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Crown Lengthening Procedures after Orthodontic Treatment and before Placement of Prosthetic Crowns

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Authors' contributions

This work was carried out in collaboration between both authors. Author SOK designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors SOK, BS, AI and YS managed the literature searches and applied the therapy. Authors SOK, AI and YS performed the surgeries. Both authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Background: The need to provide aesthetic as well a functional dental restoration continues to be a challenge for the restorative dentistry. Crown-lengthening procedures can help address those challenges and can also be useful to improve the results of orthodontic and pre-prosthetic treatment. Clinical crown lengthening should be based on the adequacy of a biological width of 2.04 mm in order to obtain healthy periodontal tissue.
Purpose: To review crown lengthening procedures used for post-orthodontic and pre-prosthetic treatment, and explain the importance of biological width and its role in dental reconstruction and maintaining healthy periodontal tissue.
Case Report: Case #1 is a crown lengthening procedure performed with gingivectomy alone without bone reduction in the region of 22 in a post-orthodontic treated patient with asymmetric clinical crown and gingiva compared to the region of 12. The procedure resulted in symmetric

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gingiva and a balanced clinical crown. Case #2 is an example of crown lengthening as a pre-prosthetic treatment prior to crown restoration in the area of 13 and 14. Gingivectomy and bone reduction were both required to obtain adequate crown length.
Discussion: Bone reduction may be required as part of a crown lengthening procedure in order to obtain adequate biological width. To determine the need for bone reduction, the anatomical relationship between alveolar bone and the gingival margin should be assessed prior to treatment.
Conclusion: Clinical crown lengthening can be useful in a variety of clinical situations where form and function need to be reestablished. The key to success for this therapy is proper planning and an adequate amount of attached keratinized gingiva.

Keywords: Crown-lengthening procedures; biological width; bone reduction; gingivectomy.

1. INTRODUCTION

Based on the Dental Practice Profile Survey conducted by the American Academy of Periodontology in 2003, crown-lengthening procedures were the most common procedure performed by periodontists [1]. Crown-lengthening can be obtained by either removing gingiva only or by removing gingiva and alveolar bone [2]. Chi [3] demonstrated that over a 2 to 12 month period, surgical crown-lengthening procedures resulted in statistically significant changes in alveolar bone height.

Crown lengthening procedures reduce excess gingival tissue and bone to increase the longevity and length of the clinical crown and to ensure suitable margins for any planned fixed prosthesis [4]. The indication for clinical crown-lengthening procedures include: extensive caries, sub-gingival fractures, endodontic perforation, and in teeth with sub-gingival margins that require crown lengthening for restoration [2]. Clinical crown lengthening is also indicated for aesthetic treatment, known as aesthetic crown lengthening, to correct gingival asymmetry and also for correction of clinically short crowns due to altered passive eruption resulting in excessive gingiva and a “gummy smile” [5].

A crown lengthening procedure can be performed with or without alveolar bone reduction where the most important factor to consider is the adequacy of the resulting biological width of the clinical crown [6]. Biological width is the amount of soft tissue that is attached to tooth above the crest of the alveolar bone. Gargiulo states that biological width should be at least 2.04 mm representing an epithelial attachment of 0.97 mm and a connective tissue attachment of 1.07 mm plus adding 1 mm for gingival sulcus depth [7]. Rosenberg et al stated that therapy is performed primarily to meet the requirements of the restoration related to aesthetics, marginal edge, retention, form and function, and is integral in determining the success of the restoration [8].

If a restoration is placed without attention to biological width, instability and breakdown of the surrounding periodontal tissue can occur and affect the success of the restoration. If periodontal tissue damage occurs there will be further bone and clinical attachment loss. In general, gingival and periodontal tissue damage results in inflammation, increased pocket depth, clinical attachment loss, increased sub-gingival bacterial accumulation, increased chronic inflammation, and severe alveolar bone loss.

2. CASE REPORTS

2.1 Case 1

The patient is a 16-year-old male referred by the Department of Orthodontics to the Department of Periodontology, Dental Hospital, Universitas Indonesia. His chief complaint was an excess of “gums” in the area of the left anterior maxilla area following completion of his orthodontic treatment approximately 2 years ago (Fig. 1). Part of the initial reason for his orthodontic treatment was to correct for an ectopic tooth eruption in the left maxillary arch.

