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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

Educational Reform

The recent report of President Reagan's National Commission on Excellence in Education makes depressing reading for anyone interested in excellent education. The report confirms the conclusions of previous studies on education in America—the standard is much lower than most would like.

Two complaints leveled against the present system of education are a lack of emphasis on the teaching of the disciplines that form the foundation of a good education—language, science, and mathematics, and the strange circumstance that teachers, though experts in the techniques of educating, are not necessarily experts in the subjects they are assigned to teach. Shifting the focus of education to courses in fundamental subjects is relatively easy and is already under way; re-education of the educators is a different matter altogether and will take longer to achieve. Part of the problem, according to Mitchell (1980), rests with the educational establishments that train teachers. He complains that teachers no longer teach but instead try to modify behavior. Perhaps, like Keynesianism, behaviorism is an idea whose time has gone. Of one thing, however, we are certain, the young people of today have the capacity for assimilating a first-class education if only they were exposed to it. It is unfortunate they are not given the opportunity and guidance to reach their full potential.

Judging from the difficulties graduates of dental schools are having nowadays in passing examinations for licensure, and from the difficulties that licensing boards are having in resisting pressures to lower their standards even further, one might well suspect that not all is well with contemporary dental education. Despite advances in techniques and materials, graduates are performing well below the standard that might be expected, especially in the operations that consitute by far the largest part of a general practice—restoring teeth to proper form and function by the placement of restorations of gold foil, gold inlays, and silver amalgam.

Unlike the response of the public schools, dental schools show little, if any, inclination to rectify the demonstrated deficiencies in dental education. If dental students are taught anything at all, surely they should be taught the skills needed to provide the types of treatment that amount to about two-thirds of the operations in a general practice. Sooner or later the deficiencies in the present curriculum of dentistry are bound to be acknowledged and reform will come—from either inside or outside the educational establishment; but in the meantime our bright young students are being deprived of excellence in dental education and the public is being deprived of the high quality of dental treatment that our present knowledge and techniques could provide.

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MITCHELL, R (1981) *The Graves of Academe,* Boston-Toronto: Little, Brown and Company.

ORIGINAL ARTICLES

Abrasion Resistance of Coated Gypsum Dies

Coating dies with acrylic resins or cyanoacrylates increases the resistance to abrasion. Immediate blotting can reduce thickness of coating.

H E LYON • R J MITCHELL

Summary

An acrylic resin (Taub Stone Die and Plaster Hardener) and two cyanoacrylate resins (Krazy Glue and Jet Instant Glue) were found to increase the resistance of stone to abrasion. The film thicknesses of a single coat of Stone Die and Plaster Hardener and Krazy Glue were less than 5 μm. Blotting immediately after the application of the coating minimized the thickness of the film. When the container of Krazy Glue was opened, resealed, stored for three months and then opened again, the film thickness of the material had increased fourfold.

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INTRODUCTION

One of the many potential sources of error in the indirect technique of dental casting is the abrasion of the margins of the die during fabrication of the wax pattern. To prevent this abrasion, it has been suggested that dies be coated with resin. Many studies have evaluated the hardness of stone that has been coated with resin. Unfortunately hardness, as evaluated by resistance to penetration by an indentor, is not a measure of resistance to scraping abrasion (Toreskog, Phillips & Schnell, 1966). Only a few coating materials have been found to increase the resistance of stone to scraping abrasion. Toreskog & others (1966) found polystyrene to be effective. Eames, Edwards & Buck (1978) found coatings of cyanoacrylate resins and a model spray increased scraping resistance, but suggest thick coatings are necessary for effectiveness. Fukui, Lacy & Jendresen (1980) investigated techniques for achieving thin coatings of cyanoacrylate but resistance to abrasion was evaluated only qualitatively.

The objective of this study was to evaluate the effectiveness of two commercially

available cyanoacrylate resins and a commercially available acrylic resin for coating dies. The properties evaluated were: (1) the resistance to scraping abrasion; and (2) thickness of coating.

MATERIALS

The three coating materials investigated were: Krazy Glue (Krazy Glue Inc, Chicago, IL 60634, USA), a cyanoacrylate resin for nonporous materials; Jet Instant Glue (Carl Goldberg Models, Inc, Chicago, IL 60661), a cyanoacrylate resin for porous materials; and Stone Die and Plaster Hardener (George Taub Products, Jersey City, NJ 07307, USA), an acrylic resin.

METHODS

Resistance to Abrasion

The test incorporated ideas used by Toreskog & others (1966) and Eames & others (1978), namely, a dull-edged scraper was moved along a right-angle edge of the specimen. Abrasion was measured after a small number of passes. As a departure from the other tests, the scraper was mounted at a negative angle of rake to prevent a cutting action.

The specimens of die stone were formed by pouring Type IV stone into an impression of a brass bar stock that had a milled edge of 90°. The impression was made with a polysulfide impression material (Permlastic, Sybron/Kerr, Romulus, MI 48174, USA) in a rigid tray with relief stops of 2 mm to ensure uniform thickness of material. The stone (Silky-Rock, Whip-Mix Corp, Louisville, KY 40217, USA) was mixed according to the manufacturer's directions. The water:powder ratio was 0.23 and mixing was done in a vacuum mechanical mixer manufactured by the manufacturer of the stone. All specimens were aged at least 3 days to allow the stone to reach equilibrium (Peyton, Leibold & Ridgley, 1952).

The 90° edge of a specimen of stone was abraded with the unsharpened edge of a 0.26 mm thick injector razor blade. The blade contacted the stone at a negative angle of rake of 45° and a load of 55 g was applied. The edge of each specimen was abraded 10 times in one direction only at a speed of 6 mm per second and debris was removed with compressed air between strokes. The load and scraping speeds were those determined by Toreskog & others (1966) to approximate those used during the fabrication of wax patterns. Four specimens were abraded for each test condition and the blade was changed after each set of four specimens had been abraded. The width of the abraded area was measured at five predetermined points 5 mm apart, giving 20 measurements for each test condition. All measurements were made with an Olympus microscope Model STM (Olympus Optical Company, Tokyo, Japan).

Six conditions were evaluated:

1. No coating - control
2. Krazy Glue - applied directly from a freshly opened original container and blotted immediately with a cotton-tipped applicator
3. Jet Instant Glue - applied directly from a freshly opened original container and blotted immediately with a cotton-tipped applicator
4. Taub Stone Die and Plaster Hardener - applied with a brush and blotted immediately with a cotton-tipped applicator
5. Taub Stone Die and Plaster Hardener - one coat applied with a brush and allowed to dry
6. Taub Stone Die and Plaster Hardener - two coats applied with a brush, allowing 30 minutes before application of second coat.

Film Thickness

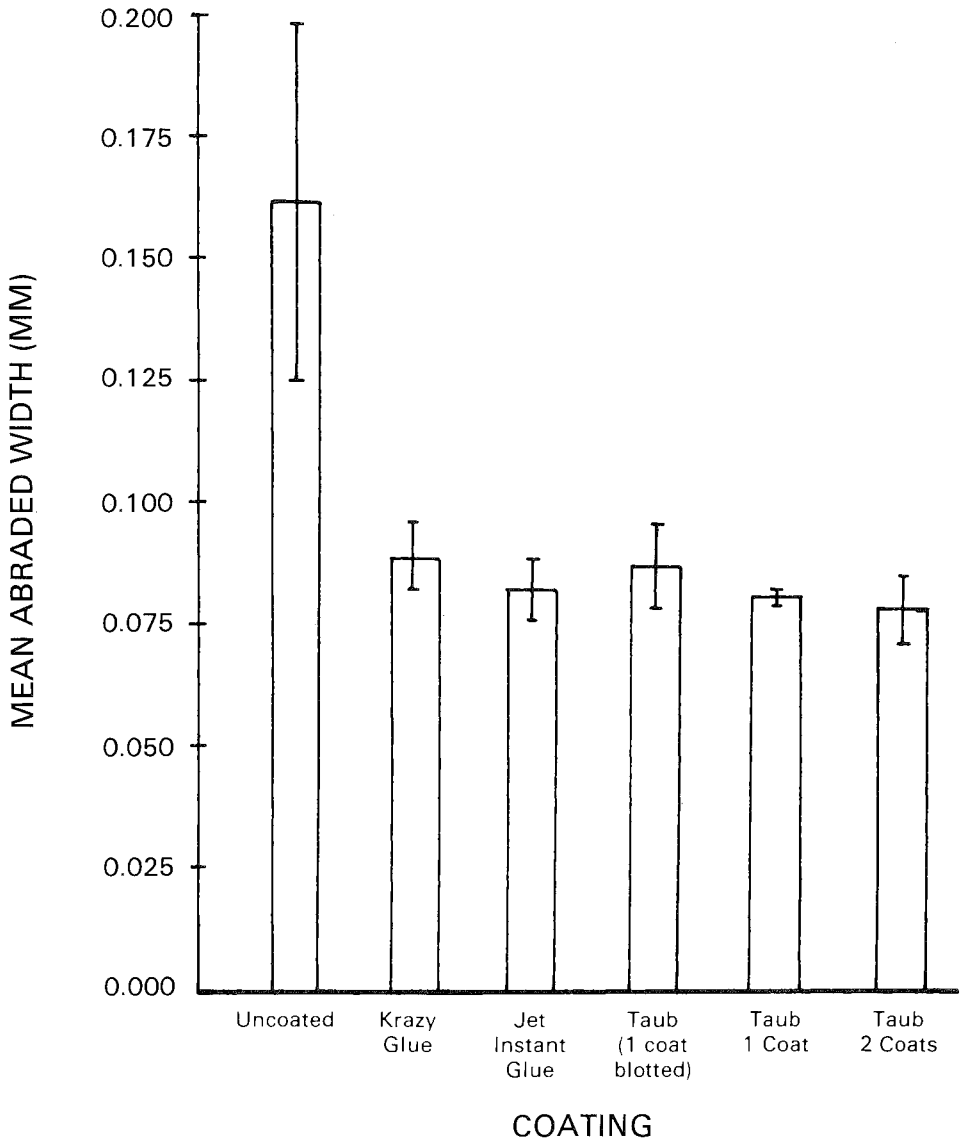
Film thickness was measured on the ends of cylinders of die stone. These specimens, 10 mm long and 5 mm in diameter, were made by pouring stone into a split brass mold, with the ends to be measured formed against glass to control flatness for measuring. The brands of stone and the technique of mixing were the same as for the stone dies that were abraded. Eight cylinders for each test condition were measured with a

Mitutoyo series 101-115 micrometer (Mitutoyo Mfg Co, Paramus, NJ 07652, USA). The cylinders were measured, coated, and then remeasured in 24 hours for film thickness. Film thickness was measured for the five conditions tested for abrasion, and, in addition, for both types of cyanoacrylate resin that had been opened (and kept capped) three months prior to use. This last test was to evaluate the effect of storage, after opening, on film thickness.

RESULTS

Resistance to Abrasion

The data on resistance to abrasion are given in the figure. The uncoated die stone abraded to a mean width of 0.162 mm and the coated die stones abraded to mean widths of 0.078 to 0.088 mm, depending on the coating. The coatings all significantly increased the resistance of the die stone to abrasion ($P \leq 0.05$; Tukey's HSD test) but



Width of stone abraded. Error bars indicated the 95% confidence intervals for the means.

the differences between the coatings were not statistically significant.

Film Thickness

The mean thickness of film and standard deviations for each test are presented in the table. Stone Die and Plaster Hardener and Krazy Glue, when applied in a single coat and blotted immediately, provided the thinnest coatings, with no statistically significant difference between them. Stone Die and Plaster Hardener, when applied in a single coat and allowed to dry without blotting formed a thicker film than when blotted ($P \leq 0.05$; Student's t-test).

