THE EFFECTS OF SURGICAL CROWN LENGTHENING (SCL) ON BIOLOGICAL WIDTH AND PERIODONTAL TISSUES AFTER PROSTHODONTIC PROCEDURES

Mohammed M. A. Abdullah*

ABSTRACT

Background: Clinical crown of the tooth is the distance from gingival margin to incisal edge or occlusal surface of the tooth. This distance should be increased when margins of caries lesion are subgingivally; margins of tooth crown fractures are subgingivally; tooth crown is too short for retention of restoration; there is excess of gingiva and anatomical tooth crown is opened partially.

Aims of the study: The present study was designed for evaluation the effects of surgical crown lengthening (SCL) on biological width and periodontal tissues after prosthodontic procedures.

Subjects and Methods: This study was carried out on thirty patients for 6 months and they were divided into three groups (ten patients per groups), all patients received surgical crown lengthening and dental reconstruction. Plaque index (PLI), gingival index (GI), probing pocket depth (PPD), and biological width (BW) were recorded in group samples following at base line, 3 months and 6 months after dental reconstruction. All results were collected and analyzed by NOVA test.

Results: All the patients completed the study uneventfully. Clinical parameters are shown in the table and the diagram; there were slight differences in the mean of plaque index, gingival index and periodontal pocket depth without attachment loss and biological width in all patients group of the present study.

Conclusion: Following surgical crown lengthening and teeth reconstruction, there were increased in all clinical parameters and biological width (BW) within 6 months compared to the control group.

KEY WORDS: Crown lengthening, periodontal surgery, biological width.

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INTRODUCTION

Surgical crown lengthening is a routinely performed treatment.\(^1\) Crown lengthening involves the surgical removal of hard and soft periodontal tissues to gain supracrestal tooth length, allowing longer clinical crowns and reestablishment of the biologic width.\(^2\) A short clinical crown is defined as any tooth with less than 2 mm of sound, opposing parallel walls remaining after occlusal and axial reduction. The common causes of short clinical crown include caries, erosion, tooth malformation, fracture, attrition, excessive tooth reduction, eruption disharmony, exostosis and genetic variation.\(^3\) Assif et al.\(^4\) suggest the therapeutic modalities which include surgical lengthening of clinical crowns, forced eruption of teeth, altering tooth preparation design and foundation restorations. However, the short clinical crown cannot be evaluated by visual inspection alone. A thorough examination that includes clinical examination, radiographic examination, and diagnostic cast analysis is essential for successful rehabilitation of severely complicated oral dentition. Several studies have also shown that 2 to 3 mm band of attached gingiva is preferable to maintain the restored tooth successfully. Since the resecting nature of this procedure, there is a risk of reducing the width of attached gingiva. For this reason, it is important to diagnose and evaluate the attached gingival when planning surgical crown lengthening procedure.\(^5\) The periodontal ligament was within normal limit. The crown-to-root ratio was about 1:3. In clinical examination, attached gingival band was 4 to 5 mm width, and periodontal pocket depth was 3 mm or less.\(^6\) Surgical crown lengthening can be performed by gingivectomy.\(^7\) While alveolar bone deformities resulting from periodontal disease dictate the degree of osteoplasty and ostectomy needed to achieve a positive architecture,\(^8\) Bragger et al.\(^9\) reported a gingival margin at the original preoperative level for 20% of the teeth in their study that had received surgical crown lengthening, and 2.5% were more coronal to the baseline. This finding was probably the result of inadequate bone recontouring and lent credence to the need for more definitive guides for the periodontist when performing crown-lengthening procedures.\(^10\) The dentist will usually prepare the finish lines of the tooth preparations for artificial crowns and place provisional restorations before surgery, and these prepared finish lines can serve as surgical guides. However, anatomic conditions, such as severe occlusal abrasion of the teeth, may not permit adequate retentive and resistance form for provisional crowns. Therefore, the purpose of the study was to evaluate the clinical changes of the periodontal tissues, for a period of 3 months and 6 months where in two surgical crown lengthening procedures gingivectomy and ostectomy with apically positioned flap were performed and assessment of changes in periodontal tissues and biological width (BW) was done prior to and after crown placement and prosthodontic procedure.

