



Dental Research News

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This month's edition is dedicated to the many members of staff and faculty who have worked so hard during the past several months in the preparation of abstracts and research grants for submission. A special tribute is also due to our students who have participated in our research programmes during the summer which has made much of this possible.

Research Review for 1991

For the past two years a *special edition of the November Research News* has been devoted to a review of our ongoing faculty research based upon abstracts submitted to the IADR/AADR meetings. The following review on pages 4-13 is again based upon abstracts which have been submitted for meetings in 1992. The full titles and authors of these abstracts were listed in full in the October issue of the Dental Research News (Vol. V, page 3). It should be made clear that this is not by any means a complete review of all of the research being conducted in our faculty. One clear area which is not covered is the excellent research programme in Microbiology which was featured separately in the January Vol. V 1991 edition of the Research News. In addition this review does not cover the

educational research which is currently being undertaken. The object of the review is to make available to our Faculty and the Dalhousie community some idea of the type and diversity of research which is currently being undertaken. Any faculty members who would like to provide a report on their own specific area of research not covered in this review should forward this on a disk to the Dental Research Development Office.

Personal Contribution

"Science, by its very nature, is a body of public knowledge, to which each research worker makes his personal contribution, and which is corrected and clarified by mutual criticism." John Ziman

**Do you have any items for the Dental Research News?
Please forward any details preferably on a disk to the Research Development Office.**

Eight Grants Submitted!

Eight research grants requests have been submitted by our faculty this year and are currently under review by MRC and NHRDP. These request have a total budget of \$3.63 million.

These grants are:-

1) NHRDP, 'Risk Assessment of Health Hazards due to Mercury from Dental Amalgam.'

Jones, D. W., Cunningham, D. P., Foong, W. C., Clovis, J., McCurdy, M., Moss, M. A., Sutow, E. J., and Wright, B. A. Total request: for 4 years, \$472,182.

2) MRC Operating Grant: 'Clonal Selection and Metabolic Changes Associated with the Endogenous Transmission of Key Periodontal Pathogens.'

Shah, H. N. and Hawkins, C. H.

Total request for 3 years \$124,324.

3) MRC Operating Grant: 'Liposomes; An Oral Mucous Membrane Drug Delivery System.' Foong, W. C., Mezei, M., Harsanyi, B. B. and Pink, D. A.

Total request for 3 years \$215,362.

4) MRC Operating Grant: 'Polymer Biomaterials' Jones, D. W., Kwak, J. C. T., Graham, B. S., Gross, M., Foong, W. C., Harsanyi, B. B. and Pink, D. A. Total funding request for 5 years \$376,130.55.

5) MRC Operating Grant: 'Ceramic and Glass Biomaterials.' Jones, D. W., Sutow, E. J., Clarke, D. B., Cameron, T. S.

Total funding requested for 5 years \$430,064.11.

6) MRC University/Industry Grant: 'Periodontal Liposomal Drug Delivery System.'

Mezei, M., Foong, W. C.

Total request 3 years \$429,020.

7) MRC University/Industry Grant: 'Glass Ionomer Biomaterials' Jones, D. W., Kwak, J. C. T., Sutow, E. J., Pink, D. A., Clarke, D. B., Cameron, T. S. Total funding request for 3 years \$609,020.

8) MRC Programme Grant 'Biomaterial Synthesis' Jones, D. W., Cameron, T. S., Clarke, D. B., Foong, W. C., Graham, B. S., Gross, M., Harsanyi, B. B., Kreuzer, H. J., Kwak, J. C. T., Pink, D. A., Sutow, E. J., and Vargha-Butler, E.

Total request 5 years \$1,780,297.

Note: Operating grants #4 and #5 also form part of the Programme Grant request and will not be funded separately should the MRC Programme Grant request be successful. This series of 8 grant submissions represent the largest total grant application request ever made in one year in the history of our Faculty.

The Art of Knowing

"In a general way science is taken to mean 'The Art of Knowing.' It is almost the same thing as research, which means the accumulation of knowledge by systematic observation, deliberate experiment and rational theory."

