

## Case Report

### Crown Lengthening Procedure: An Aesthetic, Prosthetic & Restorative Solution

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#### ABSTRACT:

During various tooth restorative procedures, maintaining healthy periodontium is an important condition for obtaining regular functioning and aesthetics. Thus, thorough knowledge of the correct anatomy of periodontium is essential. Crown lengthening procedures can be carried out for aesthetic enhancement as well as for prosthetic and restorative purposes. For teeth with sub-gingival caries, fractures or both, this treatment can establish biologic width and if needed, a ferrule length facilitating prosthetic management. This procedure involves various techniques including Gingivectomy or apically positioned flaps, which may include osseous resection. Some important factors need to be evaluated before carrying out the procedure namely, biologic width, ferrule effect, amount of keratinized gingiva present and crown to root ratio. A series of five clinical cases have been presented in this article illustrating crown lengthening with ostectomy.

**Key words:** Gingivectomy, biologic width, ferrule effect, crown lengthening.

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#### INTRODUCTION

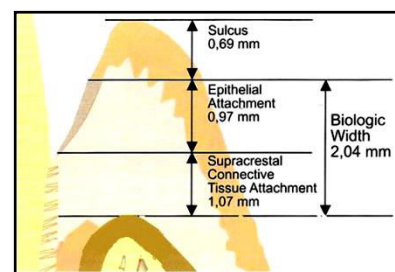
Maintaining a healthy periodontium during tooth reconstruction procedure is a pre-requisite for obtaining aesthetics and functions. For this purpose, it is necessary to know the correct anatomy of the periodontium.<sup>1</sup> A surgical procedure designed to increase the extent of supragingival tooth structure for restorative or aesthetic purposes by apically positioning the gingival margin, removing supporting bone, or both and may be accomplished by orthodontic tooth movement.<sup>2</sup> The concept of crown lengthening was first introduced by **D. W. Cohen (1962)**.<sup>3</sup> The procedure is based on two principles:

- BIOLOGIC WIDTH (BW) establishment
- Adequate KERATINIZED GINGIVA (KG) maintenance around the tooth.

#### BIOLOGIC WIDTH

It is the dimension of soft tissue that is attached to the portion of the tooth coronal to the alveolar bone crest.<sup>4,5</sup> It is the term applied to the dimensional width of the dentogingival junction, which is the sum of the combined

supracrestal fibers and the junctional epithelium. It was first described by **Sicher** in 1959 and later by **Gargiulo et al** in 1961. In the recent classification by World Workshop 2017, the term biologic width is replaced by "**supracrestal attached tissues**" consisting of junctional epithelium and supracrestal connective tissue attachment.<sup>17</sup>



#### CLINICAL IMPORTANCE:

It has been stated that impingement on the biologic width by the placement of a restoration within its zone may result in :-

- Gingival recession, pocket formation and alveolar bone loss (Tal et al., 1989).
- Crestal bone loss inferior to the encroaching margin (Perma-Benfenati et al., 1986).
- Gingival inflammation (Newcomb et al., 1974). This will occur as the body attempt to recreate room between the alveolar bone and the margin to allow space for tissue attachment. Trauma from restorative procedures can play a major role in causing this fragile tissue to recede.

### KERATINIZED GINGIVA

An adequate band of attached gingiva could be defined as that amount which is sufficient to prevent recession. Absence of keratinized mucosa increases the amount of plaque induced destruction.

Gosalind et al in 1977 – Average thickness of attached gingiva is 1.25mm.

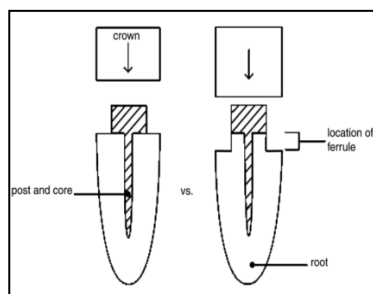
An adequate width of KG ( $\geq 2$  mm) should be maintained around a tooth for gingival health.<sup>6</sup> Therefore surrounding soft tissue should carefully be considered when tooth form or size has to be altered.

