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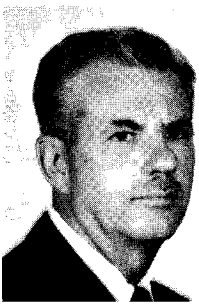

President's Message

Perhaps the leopard cannot change his spots, but our American society can-and is-changing. We want an end to armed conflict, to social injustices, to all forms of pollution and to poverty, and the elimination of disease including dental maladies.

Dentistry has been changing. We are placing an ever-increasing emphasis on prevention—the prevention of dental caries and periodontal disease. The combined agents, techniques and knowledge, perhaps are available to eradicate by far the bulk of these diseases. It is the responsibility of every dentist and his co-workers to teach each other all available preventive measures and to make all of the public aware of this possibility. This must not be a fad, a personal publicity stunt, or a psychological trick. It is not something new or novel. It is not an invention. This is the culminating result of countless dedicated researchers, clinicians and public spirited individuals. The prevention concept, with its resultant impact on the oral health of the public, is and must be a historical milestone in our profession's service to the public.

Prevention of dental caries is fundamental and essential. Unfortunately, it is apparent that we will not be able to totally stamp out dental disease in the near future. Many dentists will still be required to restore teeth that have been despoiled by carious attacks. Our Academy should resolutely stand for prevention, but in addition, we should stand for excellence in restorative dentistry. As we perform our procedures in a superior manner, we aid and assist in the cause of prevention—the prevention of the loss of tooth structure and ultimately of teeth. Though

not as heroic as the prevention of disease, this second type of prevention is just as essential.

This Academy, by standing for improving methods and ways to restore teeth to health, can render a unique service. The inspiration and motivation of our members and their influence on others to place restorations of increased longevity, to restore tooth form and contour and thus prevent periodontal complications, is our goal. Our mission is not ephemeral or "far out." It is to assist more dentists to perform finer operations for more patients. The value of this Academy will be judged by our ability to achieve this mission.

We can point to our accomplishments with pride. They are significant. But, now is the time to increase our efforts. There is much to be done and we have the privilege and opportunity to do it.

Gordon Christensen, D.D.S., M.S.D.

The practicability of compacted gold foils in general practice—a survey*

The use of various forms of compacted gold (gold foil, mat gold, powdered gold, etc.) as therapeutic agents in dentistry has been taught and practiced since dentistry's origin. The American Academy of Gold Foil Operators, which comprises about 0.6% of the dentists in the United States strongly supports the use of these materials.

Conversely, a larger and vocal group of dentists feels that compacted golds should be abandoned not only as a state board requirement, but as a dental therapeutic procedure. Such allegations as the following appear frequently in dental journals and at meetings: 1) "Gold foil techniques kill teeth;" 2) "I would not have a gold foil in my mouth;" 3) "Gold foil is not a practical procedure, and these restorations require too much time and I cannot afford financially to do them;" and 4) "They should eliminate the foil requirements from state boards, these procedures are as traumatic to dentists as they are to patients."

The American Academy of Gold Foil Operators supports compacted gold as a viable treatment in dentistry. What is the difference between the dentists who belong to this Academy and a similar sized group of dentists who do not belong to this organization? The purpose of this paper is to show Academy and non-Academy opinions about compacted golds and to draw some conclusions, objective and subjective, about the feasibility of continued use of compacted golds in general dental practice.

Methods

During the summer months of 1970 a questionnaire was sent to all

This paper was delivered at the annual meeting of the AAGFO in Los Angeles, California on November 6, 1970.

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members of the American Academy of Gold Foil Operators (621 in total). The same questionnaire was sent to all of the dentists in the State of Colorado (1,030 in total). The following questions were asked:

1. Dental school attended _____
2. Years since graduation _____
3. Nature of Practice:
   a. In which state do you practice _____
   b. Approximate population of your town _____
4. Time devoted to practice: Full-time ____, Part-time(%) ____
5. Would you approximate the longevity, in years, of the following restorations, (average quality): Amalgam ____ Cast Gold ____ Compacted Golds ____ Porcelain fused to metal____ Porcelain Inlays ____ Resin, acrylic ____ Resin, composite ____ Silicate Cement ____
6. Have you seen many compacted gold restorations fail? Yes ____ No ____
7. Have you seen many teeth with compacted gold restorations that have required endodontics? Yes ____ No ____
8. What material would you prefer in an incipient maxillary Class III lesion in *your* mouth? _____
9. Are compacted gold restorations practical in general dental practice? _____
10. Approximate the number of compacted gold restorations you accomplish in a day of practice. (Use fractions if necessary) ____
11. Your average fee for a Class V compacted gold restoration. $_____
12. Your average fee for a Class III compacted gold restoration. $_____
13. How many minutes do you require for a Class V compacted gold restoration? _____
14. How many minutes do you require for a Class III compacted gold restoration? _____

The dentists were asked to avoid placing their names on the answer sheet. The questionnaires sent in by Academy members were segregated from the Colorado dentists by a color coding system. *324* replies or *52%* were returned by Academy members. *407* replies or *40%* were returned by Colorado dentists.

The answers to the questions were compiled, analyzed statistically, and conclusions were made on the basis of the answer.

Results And Discussion

The answers to each question will be reported and the information discussed in this section. When interpreting the results of the survey

it must be considered that the results represent only that percentage of the total population, previously indicated, which responded to the questionnaire. This group of respondents undoubtedly has some biased opinions. However, one may speculate that the respective respondents had a near equal number of positive and negative reasons for returning the answer sheet.

Questions 1-4 will describe both populations of dentists to allow the reader to draw conclusions on the basis of what he knows about each group. Questions 5-14 will help to answer the question of the feasibility of compacted golds in general practice.

1. Dental school attended

In Colorado, seventy percent of the respondents graduated from 8 schools listed in order of decreasing numbers of dentists: Nebraska. Creighton, Missouri, Northwestern, Marquette, Minnesota, St. Louis and the University of Denver. The remaining thirty percent graduated from 32 other schools. Therefore, forty schools were represented in the Colorado survey. Although the midwest was the most strongly represented area, the west coast was a weak second with 6% of the respondents.

For the AAGFO, sixty percent of the respondents were from seven schools listed in order of decreasing numbers of dentists: Oregon, Washington, Southern California, Nebraska, Creighton, Northwestern and Loyola. The remaining forty percent graduated from 36 schools in the United States, Canada and England. 43 schools were represented.

This information appears to substantiate the belief that dentists graduating from schools which teach compacted golds have a greater tendency to join the American Academy of Gold Foil Operators. It also shows that most of Colorado's dentists have either attended midwest schools, or have moved to Colorado from the midwest.

2. Years since graduation

Colorado dentists responding had been out of dental school for an average of 15 years (s. d. 11). AAGFO members reported that they had been out of school an average of 22 years (s. d. 12). Although the standard deviations of both groups are high values, the statistics still infer that the Academy members have been out of school longer than Colorado dentists.

3. Nature of Practice

State. Of course, the Colorado dentists practice in Colorado but the Academy dentists form an interesting pattern. Sixty percent of the respondents, in order of decreasing numbers of dentists, practice in California, Washington, Nebraska, Oregon, Texas and Michigan. The

remainder are scattered throughout most of the states, Canada and several other countries.

Population of cities. The average size town in which the groups practice would be meaningless. The dentists in Colorado practice in all size cities from less than 1,000 to 1 million. The same is true of Academy members, except the cities range to 8 million. No relationship was found between size of city and membership in the Academy or number of compacted gold restorations accomplished routinely.

4. Time devoted to practice

The two populations differ somewhat on this point. 98% of the Colorado respondents are in full time general practice while only 74% of the Academy members are in full time general practice. The majority of the other 26% of the Academy members are in academic dentistry and practice 10-50% of the time.

5. Longevity of Restorations

To place the estimated longevity of compacted restorations in the context of other restorative therapeutic agents, the dentists were asked to estimate the average longevity of various types of restorations. The object of the question was to determine how long these dentists thought an average quality restoration would serve. This question was not intended to show the maximum longevity of a restoration. A few dentists objected to the question stating that the average life of a restoration is not what can be expected if the restoration is done well. I am in full agreement of that point. However, the question was meant to show the status quo in restoration longevity and not the ultimate possibilities.