Thickness of Coating Film

Coating	Film Thickness μm Mean	SD
Stone Die & Plaster Hardener 1 coat, blotted	2.2	2.4
Krazy Glue, fresh 1 coat, blotted	2.6	2.1
Stone Die & Plaster Hardener 1 coat, not blotted	4.4	3.1
Stone Die & Plaster Hardener 2 coats, not blotted	7.3	2.8
Krazy Glue, stored after opening	10.0	3.5
Jet Instant Glue, fresh 1 coat, blotted	10.7	3.8
Jet Instant Glue, stored unopened	11.6	3.7

DISCUSSION

Krazy Glue and Stone Die and Plaster Hardener (one coat, either blotted immediately or left to dry) formed a film with a mean thickness of less than 5 μm, a result which agrees very closely with that of the study of Fukui & others (1980). When Krazy Glue was applied after having been opened (and capped) for three months the mean thickness of film increased from 2.6 μm to 10.0 μm, indicating that storage adversely affects the film thickness. The mean thickness of the film of Jet Instant Glue changed little when stored after opening but the initial thickness of the film, 10.7 μm, was relatively large.

Stone Die and Plaster Hardener, when applied in one coat and blotted immediately, formed the thinnest film yet gave protection from abrasion that was equal to all the other products. This product was as effective in providing resistance to abrasion when brushed on and immediately blotted as when applied with a brush in one or two coats and allowed to dry, which gave a thicker film.

CONCLUSIONS

All the studied coatings increased the resistance of dental stone to scraping abrasion. There were no differences in abrasion resistance between the coatings; however, two coating materials (an acrylic resin and a cyanoacrylate resin for nonporous material) produced thinner coatings than the others if the coatings were blotted immediately.

Cyanoacrylate resins produced an increased film thickness when used after being opened and stored for three months.

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Effects of Designs of Class 2 Preparations on Resistance of Teeth to Fracture

Teeth are weakened as the isthmus of the cavity becomes wider and the pulpal floor deeper, but depth can be more injurious than width.

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The opinions and results contained in this article are those of the authors and are not to be taken as official views of the Dental Corps or the United States Air Force.

Summary

When teeth with different designs of MOD cavities were fractured, those with the narrowest isthmus and shallowest pulpal floor were found to be the strongest and those with the widest isthmus and deepest pulpal floor the weakest. Larger teeth may resist fracturing better than smaller teeth.

Introduction

For the past several years many clinicians have recognized the importance of conservatively prepared cavities and have advocated their use, thus to maintain the strength of the tooth (Bronner, 1930; Markley, 1951; Gilmore, 1964; Rodda, 1972).

Supporting the conservative approach to the preparation of cavities, Vale (1956) demonstrated a decrease in the strength of the prepared tooth when the width of the

isthmus was extended from one-fourth to one-third the distance between the tips of facial and lingual cusps. Nadal, Phillips & Swartz (1961) proved that an amalgam restoration is clinically acceptable when placed in a conservative preparation. Are there guidelines to suggest at which point remaining cusps should be strengthened by employing a pin-retained amalgam or a properly designed casting? The purpose of this study was to compare the strength of intact teeth and teeth prepared with class 2 mesio-occluso-distal cavities with isthmuses of various widths and depths. The effect of size on the strength of the teeth was also determined.

The size of the preparation, with emphasis on the width of the occlusal isthmus as related to the strength of the remaining tooth, has been examined (Mondelli & others, 1980; Larson, Douglas & Geistfeld, 1981; Re, Draheim & Norling, 1981). Variations in designs of experiments may contribute to variation in results, for example, some of the preparations were restored with amalgam, the instrument used to transmit force to the tooth varied in size, and the crosshead speed of the application of force differed.

Methods

One hundred extracted permanent maxillary premolars were chosen for this study. The size of each tooth was determined by the combined mesiodistal and buccolingual dimensions. Fifty teeth with a combined size of less than 16 mm were placed in one category, and 50 teeth with a combined size of 16 mm or more were placed in another category. The teeth were free of defects and divided into five different groups. One group included intact teeth with no preparations; the four other groups were divided according to the design of the cavity (Table 1). A total of 20 teeth was selected for each of the five different groups.

Table 1. Designs of Cavities

Design	Characteristics: Isthmus		Depth of Pulpal Floor	
		bur		mm
256S	narrow	(256)	shallow	(1.5)
256D	narrow	(256)	deep	(3.0)
560S	wide	(560)	shallow	(1.5)
560D	wide	(560)	deep	(3.0)

A mesio-occluso-distal class 2 cavity was designed and standardized (Fig 1). The major differences in design were the width of the occlusal isthmus and the depth of the pulpal floor. The difference in width of isthmus was established by the size of two different burs, #256 (0.9 mm) and #560 (1.6 mm). The difference between shallow and deep

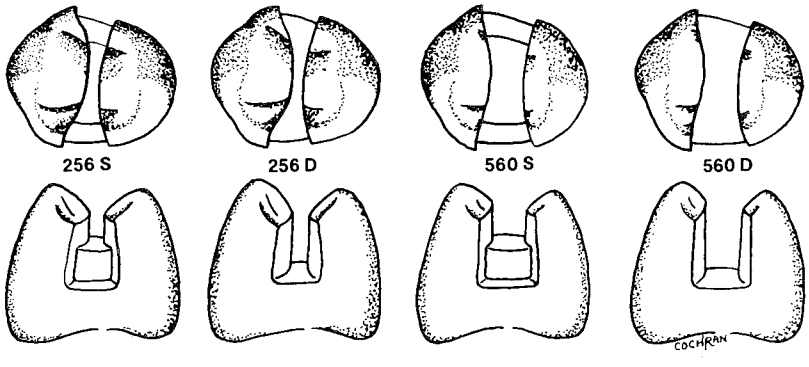

FIG 1. *The basic preparation employed, which included variations of occlusal width and pulpal depth*

pulpal floors was 1.5 mm. The width of the faciolingual dimension on the mesial and distal boxes of all prepared teeth was 3 mm. The width of the cervical floor from the axiocervical line angle to the cervical cavosurface margin of all prepared teeth was 1.2 mm. The axiopulpal line angle remained sharp with no bevel or rounding. There was also no rounding of the line and point angles in the proximal boxes.

All teeth were mounted in acrylic, a casting ring being used as a mold for holding the acrylic during setting. A specially designed instrument with a metal bar $^3/_{16}$ in (4.8 mm) wide was made to fit an Instron Universal Testing Instrument for the purpose of applying an occlusal load (Fig 2).

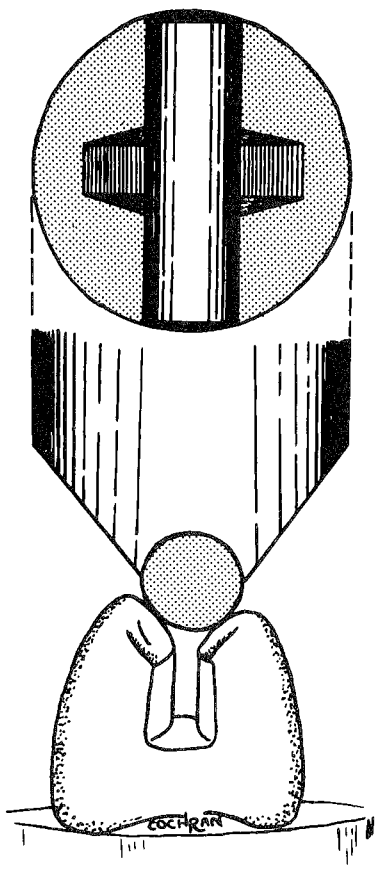

FIG 2. *The instrument used to apply the occlusal load to fracture the tooth*

Each tooth was placed under the fracturing arm, and the bar placed perpendicularly to the long axis of the tooth in a manner that laid the bar across the isthmus in a mesiodistal direction.

A static loading force in kg was applied at a crosshead speed of 10 mm per minute to ensure a straight stress-strain relationship to the breaking point. Rapid loading possibly correlates reasonably well with the sudden application of occlusal forces.

The results were subjected to a one-way analysis of variance and to the Newman-Keuls sequential range test (Winer, 1962).

Results

The results of the tests for fracture are shown in Table 2. The large standard deviations show the wide variation of fracture loads within each group. The F test in the analysis of variance showed a statistically significant difference between the five groups but did not show which of the groups differed. The Newman-Keuls sequential range test showed that the only statistically significant difference in fracture

Table 2. Force Required To Fracture Teeth

Design of Cavity	Force kgf (N) Mean	SD
Intact teeth	114.30 (1120.90)	27.25 (267.23)
Narrow isthmus & shallow floor (256S)	119.20 (1168.96)	56.11 (550.25)
Narrow isthmus & deep floor (256D)	95.68 (938.30)	26.66 (261.45)
Wide isthmus & shallow floor (560S)	106.30 (1042.45)	39.06 (383.05)
Wide isthmus & deep floor (560D)	73.00 (715.89)	21.01 (206.04)

load was between the group of cavities that were wide and deep and the other groups ($P < 0.01$).

Comparisons between the groups of the two different sizes of teeth within each design showed that in only two groups (narrow and deep, and wide and deep) did the size of the teeth make a statistically significant difference in resistance to fracture (Table 3).

Table 3. Comparison of Resistance to Fracture of Two Different Sizes of Teeth within Each Design (n = 10)

Design of Cavity	Load kgf (N) Mean	SD	*t* Value	Statistical Significance Probability
Intact				
15.9 mm or less	123.0 (1206.22)	31.6 (309.89)		
			1.8	Not significant
16.0 mm or more	105.0 (1029.70)	19.96 (195.74)		
Design 256S				
15.9 mm or less	105.35 (1033.13)	65.41 (641.45)		
			1.12	Not significant
16.0 mm or more	133.0 (1304.28)	44.09 (432.38)		
Design 256D				
15.9 mm or less	80.7 (791.40)	24.05 (235.85)		
			2.98	Significant ($P < .01$)
16.0 mm or more	110.55 (1084.13)	20.62 (202.21)		
Design 560S				
15.9 mm or less	106.75 (1045.88)	38.44 (376.97)		
			0.056	Not significant
16.0 mm or more	105.75 (1037.05)	41.73 (409.23)		
Design 560D				
15.9 mm or less	62.5 (612.92)	17.36 (170.24)		
			2.52	Significant ($P < .025$)
16.0 mm or more	83.5 (818.86)	19.83 (194.47)		

Discussion

The decrease in the load required to fracture teeth having preparations with wide isthmuses and shallow occlusal floors (560S) when compared with the teeth having preparations with narrow isthmuses and shallow occlusal floors (256S) was 11%. When preparations having wide isthmuses and deep floors (560D) were compared with preparations having narrow isthmuses and deep floors (256D), a decrease in the fracture load of 24% was noted. Both of these percentages are less than the 33% that Vale (1956) recorded in his study. This suggests that the weakening caused by a wide isthmus may not be as great as previously reported.

The teeth prepared with narrow isthmuses and deep floors (256D) were shown to be weaker than the teeth prepared with wide isthmuses and shallow floors (560S). This shows the weakening effect of increased depth on the strength of the tooth. In the 1950s, increasing the depth of the pulpal floor rather than extending the width to increase the bulk of amalgam in the isthmus was recommended (Mahler & Terkla, 1958; Gabel, 1954). The reasoning was to decrease the incidence of marginal failure in the narrow isthmus and still maintain strength in the restoration. Preventing marginal failure is important; however, as the depth of the occlusal floor increases, its effect on weakening the tooth must be considered.