Aim of the study

The aim of the present study was designed to evaluate the effects of surgical crown lengthening (SCL) on biological width and periodontal tissues after prosthodontic procedures.

SUBJECTS AND METHOD

A) Patients samples

This clinical study included thirty patients. The exclusion criteria were proximity of the tooth to edentulous ridge, systemic diseases that contraindicate periodontal surgery, diabetes, and smoking. Patients received an explanation about the purpose of the study and provided written informed consent. Prior to surgery all the patients underwent professional tooth cleaning and received oral hygiene instructions. They were divided into three groups (ten patients per groups), all patients received surgical crown lengthening (Fig. 1) and dental reconstruction. Plaque index (PLI), gingival index (GI), probing pocket depth (PPD), and biological width (BW) were recorded in group samples at base line, 3 months and 6 months intervals (Fig. 2).
B) Clinical examination

All the measurements were made by standardized using customized acrylic stents with grooves and recorded using a standard periodontal probe (Williams periodontal probe) and using at base line, 3 months and 6 months after surgical crown lengthening and reconstruction of teeth as follow (Fig. 3):

1. Plaque index (PLI) (Loe and Silness) 11
2. Gingival index (GI) Silness and Loe) 12
3. Probing pocket depth (PPD)
4. Biological width (BW).

The vertical grooves were used as the fixed reference point for the vertical probing depths (Samuel E. Lynch, 1992) 13. The biological width measured from fixed reference point (FRP) to bone level (BL) minus the distance from fixed reference point to (FRP) the base of the pocket (BOP).

C) Statistical Analysis

Means were calculated for all clinical parameters in all groups at base line, 3 months and 6 months after surgical crown lengthening and reconstruction of teeth. Data were analyzed by ANOVA test.

RESULTS

No post-surgical complications were observed. The table and diagram of clinical results summarize the mean of plaque index, gingival index, periodontal pocket depth and biological width (BW) of all patients groups in the present study (Fig.4).

The mean of plaque index of group I, II and III was 1.3±0.48, 1.5±0.52 and 1.4±51 respectively. There were significance differences in plaque index in all patients groups. In group II, we observed increased plaque index compared to group I and group III. The mean of gingival index of group I, II and III was 1.2±0.42, 1.5±0.52 and 1.3±0.48 respectively. There were significance differences in gingival index in all patients groups. The mean
of periodontal pocket depth of group I, II and III was 2.4±0.51, 3.1±0.73 and 2.7±0.4 respectively. In group II, we observed increased gingival index compared to group I and group III. There were significance differences in periodontal pocket depth in all patients groups. In group II, we observed increased in periodontal pocket depth more than group II 3.1±0.73. The mean vertical dimensions of the biological widths at baseline, 3 months and 6 months was 1.76±0.68 , 1.47±0.70 and 1.83±0.80 respectively, there was significance differences in biological width in patients in group II compared to base line and group III there was no significant difference in the biological width in group III compared to base line.

**DISCUSSION**

The present study clearly demonstrated that the diagnostic measurement closest to the real measurement (gold standard) was the transperiodontal probing. Over the years, dentists have had difficulty in correctly relating the restorative margin placement to the periodontal apparatus; in the prosthetic treatment of advanced periodontal-prosthetic case, many failures have been due to the incorrect prosthetic management of the periodontal soft and hard tissues. These failures frequently have been blamed on poor oral hygiene and poor cooperation by the patient but this is not always true. The postsurgical soft tissue remodeling occurred in conjunction with positive clinical measurements as shown by low Plaque and Gingival index scores throughout the study. It was also observed that the probing depth values tended to return to the presurgical values, with no difference between the baseline (interproximal 2.7 mm/buccal lingual 1.4 mm) and final examination (interproximal 2.8 mm, buccal lingual 1.3 mm). The peak hike in probing depth values might be a result of loss of attachment, which is due to violation of biologic width. In other words margins placed subgingivally are associated with increased probing depth. The cal value for probing depth for the 1st and 3rd weeks is 3.6742, for the 1st

