LASER- ASSISTED CROWN LENGTHENING: A CASE REPORT

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Abstract:

Laser-assisted crown lengthening is a minimally invasive procedure used to expose more tooth structure for restorative and aesthetic purposes. In this case report, a 35-year-old patient underwent crown lengthening using a diode laser, chosen for its precision, minimal bleeding, and faster healing. The procedure was completed in a single session without the need for sutures. The patient reported minimal discomfort and experienced rapid recovery. Post-operative results showed improved gingival contour and tooth exposure, with successful healing and no complications. This technique offers an effective, modern alternative to traditional surgical methods.

Keywords: *crown lengthening, laser dentistry, diode laser, minimally invasive*

INTRODUCTION

Crown lengthening is a key procedure in restorative and aesthetic dentistry, where increasing the exposure of the tooth's supragingival structure is critical for successful outcomes.

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The procedure involves the removal of both hard and soft periodontal tissues, extending the visible portion of the tooth, thereby providing adequate space for restorative materials and ensuring proper biologic width. Biologic width, first described by Cohen (1962), refers to the combined height of the junctional epithelium and supracrestal connective tissue attachment [1]. Gargiulo et al. (1961) measured this dimension in humans and found that, on average, it is approximately 2.04 mm, a critical measurement for maintaining periodontal health and preventing inflammation around restorations [2].

Crown lengthening can be divided into two primary categories: aesthetic and functional.

Aesthetic crown lengthening is performed to improve the appearance of the patient's smile, particularly in cases of a "gummy smile," while functional crown lengthening is necessary when there is insufficient tooth structure available for a crown, filling, or other restorative procedure. In both cases, achieving the correct biologic width is essential to avoid potential complications such as chronic inflammation, bone loss, or gingival recession [1].

Traditionally, crown lengthening was performed using scalpel-based techniques or electrosurgery, both of which come with certain limitations, including prolonged healing times, more postoperative pain, and greater bleeding during the procedure. With the development of laser technology, particularly diode lasers, the landscape of crown lengthening has transformed. Diode lasers, operating in the near-infrared spectrum, offer numerous advantages over

conventional methods:

1. Precision: Diode lasers allow for extremely precise tissue removal, which is crucial in delicate areas around the teeth and gums. This precision leads to more predictable outcomes and less trauma to the surrounding tissues [3].
2. Reduced Bleeding: One of the key advantages of diode lasers is their ability to coagulate blood vessels as they cut, significantly reducing intraoperative bleeding. This not only improves visibility for the clinician but also minimizes the need for suturing and results in a cleaner surgical field [4].
3. Less Postoperative Discomfort: Diode lasers are minimally invasive, meaning patients generally experience less postoperative pain and discomfort. The reduced trauma to tissues accelerates healing times and often eliminates the need for prescription pain medications [5].
4. Faster Healing: With reduced tissue trauma and a lower risk of infection, patients undergoing diode laser crown lengthening typically experience faster recovery times compared to traditional surgical methods. This can be especially beneficial in restorative cases where a quicker turnaround is needed for follow-up procedures [3,6].
5. Better Aesthetic Outcomes: The precision of the diode laser allows for smoother, more controlled tissue contours, resulting in better aesthetic outcomes, particularly in cases of aesthetic crown lengthening where gum line symmetry and appearance are paramount [7].
6. Bactericidal Effects: Diode lasers possess inherent bactericidal properties, which can help reduce the bacterial load in the surgical area, promoting healthier tissue regeneration and lowering the risk of postoperative infections or complications [4].
7. Minimally Invasive Approach: The use of a diode laser typically eliminates the need for scalpel incisions and sutures. This minimally invasive approach is associated with reduced patient anxiety, faster procedure times, and improved patient acceptance of the surgery [5].
8. Laser Settings Customization: The versatility of diode lasers allows clinicians to adjust the wavelength and power settings, customizing the treatment to individual patient needs. This adaptability ensures optimal control over tissue removal and can accommodate a range of soft tissue densities [3].

This article presents a case report on diode laser-assisted crown lengthening. The diode laser provided several clinical benefits, including enhanced precision, better management of soft tissues, and significant improvements in patient comfort. Each case

demonstrates how diode lasers can be a valuable tool for both functional and aesthetic crown lengthening, providing predictable and effective results. The reduced intraoperative bleeding, faster healing, and patient satisfaction highlight the diode laser as a superior alternative to conventional methods for crown lengthening procedures in modern dentistry [6].

CASE REPORT

A 30-year-old male patient presented with a complaint regarding the inadequate clinical crown height of tooth 37. Upon clinical evaluation, it was determined that the clinical crown was significantly shorter than the anatomic crown. The patient had previously undergone root canal treatment on this tooth two years prior, resulting in an insufficient clinical crown height for the placement of a fixed dental prosthesis.

