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Short Crown Lengthening – Surgical And Alternative Technique For Prosthetic Treatment

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Abstract

A reduced clinical crown length can result in insufficient retention, potentially leading to incorrect tooth preparation. The short crown lengthening procedure is performed to extend the clinical crown without infringing upon the biological width. Various methods for clinical crown lengthening have been suggested, including gingivectomy, apically displaced flaps (with or without bone resection), and surgical extrusion. A variety of factors can contribute to a short clinical crown. In such cases, proper restorative or prosthetic rehabilitation often necessitates the lengthening of the crown. Based on the 2003 Practice Profile Survey by the American Academy of Periodontology, crown lengthening is the most commonly performed surgical periodontal procedure.

Keywords: Short clinical crown, surgical lengthening, prosthetic procedure, aesthetics, restorative procedure, laser surgery, electrosurgery.

Introduction

When the clinical crowns of teeth are insufficient in size, achieving an aesthetically and biologically viable restoration becomes challenging. In many cases, restoring these teeth to an acceptable condition requires surgical lengthening of the clinical crowns. As a result, effective management necessitates a thorough

understanding of both dental and periodontal factors. The challenges posed by short clinical crowns call for a well-structured treatment plan and a careful sequence of procedures to ensure a successful outcome. A clear visualization of the desired result is essential for effective therapy.

Therapeutic approaches are typically combined to address the biological, restorative, and aesthetic needs associated with short clinical crowns. This article reviews methods for treating short clinical crowns, highlighting the importance of restoration margin placement in preserving periodontal and dental harmony.

Causes for short clinical crown

Short clinical crowns can result from various factors, including

Caries, erosion, tooth malformation, fractures, trauma, attrition, excessive tooth reduction, eruption, disharmony, exostosis, genetic variations [1] in such cases, increasing the clinical crown length may be necessary when the margins of carious lesions or fractured teeth are located sub gingivally, the crown is too short to adequately retain a restoration, there is an excess of gingival tissue, or the anatomical crown is only partially erupted [2].

Objectives for crown lengthening

Exposure of adequate healthy tooth structure in cases of deep subgingival fractures or carious lesions. Improved retention of restorations, ensuring they are securely held in place. Proper placement of restoration margins to avoid violating the biologic width of the tooth. Enhanced aesthetics, particularly in patients with uneven gingival margins or excessive gingival display.[3]

Biological considerations of crown lengthening procedure:

Balancing Biologic Width and Supracrestal Gingival Tissue Height

The biologic width (BW) is a critical parameter in crown lengthening procedures, defined as the combined dimension of epithelial and connective tissue attachments coronal to the crestal bone. The consensus in the literature is that placement of restorative margins within the BW can compromise periodontal health [4]. To rectify BW violations, surgical interventions involving bone removal can reestablish a stable and predictable BW in a more apical location.

Presurgical Considerations for Crown Lengthening Procedures

When planning crown lengthening surgery, several key factors must be evaluated, including: Keratinized gingiva width: Assessing the adequacy of keratinized tissue is crucial for ensuring a stable and healthy periodontal environment.

Distance from the cem ento-enamel junction or restoration margin to the alveolar bone crest: This dimension is critical in determining the need for crown lengthening and the extent of bone removal required. Crown-to-root ratio: Evaluating the crown-to-root ratio is essential for assessing the tooth's stability and potential for restoration.

Root anatomy: Understanding the root morphology is vital for identifying potential challenges and complications during surgery. Supracrestal gingival tissue dimension: Assessing the height and thickness of the supracrestal gingival tissues is crucial for determining the optimal surgical approach.

Gingival biotype: Evaluating the gingival biotype is essential for anticipating potential healing outcomes and complications. Thickness of the buccal alveolar bone: Assessing the bone thickness is critical for determining the feasibility of bone removal and the potential for complications.

By carefully evaluating these factors, clinicians can develop a comprehensive treatment plan that balances biologic width and supracrestal gingival tissue height, ultimately ensuring optimal outcomes for crown lengthening procedures.

Evaluation of tooth restorability:

Prior to initiating treatment on a tooth with a short clinical crown, a comprehensive restorability assessment is crucial [5]. This evaluation should encompass several key factors, including: Arch Position and Strategic Value: Consider the tooth's location within the dental arch and its importance in maintaining overall oral function. Periodontal Status: Assess the tooth's periodontal health, including attachment levels, bone support, and potential risks.

