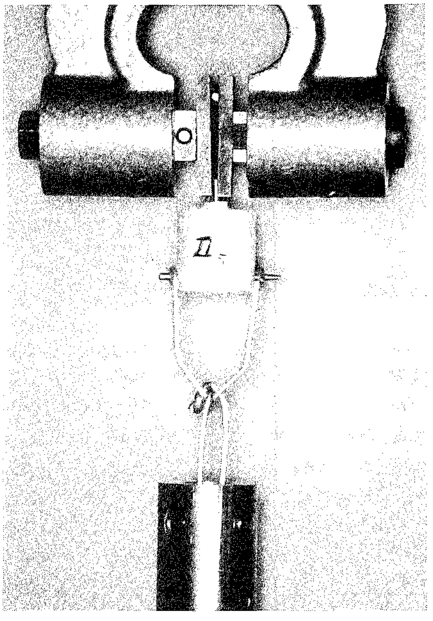

FIG 2. *Tensile testing apparatus*

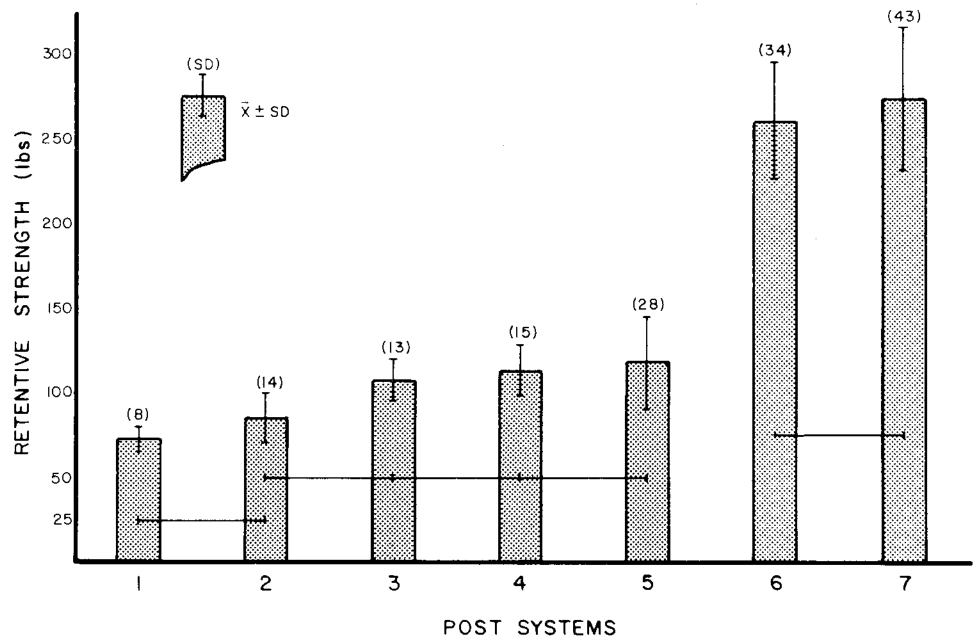

FIG 3. *Retentive strength of post systems*

Results

The results are displayed in Figure 3. Mean values are in pounds, plus or minus one standard deviation. Equal values are indicated by horizontal lines as determined by ANOVA with differences being determined by Scheffé's contrasts at the 95% level.

Discussion

Within cement types, the relative values are similar to those of previous investigators (Young, Shen & Maryniuk, 1985). All failures were between dentin and the cement. Acid etching the dentinal area (Test No 2) or placing Scotchbond in the prepared canal (Test No 5) does not seem to alter retentive strength. In addition, the presence of Scotchbond seemed to accelerate the setting time of the composite resin to the point that it could be difficult clinically to get the post seated. Acid etching (Test No 2) did allow the resin to penetrate the tubules. Figure 4 demonstrates this penetration which occurred on approximately 25% of the canal surface. However, this did not significantly improve post retention.

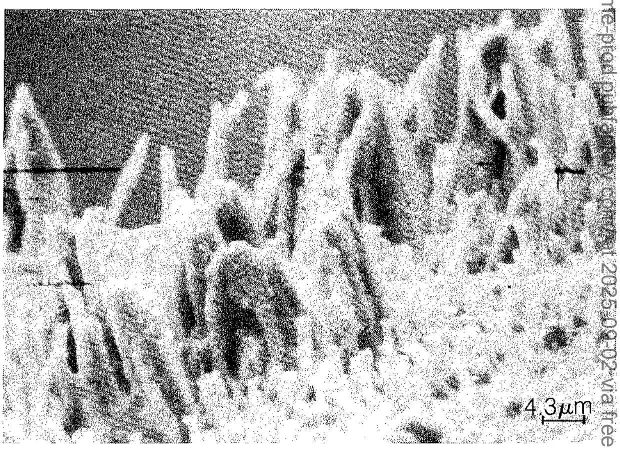

FIG 4. *Scanning electron micrograph of resin tags remaining after the dentin surrounding a cemented post had been dissolved with 20% solutions, respectively, of nitric acid and potassium hydroxide. X875 (original magnification X1750) Horizontal irregularities are defects on the film.*

The Brasseler system (Test No 4) used with glass-ionomer cement was statistically equal to the Whaledent Para-Post when used with glass ionomer or composite. This would seem to indicate that the "micro threads" on the Brasseler post have little influence on its retentive ability. The Brasseler system, however, is very convenient and the drill provided prepared the canal without trapping debris as was the case with the other systems.

The Essential Dental Systems Flexi-Post was more than twice as retentive as any other system tested. This split-shank, threaded post is stated to produce very little stress on the remaining root structure, according to a previous investigation (Musikant & Deutsch, 1984). The Flexi-Post Composite Cement is convenient to use, as its rate of set allowed ample time for application of the cement to the canal and post as well as seating of the post with the supplied wrench. Cementation with glass-ionomer cement proved to be as retentive as the composite cement. Post size No 2 was tested because its dimension was similar to that of the other posts tested. Four other sizes are available to fit various clinical situations.

Very little resistance was encountered during insertion of each of the self-threading post systems (Test Nos 4, 6, and 7) and they were convenient to use.

Conclusions

Seven combinations of posts and cementing agents were compared under similar conditions. The Flexi-Post system displayed twice the retention of the other systems evaluated.

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References

DEUTSCH, A S, MUSIKANT, B L, CAVALLARI, M S & BERNARDI, S (1985) Retentive properties of a new post and core system *Journal of Prosthetic Dentistry* **53** 12–14.

GOLDMAN, M, DEVITRE, R & PIER, M (1984) Effect of the dentin smeared layer on tensile strength of cemented posts *Journal of Prosthetic Dentistry* **52** 485–488.

GOLDMAN, M, DEVITRE, R & TENCA, J (1984) Cement distribution and bond strength in cemented posts *Journal of Dental Research* **63** 1392–1395.

HANSON, E C & CAPUTO, A A (1974) Cementing mediums and retentive characteristics of dowels *Journal of Prosthetic Dentistry* **32** 551–557.

KRUPP, J D, CAPUTO, A A, TRABERT, K C & STANDLEE, J P (1979) Dowel retention with glass-ionomer cement *Journal of Prosthetic Dentistry* **41** 163–166.

KURER, H G, COMBE, E C & GRANT, A A (1977) Factors influencing the retention of dowels *Journal of Prosthetic Dentistry* **38** 515–525.

MARYNIUK, G A, SHEN, C & YOUNG, H M (1984) Effects of canal lubrication on retention of cemented posts *Journal of the American Dental Association* **109** 430–433.

MUSIKANT, B L & DEUTSCH, A S (1984) A new prefabricated post and core system *Journal of Prosthetic Dentistry* **52** 631–634.

STANDLEE, J P, CAPUTO, A A & HANSON, E C (1978) Retention of endodontic dowels: effects of cement, dowel length, diameter, and design *Journal of Prosthetic Dentistry* **39** 400–405.

YOUNG, H M, SHEN, C & MARYNIUK, G A (1985) Retention of cast posts relative to cement selection *Quintessence International* **5** 357–360.

ZILLICH, R M & CORCORAN, J F (1984) Average maximum post lengths in endodontically treated teeth *Journal of Prosthetic Dentistry* **52** 489–491.

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DENTAL EDUCATION

Direct Gold Restorations in Dental Education

JOSE E MEDINA

INTRODUCTION

The process and contents of a dental educational program required to prepare a graduate to practice dentistry and to ensure that the continued competency of dental practitioners is maintained should be developed and instituted in accordance with the prevailing and projected trends in dental practice. In order to properly discuss the role and/or use of direct gold restorations in dental education, one must assess those factors that influence its need, its demand, and its value as a restorative service for the society we serve. Stated in another way, the dental educational program and its content should be a reflection of the prevailing and anticipated requirements a dentist must possess in order to render high quality services to the patients he/she will serve. It behooves us, then, to take a look at the future need, demand, and value for this restorative service, so that we can develop an educational program designed to fulfill the expected expertise of the practicing dentist.

