Original Article

Comparative clinical efficacy evaluation of three gingival displacement systems

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Abstract

Aim: We compared the clinical efficacy of three gingival displacement systems to accurately record intra-crevicular margins of tooth preparation. **Materials and Methods:** One mechanical (magic foam cord) and two chemico-mechanical (expasyl paste and retraction cord impregnated with 15% aluminum chloride) gingival displacement systems were used. This study was conducted on the maxillary central incisors of 20 patients (20-60 years old) requiring full coverage restoration. All the three gingival displacement systems were tested in three sessions at an interval of 14 days in same order. The casts were sectioned and viewed under an optical microscope, followed by quantitative measurements of the width of the pre and postretracted sulci. **Results:** All the three displacement systems produced highly significant horizontal gingival displacement. Retraction cord soaked in 15% aluminum chloride produced maximum displacement (0.74 mm), followed by expasyl paste (0.48 mm) whereas magic foam cord produced the least displacement (0.41 mm).**Conclusions:** Gingival displacement shown by each displacement system was found to be more than the accepted value necessary for elastomeric impression accuracy (0.2 mm) to record intra-crevicular margins of tooth preparation.

Key words: Expasyl paste, gingival retraction cord, intracrevicular margin, magic foam cord, tooth preparation

INTRODUCTION

Fixed prosthodontic treatment offers several advantages over removable prosthodontic appliances in terms of function, esthetics, comfort, speech and longevity of the prosthesis. Indirect restorations including partial veneer restorations and complete crowns are routinely used to restore defective teeth. These restorations frequently have cervical margins that are intentionally placed in the gingival sulcus for esthetic or functional reasons. In these situations, the clinician must make impressions that accurately capture the prepared cervical finish lines and permit the fabrication of accurate dies on which the restorations are fabricated.[1]

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Gingival displacement measures fall into one of the four major categories that is:

1. Simple mechanical,
2. Chemico-mechanical, rotary gingival curettage,
3. Electrosurgical, and
4. Using lasers.

The mechanical and chemo-mechanical methods of gingival displacement are the most widely used methods.[2,3] The mechanical method displaces the tissues physically whereas chemical method induces temporary shrinkage of the tissues and also controls hemorrhage and fluid seepage that often accompany subgingival margin preparation.[4]

The following criteria are considered acceptable for gingival deflection procedures with critical sulcular width of approximately 0.2 mm;[5,6] technique used should[(a)] create sufficient lateral and vertical space between the gingival

finish line and the gingival tissue[b] provide absolute control of gingival fluid seepage and hemorrhage,[c] not cause significant irreversible soft or hard tissue damage and[d] not produce any potentially dangerous systemic effects, so that a bulk of low-viscosity impression material can be introduced to capture the marginal detail.

Gingival retraction[7] cords are used together with certain hemostatic medicaments (aluminum potassium sulfate, aluminum sulfate, aluminum chloride, and epinephrine) to provide adequate displacement and fluid control, and avoid iatrogenic soft tissue damage.[8] Gingival displacement techniques using cords are often laborious, painful in the absence of anesthesia and represent a risk of damage to the epithelial attachment. To overcome these limitations, gingival displacement systems like expasyl paste (Pierre Rolland, Acteon Pharma, France) and magic foam cord (Coltene/Whaledent AG, Switzerland) are developed.[9,10] Here we determined and compared the clinical efficacy of three gingival displacement systems to record intracrevicular margins of tooth preparations efficiently.

MATERIALS AND METHODS

This cross-sectional study was conducted on the maxillary central incisors of twenty selected patients, 20-60 years of age, who required full coverage restorations. The study was approved by institutional ethics review board (reference no. PCDS/Eth/08-09/80). Following inclusion criteria were used; no signs of gingival inflammation, no bleeding on probing, presence of stippling with normal color, contour and consistency, plaque index "0," gingival sulcus depths between 2 mm and 3 mm, no signs of malocclusion. Patients were informed about the nature of the study, and suitable informed consent was obtained.

Preliminary impressions were made with a stock metal tray using irreversible hydrocolloid impression material (Tropicalgin, Zhermack, Italy). Impressions were poured with Type III dental stone (Denstone, Zhermack, Italy). In order to eliminate the variable of distortion factor due to unequal thickness of light viscosity impression material in stock tray, autopolymerizing acrylic resin (Acralyn, Asian Acrylates, Mumbai, India) custom trays were fabricated for pre-displacement and postdisplacement impressions. Teeth were then prepared with equi-gingival deep chamfer finish lines without displacement of the gingival sulcus. Three depressions of 0.5-1 mm diameter size were made with a round bur, one on each mesial, distal and mid-labial surface of the prepared teeth to get consistent measurements for every sample. All the three displacement agents were tested in each patient, in the same order, in three consecutive sessions spaced 14 days apart. During the first session, expasyl paste (Group A) was slowly injected into the sulci of prepared teeth. Blanching (from pink to white) of the marginal gingiva was observed for displacement to take place [Figures 1a and 1b]. During the second session, magic foam cord (Group B, Coltene/Whaledent, AG, Switzerland) was applied for 5 min as per manufacturer's instructions [Figures 2a and 2b]. During last session, retraction cord (Group C, Roeko Stay-put, Germany) of nonimpregnated softly braided variety, x-fine (0) size, measuring 8-10 mm length was dipped in 15% aluminum chloride hemostatic solution (indigenously made) for 15 min. It was then placed for 5 min in the sulcus and removed [Figures 3a and 3b]. Single cord technique was used in this study. To ensure consistency, the same individual performed every procedure.