Crown-to-Root Ratio: Evaluate the ratio of the tooth's clinical crown to its root length, as this impacts the tooth's stability and restorability. Inter-arch Space Occlusion: Consider the tooth's relationship with opposing teeth and the overall occlusal scheme.

Endodontic Treatment Feasibility: Assess the potential need for endodontic treatment and its impact on the tooth's restorability. Aesthetic Considerations: Evaluate the tooth's aesthetic significance and the potential impact of treatment on the patient's smile [6]

By conducting a thorough restorability assessment, clinicians can determine the most appropriate treatment approach for teeth with short clinical crowns, ensuring optimal outcomes and patient satisfaction

Surgical crown lengthening procedure:

Step 1: Diagnostic Wax-Up and Surgical Guide Fabrication

Capture a maxillary impression to create a diagnostic wax-up, allowing for precise planning and visualization of the desired outcome. Next, fabricate a silicone surgical guide, carefully ensuring that its edge is precisely tangent to the cervical region of the wax-up, thereby facilitating accurate transfer of the planned design to the surgical site.

Step 2: Registration of New Gingival Margin

Insert the surgical guide into the mouth and register the new gingival margin using a scalpel.

Step 3: Flap Elevation and Gingival Collar Extraction

Elevate a full-thickness mucoperiosteal flap and extract the gingival collar using a Gracey curette.

Step 4: Osteotomy and Biologic Width Maintenance

Measure the distance between the guide edge and the cervical bone. Ensure a distance of approximately 3 mm to maintain biologic width and accommodate prosthesis installation. Perform precise osseous contouring using manual instruments (surgical chisels) and carbide/diamond burs with adequate irrigation to prevent bone necrosis. (Fig 1,2)

Step 5: Flap Closure and Healing

Suture the flaps to ensure proper closure. Allow for 6 months of healing.

Step 6: Provisionalization and Definitive Prostheses Delivery

Install provisional facets for aesthetic testing. Deliver definitive prostheses after ensuring satisfactory healing and aesthetic outcomes.

Indications:

Crown lengthening procedures are typically indicated for teeth with diminished clinical crowns [7]. The primary objective of clinical crown lengthening is to augment tooth structure, thereby fulfilling the mechanical prerequisites for restorative interventions [8]. Furthermore, crown lengthening may be warranted for biological reasons, specifically to prevent infringement of the biological width and subsequent attachment loss surrounding the restored tooth.

In addition to providing adequate tooth structure for functionally and biologically sound restorations, crown-lengthening procedures are also indicated for aesthetic purposes. These include instances of: Short teeth, Excessive wear, Irregular gingival contours, A gummy smile [9]

Contraindications for Crown Lengthening Procedures

Crown lengthening is contraindicated in teeth with deep carious lesions or fractures that render them non-restorable. Additionally, teeth with unfavourable crown-to-root ratios due to short roots or reduced bone support are not suitable for crown lengthening.

Exposure of furcation during crown lengthening can lead to potential periodontal breakdown and compromise the tooth's prognosis [10]. A study by Dibart et al recommends a preoperative distance of at least 4 mm between the furcation and the bone crest to prevent furcation exposure in molars [11]. Moreover, crown lengthening on a single anterior tooth can lead to aesthetically displeasing gingival contours, particularly in patients with a high smile line, resulting in uneven gingival margins. [12].

Patients with debilitating systemic diseases or poor plaque control may have compromised healing potential, making them unsuitable candidates for surgical crown lengthening procedures [13].

Images:

Fig 1. Before surgical procedure Fig 2. After surgical procedure

Alternative Treatment Options for Teeth with Short Clinical Crowns

Teeth with short clinical crowns (SCC) present a challenge for restorative treatment. Several alternative techniques have been employed to address this issue, including:

Modified Tooth Preparation Design: Altering the design of tooth preparations and incorporating auxiliary retention and resistance form features can enhance the restorability of teeth with SCC.

Foundation Restorations: Placement of foundation restorations can provide additional support and retention for definitive restorations.

Orthodontic Eruption: Orthodontic eruption can be employed to increase the clinical crown length, thereby enhancing restorability.

Endodontic Treatment and Overlay Removable Partial Dentures: In cases where teeth with SCC are non-restorable, endodontic treatment followed by overlay removable partial dentures can provide a viable treatment alternative [14].

