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

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EDITORIAL

Why Insure Against Dental Disease?

Insuring against major risks such as loss of property, injury, illness, and suits for malpractice is economically sound. Insurance is possible because the probability of the misfortune is low and thus many, faced with the same risk, can contribute smaller sums to a larger fund, which can then be used to indemnify the few visited by the misfortune.

The buyer of insurance pays a premium that is relatively small compared with the loss expected should misfortune strike. By his willingness to pay the premium he converts the small risk of a big loss into a definite yearly cost. Of course the premium is higher than the true equivalent of the risk because the company providing the insurance has costs of doing business. The amount of the premium depends on the magnitude of the risk—the greater the risk the larger the premium. It also depends on the frequency of the risk. If the misfortune occurs frequently, more claims have to be satisfied and a higher premium must be paid. When the frequency reaches 100%, insurance is no longer feasible. For example, if each house were destroyed by fire each year the premium required for fire insurance would exceed the value of the house and accordingly no one would insure a house against fire. Insurance is best for risks whose probability is low and unpredictable, and where the loss, compared with the premium, is likely to be high.

The incidence of dental disease is almost universal, so why do so many people have dental insurance? With almost everyone being eligible for a claim it would seem that those needing the most treatment benefit at the expense of those needing little or none. Why then would anyone, except those needing extensive treatment, buy dental insurance? Why, for example, do 75 million Americans have dental insurance? The reason is that most of them are coerced into accepting dental insurance as a nonmonetary component of salary or wages, often referred to as a "fringe" benefit—a relic of wartime restrictions on increases in wages. Most, if not all, of the premium is paid by the employer, not by the employee; otherwise it is unlikely many would subscribe to dental insurance. This arrangement, which makes the employee's salary or wage appear to be lower than it actually is, is encouraged by the government because this portion of the employee's remuneration is free of taxation. Despite this perquisite, a sounder and less devious policy would be to pay the money for dental insurance directly to the employee and thus eliminate the middleman—the insurance company—and his costs, as well as the opportunity for fraud. Furthermore, the middleman, or third party, would be freed for more productive employment, which would help to reduce inflation.

The price the employer pays for dental insurance for the employee becomes a cost of production and is included in the price of the product, making it more expensive than it would be otherwise. Thus, ultimately, the customer that buys the product pays for the dental insurance. This distorts the economy because the demand for dental services is increased artificially, benefiting dentists and some people that obtain dental treatment without paying the full cost. In this way dentists and the dentally insured, two groups with special interests, are given an undeserved advantage at the expense of all the other consumers. Such a system, favoring special interests, is economically unsound and unstable in a free society and should not be encouraged.

A IAN HAMILTON
University of Washington
School of Dentistry SM-56
Seattle, WA 98195, USA

OPERATIVE DENTISTRY, 1981, 6, 114-116.

ORIGINAL ARTICLES

Breaking Strength of Rubber Dams Compared

JAMES S RICHESON • CLAIR D REITZ
CHRISTOPHER A STARR

Summary

The breaking strength of rubber dam varies directly with its thickness and is not affected adversely by lubricants, water, or saliva.

University of Florida, College of Dentistry, Department of Operative Dentistry, J Hillis Miller Health Center, Gainesville, FL 32610, USA

JAMES S RICHESON, MS, DDS, assistant professor

CLAIR D REITZ, DDS, professor

CHRISTOPHER A STARR, DDS, formerly assistant professor. Now in private practice in 200 Southern Blvd, West Palm Beach, FL 33405

Presented at the annual meeting of the American Academy of Gold Foil Operators, 10 October 1980, New Orleans.

Introduction

The best results in restorative dentistry are realized when the rubber dam is employed during the procedures of operative dentistry.

Currently the rubber dam is available in seven weights or thicknesses and four colors—gray, green, blue, and light beige. A survey by Going and Sawinski (1968) found that dentists in the central region of the United States used rubber dam of medium weight four times more often than heavy weight and three times more often than thin rubber dam. The purpose of this study was to determine which thicknesses of rubber dam may be best suited to particular needs. This was done by determining the absolute force necessary to break specimens of rubber dam of various thicknesses and evaluating the effect of various lubricants and treatments on breaking strength.

Materials and Methods

Samples of rubber dam (The Hygenic Corp, Akron, OH 44310, USA; Xetal, Productos de Latex, Villa A Obregon, Mexico 20, DF) were prepared with a precision steel die, ASTM D638 Type V (Accura-

Steel Rule Die Manufacturers, Inc, New York, NY 10010, USA). This produced a specimen of hourglass shape measuring 10 mm x 63 mm, in which the width of the narrowest portion measured 3.18 mm (Fig 1). Table 1 shows the various weights of rubber dam tested. The treatments to which the rubber dam was subjected before testing are presented in Table 2.

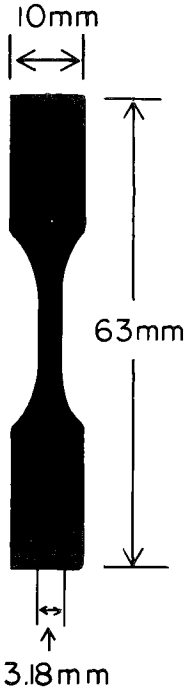

FIG 1. *Configuration and dimensions of sample of rubber dam produced by precision steel die (ASTM D 638 Type V)*

Table 1. Weights of Rubber Dam Tested

Weight	Thickness range
Thin	(0.127-0.178)
Metal (Mexican brand)	(0.160-0.215)
Medium	(0.178-0.229)
Heavy	(0.229-0.292)
Extra heavy	(0.292-0.343)
Green extra heavy	(0.292-0.343)
Special heavy	(0.343-0.394)

Table 2. Treatment of Rubber Dam before Testing

Dry (control)

Water tested immediately

Water after a 15 min wait

Saliva tested immediately

Saliva after a 15 min wait

Vaseline* tested immediately

Vaseline after a 15 min wait

Commercial shave cream** tested immediately

Commercial shave cream after a 15 min wait

Hygenic Rubber Dam Lubricant*** tested immediately

Hygenic Rubber Dam Lubricant after a 15 min wait

*Chesebrough-Pond's Inc, Greenwich, CT 06830, USA

**Mennen Brushless Shave Cream (Regular), The Mennen Company, Morristown, NJ 07960, USA

***The Hygenic Corp, Akron, OH 44310, USA

Four specimens of each grade of rubber dam were tested for each of the 11 conditions. To simulate clinical application, only one side of the samples was treated. A universal testing machine (Instron Model 1125, Canton, MA 02021, USA) operating at a crosshead speed of 500 mm · min^{-1} was used to determine the load (kg) required to break samples (breaking strength). Data were recorded and analyzed statistically by analysis of variance and Duncan's multiple range test.

Results

The effect on the breaking strength of rubber dam of treating it with various sub-

stances is displayed in Table 3. An analysis of variance showed that the treatments applied to the rubber dam did not affect its breaking strength (P = 0.01). Therefore, the mean breaking strengths for the various thicknesses of treated and untreated rubber dam are shown in Figure 2. Breaking strength varied directly with thickness, the difference being statistically significant (P = 0.01). There was no statistically significant difference between Hygenic medium weight and Xetal.

Table 3. Effect of Various Treatments on the Mean Breaking Strength of Rubber Dam (n=28 per group)

Treatments	Load Mean (Pooled SD=0.43) kg
Vaseline after a 15 min wait	2.958
Saliva after a 15 min wait	2.931
Saliva tested immediately	2.900
Lubricant tested immediately	2.891
Shave cream tested immediately	2.879
Shave cream after a 15 min wait	2.861
Lubricant after a 15 min wait	2.801
Water after a 15 min wait	2.781
Dry (control)	2.705
Vaseline tested immediately	2.695
Water tested immediately	2.651

] Joins pairs that are not significantly different. P=0.01

Conclusions

Thicker dams are strongest and should afford better gingival retraction and protection from trauma induced by instruments. The use of lubricants before the placement of rubber dam and the presence of water and saliva do not adversely affect the breaking strength of rubber dam.

The authors wish to thank Dr Ronald G Marks and Ms Shirley Geerling for their statistical assistance.

Reference

GOING, R E & SAWINSKI, V J (1968) Parameters related to the use of the rubber dam. *Journal of the American Dental Association,* **77,** 598–601.

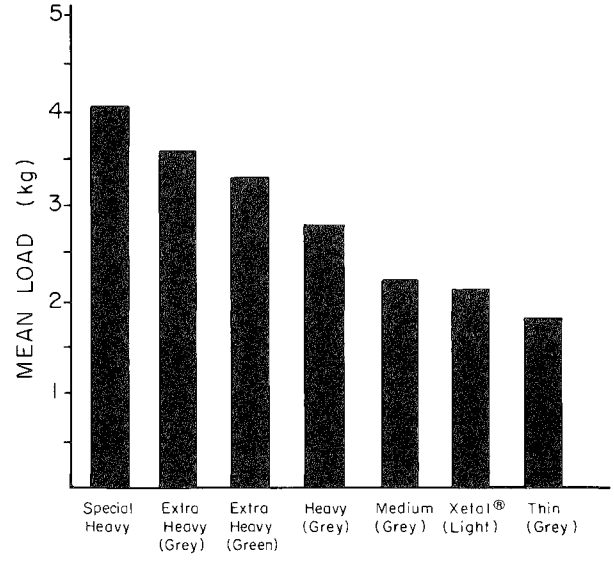

FIG 2. *Ranking of weights of rubber dams for breaking strength. The difference in the values for Hygenic medium and Xetal are not statistically significant. The differences among all other values are statistically significant* (P = 0.01 n = 44)

Rubber Dam Clamps Classified by Stiffness and Gap between the Jaws

Rubber dam clamps of the same type vary in stiffness and in the gap between the jaws. The variations exist in clamps of the same manufacturer and also between clamps of different manufacturers.

OLAV MOLVEN • NILS R GJERDET

Summary

The stiffness and distance between the jaws of 11 types of rubber dam clamp from four manufacturers were measured. Marked differences were found for each type both in clamps of the same manufacturer and also between clamps of different manufacturers. Clamps that are stiff and have a small gap between the jaws are likely to put heavy stresses on teeth and restorations. Standard classification of these properties, including length of jaws, for all clamps would provide dentists with the appropriate information for best results.

University of Bergen, School of Dentistry, Institute of Cariology and Endodontics and Department of Dental Materials, N-5000 Bergen, Norway

OLAV MOLVEN, Cand Odont, Dr Odont, assistant professor in the Institute of Cariology and Endodontics

NILS R GJERDET, Cand Odont, assistant professor in the Department of Dental Materials

Introduction

The effective use of a rubber dam requires stable, accurately fitting clamps. The design of the jaws of the clamps and the forces of retention are therefore important. Clamps should engage the teeth as closely as possible along the entire length of the jaws, at least with contact at four points, to prevent movement during the operation (Wiland, 1973). The forces exerted by clamps should not be so great as to fracture the teeth.

