Research Article

Diode Laser-Assisted Crown Lengthening For Interdisciplinary Rehabilitation of An Endodontically Treated Tooth: A Case Report

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Abstract

Background: Rehabilitation of endodontically treated teeth with inadequate remaining coronal tooth structure can be challenging when sufficient clinical crown height is unavailable for predictable restorative rehabilitation. Crown lengthening may be required to expose sound tooth structure while maintaining periodontal health and respecting the supracrestal tissue attachment. Diode lasers offer a precise approach for selected soft-tissue procedures, with the potential advantages of controlled tissue ablation and effective hemostasis.

Case Presentation: A 45-year-old female presented with an endodontically treated mandibular posterior tooth with severely compromised coronal tooth structure and inadequate clinical crown height for definitive restoration. Following interdisciplinary treatment planning, soft-tissue crown lengthening was performed using a 980-nm diode laser at 3 W in continuous-wave mode. No osseous resection was required. The procedure provided adequate exposure of sound coronal tooth structure for subsequent prosthodontic rehabilitation. Post-space preparation, metal post placement, staged provisionalization, and definitive metal crown rehabilitation were subsequently completed.

Conclusion: This case demonstrates the clinical application of 980-nm diode laser-assisted soft-tissue crown lengthening as part of an interdisciplinary approach to the rehabilitation of an endodontically treated tooth. Careful consideration of the supracrestal tissue attachment and preservation of periodontal tissues, combined with controlled soft-tissue management, can facilitate establishment of a favorable restorative environment. The case highlights the potential role of diode laser-assisted crown lengthening in selected cases requiring additional clinical crown height before definitive prosthodontic rehabilitation.

Keywords: Diode laser; crown lengthening; supracrestal tissue attachment; endodontically treated tooth; periodontal-prosthodontic interdisciplinary treatment; 980-nm diode laser.

Introduction

Rehabilitation of endodontically treated teeth with extensive loss of coronal tooth structure can present a significant restorative challenge when inadequate clinical crown height compromises the establishment of an appropriate restorative margin, retention, resistance form, and ferrule. In such situations, periodontal crown lengthening may be required to expose additional sound tooth structure and create a favorable foundation for definitive restorative treatment. Depending on the clinical relationship between the planned restorative margin and the periodontal tissues, crown lengthening may involve soft-tissue removal alone or a combination of soft-tissue and osseous resection. [1–3]

An important consideration during restorative rehabilitation is the relationship between the restorative margin and the supracrestal periodontal tissues. The term “biological width,” traditionally used to describe the dimension of the junctional epithelium and supracrestal connective tissue attachment, is now more appropriately referred to as the supracrestal tissue attachment. Placement of restorative margins within or too close to this attachment may result in persistent gingival inflammation, bleeding, periodontal pocket formation, gingival recession, and alterations in the surrounding alveolar bone. [3] Therefore, when inadequate coronal tooth structure prevents placement of a restorative margin at an appropriate position, crown lengthening may be indicated to establish adequate restorative space while respecting the periodontal tissues.

Conventional crown lengthening is commonly performed using surgical soft-tissue excision, with osseous resection when necessary to establish an appropriate relationship between the restorative margin and the alveolar crest. [1–3] in selected cases, however, sufficient sound tooth structure may be exposed through soft-tissue removal alone,

avoiding unnecessary osseous intervention. The choice of technique should therefore be based on the clinical anatomy, amount of tooth structure that needs to be exposed, periodontal tissue dimensions, and restorative requirements. Laser technology has provided an alternative approach for soft-tissue management in periodontics. Diode lasers, particularly those operating at wavelengths such as 980 nm, are absorbed by soft tissues and can facilitate controlled tissue ablation with simultaneous coagulation. Their reported clinical advantages in oral soft-tissue procedures include precise tissue removal, effective hemostasis, improved visualization of the operative field, and controlled management of gingival tissues. [13–15] These characteristics may be particularly useful when soft-tissue crown lengthening is required in a confined restorative area. However, laser-assisted procedures remain technique-sensitive, and their clinical application should be guided by appropriate case selection, tissue characteristics, laser parameters, and the amount of tissue intended for removal.The present case report describes the interdisciplinary rehabilitation of an endodontically treated tooth with inadequate clinical crown height using 980-nm diode laser-assisted soft-tissue crown lengthening, followed by staged prosthodontic rehabilitation. The case emphasizes the importance of respecting the supracrestal tissue attachment while establishing adequate sound tooth structure for definitive restoration and highlights the clinical application of diode laser-assisted soft-tissue management as part of a coordinated periodontal-prosthodontic treatment approach.

Case Presentation

A 45-year-old female patient reported to the Department of Prosthodontics, Sri Siddhartha Dental College and Hospital, Tumakuru, with a concern regarding rehabilitation of the mandibular right second premolar (45). The patient reported that root canal treatment had been completed in relation to 45 approximately 2 years previously; however, definitive post-endodontic restoration had not been undertaken. Progressive loss of the remaining coronal tooth structure subsequently resulted in inadequate clinical crown height for predictable definitive prosthodontic rehabilitation.