As the preparations get wider and deeper, their strength is considerably reduced. A combination of a wide isthmus and a deep occlusal floor is a good indication for protecting the tooth by uniting the cusps. Occlusion, periodontal health, and esthetics will help determine the type of restoration to be used.

Conclusion

- The loss of strength between teeth prepared with a wide isthmus and those with a narrow isthmus was not as great as previously reported.
- The narrow isthmus and deep pulpal floor had a greater weakening effect than the wide isthmus and shallow pulpal floor.
- The weakness caused by a wide isthmus and deep pulpal floor may require a restoration designed to reinforce the cusps.
- Larger teeth may resist fracturing better than small teeth.

(Accepted 14 October 1982)

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Marginal Leakage of Dental Amalgam

Leakage around dental amalgams does not depend solely on the shape of particle or the proportion of copper.

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KAMAL ASGAR

Summary

When amalgams prepared from alloys representing various shapes of particle and chemical composition (Tytin, Dispersalloy, Fine Cut, Spherical, Ease, and New True Dentalloy) were tested with air pressure for marginal leakage, only Fine Cut, which had the most leakage, differed significantly from the others. Marginal leakage did not depend solely on shape of particle or content of copper.

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INTRODUCTION

No restorative material that adheres chemically to tooth structure has yet been developed. As a consequence, saliva with its bacterial components can penetrate the margins of restorations and predispose them to recurrent caries and ultimate failure.

Leakage around the margins of dental restorations has been studied in the laboratory by various techniques, including the use of air pressure, dyes, radioactive isotopes, bacteria, and neutron activation (Going, 1972; Kidd, 1976). Other less commonly used methods include scanning electron microscopy (Chan, Edie & Svare, 1977), artificial caries (Kidd, 1976), and assessment of

microleakage by conductimetrics (Jacobsen & von Fraunhofer, 1975).

The technique of using air pressure was one of the first methods for assessing marginal leakage (Harper, 1912). Later on, the technique was employed by other investigators (Pickard & Gayford, 1965; Koran & Asgar, 1967; Granath & Svensson, 1970; Rupp, Paffenbarger & Manuszewski, 1977) following some modifications in the original method.

Marginal leakage of high-copper amalgams compared to low-copper amalgams has been studied by different techniques (Andrews & Hembree, 1980; Hembree & Andrews, 1979; Smith, Wilson & Combe, 1978; Boyer & Torney, 1979; Vasudev, Mohammed & Shen, 1981). The effect of dimensional change on marginal leakage has also been studied (Swartz & Phillips, 1962; Wing, 1971; Granath, 1971; Øilo, 1976; Ogura, 1977; Rupp & others, 1977).

The purposes of the present study were:

- To develop a modified technique of using air pressure to assess quantitatively marginal leakage around amalgam restorations.
- To evaluate marginal leakage in relation to dimensional change of amalgams as measured according to Specification No 1 of the American Dental Association (1977).

METHOD

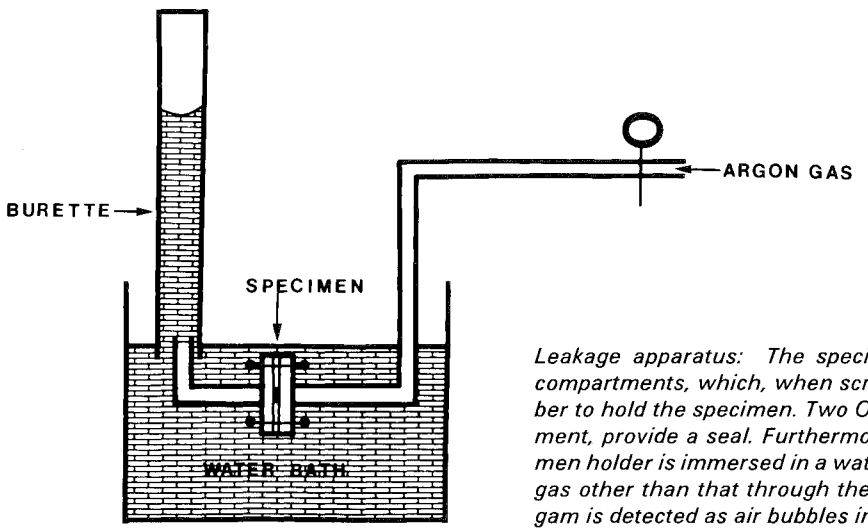
Marginal Leakage

The basic idea in the construction of the test apparatus was to force a gas through an interface of amalgam and mold and then to measure the amount of gas collected. The volume of the gas collected over a specific time is considered as the measure of leakage of the specimen; higher values mean more marginal penetration, that is, worse marginal seal.

A schematic representation of the apparatus is shown in the figure. Essentially it consists of a specimen holder and a tube. One end of the tube is connected to a gas tank and the other end leads to the specimen holder. Another tube carries the gas that leaks from the interface of amalgam and mold into an inverted graduated burette. The gas replaces some of the water in the burette thereby lowering the level of the water. At the end of the test period the amount of gas collected can be measured on the burette.

Argon gas was chosen because it is inert. It was forced through the interface of amalgam and mold with a pressure of 60 lbf · in^{-2} (414 KPa). This high pressure allows enough sensitivity to discriminate penetrability of margins among different amalgams.

Cylindrical cavities 4 mm in diameter and 4 mm deep were prepared in plastic for the test.



Leakage apparatus: The specimen holder consists of two compartments, which, when screwed together, form a chamber to hold the specimen. Two O-rings, one on each compartment, provide a seal. Furthermore, during the test the specimen holder is immersed in a water bath so that any leakage of gas other than that through the interface of mold and amalgam is detected as air bubbles in the water bath.

MATERIALS

Six amalgams were selected, three low-copper and three high-copper (Table 1). The amalgams were selected not only for their chemical composition but also for the shape of their particles (spherical, lathe-cut, and admixed).

The amalgams were prepared according to the manufacturers' instructions, and triturated with a Capmaster amalgamator (S S White Dental Products, Philadelphia, PA 19102) (see Table 1). Amalgams were condensed by hand into the molds. Lateral condensation was employed to ensure optimum adaptation. Spherical amalgams were condensed with condensers larger than those used for the rest of the amalgams. The pressure of condensation was not standardized because, generally, spherical amalgams are condensed better with lower forces than used with lathe-cut and admixed amalgams. To observe the effect of different techniques of condensation on the quality of marginal seal, a spherical amalgam (Tytin) and a lathe-cut amalgam (Fine Cut) were condensed with a standarized pressure so that the same amount of relatively high force routinely employed with lathe-cut amalgams was also used for the spherical amalgam. Also, more vertical thrusts were employed than lateral ones. Condensation was completed between 4 and 5 minutes from the end of trituration with the restorations being left slightly overpacked to be carved later. The lapse of time between the completion of condensation and the beginning of carving differed for each alloy. A wax carver was used to carve the amalgam in a direction from amalgam to cavosurface margin. Six replications were prepared for each amalgam.

The specimens were kept for 24 hours in an incubator at 37±1 °C. At the end of this period the specimens were tested for marginal leakage for a period of 15 minutes.

Dimensional Change

Dimensional change was measured according to Specification No 1 of the American

Table 1. Alloys Tested

Alloy	Description	Manufacturer	Mode of Dispensing	Hg %	Trituration Time s
Tytin	High-Cu (Uni-Comp)	S S White Philadelphia, PA 19102, USA	Predispensed	43	10
Dispersalloy	High-Cu (Admixed)	Johnson & Johnson E Windsor, NJ 08520, USA	Powder	50	20
Fine Cut	Low-Cu (Lathe-cut)	L D Caulk Co Milford, DE 19963, USA	Powder	50	12
Spherical	Low-Cu (Spherical)	L D Caulk Co	Powder	45	10
Ease	High-Cu (Admixed)	L D Caulk Co	Predispensed	50	15
New True Dentalloy	Low-Cu (Lathe-cut)	S S White	Predispensed	50	12

Dental Association. Five specimens were tested for each of the six alloys.

Statistical Analysis

The results were treated statistically by a two-way analysis of variance and Scheffe's multiple comparison test.

RESULTS

Marginal Leakage

Table 2 shows the mean values for marginal leakage. Scheffe's multiple comparison test at the 95% level of confidence showed that only Fine Cut, having the highest amount of leakage, differed significantly from the rest of the amalgams.

Table 2. Marginal Leakage and Dimensional Change

Alloy	Marginal Leakage (n = 6) ml · 15 min^{-1}		Dimensional Change μm ·cm^{-1}
	mean	SD	
Spherical	95	8.1	+5
Tytin	117	10.8	-5
New True Dentalloy	125	6.6	0
Ease	139	7.7	+4
Dispersalloy	149	9.9	+1
Fine Cut	371	62.0	-20

Vertical line connects alloys that do not differ statistically.

When the spherical amalgam, Tytin, was condensed with a comparatively high force — the same force used to condense a lathe-cut amalgam, Fine Cut — the marginal leakage was higher, 425 ml compared with 117 ml when condensed with a lower force. Under similar conditions the marginal leakage of Fine Cut was 355 ml.

Dimensional Change

The mean values for dimensional change are shown in Table 2. The coefficient of correlation calculated from the means of six replications of specimens for leakage and five replications for dimensional change was 0.915.

DISCUSSION

The results of this study show that only one amalgam, Fine Cut, having the highest amount of leakage, differed significantly from the rest of the amalgams. The other amalgams in this study showed comparable leakage regardless of their structural differences (high-copper vs low-copper) or the shape of their particles. These results confirm those of other studies, that the marginal seal of high-copper amalgams compares favorably with that of low-copper amalgams (Hembree & Andrews, 1979; Smith & others, 1978; Boyer & Torney, 1979). A more recent study showed the initial leakage for high-copper amalgams to be higher and attributed it to the resistance of these amalgams to corrosion (Andrews & Hembree, 1980). Another report (Vasudev & others, 1981) showed that a low-copper amalgam permitted less marginal leakage than a high-copper amalgam and suggested that the chemistry of low-copper amalgams was more favorable to obtaining a good marginal seal.

Spherical amalgams have long been condemned by some because of their lack of condensability and the difficulty in obtaining close adaptation to cavity walls (Wing & Lyell, 1966; Symer & Wing, 1981). This view is shared by many practicing dentists that believe spherical particles of amalgam tend to roll away from the condenser resulting in gaps and voids and lack of adaptation to cavity walls. In fact that is what happens when spherical amalgams are handled improperly. Such lack of adaptation may result in the ingress of oral fluids into the gap between the amalgam and the cavity wall causing the postoperative hypersensitivity reported by some practitioners that use spherical amalgams.

Studies have shown, however, that spherical amalgams should be condensed with

less force than lathe-cut amalgams (Koran & Asgar, 1967; Eden & Waterstrat, 1967). Lateral condensing thrusts are also required to achieve optimum adaptation. Although lateral condensation is an essential principle to be observed with both lathe-cut and spherical amalgams, it assumes an even more important role with spherical amalgams. Spherical amalgams condensed with low pressure are as strong as, or stronger than, lathe-cut amalgams. Koran & Asgar (1967) found that spherical alloys with a particle size of 0 - 50 μm when packed at a pressure of 2 lbf (8.8 N) leaked no more than low-copper lathe-cut amalgam packed at a pressure of 6 – 8 lbf (26.5 – 35.2 N). Such a characteristic of spherical amalgams helps in cases where application of high condensing pressure is not possible in inaccessible cavities such as some approximal boxes and narrow extensions. Study of the results of the present investigation reveals that while one lathe-cut amalgam (Fine Cut) showed the highest amount of leakage (370 ml), the other lathe-cut amalgam (New True Dentalloy) had a significantly lower value of marginal leakage (125 ml), comparable or better than the rest of the amalgams.

