

Evaluation and Comparison of Healing of Periodontal Flaps when Closed with Silk Sutures and N-Butyl Cyanoacrylate: A Clinico – Histological Study

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ABSTRACT

Background: The periodontal flap is one of the most frequently employed procedures, particularly for moderate to deep pockets. Silk is the most commonly used suture material for approximating the flap margins together after periodontal flap surgery. There are some major disadvantages of silk sutures and to overcome some difficulties with sutures, a need for alternative of sutures is always felt. N-butyl cyanoacrylate is a tissue adhesive, which can be used for the closure of the incised wounds.

Objective: The present study was carried out to evaluate and compare accumulation of dental plaque and response of gingival tissue during the healing period after periodontal flap surgery when closed with N butyl cyanoacrylate and silk sutures.

Materials and Methods: The study was carried out on 30 patients and divided into three groups, 10 patients per group: Group A, Group B and Group C. In each patient, a split mouth design was employed. The flap surgical procedure was carried out for the pocket therapy and the selection of the site for suture and cyanoacrylate was done randomly. Antibiotics and analgesics were prescribed and the patients were recalled after 1 week, 3 weeks and 6 weeks.

Results: It was found that healing with the cyanoacrylate is associated with less amount of inflammation during the first week when compared with silk. However, over a longer period the sites treated with both the materials showed similar healing patterns after 3 weeks and 6 weeks.

Conclusion: It can be concluded that healing of periodontal flaps when closed with silk sutures and N butyl cyanoacrylate is normal, uneventful, healed by primary intention and aids in early initial healing compared to silk suture.

Key words: N butyl cyanoacrylate, Healing, Periodontal flap surgery, Silk suture.

INTRODUCTION



Several techniques have been used for the treatment of periodontitis. The periodontal flap is one of the most frequently employed procedures, particularly for

moderate to deep pockets. Close post-operative adaptation of the flap onto the prepared root surface and the maintenance of this adaptation for a period of time hold the key to the reestablishment of a healthy dentogingival unit^{1,2,3}. Materials like silk, nylon, steel, catgut and polyglycolic-poly-lactic acid derivatives are being used for the post-operative closure of the flap. But many problems

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have been associated with the use of sutures in periodontal surgery².

Applications of sutures require passage of a foreign material through tissue due to which it produces the greatest tissue reactivity. It also provides a pathway for the retention of microorganism into the tissue which leads to infection. So, in order to overcome some difficulties with sutures, a need for supplementation or replacement of sutures is always felt.

Cyanoacrylates are tissue adhesive materials that were synthesized in 1959 by Coover et al. The chemical formula for cyanoacrylate is $H_2C = C(CN)COOR$, where R can be substituted for any alkyl group ranging from methyl to decyl.

Cyanoacrylates have been used in the repair of organs⁴, skin⁵, mucosal grafts⁶, closure of lacerations, incisions, in the post-extraction dressings⁷ and even in the fixation of mandibular fractures⁸.

The aim of present study was to evaluate and compare accumulation of dental plaque and response of gingival tissue during the healing period after periodontal flap surgery when closed with N butyl cyanoacrylate and silk sutures.

MATERIALS AND METHODS

This comparative Clinico-Histological study was carried out at the Department of Periodontics in Karnavati School of Dentistry, Uvarsad, Gujarat. The study protocol was explained to each potential subject, and written informed consent was obtained prior to the commencement of any treatment. The required ethical clearance was obtained from the college. The test materials used in the study were 3-0 black braided silk and N butyl cyanoacrylate.

Thirty patients with age group of 25-60 years having moderate to severe periodontitis with a probing depth ≥ 6 mm and good general health with no significant systemic abnormalities were included in this study. Pregnant female patients or lactating mothers, patients having history of consuming tobacco in any form and/or smoking were excluding from this study.