On examination, the clinical crown of tooth 22 appeared short compared to tooth 12 due to excessive gingiva on the surface of 22. Crown lengthening appeared to be required. Crown lengthening requires 3 basic steps. First the gingival sulcus depth and bone level are measured to determine the surgery necessary to achieve adequate biological width. In this case we found the length of the clinical crown of tooth 22 was 9 mm compared to reference tooth 12 which was 11 mm in length. We also found there to be 5 mm from marginal gingiva to bone and 3 mm from marginal gingiva to pocket base.

Based on our measurements we needed to perform a 2 mm gingivectomy to achieve adequate crown length (Fig. 1). The second step is to perform the gingivectomy (Fig. 2). Infiltration local anesthetic was injected over teeth 21, 22, 23. A pocket marker was first used to outline the incision and the gingivectomy was performed using a number 15 blade and an Orban–Kirkland knife with 45-degree external bevel incision. The surgical site was irrigated with saline, H_2O_2, and povidone-iodine solution and then covered with a periodontal pack. Postoperative results were satisfactory resulting in symmetrical gingiva and balanced clinical crowns (Fig. 3).

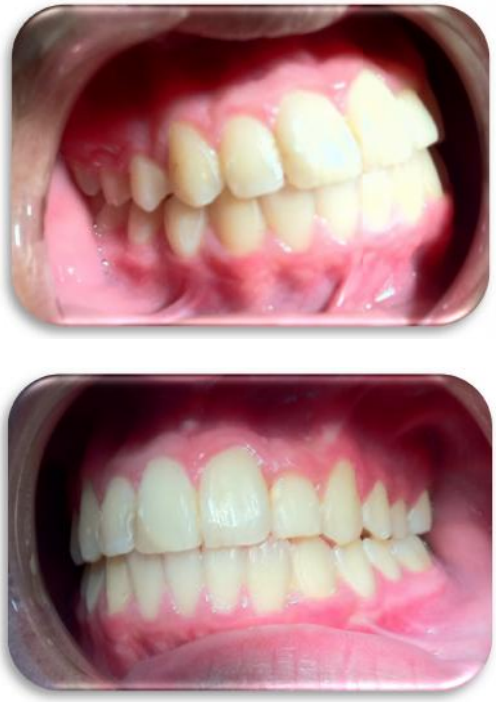

Fig. 1. Clinical condition of assymetric gingiva of tooth 12 and 22

2.2 Case 2

The patient is a 64-year-old female who was referred from the Department of Prosthodontics for correction of insufficient crown length and irregular gingival margins on teeth 13 and 14 prior to placement of crown restorations.

On clinical examination, tooth 13 had an irregular gingival margin and no clinical or sub gingival clinical crown. Tooth 14 also had irregular gingival margins and with 3 mm clinical crown present. The prosthodontists asked for us to provide 3 mm of clinical crown on tooth 13 and an additional 1 mm of crown on #14. Therefore a 2 mm gingivectomy and 2 mm bone reduction on tooth 13 and a 1 mm bone reduction on tooth 14 was planned (Fig. 4).

After infiltration of local anesthetic the planned gingivectomy was outlined with a pocket marker and the excess gingiva was removed. A cervical incision from distal of tooth 15 to the mesial of 13 with a releasing vertical incision distal to the line angle of 12 was made with a #15 blade and a full-thickness mucoperiosteal flap was elevated. Following bone exposure 3 mm of bone was reduced on 13 and 1 mm reduced from 14 (Fig. 4). The flap was repositioned and interrupted sutures placed (Fig. 5). Healing was satisfactory and followed by placement of fixed crown restorations on 13 and 14 (Fig. 6).

3. DISCUSSION

When performing a crown lengthening procedure, bone reduction may be necessary to produce a sufficient 3 mm biological width [9,10]. The decision to remove bone is determined by four criteria: pocket depth, the width of the attached gingiva, alveolar bone to the level of the gingival margin, and the desired length of the clinical crown. To meet these criteria the anatomical relationship of bone and gingival margin must be assessed. Bone level assessment is best done under local anesthesia by inserting a probe through the gingival sulcus to the crest of the alveolar bone. This is procedure is helpful to reveal the relationship of the gingival margin of the alveolar bone crest.

