COMPRENDIUM
OF
DENTAL RESIDENTS' RESEARCH PROJECTS
AND LITERATURE REVIEWS
1990

Samuel P. Davis, Lieutenant Colonel, USAF, DC
March 1991

Special Report for Period January 1990 - December 1990

Approved for public release; distribution is unlimited.

USAF Dental Investigation Service
Armstrong Laboratory
Human Systems Division (AFSC)
Brooks Air Force Base, TX 78235-5000

91-01146
NOTICES

This interim special report was submitted by personnel of the Dental Investigation Service, Clinical Sciences Division, Armstrong Laboratory, Human Systems Division, AFSC, Brooks Air Force Base, Texas, under job order NGDP-PC-CO.

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency, contractor, or subcontractor thereof. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the United States Government or any agency, contractor, or subcontractor thereof.

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The animals involved in this study were procured, maintained, and used in accordance with the Animal Welfare Act and the "Guide for the Care and Use of Laboratory Animals" prepared by the Institute of Laboratory Animal Resources - National Research Council.

The voluntary, fully informed consent of the subjects used in this research was obtained as required by AFR 169-6.

The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

SAMUEL P. DAVIS, Lt Col, USAF, DC
Project Scientist

PAUL R. PARK, Colonel, USAF, DC
Supervisor

JAMES R. HICKMAN, Jr., Col, USAF, MC
Chief, Clinical Sciences Division
This report is a compendium of abstracts and literature reviews prepared by senior residents in the United States Air Force residency programs. The projects include research papers in dental disciplines including General Dentistry (9826), Periodontics (9846), Prosthodontics (9856), Orthodontics (9866), and Endodontics (9886). The authors submitted their reports during 1990, in partial fulfillment of residency requirements. Residents in multi-year programs submitted research reports, whereas residents in one-year programs submitted literature reviews.
PREFACE

ABOUT THE COMPENDIUM

The Compendium of Dental Residents' Research Projects was recommended to the USAF Dental Education Committee in 1986 as a way to preserve the research efforts of U.S. Air Force dental residents.

This collection of abstracts provides a synopsis of research projects completed by graduates of United States Air Force residency programs. The projects were undertaken in partial fulfillment of the requirements of the training programs.

The opinions and assertions contained in the abstracts are those of the writers and are not to be construed as official, or as reflecting the views of the Department of the Air Force.

USING THE COMPENDIUM

The Table of Contents contains a numbering system to aid the reader in finding titles arranged according to discipline and year of presentation. The first two digits represent the year the thesis was written. The second two digits represent the 98XX specialty discipline:

9826 - General dentistry
9836 - Oral and maxillofacial surgery
9846 - Periodontics
9856 - Prosthodontics
9866 - Orthodontics
9876 - Oral pathology
9886 - Endodontics
9896 - Pedodontics

The last two digits are for our accounting.

The Table of Contents lists the title of the thesis followed by the name of the primary author and the page number where an abstract of the thesis may be found. The names of secondary authors are listed with the abstracts.

We are providing a bibliography of Previous Titles. This section lists the titles according to the general category of their content. Within a category you'll find the titles listed alphabetically by author. If an abstract was provided in a previous edition of the Compendium, it will be in parentheses, as will be the year of publication.

Copies of theses are on file and can be obtained by calling or writing:

USAF Dental Investigation Service
Det 4, AL/NGD
Brooks AFB TX 78235-5000
DSN 240-3502
Commercial (512) 536-3502

Copies of General Practice Residency (GPR) literature reviews are not kept on file, but their titles are listed here. Direct any inquiries concerning the authors of literature reviews to the address above.

iii
<table>
<thead>
<tr>
<th>ABSTRACT NO.</th>
<th>TITLE</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 26 01</td>
<td>TRIANGULAR FILE DESIGNS, GROUND AND TWISTED: A COMPARATIVE STUDY IN TORSION AND STIFFNESS S.A. Schmidt</td>
<td>1</td>
</tr>
<tr>
<td>90 26 02</td>
<td>EFFECT OF INTERMIXING ADDITION SILICONES ON DIMENSIONAL ACCURACY OF CASTS M. O. Zollars</td>
<td>1</td>
</tr>
<tr>
<td>90 26 03</td>
<td>EFFECT OF THE PROPHY-JET ON HUMAN VENOUS BLOOD SAMPLES F. A. Thomas</td>
<td>2</td>
</tr>
<tr>
<td>90 26 04</td>
<td>PERIODONTAL EFFECT OF SUBGINGIVAL IRRIGATION WITH THE CAVIMED SYSTEM A. R. Klous</td>
<td>2</td>
</tr>
<tr>
<td>90 26 05</td>
<td>THE EFFICACY OF THE DECIDENT DISPOSABLE DISINFECTANT SLEEVE WHEN USED FOR MULTIPLE CYCLES TO DISINFECT DENTAL HANDPIECES E. C. Staley</td>
<td>3</td>
</tr>
<tr>
<td>90 26 06</td>
<td>EFFECTS OF CO₂ LASER TREATMENT ON INTRAPULPAL TEMPERATURE W. M. Watts</td>
<td>3</td>
</tr>
<tr>
<td>90 26 07</td>
<td>MICROLEAKAGE EVALUATION OF A NEW GUTTA-PERCHA CONDENSATION DEVICE R. H. Pruette</td>
<td>4</td>
</tr>
<tr>
<td>90 26 08</td>
<td>MARGINAL ACCURACY AND TRANSVERSE STRENGTH OF FIVE PROVISIONAL RESINS G. G. Bassett</td>
<td>4</td>
</tr>
<tr>
<td>90 26 09</td>
<td>EFFECTIVENESS OF CAVITY VARNISHES AND DENTIN SEALANTS IN PROTECTING AGAINST PHOSPHORIC ACID R. C. Tollefson</td>
<td>5</td>
</tr>
<tr>
<td>90 36 01</td>
<td>SURGICALLY ASSISTED RAPID PALATAL EXPANSION REVISITED J. Armstrong</td>
<td>5</td>
</tr>
<tr>
<td>90 46 01</td>
<td>DEVELOPMENT OF A RAPID QUALITATIVE ASSAY FOR DETERMINING ELEVATED ANTIBODY LEVELS TO PERIODONTOPATHIC ORGANISMS B. L. Mealey</td>
<td>6</td>
</tr>
<tr>
<td>90 46 02</td>
<td>ANTIBODY RESPONSE TO PROTEIN TOXINS IN THE NONHUMAN PRIMATE, MACACA FASICULARIS G. R. Bauman</td>
<td>7</td>
</tr>
<tr>
<td>90 56 01</td>
<td>STRENGTH COMPARISON AMONG THREE PORCELAIN ENAMELING SYSTEMS D. Sather</td>
<td>7</td>
</tr>
</tbody>
</table>
CONTENTS (CONT)