A system for selecting clamps that closely approximate the size of the teeth has been suggested by Wiland (1973), but there are no data on the forces inherent in rubber dam clamps. Two important factors in this connection are the stiffness of the clamps and the distance between their jaws. Stiffness is defined as the force required to separate the jaws a specified distance and depends mainly on the thickness and shape of the connecting bow. If a very stiff clamp with a small initial gap between the jaws were selected for a wide tooth, the applied force would be great. On the other hand, if the clamp were not very stiff and the distance between the jaws almost the same as the faciolingual width of the tooth, the clamp, and consequently the rubber dam, would be difficult to retain on the teeth.

Unfortunately, the information needed to help select the most appropriate clamp for a particular situation is not available. Much has been done to provide dentists with detailed information about other products they buy; clearly rubber dam clamps deserve the same treatment. This study assessed the stiffness of 11 types of rubber dam clamps and measured the initial gap between the jaws. The findings reveal the need for a classification of clamps, especially with regard to the forces that can be exerted by them on teeth.

Materials and Methods

Rubber dam clamps, five of each type, were obtained from four manufacturers (see table). The jaws of the clamps were examined in a profile projector (Nikon, model 6CT2, Nippon Kogaku, Japan) and tracings made. The distance between the jaws was measured at three positions, inner, middle, and outer (Fig 1). Duplicate measurements made on 10 clamps to check the consistency of measuring showed an average variation of less than 0.05 mm.

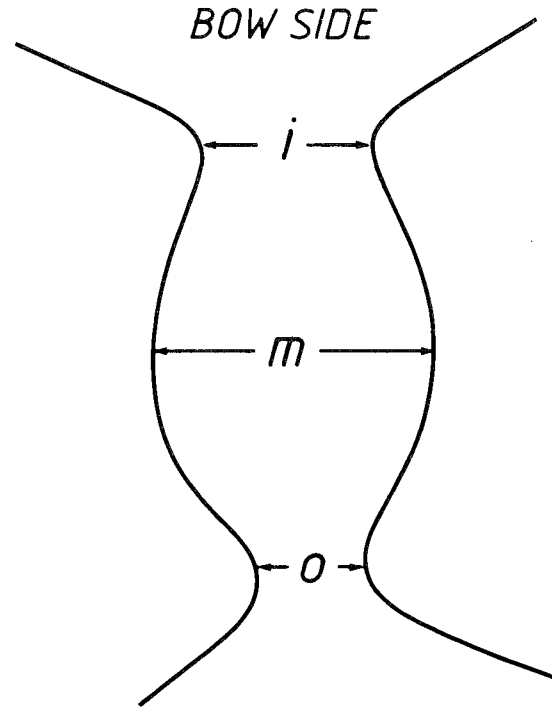

FIG 1. *Tracing of the outlines of the jaws of premolar rubber dam clamp. Distance and stiffness were measured in the mid-position (m) for all clamps. Some clamps were also measured in the outer (o) and inner (i) positions.*

Clamps Examined

Trade Name	Manufacturer/Distributor	Facial Clamps	Premolar Clamps	Molar Clamps
Alwe	Alvesta Instrument & Finmekanisk Verkstad, Alvesta, Sweden	—	0 27	26
Ash	Amalgamated Dental Trade Distributors Ltd, London, England	6 9	0 27	26
Ivory	J W Ivory, Inc Philadelphia, PA 19102, USA	6 9	0 2A	10A 5
S S White	S S White Dental Products International, Philadelphia, PA 19102, USA	210 211	209 27	26

Stiffness was measured by a mechanical testing machine (Instron 1193, Instron Ltd, England) with specially designed grips (Fig 2). The clamps were placed with the grips in mid-position of the jaws and the distance between the jaws was increased 5 mm at the rate of 10 millimeters per minute (mm $\cdot$ min^{-1}). On molar and premolar clamps measurements were made also in the outer and inner positions (see Fig 1). Stiffness was calculated as force exerted in newtons per millimeter (N $\cdot$ mm^{-1}), or newtons divided by the increase in the gap, which equaled 5 mm. Compensation was made for the flexibility of the grips.

The error of the method of testing was estimated by measuring some clamps several times; the coefficient of variation was found to be less than 3%.

Examples of potential forces that might be applied to teeth were calculated for three facial clamps. The calculations were based on observed values for gap distances, stiffness, and average faciolingual width of teeth at the cervix. The values for the last were taken from data on the measurements of teeth by Frederiksen (1972).

Results

The distance between the jaws measured in mid-position (see Fig 1) varied for clamps of the same type both between different makes and among clamps of the same

FIG 2. *Grips designed for holding rubber dam clamps in a mechanical testing machine to measure stiffness*

make (Fig 3). The smallest mean distance, 1.82 mm, was found for the Ash No 9, a facial clamp; the greatest, 5.92 mm, for the Ivory No 5, a molar clamp.

Stiffness varied between and within the four makes of clamps both of the same and different types (Fig 4). Variations between individual clamps of the same make and type usually exceeded the experimental error. The highest average stiffness found, 19.9 $N \cdot mm^{-1}$ (113.6 $lbf \cdot in^{-1}$), was for the S S White facial clamp No 211; the lowest, 4.3 $N \cdot mm^{-1}$ (24.6 $lbf \cdot in^{-1}$), for the Ivory facial clamp No 6. The Alwe clamps were the stiffest of the premolar and molar clamps. The S S White clamps were always stiffer than the corresponding Ash clamps, and the Alwe clamps were always stiffer than the corresponding clamps of Ash and Ivory. The stiffness differed when measurements were made at the outer and inner positions (Fig 5). The highest mean values were found near the bows, but they did not reach the values obtained for facial clamps of S S White and Ash.

The calculation of potential forces on central incisors that might be applied by clamps shows that the forces may differ by a factor of more than three between

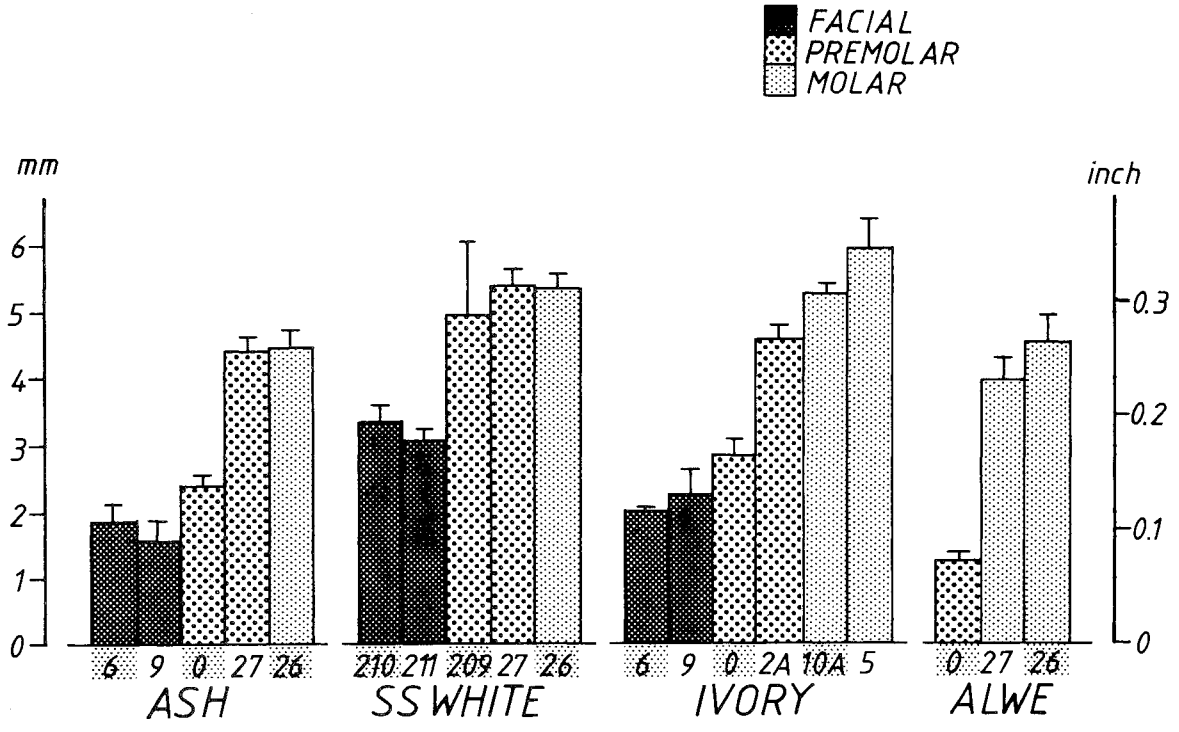

FIG 3. *The mean distance between the jaws, measured in mid-position, for 19 different rubber dam clamps from four manufacturers. The vertical lines on the bars represent standard deviations.*

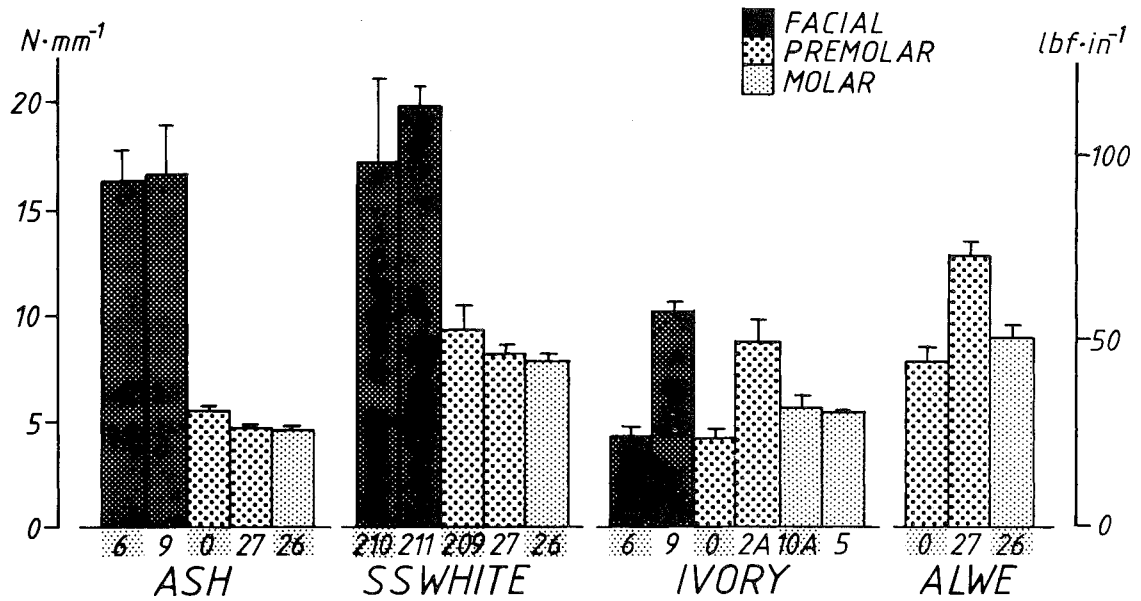

FIG 4. *The mean stiffness, measured in mid-position, for the same clamps as in Fig 3. Vertical lines on the bars represent standard deviations.*

