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RESEARCH ARTICLE

A Comparative Clinical Study to Evaluate the Healing of Surgical Periodontal Wound Closure using Fibrin Glue and Silk Suture

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ABSTRACT

Aim of this study is to compare the healing of surgical periodontal wound closure using Fibrin glue and Surgical silk suture. A total of ten subjects aged 25-54 years were divided into 2 groups; Group I where surgical flap closure was done with Fibrin glue on one sextant and Group II where surgical flap closure was done with Silk Suture on other sextant. Time taken for flap closure was recorded on the day of procedure. Post-operative clinical parameters pain, wound healing index and plaque index were recorded at 1st week, 4th week and 12th week for both groups. On inter-group comparison, statistically significant differences were seen in time taken for flap closure and pain score. Statistically significant difference between the groups was observed in wound healing index and plaque index at the end of 1st week and 4th week. At the end of 12th week, wound healing index between the groups showed no differences and no statistically significant difference was observed in plaque index. This study shows the beneficial results of using Fibrin sealant for fixing tissues after periodontal flap surgery. Both sutures and fibrin sealant were effective in bringing about healing following periodontal surgical procedure. However, fibrin sealant was found to be a more favorable approach which enhance wound healing when compared to sutures. Thus, fibrin sealant can be considered as an alternative to sutures for surgical periodontal wound closure.

Keywords: Fibrin glue; Reliseal; Silk suture; Wound healing

1 INTRODUCTION

The rationale for periodontal therapy is to re-establish and maintain the periodontal health and function.Over the years, periodontal therapy has been influenced by the trends of the times, and consequently treatment approaches have been modified somewhat.[(1)]

The traditional approach to treating periodontitis includes an initial non-surgical therapy phase followed by a surgical phase as necessary.[(2)] Close postoperative adaptation of the flap onto the prepared root surface and the maintenance of this adaptation for a period of time holds the key to the reestablishment of a healthy dentogingival unit.[(3)]

Establishing a non-tension primary wound closure of various soft-tissue flaps is essential for optimal postsurgical wound healing. Suturing is a common procedure done for this. Materials like silk, nylon, steel, catgut and polyglycolic-polylactic acid derivatives are being used for the post-operative closure of the flaps. When used properly, surgical sutures should hold flap edges in apposition until the wound has healed enough to withstand normal functional stresses.[(4)]

Although suturing post-surgically has many benefits, there are some disadvantages. Braided silk is the most common suture used for closure of oral wounds. It has the phenomenon of 'wicking,' which makes it a site for retention and ingress of bacteria into the tissues and thus a reservoir of secondary infection.[(5)] In addition, breakdown

products from the absorbable suture material itself have been shown to cause an inflammatory reaction in the tissue in certain cases.[6] Suturing also requires technical skill and an additional patient visit for its removal.[7]

In order to overcome these difficultiesconcept of tissue adhesive came forward as an alternative to sutures. Fibrin sealant is a synthetic substance used to create fibrin clot. It is composed of fibrinogen and thrombin where thrombin acts as an enzyme and converts the fibrinogen to fibrin which can act as a tissue adhesive. Fibrin sealant in addition to adhesive property also has an anti-enzymatic effect which promotes fibroblast aggregation, their growth and adhesion.[7]

The purpose of the study was to compare the healing of surgical periodontal wound closure using Fibrin glue and Surgical silk suture.

2 MATERIALS AND METHODS

A total of 10 systemically healthy subjects aged 25-54 years (mean age of 37.100 ± 5.238), who visited Department of Periodontology, Yenepoya Dental College, Mangalore participated in this split-mouth randomized controlled clinical trial.

The inclusion criteria were (a) Systemically healthy patients and (b) Patients indicated for periodontal flap surgery. The exclusion criteria were as follows (a) Pregnancy and lactation (b) Patients with habits like smoking, alcoholism and tobacco chewing (c) use of any medication possibly affecting the periodontal tissues.

The study protocol was reviewed and approved by the Institutional Research Ethics Committee, Yenepoya deemed to be University. The purpose of the study was explained to the subjects and an informed consent was obtained prior to their enrollment in the study.