ABSTRACT NO. | Page
--- | ---
90 56 02 | THE EFFECT OF TRANSLUCENCY ON TRISTIMULUS REFLECTANCE VALUES OF PIGMENTED MAXILLOFACIAL ELASTOMER OBTAINED WITH TWO COLORIMETERS OF DIFFERENT GEOMETRY E. H. Rugh | 8
90 56 03 | THE ADVANTAGES OF COATED TITANIUM IMPLANTS PREPARED BY RADIO FREQUENCY SPUTTERING FROM HYDROXYAPATITE D. R. Cooley | 9
90 56 04 | AN INVESTIGATION INTO THE EFFICACY OF STERILIZING MUSLIN WHEELS BY AUTOCLAVING P. Delahaye-Daley | 9
90 76 01 | FLOW CYTOMETRIC PLOIDY DETERMINATION OF ORAL PREMALIGNANT AND MALIGNANT LESIONS C. W. Pemble III | 10
90 86 01 | EFFECTIVENESS OF A BRUSH IN REMOVING POST-INSTRUMENTATION CANAL DEBRIS D. M. Keir | 10
90 86 02 | EFFECT OF INTRACANAL MEDICAMENTS ON THE SEALING ABILITY OF TEMPORARY ENDOODONTIC RESTORATIVE MATERIAL R. E. Rutledge | 11

GENERAL PRACTICE RESIDENTS' ARTICLES/LITERATURE REVIEWS | 13

90-26-01

TRIANGULAR FILE DESIGNS, GROUND AND TWISTED: A COMPARATIVE STUDY IN TORSION AND STIFFNESS

S. A. Schmidt, Lt Col, USAF, DC

This study examined three brands of endodontic triangular files: the Brasseler K-file, the Brasseler Canal Master file, and the Caulk/Dentsply Flexofile. Resistance to torque at predetermined angular deflections and stiffness was measured against American National Standards Institute/American Dental Association Specification No. 28. Mean torque values for Caulk files Sizes 30 and 35, and the Brasseler Canal Master Size 35 failed to meet minimum torque requirements at 360 degrees. Fifty percent of Size 20, and twenty percent of Size 35 Brasseler K-type files, and ten percent of the Brasseler Canal Master Size 25 files failed to rotate 360 degrees prior to fracture. In the stiffness test, all files easily passed the ANSI/ADA standards. The number of degrees of rotation to fracture was also measured. The Brasseler K-file fractured in rotation prior to other files tested in all file sizes except Size 25.

90-26-02

EFFECT OF INTERMIXING ADDITION SILICONES ON DIMENSIONAL ACCURACY OF CASTS

M. D. Zollars, Lt Col, USAF, DC

There are many addition reaction silicone impression materials on the market; however, little information is available on whether accurate casts are produced when the putty and wash material from different manufacturers are exchanged. This investigation compared the dimensional accuracy of Type IV gypsum casts produced from impressions made by interchanging the putty and wash impression materials from two manufacturers. Forty impressions were made of an aluminum model with five similar preparations using Mirror 3 Extrude and President as follows: 10-Extrude putty/Extrude wash, 10-Extrude putty/President wash, 10-President putty/President wash, and 10-President putty/Extrude wash using a single-step technique. The dimensional accuracy of the impressions was assessed by measuring one intra-arch, two cross-arch, and one vertical set of reference points on the casts produced from these impressions using a Unitron measuring microscope. The data were analyzed using a 2-way analysis of variance (ANOVA); and no statistically significant differences (p> 0.05) were found among the four groups. The results of this study indicate that casts produced from impressions made by intermixing Mirror 3 Extrude and President addition silicone impression materials are no less dimensionally accurate than casts produced from either single brand.
EFFECT OF THE PROPHY-JET ON HUMAN VENOUS BLOOD SAMPLES

F. A. Thomas, Major, USAF, DC

Concern has been voiced that the application of powdered sodium bicarbonate abrasive with the Prophy-Jet may be contraindicated in a variety of human disease states due to a possible rise in certain electrolyte levels. To monitor changes in venous blood electrolytes (Na+, Cl-, K+, and HCO₃⁻), ten healthy volunteers were given routine dental cleanings including use of the Prophy-Jet for periods ranging from 2 minutes, 24 seconds to 4 minutes, 30 seconds. An initial blood sample was drawn prior to cleaning. After prophylaxis, blood samples were taken at the following intervals: 5, 15, and 30 minutes, 1 hour and 2 hours. The venous blood samples were analyzed using a Ciba-Corning 288 Blood Gas Analyzer and a Beckman Astra-8 Automated Stat Analyzer. Analysis of the data revealed no significant difference overall as tested by an analysis of variance (ANOVA) for repeated measures (p > 0.1). Individual comparisons with Dunnett's test showed no significant difference for any parameter at any time period (p > 0.1). The amount of sodium bicarbonate absorbed during routine prophylaxis with the Prophy-Jet was not of sufficient magnitude to significantly alter venous blood values in healthy subjects.

