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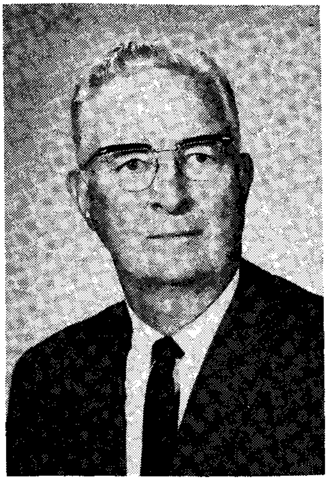

SINCE OUR LAST INTERIM MEETING, many wonderful events have taken place for your President.

First, I have had the pleasure of seeing and examining many of the beautiful direct gold restorations completed by those who operated at the University of Illinois. Many of my students attended, several were patients, and their expressions of the lectures, table clinics and operations were impressive. As I have stated before, one of our objectives of these meetings is the stimulation of students and faculty. Thanks again to those who attend the meetings and to those who participate.

Our trip to Europe from our son was another great event. Those who haven't been there should go. We can hardly wait for a second visit abroad.

The third major event was our move to the new dental school located in Maywood, Illinois, a western suburb. All members are most welcome to stop by on their next visit to the "Windy City."

By party line, I hear from our dynamic President-Elect, Dr. Ralph Werner, that things are moving well towards another great Annual Meeting in Buffalo. We all look forward to attending.

I do wish to apologize for not keeping the officers up-to-date on events from this office. Our good and reliable Secretary and Treasurer, Dr. William Gilmore, has given so much to our Academy that I wish I knew of an adequate way to thank him for a job well done. The same applies to another devoted servant of our Academy, Dr. Ralph Boelsche, who is vacating the office of Business Manager of our *Journal*. His services in this capacity and as President have been valuable contributions to our Academy.

In closing, I wish to express my most sincere appreciation to the officers and members who have given so much of their time and energy since the founding of our Academy. Your contributions have been great and have enriched our lives.

P.T.D.

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It is the sincere hope of the Academy that the recipients of this Award will continue to seek additional knowledge and raining in the use of gold foil. In that manner they will be able to perform this procedure with greater facility and satisfaction, and they will be able to render a comprehensive treatment to their patients.

Expanding the Role of Auxiliaries in Operative Dentistry

GORDON J. CHRISTENSEN, D.D.S., M.S.D.

THE PAST TEN YEARS have been a time of tremendous social changes in the United States, and dentistry has certainly shared in that evolution. The total dental health picture, including the social, basic science, and clinical components, has become increasingly stressed by dental education, governmental agencies, and practitioners. Development of interest and knowledge past the "single tooth" concept has finally come in dentistry. A concern for the majority of the population in the U.S., most of whom do not see a dentist annually, has been voiced within and outside of the profession. Departments of social or community dentistry are now functioning in many dental schools and are encouraging new avenues of involvement for dentists in the community. These and many other changes in dentistry have caused government and public health officials, practitioners, and educators to look at the manpower need in dentistry. Concern about the present and future number of dentists has developed.

The purposes of this paper are: 1) to stimulate the thinking of those who read it toward investigation of the dental manpower situation; 2) to stimulate the sincere consideration of Academy members toward the feasibility of expanding the role of auxiliaries in operative dentistry; and 3) to point out some of the advantages and disadvantages of such a program of expanded auxiliary duties. The paper will discuss the subject under the following subtitles: *Why* expand the duties of auxiliaries? *How* this expansion might take place. *What* duties should they assume?

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WHY EXPAND THE DUTIES OF AUXILIARIES?

In 1961 the Commission on the Survey of Dentistry[1] in the United States warned of the impending manpower shortage. It was reported that in 1930 when there were fewer than 75,000 dentists in the U.S., there were 58 dentists for every 100,000 people in a population of 122.8 million. In 1961, with more than 100,000 dentists in the U.S., there were only 56 dentists per 100,000 population, and only 49 of these were active. It was also reported that the Surgeon General's Consultant Group on Medical Education pointed out that 134,000 dentists will be needed by 1975 merely to meet the needs associated with population growth.

I remember very well that when the Survey of Dentistry was published in 1961, there was considerable disagreement about it, and that a large percentage of practitioners were disgusted with it. Some private practitioners had the background to have an appreciation for the survey. Events since 1961 have demonstrated that the Survey of Dentistry was not the radical, star gazing document that was criticized by many. In fact, in retrospect, it may have been too conservative in its demands for dental manpower.

Since 1961, several reports and predictions have been published concerning future manpower needs. The recent Report of the National Advisory Commission on Health Manpower, published in November, 1967,[2] pointed out the concern of the nation's health leaders about this problem. This report suggested that expansion of the size of current medical and dental schools and the development of new schools be done as soon as possible, and that incentive funds be expended for schools to expand. Loans to encourage medical and dental students were recommended. Health care for the disadvantaged should "be given the highest priority" according to the report.

A workshop on dental manpower was held in December, 1967, in St. Louis, under the authority of the American College of Dentists. It stressed the continuing and increasing need for dental manpower. George Mitchell[3] said, "Yet the fact remains that by the late 1970's, we are likely to be rocked by a manpower crisis far more severe than the one we have been working so hard to avert. This is not to say that we have been off-base in the assessments we have made, but only that our assessments, as so often happens, have not allowed adequately for the quickened pace of social change." Harold Hillenbrand[4] said at the same workshop, "We are not now meeting the needs of the 1960's, much less are we prepared to meet the needs of the 1970's. We have now in many areas a shortage of dental manpower. We are now utilizing our auxiliary personnel in a wasteful, confusing, and sometimes illegal manner. And finally, we talk of 'need for dental care' versus 'demand for dental care,' but I suggest that if the barriers of ignorance and economic want are eliminated, there is no difference between what is needed and what will be demanded."