We believe that marginal leakage of amalgams should not be considered solely on the basis of shape of particle nor should it be judged on the basis of composition. Marginal leakage of a particular amalgam should not be extended to the amalgams of the same shape of particle or composition and each amalgam should be studied individually for marginal leakage.

Effect of Dimensional Change

Some investigators have found a positive relationship between dimensional change and marginal leakage, that is, contracting amalgams leak more than balanced or expanding amalgams (Rupp & others, 1977; Kato & others, 1968; Øilo, 1976; Ogura, 1977; Crisp & Wilson, 1980). Others, however, have not found such a relationship (Swartz & Phillips, 1962; Wing, 1971; Granath, 1971). Furthermore, it has been suggested that probably dimensional change as measured according to Specification No 1 of the American Dental Association does not have clinical relevance, and that dimensional change should be measured after amalgam has set in a mold (Vrijhoef, Spanauf & Driessens, 1974; Paffenbarger, Rupp & Patel, 1979).

The high value of the correlation coefficient between dimensional change and marginal leakage that was obtained in the present study ($r = .915$) confirms the results reported by Ogura (1977) ($r = .9279$ for the lathe-cut, $r = .8275$ for the spherical).

It should be considered, however, that when the amalgam with the setting contraction of 20 $\mu m \cdot cm^{-1}$ was excluded from the statistical analysis the value for the correlation coefficient was reduced to 0.086. Considering these results it can be suggested than an excessively contracting amalgam is more susceptible to marginal leakage than those with slight contraction, balance, or slight expansion.

The findings of Øilo (1976) are in agreement with those of the present study. He found that, on microscopic examination, the quality of adaptation of amalgam to cavity walls decreased as amalgams changed from expanding (+10 $\mu m \cdot cm^{-1}$) to balanced (0 $\mu m \cdot cm^{-1}$), slightly contracting (-10 $\mu m \cdot cm^{-1}$) and excessively contracting (-20 $\mu m \cdot cm^{-1}$) amalgams. Rupp & others (1977) found that an experimental amalgam with a contraction of 55 $\mu m \cdot cm^{-1}$ had a poor clinical performance and they suggested that a setting contraction of more than 19 $\mu m \cdot cm^{-1}$ is detrimental to the performance of amalgam.

However, as mentioned by other investigators (Granath, 1971) conditions such as plasticity of the mix, elasticity of the cavity mold, and proper condensation may, up to a certain point, compensate for the contraction of amalgam.

CONCLUSION

- The modified air pressure technique used in the present study is capable of quantifying marginal leakage.
- This method is a nondestructive procedure in which the specimens can be tested in chronological studies such as corrosion experiments.

- Spherical amalgams should be condensed under lower pressure than is used for lathe-cut alloys. Also lateral condensation thrusts and condensers of larger than normal size are required for optimum marginal adaptation of spherical amalgams.
- Slight dimensional changes of amalgams ($\pm 5\ \mu m \cdot cm^{-1}$), as measured according to Specification No 1 of the American Dental Association, does not have any significant effect on marginal leakage. Amalgam that contracts more than $20\ \mu m \cdot cm^{-1}$, however, might show an inferior marginal seal.
- Marginal leakage of dental amalgams should not be judged solely on the basis of shape of particle (spherical, lathe-cut, or admixed) or composition (high-copper or low-copper).

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Depth of Seating of Pins of the Link Series and Link Plus Series

All pins can be seated completely but the second pin of the Link Plus Series requires the use of the Auto-Klutch for complete seating.

W P KELSEY III • R J BLANKENAU
W T CAVEL

Summary

When pins of the Link Series and Link Plus Series (Whaledent International) were inserted into prepared channels in extracted teeth all pins could be seated completely by various methods except for the second pin of the Link Plus Series, which required the use of an Auto-Klutch handpiece for complete seating.

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Introduction

The use of threaded pins for retention in restorative dentistry is widely accepted. These pins afford the greatest supplemental retention in dentin as well as the restorative material (Dilts, Welk & Stovall, 1968; Moffa, Razzano & Doyle, 1969). An optimal depth of 2 mm into dentin is required for maximum retention. To achieve this, several manufacturers have developed self-limiting twist drills that prepare a channel approximately 2 mm into dentin (Schaefer & Reisbick, 1981). Additionally several designs of pin and methods of insertion have been devised. These include single pins as well as two-in-one arrangements that can be placed manually, with a contra-angle handpiece having a 10:1 reduction gear (Auto-Klutch, Whaledent International, New York, NY 10001, USA), or with a standard latch-type contra-angle handpiece (Link Series, Whaledent International).

Concern has been expressed by several

investigators about the capability to seat the pins fully in the prepared channels, particularly when two-in-one pins are employed. Most studies to date have concluded that when a self-shearing pin is used, the first pin fails to seat fully in the prepared channel (Collard & others, 1981; Garman & others, 1980; Currens, Korostoff & von Fraunhofer, 1980; Barkmeier, Frost & Cooley, 1978). Differences have surfaced about which method of insertion minimizes this problem. Garman & others (1980) and Currens & others (1980) concluded that mechanical placement (Auto-Klutch) would seat the first pin more fully, whereas Barkmeier & others (1978) stated that manual placement was more effective.

Several modifications in the design of pins have been proposed to overcome this difficulty. Among these are to make the lower shaft of the pin like a machinist's tap that will actually cut dentin rather than merely compress it (Chan, 1978). Additionally, the self-shearing mechanism could be strengthened to prevent premature severance of the first pin (Garman & others, 1980). Whaledent has recently introduced a new Link Series pin (Link Plus) that appears to have incorporated several improvements, among which are more efficient and easier insertion of the pin, stress-free shearing in both stages, and more consistent placement of the pin to the full depth of the channel (Whaledent International, 1982). These purported advantages result from modification in the design of the pin that includes a change in the design of the thread, a reduction in the number of threads per millimeter of pin, and a self-limiting shoulder located 2 mm from the end of the pin. The changes made to the threads of the pin were intended to facilitate ease and completeness of placement and the shoulder was designed to prevent overseating of the pin. This pin offers the operator a choice of techniques of insertion, namely, manual, Auto-Klutch, or standard latch-type contra-angle. A plastic wrench that fits over the sleeve is provided for manual insertion and the latch-type slow-speed and Auto-Klutch handpieces are recommended for mechanical placement of these pins.

It is the purpose of this paper to report a laboratory study undertaken to compare the Link Series and Link Plus two-in-one pins and the various modes of inserting pins into dentin.

Methods

Thirty caries-free molars stored since extraction in a solution of 50% glycerine and 50% hydrogen peroxide were used in this study. After they were mounted in laboratory stone to within 2-3 mm of the cemento-enamel junction, the occlusal enamel was removed with a diamond disc to produce a flat table of dentin. The teeth were then cleaned with a slurry of pumice and water and the dentinal tables smoothed with fine sandpaper discs.

Ten test groups, each consisting of the placement of 12 pins, were formulated as follows:

Group I	First pin of the Link Series placed with a latch-type slow-speed handpiece
Group II	First pin of the Link Series placed with an Auto-Klutch
Group III	Second pin of the Link Series placed with a latch-type slow-speed handpiece
Group IV	Second pin of the Link Series placed with an Auto-Klutch
Group V	First pin of the Link Plus Series placed manually
Group VI	First pin of the Link Plus Series placed with a latch-type slow-speed handpiece
Group VII	First pin of the Link Plus Series placed with an Auto-Klutch
Group VIII	Second pin of the Link Plus Series placed manually
Group IX	Second pin of the Link Plus Series placed with a latch-type slow-speed handpiece
Group X	Second pin of the Link Plus Series placed with an Auto-Klutch

The 'first pin' in these categories refers to the terminal pin in the two-in-one arrangement — the pin that is left in dentin by shearing from the remaining pin. This remaining pin, attached to the plastic sleeve, is termed the "second pin' in the test groups (Figs 1 and 2).

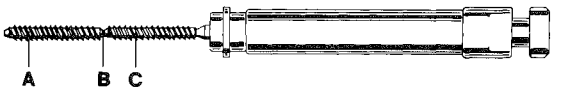

FIG 1. *Link Series Pin.* **A:** *first pin;* **B:** *shearing point;* **C:** *second pin.*

FIG 2. *Link Plus Pin.* **A:** *first pin;* **B:** *shearing point;* **C:** *second pin;* **D:** *shoulder stop.*

Four channels for pins were prepared in each tooth by one operator according to manufacturer's specifications. A ¼ round bur was used to establish a starting point at each site for a channel, after which the channel was initially prepared to approximately half the length of the Kodex drill. The drill was removed and the flutes were cleaned. The drill was then reinserted and the preparation of the channel completed. The preparation of the channel was also accompanied by a gentle stream of air to remove debris and improve the operator's visibility.

The channels for the pins were situated equidistant from each other at a point 0.5-1.0 mm from the dentinoenamel junction to ensure adequate surrounding dentin for each pin. Additionally, the channels were oriented parallel to the external surface of the tooth to avoid perforations of the pulp or roots.

Each category of 12 channels was prepared with a separate Kodex twist drill. Additionally, all of the pins to be placed in the prepared channels on a given tooth were of the same variety.

After preparation of the channels, all pins were placed by the same operator. Regardless of the type of Link Series pin, all first pins were placed until the shearing action separated the first from the second pin. The second pins were placed until the shearing action separated the pin from the plastic sleeve.

After placement, the pins were stabilized by embedding in cold-cure acrylic. The teeth were sectioned vertically along their long axes until the interface of pin and tooth was located. The samples were thoroughly debrided and the distance between the end of the pin and the depth of the channel was measured and recorded for each sample in the 10 categories of the test. These measurements were made with a microscope that had an ocular grid divided into units of 0.06 mm. Means were calculated for each of the 10 categories and the significance of the differences observed was analyzed with Student's *t* test.

Results

The mean distances between the ends of the pins and the depths of the prepared channels for each of the 10 categories of the test are shown in the table. The standard deviations are small, indicating little variation among the values recorded.

There was no statistically significant difference among the three methods of inserting the first or second pin of the Link Series or the first pin of the Link Plus Series, ($P > 0.05$). With the second pin of the Link Plus Series, however, substantially deeper seating was obtained when the pins were inserted with the Auto-Klutch compared with manual insertion or insertion with the latch-type slow-speed handpiece ($P < 0.05$).

Average Distance from Pin to Depth of Channel

	Test Category	Distance mm mean	SD
I	First pin Link Series placed with latch-type slow speed	0.015	0.001
II	First pin Link Series placed with Auto-Klutch	0.010	0.001
III	Second pin Link Series placed with latch-type slow speed	0.000	0.000
IV	Second pin Link Series placed with Auto-Klutch	0.025	0.004
V	First pin Link Plus placed manually	0.010	0.000
VI	First pin Link Plus placed with latch-type slow speed	0.010	0.001
VII	First pin Link Plus placed with Auto-Klutch	0.015	0.001
VIII	Second pin Link Plus placed manually	0.035	0.002
IX	Second pin Link Plus placed with latch-type slow speed	0.045	0.013
X	Second pin Link Plus placed with Auto-Klutch	0.000	0.000

Discussion

Pins can be placed by either manual or mechanical techniques. The Link Series of pins, as examples of mechanically placed pins, can be more advantageous in certain clinical situations than pins placed manually. Among these situations are those where access or vision is obstructed to the point where manual placement is very difficult or impossible. Additionally, the obvious benefit of safety can be realized in those situations where isolation with rubber dam is not feasible or for those clinicians that opt not to use rubber dam.