John Ziman

John Laba Memorial Research Award

The first recipient of the "John P. Laba Memorial Research Award" was Dr. Kevin Lung. His research was presented as a poster at the American Association of Oral and Maxillofacial Surgeons Association's 73rd Annual Meeting in Chicago, September 25-29, 1991. The title of this research project was "Comparison of Osseous Change with Wire Osteosynthesis or Rigid Fixation in Genioplasty." by D. S. Precious, K. Lung, J. E. Armstrong, and R. H. Goodday. The poster presentation recognized funding from The John P. Laba Memorial Fund.

The form of the anterior mandible in 45 patients was assessed before and after genioplasty. The purpose of this study was to examine the pattern of osseous change of the chin subsequent to genioplasty in two groups of patients, one of which had rigid fixation, the other, wire osteosynthesis.

Forty-five patients (34 females, 11 males), who underwent genioplasty were included in this study. Mean age of the patients was 21 years (range 14-42). Thirty-four patients had antero-superior positioning of the chin using a modified Michelet procedure. Eleven patients had sliding genioplasties, 7 advancements and 4 setbacks. Wire

osteosynthesis was used in 27 cases and rigid fixation in 18 cases. Lateral craniofacial cephalometric radiographs were obtained by standard technique. Indication for genioplasty was based on both clinical examination and the architectural craniofacial analysis of Delaire. The radiographs were obtained at the immediate post-surgery (T1) and at least one year post-surgery (T2). All patients underwent pre-surgical and post-surgical orthodontic treatment and concomitant maxillary and/or mandibular osteotomies.

A consistent pattern of bone apposition and resorption was observed following genioplasty. Based on this pattern of bony change, the placement of fixation devices should be in areas of bone deposition in order to optimize integration.

Supported by the OMS Research Fund Victoria General Hospital.

Foundation for Continuing Education and Research

Dr. D. S. Precious was elected chairman of the Foundation for Continuing Education and Research of the Canadian Association of Oral and Maxillofacial Surgeons Annual Meeting in May, 1991. The sole purpose of the Foundation is to advance the quality of patient care through research and continuing education.

1991 Review of Research

The following review of research projects represents a very small segment of our ongoing active research within the Faculty of Dentistry.

The Influence of Polishing Method on Tarnish

Resistance of Dental Alloys. Elliott Sutow and colleagues have compared the effectiveness of polishing methods for cast alloys. The objective of this study was to evaluate three methods for their influence on tarnish resistance. Thirty disc specimens were cast for each of four alloys: A. Type III gold; B. high gold content ceramometal; C. Ni-Cr-Be; and D. Type III Cu-Al. Specimens were air-abraded with 25 μ m aluminum oxide before polishing. The Cu-Al alloy was tested in 0.0001% sodium sulfide solution and the remaining alloys in 8.5% sodium sulfide solution, at 37°C, for 72 h. Tarnish was assessed by a colorimeter, using the CIELAB system. Values of ΔE^* were calculated and statistically analyzed using a Student-Newman-Keuls multiple comparison test ($p=0.05$). Analysis showed for alloys A, B and C that ΔE^* values were not significantly different for the three polishing methods. It was concluded that in comparison with the two conventional polishing methods, the customized method provided the same sulfide tarnish resistance for the gold- and Ni-based alloys, but provided less tarnish resistance for the Cu-Al alloy.

Effects of Fluoride and CO₂ Laser Radiation on Enamel Demineralization.

Tom Boran has been collaborating with Ken Zakariassen to evaluate the potential of CO₂ laser energy, as an enamel preventive treatment. Much of the practical hands-on laboratory research in this project has been undertaken by John Peters a 4th year DDS student. This investigation has examined the effect of fluoride application and low level CO₂ laser radiation on smooth surface enamel as a means of reducing subsequent sub-surface demineralization. Extracted third molars were painted with acid resistant varnish leaving four windows on the buccal surfaces measuring 1 mm in diameter. One window was used as a control, the other three were experimental labelled as follows (fluoride application only, laser radiation, combination of fluoride and laser radiation). The power level used was 1.5 watts @ 0.15 sec. with a 1.5 mm focal spot. The fluoride solution was sodium fluoride (2%) with 4 min application. The teeth were immersed in ten Caté solution (2.2 mM Ca⁺⁺ and PO₄, 50 mM acetic acid, .5 p.p.m. F @ constant pH=4.3) for 12 days. 100 μ hard tissue sections were prepared imbibed in dH₂O and photographed under polarized light. Photo enlargements were made and the lesion areas were quantified with a planimeter. The data was statistically analyzed. All experimental conditions resulted in significantly smaller zones of (cont on page 5)

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demineralization than the control, however, no significant difference was observed among the various treatment groups. Research is ongoing to determine the appropriate parameters required for managing the reduction of demineralization.