It is difficult for many of us, who seldom have an opportunity to see the overall view of the national dental problem, to visualize the degree of the manpower shortage. Some of the factors which have influenced the increased demand for dental services are: 1) Population growth. Although estimates of a few years ago have been slightly modified because of birth control measures, a significant increase is still predicted. Our population is approximately 200 million today and is expected to reach about 240 million by 1980. 2) Increased education of the population has been related to increased demand for dental services. The average educational level in our country is increasingly annually. 3) Income has increased tremendously in the past decade. This additional purchasing power has brought increased demand for dentistry, and it is expected to continue. 4) Government programs, on the local, state, and national levels, have influenced the demand for dental services significantly. In several states, a large percentage of the dental care rendered is paid for by state government funds. It is predicted that this trend will continue. 5) Other third-party payment plans such as dental service plans, union and large corporation plans, and others are increasing the demand for services. It is estimated that by 1975, 50 million persons will be covered by some form of dental pre-payment.

The demand for dental services is increasing and will continue to do so. To offset this increase, new dental schools are in developmental stages; old dental schools are receiving large sums of federal money for expansion; auxiliary training programs are increasing; many experimental programs to expand the duties of auxiliaries are in progress or are in the planning stages; a few states have expanded the duties that auxiliaries may accomplish, and others are considering doing this.

Perhaps you now concede that there may be a manpower need, but you may not think that expanding the duties of auxiliaries is one of the answers to the problem. A discussion of this subject should stimulate some thinking.

HOW CAN THE DUTIES OF DENTAL AUXILIARIES BE EXPANDED?

The introduction of the dental hygienist several decades ago caused great discussion, disagreement, and concern in the profession. It is interesting that at the current time dental hygienists are in tremendous demand, and that they have become an important and respected member of the health team. How many unknown types of dental auxiliaries are now undeveloped?

Expanding the traditional role of dental auxiliaries has been investigated and is in operation in other countries. The first program was introduced in New Zealand in 1921.[5] These dental nurses perform examinations, prepare cavities, insert restorative materials, extract teeth, and provide prophylaxis. They do not work under direct supervision of dentists. A few states in Australia have also passed legislation which allows the utilization of auxiliaries similar to those in New Zealand. Other countries have a variety of types of auxiliaries either planned or functioning.

Several programs to test the ability of dental auxiliaries to carry out various treatment procedures usually performed by dentists have been accomplished and published in North America. Some of these experimental programs are: a Canadian study,[6] a U.S. Navy Study at Great Lakes,[7] an Indian Health Study,[8] a dental school study in Alabama,[9,10] and an uncompleted Public Health Service study in Louisville, Kentucky.[11] In all of these projects, the auxiliaries were not allowed to diagnose disease or perform treatment planning, nor did they cut hard or soft tissue. Varying degrees of success have been attained. However, in most of the programs, auxiliaries were able to perform at a quality level equal to or better than dentists on the same operation. Undoubtedly, varying qualities of treatment were accepted in each study, but it is a recognized fact that the quality of treatment rendered by dentists varies from community to community and especially from state to state. There is reason to assume that the quality of auxiliary treatment would be comparable to the degree of excellence required by the supervising dentists.

Consider for a moment the dental educator in operative dentistry. He takes a group of six to ten students into a clinic facility and supervises them for a given period of time. They accomplish dental treatment to meet the demands of the instructor. It is common knowledge that the level of treatment rendered by dental students is probably better than the average community level. Cannot you visualize several well-trained and supervised auxiliaries producing excellent restorative dentistry in a similar environment? It may be better treatment than the average treatment delivered today. In the author's opinion, the key to quality auxiliary services will be *quality supervision.*

A discussion of some of the possible methods for integrating treatment auxiliaries into practice will pose some questions. Two basic requirements appear to be necessary restraints in the expanded roll of auxiliaries. It is logical that auxiliaries who perform treatment should be licensed. This would assure comparable training programs and other qualifications. They should also be required by law to perform their treatment under the supervision of a dentist. This could control the quality of their treatment.

What type of dentist should supervise auxiliaries? Perhaps a type of special certification, subject to periodic review by the State Boards could be required for such a practitioner. It is obvious that he should be of the highest ethical and moral standards, or his auxiliaries would soon degenerate to his level. Dentists who are less critical of the quality of their services often seem to have unsupervised hygienists. Likewise, this type of dentist would not be a good candidate for a new auxiliary. Although the question of supervision will require much thought and planning, it does not seem to be an insurmountable obstacle.

An example of a typical restorative dentistry practitioner might be as follows: The dentist has qualified to supervise auxiliaries by taking a post graduate course in restorative dentistry auxiliaries or by taking a series of continuing education courses. These courses might include such subjects as business administration, psychology, the practical aspects of supervision of auxiliaries, as well as advanced clinical and basic science instruction in his clinical field. It would be well if this dentist were examined by the State Board to evaluate his ethical background. After passing the examination, the dentist may have several auxiliaries who render services in his office. Many modern periodontists have several hygienists treating patients in their offices. Today the periodontist evaluates the hygienist's treatment after each patient. Likewise the qualified restorative dentist could supervise the treatment of his auxiliaries and evaluate it upon completion. The dentist would reserve the more difficult procedures for himself.

I contend that the quality of restorative dentistry would be higher in these offices than in a normal dental office, because the dentist would be evaluating his auxiliary's treatment, and the auxiliary would silently be evaluating the dentist's treatment. Solo or individual dental practice has nurtured a lowering of quality among some practitioners.

WHAT DUTIES SHOULD NEW AUXILIARIES ASSUME?

A national discussion of auxiliary expansion usually brings up the suggestion of auxiliary expansion mainly in operative dentistry. I contend that operative dentistry is a logical location for expanded auxiliary duties, but that many other areas of dentistry are even more likely candidates for increased auxiliary utilization. Periodontics is using the dental hygienist to a great degree. It is possible that even more of periodontics could be assumed by the hygienist. This seems more logical than placing the hygienist into restorative dentistry or some other area relatively remote from her training. Prosthodontics is a field which could utilize auxiliaries very easily and extensively. Impressions, denture adjustments, and many other phases of prosthodontics could be supervised just as dental students are supervised. The fields that seem most logical for auxiliary expansion are pedodontics and orthodontics. Few practitioners can deny that well trained auxiliaries could do much of the impression making, tightening of bands, insertion of appliances, and myriad other duties in these areas. Exodontia and minor oral surgery are within the realm of auxiliaries. In fact, auxiliaries could be well utilized in nearly all phases of dentistry. It is our obligation to explore these areas.