The pins of the Link Plus Series were able to be seated as fully as those of the original Link Series. This held true for both pins in the two-in-one arrangement and was not dependent upon means of mechanical insertion. These findings are consistent with the results obtained by Schaefer & Reisbick (1981). Although they did not test the two-in-one arrangement, they concluded the Link Series pin was able to fill the prepared channel consistently. In this regard, the advantages listed by the manufacturer appear to have been met. The Link Plus pins can be inserted with a safe, efficient technique; the shearing mechanism does not impede full seating of the pin and, as a result, placement of pins to the full depth is possible. Previous

studies have found the shearing mechanism to be a deterrent to the two-in-one arrangement (Collard & others, 1981; Garman & others, 1980; Currens & others, 1980; Barkmeier & others, 1978).

It was found that the second pin of the Link Plus Series could be more fully seated in the channel with the Auto-Klutch than with either manual or latch-type slow-speed techniques. This might be due to the presence of stresses during the shearing of the first pin adversely affecting the second shearing point causing it to separate prematurely. This could occur as the operator applied lateral forces to the wrench as he was threading the pin. These stresses could be duplicated by the play that often occurs in the latch-type handpiece, hence, no significant difference was noted between manual and slow-speed latch-type techniques of insertion. With the truer running reduced gear Auto-Klutch, these stresses were not as great and, as a result, the second point of stress was not weakened, allowing a deeper seating of the second pin.

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Mercury Vapor Related to Manipulation of Amalgam and to Floor Surface

Care in the use of mercury can maintain the concentration of mercury vapor in a dental office below the threshold limit value.

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Summary

A survey of 592 dental offices showed that lower concentrations of mercury vapor were associated with offices where capsules of premeasured amalgam were used rather than mercury in bulk, where closed system rather than open amalgamators were used, and where the excess mercury was not squeezed from the amalgam. The type of floor, whether of a hard surface or carpeted, did not affect the concentration of mercury vapor.

INTRODUCTION

The potential of mercury vapor in the dental office as a hazard to health has been reported (Mantyla & Wright, 1976). Mercury, even in low concentrations, inhibits the activity of a wide variety of enzymes by binding with physiologically important groups (Joselow, Louria & Browder, 1972). Mercury may also adversely affect the functioning of the kidney, heart, and gastrointestinal tract, and is associated with a range of symptoms involving changes in personality, difficulties of speech and vision, tremors, disorders of nerves, and oral pathosis (Mantyla & Wright, 1976; Joselow & others, 1972). Dental personnel exposed to unsafe levels have reported symptoms suggesting mercury poisoning (Joselow & others, 1972; Merfield & others, 1976) and, in one extreme case, a fatality resulted (Cook & Yates, 1969). Fine particulate powder of silver amalgam in the air may cause more mercury contamination than mercury vapor alone (Joselow & others, 1968).

The National Institute of Occupational Safety and Health (1973) has established 0.05 milligrams of mercury per cubic meter (mg Hg · m^{-3}) as the accepted Threshold Limit Value (TLV) for an eight-hour day, five-day work-week. According to most surveys of mercury vapor, most dentists are breathing

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air with less than the TLV; nevertheless, a significant number breathe air with greater than the TLV of mercury vapor. It has been reported that 14% of dentists in a Maryland survey and 22% in a Massachusetts survey were working in air with greater than the TLV of mercury vapor (American Dental Association, 1974; Cuzacq, Comproni & Smith, 1971).

The lowest ambient concentrations of mercury have been found in offices in which premeasured capsules are used rather than mercury in bulk (Harris & others, 1978). Open amalgamators give off higher concentrations of mercury vapor than do closed system amalgamators (Castagnola & Wirz, 1974). Dentists that squeeze excess mercury from their amalgam have been found to have higher concentrations of mercury vapor in their offices than have dentists that do not squeeze amalgam (Eames, Gaspar & Mohler, 1976; Cuzacq & others, 1971). The type of floor covering, that is, carpeting vs a hard surface, has not been shown to be related to the concentration of mercury vapor (Harris & others, 1978; Eames & others, 1976; Kantor & Woodcock, 1981).

In an effort to reduce the risk of impaired health of the dentist, this study was conducted to learn about the relationship between the concentration of mercury vapor in an operatory and the design of the operatory as well as the techniques used to manipulate amalgam. The specific purpose is to report the findings of a survey of mercury conducted by the Nassau County Dental Society of the State of New York as a community project to increase the awareness of dentists in the county to the potential problem with mercury and to assist in reducing concentrations where possible.

METHOD OF SURVEY AND ANALYSIS

During three summers from 1979 to 1981, 592 dentists in Nassau County, New York, participated in the study. Each dentist responded to a questionnaire on the use of mercury and the type of covering on the floor. The air throughout each office was sampled with a Bacharach MV-2 Mercury Vapor Sniffer (Bacharach Instrument Co, Pittsburgh, PA 15238, USA) at breathing level, at counter level near the area where mercury was used, and at storage areas of mercury and scrap amalgam. The results reported here are based on the concentration at breathing level in the operatory at the time of visit.

Recommendations for reducing the concentration of mercury vapor were given where necessary.

The information gathered from the 592 dentists and their offices was analyzed by comparing the concentration of mercury vapor at breathing level in the operatory with the type of amalgam capsule, type of amalgamator, technique of expressing mercury, and type of covering on the operatory floor.

The χ^2 test was used to determine whether the relationships were statistically significant.

RESULTS

Of the 592 dentists surveyed, 79% were working in air containing less than 0.02 mg Hg · m^{-3} (Fig 1).

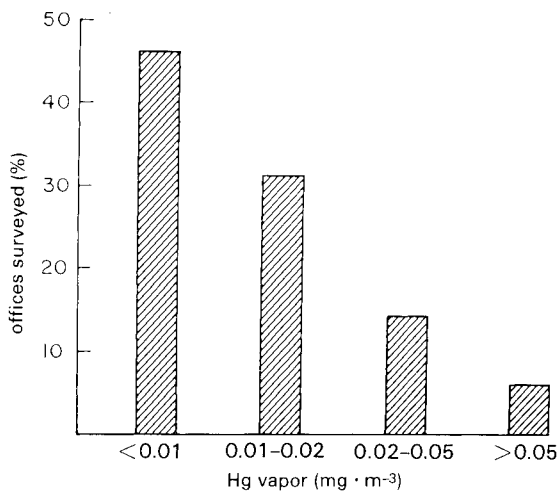

FIG 1. *Concentration of mercury vapor at breathing level in dental offices surveyed*

Type of Capsule

Of offices where capsules of premeasured amalgam were used, 0.6% had concentrations of mercury vapor greater than the TLV, compared with 9% of those where mercury in bulk was used (Fig 2). Of those where mercury in bulk with open amalgamators was used, 11% exhibited concentrations greater than the TLV (Fig 3).

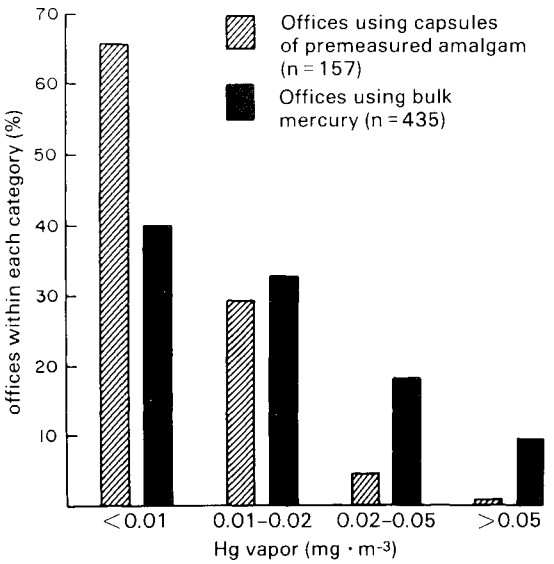

FIG 2. *Concentration of mercury vapor at breathing level in dental offices where capsules of premeasured amalgam were used compared with offices where mercury in bulk was used ($P < 0.0005$)*

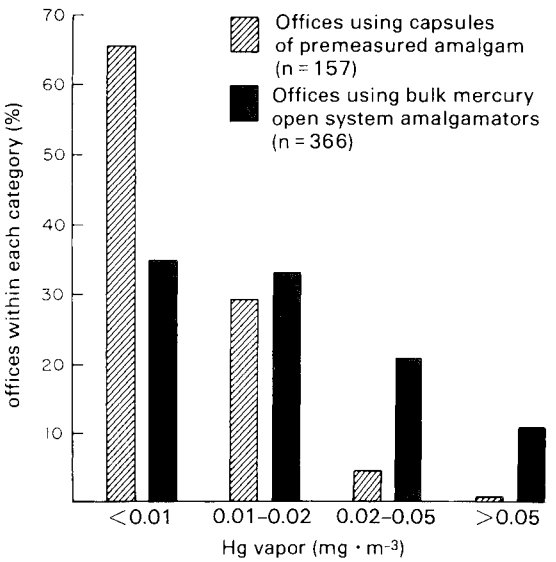

FIG 3. *Concentration of mercury vapor at breathing level in dental offices where capsules of premeasured amalgam were used compared with offices where mercury in bulk and open amalgamators were used ($P < 0.0005$)*

Type of Amalgamator

None of the dentists using closed system amalgamators had office concentrations of mercury vapor above the TLV. Of those using open amalgamators, 8% had mercury levels above the TLV (Fig 4).

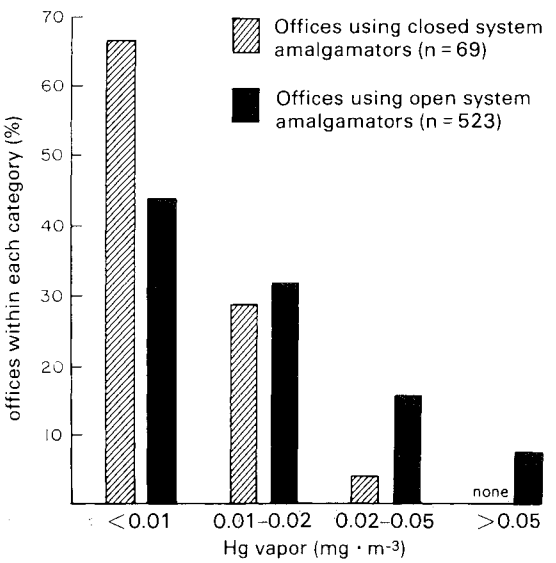

FIG 4. *Concentration of mercury vapor at breathing level in dental offices where closed amalgamators were used compared with offices where open amalgamators were used ($P \approx 0.0001$)*

Squeezing Excess Mercury

Of those squeezing excess mercury from their amalgam, 16% had office concentrations greater than the TLV, while only 3.5% of the dentists not squeezing exceeded this concentration (Fig 5).

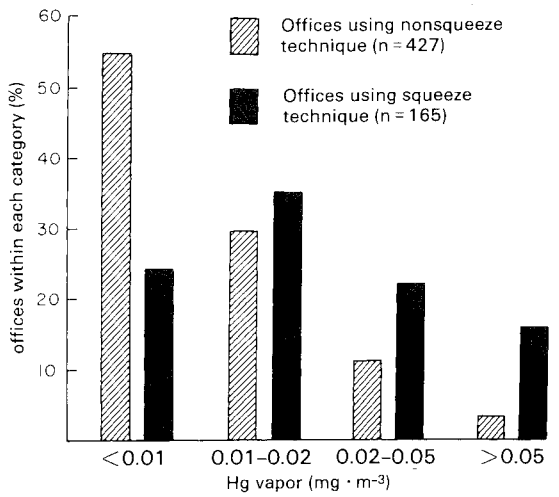

FIG 5. *Concentration of mercury vapor at breathing level in dental offices where amalgam was not squeezed (Hg:Ag close to 1:1) compared with offices where amalgam was squeezed ($P < 0.0005$)*

Carpeting and Hard Floors

The effect of hard floors or carpeting in the operatories did not appreciably change the percentage of dentists within the various categories of concentration of mercury (Fig 6).