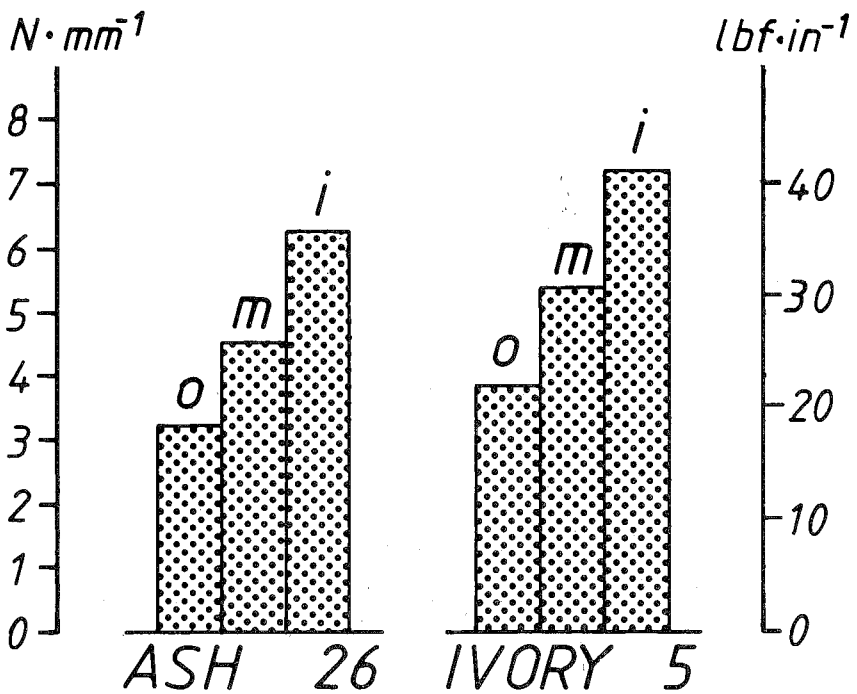

FIG 5. *The stiffness in three positions: outer (o), mid-position (m), and inner (i) for two molar clamps*

the same types of clamp from different manufacturers (Fig 6). Corresponding calculations made for other clamps revealed the same overall findings, that is, marked variation between clamps.

Discussion

The stress exerted by rubber dam clamps on teeth and restorations may in some cases be damaging. The amount of stress depends on the stiffness of the clamp and the area of contact between the jaws of the clamp and the tooth or restoration. Very stiff clamps are difficult to handle and may be uncomfortable for the patient.

The practical value of the information on potential forces (Fig 6) becomes apparent when a dentist prepares to treat, for example, an upper central incisor that is badly broken down or has a weak root. A look at the chart shows that his best choice in this instance would be the Ivory No 6 facial clamp.

Clinical use is likely to affect the properties of clamps. The initial gap between the jaws may widen because the clamps are frequently overstretched. The mechanical properties may also be altered by sterilization and contact with medicaments.

Conclusion

According to Wiland (1973), dentists base their selection of rubber dam clamps on recommendations by the manufacturers, on lists of clamps preferred by individual clinicians, and on their own experience. He suggested that maximum retention and security could be achieved by obtaining measurements of the length of the jaws of the clamps and the mesiodistal width of

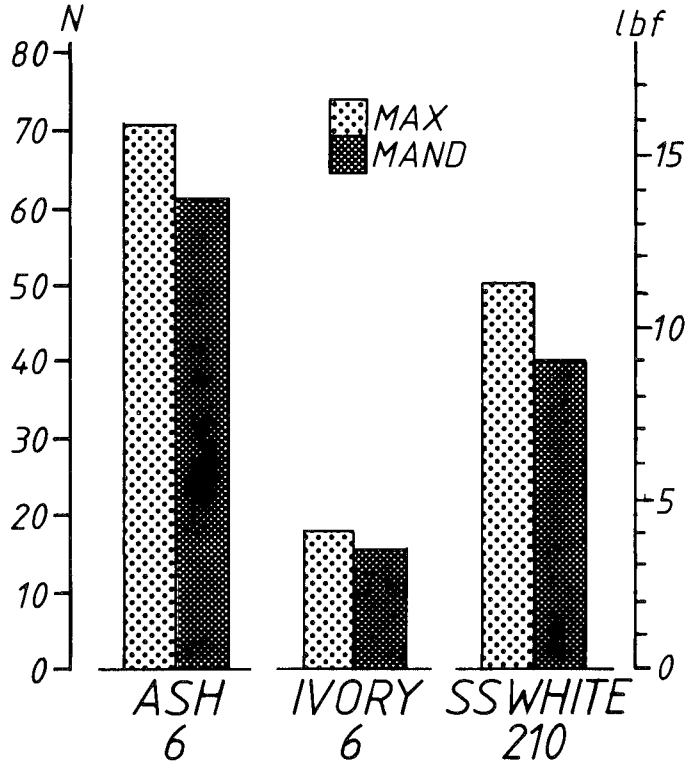

FIG 6. *The calculated forces acting on central incisors for three brands of rubber dam clamps*

the teeth and using these measurements to select the appropriate clamp. His idea, that clamps could be classified according to length of jaw, would be valuable when combined with information on initial gap between the jaws and stiffness. The dentist could then select for a particular situation the most appropriate clamp.

(Accepted 15 October 1980)

References

FREDERIKSEN, G (1972) *Den kliniske gjennomsnittanns ytre og indre størrelsesforhold. En tannanatomisk studie over et materiale innsamlet i Norge.* Universitetsforlaget, Oslo, Norway.

WILAND, L (1973) An evaluation of rubber dam clamps and a method for their selection. *Journal of the American Dental Association,* **87,** 160–164.

Editor's note:

A rubber dam clamp is used to help retain the dam on teeth and in some instances to retract free gingiva. There is growing sentiment among dentists that the terms 'retainer' and 'retractor' are more suitable names for these appliances than is 'clamp', especially as 'clamp' has a harsh connotation. As a consequence dentists are encouraged to substitute the terms 'rubber dam retainer' and 'rubber dam retractor' for the term 'rubber dam clamp'. Furthermore, and for similar reasons, a rubber dam clamp forcep is better named 'retainer holder'.

OPERATIVE DENTISTRY, 1981, 6, 124–127.

DENTAL EDUCATION

Teaching of Rubber Dam Technique in North America

Most dental schools teach the use of rubber dam,
but many believe that most of their graduates do not use it routinely.

GREGORY E SMITH • JAMES S RICHESON

Summary

A survey of dental schools in North America revealed that, of the 57 respondents, all teach rubber dam technique through the departments of operative dentistry or restorative dentistry and require that the rubber dam be used when placing restorations of amalgam or compacted gold. More than half the respondents require the rubber dam be used for the preparation of cavities for inlays and onlays.

Most of the responding schools allow students to select from two weights of rubber dam, gray being the preferred color. More than half the schools use shaving cream as a lubricant, and a similar number cut the septal rubber before removing the rubber dam. The Young frame is preferred by 58% of respondents while 38% prefer the Woodbury-True holder. Fifty-eight percent recommend wingless retainers. Three-fourths of the responding schools encourage use of a facial napkin. Most respondents believe that most of their graduates do not routinely use the rubber dam.

University of Florida, College of Dentistry, Department of Operative Dentistry, Box J-415, J Hillis Miller Health Center, Gainesville, FL 32610, USA

GREGORY E SMITH, DDS, MSD, professor and chairman

JAMES S RICHESON, MS, DDS, assistant professor

Presented at the annual meeting of the American Academy of Gold Foil Operators, 23 October 1981, in Oklahoma City.

INTRODUCTION

Rubber dam is an important aid in providing a suitable operating field for restorative dentistry (Webb, 1882; Prime, 1938; Ireland, 1962; Brinker, 1972), and the factors contributing to its use have been studied by several authors (Going & Sawinski, 1968; Wolcott & Goodman, 1964). This study sought to determine the status of the teaching of rubber dam in dental curricula.

METHOD

A questionnaire was sent to 68 schools of which 57 (84%) responded. The questionnaire comprised the following topics: which department teaches the use of rubber dam; weights, colors, and sizes of rubber dam; punching holes; lubricants; retainers and

separators; face pads; holders; ligatures; removal of rubber dam; types of operation requiring use of rubber dam; gingival surgery before applying rubber dam; and proportion of graduates using rubber dam.

RESULTS

Who Teaches the Technique of Rubber Dam

All 57 responding schools indicated that a technique of using rubber dam is taught. In most schools the department of operative dentistry or restorative dentistry has primary responsibility for teaching this subject.

Weights, Colors, and Sizes

Of the 56 schools responding to the question about the number of grades, or weights, of rubber dam used, 16 allow only one weight for restorative procedures while 40 allow students to select from two weights.

Of the 16 schools permitting only one weight of rubber dam, 9 permit extra-heavy gray dam; 2 extra-heavy green dam; 2 heavy dam; and 3 medium dam.

The 40 schools permitting two weights of rubber dam use a variety of types (Table 1). Gingival retraction, optimal seal against moisture, and resistance to tearing were the favored reasons for selecting a given weight, regardless of the weight preferred.

Table 1. Combinations of Weight Preferred (40 Schools)

Combinations of Weight and Color	Number of Schools
Heavy and medium	14
Extra heavy gray and heavy	10
Extra heavy gray and extra heavy green	5
Extra heavy gray and special heavy	4
Extra heavy gray and medium	2
Extra heavy green and heavy	2
Heavy and light	2
Extra heavy green and medium	1

Of the schools teaching the use of more than one weight of rubber dam, 20 indicated that their faculty prefer more than one weight, while 19 believe that all of the rubber dams they use meet the criteria for an optimal operating field. Fourteen schools stated that students should not be required to be proficient in just one weight of rubber dam, but should be taught to use the rubber dam regardless of type. Ten schools felt the students prefer the option of two weights of rubber dam and therefore teach their use.

Forty-seven schools prefer gray rubber dam, while 3 schools use gray as a second choice, selecting green as their first choice; 14 schools permit green as a second choice. None prefers light beige, though two schools permit it as a second choice. Eight schools do not care which color is used.

