(12)

AD

Reports Control Symbol RCS-MEDDH-288 (R1)

ANNUAL PROGRESS REPORT

FISCAL YEAR 1981

(1 October 1980 – 30 September 1981)

1 Oct 1981

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

UNITED STATES ARMY INSTITUTE OF DENTAL RESEARCH
WALTER REED ARMY MEDICAL CENTER WASHINGTON, D.C., 20307

Reports Control Symbol MEDDH-288 (R1)

US ARMY INSTITUTE OF DENTAL RESEARCH
WALTER REED ARMY MEDICAL CENTER
Washington, D.C. 20012

US ARMY INSTITUTE OF DENTAL RESEARCH
ANNUAL PROGRESS REPORT
1 Oct 1980 - 30 Sep 1981

DA Project	3A161101A91C	Task 00	In-House Laboratory Independent Research
DA Project	3M161102BS10	Task DA	Management of Dental Injury & Combat Dentistry
DA Project	3S162775A825	Task AA, AB, AC, AD	Combat Maxillofacial Injury
DA Project	3M162734A875	Task AQ	Medical Defense Against Chemical Agents

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MEDDH-288-R1	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) US Army Institute of Dental Research Annual Progress Report FY 81		5. TYPE OF REPORT & PERIOD COVERED Annual 1 Oct 80 - 30 Sep 81 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Thomas P. Sweeney, COL, DC		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Institute of Dental Research Washington, DC 20012		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 3A161101A91C Task 00 3M161102BS10 Task DA 3S162775A825 Task AA,AB,AC,AD
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Medical Research & Development Command (SGRD-RMS) Ft Detrick, MD 21701		12. REPORT DATE (cont) 1 October 1981 13. NUMBER OF PAGES 74
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release: Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

None

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Actinic Blocking Agents; Ampicillin; Anesthesia; Antibiotics; Antisepsis; Apexification Pastes; Base Metal Alloy; Biodegradable Ceramic; Biodegradable Dressing; Biodegradable Grafts; Biodegradable Polymeric Splint; Biodegradable Polymers; Bone Resorption; Calcium Hydroxide Paste; Carbon Dioxide Laser; Carbon Dioxide Pencil; Carbon Dioxide Pulp Testing; Carbon Fibers; Ceramic Devices; (cont)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

DA Project 3A161101A91C In-House Laboratory Independent Research. This program is instituted as one aspect of a broad approach to provide individual Army Scientists and Engineers an additional opportunity to maintain and increase their competence by doing original work in areas suiting their talents, thereby promoting a vigorous internal research program of the highest technical caliber.

Task 00

(Continued on reverse side)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Item 10 continued:
3M162734A875 Task AQ

Item 19 continued:
Cidex; Climactic Conditions; Climatic Extremes; Combat Injuries; Composite Restoratives; Craniofacial Tissue; Crevicular Fluid; Debridement of Maxillofacial Wounds; Dental Diagnosis; Dental Disease Prevention; Dental Emergencies; Dental Materiel; Dental Profiles; Diphenyl Hydantoin; Diphosphoinositide-Lysozyme; Epidermal Growth Factor; Esophageal Grafts; Field Dental Cutting Instrument; Field Dental X-ray; Field Materiel; Foreign Bodies; Gentamicin; Granular Ceramic Implant; Hemostasis; High Copper Amalgam; High Velocity Missile Effects; Hydroxyproline; Investment Materials; Laboratory Animal; Laser Surgery; Lip Pathology; Low-Gold Alloy; Materials Storage; Maxillofacial Wounds; Methylmethacrylate Toxicity; Microencapsulated Drugs; Microencapsulation; Monomer of Methylmethacrylate; Nerge Agent; Oral Health; Osteoclast Activating Factor; Palatal Wound Healing; Polymer Devices; Polymethylmethacrylate; Porcelain Bonding Agents; Radiographic Techniques; Restorative Materials; Salivary Amylase; Salivary Enzyme; Salivary Physiology; Secondary Missiles; Serum Lipids; Serum Proteins; Slow-Release Drugs; Sonacide; Spoon-Toothbrush; Sporocidin; Storage Simulation; Topical Anesthetics; Tracheal Grafts; Tracheal Repair; Tricalcium Phosphate Ceramic; Wound Dressing; Wound Healing; Xeroradiography.

Item 20 continued:
DA Project 3M161102BS10 Management of Dental Injury and Combat Dentistry. The objectives are to obtain information by the techniques of clinical and basic research on injuries and diseases, except communicable diseases, commonly seen in soldiers, especially in field operations and overseas. The work is divided according to the major medical specialties. Emphasis is placed on diseases and injuries which are receiving little or no study by civilian research groups, and the work is aimed at providing better preventive measures as well as treatment.

Task DA
Division of Oral Biology

DA Project 3S162775A825 Combat Maxillofacial Injury. The objectives are to develop simplified procedures for the care of complex maxillofacial wounds and injuries which require long time-consuming procedures for reconstruction, to achieve minimal morbidity rates from oral emergencies, preventable oral disease, and restorative failures. To develop more efficient, simplified, effective clinical and laboratory techniques which will result in better utilization of manpower and a saving in time and materiel.

Task AA, AB, AC, AD
Division of Oral Pathology
Division of Dental Materials
Division of Clinical Operations

DA Project 3M162734A875 Medical Defense Against Chemical Agents. The objectives and purposes are the development of the basic scientific data required for systems of soldier CW agent antidotes, soldier/patient decontamination and medical management of CW casualties.

Task AQ
Division of Oral Biology

FOREWORD

During FY 81 the US Army Institute of Dental Research has expanded its mission to include the development of dental materiel for the field. Emphasis will be placed on the development of a miniaturized, self-contained dental x-ray unit and a rugged lightweight dental cutting instrument.

Progress continues in the development of polymeric and ceramic materials for the repair of combat maxillofacial injuries. A new approach to drug administration in the field using microencapsulation techniques to provide long-term single dose therapy has produced very encouraging results.

Basic studies related to wound healing and in particular, the problems of bone resorption, also continue to give promising results. These studies could lead to new concepts in the treatment of combat maxillofacial injuries.

The need for qualified scientific personnel continues to be a problem which has increased in its impact on the ability of the USAIDR to conduct research. However, in spite of significant personnel losses during FY 81, progress has continued. Some of the significant accomplishments of FY 81 are as follow:

1. Microencapsulated extended-release antibiotic preparations of ampicillin continue to give excellent *in vivo* results at significantly reduced dose levels and free ampicillin has been identified deep in experimental wounds uncontaminated by microcapsules.

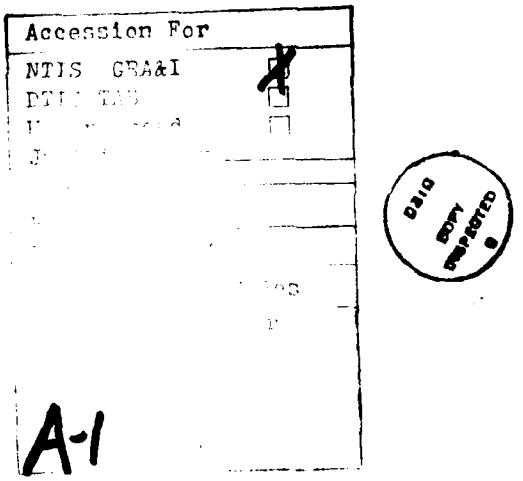
2. The presence of a powerful inhibitor of bone resorption in bone isolates has been verified and further characterized.

3. Data have been obtained which indicates that a diphosphoinositide-lysozyme complex accelerates bone healing.

4. A biochemical technique for evaluating oral health status has been developed. The data suggest that it could form the basis of a rapid, non-invasive screening technique for identifying soldiers with at-risk-profiles for dental emergencies.

5. A partly biodegradable polymeric device was found to be effective in stabilizing mandibular discontinuities in dogs. Based on these findings an effective totally biodegradable device appears feasible and is being designed.

6. The bridging of mandibular discontinuities with unidirectional-porosity, biodegradable, ceramic blocks has been accomplished in dogs. The promising results obtained indicate that the segmental replacement of bone with an appropriately designed ceramic, followed by bone ingrowth and replacement of the ceramic with functional bone is possible.



USAIDR PROJECTS, TASKS, AND WORK UNITS

(Responsible Division in Parentheses)

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OG 4010	81 10 01	DD-DR&E-AR-636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
81 04 01	H. TERM	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61101A	3A161101A91C	00	409
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)* (U) Enhanced Healing of Soft Tissue Wounds Using Diphenyl Hydantoin Incorporated into a Biodegradable Copolymer

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
002300 Biochemistry 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
81 04	81 09	DA	C. In-House

17. CONTRACT GRANT
a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	0.2	10
	CURRENT 82	0	00

19. RESPONSIBLE DOD ORGANIZATION
NAME:* US Army Institute of Dental Research
ADDRESS:* Washington, DC 20012
RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T.P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION
NAME:* US Army Institute of Dental Research
Division of Oral Biology
ADDRESS:* Washington, DC 20012
PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME:* Hollinger, J., MAJ, DC
TELEPHONE: 202-576-3446
[redacted] POC: DA
ASSOCIATE INVESTIGATORS
NAME: Finley, S., SP5
NAME:

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Wound Healing (U) Diphenyl Hydantoin (U) Biodegradable Dressing (U) Slow-Release Drug (U) Laboratory Animal

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Diphenyl Hydantoin (Dilantin) has been used systemically in the past as a means of enhancing wound healing. Results have been equivocal. The advent of slow-release technology offers the possibility of a new approach. The objective of this work is to determine if locally applied dilantin incorporated in a slow-release biodegradable dressing will accelerate or modify soft tissue wound repair. The ultimate objective is a field applicable wound dressing which will stimulate the healing process.

24. (U) Commercially manufactured 50:50 polylactic and polyglycolic acids will be solubilized in methylene chloride. Dilantin will be added. The resulting compound will be spun onto a mandril. This compound will be used as a dressing for the slow, timed release of Dilantin. The Dilantin-containing copolymer dressing will be used as a dressing for soft tissue, excisional wounds prepared on the back of rats. Wound repair evaluation will consist of tensile strength test determinations, histochemical examinations, hydroxyproline assay, collagen colubility, total protein determination, and collagen morphology using scanning electron microscopy.

25. (U) (81 04 - 81 08) Diphenyl Hydantoin containing dressings are being prepared using a number of modifications in the basic procedures in order to prepare the most acceptable dressings. Methodology for evaluating the effectiveness of the dressings has been standardized and animal studies will begin as soon as enough dressing material can be prepared.

*Available in contractors upon originator's approval

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 4011	81 10 01	DD-DR&E AR 636

3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8. DISP'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
81-04-01	H. TERM	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61101A	3A161101A91C	00	410
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)

(U) Localization of Foreign Bodies Using Xeroradiographic Techniques

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012900 Physiology 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
81 04	81 09	DA	C. In-House

17. CONTRACT GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	0.1	9
FISCAL YEAR CURRENT 82	0	00

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL NAME: Sweeney, T. P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research
Division of Oral Pathology

ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Allen, G., LTC, DC

TELEPHONE: 202-576-3258

[redacted] POC: DA

ASSOCIATE INVESTIGATORS

NAME:

NAME

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Xeroradiography (U) Foreign Bodies (U) Radiographic Techniques (U) Combat Injuries (U) Laboratory Animal

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Combat-induced injuries are often contaminated by foreign bodies which result from the positive and negative cavitation effects of high-velocity missiles. When these foreign objects are radiolucent in nature, they are difficult to localize by conventional radiographic techniques. This study intends to investigate the feasibility of employing xeroradiography for identification and localization of foreign bodies in combat wounds. If xeroradiography proves to be successful in improving the imaging of non-radioopaque foreign objects, it may allow for more rapid and efficient surgical debridement of combat wounds.

24. (U) A series of partially radioopaque and non-radioopaque foreign bodies will be surgically implanted in the subcutaneous soft tissues of ten New Zealand white rabbits. Following implantation, the animals will be radiographed utilizing conventional and xeroradiographic techniques. The resultant images will be compared for visualization of the foreign bodies.

25. (U) (81 04 - 81 08) This project has just started due to problems in obtaining appropriate equipment and supplies. No significant progress can be reported.

* Available in... restrictions upon originator's approval

DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND DD FORMS 1498A AND 1498-1 MAR 88 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 4013	81 10 01	DD-DR&E-AR 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISS'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
81 05 01	H. TERM	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61101A	3A161101A91C	00	411
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code): (U) Microencapsulated Medicaments Incorporated in a Composite Restorative For the Treatment of Dental Emergencies in the Field

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 010300 Miscellaneous Materials; 012600 Pharmacology; 002300 Biochemistry

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
81 05	81 09	DA	C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	0.2	10
FISCAL YEAR CURRENT 82	0.2	00

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Institute of Dental Research
ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T. P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION
NAME: US Army Institute of Dental Research
Division of Clinical Operations
ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Lorton, L., LTC, DC
TELEPHONE: 202-576-3393
SOCIAL SECURITY ACCOUNT NUMBER: xxx POC: DA

ASSOCIATE INVESTIGATORS
NAME: Wynkoop, J., CPT, DC
NAME

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Topical Anesthetics (U) Composite Restoratives (U) Microencapsulated Drugs (U) Antibiotics

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Emergency dental restorative work in the field often involves pulpal pain, inflammation and infection. Success thus far in our laboratory with microencapsulated medicaments in treating wounds suggests that currently available temporary restorative materials may be compatible with microencapsulated drugs. This could reduce the symptoms as well as failure rate in treating field emergencies and thus the rate of dental casualties which can be expected to occur at a rate of 100 to 140 per 1000 troops in the field. The objective of this work is to evaluate the feasibility of developing a temporary restorative material which incorporates anti-inflammatory, anesthetic and antiseptic capabilities.