University of Florida College of Dentistry, Department of Dentistry, Box J-415, Gainesville, 32610

JOSE E MEDINA, DDS, professor; formerly dean of the College of Dentistry

Presented at the annual meeting of the American Academy of Gold Foil Operators on October 17 at San Juan, Puerto Rico.

NEED

It is extremely difficult for me to accept a philosophy of practice that does not incorporate the provision of direct gold restorations as part of total restorative services to patients. The uses of this material are many: for repairing margins of gold castings, for sealing vents utilized in the cementation of full crowns, for sealing full-crown access openings for endodontic therapy, for treating small pit-and-fissure lesions, for restoring small eroded gingival class 5 and incipient class 3 lesions in anterior teeth, for sealing cupped-out incisal and cuspal abraded surfaces (class 6), and for replacing those small incisal angles resulting from fracture and/or abrasion (class 4). Without question the need exists, if we accept the philosophy of practice based on providing the highest possible quality service for our patients. Granted that some patients will not accept the proposed treatment, it is nevertheless our responsibility to recommend the best possible treatment procedures based upon the needs of the tooth and the permanency and longevity of the restoration. Every practice includes patients who require this restorative service, and it is our duty and obligation to recommend its use where indicated. Additionally, the increase in life expectancy, with a concomitant increase in the retention of the natural dentition, is generating a large increase in the number of senior citizens who are in need of this service for the indications discussed above. In my opinion, the trends indicate to me that the need for direct gold restorative services is increasing and will continue to do so into the 21st century and beyond.

DEMAND

Even though the need for direct gold restorative services exists and will increase in the years ahead, the demand for its use is another factor that bears assessment. The demand for any elective health service is influenced by many factors, among which are patient motivation and awareness, patient's education level, socioeconomic standards, time availability, and desired quality of life. As professionals, it behooves us to educate our patients to the desirability of longevity and permanency of service and to inculcate in them the motivation and desire to retain the masticatory system in good health and function. It has also been my observation that those patients with higher educational backgrounds and in the middle and above socioeconomic groups tend to be more motivated and more demanding of a higher quality of life, including oral health. As we move into the 21st century, it is my understanding that the increase in life expectancy and, therefore, the increase in senior citizens, will have a tremendous impact upon the demand for dental services. The reason for this increase in demand is due to the fact that this new population group will be better educated, will have a higher socioeconomic standard, will be more motivated, and will have more leisure time to demand and expect higher quality dental services to go along with their desire for a higher level of quality of life. I anticipate, without hesitation, that the demand for excellence of service, including the use of direct gold restorative services, will definitely increase.

VALUE

In addition to anticipating an increase in need and demand for direct gold restorative services, we must also determine in our deliberations whether such a service has value. Value can be defined as a fair return in goods or service, or it can be defined as a relative worth, utility, or importance — that is, the degree of excellence. Over the years, direct gold restorations have proven to be a good investment for longevity and permanency of service. Numerous references in the dental literature attest to the outstanding service provided by these restorations. It is true that the initial investment by the patient, both in time and money, appears to be higher than for other restorative services; however, the long-lasting benefit of this patient service assures us that the direct gold restoration is one of the most cost-effective treatments, if not the best, that can be provided. The assumption, of course, is that the service is rendered well and only where there is an indicated need for its use. We can also expound upon its merits in regard to its marginal seal and integrity, dimensional stability, tenderness to surrounding soft tissue, repairability without losing its integrity, ability to maintain the mesiodistal arch dimension, resistance to tarnishing and corrosion, and inertness to the oral environment. Its value as a restorative service is above reproach and its worth as a long-lasting service cannot be questioned. Without a doubt, it is a restoration of great value and it is the standard most of us use to evaluate the degree of excellence of other restorative services.

DENTAL EDUCATIONAL PROGRAM

Having thus far assessed the need, demand, and value of this direct gold restorative service, what, then, should be the role of a dental educational program? In view of the fact that the value and worth of direct gold restorations are second to none and that the need and demand will not diminish in the future, dental educational programs must provide the opportunity for dental professionals to be educated and trained in its use. Based on the assumption that the dental professional is a continuing student from the first day he/she enters dental school to the day he/she retires from practice, then a complete lifetime educational program needs to be implemented. It makes no sense whatsoever to assume that a recent graduate, after four years in dental school, can be a master or an expert in the assimilation of all the knowledge, skills, and judgment required to practice the profession. The majority of us gladly accept the premise that we should continue to obtain knowledge through continuing education courses but we fail to recognize the need to continue to enhance our skills and judgment through the same mechanism. Consequently, we become better informed, more knowledgeable through the years, and our judgment improves as we see our successes and failures, yet our skills often remain at the graduate level, even though we have gained speed in their application. What, then, should be the matrix of a sound educational program designed to provide the appropriate experience for the use of direct gold restorative services?

For the purpose of organization for this presentation let me divide the educational program into three components: (1) formal predoctoral education, (2) formal postdoctoral graduate education, and (3) semiformal continuing education.

Formal Predoctoral Education

The formal four-year predoctoral program leading to a DDS or a DMD degree is extremely demanding for all students. They must be exposed to an ever-increasing wealth of knowledge, they must develop minimal competencies in diagnostic and therapeutic skills, they must develop communication skills, they must develop a humanistic approach to patient care, they must be motivated to the pursuit of excellence of service — in short, they must acquire the basic fundamental knowledge, skills, and judgment to permit them to practice their profession. The student does not have the time nor has he/she developed professionally enough upon graduation to be able to master and/or be an expert in all the disciplines and requirements of dental practice. However, prior to graduation, the student must be exposed to all aspects of care, and such an opportunity must be provided, including the use of direct gold restorative services. This exposure should be a part of the regular curriculum either as a formal technic and clinic requirement, or as an elective. No graduate should complete his/her four-year program without an exposure to the direct gold service. However, every graduate must be motivated to pursue further education in order to become proficient in rendering this service.

Formal Postdoctoral Graduate Education

A postdoctoral graduate program in restorative dentistry should be made available in all dental schools. Such a program, of a two-year duration, is an excellent mechanism for the development of additional knowledge, skills, and judgment and is one of the best approaches for enhancing the experience needed for managing direct gold restorations. Under the watchful eyes of well-trained and highly skilled faculty, the graduate student will begin to develop his/her expertise. Such a program will enhance knowledge, skills, and judgment and prepare the graduate for a lifetime of service in his/her chosen profession.

Semi-formal Continuing Education

This facet of a dental educational program is perhaps the most important in enabling the practitioner to remain abreast of all current developments in the profession. However, it is of the utmost importance in mastering the use of direct gold restorations. I label it semiformal continuing education because not only does it include attendance at seminars, lectures, conferences, workshops, and so forth to enhance knowledge, but it also involves a structured program through participation in formally established study groups. A study group can be didactic in structure, but to be most effective for learning about direct gold it must also have a strong clinical participation component. If all members of a study group live in close geographic proximity, the group will meet one day a month. If the members are geographically apart they will meet for two or three days at a time four times a year. In any case, the group members will operate 10 - 12 times a year under the guidance of a mentor or director who constantly shares and demonstrates improvements in the management of direct gold and in the enhancing of the delivery of the service. Through study group participation the practitioner's skills are continually enhanced and the acquired knowledge and judgment are clinically applied. To me this semiformal continuing educational program is the most effective way to improve our level of proficiency in our constant struggle to achieve perfection for the purpose of meeting the needs and demands of our patients.

SUMMARY

I sincerely hope this assessment of the role of direct gold restorative services in dental education has been of some value to you. It is my firm belief that there is a need for this service, that this need will persist in the years to come, that there will be an increased demand for its use, and that we have the responsibility to provide the opportunities for all practitioners to become proficient in its use. Freedom of opportunity and freedom of choice, both for us as the providers of dental services and for our patients as the recipients of our services, must always be available. Let us offer our patients the best service we have available to meet their needs and demands, but let us also be prepared to render that service to the best of our ability. Let us always enhance our professional growth through a lifetime of continued learning in the hope of achieving excellence of service in all our professional endeavors.

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CLINICAL REPORT

Esthetic Correction of Incisal Fractures without Using Restorative Materials

ROBERT E GARFIELD

Summary

This paper presents an alternative form of treatment for the fractured maxillary incisor instead of the usual restorative techniques normally provided. The treatment alternative presented is orthodontic supereruption and coronal reshaping of the tooth involved. Long-lasting esthetic results may be achieved by this technique.