The accuracy of measurement before crown lengthening is affected by the biotype of the gingiva, the presence of recessions, the shape of root surface, bone dehiscence and the thickness of alveolar bone.<sup>7</sup>

### BONE SOUNDING

The alveolar crest level needs to be assessed prior to any considerations regarding aesthetic crown lengthening to determine the feasibility, surgical aspects and treatment sequence. Under local anesthesia, bone sounding can be done using a measuring instrument to puncture and penetrate the mucosa until contact is made with the underlying bone. This helps in determining the level of alveolar crest and thus the need for osseous contouring.<sup>8,9</sup>

**FERULE EFFECT-** A ferrule, in respect to teeth, is a band that encircles the external dimension of residual tooth structure. Sufficient vertical height of tooth structure (1-2mm) is necessary to allow for a ferrule effect of the future prosthetic crown. It has been shown to significantly reduce the incidence of fracture in the endodontically treated tooth.



### CROWN-ROOT RATIO

The alveolar bone surrounding one tooth will naturally surround an adjacent tooth, and removing bone for a crown lengthening procedure will effectively damage the bony support of adjacent teeth to some inevitable extent,

as well as unfavorably increase the crown-root ratio. According to Dykema et al and Shillingburg et al., a 1:1.5 Crown-root ratio is acceptable for an abutment, provided periodontium is in healthy condition. Although a crown-root ratio of 1:1 is regarded as a minimum ratio for prospective abutments under normal circumstances.

### INDICATION FOR CROWN LENGTHENING SURGERY:<sup>10,11</sup>

- Subgingival tooth fracture
- Carious loss located subgingivally
- Presence of short crown, not providing sufficient retention of prosthetic restoration
- Altered passive eruption
- Restorative requirements
- External root resorption

### TECHNIQUE OF CROWN LENGTHENING<sup>12,13,14</sup>

- Gingivectomy- Conventional, Laser, Electrocautery.
- Internal Bevel Gingivectomy/ flap surgery with or without ostectomy
- Apical positioning of flap with or without ostectomy

The selection of one technique over another depends on several patient- related factors such as aesthetics, clinical crown to root ratio, root proximity, root morphology, furcation involvement, individual tooth position, collective tooth position and the ability to restore the teeth.

### PRE-SURGICAL ANALYSIS

The following are the pre-surgical clinical analysis prior to crown lengthening procedures (Smukler and Chibi, 1997):<sup>15</sup>

- Determine the finish line prior to surgery
- If non determinable, it should be anticipated
- Transcervicular circumferential probing prior to surgery is performed for establishing the biologic width (Bone Sounding)
  - Surgical site
  - Contralateral site
- The biologic width requirements will determine the amount of alveolar bone removal
- The combination of biologic width and prosthetic requirements determines the total amount of tooth structure necessary for exposure
- Assessment of crown to root ratio
- Tooth structure topography, anatomy, and curvature are analyzed for determining
  - Osseous scallop
  - Gingival form

### SEQUENCE OF TREATMENT (Allen, 1993)<sup>16</sup>

Clinical and radiographic evaluations:

- Caries control
- Removal of defective restorations
- Placement of provisional restorations
  - Control of inflammation

- Better assessment of crown lengthening required
- Improved surgical access, especially interproximally
- Enhanced predictability of margin placement postsurgically
- Endodontic therapy
  - Precedes surgery
  - If not possible, then completion in 4 to 6 weeks postsurgically
- Control of gingival inflammation
  - Plaque control
  - Scaling and root planing
- Re-evaluation for
  - Orthodontic treatment
  - Surgical therapy
- Surgery