PERIODONTAL EFFECT OF SUBGINGIVAL IRRIGATION WITH THE CAVIMED SYSTEM

A.R. Kious, Major, USAF, DC

The purpose of this investigation was to compare the effectiveness of three different subgingival irrigants used in conjunction with ultrasonic scaling. The irrigants used were ProSol (zinc chloride), Gel-Kam (1.64% stannous fluoride) and sterile saline. Ten males, mean age of 53, with at least three bleeding pockets of 6mm probing depth in different sextants were studied. Baseline data included plaque index, bleeding upon probing, attachment level, and subgingival plaque samples. One pocket in each sextant was scaled with the Cavi-Med for 3 minutes using one of the three irrigants. Following treatment, clinical indices and plaque samples were repeated at 3, 7, 12, and 16 weeks. Test data were evaluated using an ANOVA. All treatment groups demonstrated a significant improvement in plaque indices throughout the 16-week study. The bleeding upon probing responded most rapidly for the ProSol group, but at 7 weeks the reduction was similar for all three irrigants, and by 16 weeks had returned to baseline. All groups showed similar gains in attachment by the seventh week. Phase contrast microscopy showed reduction of cell counts following treatment for all morphotypes. The filamentous forms, rods, and motile rods had returned to baseline levels by the sixteenth week, but the spirochete count did not. This study did not demonstrate a significant difference among the three irrigants at 16 weeks as determined by clinical parameters and subgingival flora.
THE EFFICACY OF THE DECIDENT DISPOSABLE DISINFECTANT SLEEVE WHEN USED FOR MULTIPLE CYCLES TO DISINFECT DENTAL HANDPIECES

E.C. Staley, Lt Col, USAF, DC

The Decident Disposable Disinfectant Sleeve is a commercially available device containing an ethyl alcohol/phenolic solution for disinfecting dental handpieces. The purpose of this study was to assess the efficacy of individual sleeves used for five consecutive disinfection cycles of handpieces. The evaluation was based on EPA/AOAC standards in screening for tuberculocidal activity. Thirty disinfectant sleeves were used. Handpieces and smooth-surfaced stainless steel penicylinders were contaminated with Mycobacterium smegmatis and used in Cycles one and five. Contaminated handpieces only were used on Cycles two, three, and four. Cultures were performed on Cycles one and five for a total of 60 cultures each of handpieces and penicylinders. Results were recorded as growth (failure to disinfect) or no growth. No growth was observed on all 30 penicylinder samples for Cycle 1 and 29 of 30 samples for Cycle 5. Positive cultures were obtained on 13 handpieces from Cycle one and 18 handpieces from Cycle 5. The sleeves performed to an acceptable level of effectiveness using penicylinders. The results support the EPA and ADA approval of the sleeve solution for surface disinfection. However, the test results on penicylinders did not correlate with tests on actual handpieces. The sleeve was found to be unacceptably inconsistent in disinfecting handpieces. The results of this study underscore the need to develop alternative tests for handpiece disinfection.

EFFECTS OF CO₂ LASER TREATMENT ON INTRAPULPAL TEMPERATURE

W.M. Watts, III, Lt Col, USAF, DC

Coherent light has been suggested for a variety of uses in clinical dentistry. Use of the laser for caries removal, treatment of dentin hypersensitivity, and surgery has been proposed. The purpose of this study was to examine the temperature effects of the CO₂ laser on the pulpal space adjacent to laser-treated cervical dentin. Seven extracted teeth were scaled and stored in a 10% formalin solution until use. Coronal access to the pulp chamber was made and a thermocouple was placed to a point approximating the cervical area. The position of the thermocouple was confirmed by radiograph. The dentin in the cervical area of each tooth was lased with a TEA-103-1 CO₂ pulsed laser with a focal area of 1.5-2.0 mm. Average pulse density was 57 joules/cm². Temperature measurements were made with a digital thermometer. The teeth were then sectioned with a diamond saw and the dentin thickness was measured with an electronic digital caliper. The results showed a mean temperature rise of 1.5°C per mm of dentin. Light and scanning electron microscopy of the samples showed evidence of cratering and cracking caused by the laser. The CO₂ laser was found to produce undesirable pulpal and surface effects when used according to the parameters in this study.
MICROLEAKAGE EVALUATION OF A NEW GUTTA-PERCHA CONDENSATION DEVICE

R. H. Pruette, Jr., Major, USAF, DC

A well-sealed root canal system prevents the percolation of irritants into and out of the periapical area. Many obturation techniques have been advocated to improve the apical seal of root canal fillings and minimize leakage. In this study, the microleakage of root canals obturated using the Endotec Thermal Endodontic Condenser and lateral condensation were compared. Twenty single-canal roots from extracted human canines were instrumented using sequential filing. The roots were then randomly assigned to one of two groups and filled with gutta percha and Roth's sealer. One group was condensed using the Endotec instrument and the other was filled using standard lateral condensation. The roots were submerged in 2% aqueous methylene blue for 72 hours and then cleared with methyl salicylate for direct visualization. The greatest extent of dye penetration was measured to the nearest 0.01 mm under a stereomicroscope. Photographs (35 mm color transparencies) were used for subjective evaluation of filling density and adaptation. The Endotec group exhibited a mean leakage of 0.25 mm (SD 0.23). Mean leakage of the lateral condensation group was 0.34 mm (SD 0.41). A one-way analysis of variance revealed no significant difference in leakage between the two groups. The Endotec condensed fillings were found to be generally more homogenous than the laterally condensed specimens. However, there was separation of the coronal and apical portions of gutta percha in three of the Endotec fillings. This separation was attributed to a tendency for the filling to be pulled out when the instrument was removed from the canal.

