E-ISSN : 2581-8899
P-ISSN: 2581-978X

Tantia University Journal of Homoeopathy and Medical Science
Review Article
|Volume 4| Issue 4 |Oct.- Dec. 2021|
E-ISSN : 2581-8899, P-ISSN; 2581-978X

INCREASE TOOTH HEIGHT: IN AND OUT REVIEW

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Abstract

When the clinical crowns of teeth are dimensionally short and it is difficult to place a restoration, surgically increasing the length of the clinical crowns can be done. The difficulties presented by short clinical crowns demand a proper treatment plan and a satisfactory result. The desired result is a reflection of an accurate treatment plan. This review examines the biological and surgical considerations as well as various methods of crown lengthening procedure. Changes in periodontal tissues, problems during and after crown lengthening procedure are also matter of concern. The effect of violation of the supracrestal gingivae by improper full-coverage restorations has also been discussed.

Key Word- Short clinical crown, Surgical crown lengthening, orthodontic forced extrusion, gingivectomy, apically positioned flap.

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Received – 10/11/2021 **Revised- 15/12/2021** **Accepted – 20/12/2021**

INTRODUCTION

In the modern society with the increased emphasis on facial aesthetics, we dentists and patients are developing a greater awareness of the gingiva on the beauty of the smile. In the past, the confusion related to the gingival level and restorative margin level was managed by inter disciplinary approach, where restorative procedure done secondary to periodontal surgery. In recent years, more attention is given on gingiva due to its excessive or reduced visibility at the restorative margin and tooth inter-face, because a good proportion of soft tissue

How to Cite this Article- Aggarwal R., Mannan A., Increase Tooth Height: In And Out Review. TUJ. Homo & Medi. Sci. 2021;4(4):69-80.

E-ISSN : 2581-8899
P-ISSN: 2581-978X

Around restorative margin gives better aesthetics and satisfactory response from a patient.

Placement of restorative margin on a grossly decayed tooth after an endodontic therapy or to change the position of gingival margin by periodontal surgery in short clinical crown require crown lengthening (CL) surgery. Crown lengthening surgery can be defined as a surgery performed to increase the length of clinical crown. Etiology for short clinical crown where crown lengthening surgery is indicated, are altered passive eruption of tooth, gingival hyperplasia, grossly decayed tooth, caries, erosion, attrition, tooth malformation or trauma.

CL can be done by surgical method or non-surgical method. D.W. Cohen in 1962 gave the concept of CL which includes gingivectomy, apically repositioned flap or apically repositioned flap with/ without osseous recontouring.[1] In periodontal practice there are several surgeries but CL is common among all. CL occupies 10% of all the other periodontal surgeries, stated by American Academy of Periodontology. [2, 3] The aim of CL is to provide a tooth crown dimension adequate for a stable dento-gingival complex (biological width) and for the restorative margin placement to achieve good marginal seal and an aesthetically pleasing restoration.[4] To re-establish and to avoid a violation of the biologic width (BW), CL is done.[3]

Biologic Considerations Of Crown Lengthening Procedure:

BW can be defined as the soft tissue present coronal to the crestal bone comprising total thickness of epithelial and connective tissue attachments. Defective margins of crown and restorations may hamper the healthy BW that finally affects the periodontal health of restored teeth.[5]

To maintain healthy BW, the crestal bone should be surgically modified so that the restorative margin helps in restoration of the BW in its new position i.e., apical to the previous location. Very few studies regarding the histologic features are present of BW of crown lengthening procedures (CLP),[6] where a mean value of 2.04 mm has been applied which helps as an indicator for the amount of bone removal needed during surgery. It was inconsistent that the amount of CL achieved post-operatively.[7-10] Fixed predetermined ostectomy measurements may jeopardize the surgical outcome of the final level of free gingival margin after CLP.[7] Parma-Benfenati et al. (1986) observed 5mm of osseous resorption in their experimental animal when restorative margins were placed at the alveolar crest.[11] Slight or no resorption was

E-ISSN : 2581-8899
P-ISSN: 2581-978X

observed where restorations were placed minimum 4 mm coronal to the alveolar crest. They also stated, allowing a minimum 3.0 mm distance from the alveolar crest to the crown margin.[12] So evaluation of biologic width violation is a necessary step related to CLP.