24. (U) Various formulations of temporary restoratives and microencapsulated medicament will be evaluated *in vitro* for their chemical compatibility physical properties and drug release profile. Promising materials will be evaluated in experimental animals for the same parameters.

25. (U) (81 05 - 81 08) PLA-PGA copolymer was found to hydrolyze at alkaline pH of CaOH. Lactic acid was not found in the breakdown products. Tests thus far indicate that ordered release of medicaments from microcapsules is possible when they are combined with bases used in cavity preparations. Toxic by-products have not been found thus far.

* Available to contractors upon originator's approval

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OG 6047	81 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISS'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	H. TERM	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61101A	3A161101A91C	00	372
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)*

(U) Storage Stability of Materials of Interest to the Military Dentist

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

010300 Miscellaneous Materials

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
79 07	81 09	DA	C. In-House

17. CONTRACT GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	0.2	7
FISCAL YEAR CURRENT 82	0	0

19. RESPONSIBLE DOD ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T. P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Division of Dental Materials
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME:* Vermilyea, S.G., LTC, DC

TELEPHONE: 202-576-3092

SOCIAL SECURITY ACCOUNT NUMBER

POC:DA

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Materials Storage (U) Restorative Materials (U) Climactic Conditions (U) Storage Simulation

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Among the most prominent problems in providing logistical support to the military dentist world-wide are those related to the shipment and storage of certain dental materials. Climactic conditions ranging through tropical, arid and arctic-like can have a profound effect on the properties and characteristics of such substances as organic-inorganic composites, waxes and elastomeric impression materials. The objective of this study is to develop reliable techniques for the assessment of the storage stability of a variety of dental materials so that the most suitable materials for application in the field environment can be identified.

24. (U) A programmable, extended range, constant temperature/humidity cabinet will be used to evaluate the "weatherability" of dental composite restoratives. Unopened "as received" packages of selected materials will be subjected to simulated storage conditions ranging from 10 to 90 days followed by conventional testing to determine the effects of those conditions on the properties and characteristics of the subject materials.

25. (U) (80 10 - 81 08) The programmable "weathering" chamber has been received and installed. However, problems continue with respect to calibration and proper operation of the chamber. Several materials with known manufacturing histories have been obtained and base line data on their properties have been developed. Work will continue when the test chamber is operational. This work has been transferred to the A825 project.

*Available in machine-produced form upon originator's approval

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OG 6049	81 10 01	DD DR&E AR(6)6

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8b. DISP'N INSTR'N	8c. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	K. COMP	U	U		NL	[X] YES [ ] NO	A. WORK UNIT

10. NO. CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61101A	3A161101A91C	00	374
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)*

(U) The Effect of Epidermal Growth Factor on Palatal Wound Healing

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY		16. PERFORMANCE METHOD
79 05	81 09	DA		C. In-House

17. CONTRACT GRANT

a. DATES/EFFECTIVE: — EXPIRATION

b. NUMBER:*

c. TYPE: — d. AMOUNT

e. KIND OF AWARD: — f. CUM AMT

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	0.2	01
	CURRENT 82	0	00

19. RESPONSIBLE DOD ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Division of Pathology
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME:* Carpenter, W.M., COL, DC

TELEPHONE: 202-57603080

[redacted] POC: DA

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Epidermal Growth Factor (U) Wound Healing (U) Palatal Wound Healing (U) Laboratory Animal

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) The oral cavity is subject to trauma from a variety of sources. Healing of many oral tissue wounds requires epithelial growth. A protein termed "epidermal growth factor" (EGF) has been isolated from the submaxillary glands of rats and studied mostly *in vitro*. The objective of the present study is to determine the ability of EGF to accelerate the healing of palatal wounds in rats. The ultimate objective is to determine if EGF has value as a medicament for treating combat maxillofacial wounds.

24. (U) Control and experimental animals will receive palatal wounds using a punch biopsy instrument. Experimental animals will be treated with EGF injections at the wound site at the time of wounding and twice daily until sacrifice. Controls will be similarly injected with physiological saline. Healing will be evaluated by a determination of the area of epithelial fill in the wounds, and histologic examination.

25. (U) (80 10 - 81 09) The evaluation of EGF in improving the healing of oral wounds in experimental animals has been completed. Some improvement in healing was noted in animals treated with EGF. However, the improvement noted was not considered sufficient to warrant continued study at this time, inasmuch as the EGF is very expensive relative to its effectiveness.

*Available to contractors upon originator's approval

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OH 6041	81 10 01	CD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	K. COMP	U	U		NL	XX YES ☐ NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61101A	3A161101A91C	00	406
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code): (U) Changes in Serum Protein and Lipid Composition as a Result of Exposure to Methylmethacrylate Monomer

12. SCIENTIFIC AND TECHNOLOGICAL AREAS:
002300 Biochemistry 012600 Pharmacology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
79 05	81 09	DA	C. In-House

17. CONTRACT GRANT
a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR — PRECEDING 81	0.3	03
FISCAL YEAR — CURRENT 82	0	00

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Institute of Dental Research
ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T.P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION
NAME: US Army Institute of Dental Research
Division of Oral Biology
ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Miller, R.A.
TELEPHONE: 301-677-4372
[redacted] POC: DA

ASSOCIATE INVESTIGATORS
NAME: Wynkoop, J., CPT, DC
NAME:

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Methylmethacrylate Toxicity (U) Serum Proteins (U) Serum Lipids (U) Monomer of Methylmethacrylate (U) Laboratory Animal

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Studies have suggested that the highly volatile monomer of methylmethacrylate is toxic. The relatively high usage of methylmethacrylate both by dental laboratory personnel and in the operatory indicate that it may present a significant health hazard to military dental personnel. Non-specific elevation of lipid content and reduced protein in the serum of rats has been described in the literature. The objective of this study is to determine the specific serum protein and lipid changes occurring in experimental animals as a result of exposure to the monomer both in liquid and vapor form. The data will be used as a basis for determining the possible requirement for future studies on the potential occupational hazard of methylmethacrylate to military dental personnel.

24. (U) Liquid monomer will be injected subcutaneously in rats and blood obtained at sacrifice. Rats will also be subject to monomer vapor inhalation over a period of 4 weeks and blood will be obtained at sacrifice. Serum lipids will be quantitated by clinical chemical methods and HPLC. Serum proteins will be quantitated by isoelectric focusing.

25. (U) (80 10 - 81 08) This project has been completed. No consistent serum protein and lipid profiles could be seen in experimental animals receiving the methylmethacrylate monomer. However, it was found that the routine determination of blood urea nitrogen (BUN) was good index of the level of methylmethacrylate monomer inhalation and is probably related to kidney damage. A routine BUN on all exposed personnel at regular intervals appears to be desirable.

*Available to contractors upon originator's approval

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OB 6037	81 10 01	CD-DR&E-AR(6)6

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	YES ☐ NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61102A	3M161102BS10	DA	361
b. CONTRIBUTING				
c. CONTRIBUTING	////////////	STOG 80-7.2:5		

11. TITLE (Procede with Security Classification Code)

(U) Acceleration of Wound Healing

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

002300 Biochemistry

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
66 07	CONT	DA	C. IN-HOUSE

17. CONTRACT GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	2.0	145
	CURRENT 82	2.0	174

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T. P., COL, DC

TELEPHONE: (202) 576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research
Division of Oral Biology

ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Hollinger, J., LTC, DC

TELEPHONE: (202) 576-3662

SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS

NAME: Heath, J., M.S.

NAME: Miller, R.A., B.S.

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Procede EACH with Security Classification Code) (U) Wound Healing (U) Osteoclast Activating Factor (U) Bone Resorption (U) Diphosphosphoinositide-Lysozyme (U) Laboratory Animal

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Procede text of each with Security Classification Code.)

23. (U) Recent studies show that 10-12% of combat wounds involved the maxillofacial apparatus. Further, 7% of noncombat injuries requiring hospital care involve the maxillofacial region. This results in the loss of approximately 1,000,000 man-hours per year. The research objective is to accelerate or otherwise improve the healing of maxillofacial injuries.

24. (U) Studies on the effects of biochemical and physical factors to include chelate complexes, cyclic AMP, prostaglandins, and *in vivo* growth factors on the rate of healing in soft tissue and bone will be done. The mechanism of any beneficial alteration in healing effected will be investigated and pursued to human usage.

25. (U) (80 10 - 81 10) Work continues on the isolation and purification of the bone resorption factor, osteoclast activating factor (OAF). A more effective protocol for the concentration of OAF activity has been developed. A significant increase has been obtained in the osteolytic activity of isolates and data continue to point to a monomer in the range of 9000 daltons which functions as a dimer. The presence of a powerful inhibitor of OAF activity has been confirmed and further concentrated. It appears to have a molecular weight of about 6000. A rat model has been developed for evaluating materials with bone regeneration potential. Data has been obtained that a diphosphoinositide-lysozyme (DPIL) complex accelerates bone healing in rats up to 21 days post-injury and a 50-50 polylactide-coglycolide (PLA-PGA) also has some stimulating effect on bone healing. A study is in progress combining DPIL and PLA-PGA in a bone healing experiment.

*Available to contractors upon originator's approval

PROJECT NUMBER 3M161102BS10

ACCELERATION OF WOUND HEALING

Identification of Leukocyte Populations Responsible for Production of OAF and Their Role in Bone Resorption

A new protocol has been developed for the concentration and partial purification of Osteoclast Activating Factor (OAF) from the supernatants of large volume, phytohemagglutinin (PHA) stimulated, human mononuclear cell (MNC) cultures. Pooled MNC supernatants were concentrated on a 10,000 MW cut-off ultra filtration membrane (Amicon PM-10). The concentrated retentate was brought to 1 M with NaCl, and after one hour of stirring it was filter dialyzed with five volumes of phosphate buffered saline (PBS) on the same membrane. The combined ultra filtrate and dialysate was first concentrated and then filter dialyzed with PBS on a 1,000 MS cut-off membrane (Amicon UM-2). Thus, only the 1,000 to 10,000 MW substances from the MNC supernatant pool remained in the UM-2 retentate. The 1 M NaCl caused disassociation of high MW (18,000 daltons) forms of OAF into smaller, active subunits.

Bioassay of the various steps of this protocol for osteolytic activity gave the following results: the MNC pool was osteolytic (caused increased release of ^{45}Ca from labeled bones *in vitro*); the PM-10 retentate was inactive; the PM-10 filtrate was osteolytic; the UM-2 retentate inhibited the release of ^{45}Ca from bones, even when it was restored to its original concentration with culture medium; and the UM-2 filtrate was more osteolytic than the MNC supernatant pool from which it had been prepared. Radioimmunoassay of the UM-2 filtrate for prostaglandin revealed the presence of microgram quantities of PGE, which is known to be osteolytic.

Fractionation of the UM-2 retentate by gel filtration showed the presence of a powerful inhibitor (more than 50% inhibition) of ^{45}Ca release with an estimated MW less than 6,000 daltons, and an even smaller, powerful stimulator of osteolysis (2.5 times more ^{45}Ca released than controls) which may be the basic monomeric form of OAF.

These results suggest that PHA stimulated the MNC to produce stimulators of osteolysis (OAF and PGE) and to produce a powerful inhibitor of osteolysis, as yet uncharacterized. This ultra filtration protocol will rapidly and economically concentrate and simultaneously remove unwanted high and low MW compounds from culture supernatants leaving the product ready for further purification of analysis.

Evaluation of an Experimental Animal and a Specific Site for Testing Osteogenic Materials

Many substances have been investigated to determine if they possess osteogenic potential. The specific sites in the experimental animal where osteogenic implant materials are evaluated can have a profound influence upon the observed result. In the past, investigators have prepared osseous defects in monkeys, sheep, dogs, rabbits, and a variety of rodents. The mandible, major trochanter, metaphysis and diaphysis of the tibia, occipital bone, and parietal bones have often been chosen as experimental bony wound sites. Several investigators have established that spontaneous bone production will occur in prepared bony defects that are less than 5 mm in diameter. The endochondral type of bone appears to be least suitable for bone induction studies because of its intrinsic ability to heal spontaneously. The intramembranous category of bone offers the most logical choice for experimental

osseous wound sites. Up to this time, a controlled study for the development of a convenient animal model for osseous wound healing studies had not been undertaken using the parietal bones of the Walter Reed strain of rat. This laboratory, therefore, began a study to evaluate 2 and 3 mm diameter prepared defects in the parietal bones of rats to determine if these sites would be suitable for testing bone-inducing agents.

Experimental animals were sacrificed at three week intervals for twelve weeks. Histologic evaluation of the prepared wound sites from the experimental animals indicated that the prepared 2 and 3 mm diameter defects did not heal by osseous regeneration, but rather a dense, irregular, collagenous tissue proliferated and obliterated the wound sites. At twelve weeks some capillary buds were evident. There were a few delicate peninsulas of randomly arranged homogenous osteoid at the periphery of one wound site in one rat (after twelve weeks). This scenario was not repeated in any of the other nineteen experimental animals.

The results of this study have established that the parietal bone can provide a suitable site for the testing of osteogenic or suspected osteogenic material. This is fortuitous because the rat is inexpensive, readily available, easily handled and anesthetized; it possesses an adequate zone of bone at the test site that will not heal spontaneously; the wound site consists of both cortical and cancellous bone; and the animal allows for accurate follow-up and assessment of the osteogenic material and of the contiguous host tissue.

A Study on 50:50 Poly (L (-) Lactide-co-glycolide) and Diphosphoinositide-Lysozyme Complex in the Promotion of Calcification in Osseous Defects

Bony repair of osseous wounds involves collagen formation with subsequent calcification. Numerous investigations have been conducted using a variety of implant materials to promote healing of osseous injuries. Polymer and copolymers of polylactide and polyglycolide have shown promise when used as implants for bone and fracture repair. Reports have indicated that a protein bound phospholipid (diphosphoinositide) complex can cause nucleation of bone calcification *in vitro*. To date, no study has investigated the combination of polylactide-polyglycolide and an acidic protein-bound phospholipid to determine what effects this complex would have on osseous wound repair.

