

## AAO Foundation Award Final Report

Principal Investigator	Hera Kim
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Award Type	Biomedical Research
Project Title	The Effectiveness of Sealants and Argon Laser Irradiation in Preventing Enamel Decalcification during Orthodontic Treatment: an <i>in vitro</i> , <i>in viro</i> study.
Project Year	1998
Institution	West Virginia University
Summary/Abstract	<p>Enamel decalcification is a significant problem in orthodontic patients. Orthodontic appliances complicate the removal of food debris and plaque. Decalcification is caused in part by dental plaque. <i>Streptococcus mutans</i> and <i>Lactobacillus</i> species levels increase in the oral cavity following the placement of orthodontic appliances. The argon laser has been shown to reduce decalcification during an acidic challenge <i>in vitro</i>. The purpose of this study was to investigate the effects of argon laser irradiation on enamel decalcification during orthodontic treatment. Nine volunteers who were treatment planned for four first premolars extractions were enrolled in the study. Each subject's premolars were assigned to one of the four groups. Group 1: control group with no treatment. Group 2 (pumice-lase): teeth were pumiced for 3 sec and lased with a 325 mW, 5 mm diameter laser beam for 60 sec. Group 3 (pumice-etch-lase): teeth were pumiced for 3 sec, acid etched with 30% phosphoric acid for 30 sec, and lased for 60 sec. Group 4 (lase-only): teeth were lased for 60 sec. A specially designed (over-sized) orthodontic band was fitted on each of the premolars to create a pocket for decalcification. The bands were placed for 5 weeks. Following extraction, the teeth were sectioned and examined under polarized light microscopy. Images of lesions were digitally analyzed and measured. Average lesion depths were calculated from three depth measurements recorded 10 microns apart. Average lesion area was calculated with the aid of an imaging analysis software. Data were analyzed using ANOVA (<math>p &lt; 0.05</math>) and Student t test. Significant differences were found in lesion depth (<math>p &lt; .001</math>) and lesion area (<math>p &lt; .01</math>) among the four test groups. The average lesion depths were <math>15.93 + 9.31\mu\text{m}</math> (control), <math>6.45 + 8.70\mu\text{m}</math> (pumice-lase), <math>1.71 + 4.82\mu\text{m}</math> (pumice-etch-lase), and <math>1.34 + 3.80\mu\text{m}</math> (lase only). The average lesion areas were <math>1028.67 + 725.68\mu\text{m}^2</math> (control), <math>555.49 + 948.20\mu\text{m}^2</math> (pumice-lase), <math>79.91 + 226.03\mu\text{m}^2</math></p>

(pumice-etch-lase), and  $55.71 + 157.59\mu\text{m}^2$  (lase only). The average lesion depth in the lase-only group were reduced by 94.1% and the average lesion area was reduced by 94.4% when compared to the control group. In the pumice-etch-lase group, the average lesion depth was reduced by 89.1% and the average lesion area was reduced by 92.2% when compared to the control group. There were no significant differences in lesion depth and lesion area between the maxillary and mandibular teeth ( $p < .06$  and  $p < .08$ , respectively) and between the teeth on the right and left side ( $p < .68$  and  $p < .55$ , respectively). These results show that argon laser irradiation is effective in reducing enamel decalcification during orthodontic treatment *in vivo*.