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EDITORIAL

Idle Dentists

Not infrequently these days we hear about dentists not being as busy as they used to be (American Dental Association, 1981). Concern is voiced that the number of dentists may now be too large for the size of the population; or, as economists would say, supply exceeds demand. This is understandable because for the past 20 years or longer both the demand for dental service and the supply of dentists have been increased artificially. The demand for dental service has been expanded by augmenting wages and salaries with dental benefits; the supply of dentists by subsidizing dental students and dental schools. Both these policies have contributed to inflation.

Inflation in the long run leads inevitably to unemployment — the longer the period of inflation the more extensive the unemployment (Hayek, 1975). So inflation must be cured, if freedom is to survive, no matter how distasteful the medicine.

Dentistry is unlikely to escape the effects of unemployment. The demand for dental service can shrink quickly by people merely postponing dental treatment. The supply of dentists, on the other hand, can be reduced only slowly because dentists are unlikely to move to other occupations. Thus some dentists may not be able to keep their appointment books filled.

A dentist lacking enough work to keep busy will probably be reluctant to delegate part of the treatment to auxiliary personnel. Consequently the number of employees in dental offices is likely to diminish as dentists try to maximize their employment and minimize their fixed costs, or overhead. Patients, many of whom prefer to be treated personally by the dentist, are bound to be pleased with the arrangement. Perhaps now is an opportune time for rededication to dental service of high quality. Perhaps, too, a little more time may be available for perfecting the details of the operations and so increasing the durability of restorations, and for educating patients to the value of a good dentition, the benefits of dental treatment, and the need for adequate diet and personal oral hygiene.

A surplus of dentists is likely to discourage entry into the profession. Accordingly, the number of applicants to dental schools will probably decline and thus the incomes of dental schools will also probably decline. This may require a reordering of priorities within the curriculum. With a smaller faculty, programs such as teaching operative dentistry to auxiliary personnel — a costly example of overspecialization (Hamilton, 1977) — should now be abandoned, leaving faculty to concentrate on the instruction of dental students. Peripheral subjects, which have burgeoned in the recent past, can now give way to greater emphasis on fundamentals. Operative dentistry has long been due for rejuvenation and for restoration of adequate time in the curriculum to enable students to become more proficient in this important discipline.

Let us make the best of our circumstances so that, with Shakespeare we can say, "Sweet are the uses of adversity, which like the toad, ugly and venomous, wears yet a precious jewel in his head."

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SHAKESPEARE, W. *As You Like It.* Act 2, Scene 1.

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ORIGINAL ARTICLES

Effect of Surfactant in Reducing Bubbles of Air on Gypsum Casts

Surfactant applied to impressions of polysulfide, silicone, and polysiloxane significantly reduces the number of bubbles on the surface of the gypsum cast but does not reduce its resistance to abrasion.

JOHN C MITCHEM • THOMAS C WAUGH

Summary

A surfactant applied to impressions made with polysulfide, silicone, and polysiloxane materials results in casts with fewer voids compared with casts from untreated impressions. On the other hand, there is no advantage in using a surfactant with polyether impressions. The application of a surfactant does not adversely affect the resistance of the gypsum cast to abrasion.

Introduction

Elastomeric impression materials are, in general, hydrophobic, and consequently air tends to be trapped in gypsum products that are poured against these materials. A proposed solution for the problem of bubbles on the surface of a cast is to use a surfactant to increase the wettability of the impression. Wettability is measured by the angle of contact between the impression material and the mix of gypsum and water, the smaller the angle the greater the wettability.

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Lacy, Treleaven and Jendresen (1977) have concluded that the wettability of impression materials is not affected by the use of surfactants. On the other hand, it has been shown that the contact angle of gypsum poured against polysiloxanes is reduced significantly by adding certain surfactants to the materials at the time of mixing (Norling & Reisbick, 1977). Also a positive correlation between the number of air bubbles on gypsum casts and the size of the contact angle of the untreated impressions has been demonstrated (Lorren, Salter & Fairhurst, 1976). This finding has been confirmed by Brukl, Norling and Kalmus (1979), who have shown that adding surfactants to polysiloxanes during mixing reduces significantly both the contact angle of the material and the number of air bubbles trapped on the casts made from these impressions.

The purpose of this study was to determine whether a commercially available surfactant (Delar Surfactant, Almore International, Inc, Portland, OR 97225, USA) applied to elastomeric impressions would alter the amount of air trapped on gypsum casts. In addition, to determine if the surfactant softened the gypsum model, the resistance of the model to abrasion was ascertained.

Materials and Methods

Impressions were taken of a quadrant of a model containing four preparations: a full crown, a 3/4 crown, an MOD onlay, and a DO inlay (Fig 1).

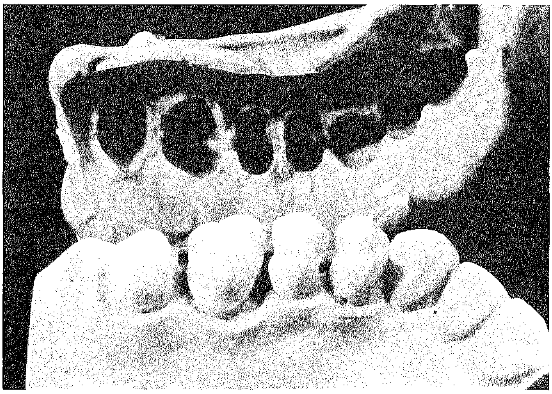

FIG 1. *Quadrant of prepared teeth used for the impression.*

In the initial phase of this study the impressions were taken with a polysulfide material (Unilastic, Kerr Mfg Co/Sybron, Romulus, MI 48174, USA). Eleven sets of casts were evaluated. Each set consisted of casts from two impressions, one of which had been treated with the surfactant according to the manufacturer's instructions. The gypsum (densite) was mixed by hand at the recommended ratio of 16 ml water to 70 g powder. All impressions were poured in approximately the same time and with the use of the same vibrator. After separation, the casts were examined with a seven-power binocular microscope and the number of bubbles present on the surface and margins of the preparations recorded.

In addition, the other elastomeric materials—silicone (Cutter Flex, Cutter Dental, Berkeley, CA 94710, USA), polysiloxane (Reflect, Kerr Mfg Co/Sybron, Romulus, MI 48174, USA), and polyether (Polygel, L D Caulk, Milford, DE 19963, USA)—were also evaluated. In this phase, five sets of casts were made. Each set consisted of two casts, one from an impression treated with the surfactant and the other from an untreated impression.

The effect of the surfactant on the hardness of gypsum was measured by abrading densite casts made from polysulfide impressions of the edge of a steel block. The block was polished on two adjacent sides and presented a sharp line angle of 90°. The casts from these impressions were triangular in cross section with a 90° angle at the apex.

The densite was mixed at the recommended ratio of water to powder. Eight sets of casts were made. Each set was made from a single mix of densite and consisted of a cast from an impression that had been treated with the surfactant and one from an untreated impression. To check the ability of the abrading instrument to differentiate between hardnesses, additional casts were made from an untreated impression using the same densite but mixed with more water (23 ml to 70 g powder). All testing for abrasion was performed on samples after 24 hours.

The abrading instrument is illustrated in Figure 2. The apparatus consists of a modified cleoid/discoid instrument weighted with 240 g. The discoid end was ground and sharpened to present a flat edge to the stone. The stone sample was drawn by hand, at a relatively constant rate, under the edge of the instrument. The resulting flattened surface was measured with a Gaertner measuring microscope (accuracy to 1 μm) at 5 locations 1 cm apart.

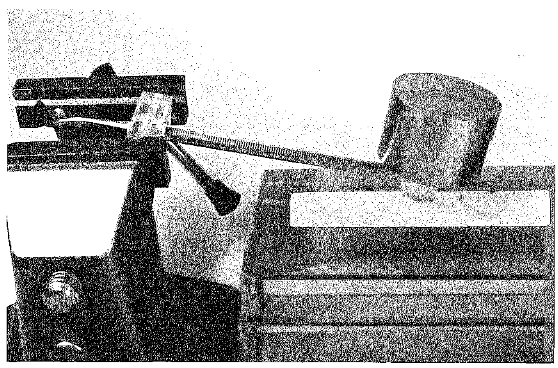

FIG 2. *Instrument used to abrade densite casts. At right a 240 g weight is attached to a modified cleoid/discoid instrument under which the stone sample is drawn by hand.*

Results

The effect of the surfactant on the number of bubbles on the casts made from the several impression materials is shown in Table 1. All of the impression materials, except the polyethers, produced casts with fewer voids when the surfactant was used. The differences are statistically significant ($P = 0.05$) according to Student's t test.

The results of the effect of the surfactant on the resistance of densite to abrasion are presented in Table 2. The data represent the mean of five measurements taken on each of eight samples. When the higher ratio of water to powder was used, a significantly wider track ($P = 0.05$) was abraded by the carver. There was no difference between the casts in resistance to abrasion when the same ratio of water to powder was used to pour impressions whether treated with the surfactant or not.

Discussion

The effectiveness of the surfactant in reducing the number of bubbles on the surfaces of casts poured from impressions made of polysulfides, silicones, and polysiloxanes but not of polyethers is consistent with the findings of Lorren and others (1976) who have shown that the contact angle of dental stone to polyether was the least—demonstrating the best wettability of three elastomers tested.

The results of this investigation do not agree with those of Lacy and others (1977) who have concluded that surfactants have no effect on wettability of impression materials. The explanation for the difference in results may lie in the different way in which the surfactant was applied. In their study the surfactant was rinsed off the impression with water and the impression dried before the cast was poured.

Table 1. Number of Air Bubbles in Casts from Impression Materials with and without Surfactant

Impression Material	Sets n	Number of Bubbles: Without Surfactant Mean ± SD	Number of Bubbles: With Surfactant Mean ± SD
Polysulfide	11	12.27 ± 2.38	0.81 ± 0.53
Polysiloxane	5	11.2 ± 2.88	1.4 ± 0.60
Silicone	5	8.6 ± 2.6	0.4 ± 0.24
Polyether	5	2.8 ± 0.58	1.0 ± 0.54

Table 2. Resistance of Gypsum to Abrasion as Affected by Surfactant and Water/Powder Ratio

Water/Powder Ratio	Sets n	Width of Abraded Track mm: Without Surfactant Mean ± SD	Width of Abraded Track mm: With Surfactant Mean ± SD
16 ml/70 g	8	0.276 ± 0.004	0.293 ± 0.009
23 ml/70 g	8	0.340 ± 0.012	not applicable

The test for resistance to abrasion appears to be sensitive to differences in abrasion in that it was able to distinguish between densites made from two different water to powder ratios.

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(Accepted 7 July 1980)

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Caries Removal with and without a Disclosing Solution of Basic Fuchsin

A solution of basic fuchsin, or preferably acid red, applied to dentin to disclose caries shows that in prepared cavities the removal of caries may frequently be incomplete.

STEVEN J FRANCO • WILLIAM P KELSEY

Summary

The application of a 0.5% solution of basic fuchsin to 11 cavities in which all the caries was thought by clinical faculty members to have been removed disclosed that caries was still present in 10 of them.

Introduction

A primary goal in the preparation of cavities is the complete removal of infected tissue from the involved tooth. The process of achieving this without unduly injuring the tooth is complicated by poorly defined objective criteria for distinguishing clinically between infected dentin and dentin that appears altered clinically but is not yet infected.

