Combined Effect of Holmium Laser and Fluoride in Prevention of Dental Caries *in vitro*

Zezell,D.M. *; Bonk, P.A. *; Salvador, V.L.R. *; Rossi, W. *; Ranieri, I. M. *; Bachmann, L. *; Eduardo, C.P.*; Vieira Jr., N.D*.; Morato, S.P. *

* IPEN-CNEN/SP – Divisão de Materiais Optoeletrônicos – P.O. Box 11049 –CEP: 05422-970 – S.Paulo - SP, Brazil.
dmzezell@net.ipen.br - pabonk@net.ipen.br - wderossi@net.ipen.br - iranieri@net.ipen.br - bachmann@net.ipen.br nilsondv@net.ipen.br – spero@net.ipen.br

* FOUSP - Faculdade de Odontologia- Universidade de São Paulo-

Abstract

The aim of this work was to investigate the possibility of using a holmium laser for preventions of dental caries. Changes in physical properties of dental enamel were observed by measuring microhardness, analyzing the relative concentration of calcium and phosphorous atoms after acid demineralization of enamel. It was observed increase in enamel microhardness, increase in enamel fluoride uptake, and a lower lost of calcium when samples were acid exposed, indicating that holmium laser can be useful for prevention of caries.

Introduction

Benefits of holmium laser in dentistry are mainly associated with its wavelength emission, absorbed into water with shallow depth of tissue penetration. The use of laser irradiation in prevention of dental caries was first indicated by Stern et. al.[1] in 1972. Several investigators proposed mechanism for this effect, in which a decreased enamel permeability and decreased solubility of enamel resulting from an alteration in composition of the mineral phase [2,3,4]. A positive combination between laser irradiation and treatment of enamel with fluoride, dodecylamine HCl (DAC), or ethane-1-hydroxy-1, 1-diphosphonic acid (EHDP) was measured by Fox et al.[5,6], where specimens had complete dissolution inhibition when exposed for 5 min., in 0,1 M acetate buffer (pH 4.5) containing no calcium or phosphate common ions. However the extent of the effectiveness of laser irradiation in those studies is limited to a very thin surface layer (1 μm) and a partial transformation of dissolution behavior throughout a thicker zone on the order of tenths of microns.

The aim of our group is to investigate the possibility of using a holmium laser, to change physical properties of enamel, measuring changes in microhardness, that can improve resistance against enamel demineralization caused by cariogenic bacteria. This can be possible because the emission in 2 μm penetrates deeper in enamel than the radiation of those lasers most frequently related in the literature.

Materials and Methods

Premolar teeth were sectioned longitudinally in order to separate sections of enamel. These sections were then embedded under pressure in resin. Samples were light polished to assure plane surface for irradiation, cleaned under ultrasound and divided in four groups: **I** – control, attacked with 0,5 M perchloric acid for 10 minutes, **II** - coated for 10 minutes with acidulated phosphate fluoride APF (2% NaF, 0,68 M H_3PO_4, pH 5.3), **III** - laser irradiated and **IV** - APF for 10 min. and laser irradiated.