

Clinical Applications of Diode Laser in Periodontal Therapy – Case Series

Dr. Asha Prabhu, Dr. Shubhangi Rajbhoj, Dr. Jyotsna Anjankar,
Dr. Munaf Maknojia

I. Introduction

A laser is a device that produces coherent electromagnetic radiation. The term "Laser" is an acronym for Light Amplification by Stimulated Emission of Radiation. In 1960, Synthetic ruby laser was the first laser introduced by **Theodore Maiman**.¹ Laser radiation is characterized by a low divergence of the radiation beam and, with few exceptions, a well-defined wavelength. Laser light is produced by pumping (energizing) a certain substance, or gain medium, within a resonating chamber. The various laser systems are usually named after the ingredients of the gain medium, but three factors are important for the final characteristics of the laser light: composition of the gain medium, source of pump energy, and design of the resonating chamber. Currently, numerous laser systems are available for dental use Neodymium-doped : Yttrium-Aluminium- Garnet (Nd:YAG), Carbon dioxide (CO₂) and Semiconductor diode lasers which are approved by USA FDA.²

There are numerous soft tissue procedures which can be performed with lasers like gingival soft tissue procedures such as gingivectomy, frenectomy, gingivoplasty, epulis or benign tumors removal, gingival depigmentation, second stage exposure of dental implants, irradiation of aphthous ulcers, coagulation of free gingival graft donor sites, and soft tissue crown lengthening.³

The two key features of laser use compared to conventional techniques :

1. Reduced bleeding intra-operatively
2. Less pain post-operatively

The degree of absorption in key tissue components dictates the type of effect gained by the laser on soft tissues. In this regard the content of **water and haemoglobin** in oral tissues is important for the efficient absorption of many commonly used dental lasers. The diode laser has become an important tool in the dental armamentarium due to its exceptional ease of use and affordability. It also has key advantages with regard to periodontal treatment. Diode laser is well absorbed by melanin, haemoglobin, and other chromophores that are present in periodontal disease. It has an excellent soft tissue surgical laser since it does not interact with dental hard tissues. The article includes a case series of clinical applications of the diode laser in the following periodontal therapeutic procedures.³

1. Gingivectomy and Gingival Melanin Depigmentation
2. Frenectomy
3. Laser Assisted New Attachment Procedure (LANAP)
4. Root Desensitization

Case 1- Gingivectomy and Gingival Melanin Depigmentation using Laser

A 25 years old male patient reported to Dr G.D Pol Foundation Y.M.T dental college, Kharghar, Navi Mumbai with chief complaint of black gums (gingival hyperpigmentation). Clinical examination revealed generalized diffused blackish pigmentation of gingiva with small clinical crown height. Treatment was explained to the patient and informed consent was taken. Oral prophylaxis were performed before surgery. Local anaesthesia was given. Bleeding points marked using crane Kaplan forceps. Gingivectomy was performed using diode laser at 1W in continuous wave mode in contact mode. Gingival depigmentation was followed after gingivectomy using diode laser at 1.5 W in continuous wave mode in contact mode. The laser beam was guided in a '**brushstroke**' pattern from the mucogingival junction towards the free gingival margin including the interdental papilla until the entire area is free of pigmentation. (Image 1)

Case 2- Frenectomy using laser

A 30 years old female patient reported to Dr G.D Pol Foundation Y.M.T dental college, Kharghar, Navi Mumbai with chief complaint of receding of gums and spacing between her upper front teeth. On Clinical examination inflamed gingiva with 2mm clinical attachment loss with 11 and 12, along with papilla penetrating frenum was observed. Treatment was explained to the patient and informed consent was taken Oral prophylaxis were performed before surgery. Local anaesthesia was given. Frenectomy was performed using

diode laser at 0.8 W in continuous wave mode in contact mode. The fibres were released and periodontal pack was given and patient was recalled after a week for removal of pack and to check healing. (Image 2)

Case 3 - Laser Assisted New Attachment Procedure (LANAP)

A 35 year old female patient reported to Dr G.D Pol Foundation Y.M.T dental college, Kharghar, Navi Mumbai with chief complaint of bleeding of gums. On Clinical examination generalized gingival inflammation was seen with periodontal pockets (5-6 mm) in posterior regions of both maxilla and mandible. Treatment procedure was explained to patient and informed consent was taken. Full mouth scaling was performed and after a period of three weeks periodontal pockets were reevaluated. The pocket depth was 5mm in posterior teeth. Laser Assisted New Attachment Procedure (LANAP) was then planned and performed using diode Laser at 0.8 W continuous wave mode for 30 sec on each side of tooth in contact mode. Use of local anaesthesia was minimal. Patient was recalled after 3 weeks and 6 weeks. Bleeding on probing was reduced and a reduction of pocket depth around 1 mm was observed following 6 weeks of recall.(Image 3)