Determining when caries is completely removed from a tooth during the preparation of a cavity has traditionally been left to the discretion of the operator. Operators learn to decide when the excavation of caries is complete primarily through training and clinical experience. The carious lesion, however, presents so many faces clinically that there are very few objective criteria that can be used to ensure complete removal of the diseased tissue without unwarranted removal of sound dentin. Consequently, these decisions fall into the realm of subjective judgments and often vary from operator to operator.

Histologically, the carious lesion in dentin has been described as being composed of five zones or layers (Bernick, Warren & Baker, 1954; Shafer, Hine & Levy, 1974). The first two zones, the zone of fatty degeneration and the zone of dentinal sclerosis, lie nearest the pulp and are considered to be sterile. The third zone is a narrow one of demineralized but intact dentin, which does not contain bacteria. Overlying this zone is the demineralized dentin, which harbors the front of the bacterial invasion. The outermost layer of the lesion contains the totally decomposed dentin. The two outermost layers can be considered infected and the three inner layers to have undergone histologic changes that precede microbial invasion (Bernick & others, 1954; Shafer & others, 1974). Clinically, the objective of excavating the caries is to remove the portion of the lesion that contains the bacteria, that is, the infected dentin, while preserving the noninfected tissue.

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The use of dyes that are purported to stain only infected dental tissue may be one way to reduce the subjectivity of this judgment (Wirthlin, 1970; Barber & Massler, 1964; Miller, 1969). Researchers have recently reported on the use of a 0.5% solution of basic fuchsin in propylene glycol for this purpose (Fusayama & Terashima, 1972; Sato & Fusayama, 1976; Fusayama, 1979). According to these studies, this solution will stain only the outer carious dentin, which is "irreversibly denatured, infected, not remineralizable, and must be removed" and will leave the inner aspect of the carious lesion unstained (Fusayama, 1979).

This study compares the clinical judgment of faculty members in determining when the removal of caries is complete, with and without the use of the 0.5% solution of fuchsin dye.

Methods

Eleven faculty members of the departments of operative dentistry and oral diagnosis participated in the study. Clinical cases were selected on the following criteria: (1) all teeth had extensive, chronic carious lesions; (2) all teeth were asymptomatic and judged to have little chance of pulpal involvement; and (3) all teeth could be properly isolated with the rubber dam.

In each instance, a dental student prepared the cavity to the point where he felt all the infected dentin had been removed. Then a faculty member was asked to evaluate the prepared cavity. If the faculty member was not satisfied that all of the infected dentin had been removed, the faculty member was allowed to continue removing caries until he was satisfied that all caries had been removed. Subsequently, a solution of 0.5% basic fuchsin in propylene glycol (Caries Detector-F, Kurarey Co, Osaka, Japan), was applied for 10 seconds according to the techniques outlined in the literature (Fusayama, 1979). The prepared cavity was then washed, dried, and re-evaluated. This procedure was repeated on a different clinical case for each of the eleven evaluators.

Editor's note: Kurarey Company has replaced fuchsin dye, which is suspected of being carcinogenic, with 1.0% acid red in propylene glycol. This change in formula has not reduced the effectiveness of Caries Detector (Fusayama, 1980).

Results

In 10 of 11 cases the fuchsin dye stained tooth structure that, according to the researchers, should have been removed. These stained areas occurred randomly throughout the cavities, but were most commonly found near the dentinoenamel junction and in the deeper aspects of the sites where caries had been excavated.

Discussion

If the research reports concerning the effect of the disclosing solution are accurate, it might be inferred from the results of this study that since few practitioners use an aid in detecting caries during the preparation of cavities many practitioners could be routinely leaving infected dental tissue in the tooth. Consequently, it might also be inferred that much of the "recurrent" caries resulting in failure of restorations is, in reality, caries that was inadvertently or carelessly left.

The prevailing reaction of the practitioners involved in the study to the use of the dye was one of skepticism. Most commented that in their opinion, routine use of the dye would result in excessive removal of tooth structure and an increased likelihood of mechanical exposure of the pulp. In the cases selected for this study, however, there was little or no risk of pulpal involvement; so fear of a pulpal exposure should not have been a significant factor in limiting the excavation of caries. In routine clinical use, however, the dye should be used before completion of excavation to help prevent removal of intact dentin.

Conclusions

Basic fuchsin as a disclosing solution, or preferably acid red, aids in detecting caries that may be missed by the dentist. A long-term study to evaluate the clinical significance of routine use of basic fuchsin dye is needed.

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(Accepted 28 July 1980)

Placement and Replacement of Restorations

A study from private general practice shows that about 60% of amalgam restorations needing replacement are less than 10 years old and about 52% of tooth-colored restorations less than seven years old. Most of the amalgam restorations failed from secondary caries.

IVAR A MJÖR

Summary

A survey of 5 487 restorations placed by 85 private practitioners shows that about 74% of the restorations were made of amalgam and 26% of tooth-colored materials. Seventy-one percent of the amalgam restorations and 79% of tooth-colored restorations replaced previous restorations. Secondary caries was the main reason for replacement of amalgam restorations (58%). Poor anatomical form, discoloration, and secondary caries were the main reasons for replacing tooth-colored restorations. About 40% of the amalgam restorations replaced were more than 10 years old and about 48% of the tooth-colored restorations were more than seven years old.

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Introduction

Restorative dentistry, which includes mainly the treatment of primary caries and replacement of defective restorations, constitutes a major part of all dental treatment. A change in the caries rate or in the frequency of replacing restorations will, therefore, affect significantly the total need for dental treatment.

Clinical caries, though difficult to diagnose objectively (Markén, 1962), requires restorative therapy. The need for replacement of restorations, on the other hand, is often more difficult to ascertain. The quality of restorations may be assessed in several ways (Elderton, 1977), either directly in the mouth (Hedegård, 1955; McLean & Short, 1969; Cvar & Ryge, 1971; Ryge & Snyder, 1973; Chandler & others, 1973) or indirectly (Matsuda & Fusayama, 1970; Mahler, Terkla & Van Eysden, 1973; Leinfelder, 1975; Osborne & others, 1978). Direct assessment usually consists of examination with a mirror and probe, sometimes supplemented with the use of guides for evaluating color, guides for evaluating the extent of marginal ditching (Chandler & others, 1973), and even clinical microscopy (Hedegård, 1955). Indirect assessment most commonly consists of studies of black and white photographs, of impressions, or of casts of the teeth with restorations.

Special types of evaluation of restorations are based on studies of the records of treatment (Moore & Stewart, 1967; Robinson, 1971; Lavelle, 1976; Allan, 1977; Dunston & others, 1978) and on questionnaires (Richardson & Boyd, 1973; Mjör, 1979, 1980). Both of these methods rest on subjective and variable judgments, as clinical techniques usually do, but they have the decided advantage of representing conditions of everyday clinical practice.

The aim of the present study was to assess the reasons for placement and replacement of restorations in patients seeking dental treatment in private general practice.

Materials and Methods

A total of 85 dentists in private practice participating in continuing dental education courses on dental materials in 1978 (49 participants) and 1979 (36 participants) were asked to record the reasons for placing restorations of amalgam and tooth-colored materials over a period of two weeks (Mjör, 1979, 1980).

The dentists were asked to record *all* amalgam or tooth-colored restorations placed, irrespective of type, and, if the restoration replaced a previous restoration, indicate the main reason for replacement. Separate forms were prepared for amalgam and tooth-colored materials. The criteria, outlined in Tables 1 and 2, were slightly different for each year but the data have been pooled to combine the results of both series.

Table 1. Criteria Specified as Reasons for Placement of Amalgam Restorations

A. Primary caries

B. Replacement of restoration
   1. Secondary caries
   2. Poor marginal adaptation (ditching/leakage)
   3. Isthmus fracture
   4. Fracture of tooth
   5. Other reasons

Table 2. Criteria Specified as Reasons for Placement of Tooth-colored Restorations

A. Primary caries

B. Replacement of restoration
   1. Discoloration — whole filling
   2. Discoloration — margins
   3. Secondary caries
   4. Poor anatomical form (lack of contact/incomplete filling)
   5. Other reasons

Additional questions were included in the questionnaires for one year:

1. The number of silicate restorations placed (Mjör, 1979).

2. The ages of the replaced restorations determined by examining the records of treatment and scored as follows (Mjör, 1980):

   a. Amalgam restorations: unknown, 0-1 year, 1-4 years, 4-10 years, or more than 10 years;

   b. Tooth-colored materials: unknown, 0-1 year, 1-3 years, 3-7 years, or more than 7 years.

3. Whether the patient was an adult (over 15 years old) or a child (Mjör, 1980).

Results

A total of 5487 restorations were analyzed. Almost two-thirds comprised amalgam restorations; the rest were tooth-colored materials. Most of the restorations were replacements (Table 3).

Table 3. Distribution of Restorations

Material		Primary caries		Replacements	
	n	*n*	(%)	*n*	(%)
Amalgam	3527	1023	(29.0)	2504	(71.0)
Tooth-colored	1960	416	(21.2)	1544	(78.8)
Sum	5487	1439	(26.2)	4048	(73.8)

Secondary caries was the reason given most often for replacing amalgams (Fig 1). The other three specific criteria for replacement constituted 9-13% each, while less than 7% of the restorations were scored for "other reasons."

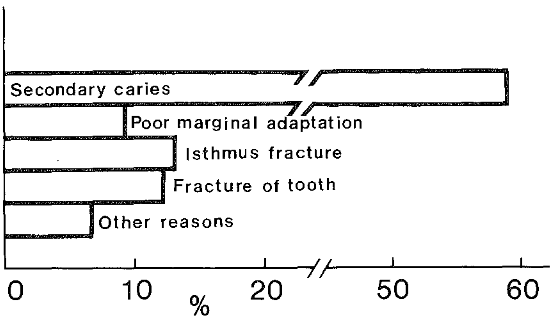

FIG 1. *Distribution of amalgam restorations according to the reason for replacement.*

The ages of the amalgam restorations that needed replacing were recorded in 732 cases. The distribution by age is shown in Figure 2. The distribution did not vary significantly among the reasons for replacement. However, marginal ditching was more common at 4-10 years than the pooled results in Figure 2 indicate. About 40% of the restorations had been in service for more than 10 years and almost half were in the group of 4-10 years of age.

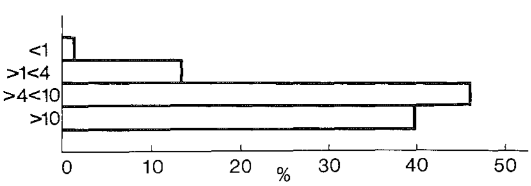

FIG 2. *Distribution of amalgam restorations according to the age of the restoration (pooled data).*

Poor anatomical form was a major reason for replacing restorations of tooth-colored materials (Fig 3). However, discoloration of

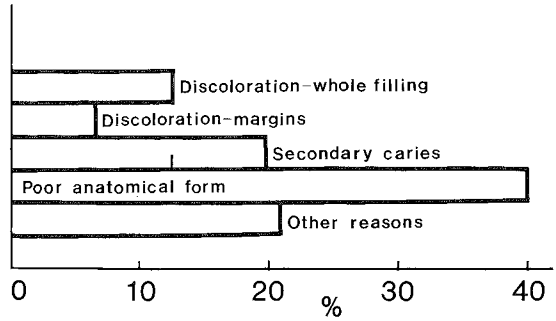

FIG 3. *Distribution of tooth-colored restorations according to the reason for replacement.*

the body and margins of restorations together constituted almost 20%, as did secondary caries and other reasons.