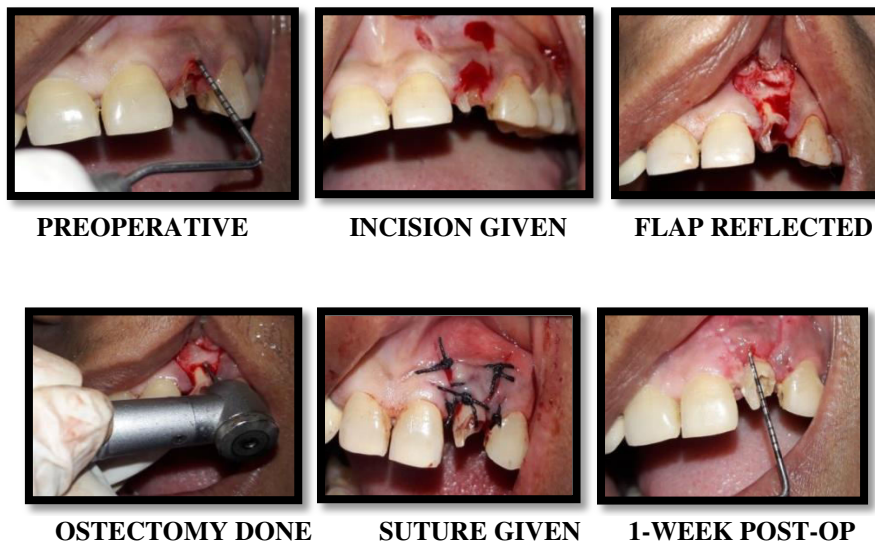
In addition to removing 2 mm of bone to establish a proper biologic width, another 2 mm should be removed to reveal enough tooth structure to allow for a 2 mm ferrule.

Here, are a series of 5 Cases done in the Department of Periodontics, Guru Nanak Institute of Dental Sciences & Research (GNIDSR), Kolkata with appropriate Informed Consent from patients:

**CASE 1**

A 55 years old female patient reported to the Department of Periodontics, GNIDSR, Kolkata, requesting "better-looking front teeth". Her medical history was noncontributory, and she did not have any oral deleterious habits Dental examination revealed that her 22 had been treated endodontically and there was extensive loss of clinical crown due to dental caries. Periodontal examination revealed good oral hygiene with minimal plaque and calculus deposits and sufficient width of attached gingiva. After discussion with the Dept. of Endodontics, crown lengthening was recommended to increase the extent of supragingival tooth structure and to allow a healthy, optimal relationship between the restoration and periodontium. Patient was informed thoroughly the pros and cons of surgical technique, and because of lack of time, she opted for surgical correction.

After giving adequate anaesthesia, transgingival probing was done. The level of incision was marked by placing bleeding spots using a pointed instrument. Using a no. 15 Bard-Parker blade, the initial internal bevel incision was performed 3 mm above the gingival margin so as to achieve the ideal contour both on labial and palatal aspect. Since, sufficient amount of attached gingiva was present, we didn't have to go for an apically repositioned flap. Then, a mucoperiosteal flap was raised. Osseous resection was performed using low speed handpiece and carbide bur under copious saline irrigation to maintain the biologic width. Additionally 2 mm of bone was further reduced to gain the ferrule effect. The flap was repositioned and sutured. Chlorhexidine rinse 0.2% twice daily was prescribed for 2 weeks, and the patient was given appropriate postoperative instructions.



Immediately after surgery, a temporary crown was given to maintain the gingival contour during healing. Custom-made post and core was placed after 1 month. Final insertion of the porcelain fused metal crowns with subgingival margin was performed 2 months after the crown lengthening surgery.

**CASE- 2**

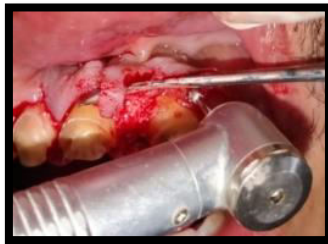
A 32 years old male patient had undergone an endodontic treatment of 11 and 21 in the Dept. of Endodontics, GNIDSR was referred to the Dept. of Periodontics, GNIDSR for crown lengthening procedure in order to extend the supragingival tooth structure and to allow a healthy, optimal relationship between the restoration and the periodontium along with aesthetic maintenance.