All subjects were divided into 2 groups depending on the treatment provided; Group I where surgical flap closure was done with Fibrin glue -RELISEAL® (Figure 1) on one sextant and Group II where surgical flap closure was done with Silk Suture -MERSILK® (Figure 2) on other sextant. The test site and control site were determined using computerised randomization. All subjects underwent scaling and root planning prior to surgical procedure.

Fig. 1: Reliseal Fibrin Sealant and Mersilk Suture

2.1 *Reconstitution of Fibrin Sealant- RELISEAL®*

Reliseal® Fibrin Sealant Kit contains (Figure 1)**:**

- 1 vial of Freeze-Dried Human Fibrinogen [Yellow Capped], Freeze Dried Human Thrombin [Blue Capped] and Aprotinin Solution [Red Capped].
- 1×5 ml plastic ampoule of sterile water.
- 4×2 ml graduated sterile syringes with four 21G and two 20G disposable needles.
- 1 Applicator with two mixing chambers and one plunger guide.

Step A: Preparation of Fibrinogen solution

- The entire content of Aprotinin solution was aspirated and injected into the vial containing Freeze Dried Human Fibrinogen Using a 2 ml disposable syringe with 21 G needle.
- The vial was swirled briefly in a slow circular motion.
- 0.5 ml of the reconstituted Fibrinogen solution was aspirated into a fresh graduated 2 ml sterile syringe.

Step B: Preparation of Thrombin solution

- 0.5 ml of sterile water from the plastic ampoule was aspirated and injected into the vial containing Dried Human Thrombin Using a 2 ml disposable syringe with 21 G needle.
- Thrombin solution was reconstituted by gently agitating the vial.
- 0.5 ml of the reconstituted Thrombin solution was aspirated into a fresh graduated 2 ml sterile syringe.

Step C: Using the Reliseal® Applicator system

- Filled syringes were placed into the applicator housing and engaged the nozzles of syringes with the mixing chamber.
- Piston ends of the syringes were fixed into the grove of the plunger guide.
- The blunt application needle (20 G) was fixed to the mixing chamber.
- The plunger guide of the Reliseal® Applicator was held and pushed with the thumb till the liquid sealant ejected out from the applicator needle.

Extra-oral antisepsis was obtained with Betadine solution. After administering local anaestheisa [Lignocaine hydrochloride (2% adrenaline,1:80,000)], full thickness mucoperiosteal flap was reflected followed by degranulation and thorough root debridement. On the test site, the reconstituted components of fibrin sealant Reliseal® (RELISEAL®, Reliance Life Sciences) (Figure 2) was applied on the under surface of the raised flap upto 2 mm from the coronal margin and repositioned back on to the root surface. The tissues were kept in position by the gentle pressure of wet gauze for 30–60 seconds, followed by the placement of periodontal dressing.

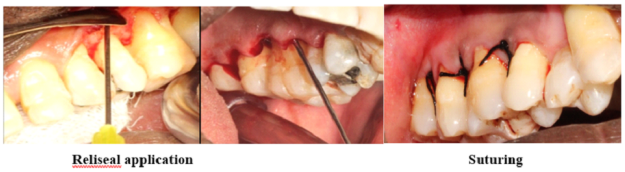


Fig. 2: Reliseal Fibrin application and Suturing

On the control site, the periodontal flap was reflected as in test site and was approximated by simple interrupted sutures using silk suture (MERSILK®, 3-0 black Silk Suture) (Figure 2). Periodontal dressing was placed.

Time taken for flap closure using suture and fibrin glue was recorded using a stopwatch. Post-operative instructions were given for all the subjects. Antibiotics and analgesics were prescribed.

Suture removal was done for group 2 subjects on the 7th day following the surgery. Subjects were recalled and surgical sites were evaluated for healing at the end of 1st week, 4th week and 12th week. Clinical parameters were assessed by a trained examiner who was not a part of the study in order to avoid bias in recording the clinical parameters.

Post-operative clinical parameters (Pain, Wound closure index and Plaque index) were recorded. Pain was assessed at the end of 1st week. Wound closure and plaque index were assessed at the end of 1st week, 4th week and 12th week post-operatively (Figures 3, 4, 5 and 6).