The age of the tooth-colored restorations needing replacement could be traced in 412 cases. The distribution by age did not vary significantly among the reasons for replacement (Fig 4). More than half the restorations were replaced within seven years, and most of these had been in service for 3-7 years.

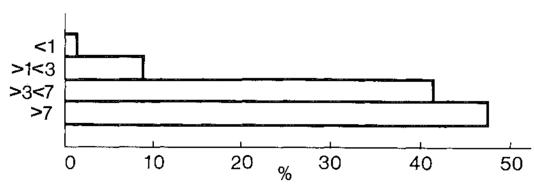

FIG 4. *Distribution of tooth-colored restorations according to the age of the restoration (pooled data).*

The question about silicate cement gave an expected answer: only about 8% of the tooth-colored restorations were made of this material. Silicate cement and composite resins were assessed by the same criteria. The few silicate restorations were placed by a few dentists who apparently had not yet changed to composite materials in their practices.

Most of the patients were adults; only a few dentists treated children.

Discussion

The scoring of reasons for placement and replacement of restorations as outlined in the present study is hampered by many problems of methodology. The terms employed (Tables 1 & 2) were not defined or explained, nor were the recorders calibrated. The brands of materials employed were unknown, as was the operative technique. However, the results from the two groups of dentists were similar, a variation of only 2-3% being noted for some of the given criteria (Mjör, 1980). Furthermore, replacing amalgam restorations 58% of the time because of secondary caries agrees with reports by many others (Table 4). Therefore, despite the objections that may be raised against the technique used, the results reflect an appropriate clinical appraisal of important aspects of operative dentistry.

Table 4. Reported Incidence of Failure of Amalgam Restorations due to Caries

Authors	Country	Restorations %
Healey & Phillips (1949)	U S A	54
Richardson & Boyd (1973)	Canada	54*
Lavelle (1976)	Canada	54
Dahl & Eriksen (1978)	Norway	53
Birkeland (1979)	Norway	57
Mjör (present)	Sweden	58

*"Recurrent and new caries" — 68% if caries under amalgam restorations was included.

In this study the proportion of amalgam restorations to tooth-colored restorations was almost two to one compared with three to one in a study of patients in a dental school (Moore & Stewart, 1967).

The high proportion of restorations needing replacement—three out of every four—is not surprising considering evidence in other reports. Elderton (1976a) has pointed out from review of the literature and from his own studies that every third restoration is unsatisfactory in some way. Moore and Stewart (1967) have found almost half of all amalgam restorations to be defective. We need to evaluate restorative dentistry in general, including details of the etiology of failing restorations in clinical practice. Secondary caries, the main reason for replacing amalgam restorations, must be reduced or prevented. Secondary caries can be detected only by examining the patient directly.

The main elements involved in the failure of restorations are the materials, the dentist, and the patient. It appears unlikely that the amalgam itself is a direct cause. However, the dentist may abuse the material, overcarve or undercarve the restorations, or leave gingival overhangs, porosities, and roughness (Healey & Phillips, 1949; Björn, Björn & Grkovic, 1969; Elderton, 1976b). Amalgams that contract greatly and amalgams with high creep may contribute to marginal degradation and ditching (Mahler, Terkla & van Eysden, 1973; Osborne & others, 1978; Mjör & Espevik, 1980) and ultimately to secondary caries (Jørgensen & Wakumoto, 1968). The oral hygiene of the patient also may be important in the development of secondary caries. In dental students under special study conditions no secondary caries could be detected after four years (Leidal & Dahl, 1980), a circumstance that underlines the importance of selection of patients in planning clinical investigations.

Other than secondary caries, the causes for replacement of amalgam restorations were limited to 10-12%. Other causes include marginal ditching, which has received much attention over the last 10 years and which has been reduced by the development of alloys that form amalgams free of γ_2-phase. Most of the restorations replaced had been inserted before the common use of these new alloys. However, the importance of creep of the alloys should not be overlooked (Gale & Osborne, 1980). In a clinical study of two conventional alloys with creep values of 1.3 and 5.5 (Mjör & Espevik, 1980) one third of the restorations made with the alloy of high creep needed to be replaced after three years, whereas one thirtieth of those of the alloy of low creep were replaced during that time. Furthermore, differences in practices are found. For example, fractures of the isthmus and lack of contact points are more common in children than in adults (Dunston & others, 1978). The anatomy of the deciduous teeth may account for this.

The age of the amalgam restorations needing replacement is important in evaluating the success of the treatment. About 40% were more than 10 years old and about 46% were 4-10 years old. These observations agree with those of Robinson (1971) and Allan (1977) who have indicated that about half the amalgam restorations last more than 10 years, yet in another study half were replaced within five years (Allan, 1977). Lavelle (1976) also has shown that about 50% of the amalgam restorations last less than 10 years.

Most of the tooth-colored restorations inserted today are made from composite or some other material with a base of resin (Mjör, 1979), but some of the restorations that were replaced were made of silicate cement. Poor anatomical form as a result of dissolution of the material constituted the reason for replacing about 45% of restorations of silicate cement (Mjör, 1979) and 28% of composite materials (Mjör, 1979).

Generally, the reasons for replacing tooth-colored materials were more complex than for those of amalgam. The score of other reasons was higher than that for amalgam restorations. Poor anatomical form and discoloration are deficiencies related more to the material than to the skill of the operator (Ruyter & Svendsen, 1978).

The rate of secondary caries will undoubtedly be influenced by the oral hygiene of the patient. Composite materials predispose accumulations of plaque (Skjørland, 1973). Many restorations of composite had secondary caries compared to those of silicate cement. However, Leinfelder and others (1975) reported no secondary caries in composite restorations in dental students after two years. Chandler and others (1973) and Qvist, Johannessen and Lambjerg-Hansen (1978) have reported a low rate of caries after three to four years.

The present study shows that 10% of the tooth-colored restorations were replaced within three years. This observation agrees with that of Qvist and others (1978). Generally, less than 50% of the tooth-colored restorations that were replaced had been in service for more than seven years. Tooth-colored restorations are, therefore, replaced more often than amalgam restorations. Several factors, apart from the properties of the material, play a role in the degradation of composite material, including the technique of the operator, etching with acid, how the material is handled, degradation due to light, and the oral hygiene of the patient.

Reasons for replacements are often difficult to ascertain, but efforts to reduce their number must be made. Manufacturers can improve the quality of restorative materials, especially tooth-colored materials. Oral hygiene is also important for the life span of restorations. In fact, patients should be told that replacements will likely be needed more frequently if their oral hygiene is not optimal. Finally, dentists must use the best possible operative technique and handle the materials correctly. Much can probably be achieved by simple efforts. I would hypothesize that just reading the manufacturer's instructions for the materials in everyday use would lead to improvement in the restorations inserted. Time should be set aside in any practice for the entire staff to read and discuss these instructions at least once a year. If we combine our efforts, including specific research on the nature and etiology of the reasons for replacing restorations, operative dentistry will undoubtedly improve.

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Width of Isthmus and Marginal Failure of Restorations of Amalgam

After three years of clinical service, restorations of amalgam placed into conservatively prepared class 2 cavities showed significantly less failure of the occlusal margins than did those in wider cavities.

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Summary

When the extent of marginal fracture of class 2 restorations of amalgam after three years was compared with the width of the occlusal isthmus, it was found that narrow restorations, one-fourth the intercuspal distance or less, have less marginal fracture than wider ones and thus are likely to give longer service.

Introduction

During the past several years, the conservatively prepared cavity for restorations of amalgam has become increasingly accepted. Cavities having a narrow isthmus, equal to one-fourth the intercuspal distance, weaken the tooth less than do those with a wider isthmus (Vale, 1959; Blaser, 1979). In addition, narrower restorations of amalgam may give longer service than do wider ones (Osborne, Hoffman & Ferguson, 1972) but this contention has not been well documented. The purpose of this study is to determine whether failure at the margins is related to the width of the restoration. The relation between failure at the margins and longevity of the restoration has already been shown (Mahler, Terkla & Van Eysden, 1973; Osborne, Binon & Gale, 1980).

Methods

Two clinicians placed 138 class 2 restorations of amalgam in patients who would be available for recall at the end of three years. The size of the prepared cavity was dictated by the principles of ACORDE, the extent of caries, existing restorations, and the relation of the tooth to approximating teeth. All teeth were isolated with a rubber dam and the cavities prepared with burs in high- and low-speed handpieces as well as with conventional hand instruments. The width of the isthmus of the cavities varied from less than one-fourth the intercuspal distance to nearly the entire occlusal surface. A base of calcium hydroxide was used where indicated and two layers of a varnish of copal resin were applied to all the cavities. A matrix band, carefully contoured and wedged to achieve proper approximal contour, was applied in a Tofflemire retainer (Teledyne Dental Products, Elk Grove Village, IL 60007, USA). Two copper-rich alloys, an admixture, Dispersalloy (Johnson & Johnson Dental Products Co, East Windsor, NJ 08520, USA) and a single component, Tytin (S S White, Philadelphia, PA 19102, USA), were placed with prescribed techniques of trituration and condensation. At least 48 hours elapsed before the restorations were finished and polished. Care was taken to prevent generating excessive heat during finishing and polishing.

At the end of three years the patients were re-examined. Black and white photographs of high quality on fine grain film at a standard magnification of one and a half times normal size were taken of all the restorations. The prints (4 x 5 in), cropped to display only the restored tooth and mounted on index cards, were sorted into groups according to the width of the restoration (Table 1).

Table 1. Classification of Restorations by Width of Isthmus

Group	Width of Isthmus
1	1/4 or less intercuspal distance
2	between 1/4 and 1/3 intercuspal distance
3	between 1/3 and 1/2 intercuspal distance
4	greater than 1/2 intercuspal distance

The photographs were evaluated in two ways by three evaluators working independently.

1. The photographs were compared with a series of five photographs depicting increasing extent of marginal fracture, each restoration being assigned to the category it most closely resembled. The distribution was analyzed by ridit (relative to an identified distribution) as suggested by Mahler and others (1973).

2. The photographs were ordered from best to worst, as suggested by Osborne and others (1976), and numbered from 1, the best, to 138, the worst. A mean and standard deviation were calculated for each group. The difference between restorations was determined by a rank sum analysis. The data were analyzed statistically by the Kruskal-Wallis test and the Mann-Whitney U test.

Results

The categorization of the restorations and ridit analysis are presented in Table 2. When width of restoration is compared with marginal breakdown, it can be seen that the narrower the restoration the lower the ridit mean and thus the less the failure at the margins.

Table 2. Categorization of Amalgam Restorations for Marginal Deterioration after Three Years — Ridit Analysis (Three Evaluators Combined)

Group	Category 1	2	3	4	5	*n*	Ridit Mean	SD
1	35	42	13	0	0 (90)	30	0.3791	0.0619
2	33	75	34	9	0 (150)	50	0.5021	0.0718
3	17	56	35	6	0 (114)	38	0.5505	0.0666
4	6	32	15	6	1 (60)	20	0.5802	0.0642
Total	90	205	97	21	1			
Cumulative frequency	45	192.5	343.5	502.5	513.5			
Ridits	0.09	0.37	0.67	0.98	0.99			

Table 3 presents the data on rank ordering; the lower the mean rank, the less the failure at the margins. The Kruskal-Wallis test determined that the samples were from different populations ($P < 0.01$).