PRELIMINARY STUDY A: Based upon presumptive *in vitro* results, this laboratory developed a nucleating agent by combining mucopeptide-N-acetylmuramoylhydrolase (lysozyme) with phosphatidyl inositol 4,5-diphosphate (diphosphoinositide). The nucleating agent was tested in the tibias of rats after prepared 2.0 mm defects had been made. The nucleating agent and host tissues were evaluated histologically.

According to histologic criteria, the experimentally produced nucleating agent hastened bone repair in the rat tibia at the one, two, and three week levels. By the eighth week, however, there appeared to be no difference between natural wound healing and the induced wound healing. Further evaluation of the nucleating agent in areas where spontaneous osseous regeneration does not occur will be undertaken. There was no evidence of an adverse host reaction to the nucleating agent.

The diphosphoinositide-lysozyme complex does appear to induce an initial robust bony response in osseous defects that is more intense than naturally occurring bony healing. If the nucleating agent complex can be modified to provide a continual, high efficiency activity, then perhaps the osseous potential generated can be sustained over longer periods of time. If this were the case, it may be presumed that bone induction could be hastened.

PRELIMINARY STUDY B: Commercially manufactured 50:50 poly (L-(-) lactide-co-glycolide) was solubilized in methylene chloride and then re-precipitated in methanol. The viscous precipitate was formed into 1 mm x 2 mm plugs using a Teflon template. Plugs were lyophilized for 24 hours at ambient temperature and then were placed in a desiccator for storage. The copolymer was tested in the tibias of rats after prepared 2.0 mm defects had been made. The plugs and host tissue were evaluated histologically.

According to histologic criteria, the copolymer implant plug hastened bone repair at the one and two week levels. By the fourth week, however, there appeared to be no difference between natural wound healing and the implant induced wound healing. At no time in the study did the host tissue display an adverse reaction to the copolymer implant plug.

The copolymer implant does appear to be a bony stimulant for osseous wound healing. Importantly, it is not an immunologic pest or an impediment to natural bony repair. The copolymer can be easily formed or molded into a variety of shapes. In addition, the polymer can provide adequate strength for holding bony fragments together; this is based upon presumptive *in vitro* laboratory observation. Also significant is the fact that the copolymer can

be fabricated into not only hard implants, but it can also be prepared as a mesh or to a lacy consistency.

The agents mentioned and described in the preliminary studies are being investigated in intramembranous bone. In addition, this laboratory is preparing a suitable form of the implant complex (50:50 poly (L-(-) lactide-co-glycolide) plus the diphosphoinositide-lysozyme for implantation into parietal bones of rats.

Publications:

1. Hawley, C.E., Snyder, A.J., and Heath, J.R., Jr: Evidence for the Inhibition of Bone Resorption by $Ca_3(PO_4)_2$ Ceramics. J Dent Res,60(A): 596 (#1149), March 1981.

2. Grower, M.F., Carpenter, W.M., and Stow, J.A.: Effects of Biodegradable Polylactic Acid Mesh on Gingival Flap Healing. J Dent Res, 60(A): 611 (#1206), March 1981.

3. Heath, J.R.,III, and Hawley, C.E.: Partial Purification and Characterization of Osteoclast Activating Factor by High Performance Liquid Chromatography. Proc Am Soc Microbiol, p 55, No. E5, 1981.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OD 6021	81 10 01	DD-DR&E-AR(6)6

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	[X] YES [ ] NO	A. WORK UNIT

10. NO. CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61102A	3M161102BS10	DA	362
b. CONTRIBUTING				
c. CONTRIBUTING	///////////	STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code)* (U) Problems Involved in Military Oral Health Care Delivery Related to Therapeutic Agents and Materials

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
012600 Pharmacology 002300 Biochemistry 010100 Microbiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
68 09	CONT	DA	C. IN-HOUSE

17. CONTRACT GRANT
a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	3.0	150
FISCAL YEAR CURRENT 82	2.0	160

19. RESPONSIBLE DOD ORGANIZATION
NAME:* US Army Institute of Dental Research
ADDRESS:* Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Sweeney, Thomas P., Col, DC
TELEPHONE: (202) 576-3484

20. PERFORMING ORGANIZATION
NAME:* US Army Institute of Dental Research
ADDRESS:* Division of Oral Biology
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME:* Setterstrom, J., Ph. D.
TELEPHONE (202) 576-3662
SOCIAL SECURITY ACCOUNT NUMBER POC: DA

ASSOCIATE INVESTIGATORS
NAME: Wynkoop, J., CPT, DC
NAME: Miller, R. A., B.S.

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Microencapsulation (U) Antibiotics (U) Tracheal Repair (U) Ampicillin (U) Gentamicin (U) Laboratory Animal

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To evaluate the special military problems of drug storage, heat susceptibility, long-term drug potency, sterility of bulk items, lack of refrigeration in combat zones and delivery to the patient. To investigate drug hazards. To investigate the use of biodegradable polymers for the long-term, slow release delivery of drugs.

24. (U) Improved means of drug delivery in the field using microencapsulated medicaments will be studied. The hazards in the use of various drugs and the use of biodegradable, biocompatible materials for surgical repair of combat wounds will be studied.

25. (U) (80 10 - 81 10) Two additional batches of microencapsulated ampicillin and one of gentamicin have been evaluated *in vivo*. The ampicillin microcapsules applied to contaminated standardized wounds in rats at single dose levels of 0.05 to 0.1 gm have eradicated infections over a 14-day period. Free ampicillin has been identified deep in the wounds uncontaminated by microcapsules and serum levels were detected at 2 and 7 days post-wounding. Gentamicin microcapsules given under the same conditions were effective only 4 to 7 days post-wounding. Evidence indicates too rapid release of Gentamicin by the microcapsules. Redesign of the Gentamicin microcapsules is in progress. Histologic evaluation of wounds treated with ampicillin microcapsules indicate a foreign body reaction beginning at 6 days post-wounding. A third generation device for the segmental replacement of the trachea was constructed. It consisted of a biodegradable PLA-PGA framework on a steel spring coil. Initial testing did not indicate the device was an improvement over previous designs.

*Available for entry upon originator's approval

PROJECT NUMBER 3M161102BS10

PROBLEMS INVOLVED IN MILITARY ORAL HEALTH CARE DELIVERY

RELATED TO THERAPEUTIC AGENTS AND MATERIALS

Biological Activity Verification of Specified
Microencapsulated Antibodies *In Vivo*

Efforts have been directed toward improving the efficacy of experimental biodegradable microcapsules that are optimally formulated to release therapeutic amounts of ampicillin and gentamicin which are effective in complete and rapid control of wound infections. During this reporting period the following batches of microcapsules have been formulated and evaluated *in vivo*.

SRI BATCH #	USAIDR *In Vivo* Experiment #	Excipient Poly (Lactide-co-glycolide)	Particle Size (μM)	Anti-Biotic Load
Ampicillin Batch A382-140-1	Efficacy Experiment 4	68:32	45-106	18.5 wt%
Ampicillin Batch A681-31-1	Dose-Response Experiment 5	68:32	45-106	18.1 wt%
Gentamicin Batch A681-94-1	Efficacy Experiment 6	68:32	45-150	10.6 wt%

Preliminary evidence of the release of bioactive ampicillin was observed in previously submitted batches of encapsulated ampicillin. This information was based on infection control studies wherein bacterial counts/gm of tissue were decreased, and infections were eliminated in treated rats. Additional evidence of the release of bioactive ampicillin by microcapsules has now been provided by (1) the detection of ampicillin in deep muscle tissue (uncontaminated with undegraded microcapsules) removed from the wound sites that were treated 14 days previously with microencapsulated ampicillin; and (2) the detection of bioactive serum levels of ampicillin in the microcapsule-treated rats at two

and seven days post-treatment. No ampicillin was detected in 48 hour serum or in deep tissue specimens from rats treated with locally applied ampicillin powder which indicated rapid excretion of unencapsulated ampicillin by the animal.

Evaluation of microcapsules A681-31-1 in a dose/response experiment to determine the lowest effective dose of encapsulated ampicillin revealed eradication of infection by 14 days with microcapsule doses as low as 0.05 grams (Table 1). The experimental parameters for this experiment are shown in Table 2. Results obtained show ampicillin microcapsules (A382-140-1 and A681-31-1) to: (1) slowly release ampicillin over the 14-day test period in a bioactive form; (2) be effective in doses as small as 0.1 to 0.05 g; and (3) to either control or eradicate all infections by 14 days.

Future studies on the ampicillin microcapsules will include reformulation of the capsules to a 50:50 ratio of PLA-PGA so that they will degrade and release the drug at a faster rate. It is anticipated that this may hasten their *in vivo* efficacy. There is evidence that approximately 40% of the ampicillin is being retained in 68:32 undegraded capsules that remains in the wound after 14 days. The possibility exists that this remaining capsule may be serving as a foreign body, thereby slowing the rate of infection control. These newly formulated capsules (50:50) will be tested *in vivo* in 1982. The most rapid infection control by the smallest effective dose of encapsulated antibiotic remains the ultimate goal.

An initial *in vivo* experiment to test the efficacy of SRI's first batch of gentamicin microcapsules revealed problems in the gentamicin encapsulation formulation. Data indicated an initial decrease in bacteria/gm of infected tissue at four and seven days; however, bacterial counts increased significantly by fourteen days, and no infections were eliminated. Except for the

Table 1

BACTERIA PRESENT AT WOUND SITES
(Bacteria/Gram of Tissue)

	Group A	Group B	Group C	Group D	Group E
48 hours	3.75×10^6	5.92×10^5	2.05×10^6	6.79×10^5	1.78×10^6
7 days	3.40×10^3	8.05×10^3	1.78×10^4	4.37×10^4	3.54×10^6
14 days	0	0	0	0	6.39×10^5

Table 2

AMPICILLIN RESERVOIR INITIALLY PRESENT IN WOUNDS OF RATS IN GROUPS A, B, C, AND D

	Amount of Microcapsule Present in Wound	Total Available Ampicillin Present at Wound Site
Group A	0.50 Grams	90.50 mg
Group B	0.25	45.25
Group C	0.10	18.10
Group D	0.05	9.05
Group E	0.00	0.00

Rats in Group E were untreated controls.

[Based on an 18.1 wt percent core load for Batch A681-31-1 (SRI)]

substitution of *Escherichia coli* (ATCC 29875) for *Streptococcus pyogenes* (ATCC 25147), the *in vivo* model system used in evaluation of encapsulated gentamicin was identical to that used for evaluation of encapsulated ampicillin. We attribute the failure of complete infection control to the too rapid release of gentamicin from the microcapsules. This theory has been substantiated by *in vitro* release studies performed at SRI.

Publications:

1. Wynkoop, J.R., Miller, R.A., Lorton, L., and Bussell, N.E.: Some Hepatic Chemistries Subsequent to Subcutaneous Injection of Methylmethacrylate Monomer. J Dent Res, 60(A):394 (#336), March 1981.

2. Wynkoop, J.R., and Bussell, N.E.: A Preliminary Examination of Alterations in IEF Urinary Protein Patterns after Mercury Chloride Poisoning. J Dent Res, 60(A):567 (#1029), Mar 1981.

3. Setterstrom, J.A., Posey, W.R., Harrington, J.S.G., and Derevjanik, M.A.: Sustained Release of Antibiotics from Biodegradable Microcapsules: *In Vivo* Evaluation of Locally Applied Ampicillin in the Control of Wound Infections. Abstracts of 81st Annual Meeting, Am Soc Microbiol, p. 5, No. A-29, 1981.

4. Tice, T.R., Meyers, W.E., Lewis, D.H., Cowsar, S.R., and Setterstrom, J.A.: Controlled Release of Ampicillin and Gentamicin from Biodegradable Microcapsules. 8th Internat Symp on Controlled Release of Bioactive Materials, Program & Abstracts, 108, 1981.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OF 6024	81 10 01	DD-DR&E AR:636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8A. DISB'N INSTR'N	8B. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	XX YES ☐ NO	A. WORK UNIT

10. NO.. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61102A	3M161102BS10	DA	363
b. CONTRIBUTING				
c. (CONTRIBUTING)		STOG 80-7.2.5		

11. TITLE (Precede with Security Classification Code)

(U) Identification and Control of Orofacial Infections of Military Importance

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

010100 Microbiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
66 07	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	2.0	145
	CURRENT 82	2.0	130

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Division of Oral Biology
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Setterstrom, J., Ph. D.

TELEPHONE: 202-576-3663 POC:DA

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: Woodyard, S., COL, DC

NAME: Heath, J., M.S.

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Crevicular Fluid (U) Hydroxyproline (U) Sonacide (U) Cidex (U) Sporocidin

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To investigate the source and treatment of oro-facial infections encountered in field conditions, foreign countries and diverse climates. To evaluate the special agents, instruments and chemicals necessary under military conditions.

24. (U) Oro-facial infections of significance in the diverse military environment will be studied by microbiological, immunological and electronmicroscopy methods. Possible sources of oral infections will be evaluated and the effectiveness of commercially available as well as in-house designs will be studied for their ability to control or prevent oral infections.

25. (U) (80 10 - 81 10) A biochemical technique for evaluating oral health status is being developed. Results to date suggest that a rapid non-invasive screening technique can be developed which can in combination with other criteria be used as a basis for identifying soldiers with at-risk-profiles for dental emergencies. The technique is based on the ultramicro determination of hydroxyproline in gingival crevicular fluid. An excellent correlation was found between hydroxyproline levels and crevicular depth. A study designed to evaluate the value of root planing in military dentistry suggests that this difficult and time consuming procedure may not produce results commensurate with the effort invested. The *in vitro* study of cold sterilizing agents for dental uses has been extended into a clinical study. The relative merits of the products Sonacide, Cidex and Sporocidin are being considered for field use.