TWO-YEAR FOLLOW UP

Of dental offices evaluated in 1979 with concentrations greater than the TLV, 72% that were rechecked in 1981 were found to be below the TLV. This reduction appears to be the result of the positive response by the dentists to our recommendations, such as removing contaminated carpets, changing to premeasured capsules, changing to a closed system amalgamator, or simply becoming more careful in handling mercury.

DISCUSSION

While a review of the literature reveals minimal information about the correlation of behavioral and physical symptoms of dental personnel with excessive mercury vapor at breathing levels in the operatory, keeping the concentration below 0.02 mg Hg · m^{-3} would seem prudent, especially in light of the ease with which over three-quarters of the dentists in our survey were able to maintain their operatories at these concentrations.

In addition, further study of the closed system amalgamator is indicated by the low concentrations associated with their use.

CONCLUSIONS

The use of premeasured amalgam capsules, closed system amalgamators, and a technique that avoids squeezing mercury from amalgam were each associated with offices that demonstrated lower concentrations of mercury vapor than offices in which bulk mercury, open amalgamators, and squeezing techniques were used.

Concentrations of mercury vapor in offices with carpeting were similar to concentrations in offices with hard flooring.

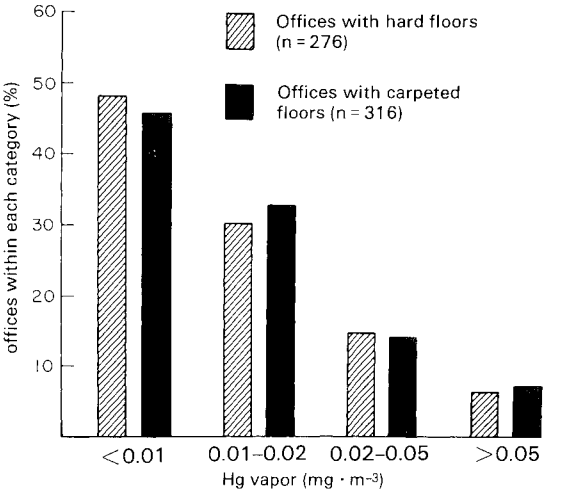

FIG 6. *Concentration of mercury vapor at breathing level in dental offices having floors with hard surfaces compared with offices having carpeted floors ($P \approx 0.90$)*

This study was supported by a grant from the Nassau County Dental Society of the State of New York. The authors gratefully acknowledge the assistance of the Nassau and Suffolk County Departments of Health.

(Accepted 4 January 1983)

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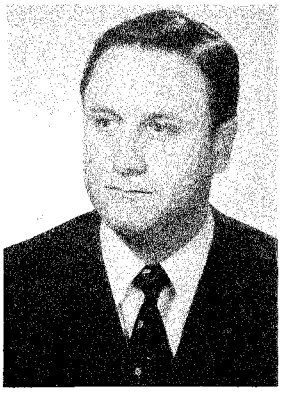
OPERATIVE DENTISTRY, 1983, 8, 28-29.

Letter from Europe

ADAM J SPANAUF



This year two very interesting dental meetings took place in Italy. The first was organized by the University of Padua Dental School. The initiators for this international meeting in operative dentistry were Dr G P Cordioli, Dr G A Favero, Dr L Favero, Italy, and Dr P G C M Battistuzzi, the Netherlands. The theme of the meeting was to show the interrelationship of certain closely related subjects, in particular operative dentistry, periodontology, and prosthodontics.

A beautiful account of the application of rubber dam in operative dentistry was presented by Dr Favero, who used old Italian masters to make a "dry" subject very lively. Emphasis was placed on the increase in efficiency and productivity by the use of rubber dam. Dr Cordioli discussed the positive and negative influences of operative procedures upon the periodontium. Dr Favero gave some practical hints on how to restore carious lesions under partial denture prostheses. Dr Battistuzzi brought the audience up to date on the latest techniques for pins and the restoration of badly broken down teeth. Dr A J Spanauf and Dr M M A Vrijhoef, the Netherlands, discussed new developments in amalgam material and the preparation of cavities. Dr F Toffenetti, Italy, showed how amalgam restorations when properly contoured and carved may adequately restore occlusal relations in function, provided the practitioner has a good knowledge of the anatomy of occlusal surfaces and the functioning of the temperomandibular joint.

At the conclusion of the meeting it was shown that both the dental profession and patients are extremely interested in improvement of the productivity of the provision of dental care. The cost of dental treatment is increasingly important as a consequence of economic decline.

The second scientific meeting took place in Milan under the chairmanship of Professor E Gianni, dean of the Dental School, University of Milan. The subject of the meeting was dental materials, their present status and clinical applications.

In his opening speech Professor Gianni

University of Nijmegen, Faculty of Medicine and Dentistry, Institute of Periodontology, Philips van Leydenlaan 25, Nijmegen, Netherlands

ADAM J SPANAUF, BSD (Sydney), PhD, senior lecturer in periodontology

defined dentistry as an art and science. Technological innovations have to take into account esthetics and scientific aspects.

Speakers from the United Kingdom, the Netherlands, and the United States of America were represented. Most of the speakers expressed cautionary notes about the new materials being introduced to the dental profession.

The following subjects were discussed:

- Possibilities of the remineralization of the carious lesion.
- Present status of composite restorative materials.
- Dental amalgam alloys.
- Biological compatibility of dental materials.
- New low-gold casting alloys.
- Future developments in techniques and dental materials.

The biocompatibility of materials was stressed. It has been stated that sometimes the property that is best in laboratory studies is not necessarily the best for the tooth.

An interesting feature of the meeting was the participation of dental students.

It may be concluded that throughout Europe there is a large divergence of interest in research on dental materials. At present there is no special center for research such as the National Bureau of Standards in the United States. Due to the economic situation the universities in Europe may be forced to establish a joint research center, as the support for research may be reduced by the state and future activities will have to be supported more and more by industries.

OPERATIVE DENTISTRY, 1983, 8, 30-31.

Hollenback Prize

The Hollenback Memorial Research Prize for 1983 is being awarded to Harold R Stanley, Jr, who is currently professor and chairman of the Department of Oral Medicine at the University of Florida, Gainesville. This prize is given annually by the Academy of Operative Dentistry to recognize excellence in research that has contributed substantially to the advancement of operative dentistry.

Dr Stanley, through a career of untiring effort, has defined for the dental practitioner the biological effect of many restorative procedures. As clinicians, we have characteristically taken great pride in our ability to manage a large variety of materials and to restore lost oral function. Through his investigative efforts, we are now more aware of the sensitive interaction between our operative procedures and the biological tissues upon which we operate. In response to his studies and successful dissemination of the results, histopathology now has a very practical meaning to the clinical dentist and restorative treatment relates more directly to oral health.

Dr Stanley is a biologist by training with a BSc degree from American University. He obtained a DDS degree from Baltimore College of Dental Surgery, University of Maryland, in 1948. During the following two years he interned with the United States Public Health Service and was on assignment as an assistant dental surgeon at the National Institute of Dental Research. He then began graduate training at Georgetown University from which he received a MSc degree in oral pathology in 1953. He was with the National Institute of Dental Research from 1953 until 1968 in the positions of assistant chief of the Clinical Investigations Branch, dental director, chief of the Oral Medicine and Oral Surgery Branch, and finally as clinical director in charge of clinical research. Dr Stanley went to the University of Florida in 1968 as chairman of the Division of Oral Pathology and was promoted to his present position in 1970.

He holds active membership in at least

ten professional organizations, including the American Academy of Oral Pathology (past president), American Dental Association, International Association for Dental Research, and American Association of Endodontists. He is a diplomate, as well as a past president, of the American Board of Oral Pathology and has been a member of the Council of Dental Therapeutics for the American Dental Association. He is a member of Omicron Kappa Upsilon national dental honor society and has been active as a consultant to the military services and Veterans Administration Hospitals.

An illustrious career has been sparkled with many awards. These include the Thomas P Hinman Memorial Medallion (1971), the Science Award for outstanding basic research in oral therapeutics from the International Association for Dental Research (1976), the Louis Grossman Award from the American Association of Endodontics (1981), and most recently, the Pulp Biology Award from the Pulp Biology Group of the International Association for Dental Research (1982).

Dr Stanley has published his work extensively in dental literature throughout the world and has been an associate editor for both the *Journal of Oral Pathology* and the *Journal of Endodontics*. In his curriculum vitae are listed well over 100 publications in major refereed dental journals, in addition to the numerous reviews and proceedings of workshops in which he has participated. He has also co-authored or contributed to a number of books in the areas of oral pathology, periodontics, and pulp biology.

To all of these accomplishments can be added, perhaps, Dr Stanley's most significant contribution to clinical dentistry and dental research. As early as 1963 he was appointed to a subcommittee of Federation

Photo courtesy Cristof Studio, San Francisco, CA

Harold R Stanley

Dentaire Internationale to study the toxicity of restorative materials. This work has been continued through the years in subcommittee for the American Dental Association. These pioneering efforts to establish communication among his peers on research methodology culminated in 1979 with the acceptance of Specification No 41 by the American National Standards Institute of the American Dental Association as Recommended Standard Practices for the Biological Evaluation of Dental Materials.

Dentistry owes a great debt to Dr Harold Stanley. The Academy of Operative Dentistry honors him as a devoted student, an outstanding educator, a dedicated researcher, and a fellow clinician.

From the presentation by Joseph B Dennison, Chairman, Research Committee, Academy of Operative Dentistry, February 1982.

POINT OF VIEW

Contributions always welcome

Letters

Have You Hugged Your Editor Today?

Those of us who drive in areas where bumper stickers are popular are familiar with this one: "Have you hugged your kids today?" The implied reminder to us to recognize and encourage those around us can be carried over to our recognition of the efforts of those who serve the rest of us. I think of the elected officers of our Academies, and of the many appointees, but even more specifically of the editor of a professional journal—in this case, *Operative Dentistry.*

While a journal is going through its growing pains, or when an editor dares to trample one of our pet concepts, we let him know about it—promptly! But after the novelty wears off, and if the journal is of uniformly high quality, we may **think** "well done," and let it go at that. However, the editor is not clairvoyant, so he can only assume that no news is good news.

From the vantage point of an associate editor, I can assure the readers of the *Operative Dentistry* journal that our own editor devotes an inordinately large portion of his time and efforts in producing one of the finest dental periodicals extant. The *Journal*'s editorial staff is minimal; further, our Editor has an unquenchable desire to print no grammatical or typographical errors. He, therefore, puts in long, long hours on evenings and weekends reviewing and editing manuscripts, and checking references in those manuscripts for accuracy. The end result is an excellent publication, of which our two Academies can be justly proud.

It would be nice if we could take a moment occasionally to drop a card in the mail, expressing a "thank you," or suggesting a desirable change. We all perform better and develop fewer ulcers and see the world with a warmer glow if we can feel that those we serve don't take us too much for granted. On behalf of those who consider our *Journal* to be one of the best in dentistry, may we say to you, Editor Ian— "Well done! Keep up the good work."