Periodontal Status and TMJ Dysfunction.

Linda Delorey and colleagues have been studying the periodontal status and TMJ dysfunction. Although a continual implied relationship persists, the association between non-working interferences (NWI), periodontal pathoses, and TMJ dysfunction is not clearly defined in the literature. The purpose of this investigation was to establish the following: (1) Determination of the prevalence of NWI on posterior teeth in adult humans. (2) Determination of the relationship, if any, between NWI and the periodontal status of posterior teeth.

(3) Determination of the relationship, if any, between NWI and TMJ dysfunction. The relationship of NWI to tooth mobility (TM), attachment level (AL), probing depth (PD), plaque index (PI), bleeding on probing (BOP), and subjective and clinical TMJ dysfunction (TMJD) was assessed in 132 military personnel with bilateral occluding posterior teeth (mean age 45). NWI & TM were recorded on 2036 teeth and AL, PD, PI, and BOP at 4072 sites (Buccal and lingual). Statistical analysis showed 47% of the population had NWI (25% unilateral NWI and 14% bilateral NWI. Symptoms of TMJD were

observed in 81% of the population with NWI, however, these findings were not significant. Measurements of the periodontal parameters showed the strongest association between NWI and buccal and lingual AL. Within the limits of this study, it is concluded that:

(1) NWI were a common occurrence in this study and 2nd molars appeared to be the most affected tooth.

(2) A strong association was shown between NWI and loss of attachment.

(3) Subjective and clinical findings of TMJD showed a strong association.

Flexible Die Materials.

Jack Gerrow and Richard Price have been comparing the surface reproduction of flexible die materials used for producing composite inlays. The use of flexible die materials has recently been suggested to simplify the fabrication of indirect composite acrylic resin inlays. The flexible die material is used instead of a gypsum product to produce a die on which the inlay is fabricated.

This study compared the surface detail reproduction of three potential flexible die materials when used in combination with four different impression materials. Dies were also made using two control materials. Ten test dies of each of the thirteen combinations were made in random order, using a standard apparatus with a 20mm line for compatibility testing. Materials were prepared according to manufacturers instructions. No separating fluids were used between the impression and die materials.

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Much of the practical hands-on laboratory research in this project has been undertaken by Andrew Harvey a third year DDS student. Two calibrated evaluators rated the dies under 10X magnification, using low-angle illumination. Dies were rated from A to F, based on the reproduction of the 20mm line. Statistical analysis supported the following conclusions:

(1) The detail reproduction of all three flexible die materials, when used with Jeltrate impressions and the detail reproduction of Blu Mousse with Agarloid impressions was worse than the control system.

(2) All three flexible die materials were incompatible with Impregum impressions and polyvinyl-siloxane impressions are incompatible with polyvinyl-siloxane die materials.

(3) Dies made with Imprint or Impregum from Agarloid impressions had similar surface detail reproduction to the control dies.

(4) Dies made with Impregum from Extrude impressions produced better surface detail than the control dies.

A further aspect of this industrially supported research project being conducted by this group is the marginal adaptation of composite resin inlays fabricated on flexible dies. The use of an indirect inlay fabrication technique for posterior composite resin restorations has been advocated to minimize microleakage and improve wear resistance. Flexible die material systems have been developed to allow the use of an indirect technique during a single patient

appointment. A study of the marginal adaptation of composite resin inlays was carried out using three flexible die material systems. Following the manufacturers' instructions, five impressions of a Class II composite resin inlay preparation on a metal master die were made in random order and poured in the designated die material for each of the test and control systems. Composite resin inlays were made on each test die. After standardized seating of the test inlays on the master die, the marginal opening at three predetermined standardized sites was measured. Statistical analysis supported the following conclusions:

(1) There was no difference in marginal adaptation of the systems at two of the measurement points (gingival and distal occlusal).

(2) At the third measurement point (buccal cusp tip), two of the experimental systems had larger marginal openings than the control system.

(3) All systems produced large ranges in marginal openings at all sites.

Theory and Experiment.

