Case Report

Clinical Applications of 980 nm Diode Laser for Soft Tissue Procedures in Prosthetic Restorative Dentistry

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Abstract:

The purpose of these case reports is to analyze the results of gingivectomy and gingival troughing to determine the evidence on the effectiveness of laser-assisted soft tissue procedures and soft tissue management in aesthetic dentistry.The patients in these case reports underwent 980 nm diode laser assisted gingivectomy and gingival troughing to achieve immediate hemostasis and moisture control, adjunctive to the aesthetic restoration of the carious lesion and prosthetic rehabilitation of the posterior tooth.Successful healing of gingival tissues has been observed after 15 days in both cases. Also, laser assisted gingival tissue management allowed the operator to finish and polish the restoration on the same day.The ability of soft tissue lasers to control moisture and facilitate hemostasis appears particularly promising for clinicians excising gingival tissue, and using resective techniques for gingival troughing. Treatment with a dental laser ensures a successful aesthetic procedure with proper tissue form, function and biocompatibility.

Keywords: diode laser; dental esthetic; electrocautery; gingival troughing

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Introduction

Over the past two to three decades, the dental profession has witnessed a shift from the disease-oriented restorative procedures to elective cosmetic procedures (1). Improvements in technology and materials have given the general, as well as cosmetic dentist many more options for treatment. This has improved the efficiency and predictability of aesthetic prosthetic-restorative dentistry for clinicians. One technology that has become increasingly utilised in clinical dentistry is the use of lasers (2).

A laser is a device which transforms light of various frequencies into a chromatic radiation in the visible, infrared, and ultraviolet regions with all the waves in phase capable of mobilizing immense heat and power when focused at close range (3).

Based on Albert Einstein's theory of spontaneous and stimulated emission of radiation, Maiman invented a pulsed ruby laser 1960 (4). The second laser to be developed was the neodymium laser (5). However, the current relationship of dentistry with the laser takes its origins from an article published in 1985 by Myers and Myers describing the in vivo removal of dental caries using a modified ophthalmic Nd:YAG laser (6). Four years later, it was suggested that the Nd:YAG laser could be used for oral soft tissue surgery (7). American Dental Technologies (ADT) pioneered laser use in dentistry and obtained FDA clearance in 1990 for laser-assisted soft tissue procedures (8).

There are different types of lasers based on their operating wavelength. Diode laser is becoming one

of the most popular types due to its portability, light weight and versatility. Diode laser is a solid active medium laser, manufactured from semiconductor crystals using some combination of aluminium or indium, gallium and arsenide to change electric energy into light energy. The available wavelength for dental soft tissue use ranges from 800nm for the active medium containing aluminium to 980 nm for the active medium composed of indium. The diode is an excellent soft tissue laser indicated for sulcular debridement and soft tissue surgical procedures (9) .

This article will discuss two applications of 980nm diode laser in cosmetic dentistry.

Case 1: Laser Assisted Gingivectomy

A 25-year-old female patient reported to the outpatient section of the department of conservative dentistry and endodontics, with the chief complaint of decayed tooth in the lower right back region. Clinical examination revealed dental caries in 44, extending subgingivally (Figure 1A). A few drops of xylocaine (Lignox, Warren Pharma) were infiltrated and laser assisted gingivectomy was performed with 980 nm diode laser (Sirolaser, Sirona, The Dental Company),with optical fibre thickness 320 µm, operating with a power of 1.5 W in continuous mode (Figure.1B). Class V cavity preparation was done. The patient hardly noticed any discomfort and there was absolutely no bleeding. the cavity was restored with a nano-ionmer restorative material (Ketac N 100, 3M ESPE) (Figure. 1C).Finishing and polishing of the restoration was performed on the same appointment. Patient was recalled after 15 days and successful healing of gingiva was observed (Figure.1D).

