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College of Dentistry**



**The Impact of Selected Topical Fluoride
Materials and Neodymium doped yttrium–
aluminum–garnet LASER on Dentine and Some
Salivary Bacteria (In Vitro Study)**

A Thesis

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Abstract

Background: The thermal effect of Neodymium doped yttrium–aluminum–garnet (Nd:YAG) laser was believed to be the major factor in stimulating fluoride uptake. Silver diamine fluoride, acidulated phosphate fluoride, stannous fluoride is used to prevent and arrest caries. Hence, the combined effects of silver and fluorides have been hypothesized to have the antibacterial effect of the silver ion and the remineralizing ability of fluoride have been suggested.

Aim of the study: The aim was to examine the influence of selected topical fluoride materials: silver diamine fluoride, acidulated phosphate fluoride, stannous fluoride with and without Nd:YAG laser application on dentine and sensitivity of salivary *Mutans streptococci* and *Lactobacilli*, in vitro.

Materials and methods: The samples in this study were consisted of 67 extracted maxillary first premolar teeth. Samples were randomly divided into 11 groups, each group consisted of six specimens, five for fluoride uptake test and one specimen and one specimen sound tooth for Scanning Electron Microscope examination. Before the surface treatments, all the specimens in the 11 groups underwent a pH cycling procedure to induce caries like lesion in dentine specimen, these groups are: first group control with neither laser nor topical fluoride materials, other groups treated with silver diamine fluoride, acidulated phosphate fluoride, stannous fluoride, Nd-YAG laser, laser then silver diamine fluoride, silver diamine fluoride then laser, laser then stannous fluoride, stannous fluoride the laser, acidulated phosphate fluoride then laser and laser then acidulated phosphate fluoride. Ion-selective electrode was used for fluoride measurements. Standardized suspensions of bacterial growth of *Streptococcus mutans* and *Lactobacilli*, they exposed to Nd:YAG laser beam at different radiation times and energies. Agar well diffusion method was used to investigate the sensitivity of *Streptococcus mutans* and *Lactobacilli* to many topical fluoride agents [silver diamine fluoride (38%), acidulated phosphate

fluoride (1.23%), stannous fluoride (0.4%)] compared with deionized water as control negative. The results of the present research was analyzed by using statistical package for social science (SPSS version 21).

Results: Result showed that there was a marked increase in fluoride uptake by dentine after treatment with silver diamine fluoride alone. Scanning electron microscope examination illustrated ultrastructural changes in dentine. After treated dentin with laser and selected fluoride material showed a partially blocked tubule and the intertubular dentin appears to have an increase in globular crystals. The results of *Streptococcus mutans* and *Lactobacilli*, which exposed to Nd:YAG laser near infrared wave length (1046 nm) at different energies and exposure times, showed a highly bacterial growth in the control group, but after radiation, there was a reduction in the mean values of CFU/ml for *Streptococcus mutans*, while highly reduction in the mean values of CFU/ml for *Lactobacilli*, with the maximum reduction was in the group that was exposed to (80mj for 30s) for both bacteria. The mean values of inhibition zones (clear zone of no growth) for *Streptococcus mutans* was a statistically highly significant difference between materials (silver diamine fluoride, acidulated phosphate fluoride) and (deionized water control, stannous fluoride), there was no inhibition zones (no kill of bacteria), regarding silver diamine fluoride, the mean value was higher than acidulated phosphate fluoride. While the results of *Lactobacilli* revealed a statistically highly significant difference between control group with deionized water and others, and highly significant difference among (silver diamine fluoride) and (acidulated phosphate fluoride, stannous fluoride), while the result was statistically non-significant when comparing the inhibition zone of acidulated phosphate fluoride and stannous fluoride materials.

Conclusions: Treatment of dentine surface with silver diamine fluoride alone gave the best result, this was detected and noticed by scanning electron microscope examination. The Nd-YAG laser was represented antibacterial

effect on *Lactobacilli* with minimal exposure time and energy, while less effect on *Streptococcus mutans* with maximum energy and exposure time. Acidulated phosphate fluoride and silver diamine fluoride have a high effect on *Streptococcus mutans* and *Lactobacilli*, while a full negative reaction by *Streptococcus mutans* was found to stannous fluoride, whereas *Lactobacilli* was sensitive to it.