Certain other problems are inherent in this question. Compacted gold restorations are usually placed by fairly competent dentists who use a rubber dam routinely, while amalgam is abused by many dentists. Therefore, the average life of amalgam and some other materials, as indicated in the survey may be shorter than their possible longevity if placed carefully while using a rubber dam.

Table 1 shows the longevity of restorations as estimated by the two groups of dentists. To draw statistical conclusions from these estimates or opinions would be foolish. However, trends in the statement of opinions are quite clear in Table 1. Both the biased group (AAGFO) and the unbiased group (Colorado) have estimated compacted gold restorations to be long lasting in relation to the other treatments.

Note the similarity between the estimates of the two groups on most of the categories of restorations. When considering the high standard deviation scores, the only category in which the groups appear to disagree in is the area of porcelain fused to metal restorations.

Table I. *Estimated Longevity in Years of Average Quality Restorations*

Treatment	Colorado Dentists N = 407		American Academy of Gold Foil Operators N = 324	
	x	s. d.	x	s. d.
Amalgam	14.06	5.76	13.52	5.76
Cast Gold	20.94	7.96	20.08	8.35
Compacted Gold	21.80	9.61	26.07	11.52
Porcelain Fused to Gold	26.56	10.38	16.65	8.07
Porcelain Inlays	12.01	7.03	13.64	6.80
Resin Acrylic	4.38	6.83	6.16	2.43
Resin, Composite	8.01	3.71	6.40	2.53
Silicate Cement	5.10	2.36	6.28	3.35

The primary reason for this question was well shown — unbiased dentists still rank compacted gold restorations very high in relation to other available treatment in 1970.

6. Failure of compacted gold restorations

When asked if they had seen many compacted gold restorations fail, 41% (Colorado) and 33% (AAGFO) responded yes. The objective of this question was to demonstrate any large difference in opinion between the two groups. There was none.

7. Endodontics and compacted gold restorations

When asked if they had seen many teeth with compacted gold restorations in them that have required endodontics, 30% (Colorado) and 19% (AAGFO) responded yes. Although the answers are very empirical in nature, it is interesting to note that the group less experienced with compacted golds has noticed more traumatic difficulty than the experienced group.

This difference may reflect the prejudice that some dentists and dental schools have concerning the alleged traumatic nature of the compacted gold operation. Stibbs[1] study indicates that there is little clinical problem related to pulpal death caused by compacting gold into teeth. Langeland[2] has shown histologic pulpal damage but this damage does not commonly show up clinically according to decades of empirical clinical evidence.

8. What would you prefer in an incipient maxillary Class III lesion in your own mouth?

This personal question demonstrates the value rating of compacted gold as a restorative procedure to these groups of dentists. Slightly over a majority of dentists in Colorado, 56%, preferred to have other materials than compacted gold in their own mouths (composite resin 48%, silicate 6%, other 2%), while 44% would still prefer some form of compacted gold. The Academy members exhibited the expected profile; 95% prefer compacted gold and 5% other materials, mainly composite resin.

In my personal opinion, this relative lack of interest in compacted golds by Colorado dentists demonstrates a lack of understanding of the potential of this treatment. The physical properties of compacted golds provide near lifetime service, and new techniques allow them to be placed quite rapidly. From the replacement of restorations to lifetime service. Obviously, supply salesman are more convincing than dental educators.

9. Are compacted gold restorations practical in general dental practice?

"Yes," say 66% of the Colorado dentists and 94% of AAGFO members. Why is there a difference between the groups? Academy members would probably conclude that the difference reflects a lack of understanding on the part of some of the Colorado dentists. Some Colorado dentists say that the procedure is slow and that it is not feasible financially. These subjects will be discussed later in the paper. Many fine publications[3-7] concerning the practical clinical use of these materials are available and should be reviewed by the reader.

10. Approximate the number of compacted gold restorations you accomplish in a day of practice

Large standard deviations make these means quite general, but they are at least indicative of the numbers of compacted gold restorations being accomplished. The 195 Colorado dentists (48% of Colorado total) who do compacted gold restorations routinely reported a mean value of 0.23 (s. d. 0.40) restorations accomplished per day of practice. The AAGFO members reported 0.76 (s. d. 0.79) restorations accomplished per day of practice. It appears that individuals in each group probably accomplish somewhat more or less than one foil every other day of practice. However, several dentists in the Academy reported as high as five restorations per day.

These answers point out some areas for consideration and possible concern. 1) Treatment with compacted golds does not comprise a large portion of dental practice even within the Academy. However, these materials allow a fine treatment for a few dental patients. 2) More effort should be exerted toward introducing the use of compacted golds into greater numbers of dental practices.

11-14. Fees for compacted gold restorations

I feel obligated to defend the use of compacted golds on a financial basis because this has been a major consideration which has kept this treatment out of many practices. As taught in some dental schools, these restorations are tedious and time-consuming at best. New procedures and materials are changing this situation, but some dentists still argue against any form of gold that is not pure gold foil. I personally feel that attitudes such as this have retarded the use of compacted golds.

Gold is gold! If compacted and finished well, all types of pure gold should have comparable longevity characteristics. The statistics portrayed in Table II include all types of pure gold used in dentistry. The gross hourly fee level for both groups fall significantly higher than the average gross hourly fee levels for dentists in most parts of the United

Table II. *Fees and Clinical Time For Compacted Gold Restorations*

		Time For Class V (min)		Fee For Class V $		Gross Hourly Fee $	Time For Class III (min)		Fee For Class III $		Gross Hourly Fee $
		x	s. d.	x	s. d.		x	s. d.	x	s. d.	
Dentists N = 407		42.45	13.29	32.72	12.68	46.21	66.89	22.69	46.47	16.18	41.68
AAGFO N = 324		65.79	20.75	44.55	15.81	44.26	68.57	26.44	62.46	21.29	54.65

States. This brief and candid documentation and discussion of fees for compacted gold restorations should demonstrate well the financial feasibility of these restorations in general dental practice.

Summary And Conclusions

The empirical surveyed opinions of two groups of dentists — one biased toward compacted gold restorations, and the other unbiased in this regard have influenced the author toward the following conclusions. 1) Schools teaching compacted gold procedures are a dominant factor in influencing the use of this treatment in dental practice. 2) The American Academy of Gold Foil Operators members are older than another near equal size random group of dentists. Encouragement of the recruitment of more younger dentists may be desirable in this Academy.

3) Both biased and unbiased groups of dentists look upon compacted gold restorations as one of the longest lasting types of restorations. 4) Both groups agree that there are some failures of compacted gold restorations. However, the majority of each group have not seen many failures due to all possible causes.

5) Academy members would overwhelmingly prefer compacted gold in incipient maxillary Class III lesions in their own mouths, while only 44% of the Colorado dentists preferred these restorations. 6) The majority of both groups (66%, Colorado, 94%, (AAGFO) state that compacted gold restorations are practical in general dental practice. 7) Although relatively few numbers of these restorations are completed each day, statistics point definitely to the financial feasibility of compacted gold restorations.

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R. V. Williams, Jr.

As the manufacturer views gold foil

Direct filling gold, and particularly mat gold for which our company is known, is a very important line of products for us as a precious metals manufacturer. This statement might be challenged by our production foreman, because he knows it is casting gold and not foil that keeps his fifty-man work force busy. The importance of foil to our business might also be challenged by our head accountant who realizes that while foil sales have been going up during the last years, the foil market simply does not have the potential to be a large revenue producing factor in our business. How then does a manufacturer like Williams Gold Refining Co., Inc. attach major importance to gold foil?

The first reason is a personal one. Our company was founded by A. D. Williams in Kansas City in 1906. Mr. Williams along with his father, John Scott, his brother, Malcolm, and his small son, R. V. Williams, had all been in Alaska in the Klondike gold rush of 1898. They knew the rigors of the Chilhoot Pass and the adventures of one of America's last frontiers. When they left the Klondike for Midwestern United States, with a fair poke from the Williams gold claim on Hunker Creek, my grandfather formed a partnership with another individual, who was bought out several years later. That two-man company produced a unique crystalline pure gold precipitate for dentistry. It was called mat gold.