MARGINAL ACCURACY AND TRANSVERSE STRENGTH OF FIVE PROVISIONAL RESINS

G. G. Bassett, Lt Col, USAF, DC
J. O. Burgess, Col, USAF, DC

Numerous resin materials have been used to fabricate provisional restorations. Recently, two new provisional resin materials with a composite resin formulation have been introduced for clinical use. This study compared the marginal accuracy and transverse strength of five commercially available resins used to fabricate provisional restorations: TRIAD (Dentsply International Corp), a VLC BisGMA; PROTEMP (Espe/Premier Corp), a Bis-Acryl-GMA; JET (Lang Dental Mfg Co), a poly (methylmethacrylate); SNAP (Parkell), a vinylethylmethacrylate; and SPLINTLINE (Lang Dental Mfg Co), an ethylmethacrylate. Ten provisional three-unit fixed partial dentures were constructed with each material on a typodont model. Marginal accuracy was determined by measuring the vertical opening from the material to the preparation margin.
using a measuring microscope at the mesiobuccal and distobuccal line angles for each abutment tooth. After storage in water for 1 week, transverse strength was measured using a three-point bend apparatus in conjunction with an Instron machine at a crosshead speed of 10 mm/min. Data for marginal accuracy and transverse strength were analyzed using analysis of variance (ANOVA) and Tukey-B tests (p< 0.05). Statistical differences of the marginal opening from least to most were: PROTEMP=TRIAD=SNAP < SPLINTLINE < JET. Three-point bend strength revealed TRIAD > JET > PROTEMP=SNAP=SPLINTLINE.

90-26-09

EFFECTIVENESS OF CAVITY VARNISHES AND DENTIN SEALANTS IN PROTECTING AGAINST PHOSPHORIC ACID

R. C. Tollefson, Lt Col, USAF, DC

Cavity varnish and dentin sealants have been marketed to protect the dentin from effects during the phosphoric acid etching procedure for composite resins. The purpose of this study was to compare the effectiveness of two varnishes, Copalite and Plastodent; and two dentin sealants, Barrier and Contact in resisting the effects of phosphoric acid liquid and gel. Sixty-six extracted teeth were sectioned to provide flat occlusal surfaces in dentin. The teeth were divided into 10 groups of six specimens each: the sealant groups were tested against liquid and gel and the varnish groups were tested against the liquid; there were four control groups. Varnishes and sealants were applied to the dentin according to manufacturer's instructions. Plastic adhesive film with a circular cutout was applied to create a standard surface area; a copper band was luted to the plastic to serve as a reservoir. The surfaces were subjected to a 10 min treatment with phosphoric acid liquid or a 30 sec treatment with gel. One group from each material received no acid treatment and served as a control. The dentin was rinsed and dried and the reservoirs were filled with methylene blue dye for 4 hrs, rinsed and brushed to remove excess dye. They were then photographed. The photographs were rated on a subjective scale of surface area penetrated by dye. Results were subjected to a chi-square analysis. Barrier was found to be significantly more effective than Copalite in resisting the effects of phosphoric acid liquid (p< 0.05). All other comparisons yielded no significant differences.

90-36-01

SURGICALLY ASSISTED RAPID PALATAL EXPANSION REVISITED

J. Armstrong, Major, USAF, DC
D. Rawley, Major, USAF, DC
R. Edwards, Major, USAF, DC

The treatment of dentofacial deformities in adults is frequently complicated by transverse maxillary deficiency. Although alternative, less
involved, maxillary osteotomies have been suggested as being adequate to effect routine orthopedic expansion, they often result in secondary relapse. The combined surgical/orthodontic procedure addresses the potential areas of incompleteness and main resistance to midpalatal separation, verifying at the time of surgery, bilateral and symmetrical expansion with creation of an anterior midline diastema. CT analysis in the axial and coronal plane was accomplished on ten patients, who underwent the described procedure, to verify the effect of the osteotomies and evaluate ossification of the osteotomy sites in the immediate, three-month, and six-month post-op period. Results of the CT analysis revealed the success of the osteotomies including the region of main resistance, the ptergomaxillary suture. This resulted in a symmetrical midpalatal separation and the creation of a midline diastema. Evidence of ossification was present at three months post-surgery, an indication to initiate closure of the midline diastema. Significant ossification in the osteotomy sites was noted six months post-surgery. Retention of the palatal expansion should continue for at least six months post-surgery, prior to appliance removal. In summary, CT analysis verified that the combined surgical/orthodontic procedure to treat transverse maxillary deficiency was successful, especially in the regions of maximum resistance. This form of treatment ensured stable midpalatal separation, thus, preventing secondary relapse.

90-46-01

DEVELOPMENT OF A RAPID QUALITATIVE ASSAY FOR DETERMINING ELEVATED ANTIBODY LEVELS TO PERIODONTOPATHIC ORGANISMS

B. L. Mealey, Major, USAF, DC

Analysis of serum antibodies to periodontopathic microorganisms has become an integral part of periodontal research. Currently available technology for such analysis is time-consuming and costly. To allow more widespread use in clinical practice, a rapid test was developed for determining elevated antibody to periodontitis-associated bacteria. The technique utilizes dot-immunoblotting (DIB) on nitrocellulose with whole formalinized Actinobacillus actinomycetemcomitans, Bacteroides gingivalis, and Bacteroides intermedius. To enhance its use in a clinical environment, antibody status was determined from whole finger-stick capillary blood. Antihuman IgG antibody conjugated with horseradish peroxidase provided rapid detection of antibody levels. An enzyme-linked immunosorbent assay (ELISA) was used to compare IgG antibody levels to the three organisms in peripheral capillary blood and venous serum from 44 subjects. Correlation between serum and capillary titers ranged from r=0.760-0.900 (p <.00001). Capillary blood antibody levels averaged 55% of those detected in serum (range: 47-68%). Serum antibody status was determined by ELISA and DIB for 34 periodontitis patients and 10 periodontally healthy subjects. Data from the two assays were compared in a blind fashion. The DIB detected elevated antibody levels to the organisms with a sensitivity of 83-100% and a specificity of 84-90%. When responses to the entire panel of three organisms were combined for each subject, the DIB had an overall sensitivity of 95% and a specificity of 83%. The data demonstrate that the DIB is highly accurate in detecting elevated
antibody levels to periodontitis-associated bacteria. The DIB uses finger-stick capillary blood with results available in less than two hours while the ELISA requires venous-derived serum and two days processing time. Thus, the DIB is conducive to clinical use for monitoring systemic antibody responses.