The patient elected to proceed with rehabilitation limited to tooth 45. The proposed treatment, available alternatives, and the anticipated limitations of the treatment were explained to the patient. Written informed consent was obtained before initiation of treatment.

Clinical and Radiographic Examination

Clinical examination revealed a severely compromised clinical crown of 45 with inadequate supragingival tooth structure for definitive full-coverage restoration (Figure 1). The remaining tooth structure was assessed with respect to the available sound coronal tooth structure, periodontal condition, occlusal relationship, and feasibility of establishing an appropriate restorative margin.

A periapical radiograph was obtained to evaluate the previously endodontically treated tooth, including the quality of root canal filling, periapical status, root morphology, and remaining radicular structure. Based on the clinical and radiographic findings, 45 was considered unsuitable for predictable definitive crown rehabilitation without gaining additional clinical crown height.

Following consultation between the Departments of Prosthodontics and Periodontology, an interdisciplinary treatment plan was formulated. The treatment objective was to expose additional sound coronal tooth structure while maintaining periodontal tissue health and providing an appropriate foundation for subsequent prosthodontic rehabilitation.

Figure 1. Preoperative intraoral photograph showing inadequate clinical crown height irt 45

Diode Laser-Assisted Crown Lengthening

The patient was referred to the Department of Periodontology for surgical crown lengthening in relation to 45. Following administration of local anesthesia, soft-tissue crown lengthening was performed using a 980-nm diode laser at 3 W in continuous-wave mode with a fiber-optic tip.

The procedure was limited to soft-tissue removal, as adequate additional sound tooth structure could be exposed without the need for osseous resection. The laser was used to precisely remove the excess gingival tissue and expose the required coronal tooth structure for subsequent restorative preparation. Care was taken to maintain an appropriate relationship between the newly established restorative area and the surrounding periodontal tissues.

Following completion of the procedure, the site was examined clinically to confirm adequate exposure of sound tooth structure and effective hemostasis (Figure 2). The patient received postoperative instructions and was scheduled for continuation of prosthodontic treatment.

Figure 2. Clinical photograph following laser-assisted surgical crown lengthening in relation to 45, demonstrating exposure of additional sound tooth structure.

Prosthodontic Rehabilitation

Two days after crown lengthening, the patient reported to the Department of Prosthodontics for continuation of treatment. Post-space preparation was performed in relation to 45. The existing root canal filling was removed to the planned depth while maintaining an adequate apical seal and preserving as much radicular dentin as possible. An impression was subsequently made for laboratory fabrication of a metal post. During fabrication of the definitive post, an acrylic provisional crown was fabricated and placed on 45 to protect the prepared tooth and maintain function (Figure 3).

Figure 3. Acrylic provisional crown placed in relation to 45 following post-space preparation and impression making.

After 1 week, the fabricated metal post was evaluated intraorally for adaptation and passive seating and was subsequently cemented according to the manufacturer's recommended protocol. A second acrylic provisional crown was then fabricated and placed following post cementation. The provisional restoration was adjusted for appropriate occlusal and proximal contacts, contour, marginal adaptation, and emergence profile (Figure 4).

Figure 4. Clinical photograph and intraoral periapical radiograph showing the fabricated metal post following cementation in relation to 45.

Following satisfactory clinical evaluation of the periodontal tissues and the post-restored tooth, definitive crown preparation was performed. A metal crown was fabricated and evaluated intraorally for marginal adaptation, proximal contacts, occlusion, contour, and overall fit. Following satisfactory evaluation, the definitive metal crown was cemented in relation to 45 (Figure 5). The patient was subsequently recalled for clinical evaluation of the definitive restoration and the surrounding periodontal tissues.

Figure 5. Postoperative intraoral photograph following definitive cementation of the metal crown in relation to 45.

Discussion

Rehabilitation of an endodontically treated tooth with extensive loss of coronal tooth structure requires coordination between periodontal and restorative considerations. In the present case, inadequate clinical crown height prevented predictable definitive restoration of the tooth. The primary objective of the periodontal intervention was therefore to expose sufficient sound coronal tooth structure to facilitate restorative preparation while maintaining a healthy relationship between the planned restorative margin and the surrounding periodontal tissues.

Crown lengthening is an established periodontal procedure for gaining additional clinical tooth structure when restorative requirements cannot otherwise be achieved. Depending on the relationship between the proposed restorative margin, gingival tissues, and alveolar crest, crown lengthening may involve soft-tissue removal alone or a combination of soft-tissue and osseous resection. [1–3] In the present case, the required tooth structure could be exposed through soft-tissue removal alone; therefore, osseous resection was not considered necessary. This approach avoided unnecessary alteration of the supporting periodontal tissues while achieving the restorative objective.