All the patients selected for the study were divided into three groups, 10 patients per group:

Group A - Patients were recalled after 1 week; Group B - Patients were recalled after 3 weeks; Group C - Patients were recalled after 6 weeks. In each patient, a split mouth design was employed. The surgical procedure carried out in this study was the modified flap operation given by KIRKLAND. In the surgical procedure after administration of local anesthesia, incisions were placed intracrevicularly [Fig 1], a full thickness mucoperiosteal flap was elevated [FIG 2], debridement, and root planning was done [FIG 3]. The selection of the site for suture and cyanoacrylate was done randomly.

Simple loop interdental ligation with 3-0 black braided silk sutures was done on one half of the selected surgical site. The application of N butyl cyanoacrylate was done on the other surgical site in a drop-wise manner on the flap margins, which were held in place [FIG 4]. Once the flaps were closed, no periodontal dressings were placed. Postoperative instructions were given. Antibiotics and analgesics were prescribed and the patient was recalled after 1 week. All the patients were recalled after week, sutures were removed and any cyanoacrylate present was also removed. Incisional gingival biopsies were taken with a blade no11 from the interdental regions to minimize the secondary trauma to the tissue. Care was taken so as to include the area of the suture in the tissue. The patients belonging to groups B and C were recalled after 3 weeks and 6 weeks respectively, the study parameters were recorded and the biopsies were taken. The biopsies were then sent, processed and stained with hematoxylin and eosin stains for histological assessment.

CLINICAL PARAMETERS

- Papillary Marginal Attachment Index (Maury Massler and Schour I)
- Turesky-Gilmore-Glickman modification of Quigley Hein Plaque index

HISTOLOGICAL EXAMINATION

- Gingival Biopsy: In the histological examination, epithelium, inflammatory cells, connective tissue and vascularity were examined in 3 high power fields (40X power). The interpretation was done by the oral pathologist.

RESULTS

The clinico - histological comparative analysis was done between the suture and the N butyl cyanoacrylate sites and the following results were obtained.

CLINICAL RESULTS

The comparison of scores of Turesky-Gilmore-Glickman modification of the Quigley-Hein Plaque index and Papillary Marginal Attachment Index between the suture and the cyanoacrylate sites in all the three Groups A, B and C showed that there was a statistically significant ($p < 0.05$) difference between the suture and cyanoacrylate only in Group A as shown in Table I and Table II, whereas no statistically significant differences was found between both the sites in Group B and Group C.

HISTOLOGICAL RESULTS

In all the histological samples, the cells observed were polymorphonuclear leucocyte (PMNs) along with chronic inflammatory cells. No histiocytes, foreign body giant cells, phagocytes were detected in either of the specimens.

The chronic inflammatory cells were present in all of the three observation days in both the sites. However there was a statistically significant ($p < 0.05$) difference between the suture and cyanoacrylate only in Group A (Table- III), whereas no statistically significant differences was found between both the sites in Group B and Group C. [FIG 5- 10]

Comparing the vascularity and connective tissue fibrosis between the suture and cyanoacrylate sites in all the three groups did not show statistically significant difference as shown in Table IV and V.

DISCUSSION

Silk is the most commonly used suture material for approximating the flap margins together after periodontal flap surgery². 'Wicking' is one of the major disadvantages of silk sutures and it has been found to cause infection³. So, in order to overcome some difficulties with sutures, a need for alternative of sutures is always felt.

An ever ending search for a material to overcome the short comings of the various wound closure techniques led to the discovery of cyanoacrylates which are today known as tissue adhesives.

The cyanoacrylates are the most widely used tissue adhesives for closure of traumatized as well as incised wounds. The cyanoacrylate material used in the present study is N butyl cyanoacrylate which is a biocompatible tissue adhesive and has good working properties like flow and fast setting time within 5-10 seconds³.