Laser Crown Lengthening :

1. Introduction

- Crown lengthening is a surgical procedure designed to expose more tooth structure for restorative or aesthetic purposes.
- Traditionally performed using scalpel and rotary instruments, but laser-assisted crown lengthening offers a modern, minimally invasive alternative.
- Lasers such as diode, Er:YAG, Nd:YAG, and CO_2 are used for soft and/or hard tissue removal.

2. Indications

- Subgingival caries or fractures extending below the gingival margin.
- Inadequate clinical crown height for restorative procedures.
- Correction of a gummy smile (aesthetic crown lengthening).
- Uneven gingival margins or altered passive eruption.

3. Types of Crown Lengthening

- Functional (Restorative) – To expose tooth structure for placement of restorations.
- Aesthetic – To improve smile line and gingival symmetry.
- Combined – Both aesthetic and restorative benefits.

4. Advantages of Laser-Assisted Technique

- Minimally invasive: Reduced bleeding and trauma compared to scalpel methods.
- Enhanced visibility: A bloodless field improves precision during surgery.
- Reduced postoperative pain and swelling.
- Shorter healing time and faster tissue recovery.
- Sterilization effect: Decreases bacterial contamination.
- No need for sutures in many cases.

5. Laser Types and Applications

Laser Type	Tissue Interaction	Use
Diode Laser	Soft tissue only	Gingivectomy, gingival recontouring
Er:YAG Laser	Soft + hard tissue	Bone and soft tissue recontouring
Nd:YAG Laser	Soft tissue, coagulation	Deep pocket reduction
CO_2 Laser	Soft tissue ablation	Gingival surgery

6. Clinical Procedure (Laser Protocol)

1. Diagnosis and case selection – Evaluate biologic width and bone levels radiographically.
2. Local anesthesia (minimal requirement due to laser precision).
3. Laser ablation of gingival tissue to desired contour and length.
4. Osseous recontouring (if required) using Er:YAG or traditional bur.
5. Postoperative care – chlorhexidine rinse, soft diet, analgesics if needed.

7. Biologic Width Consideration

- Maintain **2–3 mm** of biologic width (junctional epithelium + connective tissue attachment).
- Failure to respect biologic width may lead to chronic inflammation or attachment loss.

8. Postoperative Outcomes

- Faster healing and less discomfort compared to conventional surgery.
- Minimal gingival recession and stable gingival margins.
- Improved patient acceptance and aesthetic results.

9. Limitations

- High initial cost of laser equipment.
- Requires operator training and experience.
- Limited bone removal capability for some laser types (e.g., diode).

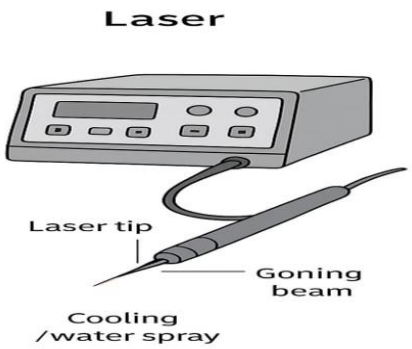

Image: Diode laser

Electrosurgery for crown lengthening :

1. Definition and Principle

- Electrosurgery is the use of high-frequency electric current (0.5–2 MHz) to cut or coagulate oral soft tissues through controlled thermal energy.[33]
- The electrical energy produces localized heat at the electrode–tissue interface, causing cell vaporization and tissue incision.[34]

2. Applications

- Commonly employed in periodontics, prosthodontics, and oral surgery for:
  - Gingivectomy and gingivoplasty
  - Operculectomy and frenectomy
  - Crown lengthening for restorative or aesthetic purposes
  - Hemostasis during surgical procedures
  - Soft-tissue troughing before impression making[35]

3. Advantages

- Enables bloodless surgical field and excellent visibility during procedures.[33]
- Provides simultaneous cutting and coagulation, reducing operative time.[34]
- Minimizes postoperative bleeding, discomfort, and swelling.[36]
- Offers a cost-effective and efficient alternative to laser or scalpel methods.[35]

4. Limitations

- Improper use can cause excessive lateral heat, resulting in tissue necrosis or delayed healing.[33]
- Limited to soft tissue procedures—cannot be used for bone cutting.[34]
- Pacemaker interference risk; contraindicated in susceptible cardiac patients.[35]
- Healing may occasionally be slower than with cold scalpel incisions.[36]

5. Electrosurgery vs. Radiosurgery

- Radiosurgery operates at higher frequencies (3.8–4 MHz), generating less lateral heat and producing faster healing than conventional electrosurgery.[36]
- Despite this, electrosurgery remains widely used for its affordability, versatility, and efficiency in soft tissue management.[35]

<u>Radiosurgery for crown lengthening:</u>

1. **Definition:**

   Radiosurgery involves the use of high-frequency radio waves (around 3.8–4.0 MHz) to incise or coagulate soft tissues with minimal thermal damage.