Case 2: Laser Assisted Gingival Troughing

A 23-year-old female patient reported to the outpatient section of the department with the chief complaint of pain in the lower right back region. After complete clinical and radiological examination, a diagnosis of irreversible pulpitis was made. Root canal therapy was completed and access cavity was sealed with miracle mix restoration (Figure.2A). Prior to impression making, few drops of xylocaine

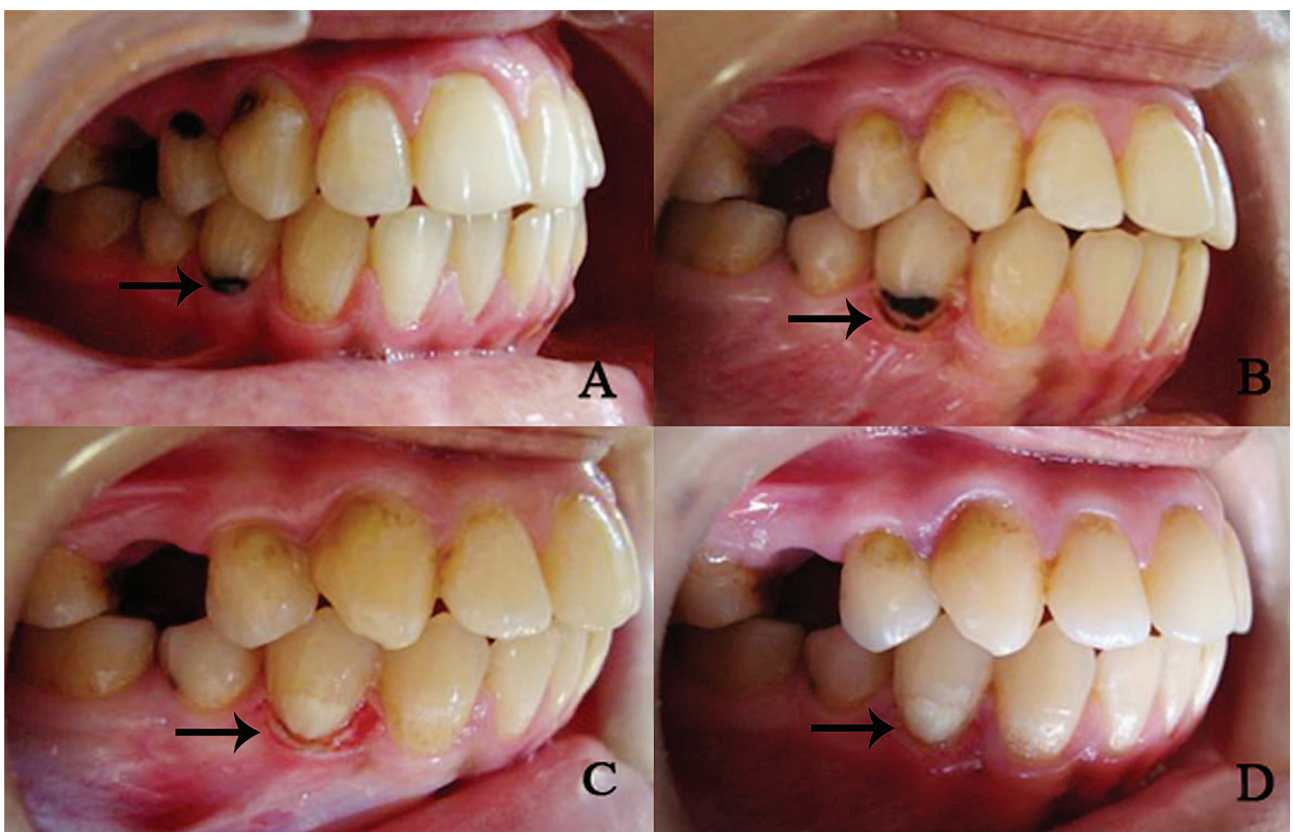

Figure 1. (A) Preoperative photo, (B) Laser assisted gingivectomy performed with 980nm diode laser, (C) Cavity preparation and restoration, (D) Successful healing of gingival observed after 15 days.