So you see, the very roots of our company grew from the field of direct filling gold. Quite apart from the sentimental attachment involved, there are additional sound business reasons for our interest in this field of foil. As a company dedicated to supporting better dentistry,

*Presented at the Annual Meeting of the American Academy of Gold Foil Operators, November 5, 1970, Los Angeles, California.

Mr. Williams is Vice President of Sales and Marketing, Williams Gold Refining Company, Inc., Buffalo, New York.

we realize that today there is still no dental restoration superior to a well placed gold foil. It is fair to say that gold foil operators, by their very dedication to this type of work, embody the same philosophy of dentistry which we endeavor to serve as part of your dental health team. You are the leaders of operative dentistry. You are innovators, continually seeking self improvement. You are teachers, continually sharing your knowledge and inspiring and motivating others. By working with men like you, it is our corporate goal to share in our field the leadership which you exemplify in yours. From contact with men like you, we derive the stimulation necessary to avoid self complacency, and to seek improvement in the products and services we make available to dentistry. What our manufacturing and accounting departments might not realize, without having the benefit of an overall perspective of dentistry, is that the field of gold foil is symbolic of an attitude of rendering the best possible service in one's chosen profession — which is in reality the job to which we should all be dedicated as members of the dental health team.

The technical area in which I might be best qualified to make a small contribution to your program is in the manufacturing process of mat gold. This procedure, which is proprietory in nature, has never been discussed openly before. However, feeling that a more thorough knowledge of materials can often enhance their use in practice, we will outline the procedure of turning 24K gold into a useful product for dentistry.

The manufacture of mat gold is basically a process of powder metallurgy. Initiated over sixty years ago by Williams in the dental field, the technology of powder metallurgy has only become general knowledge in the last twenty-five years.

It is this type of technology that made possible Chrysler "Oilet Bearing" that did not have to be oiled. In this procedure, brass is compacted and sintered, a heat-treating process described later, with graphite, allowing graphite to become mashed into the brass porosities. Today, parts which are difficult to machine are often made with powders which are sintered, and then hot or cold forged.

Many exotic precious metal alloys used in the electronics field result from powder metallurgy. For example, Williams has a patented procedure for manufacturing gold boron. Whereas ordinary melting procedures result in the boron floating out of the gold because it is not soluble, the boron is put into the gold by mixing the powders, which are then compacted, sintered, rolled and stamped into small parts.

Powder metallurgy can be simply described as a three step procedure: 1) Manufacture of the powder, 2) Quality control testing of the powder, and 3) Making of parts from the powder by; preliminary shaping, sintering, and final shaping or sizing by compression. All these steps are employed in the manufacture and use of mat gold.

Manufacture of Powder

Pure gold of commercial fineness is cast into a solid bar. The bar is then suspended in an electrolytic cell, where it acts as the anode, and a thin gold sheet to carry the electrical current is added to act as the cathode. These are connected to a source of electricity through rods at the top of the tank. The liquid in the cell, or container, is an electrolyte which conducts the electricity. The electric current causes the gold to dissolve away from the anode and precipitate as gold crystals at the cathode. In the process, impurities are kept in solution, so the precipitated gold is more pure than the original bar. The end product, 99.99+% pure, will contain only approximately 100 parts per million impurities, which are minute trace elements of copper and silver.

After the anode has been completely dissolved, the cell is dismantled and the gold powder is removed, washed and dried. Its magnified shape is a unique, random crystalline structure. It should be pointed out this shape is quite different from the nodular shape of other commonly known gold powders, which are chemically rather than electrolytically precipitated. Both are basically pure gold powder, but manufactured by different means.

Quality Control Testing of Powder

One of the primary pieces of testing equipment required for powder metallurgy is a "Sonic Sifter." This is an apparatus to measure the range of particle sizes of the gold powder. Inside the machine is a stack of six sieves. Each sieve has special size openings from large for the top sieve to very small for the bottom sieve. When the gold powder is placed on the top sieve and the instrument started, a vibrating air column causes the gold to be separated like bouncing kernels of popcorn into various particle size-fractions according to the sizes of the sieve openings. These fractions are weighed to get a distribution of particle sizes in the batch of powder. The distribution must be within the manufacturing specification to be acceptable for mat gold. Particle size distribution has a definite effect on the working properties of the end product.

Another test instrument is the bulk density apparatus. Here, a specific amount of powder is measured out in the graduate at the side of the instrument. This powder is placed in the top funnel shaped piece, and it is allowed to flow down into the cup below. When the cup is filled to overflowing, a spatula is used to push away the powder until it is flush with the top of the cup. The powder in the cup is weighed to get the bulk or apparent density. This is important to insure that the strips of mat gold will contain a uniform amount of particles from batch to batch.

Still another test requirement calls for a measurement of average

particle size. The instrument for this test is a "Sub Sieve Sizer." We know from screening what the largest particle size is and we can surmise that the smallest particle size approaches zero. This instrument gives us the average of all particles.

You may note that all of these tests are primarily for obtaining knowledge about the particle sizes and the distribution of sizes. This is important to know because it affects the uniformity of amount of gold powder, and thus the density of a given piece of the final mat. As a matter of interest, the average particle size of mat gold is 10 to 12 microns.

Making of Parts From The Powder

Preliminary shaping. The preliminary shaping in the case of mat gold involves making the strips. These strips measure 109 m.m. in length, and are formed and placed on a heat resistant sheet of lithium aluminum silicate.

Sintering. Sintering is a process of heat treatment involving both time and temperature. Since this step is vital to the creation of a successful product, I will review it briefly with you. The general principle can be visually illustrated with relative ease. Let us begin with a series of gold balls in a combustion boat. With an increase in temperature, we find that the balls start to connect to one another, even though they have not reached a melting point. The atoms of gold migrate where the balls were in contact, until actual union takes place. Time and temperature will cause this process to continue to the point that no voids are left between the balls, even though their original shape remains recognizable.

The process of sintering, during which time a certain shrinkage of the original strip takes place, is vital to the working properties of mat gold. It leaves the original structure in a more cohesive type mass. This mass has a measurable density, as taken by a Knoop indenter.

It is possible to over-sinter a powdered gold, either in terms of time or temperature. The result may be difficult to detect with the naked eye, but again it is measurable on the Knoop indenter. Such a processing error will cause additional shrinkage and render the material harder and much more difficult to condense.

It is worthy to note that this sintering process can be continued in the dental office on a tray annealer. We recognize that a chair-side heating procedure is necessary to drive off surface contamination. There remains some speculation among research authorities as to the nature of the contamination — the possibility of sulfides from the air-oxygen-water vapor is among the theories which have been advanced. Nevertheless, we know that such contamination exists because the gold will not cold-weld if the contamination is not removed. If the gold is heated at too high a temperature or for too long a period during the

decontamination procedure, the sintering process may continue until the material is no longer usable. It may be for this reason that many operators today use an alcohol flame rather than exposing the material to prolonged heat on a tray.

Final Shaping. The last step of the powder metallurgy procedure is in the hands of you, the operator, as you weld this unfinished material into a restoration of lasting beauty in the mouths of your patients. This part of the procedure you are a great deal more competent to comment on than I.

A closing note is indicated to complete the picture of the manufacture of the mat gold family. Mat Foil is basically mat gold with a thin foil overlay, the main benefit of which is probably in the practical manipulation of the material. It is manufactured much like ordinary gold mat.

Electraloy R.V.*, the new alloyed filling gold announced at this time last year, does differ in some respects from mat. The brainchild of my father, R. V. Williams, with assistance from the staff of the School of Dentistry, University of California at Los Angeles, this product involves the alloying of pure gold with calcium prior to the application of the powdered metallurgy principles.

While the results of this work are still undergoing research evaluation, early indications both clinically and scientifically are extremely encouraging. The particle size distribution and sintering are modified to some degree to render a product of greater initial density which can be more rapidly condensed or cold-welded, and it too has been covered on top and bottom with an overlay of foil for handling convenience.

Summary

The foregoing has been the thoughts of one manufacturer on gold foil. Williams considers it a key product line, not necessarily because of sales volume, but because of corporate and family involvement, and because of the type of dentist and dentistry involved in the use of direct filling golds.

I have tried to present a simplified picture of the manufacturing process of the mat gold family of products, the filling golds with which the Williams name is most frequently associated. It is my hope that I have provided you with better understanding of the materials, thus contributing to the concept of a dental health team serving the best interests of the general public.