Rubber dam is available in several sizes and shapes. Forty-six schools use 6 in x 6 in dam for almost all cases; one school uses 5 in x 6 in, and five schools use 5 in x 5 in routinely. Three schools use 6 in x 6 in for posterior cases and 5 in x 5 in or 5 in x 6 in for anterior situations. One school purchases dam in rolls and cuts it to a 6 in x 6 in size.

Punching Holes

Several techniques are taught for punching holes in rubber dam. Twenty-eight schools require students to punch it freehand from specified instructions, 7 require students to stamp their own rubber dam, 7 use prestamped rubber dam, and 16 permit students to select from some combination of these techniques.

Lubricants

Twenty-nine schools prefer shaving cream for lubricating the rubber dam. Nine use Vaseline (Johnson & Johnson, East Windsor, NJ 08520, USA), six use Hygenic Rubber Dam Lubricant (The Hygenic Corp, Akron, OH 44310, USA), and four use no lubricant.

Retainers and Separators

Thirty-three schools recommend that wingless rubber dam retainers be used primarily, 6 use winged retainers primarily, 11 use either type of retainer, and 5 do not care which design is used.

Only 31 of 55 responding schools teach the use of mechanical separators. Of these schools, 24 use the Ferrier design, 3 use the True separator primarily, and 4 use the Elliot design.

Face Pads

Of 53 responding schools, 41 use a napkin, or face pad, with the rubber dam. All 41 believe the napkin protects the face from the rubber dam. However, 23 believe the napkin is appropriate only when a strapped type of holder is used, and 11 believe the napkin acts as a wick to suck saliva from the mouth, even when correctly applied.

Holders

A total of 55 schools responded to the question identifying preferred rubber dam frames or holders (Table 2). Several schools permit students to select from two types of holders.

Table 2. Preferences for Rubber Dam Holders (55 Schools)

Type of Holder	First Preference	Second Preference
Woodbury-True	21	4
Young frame	31	12
Cunningham	0	3
Wizzard	1	2
Other	2	0

Ligatures

Some schools teach a technique wherein all the teeth in a quadrant are ligated with floss. Seven schools said they recommend this procedure while 49 said they do not routinely ligate most or all teeth included in the application of the rubber dam.

Removal of Rubber Dam

Most schools use an instrument to cut septal rubber before removing the dam; however, one school does not cut the septa of rubber (Table 3).

Table 3. Instruments Preferred for Cutting Septal Rubber (55 Schools)

Instrument	Number of Schools
Curved crown shears	20
Curved iris scissors	12
Ligature scissors	10
Straight scissors	11
Knife	1
None	1

Procedures Requiring Rubber Dam

All responding schools require that rubber dam be used when placing restorations of amalgam or gold foil (Table 4). A slightly smaller number require that rubber dam be in place when cavities are prepared for these two restorative materials. Only eight schools require placement for polishing of amalgam restorations. Most schools require the rubber dam for all restorative procedures with composite resin, for excava-

Table 4. Procedures Requiring Use of Rubber Dam (57 Schools)

Procedure	Number of Schools
Amalgam	
Cavity preparation	51
Restoration	57
Polish	8
Gold Foil	
Cavity preparation	53
Restoration	56
Composite Resin	
Cavity preparation	52
Restoration	55
Excavation of deep caries / Temporary restoration	52

tion of deep caries, and for temporary restorations.

Schools differ in requirements for use of the rubber dam for cast gold restorative therapy. Only 6 schools require placement of the rubber dam for any part of full crown work, while 36 schools require the rubber dam for preparing cavities for inlays and onlays, but only 12 require it for finishing inlays or onlays before cementation.

Gingival Surgery and Rubber Dam

Thirty-six of 57 schools answered yes to the question, "In class 5 situations do you find surgery required prior to rubber dam placement?" None checked frequently, 22 checked only occasionally, 19 checked almost never, and 3 checked never. In class 2 and 3 situations 7 schools checked only occasionally, 28 almost never, and 9 never. The use of electrosurgery followed immediately by placement of rubber dam and restorative treatment drew the following response: one checked frequently, 13 checked only occasionally, 15 checked almost never, and 13 checked never.

Use by Graduates

Only six schools indicated that they believe most graduates routinely use rubber dam for all restorative procedures. Eighteen (32% of respondents) believe most of their graduates use the rubber dam routinely for operative dentistry but not for crown and bridge procedures. A dishearteningly high number of schools—33 (58% of respondents)—believe most of their graduates do not routinely use the rubber dam.

DISCUSSION

On the positive side, all responding schools teach the use of rubber dam. Since some do not teach its use for all procedures, further studies may now be appropriate to determine what the vapor from the lungs does to amalgam during placement, to etched enamel, to cohesion of gold, or to the set of cement. It is difficult to understand why any conscientious dentist would be willing to take a chance with the dental health of his patients by operating in a poorly prepared, moist, and deleterious operating field contaminated with saliva. The legal protection alone afforded by the rubber dam should support its use.

One reason many graduates may not use the dam is that they were not taught sufficiently well to place it. Some techniques taught may be so impractical that graduates refuse to use the rubber dam. Perhaps educators should review their teaching programs in rubber dam to see if they are simple and complete. Some schools may provide too many choices with the result that students never become proficient in any one of them. The teaching of rubber dam is probably best accomplished in a program of simplicity, singleness of technique, and repetition taught by convinced clinicians.

The rubber dam is essential to the practice of operative dentistry for the isolation of the carious lesion or the defective restoration. It is invaluable for instrumentation of cavities, essential for insertion of restorative materials, desirable when finishing restorations, and essential to the achievement of excellence in restorative therapy. Care needs to be taken by educators to promote the use of rubber dam more effectively, to underscore its needs and its usefulness in dental practice, and to provide graduates with mastery in technique, which can lead to excellence in therapy.

The authors wish to thank Drs Hunter Brinker, William Frank, and Ronald Zokol, who, as members of the Rubber Dam Committee, American Academy of Gold Foil Operators, assisted in the preparation of the questionnaire.

BRINKER, H A (1972) Access—the key to success. *Journal of Prosthetic Dentistry,* **28**, 391-401.

GOING, R E & SAWINSKI, V J (1968) Factors influencing the use of the rubber dam. *Journal of the American Dental Association,* **76**, 340-345.

IRELAND, L (1962) The rubber dam: its advantages and application. *Texas Dental Journal,* **80** (3), 6-15.

PRIME, J M (1938) Fifty-seven reasons for using the rubber dam. *Illinois Dental Journal,* **7**, 197-198.

WEBB, M H (1882) Application of the rubber dam and special clamps, and preparation of gold foil. *Dental Cosmos,* **24**, 458-463.

WOLCOTT, R B & GOODMAN, F (1964) A survey of rubber dam. Part I: instruction. *Journal of the American Academy of Gold Foil Operators,* **7**, 28-34.

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Direct-filling Gold as a Standard

Gold foil remains the standard against which other restorative materials should be evaluated, both in practice and in teaching.

ROBERT B WOLCOTT • HAROLD E SCHNEPPER

Summary

A sample of 123 dental students and recent graduates of the University of California, Los Angeles and Loma Linda University responded as follows to questions about the value of direct-filling gold in the curriculum: over 75% felt that direct-filling gold helped in developing skills for other restorative procedures; over 90% that it developed a more critical evaluation of cavity preparations; over 90% that it led to appreciation of the value of sharp instruments; nearly 80% that it developed facility in observing details; and over 53% indicated that they planned to use direct-filling gold in practice.

University of California, Los Angeles, Center for the Health Sciences, School of Dentistry, Division of Restorative Dental Sciences, Los Angeles, CA 90024, USA

ROBERT B WOLCOTT, DDS, MS, professor and chairman

HAROLD E SCHNEPPER, DMD, MSD, professor, Section of Restorative Dentistry, School of Dentistry, Loma Linda University, Loma Linda, CA 92354, USA

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Every day a man used to walk by a jewelry store, stop, and set his watch by the big clock in the window. One day the jeweler happened to be standing in his doorway. He greeted the man in a friendly way and said, "I see you set your watch by my clock. What kind of work do you do that demands such correct time each day?"

"I'm the watchman at the plant down the street," said the man. "My job is to blow the five o'clock whistle."

The jeweler was startled. "But—you can't do that," he blurted out. "I set my clock by your whistle!"

A wise man checks his sources of information. Only when he is relatively certain that they are correct can he hope to make intelligent decisions.

Facts are tricky things. Two people can look at the same set of facts and arrive at exactly opposite opinions. We tend to believe what we want to believe. One psychologist claims most of us don't look at the facts before we make our decisions. Instead we make our decisions and then look around for some facts to support us. Sometimes the people you depend on for facts may be guilty of the same kind of reasoning, or lack of it. People often tend to be more optimistic about their own efforts than the facts warrant. People may also refuse to face any set of facts that may upset the status quo.

So a very humbling task faces me in trying to convey to you the rationale for looking at direct-filling gold as a standard for doing quality dentistry, a standard for teaching clinical operative dentistry. It is humbling because giants in our academy have addressed this topic before—Gerald Stibbs, George Brass, Arne Romnes, Charlie Stebner, David Grainger, and others whose wisdom and skills have challenged us with their counsel and observations. We have been challenged further in recent years by a growing number who have questioned the virtues of direct-filling gold and sincerely believe that the new amalgam and composite materials provide students and private practitioners with the same need for discipline.

Stibbs (1959) addressed this academy with a scholarly appraisal of the virtues of direct-filling gold. He viewed foil as an "agent for discipline" and was convinced that the discontinuance of its use has been the fault of the teachers of operative dentistry. He speculated that these teachers lack the skill and self-assurance to teach the techniques of foil and the enthusiasm to promote its use. The clinicians who use foil are idealists, Stibbs said, and they are patient workers. They diligently practice their art and submit their results in study club programs for critical analysis by their colleagues. In this way, they train their hands and eyes to do fine things. Furthermore, they train their minds to accept criticism and they benefit from it. A beneficial spin-off from the use of gold foil is the required use of the rubber dam. The operator, Stibbs observed, finds that he becomes "cognizant of the pleasure of working in a saliva-free field" and soon becomes addicted to the use of the rubber dam in other restorative procedures. But he admonished us all to avoid "indulgences in arrogance, rudeness, intolerance, or bigotry" as we extol gold foil's virtues and to "keep in mind that the truly great man is humble; he is confident but not conceited. With so much to learn, there is no room or time for haughty, bloated self-esteem."

