Original Article

Gingival Tissue Response Following Placement of a Light Cure Dressing and a Non-eugenol Dressing after Periodontal Flap Procedure: A Comparative Clinical Study

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Abstract

Aim: The aim was to compare the gingival tissue response following placement of a light cure dressing (Barricaid®) and a non-eugenol periodontal dressing (Coe-Pak™) after periodontal flap procedure. This was carried out by evaluating plaque deposition underneath both the dressings, healing response and the patient preference for each. **Materials and Methods:** A total of 12 patients with chronic generalized periodontitis requiring surgery in at least two different quadrants were enrolled for this split-mouth study. After periodontal flap surgery, Coe-Pak™ was placed in the quadrant assigned to Group I and Barricaid® was placed in the other quadrant assigned to Group II. Clinical parameters were recorded on day 7 and day 14. Patient comfort and pain levels were also evaluated by a questionnaire. **Results:** There were no statistically significant differences in wound healing and the clinical gingival parameters between two groups. The only significant difference was found in the plaque attached underneath the dressing, with Coe-Pak™ showing greater plaque accumulation than Barricaid®. Seventy five (75) % of the patients preferred Barricaid® over Coe-Pak™, based on its appearance and taste. **Conclusion:** The non-eugenol dressing seemed to retain more plaque on its undersurface than light-cure dressing. However, this did not have much influence on the healing outcome and clinical gingival parameters, which were optimal and comparable in both groups. The greater number of patients showed a preference for light cure dressing, based on its superior esthetics and taste.

Keywords: Periodontal dressings, periodontitis, surgical flaps, wound healing

Introduction

Periodontal dressings were first introduced in 1923 by A.W. Ward as a packing material around teeth following gingival surgery. This zinc oxide-eugenol-based material (Wonder Pak) was used to cover and protect the surgical area, and according to Ward, it is helpful to splint loose teeth and soft tissues, immobilize injured areas, desensitize teeth and provide patient comfort.[1] Blanquie suggested that the purpose of dressing was to control postoperative bleeding, decrease postoperative discomfort, splint loose teeth, allow for tissue healing under aseptic conditions, prevent reestablishment of pockets, and desensitize cementum.[2] However, Bernier and Kaplan insisted that the primary purpose of a periodontal dressing is physical wound protection, and the constituents which may aid in healing are of secondary importance.[3]

Since their inception, the value of different periodontal dressings has been questioned both in terms of alteration in healing response and patient preference. There are controversial opinions on the effect of periodontal dressings on postoperative healing. A few studies with split-mouth design reported that a dressing has little influence on healing provided that the surgical area is kept clean.[4-8] However, the majority of Periodontists believe that application of periodontal dressing is one of the important factors which influence the outcome of surgical periodontal therapy, others being surgical techniques, thoroughness of root planing, and prescription of antibiotics.[9] Periodontal dressings provide postoperative patient comfort and are known to reduce dead space beneath the periodontal

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flap. For this reason, they continue to be widely used to cover and protect the wound surface from the external environment, although their application or omission is a matter of individual preference based on clinical experience.

Coe-Pak™ (GC America Inc., IL, USA) is one of the most widely used dressings today and offers a standard to which new dressings can be compared. It is a two-component non-eugenol dressing, also containing bacteriostatic agents. Apart from having the effects common to all periodontal dressings, it is free from tissue irritating properties of eugenol dressings. It is known to possess good adhesive properties[10] and adapts closely to the teeth and soft tissue, preventing detachment of postsurgical flap from the root surface.[11] Although widely accepted, Coe-Pak™ has a number of disadvantages such as poor appearance, ill-defined setting time and poor flow properties during manipulation.[12] Particularly, its bulky nature and poor esthetics have always been a concern for patients after surgery.

Visible light-cured periodontal dressing material, commercially available as Barricaid® (DENTSPLY International Inc., Milford, DE, USA), based on polyether urethane dimethacrylate resin is stated to be an advanced concept in the protection of periodontal wound sites.[13] Its superior physical properties such as easy manipulation, better surface smoothness, interdental retention, and translucent pink color have been claimed to favor its clinical application. Due to these superior properties, this material is gaining wide popularity among periodontists and patients.