   Radio waves produce cellular vaporization by generating heat through tissue resistance, leading to precise cutting and coagulation simultaneously.

2. **Tissue Interaction:**

   - Produces a smooth, bloodless incision.
   - Minimal lateral heat damage compared to electrosurgery (due to higher frequency).

- Promotes rapid healing with less postoperative pain.

3. **Advantages:**
   - Excellent hemostasis and clear surgical field.
   - Less postoperative edema and discomfort.
   - Reduced chairside time and faster patient recovery.
   - Minimal mechanical trauma and no need for sutures in minor soft tissue procedures.
4. **Clinical Uses in Dentistry:**
   - Gingivectomy and gingivoplasty.
   - Crown lengthening and exposure of subgingival margins.
   - Operculectomy and frenectomy.
   - Biopsy procedures and soft tissue contouring around implants or restorations.
5. **Precautions:**
   - Avoid contact with bone or metallic restorations (can cause heat conduction and tissue necrosis).
   - Contraindicated in pacemaker patients unless medically cleared.
   - Correct tip angulation (10–15°) and light brushing motion prevent tissue charring.
6. **Healing:**
   - Healing comparable to or slightly faster than scalpel incision.
   - Minimal scar formation when proper technique is used.
7. **Limitations:**
   - Limited use in osseous recontouring.
   - Equipment cost and operator training required.

Discussion:

Crown lengthening is a versatile surgical procedure that offers aesthetic improvement during restorations, particularly in teeth with subgingival caries or fractures. Additionally, this procedure enables the establishment of accurate bone width [15] and correction of gingival asymmetries [16].

Aesthetic crown lengthening requires gingivectomy procedures to reveal the necessary additional tooth structure, thereby enhancing the overall aesthetic outcome. A minimum of 2-5 mm of keratinized tissue is essential to ensure gingival health [17,18]. Moreover, papilla management is crucial during surgery. Interproximal bone removal should be performed carefully to maintain anatomic structures, allowing interproximal tissues to coronally proliferate. The papilla should occupy the distance from the bone crest to the base of the contact area, approximately 5 mm or less [19,20].

Any residual interproximal space can be eliminated by apically positioning the contact area of the definitive restoration [21,22] To achieve a harmonious and long-lasting restoration, a minimum distance of 3 mm between the crestal bone and prosthetic margins is necessary to recreate the biologic width [23]. This can be achieved surgically through crown lengthening or orthodontically via forced tooth eruption, or by combining both procedures [24].

Studies have shown that the biologic width reestablishes itself after crown lengthening procedures within 6 months [25,26,27,28]. Therefore, in this case report, the definitive prosthesis was installed after the gingival healing period to achieve an aesthetically pleasing prosthetic margin.

Conclusion:

This article reviews the technique of surgical crown lengthening for prosthetic treatment. Crown lengthening is a versatile and effective procedure for enhancing the prosthetic treatment of teeth with short clinical crowns. By increasing the clinical crown length, crown lengthening enables the creation of more stable and durable restorations, ultimately improving the overall prognosis of the tooth. While alternative treatment options exist such as laser surgery offers distinct advantages, including minimal trauma, improved haemostasis, and reduced postoperative discomfort, making it highly suitable for patients requiring delicate tissue manipulation or aesthetic gingival contouring.[31] [32] In contrast, electrosurgery and radiosurgery provide an efficient, cost-effective, and versatile alternative for soft-tissue recontouring during crown lengthening, though they require careful handling to prevent lateral heat damage.[33–36], radiosurgery . Crown lengthening offers a predictable and long-lasting solution for managing teeth with short clinical crowns. As such, crown lengthening should be considered a valuable adjunct to prosthetic treatment, enabling clinicians to provide more comprehensive and effective care for their patients.

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