Clinical Implications of Lasers in Pediatric Dentistry

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ABSTRACT

The idea of substituting a drill with a laser light which has less adverse effects on patients, without vibration, noise and pain, has led its introduction in dentistry. Lasers are extremely safe compared with rotating instruments, especially in pediatric dentistry, when used in the treatment of very young children, due to the lowered risk of accidental damage to soft tissues and pulp tissue. Lasers bring new possibilities for safe and minimal removal of carious tissue with better acceptance compared with traditional techniques. This review article discusses the clinical implications of lasers in pediatric dentistry.

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INTRODUCTION

Taking care of a pediatric patient’s oral health is a challenging task, but one that can be exceptionally rewarding. Providing a positive experience to children enables them to have a trusting, long-term relationship with a dental professional. Combining skill, knowledge and cutting-edge diagnostic and operative technologies help to guide children toward a lifetime of good oral health. One of the main roles of the pediatric dentist is to provide effective education on prevention in order to reduce the incidence of dental and oral disease throughout childhood and adolescence and into adulthood.

Among the many motivational, diagnostic and operative innovations to consider, one must include lasers. Laser technology in pediatric dentistry today is a new treatment modality for children and teens; it represents an alternative instrument that sometimes complements, and at other times substitutes for traditional techniques. This article reviews about the implications of lasers in pediatric dentistry.

LASERS IN CARIES DETECTION

Conventional methods of diagnosing dental caries like manual probing and radiographic evaluation sometimes prove ineffective in detecting enamel defects. Lasers have revolutionized early caries detection by utilizing methods, such as diagno dent,\(^1\,^2\) quantitative laser fluorescence,\(^3\) optical coherence tomography. These diagnostic techniques results in noninvasive or minimally invasive approach to clinical management of dental caries. This detection is very accurate, the application is easy and very safe and also avoids radiation.\(^4\)

LASERS IN CARIES REMOVAL

Er:YAG laser can be efficiently used to remove carious tissue. The possibility to ablate small area of infected layer guarantees maximum conservation of the tooth structure. Er:YAG laser can be used to decontaminate the affected layer. The lack of smear layer after vaporization with laser aids in better retention of the composite to the dentin. Preparing the enamel surface with a laser before etching gives a better marginal seal of the composite restoration.\(^5\)

LASERS IN CAVITY PREPARATION

The use of lasers for cavity preparation and caries removal is based on ablation mechanism in which dental hard tissue can be removed during laser irradiation.\(^6\) A focused mode is used for fast cutting and defocused mode for slow cutting. For deep cutting, the tip is moved up and down as in pumping action. The operator can detect different tooth structures by hearing the sound of ablation (popping sound), which is differentiated by tissue type. Beginning of cavity preparation, focused beam of 6 W (67.9 J/cm\(^2\)) at maximum air pressure level and 32% water level. As enamel removal progressed to dentin, reduce the power to 3 W (33.9 J/cm\(^2\)) at 70% air level and 20% of water level. Line angles and point angles 22 are placed in preparation for greater mechanical retention of the restoration.\(^7\) Advantages of laser cavity preparation is laser is capable of preparing the cavity in an irregular fashion which is ideal for placement of composite or GIC which ensures that the bond strength of restoration is enhanced. Moreover acid etch step can be easily avoided, and microleakage of composite resin restoration can be minimized.
PIT AND FISSURE SEALANTS
A promising approach to nonoperative dentistry is sealing of enamel lesions with low viscous light-curing resins such as pit and fissure sealants. One of the important requirements of a pit and fissure sealant is that it should prevent microleakage at its periphery failing which, the carious process continue underneath the sealants.4

LASERS IN PEDIATRIC CROWNS
Jacobson8 revealed the contemporary technique of performing laser pediatric crowns where a Biolase is set to begin cutting the surface layer of enamel. Initial cuts are made at a setting of 5.5 watts, 65% air and 55% water. Crowns should be prepared with same specifications as in the conventional method. Undercuts are placed to improve the bond of the resin crown. This technique eliminates local anesthesia, thereby providing optimal patient comfort and compliance.

