**Introduction**

Light amplification by stimulated emission of radiation (LASER) is an active medium stimulated for photon production within a defined monochromatic beam of predetermined wavelength. This highly intense laser beam belongs to spectrum composing of infrared and ultraviolet radiations. The use of laser therapy has dominated the dentistry world as an affordable and acceptable alternative to various conventional methods or combination with these surgical techniques. Since 1970, lasers have been integrated in to therapeutic applications in the fields of medicine and allied health sciences. The beginning of 1980s intimidates the new era of application of carbon dioxide lasers in dentistry in treating oral lesions. Neodymium yttrium-aluminum-garnet (Nd:YAG) laser was the first exclusive dental laser developed in 1987 for dental surgical procedures. The high concentration of chromophores in the gingival tissues makes diode laser highly efficient in surgical management of associated tissues. This highly tissue-specific diode laser is activated in contact mode providing adequate tactile feedback, which is a predetermined requisite for treatment procedure. The primary aim of pediatric dentistry is to provide the recommended dental care to pediatric dental patients in a calm and child-friendly environment. Laser has several applications in pediatric dentistry which includes diagnosis and prevention of dental caries, soft tissue surgeries, and endodontic therapies. The recent and widely acceptable advancements in laser application and modalities have made them the most reliable treatment option among pediatric population, thus signifying their application as a considerable alternative to the existing conventional surgical procedures.

**Case Descriptions**

**Case 1: Mucocele Excision**

A 6-year-old girl child reported to the Department of Pedodontics and Preventive Dentistry with the chief complaint of small nodule-like lesion which had a recurring history on lower lip since the past 6 months. On taking a detailed history, it was confirmed that the child had persistent habit of lip biting. The small lesion measured about 0.50 mm and exhibited pale pink color and was found to be located on contralateral surface of mandibular right lateral incisor. Based on the history and clinical observations, it was initially diagnosed to be a mucocele. The child also did not complain of any history of pain or associated symptoms. Treatment options were discussed with parents thereby detailing the expected and related risks as well as enlightening the advantages of laser treatment. The lesion was excised under local anesthesia using a diode laser with a wavelength of 980 nm in continuous mode at a power setting of 1.8 W.

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**Key words:** Diode laser, Laser treatment, Pedodontic dentistry.

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**Abstract**

Lasers have become an amicable and widely prospective treatment modality in pediatric dentistry. It’s high acceptability rate among children and adolescents has embedded in designing and formulating stress-free environment in pediatric dentistry. Among the versatile range of dental lasers, diode laser predominates in possessing variable wavelengths hence facilitating its applications on numerous and extensive surgical procedures. The cardinal advantages of the laser-assisted surgeries over the conventional scalpel and blade surgical procedures are well-determined precision of the surgical technique, lack of bleeding sites, lack of edematous surgical areas, no visible scar formation, and negligible postoperative pain for the patient. Pediatric dentistry is an age defined dental specialty encompassing and assimilating all aspects of child development. However, pediatric treatment modalities differ in greater extent than adult patients. Hence, it relies upon the pediatric dentist to be well-versed, familiar, and knowledgeable with regard to the child’s growth and development consistent with their subsequent age. This article presents with three case reports in which diode laser had been utilized for specified treatment modalities.

**Keywords:** Diode laser, Laser treatment, Pedodontic dentistry.
then excised by separating it from the adjacent mucosa amidst sufficient water cooling with wet gauze to maintain the adequate tissue temperature as well as to remove debris adhering to it. No suturing or medications were required for the above procedure. The patient was told to avoid the consumption of hot and spicy food for the day and was advised to avoid biting her lower lip with a 1 week follow-up (Fig. 1).