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A surgical technique for tissue control with class V restorations*

Carious and abraded or eroded lesions in the gingival third of the facial and lingual tooth surfaces often present management problems of the gingival tissue. The lesions may extend deep into the gingival sulcus and unless preventive measures are instituted before restorative procedures, exudate or hemorrhage will obscure vision and may prevent: 1) removal of all caries, 2) proper cavity preparation, 3) dry placement of the restorative material, and 4) adequate finishing procedures.

When attempting to accomplish these procedures serious injury may also occur to the gingival tissue and the cementum, resulting in altered gingival height and/or an apical progression of the epithelial attachment. Isolation of the operative area with a rubber dam is desirable to aid in the accomplishment of good restorative procedures and the prevention of these possible injuries. Access to the gingival margin area, however, is usually limited, and isolation procedures are difficult or impossible to perform without trauma to the gingiva.

Very little information has been described in the literature concerning gingival tissue control during Class V restorative procedures. One author[1] describes the "stretching" effect of the gingiva by use of a #212 clamp (Ferrier #212 Gingival Clamp, S. S. White Co., Philadelphia, Pa.) for a few minutes and then moving the clamp apically. Krajewski, *et al*,[2] report on the hazards to the periodontium during rubber dam procedures. Drucker and Wolcott[3] have described several approaches to surgical tissue retraction.

Many times, routine rubber dam isolation with a Class V gingival clamp will provide adequate retraction and protection. However, for

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those difficult occasions which often occur, clinicians may seek some other procedure such as: 1) chemically treated retraction cord, 2) electrosurgery, 3) gingivectomy, or 4) gingival flap.

The purpose of this article is to describe a simple surgical gingival flap technique which will allow adequate isolation and to discuss the indications and contraindications for use of this procedure.

Rationale

If a clamp is used to retract the gingiva an appreciable amount, damage of a permanent nature may occur in the dentogingival junction area. It is believed that the epithelial attachment is a biologic seal rather than a strong mechanical bond to the tooth[4]. Because of this relative mechanical weakness, pressure or apical force is likely to separate the attachment epithelium from the tooth resulting in a deepened crevice or pocket formation. Also, the gingiva has a relatively small capability of expansion due to its small elastic fiber content[5].

The access gained in the sulcular area by "stretching" the gingiva with a clamp is likely to be a result of the tearing of gingival collagen fibers. Since this trauma is in a sense uncontrollable and occurs in unexpected locations, healing is often less than ideal. Therefore, surgical access may be desirable because the healing of surgical flaps is usually a predictable procedure[6] with a good prognosis, and the required amount of operative access may be obtained routinely.

Indications and Contraindications

The periodontal status of the patient should be satisfactory before restorative dental procedures are initiated. Specifically, the gingiva should be free of clinical inflammation and should be of an adequate vertical width to withstand the forces of mastication. An optimum oral hygiene level is highly desirable as a preventive measure for both caries and periodontal disease.

A flap approach for access to a cavity is generally considered in the following circumstances: 1) when caries extends apical to the gingival margin and presents an access problem for restorative procedures, 2) if supragingival caries are located in such close proximity to the gingival margin that satisfactory restorative procedures are difficult or impossible, 3) when the width of the attached gingiva is insufficient to allow the use of a gingivectomy to expose the carious lesion.

A flap is not indicated if other access procedures can be performed without undue trauma to the periodontium. A flap as described in this paper is definitely not indicated if attached gingiva is absent at the proposed surgical site (other periodontal surgical procedures are more suitable in this situation and should be performed to gain the necessary amount of attached gingiva).

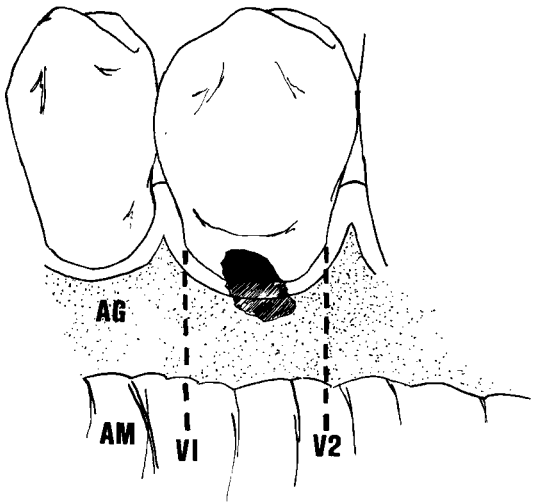

Fig. 1 — Flap design for restoring a single tooth. Vertical incisions (V1 and V2) through the attached gingiva (AG) and alveolar mucosa (AM).

Method

After adequate anesthesia has been obtained, two vertical incisions are made through the gingiva with a scalpel blade at the line angles of the tooth to be restored. Care should be taken not to incise the papilla vertically in a bucco-lingual direction. Avoiding the interdental papilla is important to prevent unfavorable tissue contours postoperatively. Each incision should extend from the gingival margin to a point apical to the mucogingival junction (Fig. 1).

An incision is next made in the gingival sulcus. The flap is reflected from the underlying tooth and bone with a periosteal elevator, taking care to avoid tearing. The mobility of the tissue flap is increased when the reflection is carried apical to the mucogingival line, and therefore complete mobility in a vertical direction is provided.

If adjacent teeth are involved, a longer flap design including those teeth may be used. Place a vertical incision at the distal line angle of the most distal tooth and another at the mesial line angle of the mesial tooth. Incise the intervening papilla mesio-distally with a vertical incision along a horizontal line just occlusal to the level of the caries. Make an incision in the sulcus and reflect the flap (Fig. 2). Scrape the reflected surface of the flap in the margin area with the scalpel blade

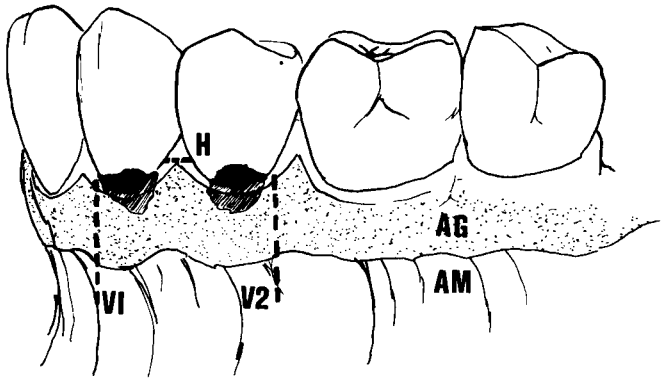

Fig. 2 — Flap design for restoring adjacent teeth. Vertical incisions (V1 and V2) through the attached gingiva (AG) and alveolar mucosa (AM). The horizontal line (H) indicates the path of a vertical incision through the interdental area.

to remove the remaining sulcular epithelium and remove any tissue tags adhering to the root surface with a curette.

When surgical exposure of the lesion has been completed, proceed immediately with isolation of the area. The #212 clamp is the retraction device of choice and should be modified ready for use. The instrument must fit the tooth both buccally and lingually and be under control of the clinician both during its placement and removal. This is necessary to avoid possible further trauma to the dentogingival tissues. The clamp should be annealed to remove its stiffness by heating to redness over a flame and allowing it to bench cool. Brass[7] excellently described the necessary modifications.

After selection and trial of the modified gingival clamp, the rubber dam (extra-heavy gauge) is applied to the area exposing several teeth on either side of the surgical area. The hole for the tooth with the lesion should be 1-1.5 mm facial to the line of the other holes to allow for adequate exposure of the lesion. The gingival clamp is carefully positioned to the desired level and stabilized with low heat compound. Stabilization is of utmost importance to assure a fixed access to the field of operation, to prevent possible trauma to the cementum and dentin, and also to afford a substantial finger rest for the clinician.

When the restorative procedure has been completed and the area cleaned thoroughly, the gingival clamp and rubber dam are carefully removed.