G D STIBBS
433 Medical Dental Building
Seattle, WA 98101

DEPARTMENTS

Book Review

ILLUSTRATED DICTIONARY OF DENTISTRY

By Stanley Jablonski

Published by W B Saunders Co, Philadelphia, 1982. 919 pages. $39.50

The purpose in creating this dictionary was to compile the definitions of words and terms that are of interest to dental practitioners, researchers, educators, students, and auxiliary personnel. This task was complicated by the many subspecialty groups in dentistry having definitions unique to their areas of interest. These complications have been resolved very well by retaining standard textbook or long accepted definitions.

In areas of particular complexity a descriptive or encyclopedic approach has been used to elaborate on the definitions.

The addition of several sections has given an extra dimension to the usefulness of the dictionary. These include a discussion of the language of medicine and dentistry, the organization and function of the American and Canadian Dental Associations, directories of schools of dentistry in the United States and Canada, and laboratory reference values of clinical importance.

The frequent inclusion of brand names, however, is not necessary and needlessly dates the edition. Such inclusion is contraindicated because if all products are not listed the dictionary appears preferential. Also many products that are listed are no longer on the market.

The encyclopedic descriptions are too lengthy and too frequent. These descriptions also tend to date the edition. For example, under amalgam, the copper content for the typical modern composition is given as 3% rather than over 10%. This type of error raises questions about the validity of other updated or revised descriptions. This type of information is more appropriate in other reference books such as the routinely updated *Dentist's Desk Reference: Materials, Instruments and Equipment* and the *Accepted Dental Therapeutics*. Both of these are revised every two or three years for the American Dental Association by recognized authorities in the respective areas of interest.

Dr Jablonski has been very careful and thorough in accomplishing his objectives in compiling this dictionary. The prospective audience of practitioners, students, and researchers, however, will continue to need Boucher's *Dental Terminology* and Dorland's *Medical Dictionary*.

N W RUPP
ADA Health Foundation
Research Unit at the
National Bureau of Standards
Washington, DC 20034

Wit and Wisdom

It's unwise to pay too much, but it's also unwise to pay too little. When you pay too much you lose a little money, that is all. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing it was bought to do. The common law of business balance prohibits paying a little and getting a lot—it can't be done. If you deal with lowest bidder, it is well to add something for the risk you run. And if you do that, you will have enough to pay for something better.

—John Ruskin

Announcements

RECIPIENTS OF 1982 STUDENT ACHIEVEMENT AWARDS

American Academy of Gold Foil Operators

Boston University	David S Kam
University of California, Los Angeles	Christopher John Wallace
University of Colorado	Deborah Kaye Deeg
Dalhousie University	Archibald D Morrison
University of Detroit	Robert T Slaby
Emory University	Carol Ann Wooden
Fairleigh Dickinson University	Ralph William Besho
Georgetown University	Nicholas G Tsakos
Harvard School of Dental Medicine	Allena Burge-Bottonbley
Howard University	John Raffel
University of Illinois	Gary L Sengbusch
Indiana University	Robert S Cheung
Université Laval	Marc Dupuis
Loma Linda University	David J Jo
Marquette University	Thomas A Lansing
University of Maryland	Rafael Bernard Alfonso
Meharry Medical College	Kathy Lynn Jefferson
University of Michigan	Robin P Steely
University of Minnesota	Norman V Eid
University of Missouri, Kansas City	John K Hague
University of Nebraska	Dennis D Timperley
College of Medicine & Dentistry of New Jersey	John C Minichetti
Northwestern University	Mark A George
University of Oklahoma	Halbert Daniel Edwards
University of the Pacific	John Bryson McBratney
University of Pennsylvania	Richard Jay Schoonmaker
University of Pittsburgh	James S Snow III
Medical University of South Carolina	Philip C Morrow
University of Southern California	James Mellert
Southern Illinois University	Larry W Osborne
Temple University	Anthony J Diorio
University of Texas	Timothy Stewart McKenzie
Tufts University	Jean Thompson Maloof
Washington University	M Rex Favero
University of Washington	Boyden S Yamashita
West Virginia University	John A Kokai

Academy of Operative Dentistry

University of Alabama	Kien Luong Nguyen
University of Alberta	Dennis James Fair
Baltimore College of Dental Surgery	Thomas K Brigada
Boston University	Joseph Cirieco, Jr
University of British Columbia	Alnoor Noordin Sonji
University of California, Los Angeles	Thomas John Stelmach
University of California, San Francisco	Ralph Hans Stanley
Case Western Reserve University	Philip John DePasquale
University of Colorado	Deborah Kaye Deeg
University of Connecticut	Douglas Hope
Creighton University	Mark J Callan
University of Detroit	Jeffrey R Teno
Fairleigh Dickinson University	Stuart H Mendel
University of Florida	Scott Lee Kuhns
Medical College of Georgia	Karyn L Stockwell
Harvard School of Dental Medicine	Kenneth John McPartland
University of Illinois	William Calvin Elton
University of Indiana	Michael E Sovanich
University of Iowa	Steven T Reynolds
Katholieke Universiteit (Netherlands)	Jan G J H Schols
University of Kentucky	Claire Cornelious Slaton
Université Laval	Pierre Grondin
Loma Linda University	James M Slepski
Louisiana State University	Thomas Benjamin Baggett III
University of Louisville	Tam S Hager
Loyola University of Chicago	David A Doyle
University of Manitoba	Brenlee Kemp
Marquette University	Lee R Krahenbuhl
Meharry Medical College	Charles Richard McLeod
University of Michigan	James A Bedor
University of Minnesota	Glenn A Hultstrand
Université de Montréal	Yves Bergeron
University of Nebraska	Gary E Martin
New Jersey Dental School	Patrick McDermott
State University of New York at Buffalo	Anthony Gerard Lombardo
University of North Carolina at Chapel Hill	Alan Watson Irvin
Northwestern University	Paull C Gossett
University of Oklahoma	George K Rains
Oral Roberts University	Rickey Lynn Grant
University of Oregon	James C Alder
University of the Pacific	John Bryson McBratney
University of Pennsylvania	Linda Carol Weisenfeld
University of Pittsburgh	Michael J Wolff
University of Saskatchewan	David W Hastings
Medical University of South Carolina	Wally Thompson Austelle
University of Southern Illinois	Jerry P Gies
University of Sydney	John Der Tateossian
Temple University	John R Bailey
University of Tennessee	David Wayne McDonald
University of Texas	James E Reed
University of Texas at Houston	Susan Ellen Haynes
Tokyo Dental College	Takashi Fujita
Tufts University	Clara M Hyun
Washington University	Raymond H Gilbert III
University of Washington	Boyden S Yamashita
University of Western Ontario	Edward M Gillis
West Virginia University	Autumn D Kercheval

NEWS OF ACADEMIES

NOTICE OF MEETINGS

American Academy of Gold Foil Operators

Annual Meeting: 29 and 30 September 1983
University of California
at Los Angeles
Los Angeles, California

Academy of Operative Dentistry

Annual Meeting: 16 and 17 February 1984
Chicago, Illinois

CERTIFICATION PROGRAM IN OPERATIVE DENTISTRY BEGINS

Fifteen candidates successfully completed the first, written phase of the new Certification Program in Operative Dentistry in February of this year at Northwestern University Dental School.

This important new program was initiated three years ago, in February 1980, by the Executive Council of the Academy of Operative Dentistry. To implement the program, an American Board of Operative Dentistry was officially established with 18 elected charter members in October 1980 in New Orleans.

The 15 candidates, who came from all sections of the United States and from Montreal, Canada, will then proceed to the second and third phases of the program—an oral examination followed by a clinical examination—to be offered sometime in June or September 1984. Details regarding these subsequent phases will be sent to the 15 participants.

The Board publicly expresses its deep appreciation of Northwestern University Dental School as a most gracious host institution, particularly to the administration, Dean Norman Olson, the faculty, and staff for their warm reception and assistance. All candidates and Board members attending were deeply impressed with the level of support and dedication displayed by the Dental School. The Board hopes that this interaction will continue in the years ahead.

The written examination will again be offered in Chicago at Northwestern University Dental School on 14 February 1984. Application forms for this examination may be obtained from the Secretary of the Board, Dr Floyd E Hamstrom, 1476 Peterson Road, Burlington, WA 98233. The forms must be completed and sent to him by 1 October 1983.

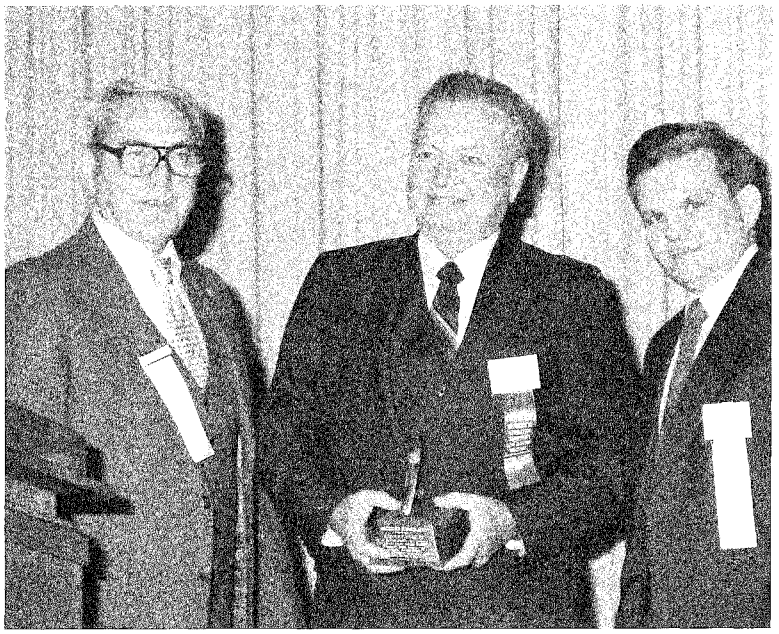
ACADEMY OF OPERATIVE DENTISTRY

The twelfth annual meeting of the Academy of Operative Dentistry was held 17 and 18 February 1983 in Chicago at the Westin Hotel. The program consisted of essays, table clinics, and limited attendance clinics. The second M G Buonocore Memorial Lecture was delivered by Alan Boyde.

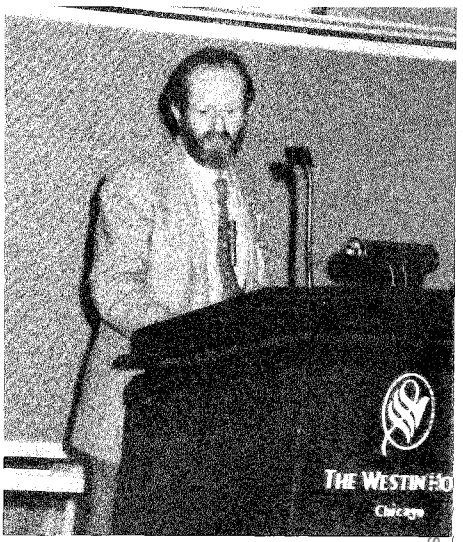
At lunch on the first day the Hollenback Memorial Prize was presented to Harold R Stanley and the Student Achievement Award to Aususto C Garcial-Aguirre of the University of Puerto Rico.

Officers elected for 1983 are: president, Robert L Kinzer; immediate past-president, Paul H Loflin; president-elect, William N Gagnon; vice president, Lawrence L Clark; secretary-treasurer, Ralph J Werner; assistant secretary, Gregory E Smith; and councillors, R Craig Bridgeman, W N von der Lehr, Barry O Evans, Anna T Hampel, Richard B McCoy, and Allan G Osborn.