Case 4- Root Desensitization using laser

A 36 year old male patient reported to Dr G.D Pol Foundation Y.M.T dental college, Kharghar, Navi Mumbai with chief complaint of receded gums and sensitivity. On Clinical examination generalized recession of gingiva was seen and sensitivity was present. Treatment procedure was explained to patient and Informed consent a was taken. Root desensitization was performed using diode laser at 0.5 W in continuous wave mode, non contact method for 2 min each tooth. Patient was recalled after 4 weeks and reported decreased in sensitivity.(Image 4)

II. Discussion

The diode laser is a solid-state semiconductor laser that typically uses a combination of **Gallium (Ga), Arsenide (Ar), and other elements such as Aluminum (Al) and Indium (In)** to change electrical energy into light energy. The wavelength range is about **800– 980 nm**. The laser is emitted in continuous-wave and gated-pulsed modes. It is usually operated in a contact mode using a flexible fiber optic delivery system. Laser light at 800–980 nm is poorly absorbed in water, but highly absorbed in hemoglobin and other pigments .The advantages of diode laser over scalpel technique is less pain, no bleeding , patient comfort, no requirement of suturing, minimal swelling and scarring post-operatively, reduction in surgical time.⁴ **Umberto R et al.(2012)** compared the effectiveness of GaAlAs diode laser alone and with topical sodium fluoride gel (NaF) for dentinal hypersensitivity and concluded that diode laser is a useful device for dentinal hypersensitivity treatment if used alone and mainly if used with NaF gel.⁵

Agarwal N etal.(2014) reported a case on the cosmetic correction of gingival depigmentation using a diode laser. The results showed an excellent outcome with diode laser and without post operative pain.⁶**Butchibabu K et al.(2015)** did comparative evaluation of the gingival depigmentation by using a surgical blade and a diode laser and concluded that diode laser were esthetically pleasing with great patient comfort ,less bleeding and no pain as compared to surgical blade.⁷ **Mahmoud et al .(2014)** conducted a study to assess Diode Laser(DL)therapeutic effects on chronic periodontitis and concluded that bleeding on probing ,pocket depth and microbial count was less in study group compared to control group.⁸

With beneficial properties over conventional scalpel that includes relative ease of ablation of soft tissue,hemostatsis,instant sterilization,reduced bacterimia,little wound contraction,reduced edma ,minimal scarring,reduced mechanical trauma,less operative and post-operative pain,faster healing,increased patient acceptance ,no sutures and requiring very little anaesthesia soft tissue lasers can be widely used as a tool for gingival soft tissue procedures.⁸

III. Conclusion

Diode laser surgery can be performed safely in close proximity to dental hard tissue. All the procedures carried out in the above study were minimally invasive and more comfortable to the patients when compared with conventional techniques. Also, postoperatively, no pain was experienced by the patient and no swelling or any other signs of infection were noticed.Hence diode laser is a safe mode of treating many periodontal conditions.

References

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Image 1: Gingivectomy And Gingival Melanin Depigmentation Using Laser



Preoperative



Gingivectomy Using Diode Laser At 1W In Continuous Wave Mode.



Gingival Depigmentation Using Diode Mode



Laser At 1.5 W In Continuous Wave

One month post operative

Image 2: Frenectomy using laser



Pre -operative



Frenectomy using diode



Immediate Post

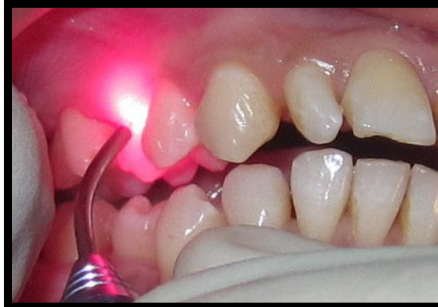


One Month Follow up

Image 3.Laser Assisted New Attachment Procedure (LANAP)



5mm periodontal pocket with 16



LANAP by diode Laser at 0.8 W continuous wave mode for 30 sec on each side of tooth



6 weeks post-operative

Image 4: Root Desensitization using laser



Root desensitization by using diode laser at 0.5 W in continuous wave mode, non contact method for 2 min