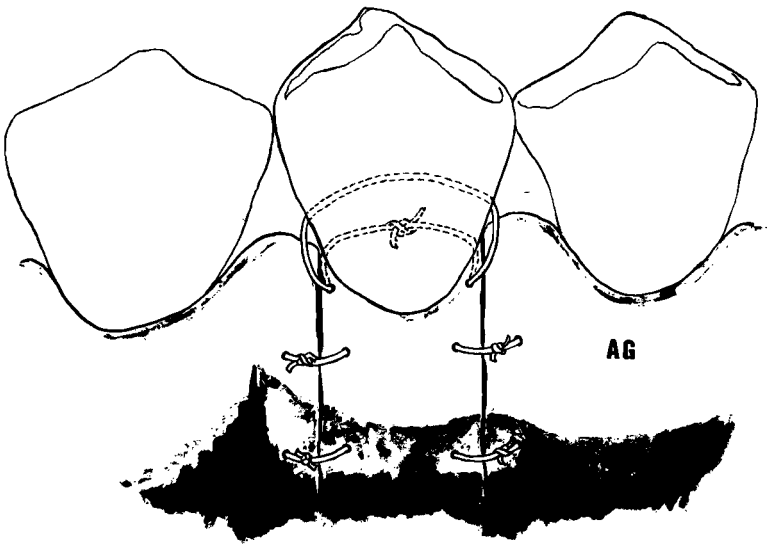

Fig. 3 — Sling suture around the tooth securing the flap in its selected location. The sling suture is tied on the lingual of the tooth. Vertical incisions are closed with interrupted sutures.

The mobile flap may now be repositioned at any height that is compatible with gingival health and then secured in the selected location with a 4-0 silk sling suture; the incisions should be closed with suitable sutures (Fig. 3). Firm pressure should be applied to the flap with warm moist gauze for a few moments to prevent the formation of a large blood clot under the flap. A periodontal dressing is desirable but not required.

Any post-operative discomfort may usually be controlled with mild analgesics. The patient should be advised to avoid trauma to the area during the initial portion of the healing period and to maintain good oral hygiene. The sutures may be removed 7-10 days post-operatively.

Summary

A surgical flap technique to aid in tissue control with Class V restorations has been presented. The attached gingiva should be of adequate vertical dimension and be free of clinical inflammation. The use of vertical incisions extending into the alveolar mucosa increases the mobility of the flap and allows selective repositioning after the restorative procedures have been completed. Isolation of the area with rubber

dam and use of a modified and stabilized #212 Class V clamp is recommended.

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David A. Grainger, D.D.S.

Gold foil—its future in dental education and state boards

The importance of thinking beyond the routine of professional life is probably the greatest responsibility facing the leaders in society today. Dentistry, the discipline of Operative, and gold foil are not excepted. Many of the ideas expressed in this paper have been taken from two books by John W. Gardner and adapted to the practice of Operative Dentistry. Those books are "Excellence, Can We Be Equal and Excellent Too?"[1] and "Self Renewal."[2] They should be read by all who contemplate a dynamic future for our profession.

Gold foil is in trouble; not only in the dental schools, but in state board examinations. Gold foil, synonymous with excellence, has been used as a successful restorative material for years. The most noble of metals, it withstands tarnish and corrosion, and effectively resists the environment of the oral cavity for a lifetime. But gold foil is being questioned, seriously questioned, as the fundamental basis for developing and testing restorative skills, and, if in fact it no longer serves the goals of the dental profession, the question must be asked, "Is there another material that will fulfill the objectives of gold foil?"

The passage of time has tended to cloud the meaning of Operative Dentistry. There is such a vast amount of information required by the dentist simply to maintain an adequate standard that it is no wonder the pursuit of excellence in gold foil procedures has lost both its meaning

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and direction, and, more seriously, its place in dentistry.

In 1931, James Mark Prime of Omaha, Nebraska, said "Let us form a group as an aid to unify thought on gold foil technique, to bring operators together from all over the country, to compare work, to discuss instruments and instrumentation, gold, cavity preparation, etc., and to assist, if possible, in bringing about a more uniform teaching in our schools. I suggest that we organize an academy to meet at the same time and place as the American Dental Association. I suggest we take some such name as the Academy of Gold Foil Operators of America."[3] Yet it was eighteen years before the spark was reignited and more than twenty before this Academy became the body that it is today.

When one takes time to read the philosophical literature on gold foil,[4-9] it is obvious that the leaders in operative dentistry have, independently, held similar strong views as to the methods that contribute towards the attainment of excellence. But excellence means different things to different people and it is difficult for the writer or speaker to convey his meaning. One reads into excellence his own aspirations and standards. We see not only what we might achieve but what depths of mediocrity we might have fallen into. To express these thoughts to the Academy of Gold Foil Operators is rather futile. We communicate; we watch each other perform; and we criticize and learn from each other. And while we are progressing we are becoming increasingly polarized from the balance of the profession that surrounds us. In short, we have our blinkers on.

On a broad scale it is apparent that many human societies have been beautifully organized to keep good men down. They are designed to limit the realization of individual promise. Perhaps this limitation is the outgrowth of a democracy, since there are only two choices available when a society gives up hereditary stratification. There is the road of equalitarianism where the backward are protected and the progressive are curbed and there is the other road where we can quite simply "let the best man win." Neither road, on its own, is healthy.

Ask anyone if they believe in equality. You will receive a positive, affirmative response. But you will receive the same reply if you suggest a philosophy of competitive performance — "let the best man win." These principles must co-exist. But living them both, with balance, every day is no easy task when applied to a teaching program. Teaching aims to inculcate not only excellence, but balance too, and it is becoming increasingly difficult for teacher and student to determine a harmonious relationship between equality and competition.

Not one of us would be happy where everything is truly equal, but then few of us would be happy where all was judged on the basis of how well we did. What we must seek and provide for our students is an environment where all can excel at something and be judged of equal minimal competence in the remainder of the performance skills.

"We know that men are not equal in their native gifts nor in their motivations; and it follows that they will not be equal in their achievements."[1] The environment we seek must provide equality of opportunity. Unfortunately, no profession remains static and, therefore, will inevitably favor those whose skills fit the requirements of that profession at any moment in time.

Have we reached that point? That gold foil no longer, no matter what we say, fits the requirements of our profession? That it is out of date, useless, pointless as a restorative material? No, it is not. But it will require a tremendous effort on the part of those who understand gold foil to re-evaluate its purpose in light of the present direction that is being taken by governments and the dental profession.

The Carnegie Commission on Higher Education[10] has listed as one of its major themes the four components of better health care: more and better health manpower, more and better health care facilities, better financing arrangements for the health care of the population, and better planning for health manpower and health care delivery.

It is in the area of more and better health manpower that the dental schools and state boards must recognize the perils associated with a loss of standards. Standards are contagious and spread throughout an organization, a group or a profession. If an organization or group cherishes high standards, the behavior of individuals who enter it is inevitably influenced. Similarly, if slovenliness infects a profession, it is not easy for any member of the profession to remain uninfluenced in his own behavior.

Since the most serious shortages of professional personnel in any major occupation group exist in the health professions[10] it is likely that enormous pressures will be placed upon the profession to increase our numbers at a rate which will be too fast for us to retain standards and quality if we are to teach and practice as we do today. We must, therefore, be innovative. We must thoroughly examine our teaching material and objectives, and pare the extraneous material from the fundamental concepts and facts. Conceptualization will be essential in the 1970's — techniques will soon be changing faster than we can teach them.

Health care is coming to be regarded not only as a necessity but also as a right to which all are entitled. As the barriers associated with cost are removed there probably will be a surge of people requesting dental care. Certainly many will lack a motivation to seek it themselves, but when large organizations provide it as part of a major plan, they will expect it nonetheless.

Within the volumes of literature it is difficult to determine the truth as to whether there is a shortage of dentists or that they are poorly distributed. There can be no doubt that auxiliaries will fulfill a distinct need in the future, but careful consideration must recognize that even with all the physical plants available and all the training programs at maximum capacity these will not provide nearly enough personnel in

the 1970's and thereafter. It is also unrealistic to consider that the majority of practicing dentists are going to alter radically their methods of dental care delivery, and so even greater pressures may be brought to bear. It is increasingly difficult to avoid the credibility gap between the teaching programs and the realities of private practice.

The Carnegie Commission[10] recommends that all university health science centers consider the immediate development of programs for the training of dentists' associates and assistants where they do not exist. They also recommend, where possible, a shortening of both predental training and dental school education. Certainly these proposals move slowly, but they will occur one day and we must be very carefully prepared if we are to retain the standards of excellence in restorative dentistry that are so important to the maintenance of preventive oral health care.