Case 2: Lingual Frenectomy
An 8-year-old boy reported to the outpatient section of the department with the chief complaint of difficulty in pronouncing certain letters in particularly “s”, “z”, “t”, etc., and unclear speech. On intraoral examination, it was identified that the patient had evident tongue-tie (Kotlow class II). The child’s tongue was restricted and hence was unable to reach the upper incisors and beyond the lower lip which was required for normal speech patterns to occur. The parents were very concerned about the present condition as it hampered the child’s confidence and also hindered his speech. Parental written informed consent was obtained after explaining in detail about ankyloglossia and the available treatment options required for it. Lingual frenectomy was planned using diode laser (Biolase®; Biolase Tech, San Clemente, California, USA) with a wavelength of 980 nm in continuous mode at a power setting of 1.8 Watts (W). Bilateral local anesthesia (one cartridge of 2% Lidocaine with Epinephrine 1:100,000) was recommended. The patient as well as the working dental personnel wore protective eye shields. The tongue tip was firmly immobilized, and the lingual frenum was dissected and released with a diamond-shaped incision using the laser beam. The muscle fibers were then separated from the floor of the mouth to enhance the tongue's mobility. The soft-tissue surface was cooled with air/water spray adjunct to high-speed evacuator. Hemostasis was adequately achieved and the soft-tissue surface was cooled with air/water spray adjunct to high-speed evacuator. The patient was told to avoid consuming hot and spicy food for the day followed by a 1 week follow-up. The follow-up was satisfactory with the teeth erupting in their exact positions (Fig. 3).

Discussion
Fear of needles is very common among children causes anxiety among them prior to receiving the treatment. Laser therapy is one such promising recent advances which relieves the patient from needle exposure. Lasers have been found to be highly useful when compared to other methods due to its easily manageable aspect within the oral cavity. Low-level laser acts on cell receptors and enhances healing, resultant repair of tissues, and reduces postoperative pain and inflammation thereby reducing the need for any local anesthetic agent for the procedure.6

The diode laser contains an active medium made up of semiconductor crystals of aluminum or iridium, gallium, and arsenic.6 The advocated wavelengths of 810–1064 nm is poorly absorbed by hard dental tissue, and hence, it is safe for oral surgical procedures.7 Continuous wave mode in diode laser is used for surgical procedures, and pulsed mode is used in frenectomy, endodontic therapy, and periodontal procedures. Continuous wave mode ablates tissue surface resulting in tissue damage. The resultant heat buildup is reduced by moving the laser beam at a rapid rate.8 The fiber in dental laser aids in directing the laser beam to the target tissue.8 The smaller the diameter of the fiber, the greater will be its density. All the three children in the discussed case reports exhibited Frankel’s Rating of 3 which defined that they exhibited a positive behavior while in dental clinic which was maintained throughout the procedure. Thus, laser therapy

Case 3: Exposure of Unerupted Teeth
A 9-year-old boy reported to the department with the chief complaint of missing upper right and left front teeth. On radiographic evaluation, it was revealed both the teeth were present in their respective positions; however, taking to consideration of parents’ concern and the child’s advancing age, decision was made for exposure of 12 and 22 using diode laser. Parental written informed consent was obtained after detailing the available treatment modalities for the condition, and exposure of unerupted teeth was planned using diode laser (Biolase®; Biolase Tech, San Clemente, California, USA). The wavelength was of 980 nm in continuous mode at a power setting of 1.8 W, and the procedure was carried out under local anesthesia of 2% Lidocaine with Epinephrine 1:100,000. The child and the dental personnel were protected with protective eye shields.

A small window was created using diode laser on either side on respective positions of 12 and 22 to facilitate their eruption. Hemostasis was adequately achieved and the soft-tissue surface was cooled with air/water spray adjunct to high-speed evacuator. The patient was told to avoid consuming hot and spicy food for the day followed by a 1 week follow-up. The follow-up was satisfactory with the teeth erupting in their exact positions (Fig. 3).

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![Image 1A to C: (A and B) Preoperative view of mucocele; (C) Postoperative view](image-url)
Figs 2A to D: (A) Preoperative view of lingual frenum; (B) Intraoral view while performing frenectomy; (C) Sutures placed; (D) Postoperative view after 1 week

Figs 3A to D: (A) Preoperative view of unerupted teeth; (B and C) Intraoral view while performing exposure; (D) Postoperative view after 1 week
can thus reduce fear and anxiety among children as well as adults during the dental visits.\(^9\)

Several laser studies conducted have evidently shown that children appear to be more cooperative during treatments procedures using laser therapy. The various applications of laser technology in pediatric dentistry include caries detection and prevention, restorations, pit and fissure sealants, soft-tissue laser ablation, primary tooth endodontics, traumatology, disinfection and decontamination, and exposure of unerupted teeth.\(^10\)