Medicine has advanced ahead of dentistry in auxiliary utilization. As an example of this point, in 1969 the University of Colorado School of Medicine will introduce a Pediatric Associates program. This course of study will take students directly from high school, place them in two years of college, followed by two concentrated years of pediatric medical school, and one year of internship, and will produce an individual in five years who can accomplish nearly all that a ten or eleven year trained pediatrician can do. Several other schools have these types of programs in operation in pediatrics, obstetrics, and other areas.

What duties in dentistry should be assigned to auxiliaries? Your opinions are as good as mine, and it would take several workshops to answer the question. I plead for common sense in the assignment of duties. It is not logical for an auxiliary to place a matrix band while the dentist watches, or insert a silicate while the dentist marches to another patient. Responsibilities should be assigned which are either preliminary operations, such as anesthetic administration and rubber dam, or complete operations, such as extraction of a tooth, an amalgam restoration, or impressions for dentures.

Communication between dentist and patient should be maintained. Effective dental hygientists have good rapport with their patients, and the dentist still maintains the ultimate authority. The same can be done with other auxiliaries.

SUMMARY AND CONCLUSIONS

An obvious dental manpower need has been documented. The feasibility of the expansion of duties of auxiliaries has been discussed. Similar programs in medicine have been described. Advantages and disadvantages of expanded auxiliary functions have been discussed.

The need is evident and will be met by some means or by some agency. The author suggests that organizations such as the American Academy of Gold Foil Operators and similar groups look seriously at providing leadership for the inevitable expansion in auxiliary duties.

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Compaction Properties of Various Pure Gold Restorative Materials

JEAN TURNBAUGH HODSON, M.S.

THE FINAL CONDITION of a pure gold dental restoration is the result of compaction; the techniques of which are related to the design of the cavity and the mass and shape of the gold. Sufficient compaction must be applied from suitable directions, with appropriate force or vibration, to settle the particles of gold into the closest possible relationship. The optimum procedure for gold foil is different from the procedures for mat or granular golds simply because the shapes are different.

Density in the finished restoration is related to two factors. The first is the mass of the material itself, the gold, and second is the amount of void space or porosity surrounding the gold. The structural mass or density of the particles or sheets is essentially the same for foil, mat, or granular golds since all are made from highly refined gold, but the pellet density varies according to the type of gold selected. The density of the restoration depends on how much gold can be packed into the cavity preparation. Differences in compacted specimens made with the various golds are found in the different configurations or shapes of the void spaces between particles and are related to the shapes of the gold particles and size of pellets as used for compaction.

The optimum goal would be to achieve restorations without porosity, but hardness tests and microscopic observations have shown that none are completely solid.[1] All gold restorations contain porosity, but porosity does not preclude success as dental restorations.

The location of porosity is more important than mere presence in the success or failure of restorations. Experienced operators identify

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porosity and voids by visual and tactile examination with an explorer or burnisher. There is a tendency to achieve better density in areas along walls or line angles in cavity preparations, such as the Class III, where the access is better from one direction than another, and to have porosity in areas that are difficult to reach.

Pressure variation during compaction prevents the production of restorations with uniformly good qualities throughout. Resistance to compaction is offered by bridging of the gold, wall friction, and strain hardening. Bridges are formed by the wedging of particles over void spaces.[2] Mat gold, particularly, has this characteristic. The same effect is found in the strain hardening of layers of gold foil over voids. In all cases, plastic deformation occurs when pressure is applied, either by impact or by burnishing, until strain hardening prevents the use of more force because of harm to the tooth.

Force alone does not determine the quality of a restoration. Careful stepping and systematic coverage of each pellet have produced dense specimens in gold foil. No pressure at all was used in the ultrasonic method to produce good specimens of mat gold. Final results were related to the shape of the golds when proper and adequate methods of compaction were used.

The restorative golds are named from their shapes. Gold foil, essentially, is a two-dimensional sheet until it is rolled into a three-dimensional pellet. Mat gold is named for the interlocking or matting of the fern-like crystals that grow by precipitation from solution. The so-called powdered golds more properly should be termed granular or spherical gold. The granules may be wrapped in gold foil by hand or machine. They may be sintered into clumps or aggregates to facilitate wrapping.

Granular or "powdered" gold is difficult to place in maxillary estorations, and a product is marketed in which the particles are wrapped with gold foil into small bundles or pellets. The wrapping may be facilitated by clumping the tiny spheres together through a process of sintering. Sintering is the welding of materials together at points of contact under heat, but without the occurrence of melting. Such "cohesion" takes place when small particles are packed closely together over a sufficient period of time at an elevated temperature that is held below the melting point of the material. The alignment between the planes of atoms at the interface of the particles is never perfect in sintering, but there is sufficient ordering to form a meniscus which, then, becomes a grain boundary. If the process is continued long enough, the grain boundary will migrate through the larger particle and bring with it the bulk of the smaller particle, which is absorbed, and the large particle grows at the expense of the small one.[3]

The sintering may be stopped when enough gold granules are fused to hold the mass together. The clumps can then be broken into convenient sizes and wrapped in two or three layers of foil.

In theory, the sintered aggregates should break apart under compaction and roll into place when the foil covering is torn apart under the condenser. The spongy texture of the sintered granules in the foil wrappings must be broken down to allow spreading in a layer thin enough to weld the granules to the underlying compacted and burnished layers through deformation and plastic flow. Experience has shown the aggregate clumps to be resistant under all types of compaction. The best specimens were produced with hand malleting and methods which promoted spreading of the pellets during compaction.

Mat gold responded best to ultrasonic vibration. The tiny particles of gold settled into dense layers without effort. Unfortunately, the use of the ultrasonic instrument is contraindicated for compacting dental restorations because there is considerable risk that teeth may be damaged or extracted during insertion of the material. An additional hazard was the temperature increase of 200 to 340 degrees Fahrenheit that was measured under the condenser point.