Fig 1: Incision Placed



Fig 2: Flap Elevation



Fig 3: Flap Debridement Completed



Fig 4: Surgical site after closure with suture and cyanoacrylate

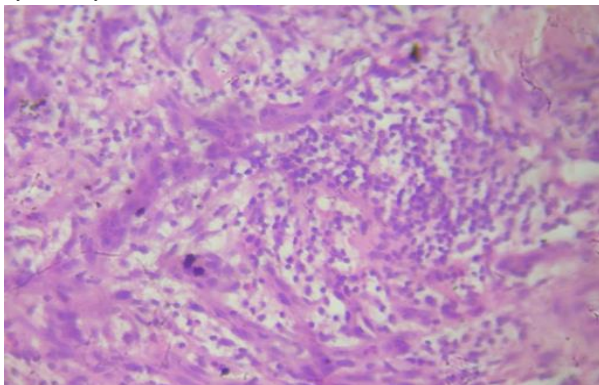


Fig 5: Histological picture of suture site after 1 week

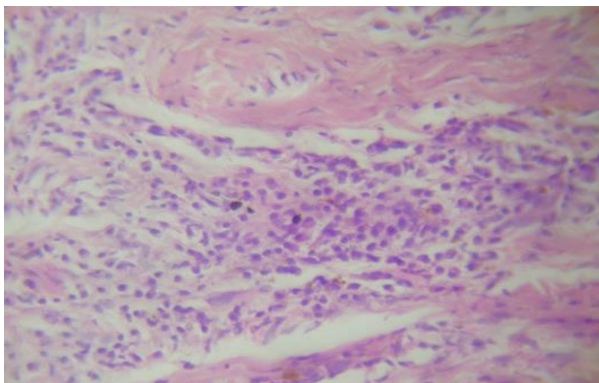


Fig 6: Histological picture of cyanoacrylate site after 1 week

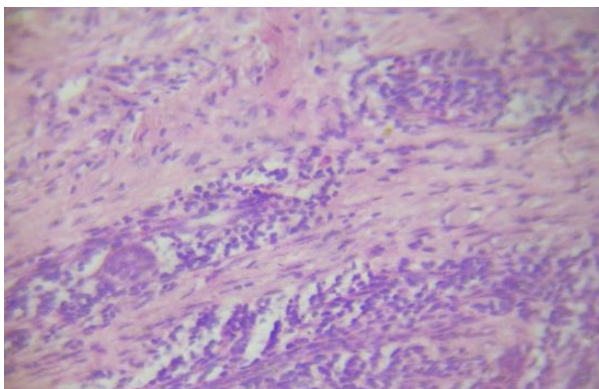


Fig 7: Histological picture of cyanoacrylate site after 1 week

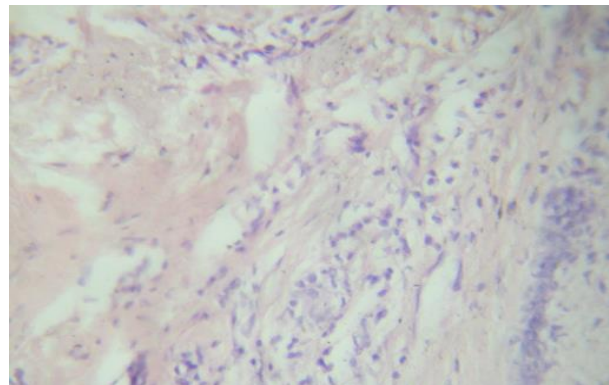


Fig 8: Histological picture of cyanoacrylate site after 3 weeks

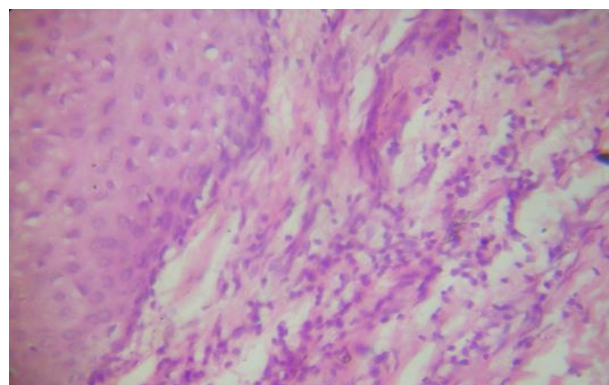


Fig 9: Histological picture of suture site after 6 weeks

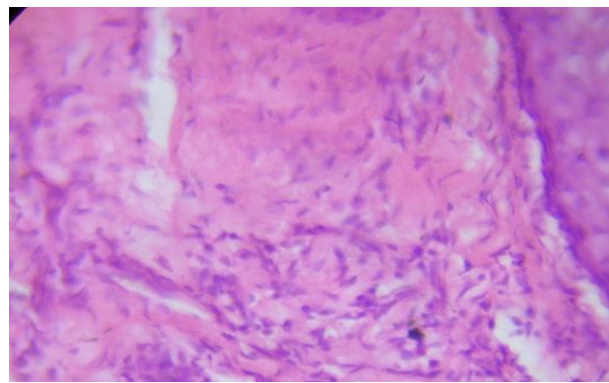


Fig 10: Histological picture of cyanoacrylate site after 6 weeks

Tissue adhesion is by valence bonding and Van der Waal's force⁹. N butyl cyanoacrylate sets by polymerization in presence of moisture and even blood, with release of heat. The material is degraded by breaking the C=C bond and is eliminated from the body through urine and feces. It has good hemostatic property¹⁰, good bonding properties with bond strength to hold the tissue margins together³ and to some extent it is also bacteriostatic.

In the study when the plaque scores were compared between the suture and the cyanoacrylate sites, there was a significant difference found in Group A ($p < 0.05$). The suture site was found to accumulate more plaque (1.93 ± 0.62) as compared to the cyanoacrylate site (1.34 ± 0.47) in Group A (Table I). This can be attributed to the suture threads acting as a site for plaque accumulation. This finding was in conjunction with studies done by Binnie and Forrest¹¹, Giray et al¹². However, there was no difference in plaque scores in Group B and in Group C (Table I). This can be attributed to the absence of the suture threads, which were removed after 1 week as well as emphasis on oral hygiene maintenance. This result was in conjunction with studies done by Binnie and Forrest¹¹ and Giray et al¹².