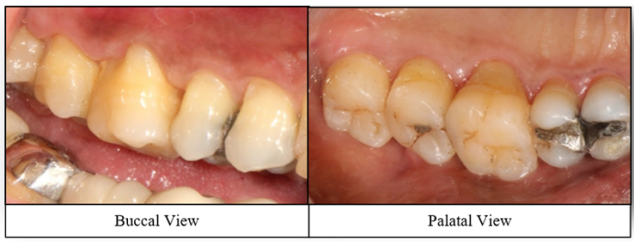


Fig. 3: Group I – 1st week follow up

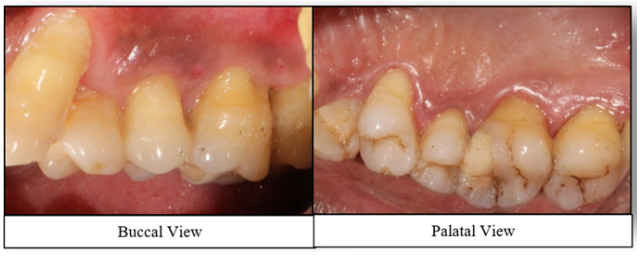


Fig. 4: Group I – 12th week follow up

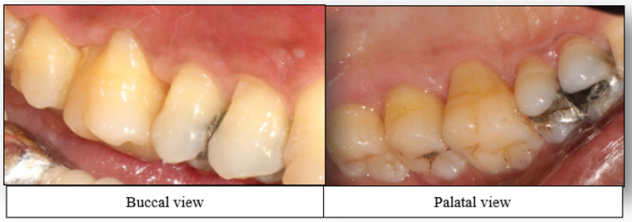


Fig. 5: Group 2 – 1st week follow up

Fig. 6: Group 2 – 12th week follow up

2.2 *Statistical analysis*

Independent t test and Paired sample t test were used to compare the parameters across different time periods between the two groups and within the groups respectively. p value <0.05 was considered as statistically significant and p value <0.01 and <0.001 were considered as highly significant and very highly significant respectively. Data was subjected to statistical analysis with the Statistical Package for Social Science Software (SPSS, version 22.0)

3 RESULTS

3.1 *Time taken for flap closure & pain*

Comparison between the two groups showed that both time taken, and pain score were higher in Group 2 and were found to be statistically very highly significant with a p value of <0.001 (Table 1, Graph 1).

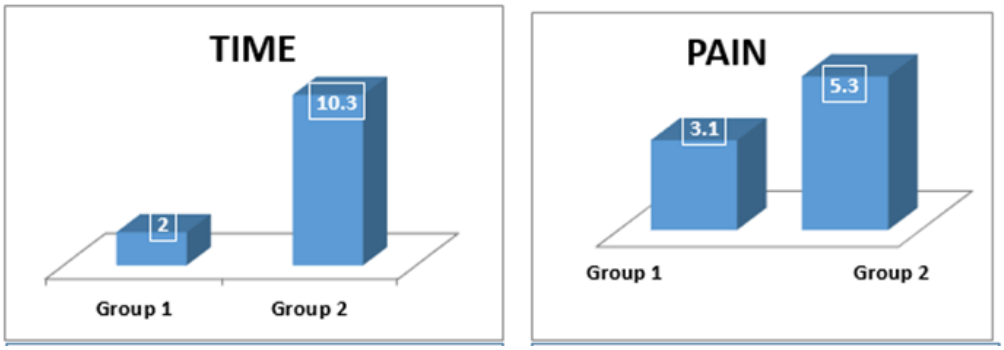
3.2 *Wound healing index*

Comparison of the 1st week and 4th week wound healing index score between 2 groups showed that wound healing index score was higher in group 1 and was found to be statistically significant. At 12th week, wound healing between group 1 and group 2 showed no differences (Table 2, Graph 2).

On intragroup comparison the mean wound healing index score between 1st week and 12th week showed that in group 1, the mean values of 12th week were higher with a difference of -0.200±0.422, but was not statistically significant and in group 2, the mean values was higher at 12th week with a difference of -1.400 ±0.516 and was found to be statistically very highly significant.