The best results were obtained in gold foil when the thin folds of the foil pellets were pressed down and welded together by direct blows from the hand or pneumatic condenser. A 0.5 mm point covered an area that was practical in size to permit driving the folds together with force light enough to avoid damage to the tooth. The behavior of mat or granular gold was different under this type of compaction. The microstructure of the individual particles showed them to be thicker and heavier than a corresponding fragment of foil. The crystals did not bend so easily as the foil and greater force was required to weld them together under hand or pneumatic compaction. Gold foil did not compact as well with ultrasonic vibration, although some dense areas were thicker than those produced with hand or pneumatic compaction. It was more difficult to control the pellets and they were spun out of the cavity by the frequency and force of the vibrations.

The maximum density of compacted gold foil was studied by placing sheets of foil together like the leaves in a book. The foil was dense under this condition. Experience proved, however, that it was difficult to place foil in layers in a prepared cavity and obtain adequate marginal adaptation. The usual practice was followed by rolling single sheets into loose pellets to make the specimens, and there was little chance for a significant number of the laminations and foldings in the foil to be lined up as precisely and as close together as in the flat sheets. The specimens were built up in layers as the pellets were pushed down with systematic and consistent malleting.

A point to consider is the quality of the restoration to be expected under optimum compaction, based on the amount, kind and extent of the porosity in the finished product. Foil porosity is created inside the folds of pellets and the voids are distributed randomly throughout a restoration. Voids in the pellets are eliminated in areas of direct contact of the foil layers where they are compressed under the impact of the condenser point. Cohesion of the gold retains the effect of compression by atomic welding of the layers together to maintain the density of the specimen. The depth or penetration of compression is limited by the strain hardening and welding of the gold and is confined primarily to the surface of the pellet insofar as achieving solid density is concerned. Voids in the lower layer of the pellet are compressed but not eliminated. Secondary void spaces occur between adjacent pellets and often are larger than the pellet porosities. These voids are more difficult to compress and may be troublesome in marginal areas of restorations.

The advantage of foil over the other gold materials lies in the potential for unbroken sheets to enclose the voids and seal off the walls of the cavity. The natural cohesiveness of the gold contributes to the sealing properties and strength of foil restorations by closing off voids and forming solid layers in the welded areas. The same effect is impossible to achieve in the granular and mat golds because the smaller and relatively denser particles form spot contacts rather than laminations and a sponge effect is created. Specimens made from particle golds are more absorbent.

Each of the three types of gold requires different handling to achieve maximum compaction. Gold foil is most amenable to impact malleting. The fern-like crystals of mat gold are placed in closest contact with vibratory shaking. The granular golds required spreading and burnishing. In general, the bulk density of restorations is increased by impact, vibratory compaction, pressure and burnishing. Higher pressures cause plastic flow, increased strain energy, and particle fracture; these, in turn, cause further increases in density, so long as the gold remains malleable at forces tolerated by the dental tissues.

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A Comparison of the Biological Effects of Filling Materials with Recommendations for Pulp Protection

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DENTISTS have a right to know whether new or experimental restorative materials, agents, and drugs are more, the same, or less irritating to pulp tissues than accepted dental products now in use.[1] All new products used in any field of dentistry should undergo biological testing before they are considered acceptable to the dental profession.[2]

Scientifically reliable information rather than merely empirical or intuitive information concerning the response of the dental pulp to pertinent clinical dental procedures is essential. Published reports based on purely clinical observation can be misleading when accepted without qualification. It must be emphasized that the extended time required for a severely injured pulp to die makes clinical evidence alone most unsatisfactory and unreliable. Statements made by either dentists or manufacturers relating to the success of new instruments and materials should be held in question until adequate scientific documentation is provided.[3] It is unfortunate that new restorative materials continue to be offered to the dental profession without appropriate evaluation. Dentists are not sufficiently demanding of demonstrated biological testing of these new products.

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There is considerable confusion regarding pulpal response to restorative materials. Much of the difficulty is related to the fact that earlier investigations were performed with low-speed cutting instruments which of themselves can produce significant pulpal response. The currently available high-speed instruments, operated with adequate safeguards, permit cavity preparation with minimal pulpal response and, accordingly, the superimposed effects of restorative materials are easier to recognize and interpret.

Generally, 2.0 mm. of remaining dentin—(R.D.) between the floor of the cavity preparation and the pulp will provide an adequate insulating barrier against the more traumatic thermogenic operative techniques and irritating components of most restorative materials. However, at lesser dentin thickness, the inflammatory response of the pulp is increased. Therefore, for comparative purposes, all specimens utilized in human pulp studies should have remaining dentin thicknesses of less than 2.0 mm.[1]

It must be emphasized that there is a difference in the pulp responses following these experimental procedures as compared to those produced by similar procedures in clinical practice. In experimental cavity preparation of noncarious teeth, irregular dentin does not underly the cut dentinal tubules, as is usually the case when cavities are prepared in areas preceded by caries or old restorations. In addition, following cavity preparation, pulps covered with a very thin layer of remaining dentin generally would receive a liner or base before being subjected to the direct effects of certain filling materials.[1]

Research in the areas of new dental materials has been accelerated in recent years with particular emphasis being placed on the search for adhesive anterior restorative materials. While substantial progress has been made, the full realization of this latter goal has not been achieved. Nevertheless, a number of experimental formulations have been developed that demonstrate physical, chemical and clinical properties of sufficient merit to warrant biological evaluation. Several of these new formulations appear particularly promising as substitutes for existing silicate and acrylic restorative materials.[4] The purpose of this study was to compare the pulpal response or determine the level of toxicity induced by these new restorative materials with ZNOE, silicate cement and Bonfil.*

One of these new formulations, developed at the Eastman Dental Center, consisted of a relatively high molecular weight liquid monomer that contained unsaturated acrylic resin, 50% filled with syn-

*L. D. Caulk Co., Milford, Delaware

thetic calcium hydroxyapatite and a few percent of methylmethacrylate monomer.

This new formulation, which was the basis of Dakor,* now commercially available, consisted of a paste which was converted in approximately two minutes, by the addition of benzoyl peroxide as catalyst and N-N-dimethyl paratoluidine as accelerator in concentrations considerably below that required for conventional self-curing acrylic resins to a translucent polymer that blended in with a variety of tooth shades. Both of these formulas will be compared.