Introduction

Incisal edge fractures are common in dental practice. The usual means of restoring these fractures, at present, are the acid-etch technique and restoration with a composite filling material. Frequently restorations of this type will show wear, discoloration, and may refracture.

In situations where the tooth form and the fracture size permit, orthodontic supereruption followed by reshaping of the defect will provide the patient with a long-term stable and esthetic result (Janzen, 1978). Supereruption for various purposes has a long-established history in dentistry (Bales & Thurmond, 1980; Benenati & Simon, 1986). Usually it is a maxillary incisor that requires this treatment (Fig 1). Careful and

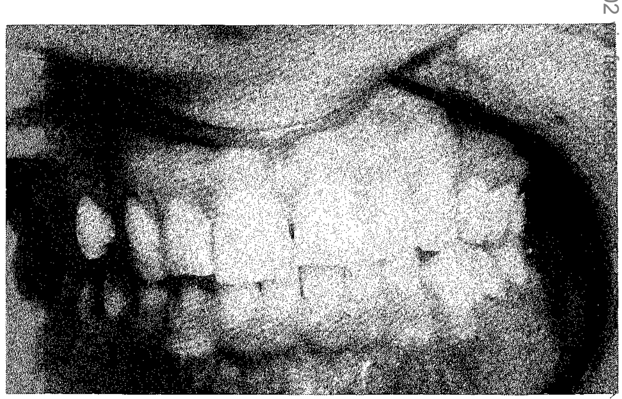

FIG 1. *A typical moderate incisal fracture*

10921 Wilshire Blvd, Suite 505, Los Angeles, CA 90024-3974

ROBERT E GARFIELD, DDS, is currently in private practice

precise occlusal adjustment is performed on the lingual surface of the supererupting tooth, and a slight bevel on the facial-incisal of the mandibular incisors is necessary to provide adequate clearance for forced supereruption to occur. Insufficient occlusal clearance will cause the supererupting tooth to move facially. Additional occlusal adjustment will quickly correct this problem. The author has accomplished approximately 50 such treatments during the past 12 years, with satisfactory results.

Technique

The tooth to be treated, and the two adjacent teeth, are fitted with any orthodontic brackets that have a horizontal slot. The brackets are attached using any acid-etch resin bonding system. The bracket on the fractured tooth is placed more gingivally than the brackets on the adjacent teeth by an amount slightly greater than the incisogingival dimension of the fracture. A highly flexible orthodontic wire is placed into all three brackets (Twist Flex Wire 0.015 dia, Unitek Corp, Monrovia, CA 91016) and secured with orthodontic bracket ligatures (Fig 2).

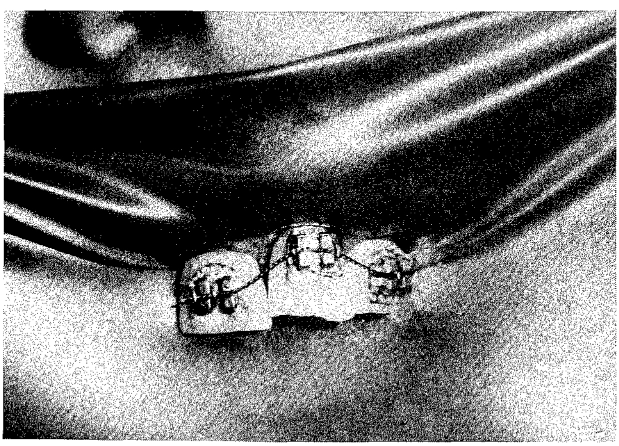

FIG 2. *Orthodontic brackets are resin-bonded to place and high-flex orthodontic wire is ligated into position.*

The forces generated will cause the wire to straighten out. Since the anchorage teeth in the adjacent areas will not intrude, the treatment tooth will have to elongate and supererupt. This process may take from one to three months depending upon root length and shape, age and physiological factors (Fig 3). A healthy

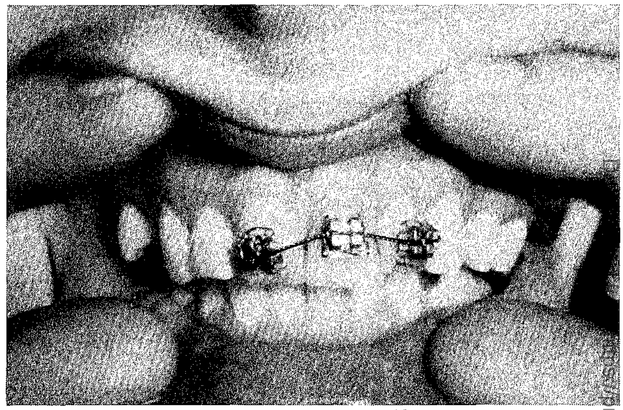

FIG 3. *Supereruption has occurred to a degree which slightly overcompensates for the fracture defect. Note that the gingival margin has followed the supereruption process.*

periodontium will supererupt along with the tooth, and it may be necessary to reposition the gingival margin for esthetic and periodontal purposes. This procedure can be referred to a periodontist, or, if appropriate, can be easily performed by the primary operator. A cervical fiberotomy is accomplished with a sharp curette. An alveolar crest reduction can be performed with a Wedelstaedt chisel, and a gingivoplasty can be done with electrosurgery or a scalpel blade. Healing is simple and the result is predictable (Fig 4).

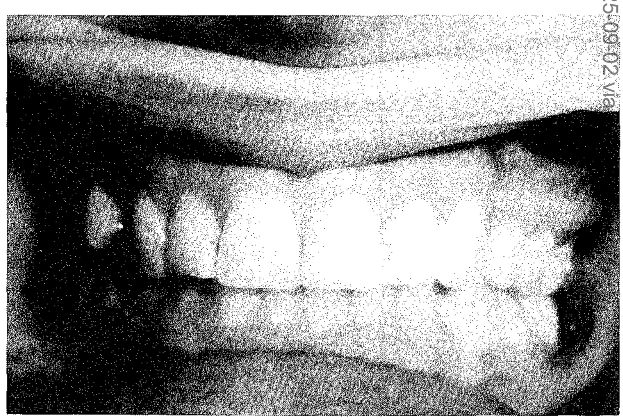

FIG 4. *Cervical fiberotomy, crestal alveoplasty, and gingivectomy combined with enameloplasty have created a highly esthetic and satisfactory result.*

Conclusions

A simple technique using orthodontic forced supereruption and coronal reshaping has been shown to provide a long-lasting, natural, esthetic result with treatment for incisal fractures of moderate size.

The disadvantages of this form of therapy are that it may take from one to three months to complete, and the cost to the patient will be approximately equal to that of a porcelain fused to metal crown. The advantages are a result that is "natural" and "permanent."

(Received 11 July 1986)

References

BALES, D J & THURMOND, J W (1980) Forced eruption in restorative dentistry *Journal of the Indiana Dental Association* **59**(3) 19–22.

BENENATI, F W & SIMON, H S (1986) Orthodontic root extrusion *General Dentistry* **34**(4) 285–289.

JANZEN, E K (1978) Fractured incisors — a meeting point between operative dentistry and orthodontics *CDS Review* (Chicago Dental Society) 37–40.

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PRODUCT REPORT

Clinical Evaluation of Cervical Composite Resin Restorations Placed without Retention

T L ZIEMIECKI • J B DENNISON
G T CHARBENEAU

Summary

This 12-month clinical evaluation of class 5 erosive lesions restored with chemically cured Scotchbond demonstrated: (1) the size of the lesions had significant effect on retention, (2) beveling and acid etching provided the most retention, (3) retention was higher in the maxillary arch, and that (4) there was a marked decrease in sensitivity over the 12 months of the study.

University of Michigan School of Dentistry, Department of Operative Dentistry, Ann Arbor, MI 48109

THOMAS L ZIEMIECKI, DDS, MS, assistant professor

JOSEPH B DENNISON, DDS, MS, professor and chairman

GERALD T CHARBENEAU, DDS, MS, professor

INTRODUCTION

Since the development of composite resin by Bowen in the 1950s, the concept of conservative esthetic dentistry has grown rapidly. The development of techniques for etching and bonding to enamel (Buonocore, 1955) photo-initiated curing of the resin, and now the potential of dentin bonding is providing the dental practitioner with many alternatives for patient treatment.

The viability of a clinically durable bond to enamel is now an accepted clinical procedure, whereas the ability to create such a bond to dentin has been long sought (Buonocore, 1956). Currently there is considerable activity dealing with the concept of dentin bonding, with advancements in the development of new materials (Bowen & Cobb, 1982; Causton & Johnson, 1979; McLean, 1979; Powis, Folleràs & Wilson, 1982), in treatment and pretreatment of dentin surfaces (Brännström, Glantz & Nordenvall, 1979; Bowen & Cobb, 1983; Causton & Johnson, 1981), and in clinical techniques (Duke, Phillips & Blumershine, 1985; Davidson, deGee & Feilzer, 1984; Hansen, 1984; McLean, Prosser & Wilson, 1985). If a successful bond of composite resin to dentin can be attained, it should provide new ways of managing those restorative procedures which extend beyond the cementoenamel junction.