"Different sciences at different times exhibit different relationships between theory and experiment. One chief role of experiment is the creation of phenomena. Experimenters bring into being phenomena that do not naturally exist in a pure state. These phenomena are the touchstones of physics, the keys to nature, and the source of much modern technology." Ian Hacking

Clinical Versus Radiographic Caries Diagnosis.

Bill MacInnis and colleagues have carried out a study in our Dental Clinic. A total of 96 patients (15 to 66 years in age, mean=35 yr.) agreed to participate. Each patient was concurrently examined for caries on pits and fissures and interproximal smooth surfaces of posterior teeth by two dentists who discussed their findings and reached a consensus. The examiners followed criteria, for caries diagnosis which differentiated between stained, arrested and active, non-cavitated, and cavitated caries. After the clinical examination, bitewing radiographs were taken. Radiographic diagnosis was carried out concurrently by two dentists using modification of published criteria. For pits and fissures there was a poor statistical agreement between the two methods.

Clinical examiners identified a total of 45 and 46 tooth surfaces with non-cavitated and cavitated caries, respectively, yet only 2% and 50% were diagnosed with caries in dentin radiographically. On smooth surfaces, the statistical correlation was higher. Out of a total of 70 and 47 incipient and cavitated interproximal surfaces clinically, 0% and 60% were diagnosed with dentinal caries radiographically.

This study showed that:

(1) caries diagnosis clinically is very liberal and

(2) radiographs are an important adjunct in restorative treatment decisions.

Characterization of Root Surfaces following Citric Acid Application.

John Sterrett and various post-graduate students have been studying for some time the effect of citric acid application methods on demineralization. Optimum citric acid demineralization of dentine has been found to occur using a 30% citric acid solution. The purpose of this study was to determine the surface characteristics of cementum and dentine following the application of 30% citric acid solution using three application techniques: 1) placing, 2) lightly rubbing, 3) heavily burnishing.

Freshly extracted human teeth were collected, these were stored in saline at 4°C. The crowns were removed and the teeth were sectioned in-half vertically; and a treatment area, apical to the coronal attachment level, was delineated on each section. One section was a) lightly scaled (cementum specimen), and the other b) vigorously root planed to remove all cementum (dentine specimens). Cotton pellets soaked in a 30% citric acid solution were applied to the surfaces for 3 minutes using the three application techniques described. Specimens were fixed and prepared for SEM viewing and systematically photographed at x2500.

Results indicate that lightly rubbing or heavy burnishing of either cementum or dentine with 30% citric acid solution yields a tufted collagen surface over much of the treated area. These findings may be important in terms of periodontal regenerative procedures that utilize root demineralization.

Porcelain Retention.

Elliott Sutow and colleagues aided by Neil Power a 3rd year DDS student, have been working on a method to determine the amount of retained porcelain on alloys following mechanical debonding tests. The objective of this study was to examine the possibility of using a pulse potentiostatic method to measure porcelain retention, as well as the retention of other metal/non-metal combinations. Disc specimens were made using three alloys [gold-based; Ni-Cr base metal and Ti-6Al-4V] and two non-metals [electrically insulating varnish and porcelain]. Various combinations of these materials were evaluated. For each combination, the following approximate coverages were used: 0, 30, 55 and 75 %. Specimens were placed in 0.045 % sodium borate solution at 24 °C for testing. Using a potentiostat, specimens were cathodically polarized at 1000 mV below their open circuit potential obtained after 1 hour. Following 1.5 hours polarization, specimens were returned to open circuit for a further 1.5 hours. At zero polarization, specimens were then subjected to 40 mV pulses, by a pulse generator. Current-time curves were stored on a digital oscilloscope. Total charge for each % coverage was found by integrating the curves. Statistical analysis of total charge vs 0 to 75 % coverage for each combination gave very strong linear correlations. It was concluded that the experimental procedure yields regression equations from which accurate values of the % retention of porcelain or other non-metals could be calculated.

Fit of Dentures Using a Visible Light Cured Polymer Material.

