Assessment of Aluminum Chloride Retraction Cords, Expasyl, and Tetrahydrozoline-Soaked Retraction Systems in Gingival Retraction

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INTRODUCTION

Dental treatment of missing teeth is removable partial denture, fixed partial denture, or complete denture. Fixed partial denture has been the frequently used treatment modality for missing one or few teeth. The successful fixed prosthodontics demands healthy and stable periodontal structures. For recording impression subgingivally, the area has to be retracted so the desired retention can be achieved. Cervical finish line needs to be accurately recorded in order to ensure success of fixed prosthodontics.[1]

Due to inadequate access to the area subgingivally, there is always limited recording of the tissue, which is the main reason for failure restoration. The displacement

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KEYWORDS: Aluminum chloride retraction cords, expasyl, tetrahydrozoline

Aim: The aim of this study was to assess different gingival displacement systems such as aluminum chloride retraction cords, expasyl, and tetrahydrozoline-soaked retraction cord to record intracrevicular margins of tooth preparations.

Materials and Methods: This study included 60 patients. Patients were divided into four groups of 15 each. In group I, aluminum chloride retraction cords, in group II expasyl, in group III tetrahydrozoline-soaked retraction cord, and in group IV no retraction cord were used. Results: The mean gingival displacement (μm) in group I was 825.6, in group II was 482.1, in group III was 742.3, and in group IV was 214.8. Significant difference was seen in between groups by one-way analysis of variance as P < 0.05. Post hoc Tukey analysis showed significant difference during multiple comparison between groups. Conclusion: Authors found that maximum gingival retraction was achieved with aluminum chloride retraction cords followed by tetrahydrozoline and expasyl.
of the soft tissue, debris, or fluids gingivally is of paramount importance before recoding impression. The impression material flows sufficiently beyond the finish line allowing overall recording of area subgingivally.

The sulcular width of 0.2 mm, sufficient lateral and vertical space between gingival tissue and finish line, gingival fluid seepage under control and hemorrhage, and minimal soft- or hard-tissue damage are few ideal requirements of gingival deflection procedure.

Gingival retraction cords are being used extensively for recording impression subgingivally with finish line. Various hemostatic medicaments such as aluminum potassium sulfate, aluminum chloride, aluminum sulfate, and epinephrine offer sufficient displacement of fluid and prevent iatrogenic injury to soft tissues. However, the use of gingival retraction cords is often difficult and painful without anesthesia and carries risk to tissue damage. Recently, gingival displacement systems such as expasyl paste and magic foam cord are developed that are helpful in preventing all tissues damage. Considering this, this study aids in assessing different gingival displacement systems such as aluminum chloride retraction cords, expasyl, and tetrahydrozoline-soaked retraction cord to record intracrevicular margins of tooth preparations.

**Materials and Methods**

The patients visiting to the department of prosthodontics for replacement of missing teeth were included in the study. It comprised 60 subjects. Inclusion criteria were patients of both genders with age ranged 18–48 years, patients with gingival sulcus depths between 2 and 3 mm, absence of bleeding on probing, healthy gingiva and periodontium, teeth with gingival stippling, and patients with plaque index of 0. Exclusion criteria were patients with periodontitis, anterior malocclusion, and patients with undergoing orthodontic treatment. Patient data such as name, age, and gender were recorded. Patients were divided into four groups of 15 each. In group I, aluminum chloride retraction cords, in group II expasyl, in group III tetrahydrozoline-soaked retraction cord, and in group IV no retraction cord were used.

Preliminary impressions were taken with irreversible hydrocolloid impression material, and model cast was made with type III dental stone. In all patients, teeth were then prepared with equi-gingival deep chamfer finish lines without displacement of the gingival sulcus. All the displacement materials were tested in three consecutive sessions after 2 weeks. During the first session, retraction cords soaked in 15% aluminum chloride hemostatic solution were inserted in gingival tissues for 15 min and then were removed. In second session, expasyl paste was slowly injected into the sulci of prepared teeth. In third session, tetrahydrozoline-soaked retraction cord was used. Single cord technique was used.

Post-displacement impressions were taken using polyvinyl siloxane elastomeric impression material and poured. Casts were sawed out into three sections buccolingually from the center of each depression of each sample to get three halves at mesial, central, and distal points. The width of the pre-retracted and post-retracted sulci on samples was measured under an optical microscope and image analyzer. The amount of horizontal gingival displacement was obtained by subtracting the pre-displacement values from post-displacement values, and mean retraction was calculated in all groups.

**Results**

Results thus obtained were expressed as mean and standard deviation. The data were entered in MS Excel sheet. The statistical analysis was performed using one-way analysis of variance (ANOVA) analysis and post hoc Tukey test, and level for statistical significance to results was set at 0.05. Table 1 shows that there were 15 patients in each group. The agent used for retraction was aluminum chloride in group I, expasyl in group II, tetrahydrozoline in group III, and no material (control) in group IV [Table 1]. Graph 1 shows that mean gingival displacement in group I was 825.6, in group II was 482.1, in group III was 742.3, and in group IV was 214.8. A statistically significant difference was observed between groups by one-way ANOVA \( (P < 0.05); \) [Table 2]. Post hoc Tukey analysis showed significant difference during multiple comparison between groups [Table 3].