Paul Loflin, the outgoing president, accepting the president's plaque from Robert Kinzer, the incoming president

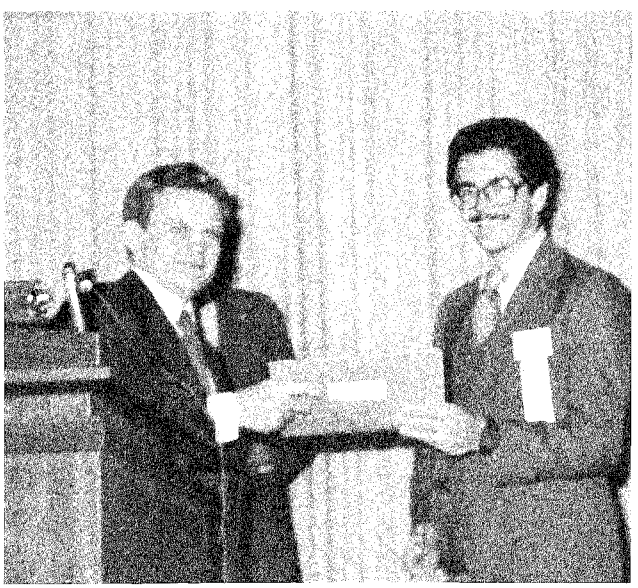


Harold R Stanley accepting the Hollenback Prize. Left, *Paul Loflin;* right, *Joseph Dennison.*



Alan Boyde delivering the Buonocore Memorial Lecture on Enamel Microstructure and Operative Dentistry

Scenes from the annual meeting of the Academy of Operative Dentistry



Aususto C Garcial-Aguirre receiving the Student Achievement Award from Joseph Dennison

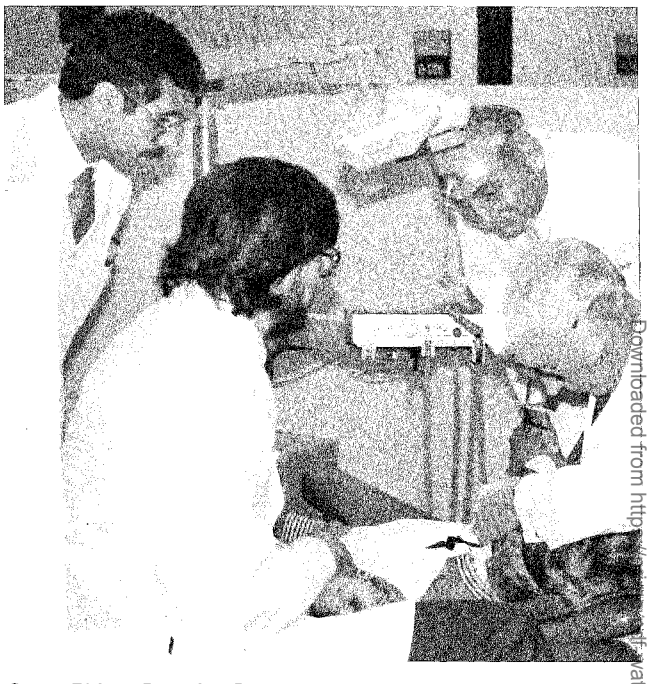
Harold Stanley delivering a lecture on "The Biology of Direct and Indirect Pulp Capping Procedures"

NEWS OF STUDY CLUBS

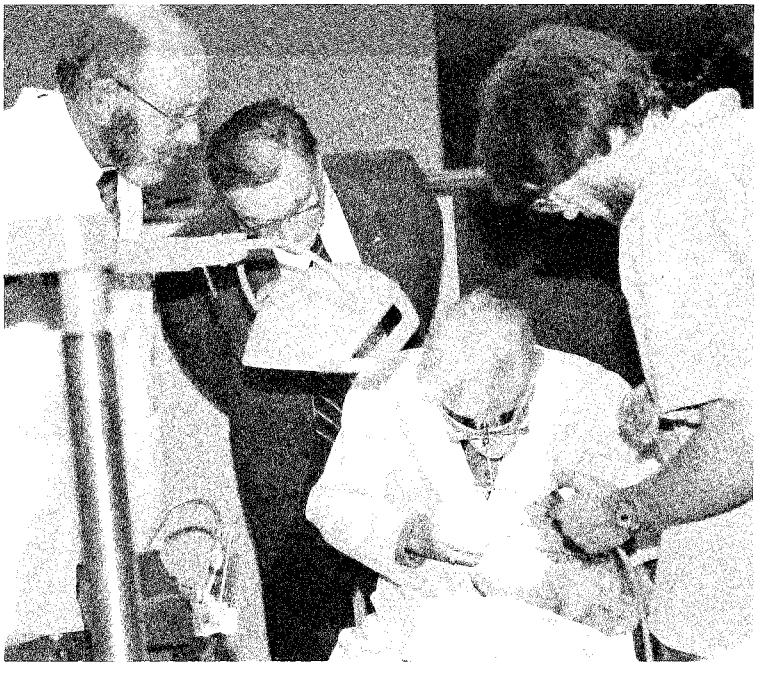
Joint Meeting Held

Two study clubs, the Winnipeg Ferrier Dental Study Club and the G V Black Gold Foil Study Club, met jointly December 10, 1982, at the University of Minnesota School of Dentistry.

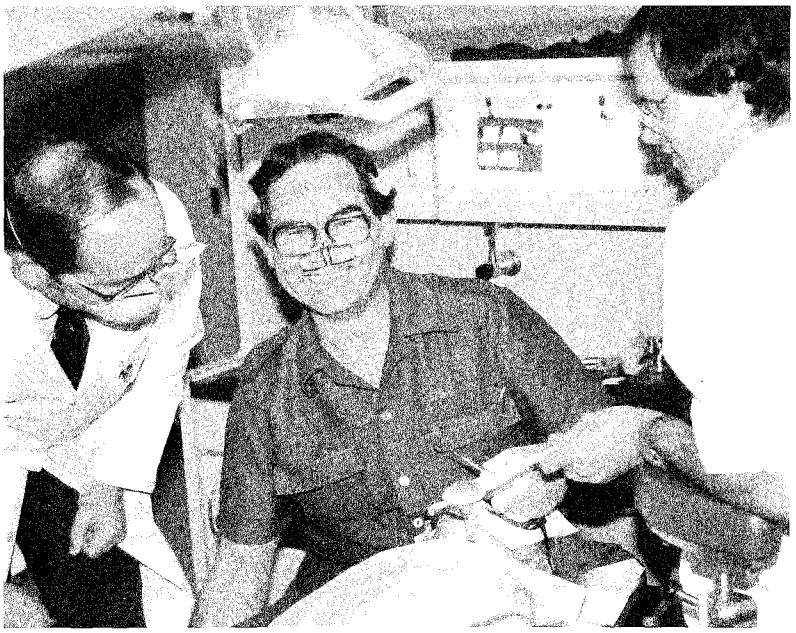
Honored guests were James Vernetti and Paul Dawson, who acted as mentors. Members who operated were: Perry Dungey, Fred Eichmiller, Lou Green, James Guptill, Bruce Haasken, Mark Jensen, Len Kahane, Andre LaChance, Thomas Larson, Allan Osborn, Anthony Romano, and Elizabeth Tippett.



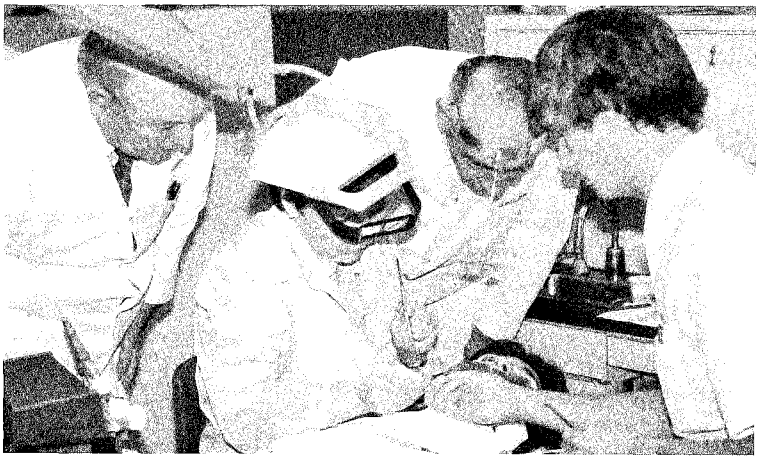
Omar Zidan, Douglas Dungey, James Vernetti assisting Perry Dungey



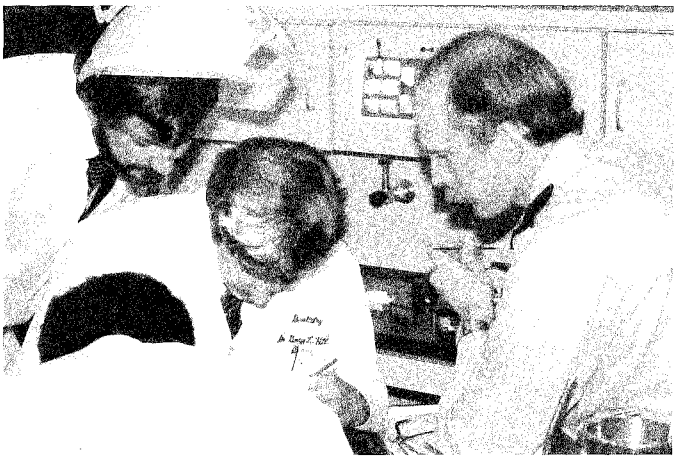
James Guptill, Miles Hirschey, Paul Dawson with student assistant



Thomas Larson,
Andre La Chance,
and student assistant



Anthony Romano, Elizabeth Tippett,
James Vernetti, and student assistant



Mark Jensen, Gary Hill,
student assistant

Press Digest

Effect of sealant placement on occlusal caries progression. Handelman, S L (1982) *Clinical Preventive Dentistry,* 4(5), 11-16.

When carious fissures on the occlusal surfaces of teeth were sealed with either Nuva-Seal or Delton there was a 2000-fold decrease in the number of bacteria recovered from the carious lesions at the end of two years. By eliminating the source of nutrition for the bacteria in infected dentin, the sealant converted the active lesion to an arrested one. The author cautions that patients need to be examined periodically to ensure the integrity of the sealant, otherwise if the sealant is not intact caries is likely to progress.

Investigations of plaque accumulation on the teeth with ceramic restorations. Trifunović, M D and Kostić, D L-J (1982) *Stomatološki Glasnik Srbije,* 29, 177-181.

When the accumulation of plaque on 60 teeth with ceramic crowns was assessed through the use of a disclosing solution (Alpha Plac) and the plaque index of Greene and Vermillion and compared with the data from 60 contralateral teeth, substantially less plaque was found on ceramic crowns. The highest index of plaque was found on approximal surfaces. The authors conclude that glazed porcelain is the most easily cleaned material in dentistry.

Wit and Wisdom

Dear Press ton,

Eye red yore pay per inn the buy bull (Jay Pee Dee). Ewe seam two no watt it's awl a bout. Yew and Miller have taut us well inn yore coarses, and the Liszt of your contributions takes a grate deal of thyme to reed. Yew taut us a lot for just one pair o'docs. Your F forts R knot inn vein, eye ass sure U. Men E pay shunts will be grate full four fine teeth B cause wee had a gloss hairy and learned to talk write and not get siouxed.

Sin Sear Lee,
Richard E Lombardi, BS
Director,
Paradental Research Institute
and Chairman,
Department of Homophonics*

*Homophone: A word having the same pronunciation as another but differing from it in origin, meaning, and spelling. MUST BE RED ALLOWED.

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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,* 4th ed, 1977; 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.

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References

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