90-46-02

ANTIBODY RESPONSE TO PROTEIN TOXINS IN THE NONHUMAN PRIMATE, MACACA FASCICULARIS

G. R. Bauman, Major, USAF, DC

Recent research indicates that periodontal disease in the nonhuman primate (NhP) is histologically, microbiologically, and clinically very similar to man. However, the immunologic aspects of the NhP have not been well defined. Since bacterial protein toxins are involved in the process of periodontal disease as well as other diseases of man, this study was designed to characterize the IgG and IgG subclass response in the NhP to immunization with the prototype protein toxin, tetanus toxoid (TT). Five NhPs were immunized with TT at baseline and again one month later. Serum samples were collected at 0, 1, and 30 days post primary immunization, and at 3, 7, 30, 60, 90, and 120 days post secondary immunization. Changes in serum IgG and IgG subclass levels with time were determined by enzyme-linked immunosorbant assay (ELISA). Development of IgG avidity (antigen binding capacity) with time was also determined by ELISA. The IgG primary response and secondary response were both significant relative to baseline (40 and 110 fold, respectively). All IgG subclasses showed significant primary and secondary responses. The overall response was dominated by IgG1 (62%) and IgG2 (25%) with minor contribution from IgG4 (6.5%) and IgG2 (6%). Avidity also increased significantly in the primary and secondary responses; however, peak avidity (60-90 days post secondary immunization) was not coincident with peak secondary response levels (7-30 days post secondary immunization).

90-56-01

STRENGTH COMPARISON AMONG THREE PORCELAIN ENAMELING SYSTEMS

O. Sather, Naval Dental School, Bethesda MD
E. Billy, Naval Dental School, Bethesda MD
L. Iambaressi, Naval Dental School, Bethesda MD
S. Lor, NIDR, National Institutes of Health, Bethesda MD

Feldspathic porcelain has been successfully veneered on cast metal artificial crown substructures. In addition to this enameling system, recommendations have been made to use fluoromica controlled crystallization castable glass and to use aluminous porcelain as substructures. This study
evaluated the force to fracture artificial incisor crowns using cast metal (Group 1), castable glass (Group 2), and aluminous porcelain (Group 3) as substructures. Fifteen substructures of each material were made. Thicknesses of the substructures were measured at 27 locations, added, and recorded. Feldspathic porcelain was veneered on each substructure. Thicknesses of the finished artificial crowns were measured at 6 locations and recorded. Heights and widths of the finished artificial crowns were also measured and recorded. Epoxy resin was used to intimately fill each artificial crown and to also serve as a support base for testing. A load was applied with an Instron testing machine at a crosshead speed of 5 mm/min to the incisal edge of each artificial crown along its long axis until fracture occurred. Mean failure loads (Pounds): Group #1 - 884 (SD=131), #2 - 457 (SD=129), #3 - 341 (SD=93). A one-way ANOVA showed a significant difference among the groups. Tukey's studentized range test was used for discrimination. All three groups were different at the 95% confidence level. Pearson's correlation coefficient compared the effects of the measured dimensions on the results. Differences in heights, widths, and thicknesses of the finished samples affect the results. Between the two all-ceramic groups (Groups 2 & 3), the substructure bulk positively correlated with the measured forces to fracture.

90-56-02

THE EFFECT OF TRANSLUCENCY ON TRISTIMULUS REFLECTANCE VALUES OF PIGMENTED MAXILLOFACIAL ELASTOMER OBTAINED WITH TWO COLORIMETERS OF DIFFERENT GEOMETRY

E. H. Rugh, Major, USAF, DC

Color parameters obtained with a small-area colorimeter have shown poor correlation with those obtained with other geometries. This study related the relative increase in tristimulus reflectance values, obtained on a thick sample using two geometrically different colorimeters, to a standard measure of translucency, contrast ratio. Samples of increasing contrast ratio were formed using increasing concentrations of mineral earth pigment in maxillofacial elastomer. For each concentration, samples were formed about 2 and 11 mm thick. The thin samples were measured with the large area colorimeter (Minolta CR200b) using black and white backings to obtain contrast ratios. The thick samples were measured using small area (Minolta CR121) and larger area colorimeters. The relative increase in tristimulus reflectance for each tristimulus value was determined (e.g., \( Y_{\text{relative diff}} = Y_{200b}Y_{121}/Y_{200b} \)). An analysis of covariance (ANCOVA) was used to analyze the differences in the tristimulus values obtained with the thick samples using the two colorimeters. Statistical analysis of results shows that the relationship of relative increase in tristimulus reflectance to contrast ratio is highly significant (\( F = 258.97, p < 0.001 \)). The relative increase may be used as an alternative indicator for translucency within the practical range of translucency found in esthetic dental restorative materials.
THE ADVANTAGES OF COATED TITANIUM IMPLANTS PREPARED BY RADIO FREQUENCY SPUFFERING FROM HYDROXYAPATITE

D. R. Cooley, Lt Col, USAF, DC

The method used to apply hydroxyapatite to implant surfaces may affect the thickness and ultimately the physical properties of the coating. This study investigated and compared the healing rates of bone around commercially pure titanium implants and titanium implants which had been sputter-coated from an hydroxyapatite target. Forty-five sputter-coated implants and an equal number of noncoated titanium implants were placed in 15 partially edentulous dog mandibles. The implants were removed at three time periods and evaluated mechanically and histologically. Analysis of variance testing indicated that the interface bond strength was statistically greater (p<.01) for the sputter-coated implants. Histologic analysis of the bone-implant interface demonstrated that coated implants had nearly twice the percentage of direct bone contact when compared to the noncoated implants. These results indicate that implants sputter-coated from an hydroxyapatite target will accelerate the bone healing at the implant interface.