In addition, Addent,** a product developed by the Dental Products Laboratory, 3M Company, has also been evaluated. This anterior restorative material consists of an organic binder with over 70% inorganic fillers in the form of glass beads and rods. According to the manufacturer, "the organic binder is a mixture of liquid vinyl-type comonomers which become highly cross-linked during setting. The mixture contains modified acrylates, cross-linking agents, and other ingredients." The translucent spherical glass beads and rods and powdered inorganic fillers provide a light transmission system for color adaptation to the surrounding tooth structure. The filler particles are treated with a water repellent coupling agent (vinyl silane), which chemically joins with the organic binder during setting to form a dimensionally stable, moisture-resistant material.

A cavity liner or coating agent was also developed to protect the dentin and pulp from potentially harmful ingredients in Addent. This liner is a film forming synthetic vinyl copolymer dissolved in acetone, which is impermeable to water, the monomeric and catalytic fractions. This material coats dentin rather than acting as a dental liner like zinc phosphate cement.[5]

These composite dental acrylic-type resins described above are of particular interest because of the improved physical and esthetic properties inherent in these formulations. Because of their lower shrinkage, lower coefficient of thermal expansion, greater hardness, resistance to abrasion, high comprehensive strength, and translucency, the composite resins offer many advantages over the conventional resins and silicates. Biologic compatibility, however, is imperative before any dental material can be readily accepted for general use.

From clinical experience we know that unlined silicate restorations are not acceptable biologically; therefore, we can assume that in order

*L. D. Caulk Co., Milford, Delaware
**Minnesota Mining & Manufacturing Co., St. Paul, Minnesota

for these experimental restorative materials to be acceptable, their average reaction (intensity) values must certainly be less than those produced by unlined silicate restorations. The toxic qualities of a silicate restoration can be greatly reduced with an appropriate liner; however, new experimental restorative materials in order to gain true adhesion may require direct contact with tooth structure. Thus, a comparison with unlined silicate restorations is more realistic.

MATERIALS AND METHODS

Class V cavity preparations were cut nontraumatically on the facial surfaces in the cervical region of 391 intact human teeth with No. 35 inverted cone carbine burs at various speeds and with an air-water spray.

Seventy-one teeth were restored with ZNOE; 55 teeth with silicate cement without a liner; 91 teeth with Eastman product; 26 with Bonfil; 28 with Dakor; 40 with Addent; 69 with the two coats of the recommended 3M Addent Cavity Liner No. 1930* plus Addent; and 11 with $Ca(OH)_2$ alone. The teeth were extracted between 1 and 127 days postoperatively, and routinely processed for histopathologic interpretation. It should be emphasized that the purpose of removing the experimental teeth over an extended postoperative period is to provide a panoramic view and a dynamic sequence of events of all the stages and degrees of pulpal response to experimental procedures rather than static appraisal of morphologic alterations. The control and experimental categories were each subdivided into two subgroups according to the postoperative interval: specimens with a postoperative interval of 12 days or less and specimens with a postoperative interval greater than 12 days. The various categories were compared by recording the incidence and average intensities of cellular displacement into the dentinal tubules and the inflammatory response in the superficial tissues (odontoblastic layer, cell free zone of Weil, and cell rich zone) and deeper tissues of the pulp. The intensity of a characteristic was recorded according to an arbitrary scale (0-4 degrees). After all the specimens were examined and graded, average intensity scores were established. A favorable situation requires that the average intensity of response be higher in the initial or early postoperative specimens and decreases in value in the older postoperative specimens. If the values in the older postoperative group are higher than or equal to the initial or early group, it is indicative of prolonged irritation, a situation that is not acceptable.[1]

*Minnesota Mining & Manufacturing Co., St. Paul, Minnesota

It is not unusual that any restorative material when compared with ZNOE will register a higher reaction or intensity score than ZNOE. The important point is that even though the test product may initially produce a higher average intensity score than the control category its average intensity score should decrease significantly in the older postoperative interval.[4]

This favorable situation is also reflected in the older postoperative interval by a decrease in the percentage of specimens with 2° or more of response. This type of evaluation permits a quick appraisal of the biologic situation. As lesions heal, the incidence of specimens with responses of two degrees or more decreases. If the reverse occurs, the technique is considered unsatisfactory and requires modification or elimination. The level of toxicity of an experimental product is thus easily recognized by the frequency of the severe responses and how long a postoperative interval is necessary for resolution to occur.

RESULTS (Chart I)

One can see that the incidence of severe lesions with ZNOE was very low and the situation did not change with increased postoperative time. Further improvement would be most unlikely when a product produces such a low range of responses initially. No severe responses occurred in the presence of $Ca(OH)_2$. With silicate, the incidence of severe lesions was moderately high (31.1%) and continued to increase with time (45%). Bonfil initially induced more severe lesions than silicate but at least showed some trend toward a decreased value. The experimental Eastman product which was the precursor of Dakor initially resembled the response to silicate but differed from silicate in that resolution of the lesions apparently occurred quickly. Dakor, likewise, appeared very irritating initially; but again the stimulus was very short-lived, and the percentage of severe lesions after 31.9 days dropped significantly.

In contrast to the silicate and Eastman product categories, Addent without a liner category demonstrated initially a lower response value but with longer postoperative intervals the value increased to equal the irritation capacity of silicate. When Addent was used with its recommended liner, the initial intensity of response although increased was at least sustained. The Addent cavity liner seemed to provide some benefit but not enough to guarantee the desired protection.