Presurgical Considerations:

1. **Width Of Keratinized Gingiva-** When it is planned to place restorative margins in the gingival sulcus, most clinicians consider average values of 2–3 mm of keratinized gingiva. [13]
2. **Distance from the Cemento–Enamel Junction (CEJ) To the Crestal Bone-** Helps to determine the BW violation. In few studies transgingival probing was considered as acceptable measurement, compared to periapical and bite-wing radiographs for the planning of CLP.[14]
3. **Crown-To-Root Ratio-** Need to maintain crown-root ratio to a minimum of 1:1.[15] Especially in teeth with small or conical roots. If the tooth is not self-supporting or cannot be supported by adjacent teeth, alternate treatment should be planned.[16]
4. **Root Anatomy-** Root anatomy (taper and divergence) is an important consideration before CLP, as they follow the diameter of the root remaining after CLP and the distance between the involved teeth.[13]
5. **Supra-Gingival Tissue (SGT) Dimension-** Assessment of SGT is very important before CLP, it accounts biological width and can be done by bone sounding technique. The mean SGT values at the mid-buccal sites ranging between 2.2 mm and 3.0 mm versus 3.4–4.2 mm at the inter-proximal surfaces in second premolars and first molars.[17]
6. **Gingival Biotype-** Gingival biotype which is thick or thin sometimes decides the surgical technique to be performed. It can be checked by inserting a probe inside the sulcus and see the transparency.[17] To cover the unesthetic dark colour endodontic restoration, it is important to take care of the mid buccal flap.[19]
7. **Amount Of The Buccal Alveolar Bone -** Thickness of buccal bone is different all over the mouth. Thickness also determines the gingival biotype (Cook et al). [20]
8. **Determining Crest Category-** When preparing anterior teeth for indirect restorations, it is necessary that the dentist should know about the Crest category. Based on the sulcus depth the following three rules (Rule of 1) can be used to place intra-crevicular margins:

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P-ISSN: 2581-978X

- The restorative margin could be placed 0.5 mm below the gingival tissue crest when the sulcus probe is 1.5 mm or
- The restorative margin is placed in half the depth when the sulcus probes more than 1.5 mm.
- And in greater than 2 mm, gingivectomy could be performed.[21,22]

- **Average Crest Patient-** Measurement at the mid-buccal site is 3.0 mm and the inter-proximal site is a range from 3.0 mm to 4.5 mm. Sub-gingivally a crown margin can be placed in 0.5 mm. [22]
- **Shallow Crest Patient-** Measurement at the mid-facial site is less than 3.0 mm and the proximal site is also less than 3.0 mm. In this situation, it is commonly not possible to place an intra-crevicular margin. [23]
- **Deep Crest Patient-** measurement at the mid-facial site is greater than 3.0 mm and the proximal site is greater than 4.5 mm. After the crown preparation; the attachment apparatus is routinely injured and when the injured attachment heals, it tends to heal back to a normal position, resulting in gingival recession.[23]
- **Deep Crest, Stable or Unstable**- the deep crest attachment is more complex because all deep crest patients do not react the same to an injury. Some patients are susceptible to gingival recession while others have a quite stable attachment