AN INVESTIGATION INTO THE EFFICACY OF STERILIZING MUSLIN WHEELS BY AUTOCLAVING

P. Delahaye-Daley, DDS
R. A. Lepianka, Major, USAF, DC

Sterilizing muslin cloth polishing wheels (rag wheels) by autoclaving has been advocated by the ADA for several years. In applying standard sterilization procedures it is essential to clean instruments promptly after use to remove debris before it can dry and harden in the serrations, crevices, etc. Thorough cleansing is extremely important because organisms concealed and protected by dried blood and scale in inaccessible parts of the instruments render sterilization more difficult. The purpose of this study was to determine whether autoclaving was an effective sterilization technique for laboratory muslin polishing wheels that had been saturated with contaminated pumice. Ten tubes of enriched thioglycollate medium were inoculated by swabbing rag wheels that were used to polish dentures which had been in patients' mouths. Three-inch and six-inch diameter ragwheels were swabbed; a positive culture growth rendered the thioglycollate medium cloudy by Day five; no growth resulted in a clear broth. All cultures obtained from contaminated rag wheels prior to autoclaving resulted in a cloudy broth. Those cultures obtained after autoclaving of the muslin wheels resulted in clear broth. These results verify that autoclaving killed the microorganisms found on the rag wheels by the penetration of steam and the higher temperatures which accompany the pressurized closed system.
FLOW CYTOMETRIC PLOIDY DETERMINATION OF ORAL
PREMALIGNANT AND MALIGNANT LESIONS

C. W. Pemble III, Lt Col, USAF, DC

Nuclear DNA content was evaluated for use as an objective parameter of
diagnostic value in 20 cases of oral premalignancy which progressed to
malignancy. Single cell suspensions were stained with propidium iodide and
subjected to flow cytometric analysis which yielded histograms of the ploidy
status for each specimen. Sufficient tissue quantity and acceptable coeffi-
cients of variation allowed for ploidy status determination for all specimens
in 13 cases. The initial premalignant lesions in these cases were variously
euploid, aneuploid, and diploid with high cell cycle 5 phase fractions. The
intermediate lesions and the subsequent carcinomas contained cell populations
with DNA contents seemingly unrelated to the precedent lesions or to the
severity of dysplasia or degree of differentiation in the malignancy. Erythro-
plakic lesions were 3.6 times more likely to be aneuploid than euploid and
twice as many carcinomas were noneuploid than euploid. Flow cytometric
analysis of nuclear DNA content is a reproducible objective parameter of oral
lesions which is applicable to formalin-fixed, paraffin-embedded tissue. The
diagnostic value and the use of this parameter in predicting the biologic
behavior of oral premalignant and malignant lesions must await further
retrospective and prospective studies.

EFFECTIVENESS OF A BRUSH IN REMOVING POSTINSTRUMENTATION CANAL DEBRIS

D. M. Keir, Major, USAF, DC
E. S. Senia, DDS, MS, BS, FACD
S. Montgomery, DDS, FACD

The purpose of this study was to evaluate the effectiveness of a brush in
removing debris in the root canal after endodontic instrumentation. The
Endobrush, an endodontically sized spiral brush, was used in this study.
Seventeen extracted human maxillary first molars with mesiobuccal canal
curvatures of 25 to 35 degrees were divided into two groups. After endodontic
access and determination of working length, one group was instrumented to a
#45 file and the other group to a #35 file at the working length. After the
teeth were sectioned at the working length, and at 2, 4, and 6 mm from the
working length, they were evaluated for debris remaining in the canal space.
The specimens were reassembled, brushed with an Endobrush, and reevaluated.
The scores for instrumentation alone (controls) and instrumentation plus
brushing were compared using paired t tests. A significant difference in
cleanliness between instrumented only and instrumented and brushed canals was
seen in both groups. The combined results of both groups showed that signifi-
cantly less debris remained in the root canal system at the 2 to 4 mm level.
and the 4 to 6 mm level after brushing, whereas no significant difference was noted at the working length to the 2 mm level. Conclusions: Instrumentation with brushing was significantly better than instrumentation alone in debriding the root canal.

90-86-02

EFFECT OF INTRACANAL MEDICAMENTS ON THE SEALING ABILITY OF TEMPORARY ENDODONTIC RESTORATIVE MATERIAL

R. E. Rutledge, Major, USAF, DC

An in-vitro leakage study was performed to determine the effect of intracanal medicaments on the sealing ability of Temporary Endodontic Restorative Material (TERM). Fifty extracted mandibular molars with uniform access preparations were restored with TERM after placement of either a dry cotton pellet (control), or a pellet moistened with eugenol, formocresol, CMCP, or a paste of sodium perborate and superoxol. Multiple measurements were made on each intact specimen, at 5 time intervals after restoration, and in some cases, after thermocycling. Statistical analysis revealed no significant leakage in the control group, or in the groups which used eugenol, formocresol, or CMCP when they were compared to the control group. Analysis, however, did show significant leakage for the group containing the bleaching paste. Results show that the sealing ability of TERM is not affected by eugenol, formocresol, or CMCP. However, TERM should not be used for the temporary restoration of teeth being treated by the walking-bleach technique.
GENERAL PRACTICE RESIDENTS' ARTICLES/LITERATURE REVIEWS: 1990

1. Bolling Air Force Base DC.
Det 1, Malcolm Grow USAF Medical Center/Col Paul K. Blaser, Director.
   b. "Postmortem Identification and the Computerization of Dental Characteristics," May 90, Robert T. Jensen, Captain, USAF, DC.
   c. "The Endodontic Management of the Curved Canal," May 90, Brett A. Johnson, Captain, USAF, DC.
   d. "Picking the Right Occlusal Scheme in Complete Dentures," May 90, Kenneth C. Stanifer, Captain, USAF DC.

2. Chanute Air Force Base IL.
Chanute TTC Hospital/Lt Col Lawrence D. Schmeltzer, Director
   a. "Osteoporosis and Dental Treatment," 16 Jul 90, Ronald S. Kovac, Captain, USAF, DC.
   b. "A Historical Look at Where To Place that Crown Margin," 16 Jul 90, Karl P. Lackler, Captain, USAF, DC.