**Discussion**

Gingival retraction is mandatory for accurate recording of impression in teeth requiring fixed partial dentures. Variable sulcular depth, degree of gingival

| Groups | Group I | Group II | Group III | Group IV |
|--------|---------|----------|-----------|----------|
| Agent  | Aluminum chloride | Expasyl | Tetrahydrozoline | Control |
| Number | 15      | 15       | 15        | 15       |
Inflammation, level of margin placement, and tissue laceration causing bleeding are some of the factors that make it difficult to expose gingival margin before impression taking. It has been observed that exposing the gingival margins of a preparation before making impression is a tedious procedure owing to variable sulcular depth, degree of gingival inflammation, level of margin placement and tissue laceration. There are numerous clinical methods for gingival displacement. These are electrosurgery method, mechanical displacement, chemico-mechanical displacement, and rotary gingival curettage.\(^6\)

The chemico-mechanical method is the routinely and frequently used method in which chemically soaked retraction cords are used. The moisture in the gingival sulcus is absorbed by these retraction cords while gingival tissue is displaced mechanically, whereas hemorrhage is controlled by chemical agents, which also aids in shrinking of the gingival tissues.\(^7\) The pH of gingival displacement agents should be acidic. The limitation of these agents is that prolonged exposure can lead to alteration and instability in smear layer and produces etching. Thus the recommended time for a chemico-mechanical displacement is 7–10 min. Though that drawback may be overcome with the use of agents at a neutral or alkaline pH solution, however, these agents are highly unstable and do not exert their astringent effect at an alkaline pH.\(^8\) This study assessed different gingival displacement systems such as aluminum chloride retraction cords, expasyl, and tetrahydrozoline-soaked retraction cord to record intracrevicular margins of tooth preparations.

In this study, we included 60 adult patients requiring fixed partial denture. Patients were divided equally in four groups of 15 each depending on the agent used for retraction. Group I comprised aluminum chloride retraction cords, group II expasyl, tetrahydrozoline-soaked retraction cord in group III, and in group IV no retraction cord was used.

Shrivastava et al.\(^9\) conducted a study on maxillary central incisors of 20 patients requiring full coverage restoration. In the first method, mechanical retraction by magic foam cord and in the second method chemico-mechanical by expasyl paste and retraction cord impregnated with 15% aluminum chloride were used for gingival displacement. Gingival retraction was tested in three sessions at an interval of 14 days in the same order as mentioned earlier. Authors found significant horizontal gingival displacement. There was displacement of 0.74 mm in chemico-mechanical type of cord that was soaked in 15% aluminum chloride followed by 0.48 mm with expasyl paste and 0.41 mm with magic foam cord.

We found that mean gingival displacement in group I was 825.6, in group II was 482.1, in group III was 742.3, and in group IV was 214.8. In a study conducted on 30 subjects using different retraction systems with cord soaked in aluminum chloride, tetrahydrozoline, and expasyl according to Latin block design by Chaudhari et al.,\(^10\) the results were different. After impressions were poured with die stone, it was noted that there was gingival retraction of 148238.33 $\mu$m$^2$ with aluminum chloride followed 140737.87 $\mu$m$^2$ with tetrahydrozoline, and 67784.90 $\mu$m$^2$ with expasyl.

Thimmappa et al.\(^11\) conducted in vivo study on 30 patients in which the tooth preparation was performed on the teeth followed by retraction of gingival using ultrapak cord, merocel strip, and magic foam cord immediately, after first week and end of second week, respectively. The amount of gingival displacement in vertical and lateral directions was significantly high, showing difference

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### Table 2: Assessment of mean gingival displacement

| Groups | Mean (μm) | SD | $P$ value |
|--------|-----------|----|-----------|
| Group I | 825.6     | 34.2 | 0.001     |
| Group II | 482.1     | 26.9 |          |
| Group III | 742.3     | 20.5 |          |
| Group IV | 214.8     | 13.5 |          |

One-way ANOVA, significant $P < 0.05$

### Table 3: Tukey post hoc analysis (for multiple comparisons)

| Groups | Mean difference | $P$ value |
|--------|-----------------|-----------|
| I vs. II | 343.5 | 0.001 |
| I vs. III | 83.3 | 0.05 |
| I vs. IV | 610.8 | 0.001 |
| II vs. III | −260.2 | 0.001 |
| II vs. IV | 267.3 | 0.01 |

$P < 0.05$, significant
between the materials tested with respect to the mean vertical and lateral gingival retraction.

Mahajan et al.\textsuperscript{12} included 52 patients with 60 teeth into four groups on random division. Color-coded yellow and black cords were used for retraction (braided, chitosan) and compared with aluminum chloride retraction cord and control was non-impregnated cord. Authors found a significant difference with aluminum chloride cord but two experimental cords showed no significant difference. But, with respect to hemostasis, dry sulcus, sulcus widening, and amount of bleeding at removal the non-impregnated cord showed significant difference where all the other three cords were better than non-impregnated cord. The limitation of the study is small sample size. In this study, only aluminum chloride, expasyl, and tetrahydrozoline retraction cords are compared.

**Conclusion**

The authors found that maximum gingival retraction was achieved with aluminum chloride retraction cords followed by tetrahydrozoline and expasyl.

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**Conflicts of interest**

There are no conflicts of interest.

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