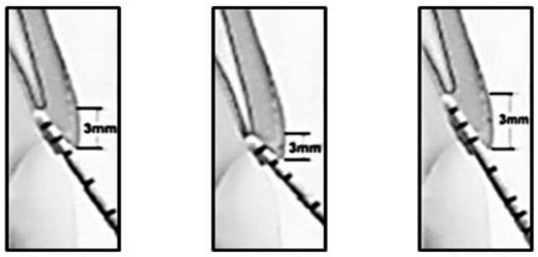

Figure 1: (a) Average crest (b) Shallow crest (c) Deep crest

9. **Condition Of Adjacent Teeth-** Level of CEJ of adjacent teeth is to be verified before CLP, especially in case of anterior teeth. It helps in keeping same marginal soft tissue level after placement of crown, which patient should be explained before surgical procedure.
10. **Area of Root Furcation-** In case of posterior teeth, it is very important to calculate the crestal bone level and root furcation area, sometimes excess removal of bone to increase the crown length leads to furcation involvement.
11. **Tooth Mobility After Surgery-** This can happen if the crown and root ratio is not proper after surgery. [16]

Objectives of Crown Lengthening Procedure: [23]

1. To expose sufficient tooth structure in case of deep carious lesion;
2. To enhance better retention of restoration;

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P-ISSN: 2581-978X

3. To place margins of restorations at correct position without violating the biologic width;
4. To improve esthetics in patients with uneven gingival margin and short clinical crown.

Indications for Crown Lengthening Procedure:[24]

The implications for crown lengthening are:

A. Restorative Needs-

- To increase heightened clinical crowns lost due to fracture, severe caries or tooth wear;
- To visualize subgingival caries;
- To create a ferrule of the tooth structure for post crown provision;
- To access a root perforation;
- To place margins of restorations such that will not impinging biological width.

B. Aesthetic Needs-

- Short teeth;
- Uneven gingival contour;
- Gummy smile.

Contraindications for Crown Lengthening Procedure:

- Non-restorable teeth (teeth with deep carious lesions or fractures).
- Unfavorable crown-to-root ratio.[25]
- In case of furcation involvement which initiates perio¬dontal breakdown.[26]
- Single anterior tooth CL resulting esthetically unpleasing contour.
- Uncontrolled systemic diseases like diabetes mellitus, hypertension etc.
- Poor oral hygiene maintenance may hamper the healing.[27]

