EFFECT OF GINGIVAL DISPLACEMENT CORD ON THE CLOSURE RATE OF GINGIVAL CREVICE: META-ANALYSIS

Dr. Bhaskar Agarwal¹ Dr. Abhinav Shekhar² Dr. Balendra Pratap Singh³ Dr. Nishi Sing⁴ Dr. Pooran Chand⁵ Dr. Shitij Srivastava⁶

¹Assistant Professor, Department of Prosthodontics, King George’s Medical University, UP, Lucknow, India ²Reader, SPPGIDMS, Lucknow, India ³Associate Professor, Department of Prosthodontics, King George’s Medical University, UP, Lucknow, India ⁴Assistant Professor, Career Institute of Dental Sciences & Hospital, Lucknow, India ⁵Professor & Head, Department of Prosthodontics, King George’s Medical University, UP, Lucknow, India ⁶Reader, SPPGIDMS, Lucknow, India

Address for Correspondence: Dr. Abhinav Shekhar B -358/1 Rajajipuram, Lucknow, India.
E-mail: dr_05online@yahoo.co.in

ABSTRACT

Background: Gingival displacement is done before making impressions for crown & bridge teeth preparations. The gingival crevice should remain opened until we make impression. The closure rate of gingival crevice is not clearly mentioned in the literature.

Purpose: To access the closure rate of gingival crevice after different gingival displacement cords are removed.

Date Sources: Google Scholar Beta, PubMed (MEDLINE), EMBASE (Ovid), Cochrane Central Register of Controlled Trials (CENTRAL), manual search of retrieved references or other reviews, theses, unpublished studies and study authors.

Study Selection: We included all clinical studies relating to closure rate of gingival crevice, in all languages, with no filters regarding the type of study because very limited data assumed to be available.

Data Extraction: Two independent investigators (AS & BA) extracted the data.

Data Synthesis & Conclusion: The closure rate of gingival crevice decreases with time. If gingival displacement is done using displacement cord for 5 to 6 minutes, the average crevice width was found to be 0.22 mm at 60 sec, this is sufficient time for making impression.

KEYWORDS: Gingival displacement, Gingival crevice, Gingival displacement cords, Closure rate of gingival crevice

INTRODUCTION - During fabrication of fixed partial denture, after tooth preparation, the gingival needs to be displaced to make an impression. The objective of gingival displacement is to primarily record the finish margin made in the prepared tooth or teeth. This objective is achieved by providing adequate space for the impression material to flow into the sulcus and provide adequate thickness to the material such that it does not tear off while removing the impression after setting.¹ The average width of the gingival sulcus should be 0.2 to 0.4 mm to have proper marginal accuracy, to avoid tearing off and voids in the impression.² Apart from having proper sulcular width, health of the periodontium, bleeding and finish margin also influence proper impression making.³ The most established method of gingival displacement is gingival retraction cord, the primary reason being its effectiveness and safety, when compared to other older methods such as gingival curettage and electro-surgery.³⁴ Kazemi et al used two different cords for gingival displacement and then made casts by making impressions and then compared them.⁵ There is not much data regarding the closure of gingival crevice after removal of retraction cord. The objective was to determine the closure rate of gingival crevice following gingival displacement using gingival displacement cord. The objectives of this systematic review and Meta-analysis were as follows: Population – All human subjects with
healthy gingival with no signs of gingival inflammation, gingivitis or Periodontitis, irrespective of age and sex. Intervention-Gingival displacement done with gingival displacement cord impregnated with haemostatic agent. Comparison-There was no comparison group in this study.

**METHODOLOGY**

We developed and followed a standard protocol for all steps of the review process. To develop the protocol we consulted-

- a. Guidelines for conducting systematic reviews and meta-analysis
- b. Checklist for reporting research studies
- c. Previous systematic reviews and meta-analysis on the same topic.

For the primary objectives, we defined the following eligibility criteria:

i. To maximize the breadth of data collection, we applied broad-spectrum search strategies, studies were not excluded based on their research design.

ii. Studies that identify gingival crevice closure as a primary or as an additional objective of a larger study were both eligible.

For the secondary objectives, we defined the following eligibility criteria:

i. Only quantitative studies

ii. Only studies done on human subjects.

To avoid inappropriate exclusions, we applied broad-spectrum eligibility criteria that included, subjects of any age group, having healthy gingiva with no signs of gingivitis or Periodontitis. Smokers were excluded from the study. Interventions that use hemostat impregnated gingival retraction cord for displacement of the gingival crevice were eligible. No restrictions were applied on the type of retraction cord, the type of hemostatic agent used and the technique of using retraction cord. Interventions on patients of either sex, and in any age or demographic group were eligible. Determining the closure rate of the gingival crevice was our primary outcome.