Oskar Sykora and Elliott Sutow have been studying for some time the variability of dentures produced by the injection moulding technique. They have shown that dentures had less posterior palatal border opening in comparison with the standard conventional trial-pack technique and that a new, high expansion gypsum stone produced less border opening compared with regular gypsum stone. The objective of their recent work was to compare a visible light cured technique with an injection technique and a conventional trial-pack technique, using the regular gypsum and the new high expansion gypsum stones. In addition high and flat shaped palates were evaluated. Test dentures were made using the three test material/techniques Denture base adaptation was measured in at least 12 locations. Posterior palatal border opening measurements were made after trimming and polishing, and after immersion in water (23°C) for 1 hour, 24 hours and 1 week. The mean openings (poor fit) as a function of material or technique were statistically analyzed. It was concluded that the fit of the dentures in the critical midline vicinity when made by the three different methods, after 1 week immersion in water, were not significantly different using the high expansion stone, and high or flat palates. However, when using regular stone, there were statistical differences as a function of the shape of the palate.

Dental Decay in Children.

Amid Ismail and colleagues are conducting research into The prevalence of non-cavitated and cavitated carious lesions in children. A total of 911 randomly selected children in grades 1-3 were evaluated on the Island of Montreal. The criteria for diagnosis were developed for a longitudinal epidemiological study of restorative treatment decisions by dentists practising under a provincial dental insurance program for children. The statistical reliability coefficients for the group were excellent.

The most frequent carious lesion found in the examined children were non-cavitated carious lesions (incipient) within 1.5 of the gingival line on smooth tooth surfaces, and stained or non cavitated carious lesions on pits and fissures.

Out of 911 children in the study, 19.6% had teeth treated with plastic sealant materials. Children of university educated parents had significantly lower prevalence of carious lesions and fillings than children whose parents had only primary school education.

Education status of parents was a significant risk marker of children with high caries experience and these children had a significantly higher mean number of non-cavitated carious lesions.

This study has found that non-cavitated carious lesions are significantly more prevalent than cavitated carious lesions in children.

Aesthetics following Orthodontic Treatment.

Bill Lobb and colleagues have studied the improvement in the appearance of patients following orthodontic treatment.

The records of 932 patients treated in our dental clinic during a period of 25 years were reviewed. Criteria for inclusion in the study included the presence of dental casts suitable for estimation of the Dental Aesthetic Index (DAI). A total of 116 patient records were included in the study. Patient's age at the start of treatment ranged between 108 months and 351 months.

Fifty patients started treatment during the mixed dentition and 66 were treated when only permanent teeth were present. The DAI significantly improved in both age groups. However, 16% and 23% of the patients in the mixed and permanent dentition groups showed negative DAI differences, respectively. In the mixed dentition group, maxillary anterior irregularities, diastema, and overjet showed statistically significant improvement after treatment.

Patients with permanent teeth showed improvement in crowding of lower incisors, maxillary anterior alignment and overjet. It was concluded from this study that 20% of patients showed lower aesthetic scores following treatment. Improvements in the DAI were related to the alignment of the anterior teeth.

Comparing laser etching and acid etching of enamel.

Bob MacDonald with colleagues Ken Zakariassen and Bill Lobb has studied the use of the laser as a means of etching enamel. Scanning electron microscopic studies have shown that laser energy can produce a roughened enamel surface. A CO₂ laser can produce an enamel surface similar to a acid etching with phosphoric acid.

The purpose of this study was to compare the force required to shear orthodontic brackets from laser etched tooth enamel compared to acid etched tooth enamel. Extracted molar teeth were mounted in acrylic blocks with enamel surfaces prepared as for a standard acid etching technique. Two areas on each tooth were identified for bonding of orthodontic brackets. Each tooth was lased with CO₂ laser on one of these areas. The other area was etched with 37% phosphoric acid gel following a standard protocol. Brackets were bonded with resin cement to the prepared enamel surfaces. The brackets were sheared from the tooth using a mechanical testing machine and the force required to remove the bracket was determined.

The mean force values (Newtons) were:- laser-etched 35±13.4, acid-etched 44.5±16.7. No significant differences were found between the two groups. Laser-etching and acid-etching methods produced similar bond strength to enamel. It was observed that failure occurred more frequently at the enamel/resin interface for the laser-etched method, this may have clinical implications.

Biocompatibility Testing.

Our biomaterials group have previously investigated the plasticizing ability of sebacate compounds. However, limited cytotoxicity data has been available to date for these sebacate materials.

The purpose of this study was to evaluate the cytotoxicity of dimethyl, diethyl and diethyl hexyl sebacate using our previously developed liposome neutral cytotoxicity method. Both NIH 3T3 and L929 fibroblast cell lines were used in this evaluation.