*Available for contractors upon originator's approval

PROJECT NUMBER 3M161102BS10

IDENTIFICATION AND CONTROL OF OROFACIAL INFECTIONS

OF MILITARY IMPORTANCE

Determination of Hydroxyproline Levels in Gingival Crevicular Fluid

Gingival tissues remain chronically inflamed in most individuals with acute exacerbation commonly developing, particularly in the gingival crevicular areas. This gingival crevice is unique in the body, being the only area where calcified hard tissues protrude through soft tissues with the additional problem of continued direct and indirect insult by a variety of microorganisms. The chronic inflammatory state represents a combination of tissue destruction and repair, with the gingival crevicular fluid representing tissue degradation products, serum and various cellular elements. This area, therefore, represents an ideal model for study of the inflammatory response.

A new hydroxyproline analysis using High Performance Liquid Chromatography to evaluate minute amounts of that substance was developed during this study. As a consequence of the sensitivity of this system, hydroxyproline levels at the nanogram level were measured, a necessity considering the minute amounts of gingival fluid available in a typical gingival sulcus. The method was as follows: The gingival fluid was collected with filter paper strips according to the method of Brill, and sample weights were determined. The strips and 4.8 µg of internal standard (norvaline) were hydrolyzed in 0.2 ml 6N HCl at 105°C for 16 hours. The hydrolysate was dried under N_2, reconstituted with 0.3 ml of 0.5M carbonate buffer pH 9 and incubated with 0.3 ml dansyl chloride (1 mg/ml acetone) for 1 hour at 55°C. The samples were evaporated and reconstituted in 1 ml methanol then filtered and injected into the HPLC. Samples

were separated on a μ-Bondapak C_{18} column and fluorescence was monitored using an excitation wavelength of 405 nm with a 485 nm emission cut-off filter. Hyp was eluted at a flow rate of 1.5 ml/min by 0.1 sodium acetate buffer pH 4.0/acetonitrile buffer system. The solvent system was programmed to remain at 95/5 acetate/acetonitrile for 10 minutes; increase to 80/20 acetate/acetonitrile in 15 minutes; followed by another linear gradient to 60/40 acetate/acetonitrile in 75 minutes. Hydroxyproline had a retention time of 31 minutes compared with internal standards retention time of 62 minutes. The results demonstrated a hydroxyproline content ranging from 30 ng for an exudate sample weighing less than 0.1 mg to 3.7 μg for a sample weighing 2.5 mg.

Crevicular fluid from fourteen (14) patients was analyzed, and hydroxyproline levels did not correspond well to conventional clinical indices of inflammation, reflecting their relative inaccuracy. A direct correlation was found, however, between hydroxyproline levels and crevicular depth, probably reflecting the increased surface area of inflamed tissue producing crevicular fluid. The results suggest that a rapid non-invasive screening technique can be developed which can in combination with other criteria be used as a basis for identifying soldiers with at risk profiles for dental emergencies.

Penetration of Tritiated Endotoxin into Root Planed and Untreated Root Surfaces *In Vitro*

An *in vitro* study was designed to evaluate the effectiveness of root planing as a treatment modality for periodontal disease. It is believed that the difficult and time-consuming process of root planing removes bacterial

endotoxins and thus facilitates the elimination of periodontal pockets.

Bacterial endotoxin was produced from strains of *Fusobacterium nucleatum* and prepared with a tritium label. Twenty teeth extracted for reasons of heavy periodontal involvement were root planed on one side and untreated on the other. Each tooth was subjected to ^{3}H-labeled endotoxin solution for 10 days to simulate the time between root-planing appointments in a periodontal practice. The penetration of the radioactive label was evaluated by microbiopsy of sequential layers of the treated and untreated root surfaces of 10 teeth and by autoradiography of 300 μm sections taken from 10 teeth.

The results indicated that the penetration of endotoxin did not differ from treated to untreated tooth surfaces. This suggests that root-planing may not provide the endotoxin-free surface expected inasmuch as endotoxin penetrates well beyond the usual planing depth and any residual endotoxin following initial root planing will easily penetrate planed areas in the interim between appointments.

Clinical Evaluation of Sporicidin

A previously reported study designed to determine the maximum effective dilution of the cold sterilizing agents Cidex and Sporicidin yielded the following results:

	Sporicidal Activity	Bactericidal Activity	Presumptive Tuberculocidal Activity
Sporicidin	1:5	1:20	1:20
Cidex	Undiluted	1:2	Undiluted

For completion of this portion of the study, manuscript preparation and a final confirmative tuberculocidal test using *Mycobacterium bovis* are presently

underway. The potential of *M. bovis* as a cause of human tuberculosis has mandated that a biohazard hood in another laboratory be secured for this study. Arrangements have been made and the confirming tests are imminent.

Results show that Sporicidin has two attractive features superior to Cidex.

(1) Dilution of the sterilizing agent which inevitably occurs during long-term clinical use is least likely to produce a noneffective product.

(2) Higher dilution of product allows for cost-effective use.

Cidex and Sporicidin will be done at the USAIDR Dental Clinic at Fort George G. Meade, MD, during actual clinical in-use procedures. The study is scheduled to begin in October 1981.

Publications:

1. Keller, D.L., Peters, D.D., Setterstrom, J., and Bernier, W.E.: Microleakage of Softened Temporary Restorations as Determined by J Endod, 7(2):413-417, Sep 1981.

2. D'Alessandro, S.M., Derevjanik, M.A., and Howard, M.: Evaluation of the Cold-Sterilant Sporicidin. J Dent Res, 60(A):324 (#54), Mar 1981.

3. Sheehe, J.P., and Hawley, C.E.: Chlorhexidine Inhibition of Hemagglutination by Oral *Bacteroidaceae*. J Dent Res, 60(A):330 (#78), Mar 1981.

4. Bussell, N.E., and Hawley, C.E.: High Performance Liquid Chromatography in Taxonomic Studies of *Fusobacterium nucleatum*. J Dent Res, 60(A):327 (#66), Mar 1981.

5. Miller, R.A., Bussell, N.E., Setterstrom, J.A., and Gross, A.: Effect of Mixed Culture Growth Conditions on the Cellular Fatty Acids of *Streptococci* (Analyzed by High Performance Liquid Chromatography). Submitted to the J Dent Res, Oct 1980.

6. DiFiore, P.M., Peters, D.D., Setterstrom, J., and Lorton, L.: The Antibacterial Effects of Calcium Hydroxide Apexification Pastes on *Streptococcus sanguis*. Submitted to the J Oral Surg, June 1981.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OG 8676	81 10 01	DD DR&E 4K 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. NEW	U	U		NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61102A	3M161102BS10	DA	364
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7:2		

11. TITLE (Precede with Security Classification Code)* (U) The Secondary Effect of High Velocity Missiles on Craniofacial Tissues.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

012900 Physiology 002300 Biochemistry

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
81 10	82 10	DA	C. IN-HOUSE

17. CONTRACT GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	0	0
	CURRENT 82	0.5	30

19. RESPONSIBLE DOD ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME:* US Army Institute of Dental Research
Division of Pathology

ADDRESS:* Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME:* Carpenter, W.M., COL, DC

TELEPHONE 202-576-3080

SOCIAL SECURITY ACCOUNT NUMBER POC: DA

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Craniofacial Tissues (U) High Velocity Missile Effects (U) Maxillofacial Wounds (U) Secondary Missiles (U) Laboratory Animal

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To conduct a systematic evaluation of animal tissues (eyes and brains) subjected to trauma as a result of high velocity missiles striking the maxillofacial complex. The increasing numbers and velocity of missiles produced by modern weaponry results in a significant increase in the production of tooth and bone fragments which can do extensive damage as secondary missiles remote from the primary missile impact site. The objective of this study is to provide a semi-quantitative evaluation of the secondary effects of high velocity missile impacts and to provide data for the "Computer Man" system which will help to define treatment strategies for a wide range of combat wounds.

24. (U) Fifty Texas Angorra goats were shot in the maxillofacial complex with high velocity missiles of various sizes in a USAIDR contract project. At autopsy the eyes and brains were removed intact. Detailed histologic evaluations of these tissues will be made using conventional qualitative methods as well as new methods which will provide quantitative data.

25. (U) NONE. New Work Unit.

*Available to contractors upon originator's approval

DD FORM 1 MAR 66 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498-1 1 MAR 66 FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OE 6022	81 10 01	DD-DR&E-AR(6)6

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISS'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	[X] YES [ ] NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AC	014
b. CONTRIBUTING	62770A	3S162772A871	DA	001
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code)

(U) Preventive Dentistry Measures of Military Significance

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012900 Physiology 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
71 01	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In Thousands)
FISCAL YEAR PRECEDING 81	1.0	97
FISCAL YEAR CURRENT 82	0.2	21

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T. P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Division of Pathology
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Allen, G., LTC, DC

TELEPHONE: 202-576-3443

SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS

NAME: Grover, P., CPT, DC

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)

(U) Spoon-Toothbrush (U) Oral Health (U) Dental Disease Prevention

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To develop new and simplified methods of preventing disease related dental emergencies in the field. To assess new methods of (1) improving the biologic management of militarily relevant oral conditions and (2) improving the cost-effectiveness factors of preventive dental therapy in the military.

24. (U) Studies will be conducted on military installations which will evaluate (1) methods of prevention of military relevant abnormalities; (2) methods of improving preventive dentistry delivery systems, and (3) methods of improving cost-benefit ratios concerning delivery of preventive dentistry as a consequence of military duty.

25. (U) (80 10 - 81 10) A study of the effectiveness of panoramic radiography in predicting dental emergencies was completed on 5000 Army recruits. Based on the evaluation of panographs 14.6% of the recruits were classed as "potential dental emergency situations (PDES). Subsequent dental emergencies within a 6-month period showed that 34% of the recruits classed as PDES actually experienced dental emergencies. While the results indicate that a significant reduction in field dental emergencies is possible using the above system, it is apparent that there is room for improvement. A statistically-based computer-assisted method for predicting and thus preventing field dental emergencies is being developed.

*Available to contractors upon originator's approval

DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

PROJECT NUMBER 3S162775A825

PREVENTIVE DENTISTRY MEASURES OF MILITARY SIGNIFICANCE

Predictabi ity of Dental Emergencies by Panography

The oral health status of recruits entering the Army demonstrates a high incidence of dental pathosis. Various epidemiologic studies have shown the loss of combat effectiveness due to dental emergencies to be of great significance. The purpose of this study was to evaluate the effectiveness and reliability of panoramic radiographs in predicting dental emergencies. The ultimate objective was to identify a method for reducing the overall incidence of potential dental emergency situations (PDES). For the purpose of this study, a PDES was defined as a pathological condition observed on the panograph which appeared to jeopardize the health of adjacent tissue. Criteria to identify PDES were based upon: (1) a gross carious lesion encroaching upon pulp; (2) a periapical radiolucent lesion; (3) a nonperiapical radiolucent lesion; and (4) an unerupted third molar. A panoramic radiographic survey of 5000 U.S. Army recruits, aged 17-26 years, was taken to record PDES without a clinical examination. PDES were found in 732 recruits (14.6%). Social Security Numbers (SSN) were recorded. From this group, 248 recruits actually reported for dental sick call over a six-month period (34% prediction rate). SSN were matched with recruits who came on daily dental sick call. This was equivalent to 19% of the total sick call. A significant number of emergency dental visits could be avoided by early panographic interpretation and immediate dental care. A statistically-based and computer-assisted method to predict dental emergencies is being developed.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OF 6040	81 10 01	DD-DR&E-AR 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	K. COMP	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AC	001
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Procede with Security Classification Code)* (U) Application of Laser Technology to Maxillofacial Wound Debridement and Prosthetic Rehabilitation

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
012900 Physiology 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
74 06	81 09	DA	C. IN-HOUSE

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	1.0	26
	CURRENT 82	0	00

19. RESPONSIBLE DOD ORGANIZATION
NAME:* US Army Institute of Dental Research
ADDRESS:* Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T. P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION
NAME:* US Army Institute of Dental Research
Division of Pathology
ADDRESS:* Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME:* POSEY, W. R., COL, DC
TELEPHONE: 202-576-3080
SOCIAL SECURITY ACCOUNT NUMBER* XXXXXXXXXXXXXXXXXX

ASSOCIATE INVESTIGATORS
NAME: Allen, G., LTC, DC
NAME:

POC: DA

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Procede EACH with Security Classification Code) (U) Carbon Dioxide Laser (U) Laser Surgery (U) Debridement of Maxillofacial Wounds (U) Laboratory Animals

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Procede text of each with Security Classification Code.)

23. (U) To determine the feasibility of the application of laser technology to the repair of prostheses, oral surgical procedures and to the debridement and treatment of maxillofacial wounds. The ultimate objective is the development of equipment which improve the management of maxillofacial wounds and prostheses repair in the field.

24. (U) Energy levels, methods of contour and approximation of pontics to establish optimum weld patterns and strengths will be investigated using neodymium laser. This will be accomplished first in a bench set-up and secondly in animals to establish feasibility and safety. The CO_2 laser will be used in periodontal defects in monkeys following periodontal surgery to determine its ability to improve the resolution of periodontal defects. Surgical debridement vs laser debridement of contaminated wounds will be done in animals.

25. (U) (80 10 - 81 10) Final compilation of data accumulated on the use of the CO_2 laser for the debridement of contaminated maxillofacial wounds in animals has not revealed any great advantage over convention surgical techniques. The hemostatic effect and ability to debride in discreet areas were not found to be of sufficient advantage to warrant the design of equipment for field use.