To record the width of the gingival sulcus at different time intervals was our secondary outcome. No setting and language restrictions were applied. Information sources were searched from year 1950 onwards. We adopted a variety of information sources from previous systematic reviews on closure of gingival crevice. The following general and subject-specific electronic databases were searched: Google Scholar Beta, PubMed (MEDLINE), EMBASE (Ovid), Cochrane Central Register of Controlled Trials (CENTRAL). The ‘Related Articles’ featured in PubMed were consulted. We consulted the following gray databases – Dissertations and databases of theses. We searched PubMed for Citation alerts. The following articles were hand searched- Indian Dental Journal, Clinical Dentistry, Journal of Physiology, Annals of Prosthodontics and IOSR Journal of Dental Sciences. We also manually screened the reference lists of all selected articles, reviews, and guidelines for eligible papers that were not identified during the other searching procedures. A variety of stakeholders, e.g., subject specialists, authors of selected papers and pertinent systematic reviews, researchers working on fixed partial dentures and periodontium were contacted to identify ongoing or unpublished research studies. For the electronic database searches, we used variations of search terms for the field of interest (gingival displacement/gingival retraction) and the intervention of interest (gingival displacement cord, closure of gingival crevice). To avoid the inappropriate exclusion of pertinent studies, we did not include ‘the outcomes of interest’ as selection criteria and aimed at a broad-spectrum search strategy. Search strategies were developed specifically for each database and were subsequently pilot tested and fine-tuned. An information specialist assisted with the development of these search strategies. To avoid the incorrect exclusion of eligible studies, the Boolean ‘NOT’ operator was used. The search strategies of all general and subject-specific electronic databases were listed in a table together with the number of identified items. Example of the search strategy of MEDLINE is presented in Table 1.

To reduce inter-examiner disagreements on study eligibility, we adopted the procedures described in the Cochrane Handbook for Systematic Reviews of Interventions and in the PRISMA-P 2015 statement.(Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. 7,8

Prior to starting the formal study selection process, we pilot tested our selection procedures on a sample of abstracts. These calibration procedures were conducted to clarify and potentially fine-tune our selection criteria and to apply them consistently. Both review authors participated in these calibration exercise. We selected studies that fulfilled our eligibility criteria. Studies were selected independently by
two experienced systematic reviewers (AB, SA), who are also topic experts.
We screened titles and abstracts for eligible studies. Each selected abstract was linked to the data source of origin. Full texts of potentially relevant articles were subsequently reviewed. To reduce the risk of inappropriate exclusion, ambiguous articles were also assessed for eligibility. Unpublished research studies, e.g., those found in gray literature databases, were also reviewed for eligibility by the two reviewers. Authors were contacted for further investigation, wherever required. Disagreements between authors on eligibility were resolved through discussions. Persisting disagreements were addressed through consultations with a third author (SBP). The Cochrane Glossary was consulted to avoid misinterpretation of terminology used in the email correspondence with authors. Two reviewers extracted data independently and in duplicate from each eligible study. To ensure consistency across reviewers, we conducted calibration exercises before starting the review. Data abstracted included demographic information, methodology, intervention details, and all reported patient-important outcomes. Extracted data items for our primary and secondary objectives included the following: the source, eligibility, duplicate publication, the study design, selection procedures, stakeholders, the setting, interventions, outcomes, flow and timing, adverse effects, withdrawals and miscellaneous data of the selected studies. To facilitate the assessment of possible risk of bias for each study, we collected information using the Cochrane Collaboration tool for assessing the risk of bias, which covers: sequence generation, allocation concealment, blinding, incomplete outcome data (e.g. dropouts and withdrawals) and selective outcome reporting. For each domain in the tool, we described the procedures undertaken for each study, including verbatim quotes. A judgment for the possible risk of bias on each of the six domains, were made from the extracted information, rated as ‘high risk’ or ‘low risk’. If there was insufficient detail reported in the study judged the risk of bias as ‘unclear’ and the original study investigators were contacted for more information. These judgments were made independently by two review authors based on the criteria for judging the risk of bias. Disagreements were resolved first by discussion and then by consulting a third author for arbitration. We computed graphic representations of potential bias within and across studies. We considered each item in the risk of bias assessment independently without an attempt to collate and assign an overall score. (Graph 1)

RESULTS

After following the proper protocol, we found only two relevant studies – Article 1: Laufer BZ, Baharav H, Langer Y, Cardash HS. The closure of the gingival crevice following gingival retraction for impression making. J of Oral Rehab. 1997:24;629-635. Article 2: Chandra Sumi. Effect of gingival displacement cord and cordless systems on the closure, displacement, and inflammation of the gingival crevice [Thesis]. India: Ram Manohar Lohia Avadh University;2010.