The aim of this study was to compare gingival tissue response following placement of a light cure and a non-eugenol periodontal dressing after periodontal flap procedure. This was done by evaluating the gingival healing, plaque deposition underneath each dressing, and patients' preference.

Materials and Methods

This split mouth, single blinded, comparative study involved patients with chronic generalized periodontitis and conducted according to the principles outlined in the Declaration of Helsinki (1975), on experimentation involving humans as revised in 2000. Ethical clearance was obtained from the Institutional Ethics Committee of Maulana Azad Institute of Dental Sciences, New Delhi, India. Twenty adult patients of either sex aged 30–55 years with generalized pocket probing depth (PD) of ≥ 5 mm, requiring periodontal flap surgery in at least two different quadrants were selected randomly for the study. Written informed consent was obtained from each subject after an explanation of the proposed study design, treatment outcome, potential risks, and benefits. Patients with systemic diseases (such as tuberculosis, uncontrolled diabetes mellitus, hypertension, etc.) which could influence the outcome of the study, pregnant and lactating mothers or those planning a pregnancy and smokers were not included in the study. A detailed history and examination were carried out along with complete hemogram and panoramic radiographs.

Presurgical phase

A total of 20 selected patients were subjected to nonsurgical periodontal treatment that included thorough supragingival and subgingival scaling and root planing. They were placed on strict oral hygiene maintenance program. Re-evaluation was done after 4–6 weeks of completion of phase I therapy and baseline clinical parameters, i.e., plaque index (PI),[14] modified Sulcular Bleeding Index (mSBI)[15] and pocket PD were recorded. Only those subjects with a PI of <1 and residual pocket probing depth ≥5 mm in all the teeth of at least two quadrants were finally included in the study. After applying these criteria at the end of nonsurgical therapy, eight patients were excluded from the study. Finally, 12 patients who fulfilled these criteria underwent flap surgery of two different quadrants with an interval of 4 weeks. Quadrants were randomly assigned to Group I (Coe-Pak™) and Group II (Barricaid®).

Examiner calibration

Four patients, not related to study, each with two nonadjacent teeth with PD ≥5 mm, were used to calibrate the examiner. The examiner evaluated the patients at two visits that were separated by 24 hours. Calibration was accepted if the data at baseline and 24 hours later were same in >90% cases. This procedure was repeated periodically during the study.

Flap surgery and placement of periodontal dressings

Flap surgery was performed in each quadrant following the standard protocol of site preparation, incision, flap reflection, and thorough debridement. Minimal bone contouring was performed in three cases of both groups while no case required any bone grafting. Primary closure was achieved using 4-0 silk suture on 3/8 circle reverse cutting needle. Thereafter, in Group I, Coe-Pak™ was placed at the surgical sites. Equal lengths of base and catalyst paste of this dressing were mixed on a glass slab according to manufacturers' instructions. It was applied and pushed well into the embrasure spaces using moist gloved hands so that it is molded to the required contour. It was extended from one tooth mesial to the first suture to one tooth distal to the last suture of the surgical segment, extending from the cervical third of teeth to mucogingival junction.

Photocured dressing, i.e., Barricaid® was placed in Group II. It was dispensed directly through syringe on the cervical third of teeth and gingival margin after drying the site. The material was muscle molded, contoured with a plastic instrument, carver, or finger pressure with lubricated gloved hands. It was light cured for 10 s per tooth per side and additional material was added wherever required and cured incrementally. One side (buccal or lingual) was covered before proceeding to the opposing side. Occlusal clearance over the dressing was also checked. The extent of the dressing was same as described above with Coe-Pak™. In both cases, patients were given postoperative instructions and advised to rinse with 10 ml of 0.2% chlorhexidine gluconate solution twice daily for 1 week for assistance in plaque control. They were also prescribed ibuprofen tablets 400 mg three times daily for 3 days.