This is a report on the clinical evaluation of chemically cured Scotchbond (3M Dental Products, St Paul, MN 55144, USA), a phosphonate ester of bis-GMA resin, as a bonding agent in the direct application of a restorative resin to eroded/abraded dentinal surfaces. This study was conducted at the University of Michigan School of Dentistry with patients selected from the general patient population. The objectives of the study were:

1. To evaluate the retention of class 5 composite resin restorations applied directly over eroded cervical dentin without using a retentive cavity preparation, but using Scotchbond (3M Dental Products) as the bonding agent.

2. To evaluate each restoration by direct visual examination for color, margin discoloration, margin adaptation, anatomic form, and recurrent caries, using written criteria and two trained examiners.

3. To evaluate tooth sensitivity, pre- and postoperatively.

METHODS AND MATERIALS

A population of 37 patients with 171 visually observable cervical abrasion/erosion lesions was selected for treatment from the University of Michigan dental clinic.

Restorations were placed in groups of three within the same oral environment, using standard operating procedures. The exposed dentin surface was cleaned with a thin slurry of XXX Silex (Moyco Industries, Inc, Philadelphia, PA 19132) on an unwebbed rubber cup, rinsed thoroughly, and isolated with cotton rolls. Gingival tissue retraction cord, Gingi-Plain Braid No 1 (The Hygenic Corp, Akron, OH 44310), was placed to provide access and improve isolation when the eroded area terminated at or below the gingival crest.

Three restorative materials and application procedures were applied on a randomly selected basis, one to each of the three teeth in a study grouping. Two thin coats of the chemically cured Scotchbond were applied to all teeth, with each coat being gently air dried for 20 seconds. The three restorative treatment groups included: 54 restorations placed with Scotchbond and a chemically cured resin restorative (Silar, 3M Co); 66 restorations placed with Scotchbond and a light-cured restorative (Silux, 3M Co); and 51 restorations placed with an enamel cavosurface bevel, acid etching of enamel only, Scotchbond and a light-cured resin restorative (Silux).

Finishing procedures were initiated 15 or more minutes after insertion of the material. The Sof-Lex (3M Co) disk system and #7901 flame-shaped carbide finishing burs (Midwest, Division of Sybron Corp, Chicago, IL 60018-1884) were used for the finishing sequence.

Two faculty members, well trained in the use of these materials, placed all restorations. One placed 62 restorations (36%) and the other placed 109 restorations (64%). All patients signed a consent form and agreed to return for 6 month recalls. A total of 171 restorations were placed and evaluated at baseline, 6 months, and 12 months. Two independent evaluations were made of each restoration, based on written criteria for each of the characteristics observed, with disagreements resolved by consensus. Epoxy models and color transparencies were made of all final restorations, with additional color transparencies taken at each recall period. The epoxy models served as a reference of the baseline restoration and were used along with the direct clinical observations and color transparencies, as required, to note changes at recall evaluations.

RESULTS

Preoperative Evaluations

Maxillary premolar and canine teeth were most frequently treated (49.7%), but the general distribution represented all areas of the dental arch. In this population, 68.4% of treated teeth were in the maxillary arch while 31.6% were located in the mandibular arch.

Of the 171 lesions treated, 19 (11%) were completely surrounded by enamel or had only the cervical margin on cementum, 39 (23%) had a portion of the lateral wall on both enamel and cementum, while 113 (66%) had only the incisal margin on enamel.

For each tooth, the projected angle of the incisal and cervical walls of the erosion defect (Fig 1) was estimated visually.

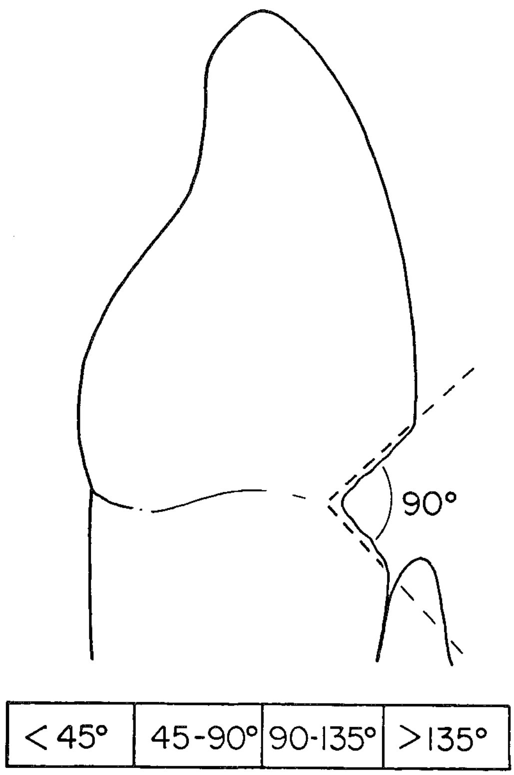

FIG 1. *The projected angle of the incisal and cervical walls of the lesion was estimated and each cavity assigned to one of four angular categories.*

Four groupings of treated teeth resulted:

- 31 (18%) had an angle of less than 45 degrees;
- 41 (24%) were between 45 and 90 degrees;
- 38 (22%) were at an obtuse angle of 90 to 135 degrees;
- 61 (36%) had an estimated angle of greater than 135 degrees and appeared saucer-shaped.

Dimensions of the erosion defects were measured using a flat-bladed periodontal probe, recording both the incisal-cervical height and the axial depth to the nearest 0.5 mm.

Symptomatology

Preoperatively, 50 (29%) of the selected teeth had some degree of tooth sensitivity. In general, there was a dramatic decrease in sensitivity from a collective preoperative value of 29.2% to 14.6% immediately after treatment, with further decreases to 8.2% after 6 months and 3% after 12 months. In the early postoperative evaluations, the restorations that were beveled and etched showed an incidence of sensitivity approximately 2½ times greater than the unetched restorations (Fig 2). No differences were noted between the etched and unetched teeth at the 12-month period. When Silux and Silar were placed without etching the incisal enamel, similar and diminishing sensitivity was observed. All of the teeth rated severe for sensitivity at 12 months were in one patient who was judged to be hypersensitive.

Retention

Restorations of Silar and Silux were equally retained at 6 months (87% and 86.4%, respectively) when placed over Scotchbond without etching the adjacent enamel (Fig 3). After 12 months there was an 8% difference between these two groups (72.2% for Silar and 80.3% for Silux). These retention values are, perhaps, the best clinical estimate of the adhesive bond strength between Scotchbond and dentin. When the incisal enamel was beveled and etched, retention was 100% at 6 months and 90.2% at 12 months. Restorations in which small material fractures occurred at the lateral margins were evaluated as partially retained but counted as "not retained." Such restorations were still judged to be clinically acceptable and had these been included as "retained" in the retention data, the values would increase by approximately 2%. At each evaluation period, the retention was less for the mandibular arch (6% at 6 months and 14.9% at 12 months) indicating, perhaps, greater difficulty of isolation during the placement procedure.

Margin Adaptation

At baseline, 18.7% of the restorations showed detectable margins (Silar 18.5%, Silux 18.2%,

