Indirect Pulp Treatment of Primary and Permanent Teeth: Laser vs Handpiece
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BACKGROUND
The indirect pulp treatment (IPT) procedure was advocated more than 200 years ago as a conservative pulp therapy. Some studies have advocated performing IPT on primary teeth and reported success rates as high as 90-99%. The impossibility of obtaining complete sterilization of the remaining carious dentin led several researchers to use a number of agents, most of which were intended to sterilize residual carious dentin. These agents include trichloride of iodine, dichloride of mercury, hydrogen peroxide, oil of cloves, and silver nitrate. The use of these agents was strongly questioned because of their caustic nature and potential damage to vital pulp tissue. Most are no longer in common use.

The basic definition of indirect pulp treatment is “The procedures or steps taken to protect or maintain the vitality of the carious tooth that, if completely excavated, the decay would result in a pulp exposure.” In addition, before performing IPT, all the caries at the dentinal enamel junction must be removed. The superficial layer of the carious dentin that needs to be removed is called the infected dentin. This layer contains the majority of microorganisms and their toxic products that are also the source of continuous insult to the pulp. The infected layer must be removed to allow the healing of the dental pulp. The deep layer or the decalcified dentin is called the infected dentin; this layer has only a few microorganisms. The affected layer can be left in place without any adverse effect on the dental pulp.

While there are case reports and evaluations of various laser techniques in the literature, statistical studies comparing the success of laser-assisted applications to traditional techniques are needed.

PURPOSE
The purpose of this prospective and randomized in vivo study was to compare the clinical and radiographic outcomes of using the laser Er:Cr:YSGG vs handpiece with a calcium hydroxide liner for protection of the dentin-pulp complex of primary/permanent teeth treated with IPT.

MATERIALS AND METHODS

CRITERIA
• 3-17 year old
• A minimum of one carious primary or permanent tooth that requires indirect pulp treatment. (anterior and/or posterior)

LASER
• Caries removed completely from the cavosurface margins and all lateral walls of cavity preparation with the laser
• Caries removed at site of “risk for pulpal exposure” were performed with the laser

CONVENTIONAL HAND PIECE
• Caries removed completely from the cavosurface margins and all lateral walls of cavity preparation with the high speed handpiece
• Caries removed at site of “risk for pulpal exposure” were performed with a #6 or #8 carbide bur at low speed

FINISHING STEPS TO RESTORATION
• Liner/Base with CaOH medicament (1-1.5mm thick layer)
• CLEARFIL SE BOND is a light-curing bonding system, and consists of a self-etching primer and a bonding agent was applied to the entire cavity as instructed by the manufacturer
• Dynact flowable composite resin (DENTSPLY Caulk)
• All teeth were restored with either resin (TPE, DENTSPLY Caulk) or a stainless steel crown (DENovo)

FOLLOW UP
• The teeth included in the study is to be examined in 6 months and 12 months after restoration
• Follow-up radiographs (Bite-wings/periapical) to be taken at each follow up appointments

The criteria to be used for determination of clinical and radiographic successful outcome of the indirect pulp treatment were:
1) absence of fistula, edema, and/or abnormal mobility
2) absence of spontaneous pain and/or sensitivity to pressure
3) absence of radiolucencies at the interradicular and/or periapical regions
4) absence of internal or external resorption

RESULTS
49 patients were enrolled in this study and a 29% no show rate. After 15 months, the success of teeth treated with the conventional handpiece was 83% (15/18) and 100% (17/17) (Z=1.78, NS) of teeth treated with the Er:Cr:YSGG laser. The success was determined by clinical and radiographic examination. Abscess and/or periapical lesions were the most predominant signs of treatment failure.

DISCUSSION
Introduction for dental use a decade ago, lasers are identified by the active medium used and each generates coherent light of a characteristic wavelength.

The 6 types of lasers currently used in dentistry are the neodymium:yttrium aluminum garnet (Nd:YAG), the CO2, the argon, the diode, erbium (Er:YAG), and the erbium, chromium:yttrium–scandium–gallium–garnet (Er:Cr:YSGG). The wavelengths are 1064nm, 10,600 nm, 488 nm, 810nm, 2949nm, and 2.98 micrometers respectively. Lasers are identified by the active medium used and each generates coherent light of a characteristic wavelength.

Lasers are used in dentistry for various soft tissue applications including hemostatic assistance for various procedures, gingivoplasty, gingivectomy, laser troughing prior to taking impressions, leukoplakia removal and biopsy of benign, premalignant and malignant lesions. Case reports have been made on biostimulation on cells to induce healing. Hard tissue investigations include elimination of root surface sensitivity and dentinal hypersensitivity, caries removal, sterilization (Bacteriocidal) and sealing of root canal spaces.

The Waterlase works because of its patented Hydrokinetic™ energy, which is produced by emitting laser energy into a spray of atomized water. The water is energized and then is capable of cutting a wide range of human tissue including enamel (the hardest substance in the body), bone, cartilage and soft tissue.

CONCLUSIONS
The teeth treated with the laser for IPT showed a higher outcome of success than those treated with the conventional handpiece. The number of subjects needed per group to detect or difference of .20 between the proportions for alpha=.05 and Power = .80 in 44 subjects. The use of the laser in addition to the calcium hydroxide base to a restoration shows a positive trend to the success of an IPT.

BIBLIOGRAPHY