Cytotoxicity of selected sebacates was compared with dibutyl phthalate and dibutyl tin diacetate (positive control). All compounds were initially entrapped in Soy Phosphatide liposomes.

The concentration effect of each liposome entrapped compound (0.1µM to 10 mM; n= 6) on the neutral red (NR) content of either type of fibroblast cell was measured spectrophotometrically.

There was no significant difference between negative controls and "empty" liposomes.

The neutral red absorbance for all test sample concentrations indicated lower toxicity than the positive control.

There was no significant difference between the sensitivity of NIH 3T3 or L929 fibroblast cells with all compounds tested.

The cytotoxicity of sebacate plasticizers was dose dependent.

The toxicity of diethyl hexyl sebacate was the least toxic of the sebacates tested.

Oral Lichenoid & Vitamin Supplementation.

John Lovas together with colleagues at other institutions have been studying oral lichenoid reactions associated with vitamin supplements. Oral lichenoid reactions have previously been associated with various medications and even some dental restorative materials.

A previously unreported finding is the formation of lesions that clinically and histologically resemble oral lichen planus in patients who are receiving vitamin supplementation.

Patients with hyperkeratotic, dysplastic, or carcinomatous lesions of the oral cavity were recruited to participate in a therapeutic clinical trial using supplemental antioxidant vitamins. Each patient received 30 mg of beta-carotene, 1000 mg of vitamin C, and 800 IU of vitamin E per day, which was divided into 4 capsules.

Five patients (10.2%) developed oral lesions that clinically resembled lichen planus. Three of the 5 cases were biopsied and showed the typical histopathologic features of lichen planus. None of the 5 patients had a previous history of either oral or cutaneous lichen planus.

It has been shown that beta-carotene increases both the number and the activity of T lymphocytes. Because lichen planus is associated with a proliferation of T lymphocytes, it appears that the immunoenhancement seen with antioxidant vitamin supplementation may have been responsible for the lichenoid change noted in these patients.

Ion-Leachable Glasses: the Effect of Temperature of Synthesis

Our biomaterials group have studied the effects of heating temperature during synthesis on the amount of fluoride remaining in ion-leachable glasses. The effect of fluoride content on mechanical and rheological properties of cement formulations was also determined.

Glasses were synthesized by wet chemistry. Following digestion with HF, chemical analysis was determined by atomic absorption and ultraviolet visible spectrophotometry and ion specific electrode for the phosphate and fluorine content. Fluorine as a function of heating temperature varied in the glass from 9.7 ± 0.5 to 21.0 ± 0.8 by weight %. Setting Characteristics were determined using a torsion rheometer. Moduli of elasticity were determined using a sonic method. Dynamic modulus of elasticity and Poisson's ratio were obtained for experimental glass ionomer cements containing various fractions of fluoride. A total of 40 specimens, five for each of the eight cement compositions were evaluated.

Good significant correlations were found between the fluoride content and the heating temperature, setting time and fluoride content; setting time and heating temperature; setting rigidity and fluoride content; and setting rigidity and heating temperature.

Young's, shear and bulk moduli also correlated well with the chemical composition of the glasses.

Experimental & Commercial Cements:

Polyalkenoate cements which bond to calcified tissues are finding increasing use as biomaterials. Although first patented over 18 years ago, significant potential remains for improvement. The interaction between ion leachable glasses and the polyacids must be customized in order to provide optimal clinical manipulation and performance.

Our biomaterials group have synthesized a range of ion leachable glasses by wet chemistry ($\text{SiO}_2\text{-Al}_2\text{O}_3\text{-CaF}_2\text{-AlPO}_4\text{-AlF}_3\text{-NaF CaO}$ and Li_2O).

The precursor powders were obtained from suspensions of Al_2O_3 , SiO_2 , H_3PO_4 and nitrates of calcium and lithium, then mixed with Ca, Al, and Na fluorides and calcined at 1000°C . The compositions were melted at 1600°C and rapidly cooled to produce a clear glass. Ca was varied from 11 to 20% and Al from 16 to 21%.

The compositions of the glasses were all significantly different. Glass powders ($< 40\mu\text{m}$) were blended with freeze dried polyacrylic acid (mol wt 23,000) and an aqueous solution of tartaric acid.