**Table of the mean and SD± of periodontal clinical parameters and biological width**

<table>
<thead>
<tr>
<th>Intervals (Groups)</th>
<th>Mean and SD± of Periodontal parameters</th>
<th>Biological width</th>
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<tr>
<td></td>
<td>PLI</td>
<td>GI</td>
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<tr>
<td>Group I</td>
<td>1.3±0.48</td>
<td>1.2±0.42</td>
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<tr>
<td>Group II</td>
<td>1.5±0.52</td>
<td>1.5±0.52</td>
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<tr>
<td>Group III</td>
<td>1.4±0.51</td>
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and 6th weeks is 11.130, and for the 1st and 12th weeks is 1.0854. Since all the values are greater than tab value, there is a significant difference in probing depth values at baseline and the 12th week examination. This indicates progressive loss of attachment over a period of time. In the present study, there were significance differences in periodontal pocket depth in all patients groups. In group II, we observed increased in periodontal pocket depth more than group II 3.1±0.73. These findings were in accordance with the study done by Dragoo and Williams. Gunay H. and co-authors (2000) showed how margins of restorations in area of gingival biological width cause pathology of periodontium. It was evaluated 116 restored and 82 healthy teeth of 41 patients. After 2 years results showed formation of periodontal pockets and increased index of gingival bleeding in the areas with distance less than 1mm from restoration margins to alveolar bone. The postsurgical soft tissue remodeling occurred in conjunction with positive clinical measurements as shown by low Plaque and Gingival index scores throughout the study. It was also observed that the probing depth values tended to return to the presurgical values, with no difference between the baseline (interproximal 2.7 mm/buccal lingual 1.4mm) and final examination (interproximal 2.8 mm, buccal lingual 1.3 mm). However, a difference was found between the clinical attachment level measurements obtained at the completion of the study and those recorded presurgically revealing an expected loss of clinical attachment in case of ostectomy procedure. These findings may suggest a tendency of the periodontium to reform a new “physiological” supracrestal gingival unit. The regret of the soft tissue from the level where the osseous crest was defined at surgery had already begun 1 month after surgery when the gingival margin reached about 60% of its final coronal position at interproximal sites and about 40% at buccal/lingual sites in case of gingivectomy procedure. In the present study there were none significance differences in plaque index and gingival index in all patients groups. These findings were in accordance with the study done by Lindhe and Nyman. There was a difference in the biological width from baseline to 3 months; but at the end of 6 months, the biological width was reestablished to its original vertical dimension at all sites without significant difference in its value from baseline. This result is similar to that obtained by Lanning and Oakley et al. This could be attributed to the slight gain in the attachment level and apical displacement of the bone level. The biological width at 3 months was significantly different compared to baseline; however, at 6 months, there was no significant difference compared to baseline. In other words, the original vertical dimension of the biological width was reestablished at treated sites 6 months following surgical crown-lengthening.

CONCLUSION

Hence within the limitations of this study, it can be concluded that there were slight differences in the mean of plaque index, gingival index and periodontal pocket depth in all patients group compared to group I of the present study due to poor oral hygiene and poor cooperation by the patient. There was no statistically significant difference in biological width at all sites. The biological width was reestablished to the original vertical dimension at all sites. Sufficient space was provided coronal to the alveolar crest for the reconstruction of the supracrestal connective tissue.

The most important question is how long a clinician should wait after surgical crown lengthening procedure to begin restorative procedures to ensure stable results?

Infect this question is still a controversial issue as many authors quote range of 1 month or 3 months or up to 6 months. More and more clinical research is still needed to come to conclusion on this issue.
REFERENCES