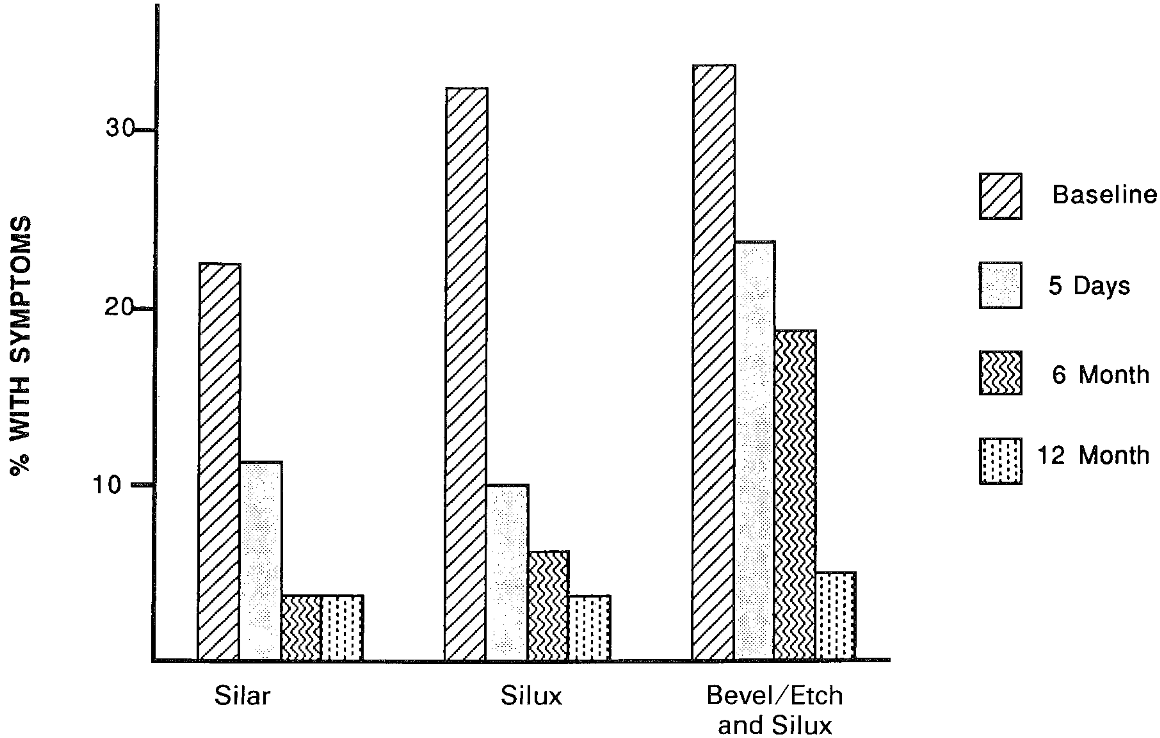

FIG 2. *Percentage of teeth reported as exhibiting some degree of tooth sensitivity*

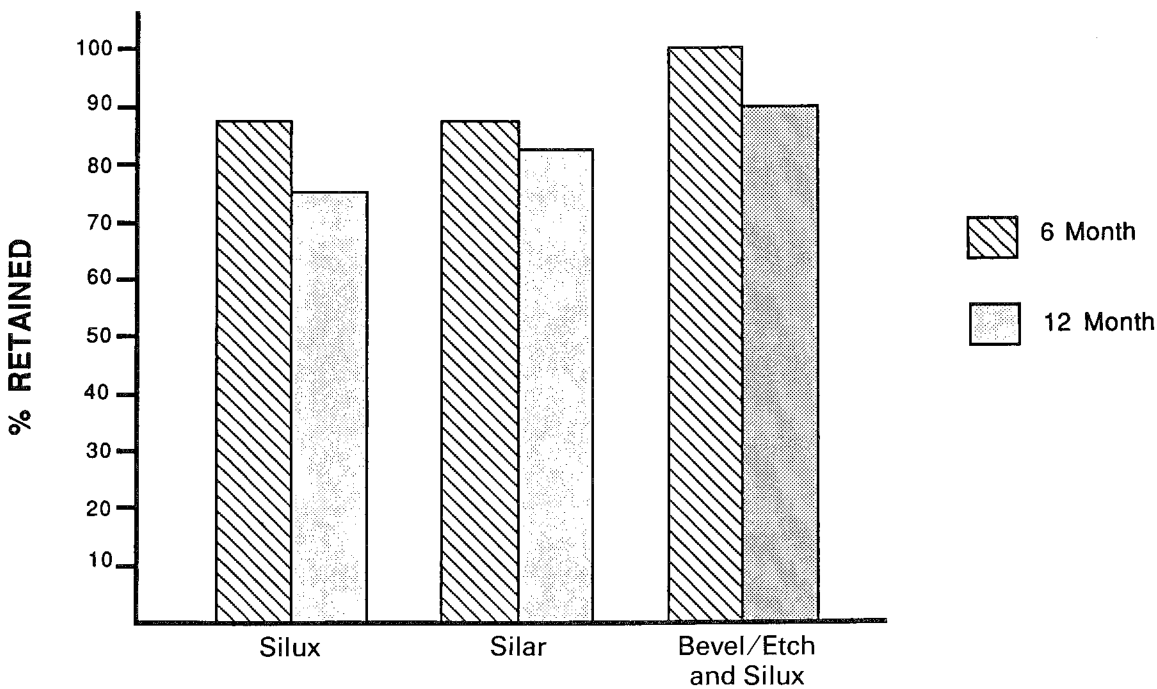

FIG 3. *Percentage of retained restorations at 6 months, and at 12 months*

and bevel/etch-Silux 19.6%) in a local area, usually along the cervical margin (Fig 4). After 6 months there was a major change in margin adaptation with nearly 68% exhibiting clinically detectable margins (Silar 70.8%, Silux 68.4%, and bevel/etch-Silux 64.7%), while at 12 months 78% of the restorations had detectable margins (Silar 87.5%, Silux 79.2%, and bevel/etch-Silux 68.8%). Although the greatest number were still detectable in a local area only, 12 restorations exhibited margins detectable along more than 50% of their border. No crevices were observed at the restoration-tooth margin at 12 months. Margin adaptation was nearly identical for each of the three variables studied.

Margin Discoloration

Evidence of margin discoloration was observed in 7.1% of all restorations at 6 months (Silar 8.3%, Silux 5.6%, and bevel/etch-Silux 7.8%) and doubled at 12 months to 15% (Silar 15%, Silux 13.2%, and bevel/etch-Silux 16.7%) (Fig 5). At 6 months the discoloration was primarily at the restoration-tooth margin without evidence of penetration. However, at 12 months about half of the margins with discoloration showed some evidence of penetration along the tooth-restoration interface. Discoloration was usually along the incisal enamel margin for the unetched restorations and, in cases where the incisal enamel was beveled and etched, along the cervical margins.

Characteristics of Restorations Not Retained

The greatest number of lost restorations, 26%, were of the saucer-shaped variety with an erosion angle of greater than 135 degrees. These lesions tended to be shallow and allowed for a minimal bulk of restorative material available to resist stress relative to occlusal function and/or tooth deflection.

Nearly two-thirds of the restorations lost had covered eroded areas less than 2 mm in dimension incisocervically and 1 mm in axial depth (see table). These dimensions should be considered in the clinical treatment planning for restoration of cervical erosion lesions. The data indicate that the surface area of dentin available for bonding is critical, and restorations covering a greater area of dentin result in a higher percentage of retention.

Failures at 12 Months

Dimension of Lesion	Incisal-Cervical*	Axial*
mm		
0.5	0	5
1.0	4	20
1.5	7	2
2.0	9	1
2.5	0	0
3.0	3	2
3.5	1	0
4.0	4	0
5.0	1	0
9.0	1	0

*The number of each column represents the number of teeth in study which failed, corresponding to the stated dimension.

CONCLUSIONS

- Beveling and acid etching of enamel adjacent to the abraded/eroded cervical lesion provided significantly greater retention than did the use of the dentin bonding agent alone.
- Without beveling and acid etching of enamel adjacent to the lesion, the light-activated Silux restorations exhibited a higher retention (8%) than did the chemically activated Silar restorations.
- Retention was 6% higher in the maxillary arch than in the mandibular arch at 6 months and 14.9% higher at 12 months.
- Although there was no difference in margin adaptation between the three groups of restorations at either recall, there was nearly a 50% increase in the number of restorations having detectable margins from baseline to 6 months and a 60% increase at 12 months.
- Margin discoloration was observed in 7% of

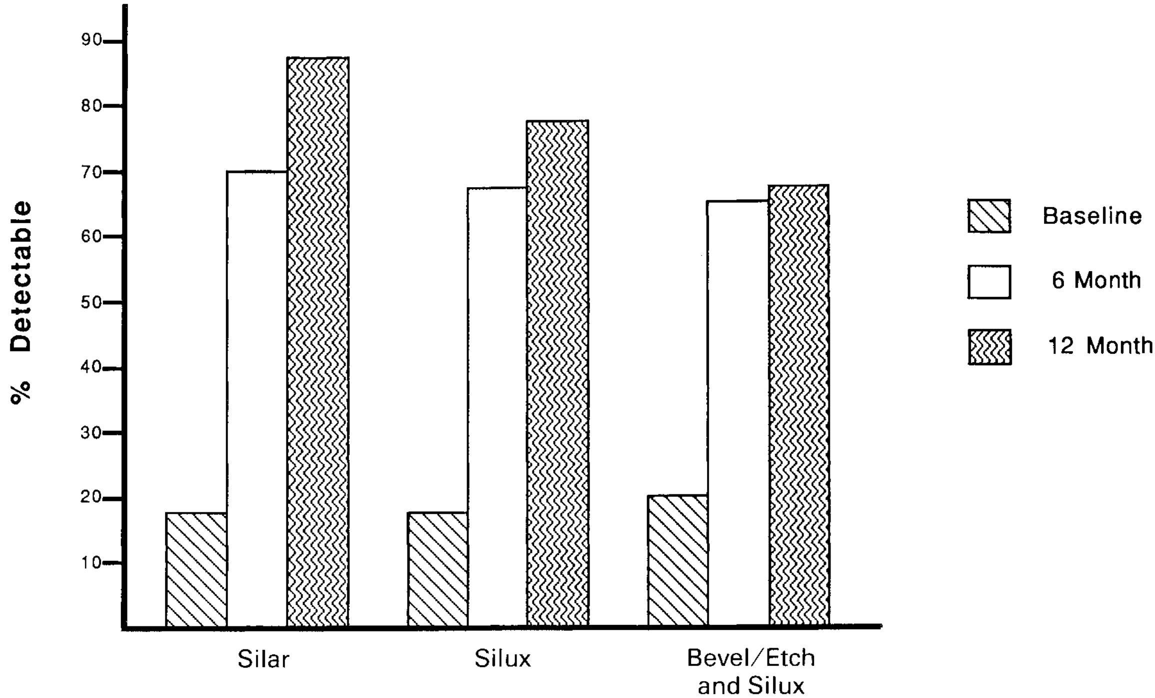

FIG 4. *Percentage of detectable margins as determined at baseline, 6 months, and 12 months*

