



DEPARTMENT OF THE AIR FORCE  
59TH MEDICAL WING (AETC)  
JOINT BASE SAN ANTONIO - LACKLAND TEXAS

17 FEB 2017

MEMORANDUM FOR SGGDTG

ATTN: MAJ STEPHEN ARNASON

FROM: 59 MDW/SGVU

SUBJECT: Professional Presentation Approval

1. Your paper, entitled **Fracture Resistance of Bonded CAD/CAM Restorations with Undermined Tooth Structure** presented at/published to **International Association of Dental Research, San Francisco, CA, 22-26 March 2017** in accordance with MDWI 41-108, has been approved and assigned local file #**17081**.
2. Pertinent biographic information (name of author(s), title, etc.) has been entered into our computer file. Please advise us (by phone or mail) that your presentation was given. At that time, we will need the date (month, day and year) along with the location of your presentation. It is important to update this information so that we can provide quality support for you, your department, and the Medical Center commander. This information is used to document the scholarly activities of our professional staff and students, which is an essential component of Wilford Hall Ambulatory Surgical Center (WHASC) internship and residency programs.
3. Please know that if you are a Graduate Health Sciences Education student and your department has told you they cannot fund your publication, the 59th Clinical Research Division may pay for your basic journal publishing charges (to include costs for tables and black and white photos). We cannot pay for reprints. If you are 59 MDW staff member, we can forward your request for funds to the designated wing POC.
4. Congratulations, and thank you for your efforts and time. Your contributions are vital to the medical mission. We look forward to assisting you in your future publication/presentation efforts.

*Linda Steel-Goodwin*

LINDA STEEL-GOODWIN, Col, USAF, BSC  
Director, Clinical Investigations & Research Support

## PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS

### INSTRUCTIONS

#### USE ONLY THE MOST CURRENT 59 MDW FORM 3039 LOCATED ON AF E-PUBLISHING

1. The author must complete page two of this form:
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  - b. In Section 2, there may be funding available for journal costs, if your department is not paying for figures, tables or photographs for your publication. Please state "YES" or "NO" in Section 2 of the form, if you need publication funding support.
2. Print your name, rank/grade, sign and date the form in the author's signature block or use an electronic signature.
3. Attach a copy of the 59 MDW IRB or IACUC approval letter for the research related study. If this is a technical publication/presentation, state the type (e.g. case report, QA/QI study, program evaluation study, informational report/briefing, etc.) in the "Protocol Title" box.
4. Attach a copy of your abstract, paper, poster and other supporting documentation.
5. Save and forward, via email, the processing form and all supporting documentation to your unit commander, program director or immediate supervisor for review/approval.
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**NOTE:** All abstracts, papers, posters, etc., should contain the following disclaimer statement:

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***"The experiments reported herein were conducted according to the principles set forth in the National Institute of Health Publication No. 80-23, Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act of 1966, as amended."***



PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS			
1. TO: CLINICAL RESEARCH	2. FROM: (Author's Name, Rank, Grade, Office Symbol) Arnason, Stephen, Maj, SGGDTG	3. GME/GHSE STUDENT: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	4. PROTOCOL NUMBER: FWH20160023N
5. PROTOCOL TITLE: (NOTE: For each new release of medical research or technical information as a publication/presentation, a new 59 MDW Form 3039 must be submitted for review and approval.) Stabilization Effects of Recent CAD/CAM Restorations in Extended MOD Preparations as a Function of Tooth Preparation Design and Under			
6. TITLE OF MATERIAL TO BE PUBLISHED OR PRESENTED: Fracture Resistance of Bonded CAD/CAM Restorations with Undermined Tooth Structure			
7. FUNDING RECEIVED FOR THIS STUDY? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO FUNDING SOURCE: 59 MDW Clinical Research Division, JBASA-Lackland, TX			
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c. Guillory, Villa L.	Col	59 DTS/59 DG/SGDTG	
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24. DATE REVIEWED February 14, 2017	25. DATE FORWARDED TO 502 ISG/JAC	
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# Fracture Resistance of Bonded CAD/CAM Restorations with Undermined Tooth Structure



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## INTRODUCTION

Colloquial conversations have been reported, in both educational and private practice settings, that bonded CAD/CAM restorations reinforce undermined cusps.

## OBJECTIVE

The purpose of this study was to evaluate the fracture resistance of teeth with and without undermined tooth structure bonded with lithium-disilicate and resin-nano ceramic restorations.