In a masterful appraisal of direct-filling gold as a "discipline for service," Brass (1962) first identified this fabulous material as a source of discipline. He observed that nowhere in dentistry can we hope for a greater degree of success in terms of achievement than in the discipline of gold foil, and that this discipline can lead to success in almost every other operative effort. Brass also observed that working with direct-filling gold teaches the discipline of cleanliness. A lack of it can lead to frustration and failure. The rubber dam ensures this cleanliness, but additionally it provides safety or protection to the patient, operator, and assistant, and, in conjunction with gold foil, teaches student and practitioner to be sensitive to the need for orderliness. This attribute, Brass reminds us, is essential to an organized and efficient placement of rubber dam, the preparation of the cavity, and the insertion and finish of a successful restoration.

No member of this academy, nor any student, has learned the techniques without a teacher. Some of us have encountered a genius or two who thought he could do anything in dentistry without any guidance. The ass who thinks himself a deer discovers the truth when he comes to a hurdle. Direct-filling gold can be that hurdle and once the clinician passes it, he is usually able to jump past others. Some of us are fortunate to be those who help make deer out of asses. We delight in teaching what we have learned.

Despite the conscientious efforts of faculty to imbue students with the merits of quality dentistry, we don't always succeed. This frustration finds itself imbedded in the procedures of direct-filling gold, in amalgam, cast gold, and composites. Many

of us wish that we could apply the same philosophy that a mother once did to her young son. After a particularly trying day, she flung up her hands and shouted, "All right, Billy, do anything you darn well please! Now, let me see you disobey that!"

The difficult tasks are not necessarily the ones involving physical and mental labor, but the ones you dislike, or the ones you do not love. There are unpleasant angles to nearly every important job in the world, but there must be an overall love for doing each, else precious time and effort are uselessly wasted. I shall never forget reading about a sign above a construction job that stated: "Builder of Difficult Foundations" (Adams, 1981). That man must have loved that calling or he would not have made a point of advertising the fact!

To gain an insight into the opinions of our students on direct-filling gold, Harold Schnepper at Loma Linda University and I submitted a questionnaire to senior students and in addition, at the University of California, Los Angeles (UCLA), to alumni of the past five years. Both Schnepper and I feel that each of our schools gives students a fairly complete training in the management of all classes of direct-filling gold.

As the following responses show, most students view the demands of direct-filling gold to be an asset to their dental training:

Have the procedures of direct-filling gold helped in developing restorative skills?

	UCLA	Loma Linda
Yes	55	53
No	13	2

Seventy-five percent of the respondents felt that overall procedures in restorative dentistry are benefited by the care and exactness related to procedures of direct-filling gold. They felt that it helped them to become more sensitive to details such as preparation, manipulation, placement, and finishing.

Are you more critical in your own evaluation of cavity preparations?

	UCLA	Loma Linda
Yes	60	52
No	8	3

Over 90% of the students and alumni felt that working with direct-filling gold helped to make them more critical of their own work as they progressed through school. The demands of direct-filling gold for exactness and detail imparted some attributes that carried over into other types of cavity preparation.

Have you learned the value of sharp instruments?

	UCLA	Loma Linda
Yes	60	52
No	6	2

Over 90% of the students and alumni were influenced favorably toward the value of sharp instruments. The details of cavity preparations cannot be achieved with instruments that are dull or improperly sharpened. Students who have been sensitized to the details of good cavity preparations for direct-filling gold learn that sharp instruments are necessary to create refinements.

Do you feel direct-filling gold was an aid in observing restorative detail?

	UCLA	Loma Linda
Yes	50	47
No	18	7

Nearly 80% of the students and alumni felt that the demands of direct-filling gold were reflected in other restorative details. The steps of preparation, condensation, and finish of the direct-filling gold restoration each deserve or demand scrupulous attention to detail if failure or flaws are to be avoided.

Do you plan to use direct-filling gold in practice?

	UCLA	Loma Linda
Yes	35[a]	30
No	33[b,c]	24

[a]Class 3 only
[b]Some planning to specialize
[c]Three not regularly: one on family only

Many students seriously questioned that they would use direct-filling gold in practice. They were probably concerned about amount of time required at the chair, acceptance by patients, and cost. Nonetheless, many have expressed intent to continue to place direct-filling gold, and some plan to use it to a limited extent. Some students plan to enter specialties other than restorative dentistry, and this explains why they will not be using the material.

What reasons do students have as to why schools teach direct-filling gold?

UCLA seniors were also polled for their attitude about the teaching of direct-filling gold during the three years in dental school (see table). Most of the responses were consistent with the previous questionnaire, except for a temperate attitude regarding direct-filling gold as an excellent method of treatment. Of course, most of our students also felt that we teach direct-filling gold to prepare them for examinations of the state boards.

• • •

There is some uncertainty whether direct-filling gold is a standard for restorative dentistry, any more than diamonds are a standard for gems, Rolls-Royce for cars, *New York Times* for newspapers, Frank Lloyd Wright for architects, Bobby Jones for gold, or John Wooden for basketball. Most of us would agree that each of these standards has its equal in quality and performance and that each even has its own frailties. No thing or person is perfect. Neither is direct-filling gold perfect in all hands. The teacher, using direct-filling gold as the material, creates the standard of excellence we are seeking.

It has been said that amalgam, gold castings, and composites demand the same degree of caution and care as direct-filling gold if they are to serve the patient well. It is difficult to renounce this espousal except to remind ourselves that each of those materials has something that compensates for shortcomings it may possess or generate. Amalgam and composites are pliable and adaptable. These characteristics com-

Placement of Direct-filling Gold during Three School Years, UCLA (Rank 1-6 with 1 Highest)

	1	*2*	*3*	*4*	*5*	*6*
Punishment	0	0	1	2	7	32
Tradition passed on by faculty	4	6	11	21	0	0
Teaches care and precision	11	15	5	5	4	2
Waste of time	0	4	3	1	25	8
An excellent treatment	1	9	16	11	4	1
For State Board	26	9	5	2	0	0

pensate, **for a time,** for some shortcomings of cavity preparation and placement of restorations. Direct-filling gold is not so forgiving. Juhani's Law gives further support to this statement: "The compromise will always be more expensive than either of the suggestions it is compromising."

Most steps of preparation for direct-filling gold must be scrupulously performed for the restoration to survive, since direct-filling gold cannot be wiped into a cavity, packed and carved, or cemented to place. Consequently, the demands for detail define a standard we must accept, and if these criteria of acceptability are valid they can be applied equally well to inferior restorative materials to enhance their usefulness. Such logic would appear to justify the use of direct-filling gold as a standard whether or not we are willing to admit it.

The American Dental Association has a closely supervised program on certification of various materials used in dentistry. Alfred Schuchard recently asked me why there has never been an acceptance program for direct-filling gold. One might surmise that it has proved itself in restoring the form of the tooth, resisting transfer of fluid, and exhibiting biologic compatibility with vital hard and soft structures of tooth and supporting tissues.

Charlie Stebner's influence on young clinicians across this country has affected their professional lives because of the emphasis he and his mentor (Charles Woodbury) placed on gold foil and rubber dam. These two procedures, Stebner maintains, seemed to improve the quality of **all** other aspects of their dental practice. In other words, we need only to refer to Peter's Law of Substitution, which tells us that if we look after the molehills, the mountains will take care of themselves. Further development of the case for quality restorative dentistry has been given to me by Lund, who has observed that a significant amount of a general practitioner's time is spent replacing defective dentistry. There is much data to support this observation. Some of the restorations being replaced have existed for a relatively short time, and if greater care had been taken during their placement (from preparation to finish) replacement would be unnecessary. Quality is not important to many clinicians. Lund observes further that failures with direct-filling gold usually manifest themselves immediately (open margins, loss of cohesion, and pitting), whereas with other materials for direct restorations (amalgam, resins) the manifestations of poor preparations, inadequate condensation, lack of proper contour, and finish are delayed. Ralph Werner specifically indicts the resins for their inability to provide reliable proximal contact, their invitation to gingival irritation, and improper contours with subsequent breakdown and recurrence of decay. These shortcomings, Werner observes, are seen by conscientious teachers of operative dentistry, and he deplores the trend of restoring incipient lesions with temporary restorative materials when a more permanent material like gold foil would be more serviceable in maintaining marginal integrity.

In conclusion, Earl Collard wrote me the following, which I feel deserves our attention:

> "Yet after gold every one presses,
> On gold everything hangs"
> —Goethe

If the art of dentistry is ever staged, gold foil will be cast as one of the leading characters. If the full story of dentistry's striving for clinical excellence is ever written, direct-filling gold must be given credit as a primary author. If a perfect taskmaster is ever sought, gold foil must be accorded the honor for it demands concentration, dedication, loyalty, and the striving for clinical superiority. It will not waver in its judgment between the weak and the strong. If an award is ever given for the saving of natural teeth for a lifetime, direct-filling gold must be acknowledged for its share of honors in this beneficent function. Gold in its form as a direct-filling material and the meticulous procedures necessary to develop a superior dental restoration remain the same—yesterday, today and tomorrow.

References

ADAMS, G M (1981) *Bits and Pieces,* **14**, 9.

BRASS, G A (1962) Gold foil—discipline for service. *Journal of the American Academy of Gold Foil Operators,* **5**, 28-36.

STIBBS, G D (1959) An appraisal of the gold foil restoration. *Journal of the American Academy of Gold Foil Operators,* **2**, 20-30.

PRODUCT REPORT

Three Private-label Amalgam Alloys Compared with Name Brands in Physical Properties

Private-label amalgam alloys are not necessarily name brands in a different package.

R JOHNSON · G W MARSHALL, JR
E H GREENER

Summary

Two name-brand (Dispersalloy and Sybraloy) and three private-label copper-rich alloys (Belvacopper, IDE alloy, and Superdent Ternalloy) were analyzed for composition, physical properties, and corrosion. None of the private-label alloys studied had physical properties, chemical composition, or structures identical to name-brand alloys. Belvacopper and IDE alloy had poor resistance to corrosion, large amounts of γ_2 phase, and high creep. Superdent Ternalloy appeared to be an alloy with properties comparable to most copper-rich alloys. Specifically, it had low creep, high resistance to corrosion, and insignificant amounts of γ_2 phase.

Northwestern University Dental School, Departments of Pedodontics and Biological Materials, 240 East Huron Avenue, Chicago, IL 60611, USA

R JOHNSON, DMD, MS, assistant professor, Department of Pedodontics

G W MARSHALL, PhD, associate professor, Department of Biological Materials

E H GREENER, PhD, professor and chairman, Department of Biological Materials

INTRODUCTION

Inflation has become a fact of American life, not only in the home but also in the dental office. With overhead costs escalating, the practitioner has been faced with the need of constantly raising his fees or of finding new ways to lower operating expenses, or both. In response to this need, mail-order supply houses have promoted a number of private-label products. When private-label, copper-rich alloys came onto the dental market, it was thought that they might be similar to or identical with name-brand alloys, merely sold in different packaging. The purpose of this study was to compare the physical properties of three private-label amalgam alloys with two widely used name brands.