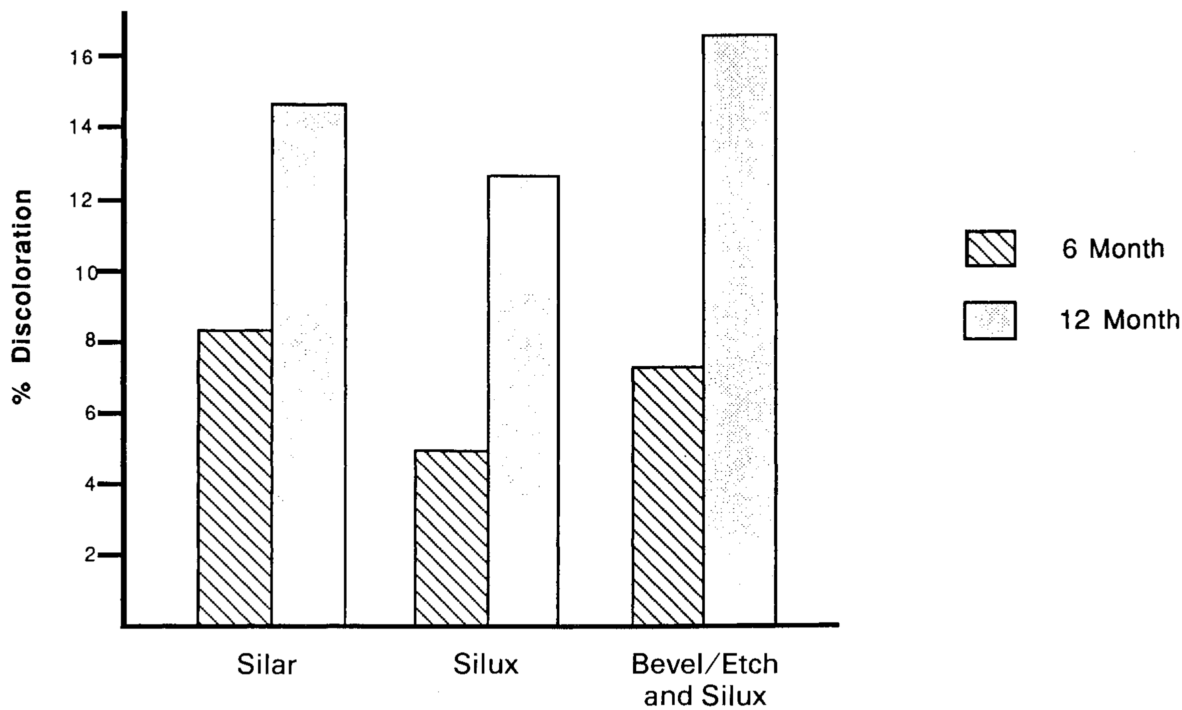

FIG 5. *Percentage of restorations exhibiting marginal discoloration at 6 months and at 12 months*

the retained restorations at 6 months and in 15% at the 12-month period.

- There was a marked decrease in sensitivity over the 12-month period.

(Received 29 May 1986)

References

BOWEN, R L & COBB, E N (1982) Method for obtaining strong adhesive bonding of composites to dentin *Journal of Dental Research* **61** *Program and Abstracts of Papers* p 230 Abstract No 463.

BOWEN, R L, COBB, E N & RAPSON, J E (1982) Adhesive bonding of various materials to hard tooth tissues: improvement in bond strength to dentin *Journal of Dental Research* **61** 1070–1076.

BOWEN, R L & COBB, E N (1983) A method for bonding to dentin and enamel *Journal of the American Dental Association* **107** 734–736.

BRÄNNSTRÖM, M, GLANTZ, P-O & NORDENVALL, K-J (1979) The effect of some cleaning solutions on the morphology of dentin prepared in different ways *Journal of Dentistry for Children* **46** 291–295.

BUONOCORE, M G (1955) A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces *Journal of Dental Research* **34** 849–853.

BUONOCORE, M G, WILEMAN, W & BRUDEVOLD, F (1956) A report on a resin composition capable of bonding to human dentin surfaces *Journal of Dental Research* **35** 846–851.

CAUSTON, B E & JOHNSON, N W (1979) The role of diffusible ionic species in the bonding of polycarboxylate cements to dentin: an in vitro study *Journal of Dental Research* **58** 1383–1393.

CAUSTON, B E & JOHNSON, N W (1981) The influence of mineralizing solutions on the bonding of composite restorations to dentin: Cyanoacrylate pretreatment *Journal of Dental Research* **60** 1315–1320.

DAVIDSON, C L, DEGEE, A J & FEILZER, A (1984) The competition between the composite-dentin bond strength and the polymerization contraction stress *Journal of Dental Research* **63** 1396–1399.

DUKE, E S, PHILLIPS, R W & BLUMERSHINE, R (1985) Effects of various agents in cleaning cut dentine *Journal of Oral Rehabilitation* **12** 295–302.

HANSEN, E K (1984) Effect of Scotchbond dependent on cavity cleaning, cavity diameter and cavosurface angle *Scandinavian Journal of Dental Research* **92** 141–147.

McLEAN, J W (1979) Status report on the glass ionomer cements *Journal of the American Dental Association* **99** 221–226.

McLEAN, J W, PROSSER, H J & WILSON, A D (1985) The use of glass-ionomer cements in bonding composite resins to dentine *British Dental Journal* **158** 410–414.

POWIS, D R, FOLLERÅS, T, MERSON, S A & WILSON, A D (1982) Improved adhesion of a glass ionomer cement to dentin and enamel *Journal of Dental Research* **61** 1416–1422.

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Distinguished Member Award

Jose Medina is well known to all of us in the American Academy of Gold Foil Operators and the Academy of Operative Dentistry.

It is particularly fitting that we are honoring Dr Medina in Puerto Rico where he received his early basic education. His professional school education was at Johns Hopkins University and the Baltimore College of Dental Surgery at the University of Maryland. After graduating in 1948, he accepted a teaching position in operative dentistry. In 1957 he became professor and chairman of this department at Baltimore. He was appointed assistant dean in 1964.

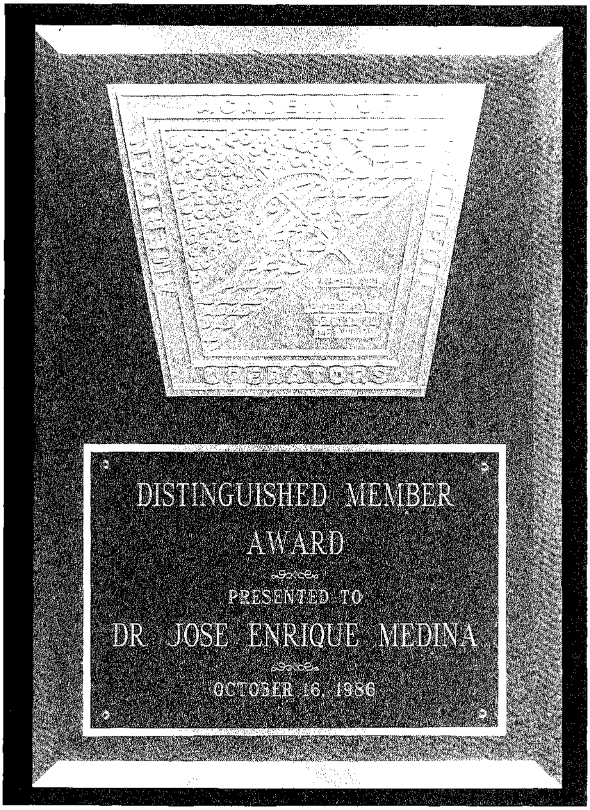
Seeking new challenges, he accepted the position of assistant dean and professor of clinical dentistry at the newly created University of Florida in Gainesville in 1967. During the establishment of this new school he was directly involved in creating new and innovative teaching methods and also involved in the design of the buildings. He was appointed dental dean at Florida in 1969.