NUMBER OF SPECIMENS WITH 2° OR MORE OF RESPONSE

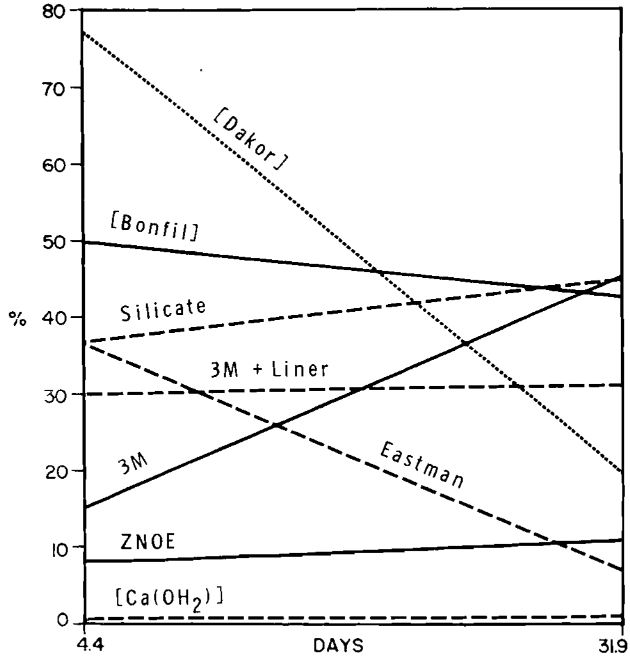

Chart 1

DISCUSSION

If the initial pulpal responses occurring with the experimental Eastman product could be reduced consistently, such a formula would approach more the ideal in terms of biologic compatibility. Realistically, if we have to accept the fact that some irritation must occur, it would be best that the irritating component of the restorative material be short-lived and that the pulpal responses resolve quickly.

If an explanation for the pulpal reactions resulting from the placement of the Addent liner and Addent restorative material was microscopic pinhole defects in the coating, due to the roughness of the cavity floor and walls, too many such defects occurred to be sufficiently protective to the pulp and comforting to the evaluator.

For the present, these newer anterior restorative materials can best be utilized more safely in old cavity preparations where reparative or irregular dentin has previously sealed the cut dentinal tubules; or after the application of established or effective bases or liners which definitely seal all opened dentinal tubules. Calcium hydroxide mixtures, such as Pulpdent* and Hydrex** are recommended. Dark discoloration, however, can occur when the Addent liner material interacts with certain base materials such as zinc oxide and eugenol, zinc oxyphosphate and $Ca(OH)_2$ preparations containing Zn, Na and Cu ions. Addent and Addent liner on Ca $(OH)_2$, Pulpdent, or Hydrex is compatible. Addent and Dycal*** is acceptable, but Dycal is incompatible with the Addent liner.

To improve biologic compatibility, research and development should continue to provide more effective cavity liners or sealers and should strive to reduce the toxic components of these new anterior restorative materials.

SUMMARY

Class V cavity preparations were made on the facial surface in the gingival region of 391 intact human teeth to compare the pulpal response of several new composite restorative materials with and without liners to those of ZNOE, silicate cement and Bonfil. The teeth were extracted between 1 and 127 days postoperatively.

It was found that the initial pulp responses created by the experimental Eastman product were quite similar to silicate, but the Addent without a liner was initially somewhat less irritating than silicate. After extended postoperative time intervals, however, the intensity of the lesions produced by Addent continued to increase. The vinyl copolymer Addent liner did not sufficiently protect the pulp tissues from the irritating properties of Addent. Certain Ca $(OH)_2$ liners and cement bases should be applied to seal all opened dentinal tubules when the new composite anterior restorative materials are used.

*Pulpdent Manufacturing Co. of America, Brookline, Massachusetts
**Kerr Manufacturing Co., Detroit, Michigan
***L. D. Caulk Co., Milford, Delaware.

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Modern Dry Field Operating and Gold Foil Restoration Techniques Introduced into the Regular Teaching Schedule of The School of Dental Medicine of Heidelberg University

LEE D. BARTH, D.D.S., COLONEL, U.S.A. (RET.)

HEIDELBERG UNIVERSITY, School of Dental Medicine, has become the first school in modern Europe to teach these techniques after a pause of 40-50 years.[1] In the summer of 1966 it was agreed that a course of study be organized for that purpose, after it was determined that interest in such subjects was strong enough to warrant setting apart the necessary time from other "essential" subjects. Because dry field and gold foil techniques had become "lost arts" no time had previously been allotted to the teaching of these subjects by the National Government (which agency sets up not only the pre-dental studies program, but also the dental studies, the time allotted for each, the examinations required for graduation). All schooling is controlled at national levels. To determine interest levels a series of introductory clinical demonstrations were planned and given before the regular winter semester began. These clinics were on an entirely voluntary basis, and

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Colonel Lee D. Barth was a guest professor, lecturer, clinician at the University of Heidelberg, School of Dental Medicine, West Germany, 1966-68. This program was supported in part by Land Baden-Wurtenberg die Verwaltung der Klinischen University Anstalten Heidelberg. The author wishes to thank the following: Prof. Dr. Dr. H. F. Overdiek, Prof. Ord. Prof. Oper. Dent. who acted as consultant for the project; Dr. G. Wilstermann, Academic Advisor, appointed to work with the project; and Dr. R. Trude, Graduate Asst. student adv. (clinic) appointed to work with the project.

the interest in them grew with each clinic, so it was decided to inaugurate a regular course of study (including a series of lectures, a clinical laboratory course, rubber dam application courses), beginning at the start of the winter semester in November 1966. Two graduate dentists were assigned to work full time with the program to begin to apply the principles learned to patient care as soon as possible and to carry on the work later.

To find the time to do all this, it was necessary for the faculty to

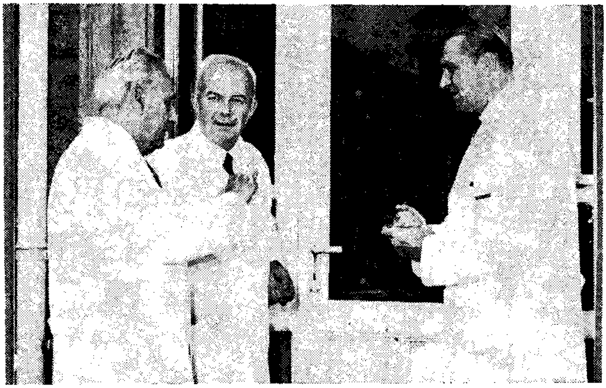

Fig. 1 From left to right are: Dr. Barth; Dr. R. Ritter, Professor Ordinarie, Director of the School of Dental Medicine, University of Heidelberg and Dean of Dental Educators in Europe; Dr. H. F. Overdiek, Professor Ordinaire and Acting Head of the Operative Section, University of Heidelberg.