It is interesting to note that state practice acts are being modified in increasing numbers to expand the duties of auxiliaries.[11] In order for a state to be classified as permitting expanded functions for dental hygienists, the practice act must allow for additional functions beyond those normally performed by this auxiliary. The dental practice acts of over two-fifths of the states have been so changed or revised. Of the 22 states, 13 modified their acts in 1969 or 1970.[11]

As these states implement their laws it will become increasingly evident that many operative tasks, until now considered the preserve of the dentist, will be performed by some type of auxiliary personnel. There should be no quarrel with this from progressive men, but the importance of standards must be carefully controlled. If we are truly honest, it does not really matter who performs a task but it matters most seriously at what level of quality the task is done.

What of the bodies that can affect or control standards? At the present time there are 622 members of the American Academy of Gold Foil Operators. There are 243 full-time and 529 part-time operative dentistry teachers in the United States and Canada. If one considers the full time operative dentistry teachers, one finds that only 36% belong to this Academy. When one considers the total number of operative teachers only 12% are members.

If it is believed that this Academy has influence in the progress of gold foil but more importantly in the progress of good restorative dentistry then, what has happened to operative dentistry in dental educational institutions? "When organizations and societies are young, they are flexible, fluid, not yet paralyzed by rigid specialization and willing to try anything once. As the organization or society ages, vitality diminishes, flexibility gives way to rigidity, creativity fades and there is a loss of capacity to meet challenges from unexpected directions. The only stability possible is stability in motion."[2] Is this the case with Operative Dentistry? Has vitality diminished in the schools? In this Academy?

Educational institutions have the opportunity to surround the student with an environment that illustrates what society expects of him. If the demands are minimal the student will believe that these are the demands of society. It is therefore vitally important that teachers create an atmosphere that encourages effort and performance at the highest level. If indeed vitality has been lost, we must create an atmosphere of self-renewal. "The most stubborn protector of his own vested interest is the man who has lost the capacity for self renewal."[2]

This philosophy may appear to be unrelated to the practice of dentistry. It is there where patients enter on a schedule that is murderous, where personnel turn over at an alarming rate, where gold foil is not only a very small part of oral health care delivery, but is, in reality, not very important when measured against the desperate needs of a nation that notices this upheaval concerning the health of its people.

There has to be more to gold foil — to anything we do — than the cavity preparation and its restoration. Our thinking has become so isolated (even among the best of our profession) to such a narrow track of procedural concern that we are rapidly losing our ability to consider it as part of the whole at all. May I suggest that our curricula have, from many student's point of view, become worse, not better since they find themselves confused and unable to relate the information they receive to health care delivery. This is due, tragically often, because of the way in which we have pursued excellence, which has locked us into attainment of individual technical perfection at the expense of all else. These procedures are a very necessary talent but the discovery of talent is one side only of our development. We are at the beginning of an era where horizons must be broadened to enable us to carry our technical perfection into the total picture of oral health care delivery. This calls for another side to our development, self analysis or evaluation which is, today, of probably greater significance than talent.

We must learn to understand ourselves and recognize that the talent we have is part of a broader picture where the combination of a series of talents raises the overall quality of delivery to much greater heights.

But this development is a most difficult one for persons well established in their chosen profession. "One of the reasons why mature people are apt to learn less than young people is that they are willing to risk less. Learning is a risky business, and they do not like failure. If you want to keep on learning, you must keep on risking failure — all your life. It's as simple as that."[2]

The most valuable asset of the teacher who can think beyond his area of expertise is that he finds himself superbly motivated. And it is for this reason that he must have absolute excellence in his chosen field. Armed with standards and an ability to understand his role he can recognize a total area of study and with tremendous skill dominate the direction it should take. The cavity preparation or its restoration is no longer the goal and becomes, instead, a much more important dimen-

sion of the whole scope of oral health care delivery. The teacher or practitioner begins to understand how his contribution matters so much to the total picture. He looks for others with this same dynamism until all the pieces fit together. What he has done is simply *raise the level of his goals*. He now assumes excellence to be an ordinary and routine part of the total goal. By developing skills, attitudes and habits of mind as the kinds of knowledge and understanding that will be the instruments of continuous change and growth on the part of the young person, he will have fashioned a system that provides for its own continuous renewal.

Gardner describes it as "not a question of doing away with the specialist. It is a question of retaining some capacity to function as a generalist, and the capacity to shift to new specialties as circumstances require. In human societies there is no reason whatever why the specialist should not retain the capacity to function as a generalist."[2]

The theme is innovation. But even the most potent innovator has to coincide his discovery with a crisis or other such point in time where people will listen. If he chooses inopportune times his ideas are not only ignored but he himself is considered controversial and the importance of progress is nullified. If we as teachers are wise, we will ready ourselves, study our objectives and be ready to take advantage of the right moment. The direction we take must, at all costs, be a unified one. It must have the same goal and the way in which it is achieved is of little importance. The solution lies, not in us finding a magic formula, but in building, together, a series of sound concepts and objectives in operative dentistry, which are honest, capable of change when needed, and of unquestionable excellence in delivery.

Innovation requires a great deal of creativity on the part of the teacher. He must develop an openness and believe in what he is doing so that he develops his ideas for himself and not to please others. He must be independent and capable of questioning all assumptions in search of a more basic truth. He must be sufficiently flexible to be able to withstand torment and inner conflict better than his fellow man. At the critical moment when the unwary decides on a course of action he must be capable of suspending judgement and yet when the moment arrives, he must be even more decisive. And, finally, he should be able to impose order on experience.

This teacher of the future may find it necessary to break fiercely with tradition and for this he will need to feel strongly about his profession and the direction he hopes to see it take. He must be prepared to face ridicule and what the final outcome of the acts of such men will be is impossible to determine. This man may well turn out to be a revolutionary. I believe as does Reich[12] that "there is a revolution coming. It will not be like revolutions of the past. It will originate with the individual and with culture, and it will change the political structure only as its final act. It will not require violence to succeed, and it cannot be success-

fully resisted by violence. This is the revolution of the new generation."

We have said little about another body which can affect and control the quality of dentistry. I refer to the State Boards of Dentistry. I would like to quote from a dental act as to the purpose of a state board. It can be considered representative of the many state board dental acts. "The practice of dentistry in the state is hereby declared to affect the public health, safety and welfare and to be subject to regulation and control in the public interest. It is further declared to be a matter of public interest and concern that the dental profession merit and receive the confidence of the public and that only qualified dentists be permitted to practice dentistry in the state."[13]

Are state licensing boards necessary? I do not know. That question may never be resolved to the satisfaction of all in the profession. What I do know to be true, however, is the statement of purpose, "that the practice of dentistry in the state is hereby declared to affect the public health"[13] and somebody must ensure that society receives excellent dental care. Where we have strayed, I believe, has been in our willingness to think that traditional methods of ensuring good dentistry are satisfactory today.

If one reviews the statistics one finds that state board procedures remained almost static until the introduction of the North Eastern States Regional Boards in 1964. In content, boards have predominently insisted on gold foil as a testing device. A survey[14] done by the American Academy of Gold Foil Operators in 1959 showed that 63% or thirty three of the Boards required the preparation and condensation of gold foil while 21% did not require its use and 12% permitted a choice of material. The 1968 figures show that only 50% or twenty six of the Boards require gold foil, 12% still permit a choice and 27% do not require its use. It is also interesting to note that less than 4% of all state board dental examiners are members of the American Academy of Gold Foil Operators. We should examine these statistics as they might concern the future of gold foil.

Simon[8] and others have described the gold foil teachers and categorized them as the zealot, the middle-of-the-roader, and the antagonist. It is not only the teachers who belong to these categories but all who are introduced to gold foil at one time or another in their career tend to have similar opinions. Since gold foil is the traditional method of clinical evaluation it is experienced by most dentists at least once in their lifetime after receipt of the doctoral degree. It is considered as that barrier over which they must move before practice may begin. It can be a traumatic, and to some a terrifying experience in their career.