Removal of periodontal dressings and evaluation of parameters

The periodontal dressing was removed on the 7th day after surgery in two parts (buccal and lingual) using a dental tweezer and a blunt probe. Immediately after removal, dressings were immersed in plaque disclosing solution [Figures 1 and 2]. The amount of pink colored area underneath the pack (tissue/tooth-facing surface) was visually inspected and scored according to the following criteria. Plaque accumulation on the inner surfaces of removed dressing was scored on a scale of 0–3 based on the modification of debris index by Greene and Vermilion,[16] i.e., 0 = absence of plaque, 1 = plaque covering < 1/3rd of dressing, 2 = plaque covering > 1/3rd, but < 2/3rd of dressing and 3 = plaque covering more than 2/3rd of the dressing. The final value for plaque retained on the pack was calculated by summing the buccal and palatal scores and dividing by 2. This resulted in a "mean" score for the pack with a range of 0–3.[17] Patients were asked to fill an assessment questionnaire and rate the preferred dressing based on pain and discomfort experienced, taste, appearance, retention, burning sensation and sensitivity experienced with each type of dressings.

Following clinical parameters were also evaluated at the surgical site on the 7th day and 14th day after surgery in both groups: Wound healing index (WHI),[18] Plaque index (PI) on tooth surfaces (Silness and Löe)[14] and modified sulcular bleeding index (mSBI).[15]

Evaluation of wound healing was based on the parameters of tissue color, bleeding in response to palpation, the presence of granulation tissue and condition of incision margin. Each of these four parameters was separately assessed on the scale of 1 (very poor) to 5 (excellent), and the total score was finally divided by 4 to get the WHI score.

Statistical analysis

A total of 24 surgical quadrants were evaluated in 12 patients who underwent periodontal flap procedure. Mean and standard deviation values of each parameter were calculated for both groups, and an inter-group comparison was established statistically on day 7 and day 14. The intra-group mean values of clinical parameters on day 7 and day 14 were compared statistically. Change in intra-group values from day 7 to day 14 for each parameter was then also compared between both the groups. The data were analyzed using the Statistical Package for Social Sciences (SPSS for Windows, version 16.0. SPSS Inc., Chicago, IL, USA) software. The comparison of each parameter for Group I and Group II was done using Mann–Whitney U-test. The intra-group difference from day 7 to day 14 for the parameters was calculated using Wilcoxon signed ranks test. The mean intra-group difference from day 7 to day 14 for these parameters was compared between Group I and Group II using Mann–Whitney U-test again. The value of $P < 0.05$ was considered statistically significant.

Results

The present study included seven females and five males with the mean age of 44.25 ± 9.55 years. There was no statistically significant difference in clinical parameters (PI, mSBI, and PD) between two groups at baseline. All 12 patients reported on both 7th and 14th postoperative day after each surgery.

Clinical parameters

Clinical parameters included WHI, PI, mSBI, and plaque deposition under dressings.

Wound healing index

The mean values of WHI on day 7 and day 14 for both groups are given and compared in Table 1. The intra-group difference from day 7 to day 14 (ΔWHI) was found to be statistically significant ($P < 0.05$) for both the groups indicating an improvement in wound healing. Inter-group comparison of this difference (ΔWHI) was also found statistically significant ($P = 0.045$) with Group II showing greater improvement in wound healing between day 7 and day

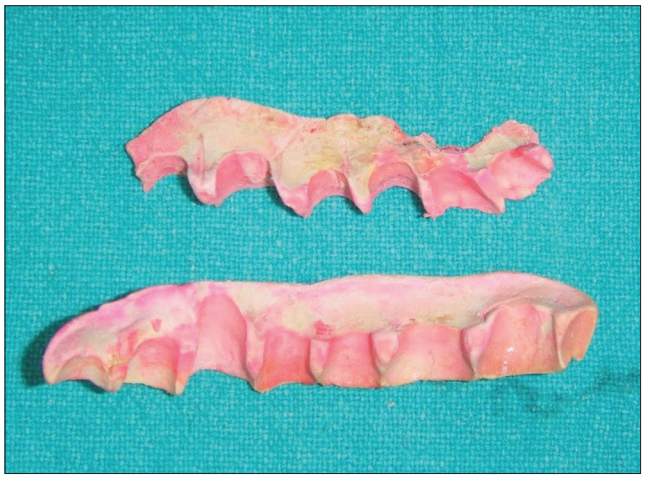

Figure 1: Coe-Pak™ dressing removed from buccal and lingual surfaces of teeth and immersed in plaque disclosing solution. Amount of plaque can be visualized on inner aspect of removed dressings