relinquish some of their allotted time from other subjects. The time given came from the Director's lecture time and the time taken from the Acting Chief of the Operative Section (Fig. 1). Lectures and clinics came through the first semester with flying colors, but not without doubtful moments. One such doubt was born when it was decided that it would be better to give the lectures in the German language — even though this meant that the lectures written in English had to be transposed into German — this required that several hours a week be spent just rewriting into German. All doubts were removed when the time needed was generously given. Another moment of doubt came when, due to the numbers interested in the course, it was thought that the instruments were in short supply, and American firms contacted paid little or no attention to purchase orders, and we contacted the Academy of Gold Foil Operators for help. The Academy responded immediately with the offer of help. However, it

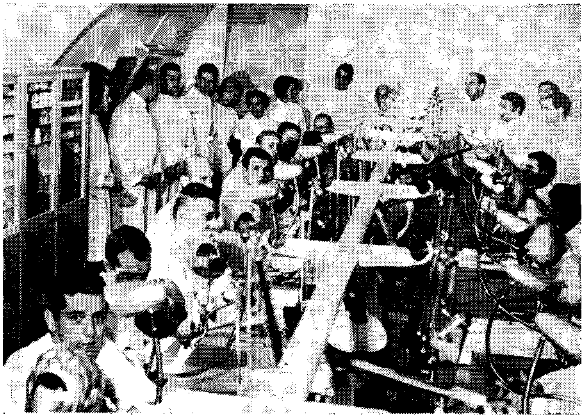

Fig. 2 View taken of part of the team in one of the clinical laboratories.

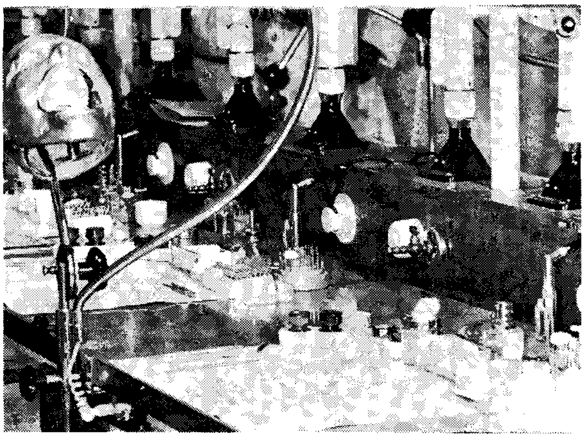

Fig. 3 Direct gold techniques including dry field techniques are applied first in laboratory.

was decided to do with what was at hand and the moment passed.

By the end of the first semester, it was decided to lengthen the courses for another semester and to use the time between semesters for concentrated efforts on the part of the instructor and the two graduate assistants. Thus, the two assistants spent most of that spring doing gold foil restorations and became irreplaceable in the program. They have continued to improve their techniques since and have been instrumental in teaching others interested in improvement.

At the end of the second semester, it was decided to continue the program another year. By this time 90% of the student body had become familiar with the advantages of direct gold restoration, and dry field operations, and foil techniques have become a regular course of study.

Every dental student has successfully completed 13 years of grade school, high school and junior college, and has successfully passed his or her entrance examinations. This entitles each of them to 10 semesters of dental study: 5 semesters of preclinical study (Figs. 2, 3) and 5 semesters of clinical study. Each school is divided into two semesters — one winter, 1 November to 1 March, and one summer semester, 1 May to 1 August. At the end of the first five semesters, the student must take another examination in order to qualify for the final five semesters. The title of Doctor is not automatic but must be won only after additional assigned research and a written paper graded by an official Prof. Ordinaire.

References

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Program

Annual Meeting
American Academy of Gold Foil Operators

Friday, OCTOBER 10, 1969
STATE UNIVERSITY OF NEW YORK AT BUFFALO, NEW YORK

8:30 a.m. *REGISTRATION*—K Capen Hall, 15 The Circle, School of Dentistry

9:00 a.m. *PATIENT DEMONSTRATIONS*

CLASS II RESTORATIONS

Dr. Daniel Frederickson	*Buffalo, New York*
Dr. Roy A. Wilko	*Snyder, New York*

CLASS III RESTORATIONS

Dr. Marshall Arbo	*San Antonio, Texas*
Dr. Roy Boelstler	*Flushing, New York*
Dr. Irving D. Anderson	*Seattle, Washington*
Dr. Ronald W. Curtis	*Lansing, Michigan*
Dr. Fred I. Hasegawa	*Seattle, Washington*
Dr. Milton Latoni	*San Juan, Puerto Rico*
Dr. Earl O. Maston	*Seattle, Washington*
Dr. Harold Oswald	*Bellingham, Washington*

CLASS V RESTORATIONS

Dr. Roberto Lima	*Sao Paulo, Brazil*
Dr. Darrel R. Ludeman	*Vermillion, South Dakota*
Dr. Donald E. Nemer	*Gregory, South Dakota*
Dr. Paul M. Morrison	*Bethesda, Maryland*
Dr. Marvin G. Schmidt	*Indianapolis, Indiana*
Dr. David Marmer	*Fresh Meadows, New York*
Dr. W. O. Meyer	*Edmonton, Alberta, Canada*
Dr. Wm. P. Brodie	*Orlando, Florida*
Dr. Frida Xhonga	*Los Angeles, California*
Dr. Robert B. Wolcott	*Los Angeles, California*
Dr. James J. Theisen	*Omaha, Nebraska*
Dr. Joseph B. Lenzner	*New York, New York*
Dr. Harris Silverstein	*Jersey City, New Jersey*

Dr. Wm. J. Thompson	*Seattle, Washington*
Dr. Arthur B. Cahalan	*Des Moines, Iowa*
Dr. Richard Adelson	*Smithtown, New York*
Dr. Don Meaker	*Zanesville, Ohio*
Dr. Allen K. Brown	*Seattle, Washington*
Dr. Richard H. Johnson	*Seattle, Washington*
Dr. H. H. Jarvis	*Buffalo, New York*
Dr. George Goldfarb	*Buffalo, New York*