To ensure safety, the operator, patient, and assistant all donned protective eyewear, adhering to the FDA's laser safety regulations. Plastic instruments were utilized throughout the procedure to minimize the risk of laser beam reflection. Prior to the surgical intervention, a topical anesthetic gel was applied to the targeted area to enhance patient comfort. The diode laser was employed at an energy setting of 1.5 watts in Continuous Wave (CW) mode. The laser tip was utilized with small brush-like strokes, progressing deeper along the initial incision to effectively excise the excess tissue. Maintaining a continuous motion of the laser tip helped to prevent excessive heat accumulation and tissue damage, while also ensuring precise control over the surgical field. After the ablation, any residual tissue was carefully removed using sterile gauze soaked in saline solution, promoting a clean operative area and minimizing the potential for postoperative complications.

Postoperatively, the patient was prescribed analgesics to manage any discomfort, although they reported no pain or adverse effects during the procedure or in subsequent follow-up appointments. Comprehensive postoperative care instructions were provided to ensure optimal healing and recovery.

Preoperative view

Crown Lengthening using diode laser

Postoperative view

Immediate Intra operative view

DISCUSSION

Laser technology, an acronym for Light Amplification by Stimulated Emission of Radiation, was first developed and successfully demonstrated by Theodore H. Maiman on May 16, 1960 [8]. Lasers in dentistry are classified based on their depth of tissue penetration: those with deeper tissue penetration, such as Nd:YAG and diode lasers, and those absorbed predominantly in the superficial layers, such as Er:YAG lasers [9].

Diode lasers, a type of solid-state semiconductor laser, are composed of materials like Gallium (Ga), Arsenide (As), and often include elements such as Aluminum (Al) and Indium (In). These lasers operate at wavelengths typically between 810 and 980 nm, making them highly effective in soft tissue procedures due to their selective

absorption in pigments like hemoglobin while being poorly absorbed in water [10].

When diode laser energy interacts with biological tissues, several reactions can occur: reflection, transmission, and absorption. Upon absorption, the tissues undergo a series of thermal effects starting with heating (37°C to 60°C), followed by protein denaturation and coagulation at temperatures exceeding 60°C. At higher temperatures (70°C to 900°C), tissue welding occurs, and beyond 100°C, tissue vaporization takes place. Carbonization of tissue is observed at temperatures above 200°C [11]. Given their minimal interaction with water and selective absorption in chromophores like hemoglobin, diode lasers are particularly effective in achieving coagulation and hemostasis during soft tissue procedures [12].

A distinct advantage of diode lasers is their minimal interaction with dental hard tissues, allowing procedures to be safely performed in close proximity to enamel, dentin, and other hard tissues. Rapid cell vaporization, caused by the loss of intracellular fluid and denaturation of proteins, results in a less pronounced inflammatory response. This reduced inflammation leads to less postoperative pain, edema, and faster healing [13]. Additionally, because diode lasers limit trauma to surrounding tissues, less local anesthesia is required compared to traditional scalpel-based surgeries [14].

Indications for Crown Lengthening

Crown lengthening can be categorized into functional and aesthetic indications:

a. Functional Crown Lengthening:
    - To access subgingival caries or tooth structure.
    - To increase the clinical crown height when reduced due to tooth wear, subgingival caries, or fracture.
    - To correct situations where the biologic width has been invaded by restorative margins.
b. Aesthetic Crown Lengthening:
    - To correct short clinical crowns due to excessive gingival display or altered passive eruption.
    - To create gingival symmetry within the smile line.
    - To correct uneven or irregular gingival margins.
    - To address gingival overgrowth due to hyperplastic tissue.

Contraindications

- Certain conditions contraindicate crown lengthening procedures, including Poor crown-to-root ratio.
- Non-restorability of the tooth due to extensive caries or root fractures.
- High furcation involvement.
- Unfavorable tooth-to-arch relationships [15].

Advantages of Laser Surgery

The use of laser technology in crown lengthening offers several key advantages over traditional scalpel-based procedures:

- Greater precision in soft tissue removal, allowing for fine control with minimal damage to adjacent structures.
- A largely bloodless operative field, improving visibility for the clinician and reducing the need for sutures.
- Sterilization of the surgical site, decreasing the risk of postoperative infections.
- Reduced swelling and scarring, leading to faster healing and improved aesthetic outcomes.
- Effective tissue coagulation and vaporization, which minimizes postoperative discomfort and pain.
- Reduced need for sutures, making the procedure less invasive.
- Shortened postoperative recovery times with minimal or no discomfort reported by patients [13,16].

The benefits of diode laser technology make it an indispensable tool in modern periodontal and restorative dentistry. Its precision, reduced patient discomfort, and superior clinical outcomes, especially in crown lengthening, highlight its value in achieving both functional and aesthetic goals.

CONCLUSION

Crown lengthening using diode laser technology offers a highly effective, minimally invasive alternative to traditional surgical techniques. The precision of the diode laser allows for greater control over soft tissue removal, ensuring minimal damage to adjacent tissues while promoting faster healing, reduced postoperative pain, and superior aesthetic outcomes. The ability of the diode laser to provide hemostasis, sterilize the surgical site, and eliminate the need for suturing makes it an excellent option for both functional and aesthetic crown lengthening procedures. As diode laser technology continues to advance, its application in periodontal therapy is likely to expand, providing clinicians with enhanced capabilities to improve patient outcomes. Further research and clinical trials will help refine laser protocols, optimize results, and solidify its role in modern dental practice.

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Conflict of Interest: None