Table 1: Comparison of mean time taken for flap closure (in minutes) and pain score (VAS scale) between the groups

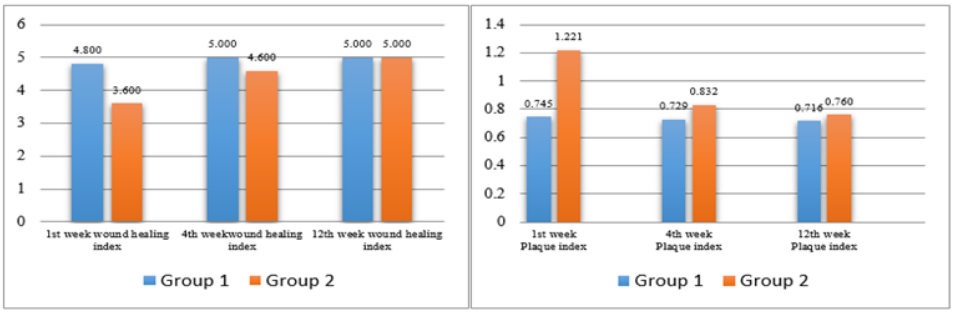
	Group	N	Mean	Std. Deviation	t	p Value
Time taken for flap closure	Group 1	10	2.000	0.408	-17.790	**<0.001vhs**
	Group 2	10	10.300	1.418		
Pain	Group 1	10	3.100	0.738	-6.957	**<0.001 vhs**
	Group 2	10	5.300	0.675		



Graph 1: **Mean time taken for flap closure and pain score between the groups at 1st, 4th and 12th week**

Table 2: Mean wound healing index score and plaque index score between the groups at 1st, 4th and 12th week

	WOUND HEALING INDEX SCORE				PLAQUE INDEX SCORE			
	Group	Mean	Std. Deviation	p Value	Group	Mean	Std. Deviation	p Value
1st week	Group 1	4.800	0.422	**<0.001**	Group 1	0.745	0.052	**0.001**
	Group 2	3.600	0.516		Group 2	1.221	0.302	
4th week	Group 1	5.000	0.000	**0.037**	Group 1	0.729	0.089	**0.018**
	Group 2	4.600	0.516		Group 2	0.832	0.088	
12th week	Group 1	5.000	0.000		Group 1	0.716	0.073	0.301
	Group 2	5.000	0.000		Group 2	0.760	0.094	



Graph 2: **Mean wound healing index score and plaque index score between the groups at 1st, 4th and 12th week**

3.3 *Plaque index*

Comparison of the 1st week and 4th week plaque index score between the two groups showed that plaque index scores were higher in Group 2 with a statistically significant difference. At the end of 12th week, plaque index score was higher in Group 2 but not statistically significant with a p value of 0.301 (Table 2, Graph 2).

On intra-group comparison of mean values at 1st and 12th week plaque index score in group 1, it was found to be higher at 1st week with a mean difference of 0.029±0.086 and there was no statistically significant difference and in group 2, the score at 1st week was higher with a difference of 0.461±0.267 and was statistically very highly significant.

4 DISCUSSION

The purpose of the present study was to compare the healing of surgical periodontal wound closure using Fibrin glue and Surgical silk suture: 10 subjects were divided into 2 groups depending on the treatment provided; Group 1 (Test) in which surgical flap closure was done with Fibrin glue on one sextant and Group 2 (Control) in which surgical flap closure was done with Silk Suture on other sextant.

The Fibrin sealant used in our study is RELISEAL® (Reliance Life Sciences. India), which is a commercially available indigenous preparation. The use of Reliseal fibrin sealants has been studied extensively; most of this research pertains to the medical field. Thus, there was a need to judge their performance in dentistry when used for flap approximation after periodontal flap surgery. To evaluate fibrin sealing system in the clinical trial, Ethicon Mersilk 3–0 sutures were used as a control since the latter is the most popular and readily available means of fixing tissues in periodontal surgery. A split mouth trial was employed in our study design where the patient serves as his/her own control, thereby reducing the influence of confounding covariates and also increasing the statistical efficiency.

The results of our study showed that on comparing the time taken for flap closure and pain score, there was a statistically significant difference between two groups. Wound healing index and plaque index showed a statistically significant difference between two groups at the end of 1st and 4th week. However, at the end of 12th week, no statistically significant difference was observed in both wound healing index and plaque index between two groups.