*Available to contractors upon organization's approval

DD FORM 1 MAR 66 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A AND 1498 (1 MAR 66) FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 6033	81 10 01	OD-DR&E 4R-[illegible]

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8A. DISB'N INSTR'N	8B. SPECIFIC DATA: CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES.	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AC	002
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)

(U) Development and Evaluation of Dental Materials and Materiel for Army Use

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

010300 Miscellaneous Materials

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
69 01	CONT	DA	C. IN-HOUSE

17. CONTRACT GRANT

a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	2.0	120
FISCAL YEAR CURRENT 82	1.0	75

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research
ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T.P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research
Division of Dental Materials
ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Vermilyea, S., LTC, DC
TELEPHONE: 202-576-3092
SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS
NAME: Kuffler, M., B.S.
NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Polymethylmethacrylate (U) Carbon Fibers (U) High Copper Amalgam (U) Low-Gold Alloy (U) Base-Metal Alloy

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To evaluate new materials and materiel of special interest to the Army dentist. Criteria for selection of materials, devices or techniques for evaluation are based on anticipated high potentials for: (1) Savings of fiscal and/or manpower resources; (2) work simplification; (3) improved health care delivery in combat areas; and (4) enhanced safety with respect to professional and ancillary personnel as well as to the patient.

24. (U) New materials will be evaluated on the basis of the following parameters: Composition, microstructure, physical and mechanical properties, cytotoxicity, and clinical performance.

25. (U) (80 10 - 81 10) The addition of carbon fibers to polymethylmethacrylate resin was found to improve fatigue resistance to such an extent that the resin can be used as a low-cost alternative to cast-metal denture bases without increasing the risk of midline fractures. It was found that the newer high copper dental amalgam alloys may be more toxic to oral tissues than conventional alloys. Continued *in vivo* study of low-gold casting alloys 30 months post-placement indicate significant problems with galvanic corrosion and discoloration. The suitability of 4 new low-gold alloys for fixed prostodontics is being evaluated *in vitro*. Twenty-five type III gold restorations prepared by improved techniques using a base metal alloy have been placed in humans. At 3 and 6 months post-placement no adverse effects have been noted.

*Available to contractors upon originator's approval

PROJECT NUMBER 3S162775A825

DEVELOPMENT AND EVALUATION OF DENTAL MATERIALS AND MATERIEL FOR ARMY USE

The Effects of Carbon-Fiber Reinforcement on the Fatigue Resistance of Polymethylmethacrylate Resins

Although the material of choice for the fabrication of denture bases, acrylic resins are not totally devoid of undesirable characteristics, susceptibility to fracture from cyclic fatigue appears to be one of the limiting factors in the routine use of these materials. Carbon fibers have enjoyed wide use as reinforcing agents for industrial resins. Carbon fiber reinforcement of denture resins has been shown to increase the impact strength of the specimen. However, data on the fatigue resistance of carbon-fiber reinforced denture resins is not available.

The present study evaluated the tensile and flexural properties of three commercially available denture base resins (Lucitone, Duraflow and Hi-I) when plain and silanized carbon fibers were used as reinforcing agents.

Results indicated that the addition of chopped, plain carbon fibers to the resin increased the number of fatigue cycles to failure by 16 percent, 33 percent and 83 percent for Duraflow, Lucitone and Hi-I respectively. Reinforcement of Duraflow, Lucitone and Hi-I with silanized carbon fibers yielded respective increases in fatigue resistance of 42 percent, 48 percent and 100 percent over the unreinforced materials. The use of plain or silanized carbon fibers did not alter the apparent tensile properties of the resins. From available data, it would appear that the use of silanized carbon fibers as a reinforcing agent may provide a lost-cost alternative to cast-metal based dentures to reduce the incidence of midline fracture. The

effects of carbon fiber orientation and polymer-fiber ratio on the fatigue characteristics of denture resins remain to be studied.

Tissue Response to Dental Amalgam Alloys

Heretofore studies dealing with biologic tissue responses induced by dental amalgam alloys have suggested that upon implementation, a dispersed phase (~12% copper) alloy did not illicit a more severe tissue reaction than did a conventional alloy. On the other hand, others have indicated that dental amalgams are potentially toxic to tissues suggesting compositional differences among commercial products may be biologically significant. Furthermore, studies designed to assess the tissue reaction of wear and corrosion products of dental amalgams have not been accomplished. To date one conventional silver-tin alloy (Micro-Cut) a spherical copper alloy (Tytin) and three spherical high copper alloys (Sybralloy, Optalloy II and Cupralloy) have been subjected to wet milling procedures to produce powders representing wear and corrosion products of the test materials. The powders have been packed into polyethylene tubes and one-quarter inch segments of tubing have been implanted subcutaneously in rats. Tissues have been harvested at three days, one week, two weeks, sixteen days, four weeks and five weeks after implantation. Initial gross examination revealed encapsulation and tissue necrosis surrounding specimens of high copper alloys. The specimens are presently undergoing histologic evaluation.

Clinical Evaluation of "Low Gold" Casting Alloys

This task was initiated to assess the *in vivo* performance capabilities of three economy dental casting alloys. The restorations cast from the test

alloys (Midas, J.F. Jelenko; Neycast, J.M. Ney Co. and Minigold, Williams Gold Refining Co.) continue to exhibit pitting and discoloration of cervical margins at the 30-month post placement evaluation. Furthermore, castings of the test alloys in contact with removable partial denture frameworks exhibit galvanic corrosion over the contact area. These findings are consistent with *in vitro* findings on the electrochemical bevior of the test alloys.

Laboratory Evaluation of Low Gold Alloys

In response to field queries as to the suitability of lower cost alloys for use in fixed prosthodontic procedures, this task was initiated to evaluate the properties of four newly marketed low gold alloys (Ney 76, Salivin, T-III, and Rajah). To date, mechanical properties and heat treatment characteristics have been determined. Typical property ranges for the alloys were: ultimate strength 44,000 psi - 70,000 psi; yield strength 30,000 psi - 53,000 psi; modulus of elasticity $12X10^6$ psi - $15X10^6$ psi; elongation 10% - 20% and hardness 110 - 230 DPN. Subjection of the alloys to serial heat treatments over a 400 - 1,800°F temperature revealed softening temperatures of 1,400°F (Ney 76); 1,600°F (T-III Lite) and 1,000°F (Rajah). Reheat treatments of the test alloys revealed hardening temperatures of 800°F (Ney 76 and Rajah) and 1,000°F (T-III Lite). The hardness of Salivan was not altered by the heat treatment procedure. From the hardness data, it would appear that three of the alloys (Ney 76, T-III Lite and Rajah) could be softened to aid in finishing and adaptation of margins of restorations and rehardened to provide increased wear resistance. Compositional and microstructural features of the alloys remain to be determined.

Clinical Evaluation of Base Metal Crown and Bridge Alloys

Techniques for the casting of a base metal alloy (Unibond) have been developed and implemented. To date twenty-five base metal and 25 type III gold restorations have been placed *in vivo*. Initial and three-month and six-month post insertion evaluations have failed to detect adverse reactions to any of the restorations. Additional restorations designed to achieve porcelain veneers are being fabricated currently. Other base metal alloys will be included upon development of relevant casting technology.

Laboratory Evaluation of Base-Metal Crown and Bridge Alloys

The potential fiscal savings afforded by the use of base metal casting alloys in lieu of the more expensive high fusing gold alloys is overwhelming. The high frequency with which additional base metal alloys appear on the commercial market obviates the need for continuous characterization of newly marketed products. Three such alloys, Unibond, Biobond and Ceramalloy II have been evaluated with respect to composition, mechanical properties, heat treatment characteristics and microstructural features. All three alloys were based on a nickel (67-74%)-chromium (11-20%) binary system. Unibond and Biobond were modified with boron (4%; 0.1%), carbon (0.07%; 0.19%), cobalt (0.07; 0.26%), manganese (0.37%; 0.02%), molybdenum (11.0%; 3.9%), silicon (0.45%; 3.5%) and iron (1.98; 0.10%) respectively. In addition, Biobond was found to contain tin (3.0%) and niobium and tantalum (3.9%). The nickel-chromium binary of Ceramalloy II was modified with boron (0.7%), carbon (0.02%), molybdenum (5.11%), silicon (4.3%), tin (0.01%), and iron (0.04%). Except for hardness and elongation, properties of Unibond and Biobond were similar. Unibond exhibited 300% greater elongation and 15%

less hardness than Biobond in the as cast condition. Subsequent to heat treatment the elongation of Unibond was 400% greater and the hardness 9% greater than that of Biobond. Ceramalloy II was stronger and harder than either Unibond or Biobond. Heat treated Ceramalloy II specimens exhibited elongation similar to that of Unibond (15%). Microstructurally all of the alloys exhibited a discontinuous grain boundary phase.

Assessment of the Effects of Cooling Rate on the Apparent Strength of the Porcelain Metal Bond

Controversy exists as to the causes of the failure of the porcelain-metal bond. The rate of cooling of the porcelain metal composite from the porcelain fusion temperature may generate shear stresses sufficient to adversely affect the apparent porcelain-alloy bond strength. On the other hand, controlled cooling rates may enhance the strength of the porcelain-metal bond. Recommendations for cooling the ceramo-metal restoration range from cooling under a protective cover, cooling in ambient air to cooling rapidly in an ice chest to provide a tempered glass effect. The present study was undertaken to determine the effects of cooling rate on the apparent strength of the porcelain-metal bond. Cooling methods evaluated were (1) in ambient air; (2) under a glass cover; (3) within an oven to 1,200°F then in ambient air; (4) atop an aluminum heat sink; (5) with forced air; and (6) within an ice chest. Data from bond strength tests revealed that specimens that were cooled in an oven or in an ice chest produced the highest bond strength values (6,700 psi and 5,600 psi respectively, followed closely by specimens cooled under the glass cover (5,200 psi). In addition to bond strength, the integrity of the porcelain surface must be considered in the selection of a cooling technique. Too

rapid cooling may increase the incidence of surface checking and subsequent bulk fracture of the porcelain. From the available data, it would appear that cooling of ceramo-metal restoration under a protective cover would provide the greatest apparent bond strength and the least risk to the contiguity of the porcelain surface.

Publications:

1. Huget, E.F., Vermilyea, S.G., Modawar, F.A., and de Simon, L.B.: Electrochemical Behavior of Gold Alloys. Milit Med, 145(10):701-703, Oct 1980.

2. Vermilyea, S.G., Kuffler, M.J., and Tamura, J.J.: Observations on Nickel-Free-Beryllium-Free Crown and Bridge Alloys. J Dent Res, 60(A): 519, March 1981.

3. Lorton, L., and Brady, J.: Criteria for Successful Composite Restorations. Gen Dent, 29(3):234-236, June 1981.

4. Lorton, L., and Whitbeck, P.: Esthetic Parameters of Mandibular Anterior Teeth. J Prosthet Dent, 46(3):280-284, Sep 1981.

5. Huget, E.F., Vermilyea, S.G., and Vilca, J.M.: "Low Gold" Crown and Bridge Alloys. J Prosthet Dent (in press).

6. Vermilyea, S.G., Kuffler, M.J., and Huget, E.F.: The Effects of Die Relief Agent on the Retention of Full Coverage Castings. Submitted to J Prosthet Dent, Feb 1981.

7. Lorton, L., and Whitbeck, P.: Diagnosis of the Aesthetic Components of the Mandibular Anterior Prosthesis. Submitted to J Oral Rehab, Aug 1981.

8. Vermilyea, S.G., Tamura, J.J., and Mills, D.E.: Observations on Nickel-Free-Beryllium-Fixed Prosthodontic Alloys. Submitted to J Am Dent Assoc, Aug 1981.

9. Huget, E.F., Vermilyea, S.G., Fehrman, S.G., and Modawar, F.A.: Laboratory Observations on the Behavior of Composite Dental Restoratives. Milit Med (in press).

10. Huget, E.F., Vermilyea, S.G., Modawar, F.A., and Tamura, J.J.: Electrochemical Profiles of Crown-and-Bridge Alloys. Milit Med (in press).

11. Skirvin, D.R., Vermilyea, S.G., and Brady, R.E.: Polymethylmethacrylate Reinforcement: Affect on Fatigue Failure. J Prosthet Dent (in press).

12. Vermilyea, S.G., Kuffler, M.J., and Tamura, J.J.: Observations on Nickel-Free-Beryllium-Free Crown and Bridge Alloys. J Am Dent Assoc (in press).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 6034	81 10 01	DD DR&E AR(Q)0

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISB'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	[X] YES [ ] NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AC	003
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code)

(U) Development and Improvement of Metallic Restorative Materials

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

009900 Metallurgy and Metallography

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
69 01	CONT	DA	C. IN-HOUSE

17. CONTRACT GRANT

a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR — PRECEDING 81	1.0	30
FISCAL YEAR — CURRENT 82	1.0	54

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T.P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research
Division of Dental Materials

ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Vermilyea, S., LTC, DC
TELEPHONE: 202-576-3092
SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS
NAME: Kuffler, M., B.S.
NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)

(U) Base Metal Alloy (U) Porcelain Bonding Agents
(U) Investment Materials

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Annual Army expenditures for precious metals utilized in the fabrication of fixed dental prostheses are in the vicinity of $1,000,000. The cost of an equal volume of base metal alloy is $30,000. Properties of base metal alloys indicates however that these alloys cannot be utilized for small castings without drastic metallurgical modifications. This work is therefore being conducted to: (a) Develop heat treatment methods for controlling properties of nickel-chromium based casting alloys; (b) evaluate nickel-chromium based alloys for use in operative dentistry.

24. (U) The properties of nickel-chromium based alloys will be studied in detail by various physical methods available in order to devise procedures which will optimize their usefulness. Any improvement obtained will be evaluated clinically.

25. (U) (80 10 - 81 10) The techniques of applying commercially available investment materials for use with base-metal alloys were revised on the basis of data developed from the preparation and subsequent fit-analysis of numerous base-metal castings. The modifications include adjustment of water-powder ratios, use of alternative reagents and use of a compensatory expansion technique. Improvements obtained with the revised techniques are encouraging. Techniques are also in development for enhancing the bonding of porcelain to base-metal alloy.