3. Davis-Monthan Air Force Base AZ.
335th Medical Group/Lt Col Robert A. Olson, Director.
   b. "Osseointegration of Titanium and Hydroxyapatite-Coated Implants," 11 Jun 90, Donald R. Hoaglin, Captain, USAF, DC.
   c. "Dry Socket: Prevention and Treatment," 11 Jun 90, Gilbert E. Smith, Captain, USAF, DC.
   d. "The Use of Ultrasonics in Endodontics," 11 Jun 90, Dean H. Whitman, Captain, USAF, DC.
4. Scott Air Force Base IL.
USAF Medical Center Scott/Col William D. Theobold, Director.
   b. "Dicor, The Castable Ceramic," 18 May 90, John M. Yaccino, Captain, USAF, DC.
   c. "Mucogingival Surgery," 1 Jun 90, Salvatore R. Cutino, Captain, USAF, DC.
   d. "Guided Tissue Regeneration," 1 Jun 90, Ronald Abbott, Captain, USAF, DC.
5. Sheppard Air Force Base TX.
Sheppard TTC Hospital/Lt Col Kevin M. Gureckis, Director.
   a. "Glass Ionomer Cement: Background, Development and Clinical Usage," May 90, Diane E. Kopra, Captain, USAF, DC.
   b. "Lasers in Dentistry," May 90, Timothy F. Lekavich, Captain, USAF, DC.
   c. "Guided Tissue Regeneration and the Management of Furcation Defects," May 90, David H. Pfotenhauer, Captain, USAF, DC.
   d. "Thumbsucking - A Review of the Literature," May 90, James G. Rafael, Captain, USAF, DC.
6. Travis Air Force Base CA.
David Grant USAF Medical Center/Col Stanley M. Plies, Director.
   b. "Metal Adhesive Resins, An Analysis of Their Properties and Their Role in Dentistry," David B. Chiesa, Captain, USAF, DC.
7. Wright-Patterson Air Force Base OH.
USAF Medical Center Wright-Patterson/Col William R. Langenderfer, Director.
   a. "Use of Vasoconstrictors in Local Anesthetics," Jul 90, Roger W. Childress, Captain, USAF, DC.
b. "Cast Glass Ceramic Veneers, Dicor State of the Art," Jul 90, Steven A. Lang, Captain, USAF, DC.

c. "Histologic and Clinical Review of Circumferential Supracrestal Fiberotomy," Jul 90, Michael E. Poth, Captain, USAF, DC.


BEHAVIORAL SCIENCE


Pederzani PS. Child Abuse and Dental Neglect. (Literature Review, 1987).

CARIOLOGY


Hughes KF. Topical Antiplaque Agents: A Literature Review. (Literature Review, 1989)


Young, VW. The Efficacy of Flow Cytometry in the Evaluation of Specific Bacterial Species Within Plaque Samples. (Abstract 88 46 06, 1988).

CRANIOFACIAL BIOLOGY


Garmage, DD. A Histologic and SEM Comparison of the Osseous Interface in Loaded IMZ and Integral Implants. (Abstract 88 46 03, 1988).

Lindell KA. Mucogingival Vasculature: A Three Dimensional Study. (Abstract 87 46 02, 1987).


**DENTAL EPIDEMIOLOGY**


**DENTAL MATERIALS**

Chaffee, MP. Castable Ceramics. (Literature Review, 1988).


Naylor, WP. A Comparison of Two Tests for Determining the Castability of Dental Alloys. (Abstract 88 56 02, 1988).

Nevins SJ. Retentive properties of threaded pins in composite resin. (Abstract 87 26 07, 1987).

Owen SW. The Effect of Polyacrylic Acid Concentration and Conditioning Time on Glass Ionomer Adhesion to Dentin. (Abstract 89 26 07, 1989).

Schuermer ES. The Shear Bond Strength of Composite Resin Bonded To Acid Etched Enamel Cleaned with a Fluoride Prophylaxis Paste. (Abstract 89 26 08, 1989).


Shigetani LM. Microleakage of composite resin bonded to glass ionomer cement. (Abstract 87 26 11, 1987).


ENDODONTICS

Beto MH. Apical root anatomy and its effect on the termination level of root canal fillings. (Literature Review, 1987).

Casey LJ. The use of dentinal etching with endodontic bleaching procedures. (Abstract 87 26 02, 1987).


DePeralta A. Apical Leakage of Bleaching Agents Through an IRM Base. (Abstract 89 26 06, 1989)

Flickinger CA. Selection of a gutta percha filling technique. (Literature Review, 1987).

Fogarty TJ. The effect of preflaring on canal transportation; evaluation of ultrasonic, sonic, and conventional techniques. (Abstract 89 86 01, 1989).

Gullickson DC. The study of root canal morphology using a digital image processing technique. (Abstract 87 86 01, 1987).

Haywood, SW. Internal Resorption. (Literature Review, 1988).

Horkacz OM. Calcium hydroxide root canal fillings. (Literature Review, 1987).


Knight KA. The stressed dental pulp. (Literature Review, 1989).

Metzler RS. The effectiveness of ultrasonics and calcium hydroxide for the debridement of human mandibular molars. (Abstract 89 86 02, 1989).


Plamondon, TJ. Histological evaluation of the pulpal response in dogs to preparing teeth anesthetized by the periodontal ligament injection. (Abstract 88 26 04, 1988).


Temple JA. Alternatives to the use of formocresol in vital pulp therapy for primary molars. (Literature Review, 1987).

GENERAL DENTISTRY

Blanco, LJ. Comparison of microleakage of composite resin veneering systems at the alloy interface. (Abstract 88 56 03, 1988).


Han JS. Extracoronal Bleaching. (Literature Review, 1989).

Jessup, JP. Modern basing concept for amalgam restorations. (Literature Review, 1988).


Scoville RK. In vitro fluoride uptake in enamel on teeth adjacent to a tooth with a glass ionomer luting cement. (Abstract 87 26 12, 1987).


**IMPLANTOLOGY RESEARCH**

Duncan, RC. Electromyographic activity of the jaw closing muscles during the unloading reflex in patients with osseointegrated implant bridges. (Abstract 88 56 07, 1988).