Five different glass polyacid ratios were evaluated. The glass/acid ratios ranged from 3.3 to 5.5 for the different formulations. Individual optimal (constant) amounts of tartaric acid and p/L were used for each glass formulation. Tartaric acid for individual materials ranged from 12-20%. Rigidity of the setting

cements was determined using a rheometer.

The strength and elastic moduli as a function of the composition were determined. Modulus measurements, were determined on disc specimens of materials which had been allowed to set in 95% rh at $37\pm 1^\circ\text{C}$ and stored under these conditions for 4 weeks. The specimens were then dried for one week in air prior to determination of the dynamic moduli at room temperature.

The results indicated that variations in alumina and calcium content had a significant effect on the modulus and strength of the cements. Higher Al relative to Ca in glasses significantly increased the shell strength.

A good correlation was obtained between the modulus and the disk strength.

The disk strengths (@ 37°C in water) of the 7 experimental synthesized glass ionomer cements were compared with 22 different commercial cement materials. The following values were obtained for the commercial materials; Phosphate 17 ± 2 to 13 ± 1 Zinc Poly-Carboxylate 34 ± 1 to 16 ± 2 ; Glass Ionomer 40 ± 5 to 20 ± 1 MPa.

Experimental glass ionomer cements had values ranging from 37 ± 3 to 20 ± 3 MPa.

It was concluded that three of the experimental glass ionomer cements produced in this study had strength values equal to or greater than all 22 commercial materials.

*Effect of Plasticizers on
Creep of Methacrylate
Polymers.*

Our biomaterials group have previously reported the glass transition temperature of commercial soft polymer-gel denture lining materials and unplasticized homopolymers of ethyl and methyl methacrylate.

Our research has also established the efficiency of plasticizer constituents as well as reporting qualitative and quantitative plasticizer leachability. Our data shows dibutyl sebacate to have the lowest leachability and is the most efficient plasticizer evaluated. Our present work aims to determine the effect of plasticizer type on the creep of an ethyl methacrylate soft polymer. Creep in compression of three commercial soft polymers and 5 experimental materials each containing different plasticizers were compared. The creep apparatus applied a stress of 15 KPa to the disc specimen. The specimens were aged at 37°C for 24 hour prior to testing in water at 37°C.

A significant relationship was found between creep and plasticizer efficiency. The mean creep values for all 5 experimental and 3 commercial materials were significantly different.

The experimental material using dibutyl sebacate as a plasticizer produced the highest creep values. It should be pointed out that Marco Chiarot 3rd year DDS has been extensively involved with this and other related polymer research projects for the past two years.

Yet More Abstracts

Since the list of abstracts submitted by our faculty was itemized in the *October Research News*, a further 16 have now been added three of which were presented at a meeting last month. This gives us a very impressive list of abstracts documenting our research.

Six abstracts have been submitted by the School of Dental Hygiene. The following four papers have been submitted to the AADS meeting in Boston, March 1992.

“A Comparison of Empathy Scores Among Dental Hygiene Faculty, Graduates and Students,”
(poster)

N. R. Prowse*, W.A. MacInnis

“A Guided Learning Instructional Method,”

T. L. Mitchell, M. E. Kinnear

“Restorative Practices of Dental Hygienists in Atlantic Canada,”

J. Clovis, W. C. Foong.

“Curricular Content in Pharmacology for Dental Hygiene,” W. C. Foong, J. Clovis.

The following two papers have been submitted to the 12th International Symposium on Dental Hygiene, The Hague, July 1-4, 1992,

“Intentional and Unintentional Learning in Extramural Experience,” J. Clovis,
M.G. E. Forgay, J. G. Messer,
H. J. Murphy.

“Dental Hygiene Curriculum - A Review Process for a Course in Restorative Techniques,”
J. Clovis.

Even more Abstracts

Four abstracts from the Department of Oral Diagnosis and Oral Max. Surgery, have been accepted by the AAOMS for their 1991 73rd Annual Meeting.

Precious, D. S., Armstrong, J. E., Goodday, R. H., Lung, K*.: Comparison of osseous change with wire osteosynthesis or rigid fixation in genioplasty.

Precious, D. S., Skulsky, F. G., Goodday, R. H. & Multari, J*.: The effect of presurgical orthodontic treatment on TMJ pain.

Precious, D. S. and Morrison, A*.: Anatomy of the superior head of the lateral pterygoid muscle in humans.