*Available to contractors upon originator's approval

PROJECT NUMBER 3S162775A825

DEVELOPMENT AND IMPROVEMENT OF METALLIC RESTORATIVE MATERIALS

Techniques for the Enhancement of Porcelain Bonding to Base Metal Alloys

The bonding of ceramic materials to base metal substrates has been difficult to achieve with any degree of consistency. Several alloy manufacturers market proprietary "bonding agents" intended for use on the alloy surface prior to porcelain application. Other alloys of similar composition apparently do not require the use of these so called "bonding agents" but recommend specific porcelains for fabrication of ceramic veneers. This task is designed to assess the efficacy of these bonding agents and porcelains on the strength of the apparent porcelain-metal bond. Six proprietary alloys (Rexillium III, Biocast, Biobond, Unibond, Neobond II, and Ceramalloy II) will be used in the study. A gold palladium silver alloy (Cameo) will be used as a control. Specimens will be 1/4 X 1/16-inch cast discs finished on 240 grit metallographic papers. Coating agents will be applied in accordance with the respective manufacturer's instructions. Following pretreatment of the cast discs with the proprietary agents, paper tubes will be affixed perpendicular to the surface of the disc. Slurries of opaque dental porcelain will be vibrated into the tubes and the excess water removed with tissue paper by capillary action. Then the specimens will be placed in an oven and subjected to the firing cycle recommended by the porcelain manufacturer. Subsequent to the firing cycle the resultant porcelain cylinders will be imbedded in acrylic resin and subjected to a parallel shear test to determine apparent porcelain-alloy bond strength. Each alloy will receive each porcelain and coating agent. Data will be analyzed by a 2-way analysis of variance and means compared using

Scheffe's method. To date the porcelains and coating agents have been received and specimens of Cameo alloy have been fabricated.

Development of Techniques to Improve the Casting Accuracy of Base-Metal Crown and Bridge Alloys

The influence of commercially available investment materials marketed for use with base metal casting alloys on the fit of base metal restorations has been assessed. Investments included Ceramigold 2, Hi-Temp, and Neoloy Crown and Bridge investment. Investing of wax patterns was accomplished in accordance with the investment manufacturer's instructions. A like number of castings were made from Biobond, Ceramalloy II, Unibond, Biocast and Neobond II alloys in each investment. Castings were examined for degree of fit with the aid of a stereoscopic microscope and judged as adequate (x); oversize (+); or undersize (-). As a group, the test castings failed to fit their respective dies. The distribution of scores for the total sample was: (x) 8%, (+) 23%, and (-) 6%. Base metal castings from Neoloy investment were consistently undersize. With Ceramigold 2 castings of Biobond and Ceramalloy II were oversize. Rounded, ill-defined margins were a characteristic feature of the base-metal castings.

This data was used as a basis for the modification of recommended investing techniques. Neoloy investment was deemed unsuitable and was dropped from the study and an additional investment, H-Temp-2 was added. Modification to investing techniques have included adjustment of water-powder ratios, use of special liquids with Ceramigold 2 and Hi-Temp-2 investments and use of a hygroscopic compensatory expansion technique. Results to date have been encouraging. The majority of castings made from the aforementioned alloys exhibited adequate fit and good marginal integrity. However, the investing

technique requires adjustment to accommodate all metal restorations and those intended for use in the porcelain fused to metal technique. Such adjustments to the investing procedure are now in progress.

Publications:

1. Kuffler, M.J., Vermilyea, S.G., and Tamura, J.J.: Casting Accuracy of Base Metal Alloys. J Dent Res, 60(A), 349, March 1981.

2. Huget, E.F., Vermilyea, S.G., and Kuffler, M.J.: Accuracy of Small Base Metal Dental Castings. Milit Med (in press).

3. Guinn, J.W., III, Griswold, W.H., and Vermilyea, S.G.: The Effect of Cooling Rate on the Apparent Bond Strength of Porcelain-Metal Couples. Submitted to J Prosthet Dent, Mar 1981.

4. Kuffler, M.J., and Vermilyea, S.G.: Apparent Accuracy of Base Metal Casting. J Prosthet Dent (in press).

5. Guinn, J.W., Griswold, W.H., and Vermilyea, S.G.: The Effect of Cooling Rate on the Apparent Bond Strength of Porcelain-Metal Couples. J Prosthet Dent (in press).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 6679	81 10 01	DD-DR&E/AR.636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISS'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	XX YES ☐ NO	A. WORK UNIT

10. NO. / CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AB	010
b. ~~CONTRIBUTING~~ /	62772A	3S162772A874	AH	001
c. ~~CONTRIBUTING~~		STOG 80 - 7.2:5		

11. TITLE (Procede with Security Classification Code)

(U) The Initial Treatment of Combat Wounds

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012600 Pharmacology 012900 Physiology 002300 Biochemistry

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
81 01	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	0.5	45
FISCAL YEAR CURRENT 82	1.0	77

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research
Division of Pathology

ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Wynkoop, J., CPT, DC

TELEPHONE: 301-677-4732

SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS

NAME: Miller, R.A., B.S.

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Procede EACH with Security Classification Code) (U) Wound Dressing (U) Anesthesia (U) Antisepsis (U) Hemostasis (U) Laboratory Animal

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Procede text of each with Security Classification Code.)

23. (U) To develop a multipurpose wound dressing which will provide anesthesia, antisepsis and hemostasis so that, where appropriate, the result will be rapid return of the wounded soldier to duty as well as reduction of the morbidity occasioned by delayed definitive treatment and secondary complications.

24. (U) Contract developed drug release systems will be evaluated in animal models developed specifically for that purpose. Various methods and materials for maintaining contact over a variety of maxillofacial contours will be evaluated for their utility of application and use in the combat situation.

25. (U) (80 10 - 81 10) An animal model has been developed in the New Zealand White Rabbit for the evaluation of topically applied anesthetic preparations on avulsive wounds. The system utilizes a spring loaded bayonet design which provides a tactile stimulus at specific distances from a standardized wound. Responses are evaluated by electromyography and are correlated with anesthetic blood levels at timed intervals from time of anesthetic administration. Data accumulated to date indicate the system provides valid interpretation of levels of anesthesia. The method is being applied to the evaluation of wound coverings which will provide extended-release anesthetics and antiseptics as well as hemostasis.

*Available ... upon originator's approval

DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE ... FORMS 1498A ... NOV 68 AND 1498-1 ... MAR 68 FOR ARMY USE ARE OBSOLETE

PROJECT NUMBER 3S162775A825

THE INITIAL TREATMENT OF COMBAT WOUNDS

Development of an Animal Model for the Evaluation of Topically Applied Local Anesthetic Preparations on Avulsive Wounds

An animal model system using the New Zealand white rabbit as the test subject is currently being evaluated at USAIDR. The system uses a spring-loaded bayonet which provides a tactile stimulus at specific distances from a standard wound site. In addition to stimulation, blood is drawn from the marginal ear vein of the animal at specific times following local anesthetic injection (10 minutes, 30 minutes, 1, 2, 4, and 6 hours) in order to determine circulating anesthetic levels as well as the levels of circulating metabolites of the anesthetic. The preliminary data, accumulated from electromyographic readings, indicate that the stimulator elicits a valid muscle twitch response. In addition, several lidocaine analyses have been evaluated using both liquid and gas chromatography. The methodology for this analysis has been standardized and supplies have been purchased.

The long-term goal of this project is to provide a workable model system for the evaluation of slow-release anesthetics in rabbits. Since good baseline data are not available in the literature, the project will provide the necessary information needed for comparison of the conventional local anesthetics to any slow-release form which might be developed in the future. The benefit of having a readily available, slow-release anesthetic in a battlefield situation would be the better utilization of available personnel - thereby freeing the medical corpsman or aidman for more critical patients, or by allowing self-administration in an isolated situation.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OG 8670	81 10 01	DD-DR&E(AR 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. NEW	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AC	011
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Procede with Security Classification Code)* (U) Development and Evaluation of Dental Materiel for Field Use.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

002400 Bioengineering 010300 Miscellaneous Materials

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
81 10	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	0	0
FISCAL YEAR CURRENT 82	0.5	165

19. RESPONSIBLE DOD ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME:* US Army Institute of Dental Research
Division of Clinical Operations

ADDRESS:* Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME:* Lorton, L., LTC, DC

TELEPHONE: 301-677-6053

SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Dental Materiel (U) Field Materiel (U) Field Dental X-ray (U) Field Dental Cutting Instrument

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To assist in the development of dental equipment capable of reliable performance and easy maintenance under all field operational conditions. Included are the development of concepts for field dental equipment which is miniaturized, lightweight, energy efficient and low cost.

24. (U) Conceptual and basic engineering requirements for a field dental x-ray system and a field dental cutting instrument will be studied. Current technology will be reviewed for its ability to produce the needed design criteria and advanced technology requirements will be identified. Experimental devices will be constructed.

25. (U) None.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 8672	81 10 01	DD-DR&E-AR 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. NEW	U	U		NL	X YES ☐ NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AD	013
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code)

(U) Epidemiological Investigation of Dental Emergencies

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
81 10	CONT	DA	C. IN-HOUSE

17. CONTRACT GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	0	0
	CURRENT 82	1.0	40

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T. P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Division of Clinical Operations
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Grover, P., CPT, DC

TELEPHONE: 301-677-6053

SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS

NAME: Lorton, L., LTC, DC

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Dental Emergencies (U) Dental Profiles (U) Dental Diagnosis

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To determine the causes of dental emergencies in a population of soldiers receiving regular dental care and to determine "at-risk'profiles" for those soldiers in critical occupation specialties so as to minimize problems with dental casualties during deployment.

24. (U) Studies will be conducted among soldier populations to pinpoint the causes of dental emergencies, their frequency and diagnostic strategies which will permit the prediction of the potential of each soldier for such emergencies. The goal is to select out the "at-risk" group for dental treatment and thus minimize dental casualties during deployment.

25. (U) None.

*Available to contractors upon originator's approval

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 8674	81 10 01	DD-DR&E AR 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. NEW	U	U			☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AB	012
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Procede with Security Classification Code): (U) Development and Evaluation of Methods and Materials for Testing Traumatic Injury.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 010300 Miscellaneous Materials 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
69 01	CONT	DA	C. IN-HOUSE

17. CONTRACT GRANT
a. DATES/EFFECTIVE: EXPIRATION
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
PRECEDING FISCAL YEAR 81	0	0
CURRENT FISCAL YEAR 82	1.0	61

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Institute of Dental Research
ADDRESS: Washington, DC 20012
RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T.P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION
NAME: US Army Institute of Dental Research
ADDRESS: Division of Oral Biology
Washington, DC 20012
PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Tortorelli, A., COL, DC
TELEPHONE: 202-576-3764
SOCIAL SECURITY ACCOUNT NUMBER: POC:DA
ASSOCIATE INVESTIGATORS
NAME: Vermilyea, S., LTC, DC
NAME:

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Procede EACH with Security Classification Code): (U) Polymer Devices (U) Ceramic Devices (U) Biodegradable Polymers (U) Biodegradable Ceramic

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Procede text of each with Security Classification Code.)

23. (U) To develop the technology and methodology for applying synthetic materials to the effective management of maxillofacial injuries in the field.

24. (U) Biodegradable and partly biodegradable polymeric and ceramic devices will be designed and constructed. Designs will be directed at providing the potential for simplifying the management of maxillofacial wounds from the point of initial injury thru early definitive treatment. (Work in this area was reported under DA OD 6021 in FY 81.)

25. (U) None.

*Available for contractors upon originator's approval

DD FORM 1498 (PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498-1 MAR 68 FOR ARMY USE ARE OBSOLETE)

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OH 6030	81 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AD	004
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code)

(U) Natural History of Oral Lesions Encountered in the Soldier

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
69 07	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	0.5	25
FISCAL YEAR CURRENT 82	0.5	27

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research
Division of Pathology

ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Carpenter, W.M., COL, DC

TELEPHONE: 202-576-3080

SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS

NAME: Allen, G., LTC, DC

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)

(U) Actinic Blocking Agents (U) Lip Pathology (U) Climatic Extremes (U) Laboratory Animal

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To recognize, characterize and develop effective therapeutic measures for those lesions and conditions which affect the soldier due to military duty. The recognition of environmental and other factors which participate in the etiology of lesions and conditions unique to the military or are casually related to military duty will enable the development of interceptive or therapeutic measures.

24. (U) To detect through clinical and/or microscopic observation oral lesions or a condition unique to the military population. To identify oral lesions or conditions which, though not unique to the soldier, are etiologically related to the performance of duty. Once identified the natural history including etiology, therapy, and prognosis will be established utilizing appropriate methods such as surveys, animal, and human investigations.

25. (U) (80 10 - 81 10) As part of research to prevent lip pathology in climatic extremes, an evaluation of "fresh" Army stocked hot and cold weather actinic blocking agents was done in experimental animals. The agents were found to be effective in 30% and 75% of the cases respectively. By comparison two commercially available agents (UVAL® and Pre-Sun®) were found effective in 100% of the cases. A planned epidemiological survey of lip pathology in a cold weather exercise was cancelled and has been rescheduled for Ft Drum in January 1982.

*Available in... instructions upon originator's approval

DD FORM 1 MAR 76 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE ... FORMS 1498A ... NOV 68 AND 1498 1 ... 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OH 6037	81 10 01	DD-DR&E-AR 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISS'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AA	007
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code)

(U) New and Improved Techniques for Grafts and Bone Regeneration in Traumatic Wounds

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012900 Physiology 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
69 01	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	2.0	55
	CURRENT 82	1.5	111

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Division of Pathology
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Tortorelli, A., COL, DC

TELEPHONE 202-576-3764

SOCIAL SECURITY ACCOUNT NUMBER POC:DA

ASSOCIATE INVESTIGATORS

NAME: Hollinger, J., LTC, DC

NAME: Woodyard, S., COL, DC

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Biodegradable Ceramic (U) Biodegradable Polymeric Splint (U) Granular Ceramic Implant (U) Tricalcium Phosphate Ceramic (U) Laboratory Animal

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Current methodologies for managing combat maxillofacial wounds and preventing/treating dental emergencies in the field will be extremely difficult to apply under the conditions anticipated in future war. New methods are required which will permit more rapid definitive care, reduce morbidity and decrease logistic load. Thus the objective of this work unit is to develop simple, rapid methods for soft tissue or bone grafting utilizable by the dental specialist in the field.