MATERIALS

Only copper-rich alloys were tested. The brands are listed in Table 1.

Table 1. Products Tested

	Private Label
IDE alloy	Interstate Dental Exchange Plainview, NY 13137, USA
Belvacopper	Belvac International Industries, Ltd Garden City, NY 11530, USA
Superdent Ternalloy	Darby Dental Supply Rockville Center, NY 11570, USA
	Name Brand
Dispersalloy	Johnson & Johnson East Windsor, NY 08561, USA
Sybraloy	Kerr Mfg Co Romulus, MI 48174, USA

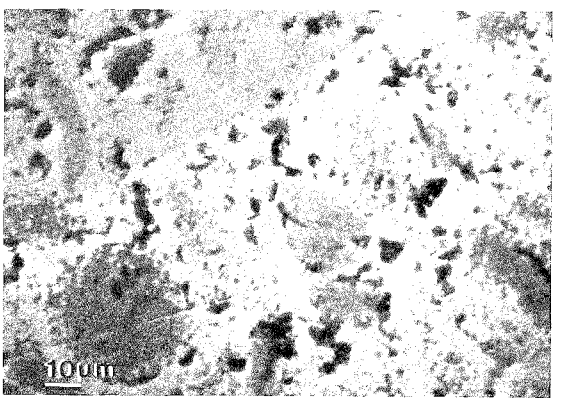
METHODS

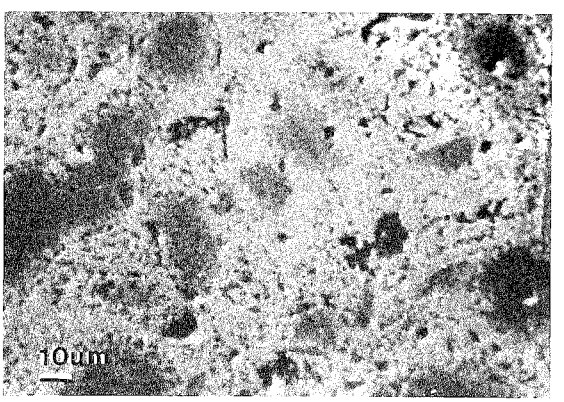
Each amalgam was prepared according to Specification No 1 of the American Dental Association and tested for compressive strength at one hour, dimensional change during hardening, and creep. After storage for seven days at 37 °C the amalgams were also examined for resistance to corrosion by the technique of potentiostatic anodic polarization in Ringer's solution (Sarkar & Greener, 1975). In this technique the rate of corrosion of a particular phase depends only on the potential of the electrode and is independent of the presence of other phases (Greener, 1976). The amalgam was made the anode, and the peak in the density of the current when compared with a standard calomel electrode at −250 mV was recorded. After a minimum of one week the samples of the amalgams were polished for metallography and photomicrographs obtained with the scanning electron microscope (SEM). Also the chemical composition of the specimens was analyzed by energy dispersive x-rays (EDX) as previously described (Marshall & Marshall, 1981).

RESULTS

Composition

Scanning electron micrographs showed that the amalgams of IDE alloy (Fig 1), Belvacopper (Fig 2), and Dispersalloy (Fig





FIGS 1 and 2. *Scanning electron micrographs of amalgams of IDE (top) and Belvacopper (below) showing both spherical and irregular particles. Both amalgams have large cores of Ag-Cu-Sn each with a diffuse, thin-banded zone of reaction. The numerous porosities suggest a γ_2 phase. X500*

3) contain both spherical and irregularly shaped particles, which typify the blend type of copper-rich alloy. Amalgams of

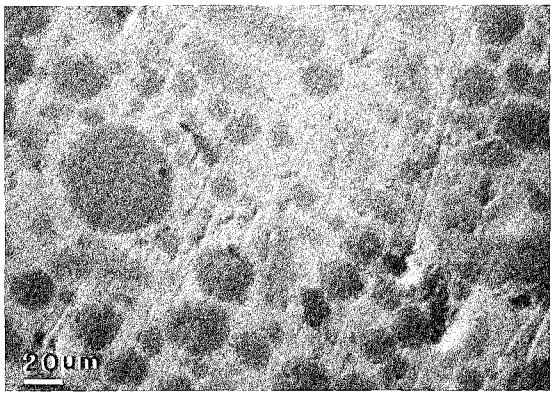


FIG 3. *Scanning electron micrograph of amalgam of Dispersalloy showing both spherical and irregular particles. There are large cores of Ag-Cu each with a very thin homogeneous zone of reaction. No γ_2 phase is evident. X250*

Superdent Ternalloy (Fig 4) and Sybraloy (Fig 5), on the other hand, contain only spherical particles, similar to other ternary alloys. All amalgams contained the γ_1 matrix of silver-mercury (Ag-Hg). All amalgams also had residual particles containing copper and consisting of a core of unreacted silver-copper (Ag-Cu) or silver-copper-tin (Ag-Cu-Sn) and an outer zone of reaction of η_1 phase, copper-tin (Cu_6Sn_5), and γ_1 phase, which varied in appearance from system to system.

Differences were observed in the residual particles of each amalgam. Amalgams of IDE alloy and Belvacopper presented large cores of Ag-Cu-Sn with a diffuse, thin zone of reaction. Numerous porosities could be seen within the matrix of these amalgams and were, from their form, suspected of being γ_2 phase. Amalgams of Dispersalloy had residual particles with a large core of Ag-Cu and a very thin, homogeneous zone of reaction. No γ_2 phase was evident. The residual particles of amalgams of Superdent Ternalloy and Sybraloy were spherical only. Amalgams of Superdent Ternalloy presented many small cores of Ag-Cu-Sn. Some of the areas observed microscopically had no obvious cores, which would seem to indicate that the Ag-Cu-Sn was totally reacted or the plane of section passed through the periphery of the spherical particle. Large, diffuse zones of reaction and particles of elemental copper were spread throughout the mix. No γ_2 phase was seen. Amalgams of Sybraloy had large residual particles with cores of Ag-Cu-Sn surrounded by its well-known and characteristic zone of reaction (Marshall & Marshall, 1981).

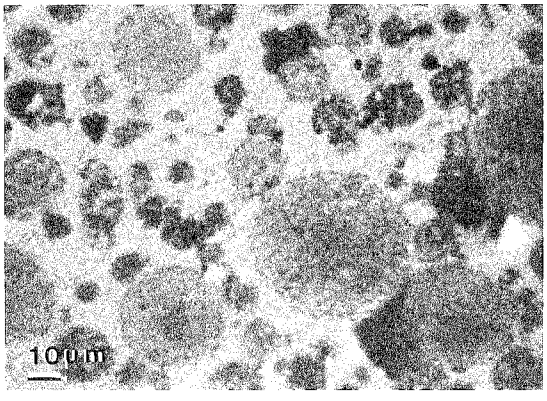


FIG 4. *Scanning electron micrograph of amalgam of Superdent Ternalloy showing only spherical particles. There are many small cores of Ag-Cu-Sn. No γ_2 phase is evident. X500*

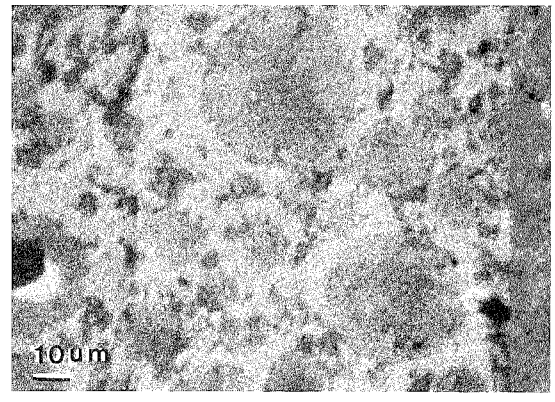


FIG 5. *Scanning electron micrograph of amalgam of Sybraloy showing only spherical particles with cores of Ag-Cu-Sn surrounded by a zone of reaction. X500*

Analysis of the amalgams of EDX disclosed that each residual particle had an unreacted core of Ag, Cu, and Sn of the proportions by weight shown in Table 2.

Table 2. Chemical Composition of Residual Cu-rich Particles from Amalgams at Seven Days (Weight %)

Amalgam	Ag	Sn	Cu
Dispersalloy	68.7 ± 1.5	2.2 ± 0.1	29.1 ± 1.5
Sybraloy	40.7 ± 2.3	26.4 ± 1.3	32.8 ± 2.2
Superdent	37.3 ± 3.0	24.0 ± 2.5	35.6 ± 0.7
Belvacopper	66.1 ± 4.1	18.1 ± 4.0	12.6 ± 1.9
IDE alloy	58.0 ± 4.1	21.8 ± 2.8	16.7 ± 2.0

Cores found in amalgams of Dispersalloy, Belvacopper, and IDE alloy had the highest proportion of Ag. Cores of Superdent Ternalloy and Sybraloy had the least amount of Ag. The small amount of Sn detected in the cores of Dispersalloy is a background error, as Dispersalloy is known to contain 72.8% Ag and 28.1% Cu. The cores of the remaining amalgams had similar quantities of Sn in the range of 18-26%. Cores of IDE alloy and Belvacopper had the lowest proportion of Cu (12-16%). The cores of Superdent Ternalloy and Sybraloy contained very similar amounts of Cu, about 35%, whereas Dispersalloy had slightly less.

Compressive Strength, Dimensional Change, and Creep

The results of the tests for compressive strength at one hour, dimensional change during hardening, and creep are shown in Table 3.

Amalgams of Sybraloy and Superdent Ternalloy had the greatest compressive strengths, whereas the compressive strengths of the remaining three alloys were similar but lower.

Amalgams of Belvacopper, IDE alloy, and Superdent Ternalloy had lower dimensional change during hardening when compared with Dispersalloy and Sybraloy.

Amalgams of Belvacopper and IDE alloy had the highest creep when compared with Dispersalloy, Sybraloy, and Superdent Ternalloy.