Table 3. Mean Rank of Width of Isthmus for Marginal Deterioration after Three Years

Group	Evaluator 1	2	3	Mean
1	47.6	53.8	50.9	50.75
2	69.6	68.3	67.5	68.47
3	70.0	75.1	78.0	77.37
4	78.5	85.3	86.3	83.37

$0.92 < r < 0.97$

∣ = No significant difference at 0.01 level of probability

The narrowest restorations (Group 1) displayed distinctly less marginal breakdown than the wider restorations (Groups 2, 3, 4). Group 2 showed less breakdown than the wider restorations in Group 3 but the difference was not statistically significant. The difference between Groups 2 and 4, however, was statistically significant for two of the three evaluators.

Discussion

Osborne, Hoffman and Ferguson (1972) and Osborne and Gale (1981) suggest several reasons why narrower restorations display less marginal deterioration than do wider restorations:

- Amalgam may be condensed more thoroughly into narrower cavities because smaller condensers are used.
- Narrower cavities may confine the amalgam better thus allowing greater force of condensation per unit area.
- Narrower cavities are filled more quickly; thus the operator is likely using a fresher mix of amalgam at the cavosurface.

While these may all be reasons for less failure at the margins of narrower restorations, a major reason may well be that occlusal stresses are less. The margins of the narrower restorations generally receive force only when the teeth are in the centric contact position, if at all, and are beyond occlusal contact during eccentric movement. This may also explain why the failure of the margins of the restorations in the widest group (Group 4) was not significantly greater statistically than those in Group 3. The margins of the widest restorations may not receive much occlusal contact because major centric and eccentric contacts occur well within the body of the restoration.

Conclusion

Class 2 restorations of amalgam with narrow isthmuses, one-fourth or less the intercuspal distance, showed less marginal failure after three years than did restorations with wider isthmuses.

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INVITED ARTICLE

Restoration with Glass-ionomer Cement: Requirements for Clinical Success

Glass-ionomer cements can bond chemically to enamel and dentine and thus have a potential as restorative materials, but a proper technique must be followed for success.

GRAHAM J MOUNT

Summary

Glass-ionomer cements, a new class of restorative material, have been available for six years, but published reports and the instructions of the manufacturers do not indicate the specific requirements for the use of this material and it is not fully understood. The suggestions given here, based on six years of clinical experience and laboratory experiments, have led to clinical success.

INTRODUCTION

Glass-ionomer cements represent a new class of restorative material for use in clinical dentistry (American Dental Association, 1979; McLean & Wilson, 1977; Wilson, 1977). The powder is similar to that used in silicate cement and the liquid is a modified polyacrylic acid similar to that used with polycarboxylate cement. Glass-ionomer cement, therefore, has some of the virtues of both. It is the first restorative material that will adhere by chemical means (physicochemical bonding) to both enamel and dentine (Hotz & others, 1977; Wesenberg & Hals, 1980) (Fig 1), thus reducing the need for mechanical

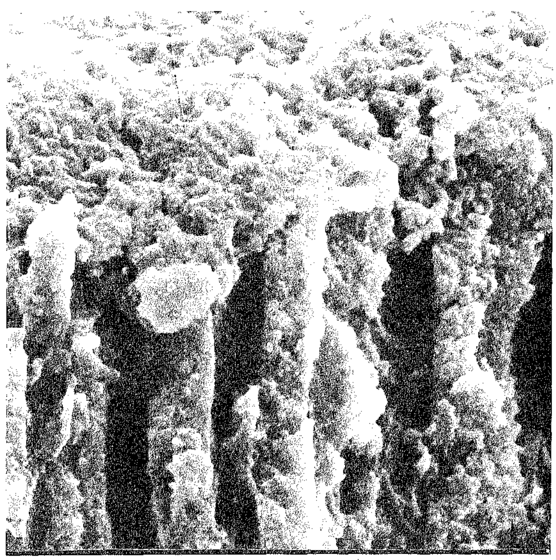

FIG 1. *Layer of Ketac glass-ionomer cement attached to dentine floor of a cavity conditioned with 50% citric acid (10 seconds). Note minimum penetration of cement down dentinal tubules. Original magnification X3000.*

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retention within tooth structure and at the same time providing a completely sealed margin (Maldonado, Swartz & Phillips, 1978).

This new type of cement was referred to first by Wilson and Kent (1972). It was marketed in Europe in 1975, Australia in 1976, and America in 1977. Several reports have been published on its use in clinical practice (Charbeneau & Bozell, 1979; Flynn, 1979; Hembree & Andrews, 1978; McCabe, Jones & Wilson, 1979; Phillips, 1980; Mount & Makinson, 1978; Lawrence, 1979), but it still does not seem to be widely understood and accepted. However, clinical and laboratory studies suggest that it has a place in restorative dentistry.

SPECIAL PROPERTIES

Glass-ionomer cement has special characteristics. The setting reaction continues for at least 24 hours and probably much longer. In the first five minutes a calcium polycarboxylate gel is formed, providing the initial adhesion to tooth structure. Over the next 24 hours an aluminum polycarboxylate gel is formed. The adhesion can then be considered mature. The cement is strongly hydrophilic for the first hour and also will dehydrate readily if left exposed to the air. Laboratory studies suggest that it may be one or two weeks before it can be safely exposed to air for longer than a few minutes. Covering the restoration immediately with a waterproof varnish is sufficient to prevent early gain or loss of water. If it is necessary to re-expose the new restoration shortly after placement a further application of varnish is warranted. Once the cement is mature it will suffer no further damage.

Apart from chemical bonding the other major advantage is that, like silicate cement, fluoride is used as a flux during the manufacture of the powder so fluoride ions are available to reduce susceptibility to caries. Fluoride ions are released in the immediate vicinity of the restoration soon after it has been placed (Forsten, 1977; Kidd, 1978; Maldonado, Swartz & Phillips, 1978) and the influence of the fluoride may extend even further around the tooth (Swartz & others, 1980).

BRANDS AVAILABLE

Three brands of glass-ionomer cement are available on the market—ASPA (A D International Limited, Amalgamated Dental Company, London, W1, UK), Fuji Ionomer Type II (G C Dental Industrial Corporation, Tokyo, Japan) and Ketac (ESPE Fabrik Pharmazeutischer Präparate, GmbH, Seefeld/Oberbay, Federal Republic of Germany). There are minor variations in the handling characteristics and ultimate physical properties, but the following recommendations for clinical success apply to all three brands.

INDICATIONS FOR USE

The material is the color of teeth and translucent but these properties vary among the three available brands. Resistance to abrasion appears to be high but tensile strength and shear strength are low. Therefore the cement is indicated for use in any area not subject to occlusal loading that might cause shear stresses:

- Class 5 erosions and abrasions
- Class 5 carious lesions
- Class 3 carious lesions
- Sealing pits and fissures

Other areas where the cement can be of value are in sealing access cavities in nonvital anterior teeth that have been bleached, repair of margins of crowns, and repair of deficiencies in preparations for crowns. It will also provide protection, at least short-term, for newly exposed dentine in traumatized anterior teeth.

PREPARING THE TOOTH FOR RESTORATION

Class 5 Erosions and Abrasions

The surface of the erosion lesion consists of smoothly abraded dentine. Into this porous surface calcium salts from saliva are deposited, almost closing the dentinal tubules (Fig 2). This presents an enhanced surface for chemical adhesion with a minimum of dentinal fluid flowing back into the area following drying. The surface needs only to be cleaned and kept clean for the application of

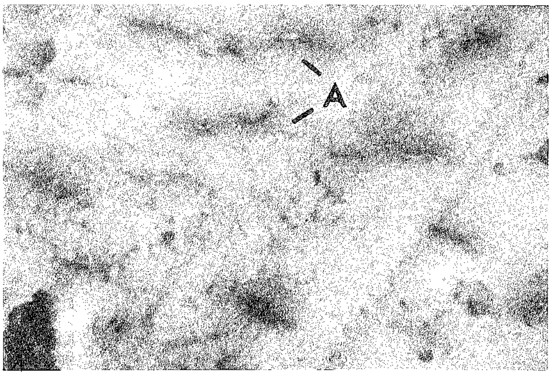

FIG 2. *Erosion lesion cleaned with rubber cup and pumice with water only. A: Orifice of dentinal tubules almost closed. Original magnification X1000.*

the cement. Cleaning can be achieved by scrubbing gently with pumice and water on a rubber cup (Phillips, 1980) specifically to remove pellicle and plaque. Any cleaning agent in a vehicle other than water will leave a residue that will interfere with the chemical bond.

The surface can also be cleaned with a mild acid such as 50% citric acid for a few seconds to achieve a chemically clean surface with only a small loss of calcium ions (Fig 3). The desirability of this is controversial (Levine, Beech & Garton, 1977; Prodger & Symonds, 1977) and clinical experience suggests it is not necessary.

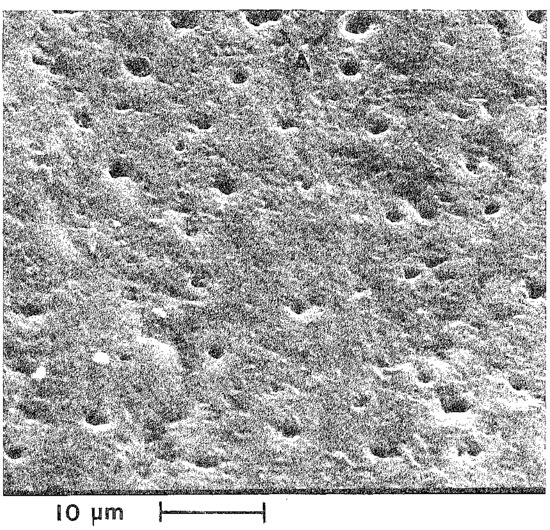

FIG 3. *Erosion lesion conditioned with 50% citric acid (10 seconds) then flushed with air/water spray. A: Dentinal tubules partly opened. Original magnification X900.*

It is most important to keep the surface free of further contamination. Rubber dam is desirable but not mandatory. Pellicle will reform within minutes of its removal (Jendresen & Glantz, 1980) and the presence of blood, saliva, or fluid from dentinal tubules will reduce the chemical bond.

If the eroded surface of the tooth has been demineralized, as evidenced by any staining or softening of the dentine not removed by cleaning (Fig 4), a normal cavity should be prepared including mechanical retention.