This brings us rather naturally to the crux of the matter. Should gold foil be used as the clinical testing device? The North Eastern Regional Board examined 875 candidates at 14 sites in 1969 and none were specifically required to prepare for an examination in gold foil. The Missouri-Oklahoma-Kansas Regional Board does not require gold foil.

This is an obvious trend and one that is moving rapidly. Regional action is under investigation by many concerned and influential people. The 26 states that presently require an examination in gold foil had an average candidate failure rate of 15% in 1966 while the others show a failure rate of 8% percent. It would be wrong to draw the obvious conclusion since many factors are considered in a state board examination, but perhaps a trend is developing. What this means is difficult to surmise. It should be apparent, however, that gold foil as a clinical testing device is under serious questioning. It is, quite frankly, not considered valid by many people and the percentage figures of active gold foil operators is certainly low where it would count the most while gold foil continues to be the testing procedure.

Responsibilities must be continually reassessed. It will be necessary to determine the efficacy of the state boards as an examining body, considering their vital role in ensuring a quality of dentistry to the public of any given state.

State boards cannot be allowed to isolate themselves from the academic institutions and thus to current knowledge and research findings. But, likewise, it is the responsibility of the academic community to be aware of the current practice of dentistry, at least in his own state, if not in the nation at large. There must be a meeting of the minds and a common understanding of what is meant by the state's and the nation's needs in oral health care. Both groups must develop the best methods of evaluating a candidate's ability to deliver that care at the highest possible level of excellence.

It has been expressed that gold foil is not a reasonable testing procedure since the practitioner rarely performs foil procedures after licensure. This should be an argument which demands rebuttal and yet it is difficult to do so. We should really ask ourselves why the statement is made in the first place. Teachers and their institutions must be blamed for this position. We have been guilty of teaching foil from both sides of our mouth. The teacher recognizes that the student must pass an examination and that he needs experience for a successful result. But the student is also taught gold foil as part of an integral treatment plan. The average student, however, never escapes a sense of foreboding which the examination barrier superimposes. He loses sight of the fundamental reasons for using gold foil, as so often does his teacher, as the date of the examination looms closer, until the confrontation is past. Success or failure, the relief is great and because we have used it as a testing method in these situations we tend to alienate the average practitioner for life.

How important is gold foil as a testing method? Would other procedures do as well? The board, in assessing a dentist's competency to insure a high quality of dental care, must face a responsibility that goes much further than a mere measurement of a technical skill. Teachers are more fortunate than state board examiners. They learn to know a

student during his stay at the dental school. They have an opportunity to assess integrity, self discipline, self renewal, honesty, and judgment. The state board examiner is denied this opportunity and his task is more onerous. It is his responsibility to protect the public and he has only one opportunity to assess the candidate. He must be right. He cannot be judged wrong. He must be certain of a procedure which will permit him to measure, not only the skills, but the attitude of the candidate towards restorative dentistry and how it should be practiced. Gold foil is a rather magnificent material for this purpose.

I do not believe that skills are transferable from one material to another. The candidate who excels in gold foil procedures does not necessarily excel with amalgam or fused porcelain. But in the pursuit of perfection with gold foil he develops superb attitudes towards the entire discipline of Restorative Dentistry. It is these attitudes which are transferable. It is these attitudes which represent the cornerstone of this Academy. Gold foil is an "all or none" material; it is a material that tests a man under stress; it must be done well; it cannot be successful with shortcuts; it can only be successful by following the principles of cavity preparation; it tests the use of hand instruments and accuracy in rotary instrumentation; and above all the preparedness of the candidate for the practice of restorative dentistry. It is doubtful that the same argument can be made for any other materials. And yet, as stated earlier, gold foil is being seriously questioned.

The problem, I believe, must lie with those who have controlled the direction of academics. An unwillingness to be different from others prevails and so we provide the student or practitioner with alternative methods, methods which are less time consuming, less difficult and which do work in the short term. There is conflict in teaching between that which is lauded as best and that which is used because it is alright. "Little by little, preoccupation with method, technique and procedure gains a subtle dominance over the whole process of goal seeking. How it is done becomes more important than whether it is done?"[2] Is this because we have, in Operative Dentistry, individuals living close to the margin of survival and who therefore cannot afford to take the chances required by innovative action to change the rules for gold foil?

We cannot return to a simpler world. It is gone forever. We must accept this fact. We must create an environment that is conducive to individual fulfillment. Simon[8] speaks of the first rule of pedagogy as being that where the student is placed in an environment where he is at ease, where he is gently corrected and where his mistakes are recognized as part of the normal learning process. The mark of the great teacher is that of stimulating his student to require a level of proficiency that is far above the teacher's own ability.

I have spoken at great length about some of the factors which influence us as teachers and as members of groups which have a responsibil-

ity to provide direction in dentistry and safeguard its quality. The future of gold foil will be dependent upon many of these things.

Experienced administrators and teachers know that some academic disciplines can be renewed through new leadership and new ideas. Others need a more massive infusion of new blood or far-reaching organizational changes. Still others can only be renewed by taking them apart and putting them together again. And some cannot be renewed at all. Operative dentistry needs self examination and the solution will be different in every dental school and teaching environment in this country. Immediate evaluation of the role played by operative dentistry must be the primary objective if gold foil is to survive. We are fortunate that the loyalty of the professional man is first to his profession and not to the organization that may house him at any given moment.

It is apparent then that the future of gold foil in education and state boards is dependent upon the direction taken by operative dentistry. The time for wide active leadership has arrived and it is very important that we state our objectives clearly for the future. These objectives should be:

1. that Operative Dentistry is truly a *biomechanical* discipline and be taught by *all* dental schools in that manner.
2. that if biological emphasis is to be stated as the primary course objective, then the mechanical procedures should be a means to the end, not the end itself.
3. that specific pathological involvement of the teeth be reassessed and broadened, if necessary, to include additional influencing factors so that in their treatment only one material need be discussed as the correct therapeutic measure. We must teach and promote the use of gold foil as a service to the patient. Ferrier[15] clearly indicated that gold foil was best adapted to teeth in which "decay had just begun."
4. that operative procedures which will be performed by the general practitioner constitute the predoctoral curriculum, be clearly delineated, and be completely flexible and that other procedures become the content of elective courses in restorative dentistry. This may ensure a more effective role for the use of gold foil in predoctoral programs which would be better evaluated at the state board level.

These broad objectives could be implemented with the following 8 point plan.

The American Academy of Gold Foil Operators, together with the Operative Dentistry Section of the American Association of Dental Schools, should,

1. Strengthen the Academy's policy of promoting excellence in all operative dentistry procedures.

2. Explore liaison with the Council on Dental Education to assist in evaluating dental school curricula in operative dentistry.
3. Establish biannual meetings with all State Board memberships and inform them of current information concerning the testing procedures.
4. Propose that, while both judgment and the performance of operative skills are a state board requirement, that state board examiners be active members of the AAGFO.
5. Propose that all chairmen of Operative Dentistry departments be active members of the AAGFO and AADS.
6. Promote active recruitment of full and part time operative dentistry faculty for membership in the AAGFO and/or affiliated study groups.
7. Promote the use of gold foil in those areas of predoctoral curricula where it is indicated as the material of choice.
8. Actively support the use of gold foil to develop attitudes of excellence in dental schools and state board examinations.

And so we are back to the subject of commitment. Balance in a faculty is critical. Expertise in all areas of operative dentistry is essential to the success of the program. The tension between equality and excellence will never be resolved but we must, in all our endeavors, pursue a course whose goal is excellence on as many fronts as possible.

Things are renewed by people who believe in them, care about them, stand by them. Gold foil is no exception. "Everyone does not have to agree in order for the consensus to be effective. It is only necessary that there be rough agreement among a substantial proportion of those men and women whose intelligence, vigor, awareness and sense of responsibility mark them as shapers of the community purpose.

Young people do not assimilate the values of their group by learning the words. They learn attitudes, habits and ways of judging. That is why young people need models, both in their imaginative life and in their environment, models of what man at his best can be."[2]

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Correction

In the article "Morphological Observations of Some Direct Filling Golds" by Elderton and Boyde (*JAAGFO* 14:19-28, April 1971), Figures 6 and 7 were incorrectly printed in transposed positions. The pictures on page 27 belong to the caption on page 26 (Fig. 6 Electraloy RV), and the pictures on page 26 belong to the caption on Page 27 (Fig. 7 Goldent).