Dr Medina's endeavors in other phases of the Health Science Complex did not go unnoticed by the University of Florida administration. He was appointed assistant vice-president for facilities, planning, and operations. Despite the load of administrative duties, Dr Medina still was able to find time to devote two and a half days a week in the operative clinic teaching and inspiring dental students.

He is a Fellow of the American College of Dentists and the International College of Dentists. His background in the Spanish languages qualified him to present papers on behalf of the International College in Spain and South and Central America. He has recently spent time lecturing in operative dentistry at Göttingen, West Germany.

Jose E Medina

Dr Medina has been involved in research and studies in epoxy resins, rotary cutting instruments, pulp protection, pin retention, elastomeric impression and other restorative materials. He was awarded the Hollenback



Memorial Research Prize for 1985 by the Academy of Operative Dentistry.

He has been the director of several gold foil study groups, particularly active in the past 25 years in the George M Hollenback Study Group.

Dr Medina's affiliation with the American Academy of Gold Foil Operators as board member and president is a culmination of many years of clinical demonstrations and literary endeavors. An active member since 1957, he has served as member and chairman of various important committees over the past 30 years, as editor of the Academy's first journal from 1958 to 1964, and as president in 1965.

Seeing the need for further excellence in all phases of operative dentistry, he was among those instrumental in bringing to fruition the organization now known as the Academy of Operative Dentistry. Well-known operative educators, study club members, and practicing dentists were contacted from the United States and Canada to determine the need for this academy. In 1972 Dr Medina chaired the group of six founding fathers that established the Academy of Operative Dentistry. He later served as a board member for three years, declining the offer of the presidency. This Academy is now 1000 members strong.

The teaching of quality operative dentistry has always been the goal of Dr Medina. He provided direction in establishing the certification program in operative dentistry, serving as president of the American Board of Operative Dentistry for six years. Dr Medina and his examination committee devoted an unbelievable number of hours to the development of criteria for testing prospective board members. He nurtured this committee until initial examinations in 1984 and 1985 produced the first certified members. He relinquished his chairmanship at this point.

In 1986 the University of Florida awarded the Florida Blue Key to Dr Medina, the first health science faculty member to receive this award. The Blue Key award, representing a service honorary society, was established in the 1920s. The honoree will be feted at homecoming and at a legislative day at the state capital — a great honor for dentistry and the dental school of Florida.

We now learn that Dr Medina is leaving his administrative post and is returning to clinical teaching.

RALPH J WERNER, DDS

DEPARTMENTS

Book Review

CURRENT TREATMENT IN DENTAL PRACTICE

Norman Levine

Published by W B Saunders Co, Philadelphia. 533 pages, black and white photographs. $68.00

Dr Norman Levine is the senior editor of this excellent textbook. He is assisted by a number of section editors, associate editors, and contributors who rightly deserve equal admiration for compiling such an extraordinary book, but space does not permit them to be named individually. The book is described as a text for the practicing dentist, its aim to assist "in the translation of new knowledge to clinical practice." The authors have evaluated the current literature and provided a distillate of information pertinent to the clinical practice of dentistry. This information has been organized into seven major parts: oral medicine and radiology; oral rehabilitation; oral and maxillofacial surgery; dental care for special persons; pharmacotherapy; pediatric dentistry; and hospital dentistry.

The part given the most emphasis and which the general dentist will find the most interesting is "oral rehabilitation." This section encompasses all aspects of general practice: operative, prosthodontics, endodontics, and periodontics. Section editor Dr Ronald Desjardins defines rehabilitation as "all aspects of dentistry needed to make anatomy and physiology 'suitable again'." The section begins with a discussion of dental materials. Composite resins dominate the bulk of the discussion, but amalgam, glass-ionomer cements, and prosthodontic alloys are aptly addressed. The surveys of castable ceramics and impression materials, however, are too abbreviated.

The operative section opens with esthetic materials, primarily composite resins. The author directs attention to the problems with composite resins and how to avoid and manage these problems. Notably, the author refers to clinical rather than laboratory studies realizing that clinical studies provide more valuable information for clinical practice than do laboratory studies.

Silver amalgam is covered next with interesting comments concerning condensation techniques. Pin-retained amalgams and castings are mentioned, and post and core systems are especially well covered.

Prosthodontics is highlighted by the sections on casting alloys, root resections and hemisections, and implants.

Endodontics includes an excellent description of pulp therapy for the partially developed dentition. The techniques for pulpotomy and apexification are well outlined. Adult endodontics is reviewed, as is surgical endodontics. Bleaching vital and nonvital teeth is also included in this section.

The section on periodontics is best read for the review of diagnostic techniques. The traditional indices as well as the newer assays are described. The techniques for scaling, root planing, curettage, and surgical flaps are detailed. An interesting section deals with the new synthetic bone graphs. The diagnostic dilemmas encountered by the general practitioner are presented in sections dealing with endodontic-periodontic relationships, root fractures, and temporomandibular joint dysfunction syndrome.

The other major parts of the textbook are delegated less space than the oral rehabilitation chapter, but they should not be considered less important. Oral medicine and radiology includes an excellent section on oral cancer and precancer. It is a good refresher of clinical manifestations, and it is up to date on the current clinical management of suspicious oral lesions. Other sections deal with oral lesions that the general dentist is likely to encounter. Special effort is made to include only those lesions that are common; no rareties are discussed. This part is well organized into definition, diagnosis, and management.

Part III on oral and maxillofacial surgery is better read as a showing of the state of the art of oral surgery. Its value is in educating the general practitioner as to what can be done with today's surgical techniques. Clinical cases of orthognathic surgery and tissue-integrated prostheses are presented. Diagnosis of space infections and a review of flap procedures are pertinent to the daily practice of dentistry, but the other information will largely enable the general dentist to consider treatment options that heretofore were not recognized and to seek an appropriate referral.

Part IV — dental care for special persons —deals with the psychological aspects of the disabled, geriatric, or oncologic patient. Physical access for wheelchairs is described. Special caries considerations for the mentally and physically disabled and medical-dental interactions of the geriatric patient are discussed. Helpful and well presented is the section outlining oncological therapies, radiation and chemical, and the impact these therapies have on the dental health of the cancer patient.

Perhaps the most beneficial chapter is Part V, Pharmacotherapy. General pharmacology is reviewed, drug distribution, transformation, elimination, and interactions. Specific therapeutic topics include analgesics, anti-inflammatory agents, and antibiotics. Descriptions of analgesics on the market today are given and they include dosages, significant effects, and interactions. Antibiotics are described as to their effectiveness in specific clinical situations. Endocarditis prophylaxis is covered, and a section on systemic diseases provides critical information concerning modifications of dental treatment needed to avoid serious medical complications.

Pediatric dentistry is the topic of Part VI. Behavior management, examination, and restorative treatment of the pediatric patient are reviewed. The two most interesting sections are "facial and oral protection in sports" and "electrical burns to the mouths of children." The section on oral protection lists the types of mouthguards available for the active youngster and includes a technique for mouthguard fabrication. The section on electrical burns describes the dentist's role in treatment of this disfiguring injury. Removable and fixed prostheses are designed to reduce the scarring which often results from these burns.

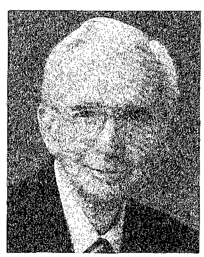
The last part, hospital dentistry, is a short installment on the establishment of a hospital dental service.

This textbook attempts to "delineate for the general practitioner . . . selected topics of both interest and concern for the improvement of dental health." The result is remarkable. Respected clinicians and researchers have gleaned the relevant facts from original literature and presented them in an excellently organized fashion. The practicing dentist owes this group a thank-you for doing what he may not have the effort, time, or skill to accomplish. This book earns the highest recommendation. Any general dentist will learn something new and useful from this text.

L VIRGINIA POWELL, DMD
University of Washington
School of Dentistry
Department of Restorative Dentistry
Seattle, WA 98195

Announcements

W J Gies Award: Wilmer B Eames



Wilmer B Eames, DDS, of Denver, Colorado, has received the prestigious William John Gies Award of the American College of Dentists for 1986, an award reserved for outstanding service in dentistry and its allied fields. Dr Eames, professor emeritus at Emory University and associate editor of the journal of **Operative Dentistry**, was presented with the Gies Award for his outstanding and meritorious research in the field of dental materials.