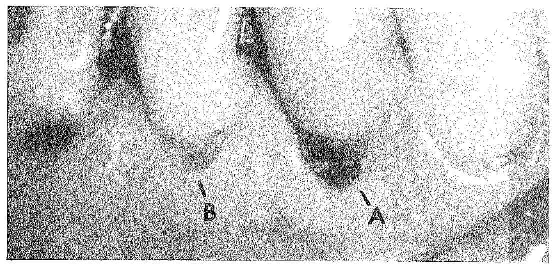

FIG 4. *Class 5 lesions in two lower premolars. A: Active caries. B: Demineralization with staining which will not polish off. Both lesions require normal cavity preparation.*

Carious Lesions

If preparation of a cavity has been necessary, rotary cutting instruments will leave a layer of debris (Fig 5), which should be re-

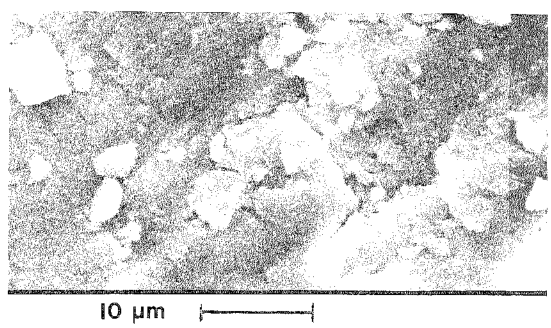

FIG 5. *The floor of a cavity cut at 2000 rev · min^{-1} with a mild steel bur showing layer of debris on the surface. Original magnification X1000.*

moved. Application of a mild acid for 10–15 seconds only is sufficient to condition the prepared cavity (Fig 6). Citric acid (50%) is

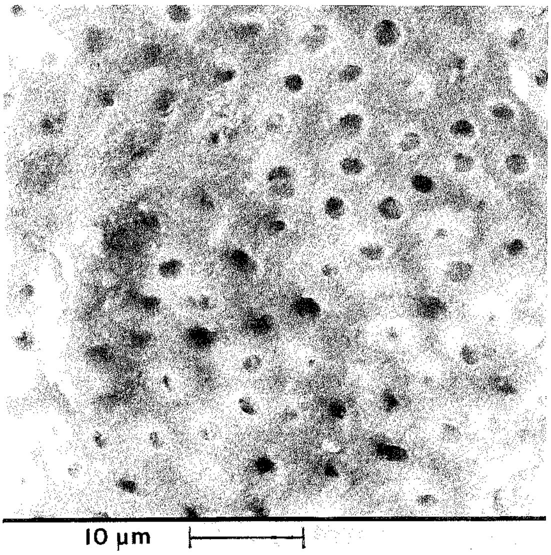

FIG 6. *Floor of a cavity cut at 2000 rev · min⁻¹ with a mild steel bur, cavity conditioned with 50% citric acid (10 seconds) then flushed with air/water spray. Original magnification X1000.*

best because any acid residue remaining after flushing with water will enhance the setting reaction of the glass ionomer without interference (McLean & Wilson, 1977). Hydrogen peroxide or tannic acid is also acceptable (Laboratory of the Government Chemist, 1979). This procedure will expose dentinal tubules, which, unlike those of the erosion lesion, are open and unprotected. Dentinal fluid can now flow into the cavity and reduce the chemical bond. It is recommended that mechanical retention by way of conventional undercuts be provided in a prepared cavity. There will still be a sealed margin in relation to the enamel or dentine walls; and if care is taken not to dehydrate the cavity unduly, so that dentinal fluid is drawn from the tubules, there may still be some adhesion to the dentine floor.

Conditioning the surface of the cavity with a mild acid is different from etching with acid for composite resins (Fig 7). With the glass-ionomer cements only pellicle and other contaminants need to be removed from the

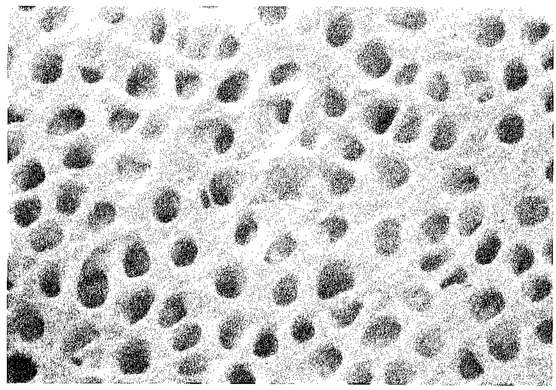

FIG 7. *Floor of a cavity cut at 2000 rev · min⁻¹ with a mild steel bur etched with 50% orthophosphoric acid (30 seconds). Compare with Fig 6. Original magnification X1000.*

surface of the enamel and dentine. Undue removal of the calcium ions is undesirable, so the conditioning agents should remain on the tooth structure for no longer than 10 seconds before the area is thoroughly flushed with a spray of air and water and then dried with air alone.

Sealing Pits and Fissures

When sealing pits and fissures on occlusal surfaces, as well as other areas difficult to reach, such as margins of crowns, it is necessary to obtain and retain a perfectly clean, dry surface (McLean & Wilson, 1974). Scrubbing with pumice and water is contraindicated because of the possibility of leaving particles of pumice impacted in narrow fissures. Cleaning with a mild acid followed by thorough flushing with a spray of air and water before drying carefully is recommended. The use of rubber dam is advisable particularly in areas of difficult access.

PROTECTING THE PULP

The response of the pulp to the glass-ionomer cements appears to be mild (Kawahara, Imanishi & Oshima, 1979; Tobias & others, 1978). The polyacrylic acid is similar to that used for the polycarboxylate cements but with further additives. Recent studies suggest that the pulp recovers rapidly from an early moderate inflammation, which is likely to be exacerbated in a deep cavity conditioned with a mild acid (Prosser & Wilson, 1980). Where less than 1 mm of dentine remains a small quantity of calcium hydroxide should be placed over the region of the pulp prior to conditioning the cavity.

DISPENSING AND MIXING

The manufacturers' directions on the ratio of powder to liquid must be observed (Crisp, Lewis & Wilson, 1976). Insufficient powder markedly increases solubility and lowers the resistance of the set cement to abrasion. Excess powder will reduce the amount of free acid available to produce the chemical bond and also will reduce translucency.

Unfortunately, the manufacturers' brochures supplied with two of the materials on the market are not clear on this matter. Capsules are the simplest solution because auxiliary staff must be carefully trained to obtain standard reproducible results when mixing on a glass slab or paper pad.

The use of a chilled slab will prolong working time without unduly extending setting time (Stokes, 1980). However, the liquid must be kept at room temperature because chilling increases the viscosity. It is possible to restore the fluidity by standing the bottle of liquid in water at 70°C for 10–15 minutes but viscosity may increase again.

Mixing should be carried out rapidly, within 30 seconds, using only a small area of the slab. It is necessary only to wet the surface of each particle of powder without dissolving the powder entirely in the liquid. The finished consistency will vary slightly with the different products but there must still be a wet glossy surface on the material when it is placed on the tooth.

PLACEMENT

The use of a syringe ensures minimum porosity and positive placement, particularly in retentive areas. One of the materials (Ketac) is supplied in a capsule, which becomes a syringe.

As with most restorative materials, use of a matrix is desirable. The cement flows readily and contour is not difficult to achieve. The use of a mylar strip is recommended for class 3 restorations. A matrix of dead-soft tin foil is useful for class 5 cavities and sealing fissures. For extensive restorations a matrix can be cut out of tin foil, shaped to the contour of the remaining tooth and supported with green stick compound as required. A hole for access can be cut in an appropriate position and the cement expressed from the syringe into the cavity.

CONTROL OF THE ENVIRONMENT

When set, glass-ionomer cements have a high content of water and in the early stages of setting will absorb further water (Wilson, 1977). On the other hand, if left exposed to air after initial setting, they will lose water rapidly and shrink and crack (Figs 8, 9). This

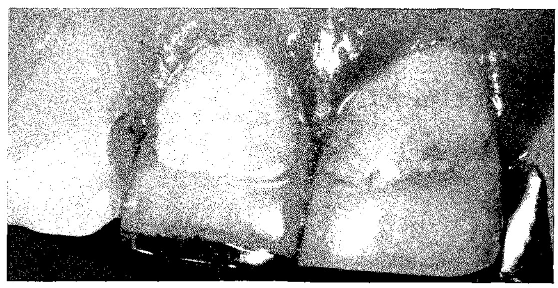

FIG 8. *Class 5 restorations in maxillary central incisors using Fuji glass-ionomer Type II. Crazing and loss of translucency from prolonged dehydration following placement.*

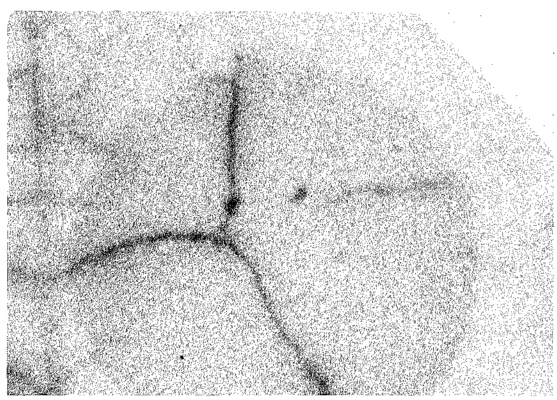

FIG 9. *A 5mm disc of ASPA glass-ionomer cement exposed for 30 minutes after initial set. Note deep cracks in the disc and crazing of flash around it.*

will leave the surface of the restoration susceptible to staining as well as place heavy stress on the newly forming ionic bonds, thus possibly leading to loss of adhesion.

The initial instability is transitory and is related to the rather prolonged two-stage setting (Crisp, Lewis & Wilson, 1976). The initial cross-linkage is with calcium ions, leaving the material carvable after removal of the matrix. A further bonding with the aluminum ions then occurs, and the material matures.

Problems can be readily avoided by controlling the environment of the cement after initial setting with an immediate application of a waterproof varnish. The manufacturer generally supplies such a varnish, which is specific to this material and is not interchangeable with the copal resin varnish used under amalgam and in other areas of restorative dentistry. Immediately after removal of the matrix apply the varnish. Dry with a gentle application of compressed air; then trim if necessary, without attempting to complete the contouring and polishing. Use a sharp scalpel blade or a small plug finishing bur moving only from restoration to tooth. The bond between restoration and tooth is still immature and should not be unduly stressed.

Following trimming, varnish again and blow dry. Within an hour the restoration will be sufficiently resistant to absorption of water to remain undamaged if the varnish is lost (Crisp, Lewis & Wilson, 1980). On the other hand, it will be at least 24 hours and possibly longer before it is mature enough to withstand exposure to dehydration for longer than a few minutes. Therefore a further application of varnish will be required if it is necessary to isolate the restoration again within this time. Certainly after 14 days both Fuji and Ketac can be considered to be quite stable. ASPA should still be protected with varnish if it is subjected to dehydration.

POLISHING

Once the restoration is mature it is possible to develop a clinically acceptable smooth surface. For gross trimming use fine diamonds or plug finishing burs. A final surface can be developed with careful use of graded discs or polishing paste. Keep the restoration wet while polishing. Some restorations that are four years old are shown in Figure 10.

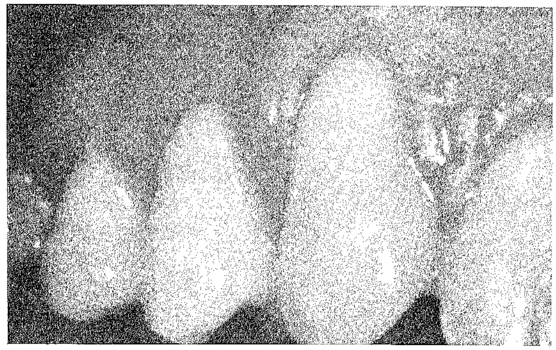

FIG 10. *Class 5 erosion lesions in upper right canine and first premolar restored with Fuji Type* II *four years after insertion.*

RECOMMENDATIONS IN SUMMARY

1. Isolate the tooth.
2. Clean the cavity.
   (a) Class 5 erosions and abrasions—pumice and water only.
   (b) Carious cavity — remove caries, obtain retention, line with calcium hydroxide if necessary, condition with a mild acid —10 seconds only.
3. Flush with water and dry thoroughly.
4. Mix material to the manufacturer's directions.
5. Place, using a matrix—set for 3-4 minutes.
6. Remove matrix and varnish immediately—use waterproof varnish.
7. Trim only if essential.
8. Varnish again—use waterproof varnish.
9. Polish if necessary after at least 24 hours.