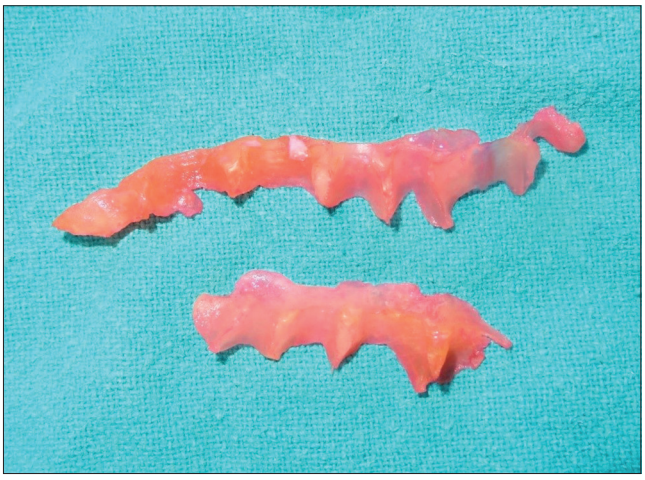

Figure 2: Barricaid® dressing removed from buccal and lingual surfaces of teeth and immersed in plaque disclosing solution. Amount of plaque can be visualized on inner aspect of removed dressings

14 than Group I. However, the inter-group difference in mean values of WHI was not statistically significant ($P > 0.05$) at any point of time.

Plaque index

No statistically significant differences were observed between the two groups on day 7 and 14 for PI on the tooth surfaces. Intragroup comparisons showed a significant decrease in PI from day 7 to day 14 [Table 2]. This implies that both the dressings influence the plaque deposition or its regression over time on the tooth surfaces in a similar manner.

Modified Sulcular Bleeding Index

There was no statistically significant difference observed between two groups at both 7 days and 14 days' time points [Table 3]. Mean values decreased significantly over time from day 7 to 14 in both groups. This difference was also not statistically significant on the inter-group comparison. This implies that inflammatory status of soft tissue at the surgical site and improvement of clinical gingival parameters from 7th to 14th day was influenced by both the dressings in a similar manner.

Plaque deposition under dressings

This was the most significant finding in the present study. It was evaluated on the 7th day according to modified Greene and Vermillion's criteria. Group I showed a greater amount of plaque accumulation under dressings as compared to Group II [Table 4].

Patient reported parameters

These parameters included pain assessment based on the verbal rating scale, and patient's preference based on burning sensation, hypersensitivity, appearance, and taste and retention of dressings.

Pain assessment

Mean pain score was recorded in the postoperative questionnaire given to patients and compared between the two groups [Table 5]. On statistical analysis, it was found that no particular dressing significantly influenced the general pain perception after surgery more than the other.

Discomfort assessment

Discomfort to patients was assessed using a questionnaire asking specifically about burning sensation and hypersensitivity in the operated area, during the first postoperative week. Only one patient reported the incidence of mild burning sensation in the case of Coe-Pak™ (Group I). Five patients in Group I and three patients in Group II experienced hypersensitivity [Table 6].

Patient's preference

All 12 patients were in favor of Barricaid® when asked about esthetic appearance and taste. Their opinion was equally divided when asked about retention of dressing to the operated area. However, 75% of patients (9 out of 12) showed an overall preference for Barricaid® than Coe-Pak™ [Table 7].