LASERS IN PULPOTOMY
Pulpotomy is a procedure in which the inflamed or infected but vital coronal pulp is removed, leaving the healthy pulp in the root canal. Different techniques are used for this: Buckley’s formocresol 1/5 dilution, glutaraldehyde, calcium hydroxide, ferric sulfate, MTA, electrocauterization, and laser. Different authors found interesting results concerning bacterial reduction in dental tissues treated with lasers. Matsumoto et al9 and Ebihara et al10 described the histological characteristics and the reaction of the laser-irradiated pulp. In the positive controls, necrosis of the superficial layer, hyperemia, and inflammatory cells resulting from dentinogenesis were observed. In some specimens, a well-shaped newly formed dentin bridge appeared. The use of the Er:YAG laser allows opening the cavity in a completely sterile way, an advantage which is not provided by any other means of access to the pulp chamber. The Nd:YAG laser is especially well suited to work on soft tissues; its properties include cutting, sterilizing, coagulating and vaporizing. For the treatment performed in this study, its capacity to sterilize and coagulate were particularly relevant. Laser sterilization reinforces the overall sterilizing procedure, and laser coagulation produces a thin necrotic layer over the vital remaining pulp. The vital pulp responds in some cases with the formation of a dentin bridge.11

LASERS IN INDIRECT AND DIRECT PULP CAPPING
Pulp capping is superior with disinfection attained up to the depth of 300 μm. Local analgesia is not required with laser due to less heat generation in the pulp chamber.12 Laser tissues have advantages with respect to control of hemorrhage and sterilization and is thus, beneficial for use in direct pulp capping. Er, Cr:YSGG laser at 1 W, 20 Hz with 20% air and 15% water is used.13

LASERS IN ACCESS CAVITY PREPARATION AND CANAL PREPARATION
Er, Cr:YSGG lasers have been developed for access cavity preparation and enlargement of root canal orifices. The pulsed Nd:YAG laser with 2 W at 20 pps for 1 s is recommended for removing pulp remnants. It is an effective arsenal in the dentists quiver for pediatric endodontics. Rooney14 reported sterilization rates of 80 to 90% depending on the conditions of root canals, type of laser device, application parameters.

LASERS IN ANALGESIA
Analgesic effect on nerves supplying oral cavity is by decreasing firing frequency of lasers with a threshold effect by maximal suppression. Duration of analgesic effect can persist for 15 minutes approving for usage on patients having phobia to needles.12

LASERS IN ORTHODONTIC TOOTH MOVEMENT
Low-level laser therapy (LLLT) can be effectively used for retraction of maxillary canines into the first premolar extraction spaces along with fixed edgewise appliance. LLLT enhances rate of tooth movement and hence used as an adjunct to reduce treatment duration.13

LASERS IN MANAGEMENT OF GINGIVAL TISSUES
In newborn tight maxillary frenum may interfere with proper latching to breastfeeding. In older children, high frenal attachment may lead to mid-line diastema. Er:YAG laser is directed at the insertion of frenum and area between two front teeth. Sutures are not required. Postoperative period is uneventful.14

LASERS IN MANAGEMENT OF ANKYLOGLOSSIA
Ankyloglossia is a relatively common finding in the newborn population and is responsible for a significant proportion of breastfeeding problems. The abnormal attachment of the lingual frenum is one of the most misdiagnosed and overlooked congenital abnormalities observed in children. A suture can be placed at the junction of the frenum when using an Er:YAG or Er, Cr:YSGG laser. If using a CO2, Nd:YAG, or diode
laser, no additional sutures are necessary. The benefits of laser treatment include reduced bleeding during surgery with consequent reduced operating time and rapid postoperative hemostasis, thus, eliminating the need for sutures. The lack of need for anesthetics and sutures, as well as improved postoperative comfort and healing, make this technique particularly useful for very young patients.  

**LIMITATIONS OF LASERS IN PEDIATRIC DENTISTRY**

There are some disadvantages of laser use in pediatric dentistry. Laser use requires additional training and education for the various clinical applications and types of lasers. High start up costs are required to purchase the equipment, implement the technology, and invest in the required education and training. As different wavelengths are necessary for various soft- and hard-tissue procedures, the practitioner may need more than one laser. Most dental instruments are both side and end-cutting. When using lasers, modifications in clinical technique along with additional preparation with high-speed dental handpieces may be required to finish tooth preparations. Wavelength-specific protective eyewear should be provided and consistently worn at all times by the dental team, patient, and other observers in attendance during laser use. When using dental lasers, it is imperative that the doctor and auxiliaries adhere to infection control protocol and utilize highspeed suction as the vaporized aerosol may contain infective tissue particles.

**CONCLUSION**

Lasers have proven to be a boon in management of pediatric patient. They are effective and cause less trauma to the site under treatment. Moreover, the patient undergoing laser therapy are less apprehensive. But as every coin has two sides, lasers should be used by operators who are well versed with it to ensure maximum benefit.

**REFERENCES**