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Understanding Laser-Tissue Interaction for Laser Selection in Clinical Procedures

Laser technology has revolutionized modern dentistry by enabling precise, minimally invasive treatments across various clinical applications. However, the effectiveness of laser procedures depends on understanding the fundamental interactions between laser photons and biological tissues. This study explores the principles of laser-tissue interaction to guide optimal laser selection for specific clinical procedures.
Different laser systems—such as Er:YAG, Er,Cr:YSGG, Nd:YAG, diode, and CO_2 lasers—interact uniquely with enamel, dentin, soft tissues, and bone. The absorption characteristics of water, hydroxyapatite, and organic components determine laser penetration depth, thermal effects, and tissue response. Studies have shown that Nd:YAG lasers enhance enamel resistance to demineralization, while diode lasers aid in bacterial reduction in periodontal therapy. However, excessive thermal exposure can cause undesirable effects, such as carbonization, coagulation, or collagen denaturation.
This presentation will discuss key parameters, including wavelength, fluence, pulse duration, and power settings, that influence treatment outcomes. Additionally, clinical applications of lasers in caries prevention, periodontal therapy, endodontics, and laminate venner will be reviewed.
Understanding laser-biomaterial interactions is critical to maximizing therapeutic benefits while minimizing adverse effects. By integrating fundamental laser physics with clinical knowledge, practitioners can make informed decisions to improve patient outcomes. Future research should focus on exploring novel laser-based treatment modalities.
Keywords: Laser dentistry, laser-tissue interaction, Er:YAG; Er,Cr:YSGG, Nd:YAG, diode laser, photothermal effects, clinical applications.

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Laser Assisted Endodontics: Beyond pulp space decontamination

Laser irradiation was first applied in Endodontics in 1971. By that time, little did we know about laser -tissue interaction, and all efforts for the next 40 years aimed at, either melting dentin and sealing dentinal tubules, and/or bacterial elimination (directly or indirectly). Several wavelengths were investigated for this, with varying success in either field. The advances in the field of Photo-Bio-Modulation therapy (PBM), evolved the goals of Laser- Assisted Endodontics, from being a pure antimicrobial procedure, to providing analgetic/anti-inflammatory and expediated healing – evident both in vital and non-vital pulp cases.