Postdisplacement impressions for all the three displacement agents were made immediately using polyvinyl siloxane elastomeric impression material of ultralight viscosity (Aquasil Ultra Xlv, Dentsply, De Tray, Germany) using double mix-single step technique. Impressions were disinfected by dipping in 2% glutaraldehyde solution for 10 min and later poured with improved type IV die stone (Elite Rock, Zhermack, Italy). Casts obtained were sawed out into three sections bucco-lingually from the center of each depression of each sample to get three halves at mesial, central and distal points. This was followed by quantitative measurement of the width of the pre retracted and postretracted sulci on samples, under an optical microscope (Olympus research microscope with attached magnus) and image analyzer (Image Pro Plus 3.0). The width was measured as the distance from the tooth to the crest of the gingival [Figure 4].The amount of horizontal gingival displacement was obtained by subtracting the predisplacement values from postdisplacement values at all the three points-mesial (M), distal (D) and central points (C) following which mean retraction was calculated for each group.

Figure 1a: Application of expasyl

Figure 1b: Retraction obtained from expasyl

Figure 2b: Retraction obtained from magic foam

Figure 3b: Retraction obtained from retraction cord

RESULTS

The clinical efficacy of three different gingival displacement systems was evaluated for horizontal gingival displacement. The mean horizontal displacement by each gingival displacement was measured [Table 1]. All the three-displacement systems produced highly significant horizontal gingival displacement ($P = 0.001$), both individually and when compared to one another [Table 2]. Retraction cord

Figure 2a: Application of magic foam

Figure 3a: Retraction cord placed around prepared tooth

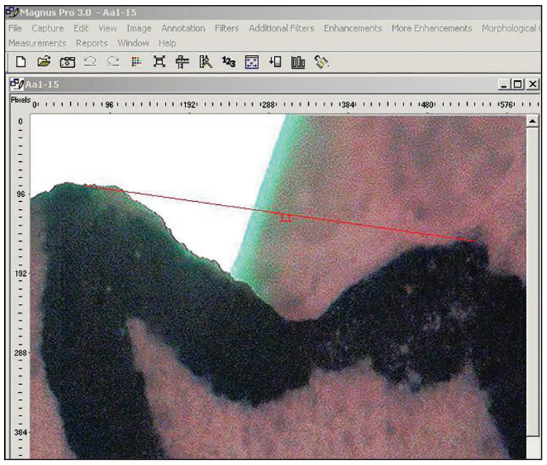

Figure 4: Measurement of pre and postretraction width (from the tooth to the crest of the gingival margin) under an optical microscope and image analyzer (Image Pro Plus 3.0)

soaked in 15% aluminum chloride produced maximum displacement (0.74 mm), followed by expasyl paste (0.48 mm). Magic foam cord produced least amount of horizontal displacement (0.41 mm) among the groups [Table 1].

Table 1: Mean gingival displacement (in microns), SD and one-way ANOVA analysis

Groups	Gingival displacement (mean±SD, in microns)
Group A (expasyl paste)	489.30±26.127
Group B (magic foam cord)	415.35±39.65
Group C (retraction cord)	740.35±53.40
Total	548.33±146.01

SD: Standard deviation

Table 2: Tukey *post-hoc* analysis (for multiple comparisons)

Groups	Mean difference	*P*
A versus B	73.950*	0.001
A versus C	−251.050*	0.001
B versus C	−325.000*	0.001

*The mean difference is significant at the 0.05 level

DISCUSSION

The marginal fit of restoration is of utmost importance for the optimal success of fixed restoration where in finish line of tooth preparation must be reproduced exactly in impression. Gingival tissue displacement should be chosen such that the gingival sulcus is properly retracted and that hemostatic action and elimination of tissue fluid (crevicular fluid) are ensured.[11] Many clinicians have difficulty with gingival displacement procedures primarily because they have not mastered effective soft tissue management procedures due to the poor state of patient health.[1] Thus patients selected for this study were in good general and oral health. We use the single cord technique in this study as it is relatively simple and efficient and is probably the most commonly used method of achieving gingival displacement.[1] It is also known that better sulcus enlargement can be achieved with a chemically treated cord, which causes transient ischemia**,** shrinking the gingival tissue. In addition, medicaments help control seepage of gingival fluid.[1,12,13] Interestingly soaking retraction cords in aluminum chloride solution aids in hemorrhage control.[14] The time period between the sessions of each gingival displacement was kept 14 days because gingival inflammation due to displacement system previously used, if any, subsides in 14 days.[15] Smallest crevicular width enabling consistent accuracy and defect free impression is reported to be 0.22 mm.[16] In all the three groups, the amount of gingival displacement was greater than the minimum required amount of sulcus width for the elastomeric impression material. Thus indicating that, clinically, all the three-displacement systems can produce an adequate amount of gingival displacement to record the intracrevicular margin of the tooth preparation efficiently.

The results of our study were in confirmation with previous reports.[17,18] We conclude that within the limitations of this study, the amount of gingival displacement shown by each displacement system was observed to be more than the accepted value necessary for elastomeric impression accuracy (0.2 mm) to record the intracrevicular margin of the tooth preparation efficiently.

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