Table 1: Comparison of mean values of wound healing index

	WHI at 7 days	WHI at 14 days	Mean change (ΔWHI)	*P*
Group I (mean±SD)	3.34±0.49	4.17±0.57	0.83	0.004*
Group II (mean±SD)	2.92±0.51	4.33±0.49	1.41	0.002*
P	0.143	0.59	0.045*	

*Statistically significant. SD: Standard deviation, WHI: Wound healing index

Table 2: Comparison of mean values of plaque index

	PI at 7 days	PI at 14 days	Mean change (ΔPI)	*P*
Group I (mean±SD)	1.96±0.36	0.95±0.31	1.01	0.002*
Group II (mean±SD)	1.77±0.45	1.22±0.38	0.55	0.002*
P	0.319	0.101	0.052	

*Statistically significant. SD: Standard deviation, PI: Plaque index

Table 3: Comparison of mean values of modified Sulcular Bleeding Index

	mSBI at 7 days	mSBI at 14 days	Mean change (ΔmSBI)	*P*
Group I (mean±SD)	1.55±0.41	0.94±0.41	0.61	0.003*
Group II (mean±SD)	1.33±0.20	0.90±0.24	0.43	0.003*
P	0.34	0.29	0.26	

*Statistically significant. SD: Standard deviation, mSBI: Modified Sulcular Bleeding Index

Table 4: Comparison of mean values of plaque underneath dressing

	PUD (mean±SD)
Group I	2.90±0.29
Group II	1.83±0.71
P	0.001*

*Statistically significant. SD: Standard deviation, PUD: Plaque underneath dressing

Discussion

The rationale for the use of periodontal dressings has always been debatable as their effects on periodontal wound healing have been questioned over the years, and they are said to be associated with more plaque accumulation when compared to no dressing.[4,6,19] Therefore, the effect of various dressings on wound healing, the amount of plaque accumulation beneath dressings, their biocompatibility with postsurgical tissue, are the most important parameters, based on which these materials can be critically assessed and a preference established.[20]

Table 5: Comparison of pain score based on verbal rating scale

	Pain score (mean±SD)
Group I	3.17±2.37
Group II	4.0±2.13
P	0.26

SD: Standard deviation

Table 6: Discomfort reported by patients

	Burning sensation (yes/no)	Hypersensitivity (yes/no)
Group I	1/11	5/7
Group II	0/12	3/9

Table 7: Patient's preference

Criteria	Patient's preference for dressing (Coe-Pak™/Barricaid®)
Appearance and taste	0/12
Retention of dressing	6/6
Overall preference	3/9

Visible light cure periodontal surgical dressing available by the brand name of Barricaid®, is based on a polyether urethane dimethacrylate resin which claims to be an advanced concept in the protection of periodontal surgical sites.[13] It is said to have the advantage of possessing a translucent pink color, that simulates gingiva and a rate of curing, which is easily controlled by illumination with visible light. It is easily applied, tinted and its translucency permits clinical observation without removal of the dressing. Furthermore, histologic studies have shown that extracts and solid specimens of polymerized light cure dressing are exceedingly biocompatible.[21,22] This study was planned to compare the effect on healing and patient acceptance of light-cure dressing with age-old standard, i.e., non-eugenol pack. A split-mouth study design was used which has the advantage of allowing each patient to act as his/her own control and removing a lot of inter-individual variability from the estimates of the treatment effect.[23]

The results showed significantly less plaque attached underneath the dressings in Group II, as was also observed by Richard *et al.* in 1989.[24] The rough and flint-like surface texture of hardened non-eugenol pack attract more plaque on its irregular surface. Since, the light-cure dressing has a smooth and shiny surface forming a firm, nonbrittle, elastic covering when set, it accumulates less plaque as compared to Coe-Pak™.

Within both the groups, following the removal of dressing, the PI scores decreased from day 7 to day 14. This is in accordance with the findings of many clinicians, who also reported slightly greater accumulation of plaque beneath the periodontal dressings initially, but not to a detrimental level to retard the healing process.[19,20,25,26]

The difference in the WHI between the two groups was not significant at both time points, but the mean values indicated improvement in healing over time from day 7 to day 14 within each group. This is in accordance with the findings of Madan *et al*.[27] and Smeekens *et al*.[28] who reported satisfactory healing of surgically treated oral tissues after application of a photocuring periodontal dressing material based on the histological evaluation.