Various Methods of Crown Lengthening Procedure-

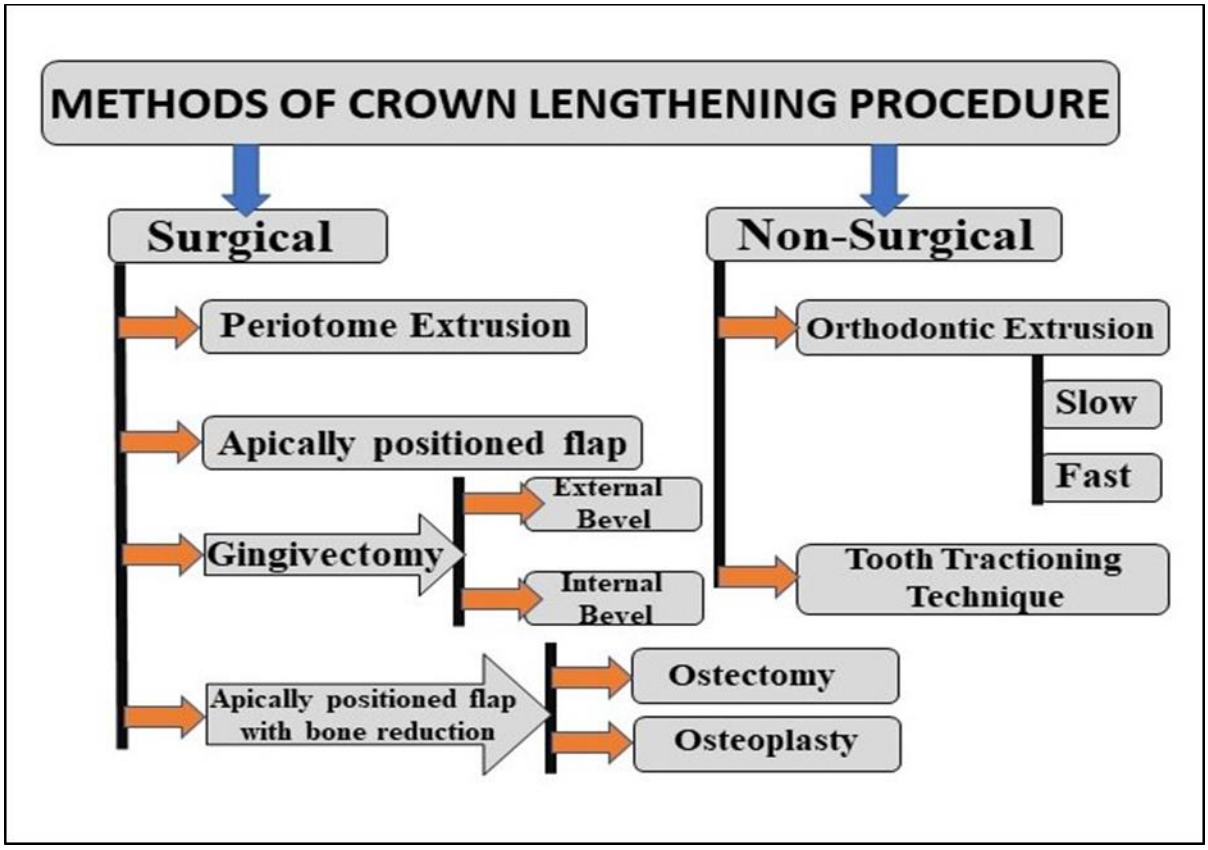
CLP can be divided into two major groups, surgical and non-surgical method. In non-surgical method orthodontic tooth extrusion is the treatment of choice where in surgical method periotome extrusion, apically positioned flap, gingivectomy can be done by conventional (scalpel or Kirkland) method or by using electro cautery and laser.[29-31] The orthodontic tooth eruption should be performed in esthetical area, but the treatment time is longer than surgical method and causes discomfort to the patient. For last few years, various surgical methods for CL gaining its popularity due to less chairside time and cost factor.

A. Surgical Method:

- **Periotome Extrusion:** To avoid the extensive resective osseous surgery, the desired tooth was extruded with the help of periotome to increase the crown length. In a study the new bone formation was observed around the periapical area at the 3-month post-operative examination and there was

E-ISSN : 2581-8899
P-ISSN: 2581-978X

no mobility and any root resorption. The advantages are reduction of overall operative time and elicits low root resorption or ankylosis rates. Need to maintain crown-root ratio to a minimum of 1:1.[15]



- **Apically Positioned Flap (With/Without Bone Reduction):** This procedure increases the clinical crown length, reduces pocket depth, and maintains adequate keratinized gingiva. The surgical technique proposed by Nabers was denoted attached gingiva repositioning of which was later modified by Ariaudo & Tyrrell (1957).[32] In 1962 Friedman proposed the term apically repositioned flap more accurately to describe the surgical technique introduced by Nabers. At least 4 mm of sound tooth structure must be exposed at time of surgery so that after healing the supra-crestal soft tissues will move coronally and cover 2-3 mm of the root[33,8] resulting only 1-2 mm of supragingival sound tooth structure. According to Friedman (1962) the technique should be performed in the following way: An internal bevel incision followed by crevicular incisions and initial flap elevation, then interdental incisions and the pocket wall is removed. Vertical incisions are then made to remove of all granulation tissue, scaling and root planning, and

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P-ISSN: 2581-978X

osseous surgery can be done if needed, the flap is displaced apically. The advantage of this technique is reestablishment of biologic width due to gingivectomy in conjunction with ostectomy procedure.