The time taken for suturing is critical compared to the surgical procedure itself since suturing consumes extra time which can cause additional trauma to the patient and fatigue to the surgeon during the procedure. In our study, it has been found that the use of fibrin glue saves remarkable amount of time and makes it easier to fix the tissues in difficult inaccessible areas and esthetically critical areas. Our results are in agreement with the study conducted by Pini Prato [8], in which the time saved range from 3–19.5 in flap and graft procedures.

Assessing severity of pain is an indicator of patient's comfort during the post-operative period. In our study, we used Visual analog scale for recording pain score at the end of 1st week for both the groups. The results demonstrated that the pain experienced by group 1 was less as compared to that of group 2. This may be due to better tissue handling and less tissue inflammation in group1. The same was noted by Joshi et al [9] where cyanoacrylate group experienced reduced pain when used for wound closure after surgical removal of impacted third molars. Contrary to the present study, Khalil et al [10] found no statistically significant difference between the pain score when tissue adhesive was compared with suture for intra-oral surgical wound closure.

In our study, the highest plaque index score was observed at 1st week in Group 2, it can be attributed to the difficulty in oral hygiene maintenance post-surgery. This may be related to suture threads acting as sites of plaque accumulation, which is similar to those reported by several authors. [11–13]

There was a decline in plaque index score in 4th and 12th week in group 2. This is in concurrence with Kulkarni et al [11] and Giray et al [12] who attributed it to the removal of sutures resulting in less plaque accumulation. In group 1, there was lesser accumulation of plaque because of the smooth adaptation of flaps to the tooth surface when fibrin glue was used which is in consistence with the study results obtained by Pini Prato [8] and Bartolucci E [14].

Healing can be best evaluated by the presence or absence of inflammation and infection. [13,15] In this study we used wound healing index to describe the extent of clinical healing after periodontal surgery which was proposed by Landry, Turnbull and Howley. [16] At the end of 1st week and 4th week, better healing was observed in group 1. This can be correlated with the histological study results obtained by Pulikkotil et al [7] and Kulkarni et al [11].

Better wound healing may be related to the presence of factors such as thrombin, fibrin, fibronectin and platelet-derived growth factor, which are known to retain their biologic activities on cell proliferation and differentiation in fibrin adhesives. [17] Fibrin sealants stimulate early wound healing and connective tissue growth by accelerating revascularization and facilitating the migration of fibroblasts. [18]

During our procedure, rapid hemostasis was observed as an incidental finding soon after the application of fibrin glue, unwinding its hemostatic property and making it possible to approximate flaps precisely. This could be another beneficial effect of Reliseal. Whereas in those approximated with sutures, there was slight bleeding at the line of suture. The findings of are in concurrence with the study results by several authors [8,13,14,16] in which they stated that involvement of physiologic substances in biologic adhesive system appears to augment normal clotting mechanism and therefore has a distinct advantage over suturing and

synthetic sealants.

In sutures, it was noticed that there was a marginal fixation of the flap, while fibrin sealant provided a whole surface of adhesion to the underlying tissues. This total adhesion, together with fast hemostasis, helps in preventing flap displacement and hematoma formation. [8,13]

One of the drawbacks of fibrin sealant is that fibrin sealants prepared from donors carry the risk of transmitting diseases. [19] Another limitation of fibrin sealant is its high cost. The overall convenience of the use of fibrin sealing system should be evaluated on the basis of its cost and benefits. [20] On one hand the fibrin sealant kit is expensive; on the other hand, the use of the glue saves time during surgical procedures and avoids time wasted in suture removal. [8]

There were no adverse effects with the use of Fibrin sealant observed in any of the subjects in our study. In the present study, we only assessed clinical parameters following flap surgery with the use of fibrin sealant. Further studies with large sample size assessing both clinical and histological parameters would yield interesting results.

5 CONCLUSION

This study shows the beneficial results of using Fibrin sealant for fixing tissues after periodontal flap surgery. On comparison between the two groups, both sutures and fibrin sealant were effective in bringing about healing following periodontal surgical procedure. However, fibrin sealant was found to be a more favorable approach which enhances wound healing when compared to sutures. Thus, fibrin sealant can be considered as a better alternative to sutures for surgical periodontal wound closure.

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