With time, the closure rate decreased both at Transitional Line Angle (TLA) & Mid Buccal (MB) region. The mean closure rate of the gingival crevice at MB of both the studies measured at 20 seconds was 0.11 mm which subsequently decreased to 0.10 mm at 40 seconds, 0.07 mm at 60 seconds, and 0.04 mm at both 120 seconds and 180 seconds. (Table 2) The mean closure rate of the gingival crevice at TLA of both the studies measured at 20 seconds was 0.22 mm which subsequently decreased to 0.08 mm at 40 seconds, 0.07 mm at 60 seconds, 0.03 mm at 120 seconds and 0.05 mm at 180 seconds. Closure rate was more at TLA than at MB, during first 20 seconds (p<0.01). After that no significant difference was found in the closure rate. (p>0.62) (Table 2) Table 3 depicts the gingival crevice width at different time after removal of retraction cord at TLA and MB, the mean gingival crevice width of both the studies at MB was 0.40 mm at 20 sec which decreased to 0.33mm at 40 seconds, 0.28 mm at 60 seconds, 0.22 mm at 120 seconds and 0.21 at 180 seconds. The gingival crevice width at different time after removal of retraction cord at TLA was 0.29mm at 20 sec which decreased to 0.22 mm at 40 seconds, 0.17 mm at 60 seconds, 0.10 mm at 120 seconds and 0.06 at 180 seconds. (Table 3)

DISCUSSION

There was a marked difference between the gingival crevice closure rate between TLA & MB during the first 20 seconds after removal of gingival displacement cord in the both the studies. The gingival closure rate at TLA was more than at MB. This can be because the soft tissue architecture around the MB area is different
than that of area of TLA. Presence of collagen fibers is more at TLA with thick gingival and alveolar bone; this can be the reason of higher closure rate at TLA initially when compared to MB region.  

On comparing the closure rate of both the studies, there was a marked difference in the finding at both TLA & MB, this can be attributed to the difference in the demographic difference in the stake holders, the time for which the cord was left in the gingival crevice (6 & 5 minutes), difference in the hemostatic agent used (Aluminum sulfate & Epinephrine) and technological advancement in video recording medium (both the studies have been done at an interval of approximately 15 years).

According to the study done by Laufer, width of gingival crevice was more than or up to 0.22 mm up to 180 seconds at MB and up to 20 seconds at TLA while Chandra reported that width of gingival crevice was more than or up to 0.22 mm up to 40 seconds at MB and up to 60 seconds at TLA. The difference in both the studies can be again attributed due to the difference in the demographic difference in the stake holders, the time for which the cord was left in the gingival crevice, difference in the hemostatic agent used and technological advancement in video recording medium. These findings indicate that for impression making a clinician has approximately 60 seconds after removal of the gingival displacement cord.

**LIMITATIONS**

Conference proceedings were not followed up.

**CONCLUSIONS**

The closure rate of gingival crevice decreases with time. If gingival displacement is done using displacement cord for 5 to 6 minutes, average gingival crevice closure rate at MB & TLA was found to be 0.07 & 0.07 mm respectively at 60 sec and the average crevice width at MB & TLA was found to be 0.28 & 0.17 mm respectively at 60 sec, which is sufficient time for making impression.

**FUNDING**

All expenses for conducting this systematic review were paid evenly by each reviewer.

**Table 1 - Search strategy for the MEDLINE**

| PubMed (Medline) | (gingival sulcus) OR gingival crevice) AND gingival retraction cord) OR gingival displacement cord) AND gingival displacement) OR gingival retraction) AND gingival crevice closure) OR gingival sulcus closure |

**Graph 1 - The risk of bias of the two individual studies**
Table 2 - Comparative gingival crevice closure rates

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Article 1</th>
<th>Article 2</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Closure rate at MB</td>
<td>Closure rate at TLA</td>
<td>Closure rate at MB</td>
</tr>
<tr>
<td></td>
<td>Mm</td>
<td>Picas</td>
<td>Mm</td>
</tr>
<tr>
<td>20</td>
<td>0.04</td>
<td>.041</td>
<td>0.17</td>
</tr>
<tr>
<td>40</td>
<td>0.03</td>
<td>0.06</td>
<td>0.16</td>
</tr>
<tr>
<td>60</td>
<td>0.02</td>
<td>0.04</td>
<td>0.12</td>
</tr>
<tr>
<td>120</td>
<td>0.01</td>
<td>0.01</td>
<td>0.06</td>
</tr>
<tr>
<td>180</td>
<td>0.03</td>
<td>0.02</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table 3 - Gingival crevice width at different time after removal of retraction cord at TLA and MB

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Article 1</th>
<th>Article 2</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width at MB (mm)</td>
<td>Width at TLA</td>
<td>Width at MB (mm)</td>
</tr>
<tr>
<td>20</td>
<td>0.32</td>
<td>0.23</td>
<td>0.48</td>
</tr>
<tr>
<td>40</td>
<td>0.29</td>
<td>0.17</td>
<td>0.37</td>
</tr>
<tr>
<td>60</td>
<td>0.27</td>
<td>0.14</td>
<td>0.29</td>
</tr>
<tr>
<td>120</td>
<td>0.24</td>
<td>0.09</td>
<td>0.21</td>
</tr>
<tr>
<td>180</td>
<td>0.22</td>
<td>0.05</td>
<td>0.20</td>
</tr>
</tbody>
</table>

REFERENCES