24. (U) The fate, metabolism, osteogenic potential and tissue compatibility of ceramic and copolymer materials will be studied alone and in combination. The application of these and other materials to avulsive type wounds in both animals and humans will be pursued.

25. (U) (80 10 - 81 10) Five additional partly-biodegradable polymeric devices were evaluated during FY 81: Three of which were implanted in dogs. This device was used successfully in dogs during FY 80 for splinting mandibular discontinuity defects while holding osteogenic agents within the discontinuity. The three additional devices implanted were retrieved at sacrifice at 3, 8 and 12 weeks post-surgery and subjected to stress tests which indicated that sufficient strength was maintained to support the mandibular stump. Two of the devices were not implanted but stress-tested only to evaluate the effect of the sterilization procedure (2 megarad irradiation). Device strength was reduced 50% by the irradiation procedure. Long-term evaluation (12-24 months) of biodegradable tricalcium phosphate ceramic implants for bridging mandibular defects is in progress. A third generation ceramic is being designed. Follow-up of patients receiving granular biodegradable ceramic in periodontal pockets continue to demonstrate improvements in pocket depth and bone regeneration.

* Available to contractors upon originator's approval

DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. AMC FORMS 1498A NOV 75 AND 1498-1 1 MAR 68 FOR ARMY USE ARE OBSOLETE

PROJECT NUMBER 3S162775A825

NEW AND IMPROVED TECHNIQUES FOR GRAFTS AND BONE

REGENERATION IN TRAUMATIC WOUNDS

Evaluation of a Partly Biodegradable Device for
Mandibular Bone Grafting

Partly biodegradable devices for holding bone stimulating materials within a mandibular bone defect were implanted in three dogs during the past year. Two additional devices were not implanted in animals but were used only for stress testing before and after sterilization with 2 megarads irradiation. A 2 cm segment of the right mandible of each dog was removed. A tray-like device constructed of polylactic acid (PLA) reinforced with a nondegradable ceramic fabric was used to bridge the defect in each animal. The laminate structure of the trays was designed to provide added structural strength during healing and minimal bulk following degradation of the PLA. The trays were also expected to display little or no warpage *in vivo*. Autogenous bone chips and bone marrow obtained from the illiac crest were placed in each tray and the wound closed in layers. The animals were given prophylactic doses of procaine penicillin G and maintained on a fortified liquid diet.

The dogs were sacrificed at 3,8, and 12 weeks post-surgery. The right mandibles were retrieved, and the trays were examined for structural strength, integrity and biodegradation. The unused trays were subjected to the same structural examinations. the implanted trays had not significantly biodegraded even at the 12 weeks post-operative mark. Structural stress tests indicated sufficient strength at all three time frames to support the mandibular stump even though stress tests before and after sterilization revealed an almost 50% reduction in strength following irradiation at 2 megarads. Histopathologic examination of the repair tissues indicated good healing relative to the time

frame involved. No warpage was seen in the trays. Efforts are continuing to develop completely biodegradable trays and as more trays become available, studies will be continued in both dogs and monkeys. Sterilization parameters using irradiation will also be further investigated to determine optimal conditions.

Evaluation of a Biodegradable Unidirectional Porosity Ceramic Block for Bridging Bony Defects

A total of 7 mongrel dogs have been operated on in this study. A 2 cm portion of the mandible was resected along with its periosteum. Sized blocks of biodegradable tricalcium phosphate were wired between the bony stumps and a metal bone plate was used to stabilize the mandible. The ceramic blocks were constructed to contain unidirectional cylindrical porosities (averaging 250 microns in diameter) the full length of each block. The ceramic blocks were placed in the bone wound with the long axis of the porosities aligned to face each bony stumps so that bone growth into the ceramic blocks could be facilitated. The ceramic blocks also contained random voids with a maximum diameter of 350 microns. Five of the animals were sacrificed at 2, 6, 8, 12, and 24 weeks. Histologic evaluation indicated a progressive bony ingrowth into the ceramic porosities. At the 24 week post-operative time the bony ingrowth extended the full length of the ceramic block. Only slight biodegradation of the ceramic block was observed at 24 weeks. The two remaining dogs are being maintained for long-term evaluation at 12 and 14 months post-operative. The results obtained thus far seem promising. A new ceramic design with bidirectional porosities is being constructed. Success of the biodegradable ceramic for the segmental replacement of bone hinges on the

segmental replacement of bone hinges on the ability to produce a ceramic design that will facilitate rapid bone ingrowth and an ordered degradation rate so that the new bone will achieve structural strength prior to the loss of strength in the ceramic device.

Biodegradable Ceramic in Human Periodontal Defects

This study will be completed in FY 82. Biodegradable tricalcium phosphate powder was implanted in periodontal defects in 51 patients. The objective was to determine the ability of tricalcium phosphate powder to increase attachment levels in periodontal defects and thus eliminate the progression of periodontal disease in serious defects. To date surgical reentry examinations have not been possible in a number of patients due to their unavailability for a variety of reasons. An additional number of patients cannot be considered in the final results due to necessary changes in study design dictated by experience with some of the initial patients treated in this study. To date only 12 patients remain for whom adequate data will be available for drawing final conclusions. Thus far the data obtained indicate significant improvements in pocket depth, periodontal attachment levels and bone regeneration.

Publications:

1. Tortorelli, A.F., and Posey, W.R.: Bone Ingrowth and Replacement of Ceramic in Mandibular Continuity Defects. J Dent Res, 60(A):601, No. 1168, Mar 1981.

2. Grower, M.F.: Utilization of Polylactic and Polyglycolic Acid in the Fabrication of Biodegradable Wound Coverings and Hollow Organ Implants. J Dent Res, 60(A):303 (#S40), March 1981.

3. Posey, W.R., Russell, E.A.,Jr, Cutright, D.E., and Nelson, J.F.: Wound Morphology Induced by High Velocity Projectiles. J Dent Res, 60(A): 302 (#S36), March 1981.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OH 6038	81 10 01	DD-DR&E AR(6)6

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	H. TERM	U	U		NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AB	006
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code)

(U) Development of Endodontic Procedures for Military Dentistry

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
68 07	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 81	0.5	27
	CURRENT 82	0	0

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Institute of Dental Research

ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME: US Army Institute of Dental Research
Division of Oral Biology

ADDRESS: Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Peters, D., COL, DC

TELEPHONE: 301-677-6053

SOCIAL SECURITY ACCOUNT NUMBER: POC:DA

ASSOCIATE INVESTIGATORS

NAME: Baumgartner, S.C., LTC, DC

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Carbon Dioxide Pulp Testing (U) Carbon Dioxide Pencil (U) Apexification Pastes (U) Calcium Hydroxide Paste

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Army endodontic procedures in the military total 108,000 per year and are 25% of dental emergency procedures. Tooth reimplantation with endodontic therapy is involved in most serious facial injuries and involved typically 3 to 5 patient visits. The military can gain at least 50% reduction in patient and specialist man-hours spent in endodontic therapy with the development of more rapid and reliable treatment materials and techniques.

24. (U) Two areas to be investigated under this project are: (1) Analysis of endodontic materials including those in use and newly developed; (2) techniques used in endodontic therapy with emphasis on the development of the most rapid and accurate method within the military type practice.

25. (U) (80 10 - 81 10) Evaluation of possible damage to hard tissue and pulp resulting from pulp testing with a CO_2-pencil was done in experimental animals (dogs). No histologic or electron microscopy evidence could be found of damage to any tissues even with greater than normal tooth-CO_2 pencil contact. The antibacterial properties of 4 calcium hydroxide apexification preparations were evaluated *in vitro*. Two of the preparations had a temporary inhibiting effect on test organisms. This work unit is being terminated due to loss of research personnel and a low priority.

*Available in restricted form upon originator's approval

PROJECT NUMBER 3S162775A825

DEVELOPMENT OF ENDODONTIC PROCEDURES FOR MILITARY DENTISTRY

The *In Vivo* Effect of Dry Ice Pulp Testing on Canine Enamel and Pulpal Tissue

The carbon dioxide pencil was used on the teeth of two dogs to evaluate the possibility of hard tissue or pulpal damage. The tests were made for periods of 5, 15, and 60 seconds. Following testing the dogs were injected with Procion Brilliant red dye. Prior to and following testing silicone rubber impressions of the dogs dentition were taken. The dogs were sacrificed at intervals of 2 days and 60 days post-testing. No change in the enamel surface could be shown by use of the scanning electron microscope evaluation of pre- and post-testing replicas of the enamel surface. No histological evidence of pulpal inflammation or changes could be shown using hematoxylin and eosin staining. Finally no evidence of increased hard tissue formation within the pulp was demonstrated by use of the Procion red dye and histological evaluation with the ultraviolet light.

The Antibacterial Effects of Calcium Hydroxide Apexification Pastes

Four calcium hydroxide based apexification pastes were tested for their antibacterial effect on *Streptococcus sanguis*. Since the high pH of calcium hydroxide would make it antibacterial by itself the question arises as to the necessity of adding an antimicrobial agent to the calcium hydroxide paste. The purpose of this study was to investigate the *in vitro* antibacterial effect of four pastes, calcium hydroxide alone with distilled water added or calcium hydroxide with either camphorated parachlorophenol, metacresylacetate or methyl cellulose.

Calcium hydroxide with water or methyl cellulose added did not show any growth inhibition of the test organism. On the other hand the pastes containing either the camphorated parachlorophenol or the methylcresylacetate showed definite zones of inhibition in the test system used. It was concluded that the inhibitory agents are capable of diffusing from the setting pastes and thus provide a zone of antimicrobial activity around the zone of placement *in vivo* and thus be more effective than calcium hydroxide alone.

Publications:

1. Drobotij, E., Grower, M.F., Bernier, W.E., Peters, D.D., and Lorton, L.: Comparison of the Flushing Effectiveness of Four Different Types of Needles after Canal Preparation. J Endod, 6(12):870-875, Dec 1980.

2. Augsburger, R.A., and Peters, D.D.: *In Vitro* Effects of Ice, Skin Refrigerant, CO_2 Snow on Intrapulpal Temperature. J Endod, 7(3):110-116, March 1981.

3. Peters, D.D., and Augsburger, R.A.: *In Vitro* Cold Transference of Bases and Restorations. J Am Dent Assoc, 102:642-646, May 1981.

4. Peters, D.D., and Augsburger, R.A.: *In Vitro* Model System to Evaluate Intrapulpal Temperature Changes. J Endod, 8(3):320-324, July 1981.

5. Freccia, W.F., Peters, D.D., Lorton, L., and Bernier, W.E.: An *In Vitro* Comparison of Non-Vital Bleaching Techniques in the Discolored Tooth. Submitted to J Endodont, Mar 1981.

6. Cecic, P., Grower, M.F., and Peters, D.D.: Comparison of the Effects of Various Irrigating Solutions on Dentine Permeability. Submitted to J Endodont, Oct 1980.

7. Freccia, W.F., and Peters, D.D.: A Technique for Staining Extracted Teeth: A Research and Teaching Aid for Bleaching. Submitted to J Endodont, Nov 1980.

8. Benner, M.D., Peters, D.D., Grower, M.F., and Bernier, W.E.: Evaluation of a New Thermoplastic Gutta Percha Obturation Technique Using ^{45}Ca. Submitted to J Endodont, Nov 1980.

9. Bernier, W.E., Lorton, L., and Peters, D.D.: The Effect of Immediate Versus Delayed Dowel Space Preparation on Endodontically Filled Teeth. Submitted to J Endodont, Jan 1981.

10. Freccia, W.F.: Misconceptions Concerning the Clinical Use of Hypnosis in Dentistry. Submitted to J Amer Dent Assoc, Feb 1981.

11. Tsaknis, P.J., and Little, J.A.: Light and Electron Microscopic Analysis of the Pulpal Effects of Vital Bleaching. J Dent Res, 60(A):353 (#171), Mar 1981.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OK 6020	81 10 01	DD-DR&E-AR-636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISB'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	[X] YES [ ] NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62775A	3S162775A825	AA	008
b. CONTRIBUTING				
c. CONTRIBUTING		STOG 80-7.2:5		

11. TITLE (Precede with Security Classification Code): (U) Biodegradable Materials for the Treatment of Fractures and Soft Tissue Wounds in the Military Situation

12. SCIENTIFIC AND TECHNOLOGICAL AREAS:
01290 Physiology 010300 Miscellaneous Materials

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
68 01	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	2.0	68
FISCAL YEAR CURRENT 82	0.5	59

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Institute of Dental Research
ADDRESS: Washington, DC 20012
RESPONSIBLE INDIVIDUAL
NAME: Sweeney, T.P., COL, DC
TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION
NAME: US Army Institute of Dental Research
Division of Pathology
ADDRESS: Washington, DC 20012
PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Tortorelli, A., COL, DC
TELEPHONE 202-576-3764
SOCIAL SECURITY ACCOUNT NUMBER: POC:DA
ASSOCIATE INVESTIGATORS
NAME: Hollinger, J., LTC, DC
NAME: Grower, M., LTC, DC

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)
(U) Esophageal grafts (U) Tracheal grafts (U) Biodegradable grafts (U) Laboratory Animal

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To develop rapid and improved methods of treating combat injuries of the head and neck in the field using biodegradable materials. To develop premedicated biodegradable tissue fixation devices.

24. (U) Biodegradable polylactic acid, polyglycolic acid and various combinations of these polymers as well as other polymers being developed will be applied in the development of surgical procedures for a variety of hard tissue, soft tissue and hollow organ injuries in animals and extended to man where appropriate.