## MATERIALS and METHODS

Seventy extracted maxillary molars of similar size were used in this study. Thirty teeth were prepared with 3.0mm of buccal and lingual cusps remaining with undermined enamel (extended preparations) and thirty teeth were prepared with 4.5mm of buccal and lingual cusps remaining (standard preparations). After scanning and milling (CEREC Omnicam, MCXL, Sirona), 10 teeth per preparation type were restored with lithium disilicate (e.max CAD, Ivoclar Vivadent), 10 teeth per preparation type were restored with resin-nano ceramic (Lava Ultimate, 3M/ESPE), and 10 teeth per preparation type were unrestored (negative control). An additional ten teeth were not prepared or restored (positive control). All seventy teeth were thermocycled (2000 cycles, 5° C - 55° C, Sabri Dental Enterprises) and cyclically loaded (150N, 100,000 cycles, 1Hz, Sabri Dental Enterprises). Specimens were fractured in a material testing device (Instron) using a 6mm-diameter cylindrical piston resting on the buccal and lingual inclines. Data were analyzed with a two-way ANOVA/Tukey's and Dunnett's (alpha=0.05). Fracture modes were categorized as Type 1: isolated fracture of restoration, Type 2: isolated fracture of a small portion of the tooth, Type 3: restoration fracture involving 1 cusp, Type 4: fracture involving more than half of the tooth, without periodontal involvement and Type 5: fracture with periodontal involvement.



Standard Preparation



Extended Preparation

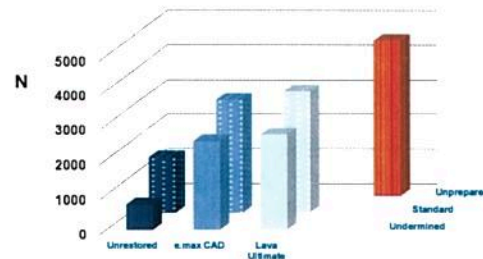
## RESULTS

The extended preparations with undermined cusps resulted in significantly less fracture strength than the standard preparations (p<0.001). The unrestored teeth had significantly less fracture strength than the restored teeth (p<0.001), which were not significantly different from each other (p=0.623). All groups had significantly lower fracture strength than the unprepared group (p<0.007). Fracture modes are displayed in the graph below.

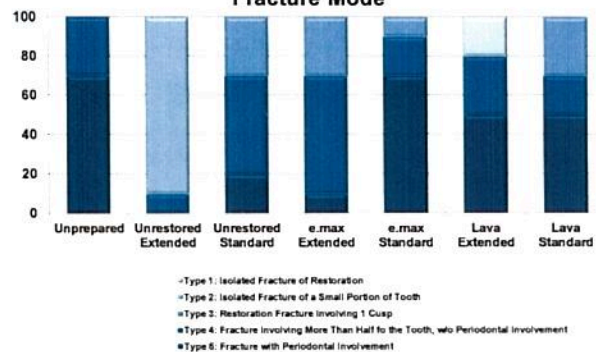
	Fracture Strength (Newtons, st dev)		Mean
	Preparation Type		
	Extended (Undermined)	Standard	
e.max CAD	2547.9 (468.7)	3248.2 (781.2)	2936.9 (736.0) A
Lava Ultimate	2736.9 (524.6)	3504.9 (916.4)	3120.9 (826.7) A
Unrestored	731.0 (290.2)	1586.6 (436.8)	1158.8 (568.2) B
Mean	1966.5 (1030.6) b	2799.9 (1121.2) a	
Unprepared 4475.3 (797.4)			

Groups with the same upper case letter per column or lower case letter per row are not significantly different (P>0.05)

Fracture Strength



Fracture Mode



## CONCLUSIONS

Although bonded CAD/CAM restorations reinforced tooth structure, fracture strength was significantly lower with teeth with undermined cusps. Type of material did not significantly affect fracture strength. Of the restored teeth, the extended preparations restored with e.max CAD had the least catastrophic failures.



**59th Medical Wing (59th MDW)  
Institutional Review Board (IRB)**  
59th Clinical Research Division/SGVUS/(210) 292-7143  
2200 Bergquist Dr, Bldg 4430, Lackland AFB, TX 78236-5300

27 Nov 15

**FINAL DETERMINATION – NON-HUMAN RESEARCH**

**Determination Date:** 25 Nov 2015

**Project Lead:** Capt Stephen Arnason/SGDTG

**Reference Number:** FWH20160023N

**Project Title:** Stabilization Effects of Recent CAD/CAM Restorations in Extended MOD Preparations as a Function of Tooth Preparation Design and Undermined Enamel

You may begin your project, as you would any other clinical or operational activity, with the approval and sponsorship of your leadership.

Your project was determined on 25 Nov 2015 to be considered **not human research** as defined by DoD regulation **32 CFR 219 and FDA regulation 21 CFR 56**. Continued IRB oversight for this activity is not required. The proposed project does not include non-routine intervention or interaction with a living individual for the primary purpose of obtaining data regarding the effect of the intervention or interaction, nor do the researchers obtain private, identifiable information about living individuals.

Since the IRB does not have regulatory oversight for your study, it is the investigator's responsibility to validate the study's scientific merit and research design and to ensure the conduct of the study is upheld by the highest ethical standards, as required by the Wing. Should you require assistance in reviewing the scientific merit and research design of your study, please contact the Protocol Office. Protection of subjects' rights safety and welfare and responsibility for protecting PHI/PII and research data now fall on the investigator and their commander.

In accord with DoDI 6000.08 any intramural funding of this study as research or as a clinical investigation may continue to be received or sought regardless of this IRB determination.

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