

**Academy of Laser Dentistry
ALD 2008, San Diego, CA
Thursday, April 10, 9:30 am – 9:45 am
STUDENT SCHOLARSHIP**

**Effect of a New 9.6- μ m Carbon Dioxide Laser and Fluoride on
Caries Progression in Demineralized Enamel**

*Monica Chmiel, DDS, MS (presenting); John Featherstone, MSc, PhD; Dan Fried, PhD; Art Miller, PhD; Peter
Rechmann, Prof. Dr. med dent
University of California, San Francisco, California*

Aim of the Study - The overall objective of the present study was to further explore the specific set of optimal laser conditions that may be used clinically for the prevention and potential reversal of carious lesions. The specific aim of this study was to provide experimental evidence that the use of a new prototype carbon dioxide laser combined with fluoride produces a significant protective effect against lesion progression using incident fluences of 2.0 and 4.0 J/cm².

Material and Methods - The laser used was a Model LPS-500, Serial #030106, Pulse Systems, Inc. (PSI), manufactured in January 2003 in Los Alamos, New Mexico. The hypothesis to be tested is that treatment with a new carbon dioxide laser (9.6 μ m, 20 pulses per spot, 20 μ s pulse duration, and a 20 Hz repetition rate) and fluoride significantly inhibits the progression of artificial caries-like lesions in smooth-surface dental enamel to a greater extent than the laser or fluoride treatments alone. This study also explored the effect of fluoride therapy alone, as well as laser treatment alone and possible sequence effects of combination treatment under these specific laser conditions. Samples (100) of sound enamel were divided into 10 groups. Ninety samples were partially demineralized in a 50% HAP/0.1M lactic acid/carbopol solution (pH 5.0). Experimental groups were exposed to various combinations of laser and fluoride treatments using the above parameters and then submitted to 9 days of pH cycling. New group numbers were randomly assigned by an independent operator to eliminate experimenter bias during sample analysis. The ΔZ values were compared to the three control groups (demineralization solution only, fluoride only, laser only, and no fluoride or laser treatment), giving a measure of the efficacy of laser and fluoride treatments in inhibition of caries progression in demineralized smooth surface enamel. Comparison of ΔZ values for each of the groups indicated the amount of demineralization/remineralization that occurred under the various experimental conditions. Relevant pair-wise comparisons were made by student t-test with the level of significance adjusted by the Bonferroni correction (p value of .00294). The means of the volume % mineral at depths of 15 μ m, 20 μ m, and 25 μ m were examined by an ANOVA with a post ANOVA Tukey's multiple comparison test (p < 0.05) to determine the statistically significant differences between groups. The mean volume percentage mineral at each depth from the outer surface was plotted versus depth in μ m for each of the groups.

Results - Microhardness analysis was performed to determine the relative mineral loss as ΔZ (volume % x μ m). Mean (SD) ΔZ values for groups I-X were, respectively: 936.17 (770.88); 515.47 (420.84); 703.23 (534.59); 553.57 (260.72); 581.36 (281.76); 488.08 (292.64); 4310.98 (672.52); 4406.15 (1099.18); 5378.44 (644.38); and 2141.70 (1290.43).

Conclusion - This new carbon dioxide laser did not have a significant protective effect against lesion progression. Fluoride treatment only with a 5-minute topical gel not only inhibited further lesion progression in a pH-cycling model but also was effective in remineralization of artificial caries-like lesions.

This presentation discusses investigational devices that have not received U.S. FDA approval or clearance for the specified clinical indications. The presentation represents scientific research.

Biography: *Monica Chmiel grew up in Toronto, Ontario, Canada. She attended Queen's University in Kingston, Ontario where she received her Bachelor of Science degree. She completed her dental training at Columbia University in 2004. Monica then attended the University of California, San Francisco to complete her orthodontic residency and Master's of Orocraniofacial Sciences in June 2007.*

Disclosure: *Dr. Chmiel has no commercial relationships relative to this presentation.*

Dr. Chmiel may be contacted by e-mail at monicachmiel@hotmail.com.