12:15 p.m. *LUNCHEON*

1:15 p.m. *OPENING CEREMONIES*

Call to Order	Dr. Paul T. Dawson, PRESIDENT
Invocation	Dr. Floyd E. Hamstrom
Greetings	Dean James A. English
Announcements	Dr. George W. Ferguson, VICE PRESIDENT and LOCAL ARRANGEMENTS COMMITTEE
Introduction of Essayists	Dr. Ralph J. Werner, PRESIDENT-ELECT and PROGRAM CHAIRMAN

ESSAY PROGRAM

"The Finishing of Gold Foil"
Dr. Gordon D. Raisler, *Seattle, Washington*

"Direct Gold Alloys"
Dr. Frida Xhonga, *Los Angeles, California*

"Rationale For Design of Cavity Preparation"
Dr. Donald A. Welk, *Lexington, Kentucky*

"Renewal of Oral Mucosal Epithelium: A Cybernetic Model"
Dr. A. Ian Hamilton, *Seattle, Washington*

TABLE CLINICS

"Preparation and Care of Gold Foil"
Anita Hamstrom, *Burlington, Washington*

"Tray Set Ups"
Dr. Robert O. Blackburn, *Findlay, Ohio*

"Better Understanding of Operative Procedures"
Dr. Peter Cunningham, *Bufalo, New York;*
Dr. Peter Osborne, *Buffalo, New York*

"Operative Research by the staff of the University of Kentucky"
Dr. Harold R. Laswell, CHAIRMAN, *Lexington, Ky.*

"Conservation of Dentin in Cavity Preparations"
Dr. Carl J. Monacelli, *Brookline, Massachusetts*

Commercial Exhibitors will be present

7:30 p.m. *SOCIAL HOUR—Buffalo Statler Hilton Hotel*

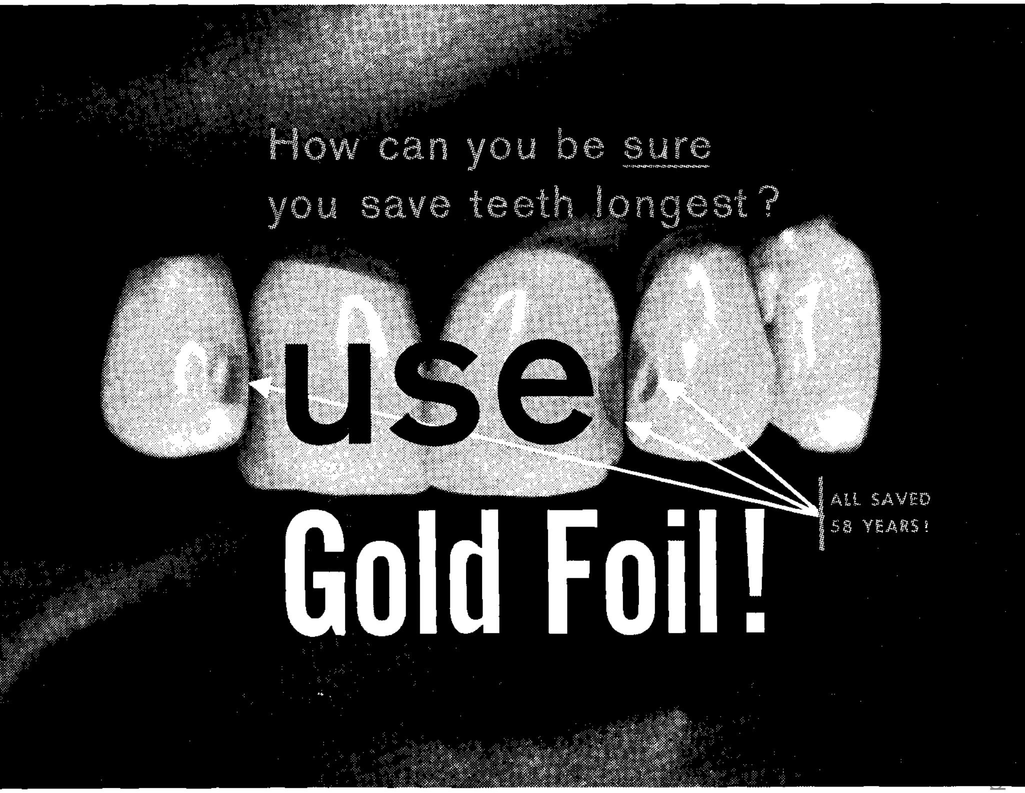
8:00 p.m. *ANNUAL BANQUET*

NOMINEES FOR ACADEMY OFFICERS

The Nominating Committee has submitted the names of the following members for offices during the 1970-71 term:

RALPH J. WERNER	*President*
GEORGE W. FERGUSON	*President-Elect*
G. RON HEATH	*Vice-President*
HUNTER A. BRINKER	*Secretary-Treasurer*
CLIFFORD H. MILLER	*Executive Council*—1971 (2 *year*)
FLETCHER M. CRAIG	*Executive Council*—1972 (3 *year*)

The balloting will take place at the annual business meeting on October 9, 1969 at the State University of New York at Buffalo.



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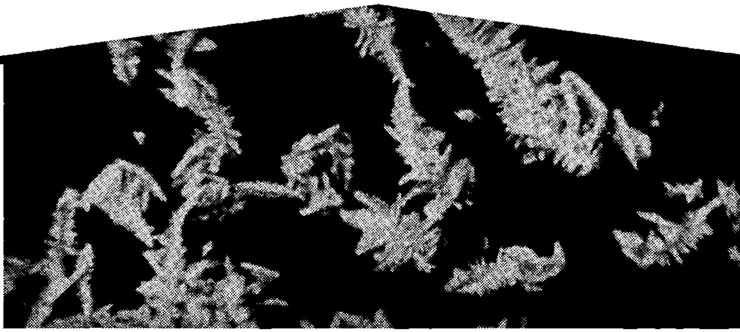

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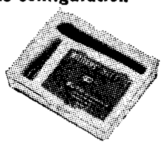

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