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ROLE OF DIODE LASER IN ORAL SOFT TISSUE SURGERY PROCEDURES

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Abstract:

Soft tissue diode lasers have gained recognition among medical professionals for their ability to provide surface sterilization, create a dry surgical field, and enhance patient comfort during surgical procedures. Diode lasers operating at wavelengths between 810-980 nm, either continuously or in pulsed mode, have emerged as valuable tools for intraoral soft tissue surgery. The primary aim of using diode lasers in oral surgery is to address the limitations of traditional surgical techniques and offer minimally invasive procedures with reduced patient discomfort. The feasibility of diode laser application in oral soft tissue surgery is based on the laser's absorption by tissue pigments and hemoglobin, while showing low absorption by hydroxyapatite and water. This article reviews the use of soft tissue diode lasers in managing oral mucosal lesions, including conditions like epulis fissuratum, ranula, mucocele, pyogenic granuloma, and hemangioma.

Keywords:

Diode lasers, oral mucosal lesions, oral surgery, pigments, soft tissue, wavelength.

Introduction

Laser technology, initially introduced in the 1960s, has found applications in both dental and medical fields. Laser, an acronym for "Light Amplification by Stimulated Emission of Radiation,"[1] generates a high-intensity, monochromatic electromagnetic radiation beam. In the realm of dentistry, particularly in oral surgery, laser systems and their applications are rapidly evolving. The adoption of surgical lasers in dentistry aims to overcome the limitations of traditional oral surgery procedures and offer minimally invasive techniques with reduced patient discomfort. Soft tissue diode lasers have gained prominence for their ability to sterilize surfaces, create a dry surgical environment, and enhance patient acceptance during surgeries. Diode lasers with wavelengths ranging from 810 to 980 nm, operating continuously or in pulsed mode, have proven effective in intraoral soft tissue surgery. These lasers are selected based on economic and ergonomic factors, leading to cost savings compared to other advanced laser devices[2.] Diode lasers are preferred for addressing soft tissue lesions due to their high success rates and effective absorption by chromophores such as hemoglobin and melanin, which are abundant in oral mucosa[3]. Common diode laser wavelengths studied include 808 nm, 810 nm, and 940 nm. They are employed in various procedures, including gingival contouring, operculectomy, and reshaping mucosa in edentulous areas. These lasers find particular utility in prosthetic surgical procedures like vestibuloplasty[4,5]. Studies have shown the effectiveness and safety of diode lasers in removing small exophytic lesions, offering ease of use, adequate coagulation, no need for sutures, reduced inflammation, and faster healing[8]. Therefore, diode lasers are recommended for the removal of benign oral lesions like ranula, mucocele, pyogenic granuloma, fibrous hyperplasia, fissure papules, and hemangiomas.

Materials and methods:

A comprehensive literature search was conducted from 2013 to June 2023 using databases such as PubMed, ResearchGate, Romanian Journal of Rehabilitation, and Journal of Oral Medicine, Oral Surgery, Oral Pathology, and Oral Radiology. The search terms included "Oral surgery," "diode laser," and "soft tissue." Inclusion criteria comprised full-text articles in English, reporting clinical trials and case series that used high-power diode lasers in oral surgery. Exclusion criteria involved articles in languages other than English, those not available in full text, and studies assessing different types of lasers or low-level laser therapy. Independent researchers reviewed titles and abstracts, leading to a detailed evaluation of 25 selected articles. The collected data encompassed the mode of laser application, patient satisfaction, healing patterns, ease of operation, and economic considerations. The review also included bibliographic details, author names, countries, publication dates, and affiliations.