25. (U) (80 10 - 81 10) Two experimental animals (dogs) with biodegradable segmental esophageal grafts continue to function 29 and 36 months post-surgery. Cineflouroscopy to determine contractile activity of the healed grafts is planned. Although several modifications of a device for the segmental replacement of the trachea in dogs have been implanted in a number of animals, none have thus far been successful. None of the animals have survived beyond 6 weeks post-surgery. Efforts have continued under another work unit (DA OD 6021) to design an effective device.

*Available in... interfaces upon originator's approval

PROJECT NUMBER 3S162775A825

BIODEGRADABLE MATERIALS FOR THE TREATMENT OF FRACTURES AND SOFT TISSUE WOUNDS IN THE MILITARY SITUATION

Replacement of an Excised Tracheal Segment in Dogs Using Combination Biodegradable and Biocompatible Prostheses

Various materials have been used in attempts to construct a satisfactory prosthetic replacement for segments of the trachea. This study was undertaken to determine whether a fibrillar network of polylactic acid (PLA) and polyglycolic acid (PGA) polymers, completely enclosing a framework of biocompatible material, would allow for ingress of and replacement of host tissue with subsequent biological repair of the dog trachea. Many problems were encountered with the materials employed, and all prostheses ultimately failed in the short term.

In order to achieve longer stability in our prostheses, as well as effect a more rapid degradation, alternate layers of PLA and combinations of various percentages of PLA and PGA mixtures were used. Solutions were prepared ranging from 6 to 10% in methylene chloride, then sprayed with water-pumped nitrogen gas through an atomizer to precipitate small fibrils on a rotating teflon mandril at a distance between 12 and 16 inches. Once an inner core of the fibrous polymer was applied, the framework was slipped over this inner core and the spraying continued until the framework was completely encased in polymer and the desired thickness was attained.

Three types of material were used as frameworks: alumina ceramic rings, teflon cribs cut from tubing, and spring steel coils coated with polyvinylchloride. The prostheses averaged 5 cm in length with an average inside diameter of 1.8 cm and wall thickness of 0.4 cm. The prostheses were sterilized by megadose gamma radiation which, as was demonstrated by this and other studies, had

deleterious effects on the properties of all polymer components. Eight large mongrel dogs were operated: three using prostheses with ceramic rings, three with teflon cribs, and two with steel coils. A 3 cm segment of lower cervical trachea was excised in each case and an end-to-end anastomosis was accomplished anteriorly and posteriorly using interrupted sutures of polyglycolic acid. All animals were placed on a regimen of penicillin and gentamycin postoperatively.

The animals survived an average of 4.3 weeks, with the longest survival of 5.6 weeks. In all, advancing cyanosis and respiratory difficulties necessitated sacrifice. The prostheses using the ceramic ring framework failed for two reasons. As the polymer between the rings began to degrade, it constricted and pulled the rings together causing them to rotate and partially block the lumen. In one animal, two of the rings fractured and perforated into the lumen. With the teflon crib framework, the properties of the teflon were so changed by the gamma radiation that all three crumbled within 4 weeks, necessitating sacrifice of the animals. An attempt was made to sterilize additional teflon-supported prostheses using ethylene oxide. However, the small amount of heat generated in this process caused separation of the polymer from the teflon framework which could not be repaired and they were not implanted. The prosthesis with the spring steel framework proved to be the most stable, but with both dogs sacrifice was necessary because of fragmentation of the inner core of polymer and blockage of the tracheal lumen.

All implanted prostheses showed accumulation of debris to various extents within the lumen, with progressive narrowing. The collections were greatest in the area of the posterior or more caudal anastomosis, demonstrating that the lack of ciliated epithelium disrupts normal clearance of

mucus and debris. Histological examination did show good ingrowth of host cells and biodegradation of the polymer on the tissue surfaces of the prostheses by the end of the second week *in vivo*.

In conclusion, to date in these studies, no satisfactory framework-polymer combination has been successfully maintained as a substitute for a tracheal segment long enough to be replaced by host tissue in a biologic system.

Publications:

1. Grower, M.F., Tortorelli, D.E., Cutright, D.E., and Grover, P.: Reconstruction of the Dog Trachea Using Biodegradable and Biocompatible Grafts. J Dent Res, 60(A):601 (#1169), Mar 1981.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA 0G 0717	81 10 01	DD-DR&E-AR(6)6

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
80 10 01	D. CHANGE	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62734A	3M162734A875	AO	001
b. CONTRIBUTING	62772A	3S162772A875		
c. CONTRIBUTING		STOG 80-7.2:1		

11. TITLE (Precede with Security Classification Code)*

(U) Study of Saliva as a Diagnostic Tool for Presence of Lethal Agents

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

002300 Biochemistry

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
79 10	CONT	DA	C. IN-HOUSE

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 81	2.0	136
FISCAL YEAR CURRENT 82	2.0	103

19. RESPONSIBLE DOD ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Washington, DC 20012

RESPONSIBLE INDIVIDUAL

NAME: Sweeney, T.P., COL, DC

TELEPHONE: 202-576-3484

20. PERFORMING ORGANIZATION

NAME:* US Army Institute of Dental Research

ADDRESS:* Division of Oral Biology
Washington, DC 20012

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME:* Wynkoop, J., CPT, DC

TELEPHONE 301-677-4732 POC:DA

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: Miller, R.A., B.S.

NAME: Setterstrom, J., Ph. D.

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)

(U) Salivary Amylase (U) Nerve Agent (U) Salivary Physiology (U) Salivary Enzyme (U) Laboratory Animal

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To determine if saliva can be used as a diagnostic tool in evaluating the exposure of combat troops to lethal agents. To determine if parameters in saliva can be used to monitor the progress of therapy for lethal agent exposure. Develop a rapid simplified field technique for identification of lethal agent exposure in the combat soldier.

24. (U) Changes in saliva produced by lethal agent exposure will be evaluated. The particular areas of study will be protein, electrolyte and immunological components. Possible methodology developed will be evaluated in the field and at the hospital level.

25. (U) (80 10 - 81 10) Work to date has suggested that changes in salivary amylase may serve as the basis of a method for the identification of nerve agent exposure in the field. A protocol has been developed for continued research to both verify and extend previous work done with cynomologous monkeys. The new protocol will use Rhesus monkeys. Several enzyme systems will be assayed concurrently under the influence of administered nerve agents. Preliminary work on the standardization of methods and determinations in Rhesus monkey saliva of the various systems to be assayed have been completed. Continuation of this work awaits availability of facilities for nerve agent administration.

*Available to contractors upon originator's approval

DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

USAIDR PUBLICATIONS

FY 81

1. Huget, E.F., Vermilyea, S.G., Modawar, F.A., and de Simon, L.B.: Electrochemical Behavior of Gold Alloys. Milit Med, 145(10):701-703, Oct 1980.

2. Drobotij, E., Grower, M.F., Bernier, W.E., Peters, D.D., and Lorton, L.: Comparison of the Flushing Effectiveness of Four Different Types of Needles After Canal Preparation. J Endod, 6(12):870-875, Dec 1980.

3. Augsburger, R.A., and Peters, D.D.: *In Vitro* Effects of Ice, Skin Refrigerant, CO_2 Snow on Intrapulpal Temperature. J Endod, 7(3): 110-1161, March 1981.

4. Vermilyea, S.G., Kuffler, M.J., and Tamura, J.J.: Observations on Nickel-Free-Beryllium-Free Crown and Bridge Alloys. J Dent Res, 60(A): 519, March 1981.

5. Kuffler, M.J., Vermilyea, S.G., and Tamura, J.J.: Casting Accuracy of Base Metal Alloys. J Dent Res, 60(A), 349, March 1981.

6. Peters, D.D., and Augsburger, R.A.: *In Vitro* Cold Transference of Bases and Restorations. J Am Dent Assoc, 102:642-646, May 1981.

7. Lorton, L., and Brady, J.: Criteria for Successful Composite Restorations. Gen Dent, 29(3):234-236, *June* 1981.

8. Peters, D.D., and Augsburger, R.A.: *In Vitro* Model System to Evaluate Intrapulpal Temperature Changes. J Endod, 8(3):320-324, July 1981.

9. Keller, D.L., Peters, D.D., Setterstrom, J., and Bernier, W.E.: Microleakage of Softened Temporary Restorations as Determined by Microorganism Penetration. J Endod, 7(2):413-417, Sep 1981.

10. Lorton, L., and Whitbeck, P.: Esthetic Parameters of Mandibular Anterior Teeth. J Prosthet Dent, 46(3):280-284, Sep 1981.

11. Setterstrom, J.A., Posey, W.R., Harrington, J.S.G., and Derevjanik, M.A.: Sustained Release of Antibiotics from Biodegradable Microcapsules: *In Vivo* Evaluation of Locally Applied Ampicillin in the Control of Wound Infections. Annual Meeting of the American Society of Microbiology, A-29, 5 (1981).

12. Huget, E.F., Vermilyea, S.G., and Kuffler, M.J.: Accuracy of Small Base Metal Dental Castings. Milit Med (in press).

13. Huget, E.F., Vermilyea, S.G., and Vilca, J.M.: "Low Gold" Crown and Bridge Alloys. J Prosthet Dent (in press).

14. Huget, E.F., Vermilyea, S.G., Fehrman, S.G., and Modawar, F.A.: Laboratory Observations on the Behavior of Composite Dental Restoratives. Milit Med (in press).

15. Huget, E.F., Vermilyea, S.G., Modawar, F.A., and Tamura, J.J.: Electrochemical Profiles of Crown-and-Bridge Alloys. Milit Med (in press).

16. Kuffler, M.J., and Vermilyea, S.G.: Apparent Accuracy of Base Metal Casting. J Prosthet Dent (in press).

17. Skirvin, D.R., Vermilyea, S.G., and Brady, R.E.: Polymethylmethacrylate Reinforcement: Affect on Fatigue Failure. J Prosthet Dent (in press).

18. Vermilyea, S.G., Kuffler, M.J., and Tamura, J.J.: Observations on Nickel-Free-Beryllium-Free Crown and Bridge Alloys. J Am Dent Assoc (in press).

19. Guinn, J.W., Griswold, W.H., and Vermilyea, S.G.: The Effect of Cooling Rate on the Apparent Bond Strength of Porcelain-Metal Couples. J Prosthet Dent (in press).

Submitted for Publication:

20. Cecic, P., Grower, M.F., and Peters, D.D.: Comparison of the Effects of Various Irrigating Solutions on Dentine Permeability. Submitted to J Endodont, Oct 1980.

21. Miller, R.A., Bussell, N.E., Setterstrom, J.A., and Gross, A.: Effect of Mixed Culture Growth Conditions on the Cellular Fatty Acids of *Streptococci* (Analyzed by High Performance Liquid Chromatography). Submitted to the J Dent Res, Oct 1980.

22. Freccia, W.F., and Peters, D.D.: A Technique for Staining Extracted Teeth: A Research and Teaching Aid for Bleaching. Submitted to J Endodont, Nov 1980.

23. Benner, M.D., Peters, D.D., Grower, M.F., and Bernier, W.E.: Evaluation of a New Thermoplastic Gutta Percha Obturation Technique Using ^{45}Ca. Submitted to J. Endodont, Nov 1980.

24. Bernier, W.E., Lorton, L., and Peters, D.D.: The Effect of Immediate Versus Delayed Dowel Space Preparation on Endodontically Filled Teeth. J Endodont, Jan 1981.

25. Freccia, W.F.: Misconceptions Concerning the Clinical Use of Hypnosis in Dentistry. J Amer Dent Assoc, Feb 1981.

26. Osborne, W.H., Snyder, A.J., Tempel, T.R.: Attachment Levels and Crevicular Depths at the Distal of Mandibular Second Molars Following Removal of Adjacent Third Molars. J Periodont, Feb 1981.

27. Vermilyea, S.G., Kuffler, M.J., and Huget, E.F.: The Effects of Die Relief Agent on the Retention of Full Coverage Castings. J Prosthet Dent, Feb 1981.

28. Freccia, W.F., Peters, D.D., Lorton, L., and Bernier, W.E.: An *In Vitro* Comparison of Non-Vital Bleaching Techniques in the Discolored Tooth. Submitted to J Endodont, Mar 1981.

29. Guinn, J.W., III, Griswold, W.H., and Vermilyea, S.G.: The Effect of Cooling Rate on the Apparent Bond Strength of Porcelain-Metal Couples. Submitted to J Prosthet Dent, Mar 1981.

30. DiFiore, P.M., Peters, D.D., Setterstrom, J., and Lorton, L.: The Antibacterial Effects of Calcium Hydroxide Apexification Pastes on *Streptococcus sanguis*. Submitted to J Oral Surg, June 1981.

31. Lorton L., and Whitbeck, P.: Diagnosis of the Aesthetic Components of the Mandibular Anterior Prosthesis. Submitted to J Oral Rehab, Aug 1981.

32. Vermilyea, S.G., Tamura, J.J., and Mills, D.E.: Observations on Nickel-Free-Beryllium-Fixed Prosthodontic Alloys. Submitted to J Am Dent Assoc, Aug 1981.

DISTRIBUTION LIST

5 copies to:

US Army Medical Research and Development Command
Fort Detrick, Frederick, MD 21701

12 copies to:

Defense Technical Information Center
ATTN: DDC-DDA
Alexandria, VA 22314

1 copy to:

Superintendent
Academy of Health Sciences, US Army
ATTN: AHS-COM
Fort Sam Houston, TX 78234

1 copy to:

Director
Biological & Medical Sciences Division
Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217

1 copy to:

Commander
Naval Medical R&D Command
National Naval Medical Center
Bethesda, MD 20014

1 copy to:

HQ AFMSC/SGPA
Brooks AFB, TX 78235

1 copy to:

Director of Defense Research and Engineering
ATTN: Asst Director (Environmental and Life Sciences)
Washington, DC 20301