An important consideration during crown lengthening is preservation of the supracrestal tissue attachment, historically referred to as the biological width. Placement of restorative margins too close to the alveolar crest may interfere with the normal periodontal tissue attachment and can contribute to inflammation, bleeding, periodontal pocket formation, gingival recession, and changes in the supporting tissues.[3] The purpose of crown lengthening in such situations is therefore not merely to increase the visible clinical crown but to establish sufficient space for restorative procedures while respecting the periodontal tissues. Previous clinical studies have demonstrated positional changes of the gingival margin and periodontal tissues during healing following crown-lengthening procedures, emphasizing the importance of periodontal tissue stability when planning definitive restorations.[7,8]

In the present case, a 980-nm diode laser was selected for soft-tissue crown lengthening. Diode lasers have been used in various oral soft-tissue procedures because of their ability to provide controlled tissue ablation and coagulation.[13–15] In this case, the laser permitted controlled removal of the excess gingival tissue and simultaneous hemostasis, providing a relatively clear operative field during the procedure. Effective hemostasis is particularly advantageous during restorative crown-lengthening procedures because visualization of the remaining tooth structure and the intended restorative area is important for accurate tissue removal.

Other reported advantages of diode laser-assisted soft-tissue procedures include precise tissue management, reduced intraoperative bleeding, and controlled soft-tissue ablation.[13–15] These characteristics may make diode lasers useful in selected cases where soft-tissue modification is sufficient to achieve the required clinical crown height. However, these potential advantages should be interpreted cautiously. A diode laser should not be considered inherently superior to conventional crown-lengthening techniques on the basis of a single case. The clinical outcome depends on appropriate case selection, tissue characteristics, laser wavelength and power settings, exposure time, operator experience, and the amount of tissue intended for removal.

The use of a soft-tissue-only approach was particularly relevant in this case. Since adequate sound coronal tooth structure could be obtained without osseous resection, the periodontal intervention was limited to gingival tissue removal. This highlights the importance of determining the amount of tooth structure required for restoration and assessing the periodontal anatomy before selecting the crown-lengthening technique. An unnecessary osseous procedure should be avoided when the restorative objective can be achieved through conservative soft-tissue management.

The additional sound tooth structure obtained through crown lengthening subsequently facilitated the prosthodontic phase of treatment. Adequate remaining coronal tooth structure and ferrule are important considerations in the restoration of endodontically treated teeth. Sorensen and Engelman demonstrated increased fracture resistance associated with the presence of coronal tooth structure, while subsequent literature has emphasized preservation of remaining tooth structure and the importance of the ferrule effect in restored endodontically treated teeth.[4–6,9] In the present case, the metal post was used primarily to provide retention for the restorative core, rather than to strengthen the root, consistent with established principles of post-endodontic rehabilitation.[5]

The sequential periodontal and prosthodontic treatment also illustrates the importance of interdisciplinary planning. The periodontal procedure established the required clinical crown height while maintaining consideration of the supracrestal periodontal tissues, whereas the subsequent prosthodontic treatment utilized the newly exposed tooth structure for post placement, provisionalization, and definitive crown rehabilitation. Thus, the laser-assisted crown-lengthening procedure functioned as an integral component of the overall restorative treatment rather than as an isolated periodontal procedure.

A further consideration is the timing of definitive restoration following crown lengthening. Changes in gingival position may occur during periodontal healing, and therefore the stability of the periodontal tissues should be evaluated before definitive restorative margins and contours are finalized.[7,8] In the present case, the restorative treatment was performed sequentially with provisionalization and subsequent evaluation before definitive crown

placement.

The present case demonstrates the clinical application of 980-nm diode laser-assisted soft-tissue crown lengthening in a selected case where additional clinical crown height was required and osseous resection was not necessary. The principal significance of the approach lies in achieving the restorative objective while respecting periodontal tissue dimensions and providing controlled soft-tissue management. As a single case report, however, this treatment cannot establish the superiority of diode laser-assisted crown lengthening over conventional techniques. Further comparative clinical studies are required to determine whether the proposed advantages of laser-assisted procedures translate into consistent improvements in postoperative morbidity, healing, periodontal stability, or restorative outcomes.

Conclusion

Diode laser-assisted crown lengthening can be a useful option for selected cases requiring additional clinical crown height before definitive restoration. In the present case, 980-nm diode laser-assisted soft-tissue crown lengthening provided adequate exposure of sound coronal tooth structure without the need for osseous resection, while allowing controlled tissue removal and effective hemostasis. Careful consideration of the supracrestal tissue attachment, preservation of periodontal tissues, and interdisciplinary coordination with prosthodontic treatment were essential to achieving a favorable restorative environment.

Although the findings of a single case cannot establish the superiority of laser-assisted crown lengthening, the present case demonstrates its practical application as part of an interdisciplinary approach to the rehabilitation of an endodontically treated tooth.

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