Table 3. Physical Properties of Test Amalgams as per ADA Specification No 1

Amalgam	Compressive Strength at 1 hour	Dimensional Change	Creep
	MPa	$\mu m \cdot cm^{-1}$	(%)
Dispersalloy	154 ± 14	7.8	0.62
Sybraloy	344 ± 14	6.2	0.10
Superdent	215 ± 30	2.8	0.33
Belvacopper	138 ± 14	1.8	2.63
IDE alloy	149 ± 17	1.6	2.59

Corrosion

The curves of the density of the current in relation to its voltage are shown in Figure 6. The lower peaks (approximately –300 mV) have been directly related to the amount of γ_2 phase in each amalgam (Sarkar & Greener, 1972). At this potential, amalgams of Dispersalloy and Sybraloy, which have little or no γ_2 phase (Marshall & Marshall, 1979), had values of 48 $\mu A \cdot cm^{-2}$ and 10 $\mu A \cdot cm^{-2}$, respectively. Amalgam of Superdent Ternalloy presented a density of current of 10 $\mu A \cdot cm^{-2}$ and can thus be considered low in or free of γ_2 phase. Amalgams of Belvacopper and IDE alloy had respective densities of current of 1000 and 900 $\mu A \cdot cm^{-2}$. These last two private-label amalgams produced densities of current only slightly less than a comparable, low-copper amalgam (Optaloy, L D Caulk, Milford, DE 19963, USA), which had a peak in density of current of 1600 $\mu A \cdot cm^{-2}$. It must be concluded that the content of γ_2 phase has not been substantially reduced in these formulations.

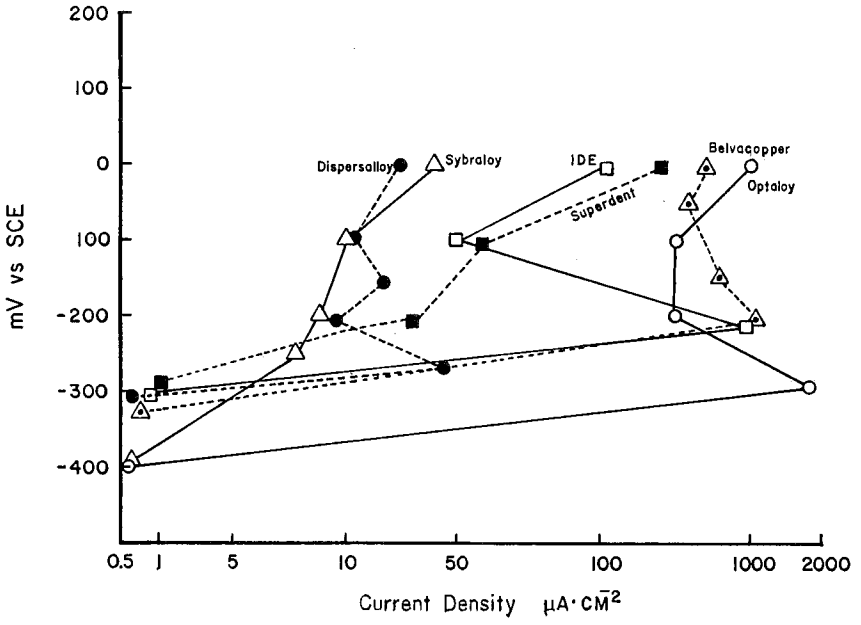


FIG 6. *Anodic polarization of amalgams 7 days old in Ringer's solution at 37 °C*

DISCUSSION

This investigation has not shown these private-label alloys to be necessarily identical with name-brand alloys. Amalgams of Belvacopper and IDE alloy appear similar in physical properties and resistance to corrosion. However, they are not alike in chemical composition or in structure. Amalgam of Superdent Ternalloy is different from amalgam made from either Sybraloy or Tytin, though many of its physical properties, its chemical composition, and microstructure when set are similar to those of Sybraloy.

Of the three private-label copper-rich amalgams, only Superdent Ternalloy appears to be an alloy truly low in or free of γ_2 phase. Amalgams of Belvacopper and IDE alloy displayed values of creep indicative of the presence of γ_2 phase as well as evidence of γ_2 phase in both photomicrographs and tests of corrosion.

The authors acknowledge the assistance of Mr K Szurgot and Ms V Marker in obtaining experimental data.

References

GREENER, E H (1976) Anodic polarization of new dental amalgams. *Journal of Dental Research,* **55,** 1142.

MARSHALL, G W & MARSHALL, S J (1981) X-ray diffraction and SEM/EDS analysis of phases in new dental amalgams. *Journal of Oral Rehabilitation,* **8,** 43–53.

MARSHALL, S J & MARSHALL, G W (1979) Time-dependent phase changes in Cu-rich amalgams. *Journal of Biomedical Materials Research,* **13,** 395–406.

SARKAR, N K & GREENER, E H (1972) Detection and estimation of γ_2 phase in Dispersalloy by electrochemical techniques. *Journal of Dental Research,* **51,** 1675.

SARKAR, N K & GREENER, E H (1975) Electrochemical properties of copper and gold containing dental amalgams. *Journal of Oral Rehabilitation,* **2,** 157–164.

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POINT OF VIEW

Are You a Dentist's Dentist?

M H CARLSON

The dentist is in a unique position to select for his own dental treatment the practitioner who will provide the best care. The observant dentist recognizes the variations in philosophy and aptitudes of his colleagues. The general public, on the other hand, does not have the knowledge to evaluate the qualifications of a dentist.

In the mind of the public, the fact that the dentist has passed examinations required by the state and occupies an office similar to other dental offices signifies that his capabilities are equivalent to those of all other practitioners. The process of selection used by the public commonly consists of social processes—referral by a coworker, friend or member of the family, the yellow pages, or contact with the dentist in an organization such as a church or club. The public often selects a dentist on recommendations such as, he is a nice guy, doesn't hurt his patients, and doesn't charge much for his services.

M H CARLSON, DDS, 11 North 11th Avenue, Yakima, WA 98902, USA

Dr Carlson conducts a private practice

A dentist is in an enviable position when it comes to choosing a dentist for himself. He knows that a consistently high quality of restorative dentistry is not an accident and can recognize certain significant details that are common in the practices of dentists who produce fine restorations. Some of the more obvious signals that convey the quality of practice may be identified.

The routine use of the rubber dam in every applicable situation is the single most useful procedure in controlling quality in restorative dentistry. Simplified application, with frames and clamps of carbon steel, insures a clean, dry, controlled field. Shortcuts have been devised, but none are as simple and effective as the rubber dam.

Dentistry should be a full-time vocation; dentistry as a hobby denies patients the dentist's complete attention. Distractions that lead to compromising treatment reduce the level of care, inevitable when attention is diverted or diluted.

Dedication to excellence in all restorative situations from Class 1 amalgams to complete rehabilitation should be axiomatic. The polishing of amalgam restorations, the clickless finishings of gold castings, proper placement and pressure of contacts, re-

moval of occlusal disharmonies, and care of the periodontium are all important to the concept of total dental health and convey the impression that all the energies and enthusiasm of the dentist are directed toward dental objectives.

The dentist who continues his education by membership in a study club enjoys exposure to clinical critiques that expand his skills. The loss of the finely honed edge is subtle and imperceptible in the setting of the individual office without critiques by peers; criticism and review from colleagues is necessary to maintain the fine edge of skill needed to perform exquisite restorative care. The opportunity to perform for his peers, exhibiting the greatest care and idealism, where time and expense are no object, is the best possible theater in which to demonstrate individual clinical expertise.

Mentors and members of clinically participating study clubs are amazed that more dentists are not interested in membership in such clubs where the opportunity to learn by performing operative procedures is limited only by the participant's imagination. At the same time the traveling evangelists are selling courses dealing with psychological, sociological, and economical awareness, which are important in the holistic approach, but help little in the preparation of cavities. The best learning experience relates directly to clinical skills, for in restorative dentistry the use of the bur and chisel are more important than talking a good game.

In selecting the quality of care for himself, the dentist should expect his practitioner to practice what he preaches. He should have clean teeth and breath and no unrestored angles on anterior teeth long ago fractured and forgotten or missing teeth that have not been replaced by the most efficient and esthetic restorations.

If the dentist selected meets the criteria established by such critical standards, the service received will be what the patient expects and deserves. The ultimate question is, "When all criteria are exhausted, would I wish to be the recipient of my own dentistry?"

DEPARTMENTS

Book Reviews

CLINICAL ORAL PEDIATRICS

Edited by George E White

Published by Quintessence Publishing Co, Chicago, 1981. 412 pages. Illustrated, black/white and color. $68.00

Although this text includes most topics covered in other books on pediatric dentistry, several notable additions have been made. They are the chapters on the relationship of rhinology, otology, laryngology, and oral medicine to pedodontics. They provide excellent reference material.

The chapter by Andreasen on traumatic injuries to the teeth is excellent. His chapter supports his reputation as one of the accepted experts in this field. His classification of the many types of dental injuries is based on a system adopted by the World Health Organization. These injuries are thoroughly discussed and vividly demonstrated with numerous photographs and drawings.

The chapters on periodontal disease and common pathology of the gingiva are valuable as a convenient source of information to the busy clinician. The abundant photographs in these chapters are valuable for educating both parent and patient. It would be particularly helpful to have the pictures in both these chapters in color in the next edition. The references at the end of all chapters provide the reader with access to a wealth of additional information.

Clinical Oral Pediatrics is a publication of high quality. The photographs and illustrations are exceptionally clear and the paper and print are excellent.

Dr White and his contributors have done outstanding work in preparing this text. It should be considered an excellent addition to the pedodontic literature.

JOHN M DAVIS, DDS, MSD
University of Washington
School of Dentistry
Department of Pedodontics
Seattle, Washington

A MANUAL OF FOUR-HANDED DENTISTRY

by J Ellis Paul

Published by Quintessence Publishing Co, Chicago, 1980. 155 pages and 264 photographs. $42.00

For this manual, the author has selected only a segment of what could be written on four-handed procedures. The topics chosen focus upon seating the dentist, the assistant, and the patient; techniques for aspiration; maintaining a clear field; handling and exchanging instruments; and placement of rubber dam. Trays and color coding are introduced, and clinical procedures for amalgam and synthetic restorations as well as crowns and bridges are illustrated and explained.

The more effectively covered areas are techniques of aspiration and handling and exchange of instruments. The value of these sections lies in the clear, concise description supported by photographs to demonstrate both the intended result as well as incorrect application. Alternative methods are given for some procedures, especially in the exchange of instruments.

The reviewer is accustomed to using rubber dam for routine operative procedures and is bothered by the absence of rubber dam in photographs where it would normally be used, and disappointed at the example of the isolation of a single tooth for placing a synthetic restoration in a class 3 cavity. When I remind myself that the purpose of the manual is to focus on four-handed procedures, I can overlook the inconsistencies in technical procedures. The value of this manual can be greatest when readers ignore minor empirical conclusions with which they differ and sort out the largely sound four-handed procedures that are presented.