The removal of mucocele using laser technology provides adequate healing, considerably no blood loss and absence of any postoperative discomfort and pain.\(^10\) The absolute mean time required to effortlessly carry out this procedure was approximately only 3–5 minutes when compared to the cumbersome conventional treatment methods. Sutures were not used in case report 1 due to the pertaining advantages of laser therapy, and the wound would gradually heal by secondary intention over time. The healing progressed with no complications. In 2015, Pagila et al. reported a similar case scenario of mucocele removal in a 3-month-old infant using diode laser technology which reported adequate wound healing within 2-week time period.\(^13\) Ramkumar et al. also reported similar case of mucocele excision with a diode laser in a 16-year-old patient in which he stated the reduced procedural time and hemostasis while using diode laser.\(^11\) Several dental appliances have been advocated for restricting and controlling lip biting habit. These include lip bumpers, soft mouth guards, occlusal coverage/splint, oral screen, etc. Psychological management always remains the primary mode of treatment in management of any oral habit. However, a considerable aspect of this lesion is that this habit can be a manifestation of underlying medical or psychological problems in the child. Since the child was cooperative and willing to rectify the habit, adequate counselling was provided to both the parents and child regarding the ill effects of lip biting, and the subsequent follow-up revealed that the child had discontinued the deleterious habit.\(^11\)

Frenectomy with high-power laser has been widely studied by several authors, regardless of the type of surgical laser used.\(^12\) In a study performed in 150 patients, in which frenectomies were performed, the qualitative and quantitative postoperative symptomatology was evaluated. Sixty-eight percent of the patients reported no symptoms, while 32% of the patients reported some symptoms, and among these, 83% used analgesic (oral) for up to 48 hours.\(^13\) Also, 100% of the patients reported that the procedure was well tolerated and “acceptable,” with no recurrence after 4 years of evaluation.\(^13\) During the follow-up, it was revealed that there was considerable improvement in the child’s speech and pronunciation as reported by the child’s parents. The child was reportedly undergoing speech sessions in a nearby speech therapy institute which also helped in tremendous change in child’s speech following the laser frenectomy.\(^13\)

Opareculotomy is the surgical excision or ablation of the painful, inflamed, or infected operculum by a wide variety of techniques including scalpel, caustic agents, radiofrequency surgery, electrosurgery, cautery, CO\(_2\) laser, or hot-tip diode surgery. Opareculotomy, however, is also advocated as a precaution to prevent pericoronitis; it is most commonly associated with third molar due to thick flap of tissue or operculum covering the third molar region, though at times it can be seen associated to some primary and permanent teeth as well.\(^13\) Tooth eruption is advocated to be a delayed process, if the tooth emergence into the oral cavity occurs at a time which is considerably deviating from normal pattern established according to the person’s sex and background.\(^13\) A permanent tooth normally considered to erupt no lesser than 6 months after natural preexisting timeline following the exfoliation of its predecessor. Roberts-Harry et al., in their studies, confirmed that exposure of unerupted teeth using lasers provided better acceptability to both dentists and patients.\(^14\)

The laser fiber tip is positioned in a sweeping manner on the surgical surface to achieve adequate hemostasis leading to surface carbonization of the lesion; hence, due to this carbonization, sutures are not recommended following laser surgeries, and surgical site is left to heal by secondary intention. Wound healing is accelerated by several adjunctive sources of vitamin E, adequate fats, minerals, cyanoacrylate, etc. Post laser surgical procedures in all the three discussed case scenarios, vitamin E supplementation was advised. Vitamin E is a group of compounds that include both tocopherols and tocotrienols. Vitamin E possess high antioxidant property, increases neurological functions, enhances enzyme mechanism, and promotes increased healing of surgical sites.\(^15\) All the three different case scenario thus highlight that the diode laser has wide variety of applications that can be effectively used in management of oral lesions in a convenient manner.

**Conclusion**

Diode laser has shown to be able to supply an exhaustive therapeutic efficacy in the different clinical situations together with a precise and fast performance, speeding restorative tissue processes, reducing pain and postoperative edema.\(^16\) These peculiar characteristics make the diode laser a user-friendly tool of undoubted help in different pediatric dentistry. Its avid application of ease of use, better hemostasis, no suture technique, and considerable absence of postoperative pain thus signifies that diode lasers can be used as an acceptable treatment aid in pediatric patients. The use of high-power diode laser can be a satisfactory alternative to conventional surgical techniques in pediatric patients, providing better postsurgical conditions.\(^17\)

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