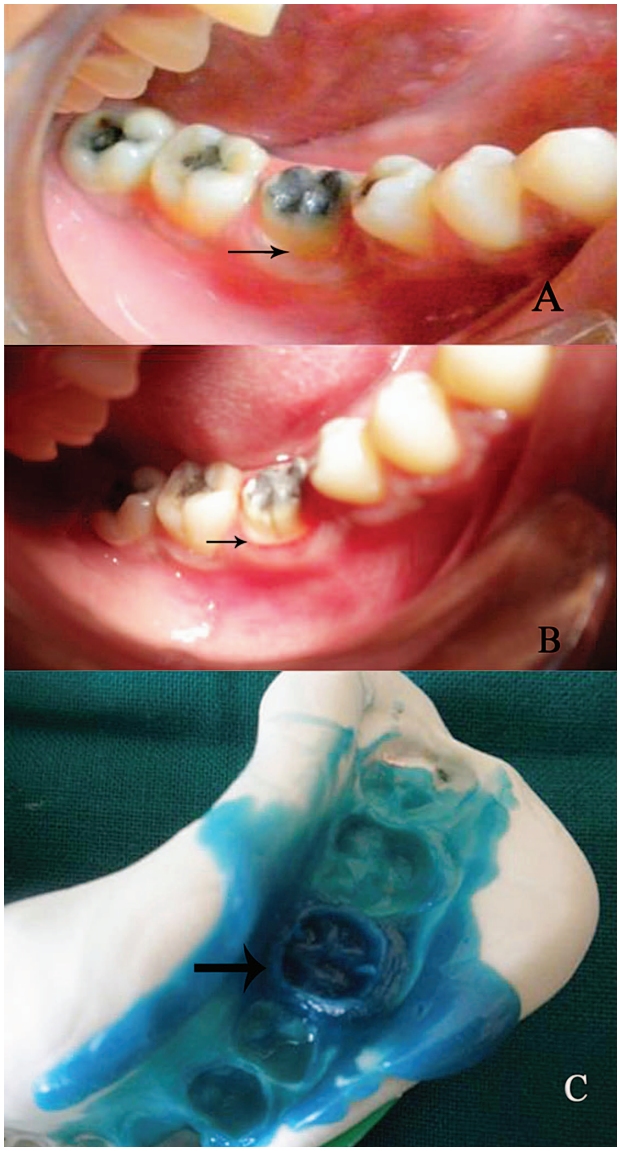

Figure 2. (A) Preoperative photo, (B) Crown preparation after laser assisted gingival troughing using 980 nm diode laser, (C) Finish line clearly observed in the impression.

(Lignox,warren pharma) were infiltrated and gingival troughing was accomplished using 980 nm diode laser (Sirolaser, Sirona, The Dental Company),with optical fibre thickness 320 µm, operating with a power of 1.5 W in continuous mode to adequately displace the gingival (Figure 2B). Tooth preparation was finished for porcelain fused to metal crown and impression was taken with putty-wash technique using condensation silicone (Figure. 2C).

Discussion

Esthetics in dentistry, is a philosophy concerned especially with the appearance of a dental restoration, as achieved through its color or form (10). The goal of aesthetic dentistry is to produce invisible restorations that provide proper form and function to achieve tissue biocompatibility. Two separate issues appear vital for success when performing aesthetic general dentistry. The first is achieving adequate isolation of the operative site, including isolation from moisture contamination, as in class V carious lesion, extending subgingivally (11). The traditional surgical approach utilizing a scalpel blade exhibits the disadvantage of eliciting bleeding, which is a concern particularly if restorative dentistry is to be performed subsequently. Electrosurgery has been utilized effectively to excise gingival tissue, while simultaneously providing adequate hemostasis (12). However, the problem with this technique is the lateral heat generation, which can cause necrosis of the alveolar crest, leading to recession and exposure of restorative margins (12,13). This becomes detrimental within the esthetic zone. This problem is controlled by laser technology, by sealing the blood vessels and leaving the healthy tissue intact; the caries removal and restoration then can proceed at the same appointment time (11). Lasers offer the potential of increased operator control and minimal collateral tissue damage. Diode lasers, specifically, operate at a wavelength that is easily absorbed by the chromophores (melanin and haemoglobin) in the gingival tissues, while posing little risk of damaging the tooth structure (14).

The second point for cosmetic success are the impression procedures for fabrication of indirect restorations. Exposure of subgingival finish lines in conjunction with adequate moisture control are prerequisites for the achievement of accurate impressions. A double-cord retraction technique has been advocated to mechanically displace the sulcus, providing access to the finish line so that it may be adequately captured by the impression material (15). However, the double retraction cord technique is considered cumbersome by many clinicians. Diode lasers offer the potential of utilizing a resective technique for gingival troughing, which simplifies the impression procedures while providing adequate hemostasis and allowing improved control of heat transfer to the adjacent tissues (16).

Conclusion

In everyday practice, the patients' clinical needs are

varied and unpredictable. Essential to the running of a successful practise is the recognition of the dentist's capability of meeting the patient's expectations. Each preparation is rendered unique through individual clinical demands. Not least of these is the demand on soft tissue management, from the desire to excise gingiva that can hide a finish line or a carious lesion and the desire for predictable gingival retraction to the elective resection of soft tissue as part of a complex cosmetic procedure. The correct use of laser wavelengths as an adjunct to prosthetic restorative procedures can enhance the predictability, accuracy and speed of case management.

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