The strength of this manual is in the consistency among the narrative of procedures, photographs depicting phases of each procedure, and the descriptive legends. Other positive aspects are the presentation of these procedures that represent the author's conclusions or are offered as fact without attribution. Selected, limited reference is made to sources of products or concepts. Areas of weakness are the lack of referencing to related publications and the absence of an index or bibliography. By selecting portions of procedures that seem insignificant (nine photographs with legends to show placement of cavity liner) and overlooking or misrepresenting other essential procedures (use of rubber dam for operative procedures), the author loses credibility in the eyes of the reviewer. Qualifications for the author as an authoritative source are not known or provided. The author expresses a desire to promote principles that focus upon "elimination of those dreadful incapacitating maladies of lumbar and cervical disorders, foot, leg and shoulder pains . . ." Basic orthopedic principles appear among practical applications with an acceptable end result. Although this section provides a unique occasion to cite authoritative sources and documented research in orthopedics to support the author's conclusions, such an opportunity was not chosen.

This publication is suited for a reader who is seeking basic principles of four-handed procedures and is willing to research areas where information is lacking or erroneous. Selected innovative procedures, which may prove to be of value, are offered. The manual is purported to be "thoroughly readable . . . [with] economy of phrase, clearly and simply illustrated." This appears to have been accomplished. Ellis Paul has produced a short manual for practical application and should not be credited with having made a major contribution to the literature.

HARVEY A STRAND, DDS
University of Washington
School of Dentistry
Department of Restorative Dentistry
Seattle, Washington

THE SCIENCE AND ART OF DENTAL CERAMICS. VOLUME 2: BRIDGE DESIGN AND LABORATORY PROCEDURES IN DENTAL CERAMICS

By John W McLean

Published by Quintessence Publishing Co, Chicago, 1980. 512 pages. Illustrated and indexed. $120.00

John McLean is well known to most dentists internationally because of his frequent and excellent lectures and publications on various subjects in restorative dentistry and dental materials. In this new book, which is Volume 2 on the subject, McLean has collaborated with John R Hubbard and Michael I Kedge to bring to the profession a book that is currently without equal.

The book has been written for anyone who is serious about learning more on the subject of dental ceramics. It emphasizes laboratory procedures but also contains numerous clinical subjects such as design of the preparations, design of metal framework, anatomy of teeth, staining of the surface of crowns or bridges before cementation, precision attachments, and other subjects. I have long felt strongly that **dentists** should know more about the laboratory phases of fixed and removable prosthodontics. Unfortunately, in recent years many schools have reduced the time devoted to such subjects. McLean's book should allow interested dentists or technicians the opportunity to upgrade themselves on this subject while practicing their skills.

There are over 700 color photographs of high quality. The table of contents is detailed and the book is well referenced. A very interesting and useful section at the end of the book, "Common Faults in Processing Metals and Porcelain," lists the fault or problem, the page reference in the book, the cause, and the remedy.

Major topics include: reproducing natural teeth in dental porcelain; construction of porcelain veneer crowns; complete porcelain veneer crowns; cast metal-ceramic crowns (design); cast metal-ceramic crowns (construction); special effects in dental porcelain; construction of metal ceramic bridgework; precision attachments for metal-ceramics; building occlusion in dental porcelain; and alumina reinforced ceramics—special applications.

Although McLean has given us a superb, detailed, technical guide to dental ceramics, he might have included more on the frustrating and highly pertinent subject of selection of metal for restorations of porcelain-fused-to-metal and the use of metals such as gold-palladium, silver-palladium, nickel-chrome, and other base metals.

This book has definitely filled the need for a scientific yet practical, technically thorough work on the laboratory procedures in dental ceramics.

GORDON J CHRISTENSEN,
DDS, MSD, PhD
Provo, Utah

Letters

Surfactants

Dear Sirs:

Just had to write and tell you how *Operative Dentistry* has made my life easier. Your recent article on surfactants ("Effect of Surfactant in Reducing Bubbles of Air on Gypsum Casts" by John C Mitchem and Thomas C Waugh, Spring 1981, vol 6, no 2, pp 42–45) was superb. I purchased the Almore surfactant and now pouring impressions in silicone is a breeze!

At a time when almost all of us are having to "tighten our belts" one thought comes to mind. Articles such as that of Mitchem and Waugh **more** than pay for the annual subscription fee.

Thank you!

VAUGHN I IKEMURA, DDS
700 E Walnut Street
Pasadena, CA 91101

PS: I followed the directions on the spray bottle of surfactant and merely used a blast of air to remove any excess surfactant before pouring.

Wit and Wisdom

WORD DIET

Every so often, if we don't watch ourselves, our sentences start putting on weight, our paragraphs begin to develop a paunch. Time to go on a word diet. The

best word diet is to load up on nouns and verbs and go easy on the adjectives and adverbs. If you don't, the next thing you know everything you write is overweight and your letters and memos have to huff and puff just to get up the stairs. The *Peoples Daily,* the newspaper of the Communist Party of the Peoples Republic of China, ran a front-page story confessing that most of its stories have been too long and promising to make the items shorter in the future. The article includes a reader's letter, saying, "The longer the articles, the fewer the people who read them." Incidentally, the *Peoples Daily* story about how long the *Peoples Daily* stories are is real long itself; it takes up a third of the page.

The problem, I'm willing to bet, is that since the *Peoples Daily* is an official publication, there must be various levels of responsibility. There must be different offices that every story has to be approved by. And so, it turns out to be written by a committee. Anything which is written by a committee is bound to be longer. We have the same problem in this country. The US Transportation Department is spending $133,000 at the University of Utah to study the poisonous fumes that are given off by upholstery and other materials in the interior of a car when a car burns. That's a simple enough thing. But the researchers realize that you don't get hundreds of thousands of dollars from the government describing anything in simple terms, and so they call their project—quote—"The Development of Protocol and Combustion Exposure Chamber for Evaluating Combustion Product Toxicity and Smoke Resulting from Burning Transportation Vehicle Interior Materials." And as if that weren't enough, they go on to explain, "Experiments are being conducted examining the effects of changes in the combustion mixture caused by supplementing the passive air flow to the combustion zone of the furnace. Hydrogen cyanide exposures of rats performing the leg flexion avoidance paradigm and walking in an exercise wheel have been made to compare the sensitivity of two end points of incapacitation used to assess combustion toxicity." I think Al Kelly, the old double-talker in show business, would just have loved that.

And at the Pentagon, something else has come up. Two contractors who are bidding on the right to build a certain helicopter for the Army have submitted reams—tons—of paperwork. According to the *Armed Forces Journal,* one of the proposals contains 70 volumes and totals more than 650,000 pages. It is nine times longer than the Holy Bible. The journal says—quote—"If all the proposal's pages were laid side by side, an Army evaluator would have to walk 328 miles round trip just to read it." And here's the real tipoff: the helicopter the bidders want to build will weigh one and a half tons. The paperwork that they have already submitted weighs 2.8 tons. We've had a tax cut. We've had a budget cut. Time now for a word cut.

CHARLES OSGOOD

From *Newsbreak,* broadcast on the CBS Radio Network August 13, 1981. Mr Osgood has published a collection of his topical verse and prose: *Nothing Could Be Finer than a Crisis that is Minor in the Morning* (1979) New York: Holt, Rinehart and Winston.

Announcements

DICK TUCKER DONATES TO JOURNAL

Dr Richard V Tucker has made the first donation for 1982 to *Operative Dentistry.* His generous gift of $1000.00 helps ensure a journal of high quality and integrity without the need to resort to advertising commercial products for financial support. We greatly appreciate his thoughtfulness.

IN MEMORIAM

John Johnson White, DDS

John White died July 15 in Bakersfield, California; he was 77 years old. Dr White, a native of Los Angeles, graduated from the University of California School of Dentistry in 1926 and practiced dentistry for 50 years. He was a past president of the USC Century Club, of the Kern County Dental Association, and of the California Dental Association. He had been a director of the California Dental Service and a recipient of the Paul Harris fellowship. Dr White was a long-time member of the American Academy of Gold Foil Operators and a fellow of the American College of Dentists. He is survived by his wife, Frances, and his sons, John and Warren.

Robert McShirley

Robert McShirley, former president of McShirley Products, Glendale, California, died on September 17 at the age of 81. Bob was well known to the membership of the American Academy of Gold Foil Operators for his sincere interest in improving methods and armamentaria used in operative dentistry. He was in regular attendance at the annual meetings of the AAGFO and a generous supporter of the *Journal of the American Academy of Gold Foil Operators.*

Bob is survived by his wife, Lilian, two sons, Robert Jr and Richard, who have been active with the company for the past two years, and a daughter, Susan.

The Academy of Operative Dentistry and the American Academy of Gold Foil Operators extend to the family their sincere sympathy and are grateful that Bob came our way to influence our understanding and quality of our dentistry.

—Robert B Wolcott

NOTICE OF MEETINGS

American Academy of Gold Foil Operators
Annual Meeting: 4 and 5 November 1982
University of Southern California
Los Angeles, California

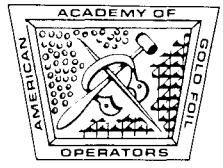
Academy of Operative Dentistry
Annual Meeting: 17 and 18 February 1983
Continental Plaza Hotel
Chicago, Illinois

Press Digest

Expanded duty auxiliary—a threat or a benefit. Rosen, H A (1981) *Journal of the American College of Dentists,* 48, 156-158.

Studies of the number of dentists in relation to the size of the population and its dental needs do not substantiate the need for expanded duty dental assistants (EDDA). The training of dental hygienists might be broadened to increase their productivity, give them a better balance of clinical practice, and make their work more interesting. The insertion, carving, and finishing of direct restorations should remain in the hands of dentists. Not all dentists can be trained to work in teams. Although efficiency is desirable, super efficiency can dehumanize a practice and be counterproductive. The motivation of patients remains a central problem, so the dental team of the future should include behavioral scientists or dentists trained in behavioral science.

OPERATIVE DENTISTRY



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EDITOR
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ASSOCIATE EDITORS
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GERALD D STIBBS

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AMERICAN ACADEMY OF GOLD FOIL OPERATORS
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OPERATIVE DENTISTRY

Aim and Scope

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

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INSTRUCTIONS TO CONTRIBUTORS

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Submit the original manuscript and one copy; authors should keep another copy for reference. Type double spaced, including references, and leave margins of at least 3 cm (one inch). Supply a short title for running headlines. Spelling should conform to *Webster's Third New International Dictionary,* unabridged edition, 1971. Nomenclature used in descriptive human anatomy should conform to *Nomina Anatomica,* 4th ed, 1977; the terms 'canine', 'premolar', and 'facial' are preferred but 'cuspid', 'bicuspid', and 'labial' and 'buccal' are acceptable. SI (Système International) units are preferred for scientific measurement but traditional units are acceptable. Proprietary names of equipment, instruments, and materials should be followed in parentheses by the name and address of the source or manufacturer. The editor reserves the right to make literary corrections.

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References

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

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