The evaluation of PMA index was done to check clinically the inflammation of the tissues as a response to both the materials. There was significant difference found in Group A ($p < 0.05$). In Group A, the significant difference in the scores between the suture site (1.80 ± 1.54) and the cyanoacrylate site (0.60 ± 0.69) can be attributed to the presence of the silk material within the tissue and increased plaque accumulation (Table II). It was found that the clinically appearing redness was more on the suture site than on the cyanoacrylate site. This could be attributed to the fact that silk was present within the tissues, which might have provoked the response, according to Macht and Krizek¹³. Levin² believed that silk was treated as a foreign protein by the body, it had a tendency to fragment the wound and increased inflammatory response. However, Giray et al.¹² attributed it to the trauma during suturing and also to the increased plaque accumulation at the suture site.

The reduced inflammation in Group B and in Group C can be related to the fact that the sutures were removed after 1 week. This finding is similar to those reported by Kulkarni and Chava¹⁴, Giray et al.¹² and Binnie and Forrest¹¹.

The Incisional gingival biopsies were taken from the interdental region to assess the tissue response of the test materials histologically.

In Group A, healing was uneventful and proceeded in a normal way except for slight increase in the inflammatory infiltration on the

suture site. This is similar to those findings reported by Giray et al¹². In Group B and Group C there was no statistically significant difference in inflammatory cell response between both the sites.