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SPECIAL ARTICLE

Professionalism

CLIFFORD H MILLER

Professionalism is a subject that is more important to dentistry today than ever before. It could be categorized as a subjective term and might well be defined in several ways carrying with it a different shade of meaning for each of us. Dr Robert J Nelsen, Executive Director of the American College of Dentists, perhaps best described this term in a speech given at the annual meeting of the American College of Dentists in 1973: "Professionalism pertains to that quality of conduct which accompanies the use of superior knowledge, skill, and judgment towards the benefit of *another person or to society* prior to any consideration of self-interest by the professional person or professional organization."

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We should like to think that dental schools will provide students with the opportunity of developing this superior knowledge, skill, and judgment as it relates to the profession of dentistry. We also hope that during the formative years children and young adults develop the strong moral and ethical convictions that enable them to apply these skills in dentistry in keeping with the definition, to the benefit of the patient without clinical judgment being tempered by self-interest.

These lofty goals or aspirations for dentistry are not new to the profession, but have stood the test of time since the inception of modern dentistry. Dentists have a rich heritage and legacy, which were initiated by probably the most famous dentist of all time — Dr Greene Vardiman Black. Dr Black gave an address at the opening of the Chicago College of Dentistry in 1884, which, incidentally, was the precursor to Northwestern University Dental School, in which he said, "Let me state in the beginning that one's duties to his profession, no matter what that profession may be, includes his whole duty to his fellow man and himself. To do this duty requires honesty of purpose, sincerity in the performance of labor, and a correct understanding of the mutual relations of man to man. These three grand requisites of success we hope each of you have gained in your previous training, so that you come to us with those qualities well fixed and ready to guide you in the special duties that devolve upon you here, for without them no man can rightfully expect the high measure of success which all must desire. Dentistry does not differ from the other professions in these respects. There is nothing in this profession which anywise changes our general duties to our fellow man, or relaxes the vigor with which we should labor for the general welfare of the human family. But on the contrary, the more we shall learn of the infirmities of man, the stronger should our sympathy with the suffering become, and it is closer to the rules of right doing."

Upon being admitted to dental school, students have officially entered into the profession and accepted its responsibilities. The faculty and administration should help to provide the motivation and guidance necessary to ensure that each student can attain his or her avowed goals. These goals, however, will differ for each individual. Those with high ideals and principles, coupled with strong self-confidence, will set high goals and without compromise will achieve them. Others might not have the same high aspirations to begin with and still others may lower their sights somewhat, by yielding to pressures or temptations. If dental students could only accept the fact that for the first time in their formal education they all have the same terminal objective, namely, to enter the dental profession. By accepting this as a benefit and not a liability and working cooperatively, students could achieve standards of excellence that would surpass those heretofore achieved either individually or collectively. This should not be an unattainable goal, since there is currently a greater fund of knowledge, more sophistication in teaching methods, and better materials and instrumentation than ever before. This goal will be difficult, if not impossible, however, if students continue to succumb to cutthroat competition among classmates, which is so prevalent in our school systems today. Such competition can lead only to a rapid breakdown of class spirit and morale with the ultimate levels of achievement being markedly reduced. Students will not all excel in the same areas of academic or technical endeavor. Those with special skills should not be reticent to help those who are less fortunate, for in the final analysis all will profit from this cooperative attitude. The bonds of friendship that develop out of experiences shared in dental school will be stronger than any that have occurred before or are likely to occur in the future. This close-knit relationship is exemplified by the loyalty and dedication displayed in the class reunions of dental alumni. Working cooperatively as a class is healthy and constructive and will go a long way in helping to minimize the pressures and tension inherent in all levels of higher education. It is not intended to replace individual effort, however, and each student should attempt to approach his ultimate level of knowledge and technical competence as measured against the yardstick of professional excellence.

As the clinic years begin, there are many temptations to compromise ideals and clinical judgment in treating patients to expedite the completion of clinical requirements for graduation. Some view patients merely as the vehicle to bring their bridge special, overlay denture, or class 3 foil into the clinic. This sort of temptation is strong and can influence students who are confronted with high payments for tuition, family responsibilities, and the desperate need to graduate on time. Those who accept the clinic numbers as guidelines instead of goals, however, will be less apt to yield to these temptations and more likely to far exceed the minimal levels of technical competence, which these numbers imply. Giving the best of one's self consistently while in school will virtually assure a rewarding, successful, professional future.

The first opportunity to put this philosophy to the test is at the time of the regional or state board examinations. State and regional boards are not designed to measure the upper levels of skill or judgment, but rather to serve as guardians of the public and profession, to ensure that those lacking in scientific knowledge, technical skill, and moral and ethical judgment will not be licensed to practice a profession that is governed in large measure by self-discipline. It is for this reason that it is important for the student to feel confident in his or her ability to pass any such examination and respect the intent, if not always the means, of the examining boards.

Entering the dental profession in the 1980s offers demands and challenges that did not exist a decade or more ago. The trustee from Illinois and president-elect of the American Dental Association, Dr Robert Griffiths, has traveled extensively throughout the country, visiting dentists and learning of their problems and concerns. The overriding concern is a lack of busyness attributed by some to an overproduction of dentists throughout the country. This apparent oversupply of dental manpower, at least in certain urban areas, could be the result of a miscalculation on the part of the 1961 Commission on the Survey of Dentistry in the United States, which forecast a deficit of as many as 41 000 dentists to meet the demand for dental service by 1975. It recommended a significant increase in the capacity of dental schools to meet the expected need. Congress responded to this report and passed legislation that made federal funds available for the construction of new dental schools and expansion of existing facilities. As a result, the number of dental schools increased from 47 in 1962 to 60 in 1980. Congress also passed the Health, Manpower Bill of 1971, which necessitated larger classes as a prerequisite to receiving capitation grants. The net result of these actions was an annual increase in the number of dental school graduates from 3 253 in 1960 to in excess of 5 100 in 1980. Small wonder that prognosticators of dental manpower and some dentists are beginning to express concern about oversupply.

A professional education is a privilege and every privilege carries with it responsibilities. The responsibility of the school is to provide students with the tools to excel, and the students' responsibility is to utilize these tools, without compromise, to the best of his or her ability, and in the best interests of patients. This will assure dentistry of a position in the forefront of the health professions where there is ample room to expand the horizons of knowledge through research and education and thereby provide a more comprehensive service to humanity without the threat of overcrowding.

There are other changes taking place in the traditional ways in which dentistry is practiced. Third-party clinics, group practice, and even department store dentistry has arrived on the scene. And as if this were not enough, the Federal Trade Commission has been exerting its influence on the health professions. As a result of its activities it is now legal for dentists to advertise individually or in groups. This same group (the FTC) is currently supporting the concept that auxiliaries be allowed to provide services directly to the public, both as independent contractors and free from the requirement of direct supervision of dentists. In this atmosphere professionalism as it applies to dentistry will most assuredly be put to the test.

The way in which we, as dentists, cope with these problems will determine the future fate of the dental profession. It is for this reason that professionalism is more important today than ever before. We have a strong national organization that is working diligently in our behalf to resolve some of these problems. The American Dental Association has recently launched an expensive institutional advertising campaign in an effort to increase public awareness of the need for dental care. This is the first attempt at such an approach and perhaps the association has responded too much to Madison Avenue gimmickry with clever slogans, television promotion, and bumper stickers. In the eyes of many, this type of approach lacks the very qualities inherent in the kind of professionalism we are addressing today, since as dentists we are not selling a product but rather providing a health service. It is essential that the direction and leadership, which our national organization takes, emanates from within the profession itself, and not as a result of political or financial pressures that are brought to bear. The dental profession must provide the innovative ideas to meet the public demands for dental care and help direct the government and the American Dental Association in the most appropriate ways to allocate funds to meet these challenges.

As we discuss the various approaches to bringing the message of dentistry to the public's attention and the recent legalization of advertising, we must remember that just because an act has been legalized does not necessarily make it ethically or morally correct. The most effective form of patient education, which has stood the test of time, is that taught by the dental professional in his daily practice. In this manner, confidence in and appreciation of the benefits to be accrued from quality dental care are developed. A career in dentistry is an honorable profession, one that a recent survey shows to be highly regarded and respected by the population. The achievement of this goal carries with it a high price in tuition and instruments, not to mention the personal and family sacrifices that must be made. Setting up a dental office also necessitates a major financial commitment before one begins to materially reap the benefits of his or her education. It is unrealistic to expect to harvest the fruits of one's labor overnight, however, with exorbitant fees or unrealistic schedules. Rather, work with compassion and understanding and establish a philosophy and pace for dental care that provides time for family and friends and pride in one's professional accomplishments.

In conclusion, it is fitting to quote once again from our illustrious predecessor Dr G V Black at the end of a paper entitled, "Limitations of Dental Education" in 1907: "I want to appeal to every practitioner to study this whole matter of the limitations of dental education with great care to the end that you should not expect the impossible of dental schools. Remember that dental schools have no power to control the acts of their students after they go out into practice. It often occurs that a student whose conduct in school has been exemplary, who has made a good record, disobeys every precept of ethics and morality he has been taught after leaving school. Though the school may be thoroughly disgusted with such a result, it can do nothing but regret that it has not had the power to make men honest. Remember also, that the dental school cannot make all of its graduates efficient practitioners, nor can any State board sift out all incompetent men, or men who may rapidly become incompetent through careless or immoral habits.

"A student may, under the influence thrown around him in school, do fair work in both his studies and operations, and after the last cramming for the State board examination, he may throw aside his books, fall into careless habits in operating, and within a few years become a thoroughly incompetent man. I have known such students to sell all of their books to the secondhand dealer the next week after passing these examinations. I wish to heaven they would sell their instruments also and seek other employment. The professional man has no right to be other than a continuous student. Therefore, until we can have laws by which the licenses of such men can be rescinded, we may expect some men will be dishonest, and others careless, no matter how well the dental schools and the examining boards may do their work.

"As professional men, we can work together for the benefit of all our people and so manage our dental education as to secure this end. If we work together with zeal and skill to that end, the profession will win high honors in the future."

OPERATIVE DENTISTRY, 1981, **6**, *70–74.*

P R O D U C T   R E P O R T

Accuracy of Casts from Three Impression Materials and Effect of a Gypsum Hardener

Impression materials of polyvinylsiloxane were found to be slightly more accurate than hydrocolloid. Casts poured from stone mixed with water were more accurate than those from stone mixed with a hardener.

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Summary

The accuracy of casts of Vel-Mix made from impressions of Citricon, President, and Rubberloid was compared. President was found to be slightly more accurate than Rubberloid but there was no statistically significant difference between Citricon and President or between Citricon and Rubberloid. Casts poured from stone mixed with water were more accurate than those from stone mixed with Stalite.