Discussion:

The application of soft tissue lasers in treating oral mucosal lesions offers numerous advantages for both dentists and patients. Laser technology is commonly used for resecting lesions and conducting soft tissue surgeries. Benefits of using lasers include minimal bleeding during surgery, reduced swelling, scarring, and clotting, absence of sutures, shorter operation times, and reduced postoperative pain. Additionally, lasers instantly disinfect surgical wounds without causing mechanical trauma to tissue[6,7,8]. Diode lasers were introduced in dentistry and oral surgery in the mid-1990s[9,10], owing to their compact size, portability, and cost-effectiveness compared to other laser devices[11]. Surgical wounds created by lasers tend to heal without scarring due to minimal wound contraction, resulting from reduced induction and formation of myofibroblasts and collagen[12,13]. However, laser surgery may release fumes with a burning odor, which can be distressing for the patient. To mitigate this, powerful pneumatic suction devices should be used during surgery[14]. Diode lasers are believed to be effective in treating patients with coagulopathy, as they interact with hemoglobin, potentially eliminating the need for sutures and systemic drugs to manage postoperative pain and inflammation. The side effects and adverse consequences of diode lasers have been extensively studied. As a result, it is possible to avoid using sutures, which may serve as a haven for plaque accumulation. Because of these advantages, systemic medications are not necessary to manage postoperative pain and inflammation. To keep his mouth clean, the patient only has to use mouthwash; in other situations, he will additionally need to apply a local anesthetic, like 2% lidocaine. Numerous investigations have been conducted on the negative effects and detrimental outcomes of diode lasers. For contact

applications, holmium-doped yttrium aluminum garnet (Ho:YAG) and neodymium-doped yttrium aluminum garnet (Nd:YAG) are being studied at wavelengths of 830 and 940 nm. They discovered through histology analysis that the diode laser had a small thermal impact on the tissue surface's charred zone's depth[15]. In a different experimental investigation, Goharkhay et al. compared the histological effects of laser treatment on the oral mucosa of pigs using a surgical blade and a diode laser with a wavelength of 810 nm. They looked at the breadth, depth, and vertical and horizontal tissue damage in the oral mucosa. They demonstrated that epithelial damage happened, that the depth of damage depended on penetration, and that it strongly correlated with the average power used—rather than the tip diameter or other laser parameters[16] Romanos et al. According to Ishii et al., mucocele, gingival fibroids, hemangiomas, and frenectomy are examples of oral mucosal lesions that can be effectively treated with a diode laser[17]. Furthermore, Ishii et al. According to Kharadi et al., leukoplakia-related precancerous lesions can be successfully treated with lasers and have a lower chance of recurrence[18,19]. In their investigation of the effectiveness of diode laser therapy for oral leukoplakia, Darcangelo et al. achieved successful, problem-free recovery. & Amaral et al. discovered that greater coagulation during and after surgery, as well as decreased bleeding and edema at the surgical site, made diode lasers superior to traditional scalpels for the excision of oral soft tissue.It doesn't require sutures and doesn't leave any scars[20,21].In contrast to the CO2 laser group[22], diode laser excision of minor benign oral lesions was linked with a lack of postoperative problems in the majority of patients. The postoperative course of ten hemangiomas treated with a diode laser was investigated in a clinical case study.There was just one recurrence and no surgical complications noted after a six-month follow-up period[23]. An evaluation of the use of diode lasers with varying wavelengths (810-980 nm) for oral papilloma lesions was carried out. Thirty days after surgery, 95.4 patients had reported complete healing with no postoperative complications[24]. This case was treated with a diode laser under local anesthesia with noticeably better results, taking into account the role of the diode laser in the treatment of intraoral soft tissue lesions and its role in the treatment of OSMF reported in the literature. is acquired[25].

Conclusion:

Diode lasers have shown remarkable potential in the treatment of oral soft tissue lesions and maxillofacial diseases, providing numerous advantages over traditional surgical methods. Reports in the literature endorse replacing conventional scalpel procedures with diode lasers due to their benefits, such as minimal bleeding and pain, ease of debridement, reduced inflammation, shorter recovery times, and precise incisions resulting in excellent cosmetic and functional outcomes. These lasers also prove cost-effective, leading to higher patient satisfaction and compliance.They make exact incisions that result in a fantastic cosmetic and functional outcome. Aside from periodontal surgery, it can be regarded as the treatment of choice because of its quicker action, improved epithelialization, lack of bleeding, and improved healing

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