Dr Eames received his dental degree from Kansas City-Western Dental College in 1939 and spent more than 20 years in private practice in Colorado, including four years with the US Army Air Corps during World War II. His research began during his days as a private practitioner. He entered academics in 1961 at Northwestern University where he served as professor of operative dentistry and continued to expand his dental research.

He joined the faculty at Emory University in Atlanta in 1967 as professor of operative dentistry and director of the applied dental research program. In addition to his significant contributions in dental materials research, he established a program that stimulated interest among undergraduate students in dental research through their own active participation. He is currently a visiting clinical professor at the Colorado University School of Dentistry.

Dr Eames' research has had a significant influence on the practice of dentistry. One example is his work with the mercury-alloy ratio for silver amalgam restorations. His efforts led to the standards in use today, based upon his many years of research and teaching, that have come to be known as the Eames Technique. Other major research efforts of Dr Eames include his work with composite resins, dental burs, luting agents, and high-speed instrumentation. Although officially retired from teaching, he has not retired from active dental research or lessened his enthusiasm for serving the dental profession.

A noted lecturer and author, he has presented more than 400 major lectures and has authored more than 100 significant dental publications, in addition to the 50 scientific abstracts of his work published by the International Association for Dental Research.

He has been the recipient of many other awards, including the George M Hollenback Research Award from the Academy of Operative Dentistry, the Man of the Year Award from the Colorado Chapter of the American College of Dentists, the Albert L Borish Award from the Academy of General Dentistry, the William Souder Award from the International Association for Dental Research, the Hinman Distinguished Service Medal, Alumnus of the Year from the University of Missouri-Kansas City, the Schweitzer Research Award from the Greater New York Academy of Prosthetics, and the University of Colorado Distinguished Service Award.

Congratulations, Dr Eames, you certainly deserve all the accolades which have come your way. You serve your profession with distinction.

Continuing Education Course on Direct Gold Restorations

The Direct Gold Restoration courses given the last two years have been most successful. A survey of all past participants indicates a very high level of enthusiasm for the value of the courses as they were presented. Most state that their *expectations were exceeded* and that they would like to take a more advanced course.

In order to help satisfy the needs of a significant number of practitioners and educators, it has been decided to hold another course June 16-19, 1987, at Indiana University School of Dentistry. This course will be structured to accommodate both those wishing to take the basic course (Class 1 and 5) as well as those who desire the more advanced course (Class 2 and 3). As before, it will include lectures, laboratory exercises, and clinical procedures.

Since this is a sponsored course, the cost to the participants will be subsidized. For this reason the registration fee for *members* of the *American Academy of Gold Foil Operators,* the *Academy of Operative Dentistry,* or *Operative Dentistry faculty* in *US* or *Canadian dental schools* will be *$100.00.*

The registration will, of necessity, be restricted in order to provide a reasonable faculty-student ratio. All transportation, lodging, meals, and incidental expenses will be the responsibility of the individual or his or her school. Accommodations will be available on the campus for the convenience of the participants.

Anyone desiring to take this course should contact Dr Thomas for an application as soon as possible at the following address: Dr Julian J Thomas, Jr, Chairman, Department of Operative Dentistry, Northwestern University Dental School, 240 E Huron Street, Chicago, IL 60611.

USC Dental Historian Pens Life of ADA Leader

Harold Hillenbrand, executive director of the American Dental Association from 1946 to 1969 and an ADA "elder statesman" until his death last May, is the subject of a biography by a dental historian at the University of Southern California.

The Hillenbrand Era: Organized Dentistry's

Glanzperiode [*Golden Age*] — a chronicle of Hillenbrand's campaigns for "better standards and better recognition" for America's dentists — is the just-published work of Clifton O Dummett, DDS, professor at the USC School of Dentistry, Los Angeles, and former president of the American Academy of the History of Dentistry.

Dr Dummett was commissioned to research and write *The Hillenbrand Era* two years ago by the book's publisher, the American College of Dentists, a nonprofit society based in Bethesda, Maryland.

The book was written in collaboration with Dr Dummett's wife, editor-author Lois Doyle Dummett, who had also assisted Dr Dummett in writing a biography of the black civil rights pioneer who fathered America's oral hygiene movement (*Charles Edwin Bentley: A Model for All Times,* North Central Publishing Co, St Paul, 1982). Dr Dummett's other landmark contribution to dental scholarship was a textbook, *Community Dentistry: Contributions to New Directions* (C C Thomas Co, 1976).

Dr Dummett has witnessed much of the dental history about which he writes. Born 67 years ago in Georgetown, Guyana, and trained in dentistry at Northwestern University and the University of Michigan, he became the nation's youngest dental dean when, at 28, he assumed that post at the School of Dentistry of Meharry Medical College in Nashville, Tennessee.

Later, while serving with the Veterans Administration, he became the first dentist in VA history to be named a hospital associate chief of staff for research and education.

After an 18-year career with the VA, he joined USC in 1966 to become dental director of USC's South Central Neighborhood Health Center, professor of dentistry, and chairman of the department of community dentistry.

Inquiries about copies of the book may be directed to Dr Gordon H Rovelstad, Executive Director, American College of Dentists, 7315 Wisconsin Ave, Suite 352N, Bethesda, MD 20814-3304.

NOTICE OF MEETINGS

Academy of Operative Dentistry

Annual Meeting: 12 and 13 February 1987
Westin Hotel
Chicago, Illinois

Subscription Reminder

If you have not renewed your subscription please do so soon — this is the last issue you will receive until your renewal is received. Barring the unforeseen, the Journal will be published regularly during the last week of January, April, July, and October. Allowing for normal distribution time, you can expect to receive your issues within a couple of weeks of our publication schedule. So, to ensure continued delivery of your subscription to *Operative Dentistry,* send in your renewal now!

Baylor College of Dentistry Inducts Dr Bouschor into Hall of Fame

Dr Charles F Bouschor was inducted into the Baylor College of Dentistry Hall of Fame at the College's Homecoming banquet on Friday, October 3, 1986.

Dr Bouschor, professor emeritus, served as chairman of the Department of Operative Dentistry at Baylor College of Dentistry from 1949 until his retirement in 1973. He earned the respect of his more than 2,000 students by demanding excellence in their work, yet always making himself available to help them in problem areas. Congratulations to our distinguished colleague Dr Bouschor.

Direct Gold Course in West Germany

Dr Allan G Osborn of Winnipeg, Manitoba, Canada, recently conducted a two-day lecture, demonstration, and performance course on gold foil and porcelain inlays at Werheim, West Germany, on January 23-24. Dr Osborn is one of a number of outstanding clinicians who have been invited to teach direct filling golds in West Germany in recent years. Who said gold foil is not acceptable and that there is no interest!

American Academy of Gold Foil Operators

Annual Meeting: 7-9 October 1987
University of Colorado
School of Dentistry
Denver, Colorado

Several officers and hosts in front of the University of Puerto Rico dental school. Left to right: Nelson W Rupp; Luis Marini; Jose Medina; Dean Carlos Suárez; Ralph Boelsche; Raphael Aponte; and Allan Osborn.

Jose Medina, accompanied by Mrs Medina, accepts the Distinguished Member Award from Ralph Werner.

New officers of the Academy are, left to right: Michael A Cochran and William H Harris, councillors (councillor Alfred C Heston is not in photo); Richard V Tucker, vice president; Allan G Osborn, president elect; Ralph A Boelsche, secretary-treasurer; and Julian J Thomas, president.

Dr and Mrs Carlos Suárez, hosts, engage in conversation with past president Nelson Rupp.

Clinical demonstrations: at left, Dr (Lieut USN) Marion Royer with class 5 gold foil; at right, Dr and Mrs Tom Larson and class 3 gold foil.

Enjoying a moment of relaxation are Dr and Mrs Luis Marini, Dr and Mrs Raphael Aponte and Dr Rupp and his wife Helen.

INSTRUCTIONS TO CONTRIBUTORS

Correspondence

Send manuscripts and correspondence about manuscripts to the Editor, David J Bales, at the editorial office: OPERATIVE DENTISTRY, University of Washington, School of Dentistry SM-57, Seattle, WA 98195, USA.

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, including references, 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,* 5th ed, 1983; 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 in parentheses by the name and address of the source or manufacturer. 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 size of figure 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 number of the figure. Type legends on a separate sheet. Where relevant, state staining techniques and the magnification of prints. Obtain written consent from holders of copyright 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 & others, 1975). Four or more authors should always be cited thus: (Jones & others, 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. Titles of books should be followed by the name of the place of publication and the name of the publisher.

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University of Washington
School of Dentistry SM-57
Seattle, WA 98195 USA