Review Article

Lasers in Pediatric Dentistry: A Ray of Hope

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Abstract: Pediatric laser dentistry is a promising field in modern minimally invasive dentistry, and it can be "child friendly" approach. Its usage in surgical cases, operative dentistry, oral pathology, pulpal treatments, and prevention is analyzed. The current and the future situation of laser treatment in pediatric dentistry is evaluated with a promising view towards an improvement in our treatments and obtaining standardized protocols. Recent advances in laser technology and research have set the stage of revolution in pediatric dental practice to provide optimal, preventive, interceptive and restorative dental care in a stress free environment.

Keywords: Dentistry; Laser; Pediatric; Pulp.

INTRODUCTION

Currently, the use of the different types of lasers could change the pattern of dental practice, and are classified by diverse manners according to: Tissue applicability (soft or hard tissues); the lasing medium utilized (gas or solid lasers); the range of wavelength; and the risk related with its application. The use of lasers in dentistry has been evolved since 1960's by Maiman.[1] Dental lasers offer many advantages like avoiding needles and high-speed hand pieces, which makes less traumatic experience and improves behavioral management of the child. Recent advances in laser technology and research have set the stage of revolution in pediatric dental practice to provide optimal, preventive, interceptive and restorative dental care in a stress free environment.

Laser is an acronym or light amplification by stimulated emission radiation and it is the greatest invention of this century. Laser treatment represents a main source of remedy in some fields like medicine and surgery, whereas in dentistry it is used as adjunctive during hard and soft tissue management.[2] The use of different types of new lasers enables pediatric dentist to provide minimally invasive dentistry for hard and soft tissue procedures with minimal discomfort, and no pain during and after treatment. It minimized the use of injections, eliminated the vibrations, smell of conventional dentistry and was appreciated by parents and children. This makes dental visit stress free and install positive dental attitude in a child.[3] Recent advances in laser technology and research have set the stage of revolution in pediatric dental practice to provide optimal, preventive, interceptive and restorative dental care in a stress free environment. This paper reviews some of the laser applications in pediatric dentistry.

CLASSIFICATION OF LASERS:

1. Based on active material used[4]
   - Gas lasers
   - Solid lasers
   - Liquid lasers
2. Based on the wavelength [5]
   - Invisible ionizing radiation
   - Visible
   - Invisible thermal radiation
3. Based on their operating mode
   - Continuous
   - Pulsed
4. Based on their power supply
   - Low power lasers
   - Mid power lasers
5. Based on delivery systems
   - Flexible hollow wave guide or tubes
   - Articulated arms
   - Fiber optic
6. Based on clinical use [6]
   - For diagnosis Ex: Laser fluorescence, laser Doppler flowmetry
   - For non-surgical treatment
   - Laser activation of bleaching agent
   - Laser activation of light curing materials
7. For surgical treatment
   - Soft tissue
   - Hard tissue
   - Combined

Lasers permit pediatric dentists to offer an integral management and are safe and successful when the operator has an

appropriate training. Applying laser for dental caries elimination, bone removal, and soft and hard tissues treatments can decrease postoperative infections and anxiety in infants, children, adolescents, and persons with special health care needs. In soft tissues will reduce the use of cutting armamentarium and sutures. Irreversibly, specific laser technologies including a combination of diagnostic and therapeutic approaches will become basic elements of modern dental practice.[7]

Laser Applications in Pediatric Dentistry

1. Hard tissue applications:[8]
   - Caries detection by laser induced fluorescence
   - Prevention of enamel and dental caries
   - Caries removal
   - Cavity preparation
   - Pit and fissure sealants
   - Curing light activated resins
   - Laser pediatric crowns
   - Bleaching of vital and non-vital tooth
   - Laser fusion of vertical root fracture
   - Removal of old restorative materials
   - Laser analgesia
   - Orthodontic tooth movement
   - Dental traumatology
2. Soft tissue applications: [8]
   a. Exposure of teeth to aid in tooth eruption
   b. Frenectomy
   c. Ankyloglossia
   d. Aphthous ulcers
   e. Herpes labialis lesions
   f. Dentigerous cyst
   g. Leukoplakia
   h. Treatment of mucocele
   i. Pediatric endodontics
   j. Gingival remodeling and Gingivectomy.

Mechanism of Laser Action: Laser light is a monochromatic light and consists of a single wavelength of light. It consists of three principal parts: An energy source, an active lasing medium, and two or more mirrors that form an optical cavity or resonator. For amplification to occur, energy is supplied to the laser system by a pumping mechanism, such as, a flash-lamp strobe device, an electrical current, or an electrical coil. This energy is pumped into an active medium contained within an optical resonator, producing a spontaneous emission of photons. Subsequently, amplification by stimulated emission takes place as the photons are reflected back and forth through the medium by the highly reflective surfaces of the optical resonator, prior to their exit from the cavity via the output coupler . In dental lasers, the laser light is delivered from the laser to the target tissue via a fiberoptic cable, hollow waveguide, or articulated arm . Focusing lenses, a cooling system, and other controls complete the system. The wavelength and other properties of the laser are determined primarily by the composition of an active medium, which can be a gas, a crystal, or a solid-state semiconductor.[9]

Laser safety: While most dental lasers are relatively simple to use, certain precautions should be taken to ensure their safe and effective operation. First and foremost is protective eyewear by anyone in the vicinity of the laser, while it is in use. This includes the doctor, chair-side assistants, patient, and any observers such as family or friends. It is critical that all protective eyewear worn is wavelength-specific. Additionally, accidental exposure to the non-target tissue can be prevented through the use of warning signs posted outside the nominal hazard zone, limiting access to the surgical environment, minimizing the reflective surfaces, and ensuring that the laser is in good working order, with all manufacturer safeguards in place.[10] With regard to prevention of possible exposure to infectious pathogens, high volume suction should be used to evacuate any vapor plume created during tissue ablation, and normal infection protocols should be followed. Each office should have a designated Laser Safety Officer to supervise the proper use of the laser, coordinate staff training, oversee the use of protective eyewear, and be familiar with the pertinent regulations.

Medico-legal considerations: Conservative soft tissue surgery with a dental laser is considered within the scope of accepted dental practice and typically considered a covered procedure under most professional liability insurance policies designed for dental specialists. Informed consent must be routine and is best handled as part of the

general consent form that all patients read and sign prior to the initiation of dental treatment. It is highly recommended that each clinician take a course from a reputable provider.[11]

CONCLUSION: Laser technology for hard tissue application and soft tissue surgery is at a high state of refinement, having had several decades of development, up to the present time, and further improvements can occur. The field of laser-based photochemical reactions holds great promise for additional applications, particularly for targeting specific cells, pathogens, or molecules. 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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How to cite this article: Singh G , Gupta K , Pandey M , Dwivedi A , Gupta S , Katyayan R. Lasers in Pediatric Dentistry: A Ray of Hope. Rama Univ J Dent Sci 2017 June;4(2):11-13.

Sources of support: Nil **Conflict of Interest**: None declared