REVIEW ARTICLE

Lasers in Pediatric Dentistry - A Review

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ABSTRACT

The American Academy of Pediatric Dentistry recognizes the judicious use of lasers as a beneficial instrument in providing dental restorative and soft tissue procedures for infants, children, and adolescents, including those with special healthcare needs. This article is intended to inform and educate dental professionals on the fundamentals, types, diagnostic and clinical applications, benefits, and limitations of laser use in pediatric dentistry.

Keywords: Dental lasers, Lasers, Pediatric dentistry, Safety, Soft tissue.

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INTRODUCTION

Oral and maxillofacial surgeons incorporated the carbon dioxide (CO_2) laser into practice for the removal of oral lesions in the 1980s.[1,2] The first laser specifically for dental use was a neodymium-yttrium-aluminum-garnet (Nd: YAG) laser, developed in 1987.[3] The use of lasers is contributing to many areas of dentistry including periodontics, pediatrics, endodontics, oral surgery, restorative dentistry and dental hygiene, cosmetic dental whitening, and management of temporomandibular joint pain to name a few. While a detailed description of how lasers work is beyond the scope of this document, it is important to understand the basics of laser physics before selecting a laser for dental treatment. The term laser is an acronym for light amplification by stimulated emission of radiation. Lasers are classified by the active medium that is used to create the laser energy. Within a laser, an active medium is stimulated to produce photons of energy that is delivered in a beam of unique wavelength that is measured in nanometers.[4] The wavelength of a dental laser is the determining factor of the level to which the laser energy is absorbed by the intended tissue. Target tissues differ in their affinity for specific wavelengths of laser energy depending on the presence of the chromophore or the laser absorbing elements of the tissue.[4-6] Oral hard and soft tissues have a distinct affinity for absorbing laser energy of a specific wavelength. For this reason, selecting a specific laser unit depends on the target tissue, the practitioner wishes to treat. The primary effect of a laser within target tissues is photothermal.[7] When the temperature of the target tissue containing water is raised above 100°C, vaporization of the water occurs, resulting in soft tissue ablation.[1] Since soft tissue is made up of a high percentage of water, and excision of soft tissue initiates at this temperature. Hard tissue composed of hydroxyapatite crystals and minerals is not ablated at this temperature, but the water component is vaporized and the resulting steam expands and then disperses the encompassing material into small particles.[6] Laser operating parameters such as power, frequency, emission mode, thermal relaxation time, and air and water coolant used affect the clinical abilities of a laser. In addition, the delivery system of laser unit as well as the tissue concentration of the chromophore greatly influences the laser-tissue interactions. Various types of lasers have been used in dentistry.

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LASER SAFETY

Laser plume, a mixture of gases as well as debris, is generated during the use of lasers. When using dental lasers, it is imperative that the doctor and auxiliaries adhere to infection control protocol and utilize high-speed suction as the vaporized aerosol may contain infective tissue particles.[2,8] The practitioner should exercise good clinical judgment when providing soft tissue treatment of viral lesions in immune-compromised patients.[9,10] To prevent viral transmission, palliative pharmacological therapies may be more acceptable and appropriate in this group of patients. 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.[2] Many states have well-defined laser safety regulations, and practitioners should contact their specific state boards to obtain this information.

LASERS IN PEDIATRIC DENTISTRY

One of the benefits of laser use in pediatric dentistry is the selective and precise interaction with diseased tissues.

With the benefit of hemostasis during soft tissue treatments, wound healing can occur more rapidly with less post-operative discomfort and a reduced need for analgesics.[6,11-13] Little to no local anesthesia is required for most soft tissue treatments.[14] Reduced operator chair time has been observed when soft tissue procedures have been completed using lasers.[12,13] Lasers demonstrate decontaminating and bactericidal properties on tissues, requiring less prescribing of antibiotics postoperatively.[6,12,13] Lasers can provide relief from the pain and inflammation associated with aphthous ulcers and herpetic lesions without pharmacological intervention. The noncontact of erbium lasers with hard tissue eliminates the vibratory effects of the conventional high-speed handpiece allowing tooth preparations to be comfortable and less anxiety provoking for children and adolescents.[6,15-17] Nd: YAG and erbium lasers have been shown to have an analgesic effect on hard tissues, eliminating injections and the use of local anesthesia during tooth preparations. There are some disadvantages of laser use in pediatric dentistry. Since different wavelengths are necessary for various soft and hard tissue procedures, the practitioner may need more than one laser. Laser use requires additional training and education for the various clinical applications and types of lasers. High startup costs are required to purchase the equipment, implement the technology, and invest in the required education and training.

CONCLUSION

A further area of future growth is expected to be a combination of diagnostic and therapeutic laser techniques. Looking to the future, it is expected that specific laser technologies will become essential components of contemporary dental practice over the next decade.

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