There was also no statistically significant difference seen in comparing the vascularity of both the sites in Group A, B and C which is consistent with results reported by Bhaskar and Frisch¹⁵, Binnie and Forrest¹¹, Greer¹⁰, Giray et al¹². The vascularity was normal to slight hypervascularity because of endothelial proliferation in both the sites. This can be attributed to the proliferation of vessels as a part of the normal healing process. This is in agreement with study conducted by Giray et al¹².

When the connective tissue was evaluated over the days the connective tissue was found to get organized as the healing progressed. There was no clinically significant difference in the overall fibrosis in the suture and cyanoacrylate sites in all the three groups.

No giant cell proliferation or histiocytes were noted in either of the sites in this study. However, Greer¹⁰ reported presence of microhistiocytes at 6 weeks. Miller et al.⁹ reported some giant cell proliferation in the cyanoacrylate site. Giray et al.¹² did not report any giant cells in the cyanoacrylate site but found giant cell proliferation on the suture site on the 14th post-operative day. Bhaskar and Frisch¹⁵ reported that giant cell reaction and phagocytosis would be observed if the cyanoacrylate material was implanted deep into the tissues. This was not the case in this study as the material was placed superficially.

CONCLUSION

From this study, following conclusions can be drawn:

1. Healing of periodontal flaps when closed with silk sutures and N butyl cyanoacrylate is normal, uneventful and healed by primary intention.
2. Healing with N butyl cyanoacrylate is associated with less inflammatory reaction than with silk sutures during the initial healing

Table 1: Comparison of Plaque scores in Groups A, B and C

Group	Site	Mean	S.D.	t-value	P-value	Results
A	SS	1.93	0.62	2.357	0.030	S
	CS	1.34	0.47			
B	SS	1.41	0.35	0.270	0.790	NS
	CS	1.36	0.48			
C	SS	0.99	0.30	0.081	0.936	NS
	CS	0.98	0.50			

Table 2: Comparison of PMA scores in Groups A, B and C

Group	Site	Mean	S.D.	t-value	P-value	Results
A	SS	1.80	1.54	2.233	0.039	S
	CS	0.60	0.69			
B	SS	0.90	0.99	0.780	0.445	NS
	CS	0.60	0.69			
C	SS	0.90	1.37	0.190	0.851	NS
	CS	1.00	0.94			

Table 3: Comparison of inflammatory cells in Groups A, B and C

Group	Site	Mean	S.D.	t-value	P-value	Results
A	SS	1.90	0.73	2.151	0.045	S
	CS	1.30	0.48			
B	SS	1.80	0.63	0.671	0.511	NS
	CS	1.60	0.69			
C	SS	1.40	0.51	0.000	1.000	NS
	CS	1.40	0.51			

Table 4: Comparison of Vascularity in Groups A, B and C.

Group	Site	Mean	S.D.	t-value	P-value	Results
A	SS	1.50	0.52	0.000	1.000	NS
	CS	1.50	0.52			
B	SS	1.60	0.51	0.372	0.714	NS
	CS	1.70	0.67			
C	SS	1.70	0.48	0.447	0.660	NS
	CS	1.60	0.51			

Table 5: Comparison of Fibrosis in Groups A, B and C.

Group	Site	Mean	S.D.	t-value	P-value	Results
A	SS	1.80	0.63	1.134	0.272	NS
	CS	2.20	0.91			
B	SS	2.00	0.66	0.000	1.000	NS
	CS	2.00	0.81			
C	SS	1.90	0.73	0.606	0.552	NS
	CS	2.10	0.73			

period of 7 days. Both the materials showed similar healing over a longer period of time.

3. N butyl cyanoacrylate had an added advantage of the relative ease of application and less time consuming as compared to silk sutures.

The drawbacks of the present study were that the material was not tested in the posterior teeth, where it is difficult to apply, secondary trauma caused by the biopsy, and cyanoacrylate was placed superficially. The future studies should be done so as to assess the materials in the closure of flaps in the posterior areas and in the deeper areas within the tissues to evaluate the response of alveolar bone.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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