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Introduction

The recently introduced polyvinylsiloxane impression materials are more elastic and have less dimensional change than any other type of impression material (Craig, 1977). They are polymerized by addition whereas the silicone impression materials are polymerized by condensation. Polyvinylsiloxanes are supplied as two pastes, one containing a polysiloxane of low molecular weight with terminal vinyl groups, reinforcing filler, and a catalyst of chloroplatinic acid, the other containing a polysiloxane of low molecular weight with terminal silane hydrogens and reinforcing filler. When equal lengths of the two pastes are mixed, the hydrogen and the vinyl groups react without forming by-products. As a result there is no shrinkage because there are no reaction products to evaporate during polymerization, provided the raw materials are not volatile (see Fig. 1).

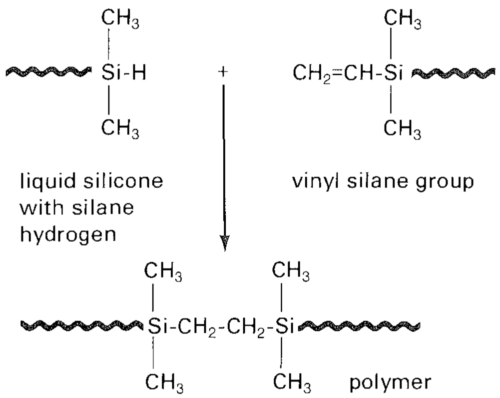

FIG 1. *Reaction of polymerization*

Polyvinylsiloxanes have the following advantages:

- A 1:1 paste system, by volume as well as by weight.
- High molecular weight of all components so that even if used in excess they do not evaporate from the polymerized product.
- No irregularities from reaction products to impair the surfaces of castings.
- Polymerization is little affected by variations of atmosphere, humidity, or oral environment (Coltene, 1978).

The accuracy of a cast poured from an impression depends on several additional factors: fit of tray to the tissue, compatibility of the impression materials with the die stone, and the dimensional stability of the impression.

The purpose of this study is to evaluate the accuracy of several impression materials and their compatibility with a die stone mixed with either tap water or a gypsum hardener.

Materials and Methods

The impression materials examined were:

1. Reversible hydrocolloid—Rubberloid (Van R Dental Products, Inc, Los Angeles, CA 90034, USA)
2. Silicone—Citricon (Kerr Mfg Co/Sybron, Romulus, MI 48174, USA)
3. Polyvinylsiloxane—President (Coltene, Altstaetten, Switzerland)

The die stone used was:
Vel-Mix (Kerr Mfg Co/Sybron)

The gypsum hardener used was:
Stalite (Buffalo Dental Mfg Co, Brooklyn, NY 11207, USA)

A standard metal die and gauge block were prepared consisting of two machine-tapered cylinders with base and a precisely machined gauge block with calibration windows for viewing (Figs 2 & 3).

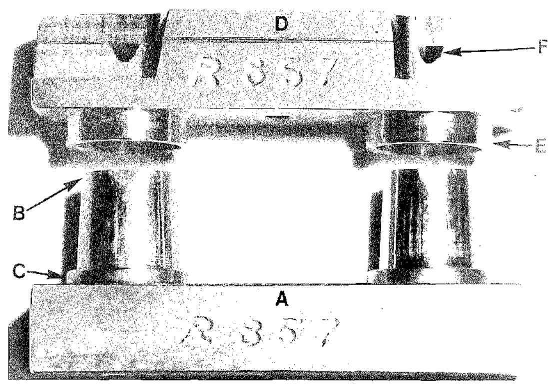

FIG 2. *Components of metal die and gauge block: A — base of die; B — taper cylinder of master die; C — ferrule of master die; D —base of gauge block; E — ferrule of gauge block; F — measuring window of gauge block.*

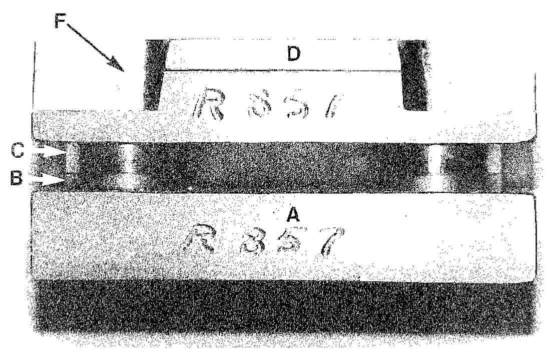

FIG 3. *Die and gauge block assembled: A — base of die; B — ferrule, base of taper cylinder; C — ferrule of gauge block; D — base of gauge block; F — measuring window (area where measurements of accuracy are made).*

Perforated impression trays of cold cure acrylic custom made to manufacturer's specifications were used for polyvinylsiloxane. Silicone impressions were made by the double impression (putty-wash) method with the recommended adhesive. Metal water-cooled trays were used with the reversible hydrocolloid.

Thirty impressions of the male section of the test die were taken with each impression material. For each group of 30 impressions, 15 casts were poured with the die stone mixed with water, and 15 poured with the die stone mixed with Stalite. The die stone was mixed mechanically under vacuum and vibrated into the impression. The casts were allowed to set in an environment of 100% humidity. Upon final set, they were separated from the impression trays and excess stone was trimmed. Each cast was seated in the gauge block part of the test die under a load of 500 g applied through a Gilmore needle ensuring that all the casts were seated under a uniform load. The width of the gap between the cast and the test die was measured at the window of the gauge block by a micrometer slide microscope (Gaertner Scientific Corp, Chicago, IL 60614, USA).

The observational error of the microscope was determined to be $\pm$ 0.77 μm and the experimental error to be $\pm$ 13.375 μm giving a total experimental error of 14.2 μm.

The results were assessed by a two-way analysis of variance to determine statistical significance.

Results

Accuracy of the fit of the casts and gauge block is presented in the table.

All the results fall within a narrow range indicating little difference in accuracy among the three impression materials. Mixing the stone with water rather than with Stalite gave more accurate casts with Citricon (P = 0.004) and President (P = 0.05), but with Rubberloid the difference was not statistically significant. The differences between President and Citricon and between Citricon and Rubberloid, when the stone was mixed with water, are not statistically significant. The difference between President and Rubberloid is statistically significant (P = 0.034) but the difference may be too small to be of clinical significance.

Discussion

The results demonstrate that polyvinylsiloxane is slightly more accurate than hydrocolloid impression materials. These findings support those of Craig (1977) and Lacy, Bellman, and Jendresen (1978).

The greater accuracy of polyvinylsiloxane may be due to the chemical nature of the polymerization. The product in the addition reaction is stable, and no by-products are lost by evaporation to cause shrinkage. The merits of polymerization by addition have been reported (Coltene, 1978; Braden, 1976).

The adhesion of the impression material to the impression tray is important. Dimensional stability of impression materials decreases as the volume of the material increases (Podshadley & others, 1970; Gunther, 1978; Mitchel & Damele, 1970; Schnell & Phillips, 1958). Adhesion may counteract the effect of volume. With custom impression trays and reduced volume of impression material, reliable adhesion over the entire surface of the tray is still important. When adhesion is good, the impression material is not permit-

Discrepancy of Fit between Master Die and Stone Casts

Impression Material	Solvent	Discrepancy μm Mean SD
President	water	67.50 $\pm$ 11.15
Citricon	water	71.50 $\pm$ 9.80
President	Stalite	77.00 $\pm$ 15.65
Rubberloid	water	77.75 $\pm$ 12.60
Citricon	Stalite	87.50 $\pm$ 15.60
Rubberloid	Stalite	90.65 $\pm$ 14.30

ted to shrink from the surface irregularly, but will shrink perpendicularly to it (Fig 4).

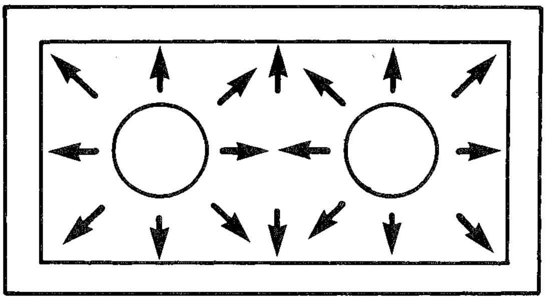

FIG 4. *Schematic view of impression in a tray shows that if adhesion is good the impression material shrinks perpendicularly from the surface rather than irregularly.*

Should the impression material not adhere to the tray, the resulting shrinkage will be reversed and irregular (Fig 5). In this situation, the contraction of dimension A will be greater than would occur with good adhesion (Pfannenstiel, 1970). According to Meiners (1973), the shrinkage of a fixed polymer before and after setting may be represented schematically (Fig 6). When this principle is applied to the results obtained in the present study, the lumen will increase (Fig 7).

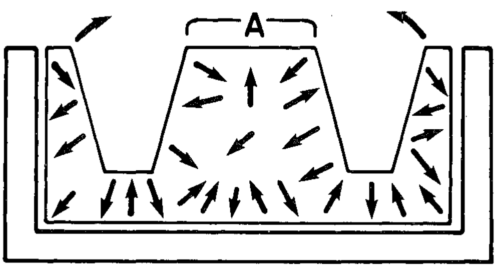

FIG 5. *Impression material that does not adhere to the tray will shrink irregularly. Contraction of dimension A will be greater than with good adhesion.*

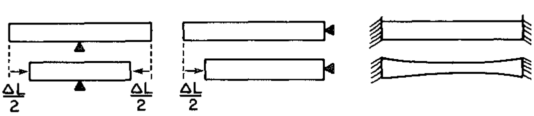

FIG 6. *Schema of shrinkage of a fixed polymer before and after setting.*

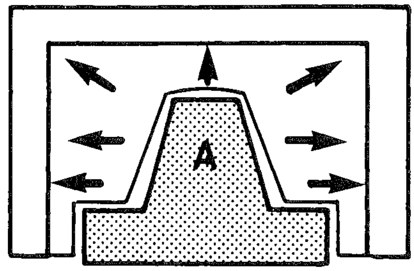

FIG 7. *Diagram showing the regular shrinkage of material that occurs with good adhesion to tray.*

The results of the present study emphasize the importance of proper adhesion between the impression material and the impression tray. Adhesive was applied to the trays used with Citricon and President, and the resultant shrinkage was lower than that with the hydrocolloid, where no adhesive was used. The performance of the hydrocolloid might improve if an adhesive were available.

Properties of impression materials other than their accuracy should be considered in selecting a material for clinical use. All three of the materials studied have a record of good clinical performance.

A mean discrepancy of 10 μm or less should be evaluated in reference to the total restorative procedure, that is, the waxing, investing, and casting techniques that affect the clinical result. Each of these procedures may impart plus or minus effects, which, in total may balance or influence the accuracy of the end product. The casts of Stalite and Vel-Mix added to the discrepancy.

The compatibility of hydrocolloid with the die stone used in the present study is good (Nicholson & others, 1977). Probst, Duncanson, and Winters (1978) reported that Stalite increases the strength of the die stone. However, Stalite has been found to increase the setting expansion of gypsum die products (Probst & others, 1978). The increased hardness of the surface of the stone imparted by Stalite often outweighs the compensatory procedures required for the total restorative product. The handling of a laboratory material is not unlike the medication of a patient; along with all the desired effects there are side effects that must be reconciled.