Maintaining biological width is important for the success of any future restorations placed on the teeth. Patterns of bone loss can vary due to differences in bone thickness around the tooth. Variations in bone thickness and resorption levels can affect the margins of the restoration causing excessive pressure, irritation, and a “squeeze” on the biological width [11].

The keys to successful and stable results from crown-lengthening procedures are accurate diagnosis and treatment planning. In addition to the above listed criteria for crown lengthening procedures, other aesthetic considerations such as facial symmetry, the anatomy of the lips, and smile lines should be considered in cases involving anterior teeth or aesthetic restorations. However, the single most criteria for success is maintaining an adequate biological width.

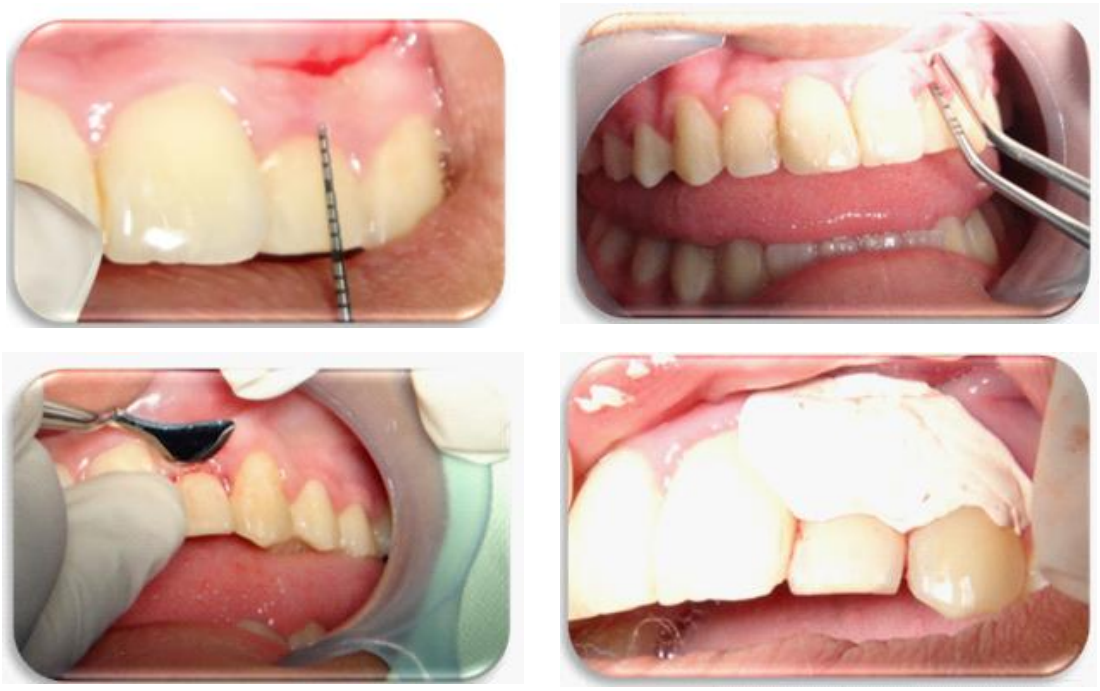

Fig. 2. Crown-lengthening procedure tooth 22 for support post-orthodontic treatment: Gingivectomy