Precious, D. S., Skulsky, F. G., Goodday, R. H.* and Field, C.: The potential role of infection in hemorrhage following LeFort 1 Osteotomy.

Three Abstracts Presented.

The following three abstracts were presented by the Division of Periodontics at the American Academy of Periodontology Annual Meeting in Vancouver, Oct. 2nd- 5th 1991.

Peak Citric Acid Concentration for Dentine Demineralization.
T. Bankey and J. D. Sterrett.

Epithelial Remnants of the Gingival Portion of the Periodontium of Young and Old Dogs. J. D. Sterrett., J. Lindhe, and T. Berglundh.

Clinical Comparison of Preloaded Flurbiprofen for Post-Periodontal Surgery Pain.
K. Gravitis, C. H. Hawkins and J. D. Sterrett.

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Research Publications

Four research papers have been published recently.

"The Longitudinal Effectiveness of Osseointegrated Dental Implants. The Toronto Study: Bone Level Changes" Douglas V. Chaytor, George A. Zarb, Adrienne Schmitt, and Donald W. Lewis, published in The International Journal of Periodontics and Restorative Dentistry, Volume 11, November 2, 1991.

"Ridge contour related to esthetics and function," Christopher H. Hawkins, John D. Sterrett, H. Joseph Murphy, and Joanne C. Thomas, published in The Journal of Prosthetic Dentistry, Volume 66, Number 2, August 1991.

"Clinical and structural characteristics of periodontal tissues in young and old dogs," T. Berglundh, J. Lindhe and J. D. Sterrett, published in J Clin Periodontal 1991: 18: 616-623.

"Considerations on the contribution of ageing to loss of periodontal tissue support" Panos N. Papapanou, Jan Lindhe, John D. Sterrett and Lennart Eneroth published in J Clin Periodontal 1991: 18: 611-615.

The Science of Scientific Writing.

A guest editorial in the August edition of the ACFD Forum dealt with the question of clarity of writing relative to the scientific literature. Robert Green of Jefferson College makes the statement that "Going to the laboratory (or Clinic) doesn't make one a scientist any more than going to church makes one a Christian. One needs not only to be inventive and creative but also articulate." Science is often hard to read. This really should not be the case. Most people assume that difficulties are born out of necessity, due to the extreme complexity of scientific concepts and data analysis. Greene's article states that "...to days scientific literature is generally forgotten by tomorrow." As T. H. Huxley wrote over a 100 years ago "The ultimate fate which is the euthanasia of a scientific work, is to be enclosed among the rubble of later knowledge and forgotten." An excellent reference article by Gopen and Swan on this same topic also appeared in the November-December 1990, edition of American Scientist. This paper should be read by all who attempt to put pen to paper or rather 'Mac-compute' their scientific ideas. The paper deals with the problem of scientific writing for ones peers. The theme of this excellent article is to write with the reader in mind. As the authors state "If the reader is to grasp what the writer means, the writer must understand what the reader needs." It is pointed out that readers do not simply read; they interpret. Any piece of prose, no matter how short, may convey 10 different meanings to ten different readers. Another useful piece of advice simply states that "Information is interpreted more easily and more uniformly if

it is placed where most readers expect to find it." A further comment which is particularly important to remember is; "We cannot succeed in making even a single sentence mean one and only one thing; we can only increase the odds that a large majority of readers will tend to interpret our discourse according to our intentions. The authors make the important statement that "It may seem obvious that a scientific document is incomplete without the interpretation of the writer; it may not be so obvious that the document cannot "exist" without the interpretation of each reader." Greene makes the point that "The likelihood of success in the scientific arena depends on the ability to publish your work and write grants that present your ideas clearly, concisely and in the most articulate fashion." The next journal article we write, the next abstract or grant we put together will surely be different having read the excellent advice presented by these authors.

References-Scientific Writing: The Science of Scientific Writing, by G. D. Gopen and J. A. Swan. American Scientist, 78:550-558, 1990.

Clarity in Writing, Guest Editorial, Robert M. Greene, ACFD, Forum, Vol 24, August 1991 page 30-31.

IADR 70TH GENERAL SESSION,
JULY 1-4, 1992, GLASGOW,
SCOTLAND. Abstract packets
for the meeting have arrived
and are available from Jean
Hames.

Note:-Deadline for
submission of abstracts is
January 10, 1992.