**PRE-OPERATIVE**



**INCISION GIVEN**



**FLAP REFLECTED & OSTECTOMY DONE**



**SUTURE GIVEN**

**CASE 3**

A 39 years old female patient had undergone an endodontic treatment of 22 in the Dept. of Endodontics, GNIDSR was referred to the Dept. of Periodontics, GNIDSR for crown lengthening procedure in order to extend the supragingival tooth structure and to allow a healthy, optimal relationship between the restoration and the periodontium along with aesthetic maintenance.



**PRE-OPERATIVE**



**1 WEEK POST-OPERATIVE**

**CASE 4**

A 48-year old female patient was referred from Dept. of Prosthodontics to Dept of Periodontics, GNIDSR with the chief complaint of short clinical crown height for crown lengthening procedure in order to extend the supragingival tooth structure and to meet the aesthetic demands of the patient.



**PRE-OPERATIVE**



**1 WEEK POST-OPERATIVE**

### CASE 5

A 31 years old female patient had undergone root canal treatment of 13 in Dept. of Endodontics, GNIDSR. Due to extensive caries, the patient had lost lot of tooth structure. So, the patient was referred to Dept. of Periodontics, GNIDSR for increasing the tooth length for favourable prosthesis.



PRE-OPERATIVE



14 DAYS POST-OPERATIVE

### DISCUSSION

Crown Lengthening is a surgical procedure that requires exposure of adequate tooth structure for restorative procedures. The clinician either excises or apically positions soft-tissues during the procedure. The dentogingival junction comprises of the connective tissue attachment of the gingiva and the epithelial attachment. **Gargiulo et al**, 1961 reported that the connective tissue attachment varied in length from, 0 to 6.84 mm with a mean of 1.07 mm; this measurement combined with the mean length of the epithelial attachment 0.97 mm has been called the physiologic dentogingival junction/biologic width 2.04 mm<sup>18</sup>. The physiologic location of the biologic width can vary with age, tooth migration due to loss of arch or occlusal integrity, or orthodontic treatment. Violation of the biologic width is a common occurrence in the practice of restorative dentistry, e.g. placement of a deep subgingival restoration. During the clinical procedure, crown to root ratio needs to be maintained in 1:1 ratio minimally. Ferule effect is also an important criteria which the operator needs to keep in mind while carrying out the procedure.

The cases discussed here have been treated with various techniques to achieve restorative, prosthetic and aesthetic needs of the patient. All cases were treated in such a way that there is no violation to Biologic Width that can have deleterious effect on periodontium leading to gingival inflammation, loss of attachment and alveolar resorption.

### CONCLUSION

This article presents various cases of crown-lengthening procedures for aesthetic, restorative and prosthetic reasons. It is an useful procedure to provide tooth length for proper restoration of a tooth without compromising the periodontium or the retentive qualities of the restoration.

It is also useful for enhancing maxillary anterior aesthetics. Crown lengthening may be as simple as a limited removal of soft tissue or as complex as orthodontic extrusion followed by flap with osseous surgery on a tooth requiring endodontic therapy. Crown lengthening is contraindicated, if the aesthetics is compromised, crown-root ratio is altered, non-restorable

caries/ root fracture/ insufficient restorative space is present.

Careful evaluation, case selection, treatment planning and surgical treatment to achieve results that meet the functional and aesthetic challenges of current dental practice. When a restoration is placed, the preservation of an intact, healthy periodontium is necessary to maintain the tooth or teeth being restored. Predictable long-term restorative success requires a combination of restorative principles with the correct management of the periodontal tissues. Thus, other disciplines also should be concerned about the role of biologic width and its implications.

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