Leslie E. Smith, B.S., D.D.S., F.A.C.D.

Gold foil storage

One of the most important facets of gold foil use is the protection of the material during storage. Currently, there are obvious differences among batches of foil when the bottles are opened. In some instances the foil rolls out with the appearance of grains of rice. Each pellet is independent of the others when the bottle is inverted. When other bottles are inverted, the foil comes out in clumps, and it is difficult to separate the individual pieces. The latter condition occurs more commonly when a shipment is received directly from the factory by air.

The implications are obvious. In the latter instance, the gold foil is fresh and uncontaminated and has the tendency to weld simply from the weight or pressure of the other pellets. In the former instance, the pellets are contaminated and show no such tendency to cohere. The conclusion is that foil can become contaminated in storage even though it is in its original containers.

Some dentists may question this premise at the outset, for students are traditionally taught[1] that all gold foil products are surface treated with ammonia after being manufactured to protect against contamination prior to use. In order to clarify the use of ammonia as a surface protector, a letter was written to one of the manufacturers[2] with the following inquiry: "Could you please provide . . . information regarding the ammonia compound which you use to protect gold foil surfaces? What is the chemical: is it a gas or a solution, and how is it applied to the surface?"[3] The reply from the company was as follows: "The ammonia compound used to protect the surface of our Pure Gold Foil is ordinary household ammonia purchased in any supermarket. It is applied to the surface of the foil as a gas. An open container of ammonia is placed in a chamber along with the gold foil and the fumes are allowed

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to permeate for approximately one hour. We might add that *only* our No. 44 Non-Cohesive Pure Gold Foil is subjected to this treatment. Our Pure Gold Foil Cylinders and Extra Pliable Cylinders as well as Goldent is not subject to this ammonia treatment."[4]

The possibility of contamination seems to be great, since the foil is packaged in glass vials with cotton plugs and plastic caps. This does not form a vacuum seal, and it is possible that the plastic stopper itself could yield contaminants. These possibilities are being investigated now.

If the foil is stored in these vials in an area where other chemicals or gases are present, it will surely become contaminated.[5] If the contaminants form fixed salts, the foil will be irreversibly non-cohesive.[6]

Possible Methods To Prevent Foil Contamination During Storage

Many of the problems encountered in the use of gold foil can be traced directly to contamination which occurs prior to actual use. In an attempt to circumvent this problem some thought was given to the protection of the foil prior to use. Some of the possibilities are the following:

1. Treat all foil with ammonia before shipment. Ammonia is readily absorbed to the surface of gold foil and acts as a protective coating until the material is ready for use. It is removed by annealing.[7]

2. Package foil in vacuum sealed containers. This procedure (as well as the other three mentioned here) would assume that the foil is clean and pure when preparation is completed by the manufacturer.

3. Package foil in nitrogen-filled containers. Nitrogen is only one of several possible inert gases which could be used to ensure the surface purity of the foil in transit.[8]

4. Package foil in alcohol, either ethanol or methanol. Ethanol or methanol immersion will also act to prevent surface contamination of the foil by forming a surface film which is readily removed by annealing.

It is possible that the use of ammonia deposition does not give the best protection. The chemistry of this mechanism should be further investigated to see if ammonia can be displaced by some of the fixed salt gases, e.g., sulphur or phosphorous. The packaging of the foil in either a vacuum or nitrogen environment probably would increase materially the cost of the product. Also the problem of storage after the original container was opened would be present, and, unless great care was taken, the entire contents of the package could be contaminated almost immediately.

Suggested New Technique for Storage

The one practical solution is packaging in alcohol. If methanol is used, the additional cost is not too great, and the foil can remain in

storage for an indefinite period in its original container even after the seal has been broken. The foil pellets can be removed from the vial or package as needed and placed on a clean filter paper or lintless gauze or on a cold electric annealer. If an alcohol flame is used for annealing, the alcohol remaining will ignite and burn off leaving a clean, residue-free surface, since the gases formed by combustion are completely volatile.

If an electric annealer is used, the pellets should be dried on filter paper or gauze before being placed on the hot annealer, or they can be placed on a cold annealer and heated only long enough to completely evaporate the alcohol. It would be best to leave the annealer on until the procedure is completed in order to minimize the possibility of air contamination.

The importance of starting with a cold annealer when using pellets saturated with alcohol cannot be minimized. If saturated pellets are placed on a hot annealer grid, the alcohol within some of the pellets explodes in a few seconds and the pellets jump off the grid, or move erratically over the surface.

If one wishes to use a low wattage electric annealer with a maximum surface temperature under 800° F., foil can be annealed in bulk in a small, thimble-sized porcelain crucible in a porcelain or burn-out furnace. If the latter is used, it should be clean and the temperature raised in excess of 650° C. or 1200° F. for several minutes to assure that any volatile residues have been eliminated. Then the crucible with 25 to 50 pellets can be placed in the furnace at 650° C. or 1200° F. for 30 to 60 seconds, depending on the number of pellets. When the latter are removed from the furnace, they can be transferred directly to a vial of alcohol. The pellets will be clumped in the crucible when it is removed from the furnace unless they have previously been contaminated with fixed salts. If the pellets are not clumped when the crucible is removed from the furnace, they should be discarded. It is best to invert the crucible onto a clean filter paper and immediately transfer the contents to the alcohol vial. After it is capped, the vial can be shaken vigorously for a few seconds, and the pellets will separate into individual pieces. In like manner, any pellets left on an electric annealer grid at the end of a procedure can be spilled onto a clean filter paper and transferred to alcohol. They will clump when they contact each other on the paper, but vigorous shaking of the vial will cause them to separate.

When the pellets are ready for use again, the above described procedures can be followed. The easiest way to remove pellets from an alcohol vial is to decant the vial into another clean, stoppered vial kept for this purpose. The pellets can then be spilled onto a filter paper and the desired number removed, or they can be removed from the bottle one at a time with a pair of cotton pliers.

If the temperature indicator on the furnace used for bulk annealing

is not accurate and there is a temperature override or the pellets remain too long in the furnace, the batch may melt. Although the weight of these individual pellets is small, when twenty-five to fifty are placed together, the combined weight causes a collapse of the pellet in a temperature override, and they will weld together by the pressure of the combined weight, making it impossible to separate them without damage.

Storage in alcohol in a well-stoppered bottle, preferably ground glass, (because cork and some plastics can yield contaminating gases themselves), can be indefinite. Hand rolled pellets, of course, can be stored in the same manner. An additional benefit can be derived with this type of foil, for there is always a certain amount of moisture or body oil contamination during the rolling process. The alcohol itself will tend to remove these contaminants by its solvent action.

Conclusions

Consideration should be given to storing gold foil in methyl alcohol, prior to use and during transit from the place of manufacture, to avoid contamination.

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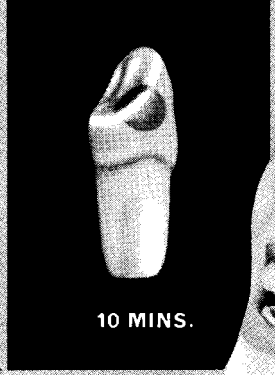

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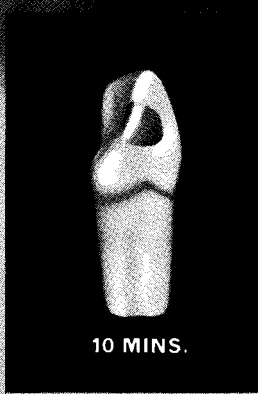

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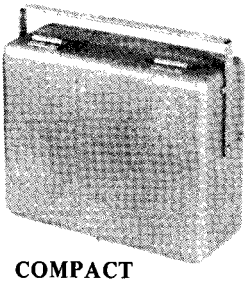

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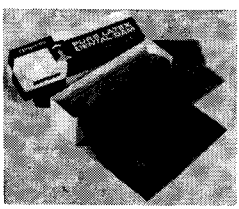

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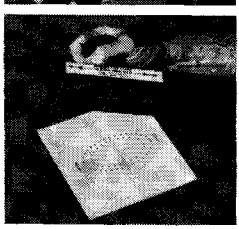

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