Conclusions

1. President was slightly more accurate than Rubberloid. The differences between Citricon and President and between Citricon and Rubberloid were not statistically significant.
2. A tray adhesive for hydrocolloid might improve accuracy of the impression.
3. The discrepancy of the cast produced from all the tested impression materials was increased when Stalite was used to mix the die stone.

The authors express appreciation to John K Moore, PhD, of the Division of Clinical Pharmacology, School of Medicine, University of California, San Francisco, for performing the statistical analyses.

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POINT OF VIEW

Franchise Dentistry: A Backward Step

JERRY M BROWN

I truly believe, as I hope you do, that if dentistry is to remain part of the healing arts, it cannot deteriorate to the role of selling a product. Dentistry must remain a service dispensed in a one-to-one manner. I have worked too hard as a bean staker, cherry picker, busboy, waiter, bartender, student, and teacher in becoming a dentist to allow American dentistry to follow in the footsteps of the American drugstore. I **do not** wish to hear that the future dental facility will be a carbon copy of Duane Reade — the drugstore chain.

In the recent October 6 issue of the *ADA News* you might have read that another dental McDonald's opened last spring — with 139 more dental stores on the drawing board. The founder of the national chain of Mr Donut shops wants to "cash in" on his marketing experience. He has been quoted as saying, "Our dental stores are free-standing with a strong identity of their own. It's not unlike a donut shop." I ask you! What **is** dentistry — a retail operation?

It is common knowledge that today's young dental graduate is deeply in debt, lacks experience, and is unable to afford the expense of beginning a private practice. This young dentist may find himself working in a store in Times Square, drilling and filling right alongside the ladies lingerie department. There is a certain mentality that develops in a person working in such an atmosphere; he or she becomes more concerned with quantity and production than with the quality of the service.

How are we going to combat this cancer — franchise dentistry? A few of my patients, employees of a large business, were products of such a factory. The assembly-line dentistry they went through — get the patient in and out of the office in the least possible time and with a minimum of contact between dentist and patient — prompted them to seek me, as they will seek you, because we offer a more personal service.

We have to convince the vast majority of people that there is nothing better for them than the private dental practice. Most families hesitate to be without a family physician; they should also hesitate to be without a family dentist. Dentists must encourage people to make the same commitment to a local dentist as they do to a physician. The trust that develops between the patient and his or her dentist becomes a family tradition. People love a bargain, but a medical/dental mill is no bargain.

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DEPARTMENTS

Correction

In the first paragraph of the summary of "Mercury-Alloy Dispensing Systems," in the Winter 1981 issue (Volume 6, No 1, p 20) it was erroneously stated that the Sybron/Kerr dispenser was one of the most variable tested, whereas in fact it was one of the most accurate and least variable. The sentence should have read: "The Johnson & Johnson and S S White dispensers were the most variable ...." Please paste the enclosed self-adhesive correction over the summary on page 20 in the last issue.

Book Review

DENTAL AMALGAM

by Matthijs M A Vrijhoef, Albert G Vermeersch, and Adam J Spanauf

Published by Quintessence Publishing Co, Chicago, 1980. 113 pages. Illustrated and indexed. $46.00

With anticipation and excitement from reading the inside of the dust cover and casually thumbing through this seemingly well-illustrated book, this reviewer had high hopes for a book of textbook quality suitable for preclinical students. The authors, from the universities of Nijmegen and Louvain, state, "We hope that, after turning to the last page in this book, the dental student has acquired the necessary knowledge for the correct use of modern amalgam alloys. As to the dental practitioners we hope that they have gained some insight with respect to recent developments in the field of dental amalgam and strengthened their clinical view, thereby contributing to a better recognition of the casualties related to amalgam restorations and a more sophisticated problem solving."

In an era characterized by rapid change in technology and claims by manufacturers for the superior quality of their specific products, both dental student and practitioner need authoritative guidelines in selecting materials, as well as clear instruction in their manipulation. Unfortunately, this book does not fulfill the expressed hopes of the authors for a guide to the correct use of amalgam or the hopes of this reviewer for a book of textbook quality.

Although the type is attractive and readable and the pages are generously illustrated with black and white diagrams, charts, and photographs of good quality and clinical interest, neither the text nor the labels for the illustrations adequately explain them. The clinical photographs and the photographs of microstructure of dental amalgam would be more helpful with better description or devices for directing the reader's attention to the areas of interest. Although perhaps understandable to a materials scientist, the graphs are not self-explanatory. It is doubtful that the freshman student or the practicing dentist who is overly busy will take the time to understand the importance of the information as depicted. Better labeling on the graphs would make them more meaningful.

Much of the text in the three chapters "Microstructure," "Physical Properties," and "Chemical Composition" is difficult reading. Understandably, for most dental readers these subjects, by virtue of the weightiness of the science of dental materials, are difficult. More thorough and better editing of the material and proofreading for mistakes in spelling and order of words would make these chapters more readable. Expanded description would help the reader understand these highly technical subjects. Possibly the authors intend and expect the reader to use the extensive list of references at the end of each chapter for better understanding. However, unless the reader has access to a university library, many of the references listed would be unavailable.

The text in the other two chapters is more readable. Chapter 1, "General Information," dealing with the preparation of the cavity, compaction, carving, and finishing of an amalgam restoration, is much too brief to "help the student have a good start and (will) enable him to straighten out certain problems." Chapter 5, "Technical Considerations," from its beginning, which describes the importance of selecting a good alloy and mercury, to its conclusion, which describes carving, burnishing, and polishing, is good information. It is the highlight of the book. It briefly explains those procedures the clinician should and should not do in manipulating and finishing amalgam to produce restorations of quality.

On the inside of the dust cover the publisher states that "a good professional journal is indispensable for continuing, up-to-date study." A good professional journal is essential to a profession, but excellent professional journalism is also essential. It is here that this book misses the mark. Although it contains much information, the style of writing and the lack of thorough editing make it unattractive. The publisher has not contributed to quality.

LYLE E OSTLUND
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Dear Woody

Amalgam (Vol 4, No 4)

Several techniques are being advocated for finishing the surface of amalgam at the time of placement. What are the advantages and disadvantages of: 1) leaving the surface as carved, 2) burnishing, 3) gently polishing with a soft rubber cup and fine wet abrasive, and 4) waiting 15 minutes and polishing with pumice and tin oxide?

Woody's Answer

At the first appointment the finish of the surface of restorations of dental amalgam should be made dense and smooth. This quality of surface can be achieved only if the amalgam, when placed, is properly compacted. Proper compaction requires (1) using a fresh mix of amalgam for the outer layer; (2) placing small increments in the cavity; (3) condensing with heavy force; (4) overfilling to remove the excess mercury from the amalgam that will remain after carving the restoration; (5) burnishing the overfill to help bring the excess mercury to the surface; and (6) carving to contour when the amalgam has set sufficiently for the carver to cut the amalgam, not wipe the soft amalgam away.

The treatment of the surface after carving is controversial because of the confusion of terms. Burnishing, by definition, is rubbing the surface to make it smooth and shiny. Other terms being used include 'surfacing' and 'back-carving.' These terms have the same meaning: that is, to rub the surface lightly with the broad surface of an instrument such as the back of a large spoon or the back (blunt and smooth) side of a carver. The object of this smoothing of the surface is to make the surface dense and smooth without generating pressure at a point with a ball burnisher. Pressure at a point grooves the surface and is evidence of the crushing of the partly set crystal matrix.

Burnishing should never be used to complete the condensation of the amalgam. Condensing, or compacting, is completed as described on fresh mixes of amalgam when first placed in the prepared cavity.

The use of a soft rubber cup and a fine abrasive such as Nupro Gold also gives a smooth surface.

If subsequent polishing is delayed or not done, many of the restorations, whether burnished or rubbed with the rubber cup and abrasive, will look as though they had been polished. With either of these techniques it is easy to leave flash or excess over the margins, especially in the occlusal grooves. Lightly touching these areas with a small round bur, a finishing bur or a 40-blade carbide bur, will quickly refine the margins.

Operative and Restorative Dentistry (Vol 5, No 1)

I am curious about the relation between operative dentistry and restorative dentistry. Can you define each and indicate their relationship?

Woody's Answer

Operative dentistry is that particular branch or specialty of the science and art of dentistry which aims at the preservation of the natural teeth and their supporting structures or restoration to a state of health and beauty.

That definition is taken from McGehee's *Textbook of Operative Dentistry* published in 1936. In that definition it can be seen that operative dentistry encompasses two functions — preservation (diagnosis and prevention) and restoration. Neither of these functions can be minimized nor should either be emphasized to the neglect of the other. The definition does, however, seem to limit attention to the single tooth and the connected soft tissues.

Restorative dentistry is a subdivision and involves the surgical and mechanical processes required to restore affected parts to a state of health and beauty. This does not, however, restrict the operator to the restoration of existing natural teeth but may include replacing missing teeth to restore function and esthetics.

Quite frequently restorative dentistry is divided into two groups, fixed and removable. When this is done, the overlapping of operative dentistry and the subgroup, fixed restorative, is not separable because that further involves a separation of the restoration of single teeth from the fixed partial denture. There really is no firm dividing line and there is no need for such.

If, on the other hand, we start with a definition of restorative dentistry, the same two functions — preservation (diagnosis and prevention) and restoration — must be included. From that it follows that operative dentistry would be a subdivision of restorative dentistry, encompassing the surgical and mechanical processes.

Now we have gone the complete circle and operative dentistry becomes restorative dentistry or restorative dentistry becomes operative dentistry with no perceptible difference. Some might say one group puts in fillings and the other restorations, but I certainly will not try to say which or who does what to whom.

Composites (Vol 5, No 2)

Should the surface of a restoration consisting of a composite with large particles of filler be polished before glazing?

Woody's Answer

Yes, restorations of composite should be polished to as smooth a surface as possible before glazing. The 3M Sof-Lex series of disks and strips are excellent aids in this final polish.

To determine if the surface of the composite should be glazed, use a sharp exploring point to rub lightly over the polished composite. If the surface of the composite feels rougher than that of the tooth, a glaze is recommended. The microfil composites can be polished and do not need a coating of glaze.

The reason for polishing before glazing is based on the knowledge that the glaze will wear away in time. As the glaze wears, the smooth surface will be exposed; but the glaze in the defects will be protected and overall the surface will remain much smoother.

Announcements

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University of Washington	Allan Scott Baker
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NOTICE OF MEETINGS

American Academy of Gold Foil Operators

Annual Meeting: 22 and 23 October 1981
University of Oklahoma
Oklahoma City, Oklahoma

Academy of Operative Dentistry

Annual Meeting: 18 and 19 February 1982
Continental Plaza Hotel
Chicago, Illinois

As a result of continuing efforts to improve the arrangements for the annual meeting, the Academy of Operative Dentistry fortunately has been able to secure for 1982 the superior facilities of the Continental Plaza Hotel in Chicago. The new arrangements will enhance the enjoyment and efficiency of the program.

Press Digest

Effect of finishing procedures on surface textures of some resin restoratives. van Dijken, JWV, Meurman, J H & Järvinen, J (1980) *Acta Odontologica Scandinavica* (38) 293-301.

A laboratory study has shown that the microfilled composite resins, Isopast and Silar, can be finished to a smoother surface than can the conventional composite resins, Adaptic and Fotofil. Sof-Lex disks and polishing paste produced a surface on Isopast and Silar equal to that obtained under a matrix band.

INSTRUCTIONS TO CONTRIBUTORS

Correspondence

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

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

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