- **Internal Bevel Gingivectomy (with/without Ostectomy):**[30]
  - **Without Ostectomy-** To perform this technique the practitioners should rule out the enough attached gingiva should present after the incisions so that mucogingival defects will not occur. The inverse bevel incision is made depending upon the requirements of the crown exposure. Then crevicular incision is made from the bottom of the gingival sulcus to the bone followed by flap refection and 3rd incision to remove the tissue tags followed by suture.
  - **With Ostectomy-** A mucoperiosteal flap is elevated and the alveolar bone is reduced in a scalloped way by osteoplasty and ostectomy, using a combination of burs and chisels to expose the desired tooth length. The bone is reduced close to the tooth and the final removal of adjacent bone of the tooth is done by hand instruments. The process then is completed with bone curettes.
- **External Bevel Gingivectomy:**

This technique is indicated when there is sufficient sulcular depth and keratinized tissues are present. It can be performed with the help of scalpel or a Kirkland knife (conventional), lasers or electrocautery.[34] The incisions which are directed coronally, started apical to the point of tissue that is intended to be removed. The incision should be beveled angulated to the tooth surface and should refashion the normal festooned pattern of the gingiva as much as possible.[30]

B. **Non-Surgical Method:**

- **Orthodontic Extrusion-** when the amount of bone reduction around the affected tooth and adjacent teeth would be more, increasing the clinical crown length by orthodontic extrusion is suitable. The advantage of this procedure is the minimize hazard to the adjacent teeth because it causes very mild change in the proportion of crown to root ratio. Orthodontic extrusion for crown lengthening is of main importance in appealing zone. The extrusion can be accomplished in 2 ways:[30]

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- **Using Slow Orthodontic Force-** the tooth can be extruded very slowly moreover, bringing the alveolar bone and gingival tissue with it. The tooth is extruded until the bone level has been brought coronal to the ideal level.
- **Using Rapid Orthodontic Force-** where the tooth is extruded rapidly. During this period, a supercrestal fibrotomy is done weekly to prevent the tissue and bone from following tooth.

➢ **Tooth Tractioning Technique[35]**

Tooth traction (extrusion), first described by Heithersay in 1973, has repeatedly demonstrated its benefits in certain cases by recovering biologic width. The traction technique includes ease, simplicity, and low cost.[32] In this technique acrylic plate with cutout made in the area adjacent to the desired site and light pressure elastic in place for initiation of traction. The two ends of the elastic should be attached to the retentive rods which is a part of cemented cast metal post-core. After a period of 15 days, final result and final radiograph reveals good gingival margin and recovered biologic width.

Change In Periodontal Tissues After Surgical Crown Lengthening: [8, 36]

The study of Brager U., Launchenauer D. and Lang NP. In 1992 showed the periodontal tissue changes after surgical crown lengthening. Six weeks after the operation there is no change in attachment level and probing depth. Between 6 weeks and 6 months in 85 % of cases there were no change. It is proposed that the epithelial basal membrane bonding epithelium with connective tissue under it, totally recovers just after 1 month.

Problems During And After Crown Lengthening Procedure:[37]

1. Crown lengthening on a single anterior tooth may create an esthetic deformity;
2. Excess removal of bone decreases the root-to-crown ratio which will lead to tooth mobility;
3. Removal of healthy bone to create a normal bony architecture;
4. Ostectomy may expose furcation area in posterior teeth.