After removal of the dressing on day 7, Group II showed greater improvement in healing score on day 14 as compared to Group I (seen by ΔWHI). This was because initial mean value of WHI on day 7 for Group II was lower than Group I (although not statistically significant). This initial low score of WHI in Group II, implying slower healing may be attributed to partly-cured material in the depth of dressing, containing residual free monomer that impedes healing of gingiva in contact. Similar results were reported by Gilbert *et al.* in their *in vitro* study who suggested that uncured material produces a surrounding zone of growth inhibition and cell toxicity, however, this growth inhibition last for only 5 days. The fully-cured material has been reported to cause no such effect on cells.[22] After removal of the light cure dressing, healing progressed uneventfully and was found comparable with Group I on day 14.

mSBI was used to assess the bleeding tendency of the gingival margin. This index requires a periodontal probe to be passed along the gingival margin instead of probing the depth of sulcus as done in commonly used Gingival Index. Since bleeding tendency was evaluated at one and 2 weeks after surgery, it was necessary to avoid probing of gingival sulcus so that reattachment of newly formed junctional epithelium was not disturbed. Light cure dressing was not associated with any significant increase in bleeding as seen in mSBI scores thus reflecting its acceptable biocompatibility. This finding is supported by a study of Petelin *et al*. who evaluated the effects of periodontal dressings on fibroblasts and gingival wound healing in dogs.[29] Alpar *et al.* and Gilbert *et al.* also showed similar results.[21,22] Baghani and Kadkhodazadeh reviewed various periodontal dressings in 2013. They stated that Barricaid® is cytocompatible when its polymerization is complete.[30] The mSBI scores were higher on day 7 than day 14 after surgery within each group. This could be due to the normal inflammatory response of tissues after surgical manipulation or the tissue reaction to the presence of silk sutures as also reported by previous studies.[31,32]

Considering patients' subjective and objective evaluation of the dressings, there were no significant differences in pain and discomfort experienced by them in both the groups. A review of periodontal dressings by Sachs *et al*. in 1984 states that the degree of pain and discomfort and the tissue healing is majorly attributed to the nature of the surgical technique itself, amount of surgical trauma, tissue management, and duration of the operation rather than the presence or type of dressing.[20] However, despite similar pain and discomfort with both the

dressings, 75% of subjects preferred light cure dressing over non-eugenol pack due to its better appearance, the absence of annoying taste and reduced bulk.

Another important consideration is the preference of the operator in terms of handling, manipulation as well as the working time of each dressing. Light cure dressing includes a single paste, therefore eliminating the time required for mixing as with non-eugenol pack. However, direct application technique by syringe could also raise issues of cross infection, unless the syringe is discarded after every surgery. Light cure dressing has the advantage of total control over the placement and setting time as well as incremental additions, whereas setting time of non-eugenol dressing is fixed, limiting the working time. While manipulation, both of these dressings need to be handled with moistened gloves, however after complete setting, light-cured dressing has an advantage of being firm in consistency, whereas non-eugenol dressings become brittle. Translucency of Barricaid® allow for superior esthetics as well as monitoring of surgical site without removal of dressing. As far as cost-effectiveness is concerned, non-eugenol dressing is more economically-viable option. Therefore, both the clinician's personal preference as well as the patient acceptance are important while deciding the periodontal dressing of choice for specific clinical situations. The clinical performance of both the dressings in terms of healing, plaque and bleeding scores were found to be acceptable.

A double-blind study with a larger sample can establish more accurate evidence. Histological evaluation of gingival tissue and scanning electron microscopy of the removed dressing would have further shed light on the healing response. The microbial analysis would clarify the nature of plaque under each dressing.

Conclusion

Within the scope of this study, it was found that the clinical gingival tissue response following placement of periodontal dressings after periodontal flap surgery was similar with both light cure and non-eugenol dressings. Although non-eugenol dressing retained more plaque on its under surface than light-cure dressing, this did not have much influence on the healing outcome and clinical gingival parameters, which were acceptable and comparable in both groups, suggesting that both dressings have similar effects on gingival healing after periodontal surgery. However, a greater number of patients showed a preference for light-cure dressing, based on its superior aesthetics and taste.

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Conflicts of interest

There are no conflicts of interest.

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