Kwan JY. Eight-week histologic study of modifications of the core-vent implant system. (Abstract 89 46 03, 1989).


**INFECTION CONTROL**

Bussone R. Effectiveness of three methods of reducing bacteria on alginate impressions. (Abstract 89 26 01, 1989).


Kinyon TJ. Effectiveness of warmed disinfectants with "barrier system" at decreased times. (Abstract 89 26 13, 1989).

Komoroski, M. Chlorhexadine in the USA. (Literature Review, 1988).

Krause KK. The effectiveness of chlorine dioxide in the barrier system. (Abstract 89 26 04, 1989).

Mjos DP. Culturing methyl methacrylate to determine the best method of sterilization for cranial implants. (Abstract 87 26 05, 1987).
Overton JD. Glutaraldehyde test kits: evaluation for accuracy and range. (Abstract 87 26 08, 1987).


**MICROBIOLOGY IMMUNOLOGY**

Blanchard SB. Salivary IgA and IgA subclass responses to Bacteroides gingivalis in the cynomolgus monkey. (Abstract 89 46 01, 1989).

Hrabowy EW. Viral hepatitis and hepatitis testing. (Literature Review, 1987).

Nikolaus BE. The germicidal effect of citric acid against anaerobes. (Literature Review, 1986).

Sabatini, R. Comparison of in-vitro murine macrophage activation by lipopolysaccharides from selected Bacteroides gingivalis strain. (Abstract 88 46 02, 1988).

**NEUROSCIENCE/TMJ**


Edinger BJ. Diagnosis and treatment of anterior disc displacement in the temporomandibular joint. (Literature Review, 1987).

**ORAL AND MAXILLOFACIAL SURGERY**

Beauregard M. Current concepts in alveolar ridge augmentation. (Literature Review, 1987).


Hisel JE. Osseointegrated implants. (Literature Review, 1987).


Nusstein, JM. Treatment of the avulsed tooth. (Literature Review, 1988).


ORAL MEDICINE


ORTHODONTICS


Larson BE. Torsional elastic property measurements of selected orthodontic archwires. (Abstract 87 66 03, 1987).

Law JH. Stability following combined maxillary and mandibular osteotomies treated with rigid internal fixation. (Abstract 87 66 01, 1987).


Sweetman KA. The diagnostic reliability of deep antegonial notching as an indicator of future mandibular clockwise rotation. (Abstract 87 66 02, 1987).


PATHOLOGY


Holt B. A case of diffuse sclerosing osteomyelitis or disappearing bone disease. (Literature Review, 1989).


Rhodes SC. Malignant hyperthermia, implications for the general dentist. (Literature Review, 1987).


Weiss, PJ. Implication of AIDS to dental care providers. (Literature Review, 1988).
PERIODONTICS


Colosimo ME. Gingival hyperplasia secondary to systemic medications. (Literature Review, 1989).

Deas DE. Longitudinal assessment of disease sites by attachment level changes and bone density loss as measured by digital image analysis. (Abstract 89 46 04, 1989)

Eckles, RL. Periodontal dressings: Do they support the growth of periodontal pathogens? (Abstract 88 26 06, 1988).


Feeley JP, II. Tetracycline and citric acid etching of roots of periodontally involved teeth. (Abstract 89 26 03, 1989).

Fegley FM. Mesenchymal tissue response to heterotropically placed demineralized bone powder particles in the rat. (Abstract 87 46 03, 1987).


Jones, FL. Guided tissue regeneration and new attachment formation in the human periodontium. (Literature Review, 1988).

Kaster GA. Chemotherapeutic agents in periodontics. (Literature Review, 1987).

Kwan JY. Clinical and histological evaluations of hard tissue replacement alloplastic grafting material, case reports. (Abstract 89 46 02, 1989).


Risinger RK. Ceramic implants in periodontal therapy. (Literature Review, 1989).

Snodell SF. Literature review - mechanisms and treatment of dentin hypersensitivity. (Literature Review, 1987).

Vafides, DA. The Keyes approach to periodontal therapy: how valid? (Literature Review, 1988).

Wellejus, MT. Grafting of periodontal defects. (Literature Review, 1988).

**PHARMACOLOGY, THERAPEUTICS AND TOXICOLOGY**

Bedell, CE. The influence of acetylsalicylic acid and acetaminophen on clinical and histologic aspects of orthodontic tooth movement. (Abstract 88 66 01, 1988).


Humphreys, LG Jr. The use of iontophoretically applied acyclovir on recurrent herpes labialis. (Abstract 88 46 05, 1988).


**PROSTHODONTICS**


Belles DM. Effect of metal design and technique on the marginal characteristics of the collarless metal-ceramic restoration. (Abstract 87 56 03, 1987).

Bohnenkamp DM. The effects of fabrication techniques and storage methods on the dimensional stability of removable acrylic resin orthoses. (Abstract 87 56 04, 1987).

Branham LA. Chairside porcelain modification. (Literature Review, 1987).

Evans, DB. The influence of condensation methods on porosity and shade of body porcelain. (Abstract 88 56 04, 1988).


Helbert TF. The effect of thermal cycling on the surface roughness of dental casting investments. (Abstract 87 56 01, 1987).

Hill EE. Two kinematic methods for locating the transverse horizontal axis of the mandible. (Abstract 89 56 01, 1989).

Lee, KM. Rotational path removable partial dentures. (Literature Review, 1988).

Over LM. The science and application of color in fixed prosthetic dentistry. (Literature Review, 1986).


Rockwood DP. Porcelain finishing techniques that duplicate natural tooth surface texture. (Abstract 87 26 13, 1987).


Tiffany RL. Effects of different surface treatments on the tensile bond strength of polymethyl methacrylate processed against chemically etched Ticonium 100. (Abstract 87 56 05, 1987).

Verrett RG. An investigation into the effects of sprue attachment design on castability and porosity. (Abstract 87 56 02, 1987).

Wimsatt JA III. Review of the resin bonded, acid-etched fixed partial denture with emphasis on preparation design. (Literature Review, 1988).