E-ISSN : 2581-8899
P-ISSN: 2581-978X

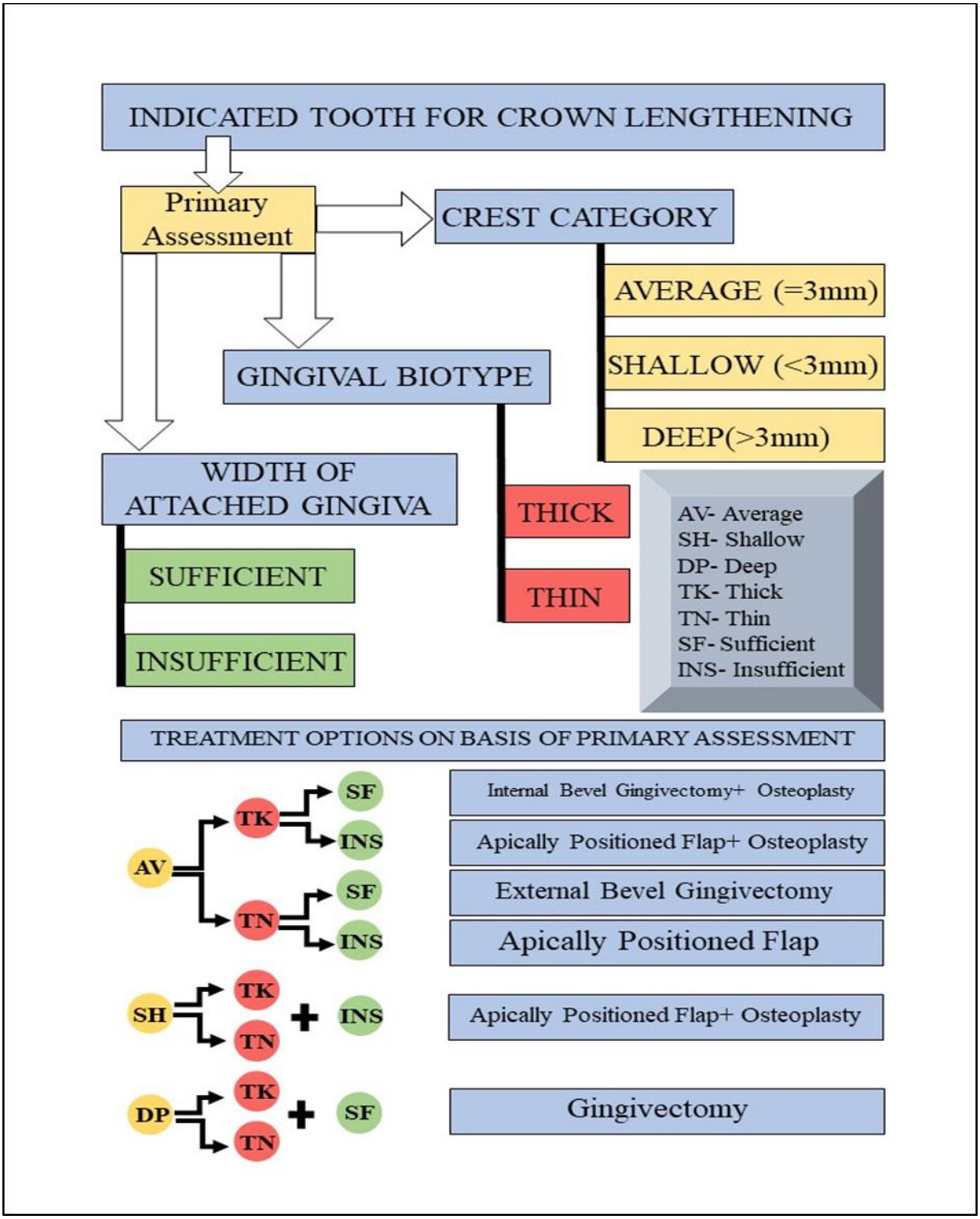

Fig 1 Guide Map For Surgical Crown Lengthening

CONCLUSION

Extension of the subgingival preparations for better retention form may violate periodontium and may compromise esthetics. The distance from marginal gingiva to margins of restoration should not be more than 0.7 mm while preparing subgingival margin. When it is difficult to

E-ISSN : 2581-8899
P-ISSN: 2581-978X

save periodontal support, orthodontic intervention for tooth eruption can be an alternative treatment modality for CL. It can be reviewed on basis of past studies that the distance from crestal bone to margins of restoration should be 3 mm to avoid the violation of biological width. Final restoration after surgical crown lengthening where osseous surgery has been performed can be done after 6 months and 1 month where only gingivectomy has been done.

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Conflict of Interest: None **Source of Support: Nil**