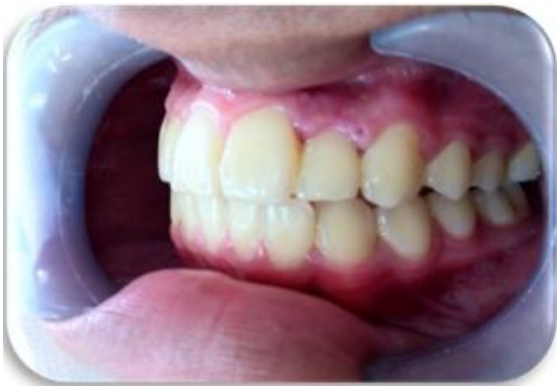

Fig. 3. Condition tooth 22 after crown-lengthening procedure

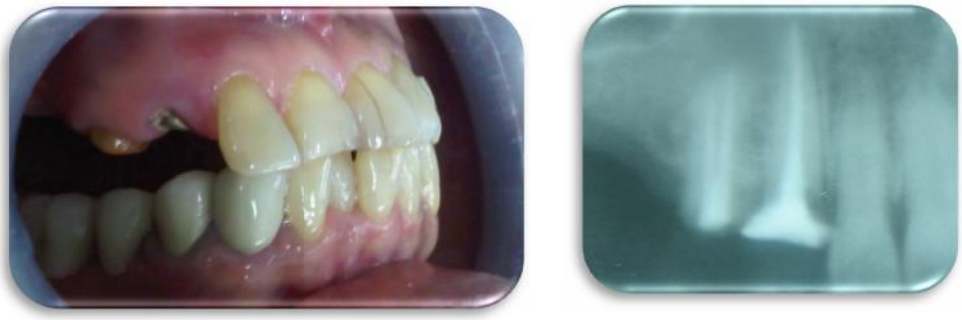

Fig. 4. Clinical condition of tooth 13,14

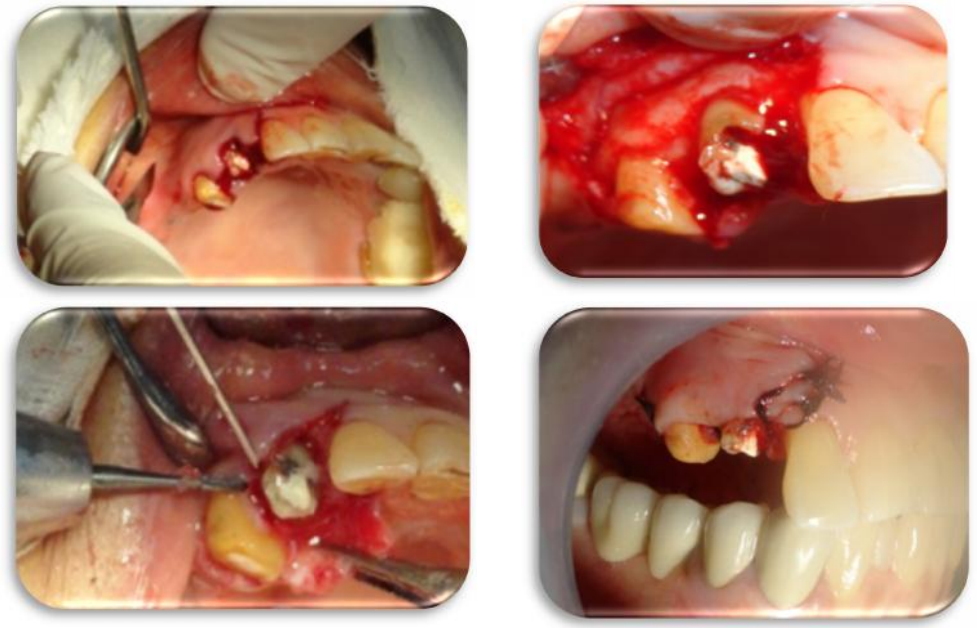

Fig. 5. Crown-lengthening procedure step tooth 13,14: Gingivectomy and bone reduction

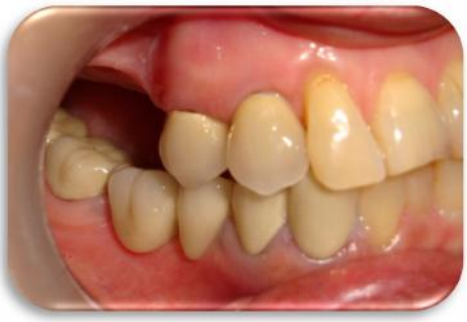

Fig. 6. Condition tooth 13,14 after crown-lengthening procedure

4. CONCLUSION

In terms of planning treatment: if there is a pocket depth of 4 mm and adequate attached gingiva, then a gingivectomy is indicated; if the pocket depth is 4 mm or more and attached gingiva is lacking, an apically positioned flap is indicated; and if the crown is short and there is no adequate attached gingiva, then crown lengthening with bone reduction is necessary.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this paper and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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