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Effect of Autologous Fibrin Glue on Soft Tissue Healing After Periodontal Flap Surgery- A Clinically Designed Study

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A B S T R A C T

Aim and Objective: *The aim of this study is to evaluate the effectiveness of autologous fibrin glue in periodontal flap closure. Here the objective is to assess it's healing properties and tissue adhesion capability.*

Materials and Methods: *30 patients of chronic periodontitis case were selected to conduct a clinical study involving advanced periodontal pocketing (=>5mm) and attachment loss (=>5mm) after non-surgical therapies. After fulfilling inclusion and exclusion criteria, open flap debridement was performed to provide direct access to root surfaces and underlying bone on selected site. Autologous fibrin glue was applied during flap closure. Simplified healing index and roll test was done at 1month and 3 months interval.*

Results: *Autologous fibrin glue demonstrated efficient hemostasis and enhanced tissue adhesion, improved patients comfort during the healing process. Statistical analysis report show significant p value of simplified index and roll test.*

Conclusion: *Autologous fibrin glue holds promising results in periodontal flap closure. Its use can enhance patient outcomes by reducing the discomfort post-operative and contribute to successful periodontal treatment.*

Key words: *autologous fibrin glue, soft tissue healing, open flap debridement*

INTRODUCTION

Periodontitis is a irreversible chronic inflammatory multifactorial condition, characterized by clinical attachment loss and bone loss leading to tooth loss in severe cases.(1) Primary intervention involves the

mechanical removal of disease-causing agents by SRP (scaling and root planing) , which remain the gold standard non-surgical treatment, as stated by Herrera in 2016.[2] The effectiveness of SRP becomes limited by instrument limitations, where curettes efficiency decreases below 3.73 mm pocket depth and reaches a limit of ~6 mm depth. Beyond a critical depth of 5.4 mm, open flap debridement, a surgical periodontal intervention is preferred, as stated by Heitz-Mayfield and Lang in 2013[3]; Lindhe, Socransky, Nyman, Haffajee, and Westfelt in 1982.[4]

For optimal wound healing post-surgical i.e after open flap debridement, its closure is a crucial step for wound stability and integrity. Suturing done for primary closure, have shortcoming such as infection risk, scarring and need for removal. To address these issues, tissues adhesives like fibrin sealants have emerged as a potential alternative to it. They offer viable solution for non-tension wound closure. Fibrin sealant is a substance used to create fibrin clot, is composed of fibrinogen and thrombin. Thrombin function as an enzyme in converting fibrinogen to fibrin which acts as tissue adhesive. Fibrin sealant has depicted anti-enzymatic property along with adhesive property, this is effective in promoting fibroblast aggression, growth and adhesion.[5]

Regeneration and repair is the outcome expected following periodontal therapy in healing phase. The healing at cellular level involves intricate interactions of cells i.e epithelial cells, gingival fibroblasts, periodontal ligaments cells and osteoblasts and ECM (collagen, fibronectin, hyaluron, elastin) remodelling. In this process, growth factors play crucial role by recruiting fibroblasts and stimulating tissue recovery.[1] Platelets also secrete fibrin, fibronectin and vitronectin, which act as a matrix for the connective tissue and as adhesion molecules for more efficient cell migration. This concept has lead to the idea of using platelet as therapeutic tools to improve tissue repair particularly in periodontal wound healing [6]

Histological analysis have shown an adequate epithelium with rete ridges formation, young connective tissue presence at site of fibrin glue application, more fibroblasts and less number of inflammatory cells and blood vessels were seen at site. Higher density of collagen fibers was seen which was regularly arranged in the connective tissue stroma.[5]

By the process of cryo-precipitation, fibrin glues are stem from whole blood involving two-step process of viral inactivation and removal. These biologic glues contain various purified and virally inactivated proteins of human origin such as fibrinogen, thrombin, factor XIII, anti-fibrinolytics agents and calcium chloride. However, along with proteins they also contain microbes of pathogenic nature, which might be carried forward to recipient from donor's blood. Over the past three decade, assessment of efficacy and safety of fibrin glues have been undertaken. Prospective application of autologous fibrin glue aim to replace those biologic glues derived from poled plasma, as they over advantage of no risk of infection and moderate to severe hypersensitivity reaction to foreign substances.[7]

Therefore this study aims to assess the soft tissue healing after periodontal flap surgery using autologous fibrin glue.

MATERIAL AND METHOD

30 patients were selected from the outpatient Department Of Periodontology of NIMS Dental College and Hospital of Jaipur, Rajasthan of chronic periodontitis condition. Ethical clearance was obtained from the concerned ethical committee of NIMS UNIVERSITY, Dr. B.S.Tomar City, Jaipur. IEC/P-26/2022.An informed consent form was taken after verbally discussing the treatment plan with the concerned patients.

Patients of 20-50 years of the both gender were assessed for selection based on inclusion criteria

involving, moderate to severe periodontitis as assessed by clinical criteria i.e probing depth ≥ 5mm atleast in a sextants, with signs of clinical inflammation consistent with local etiological factors, loss of attachment =>5mm. Patients who demonstrated acceptable oral hygiene were taken in consideration. Patients with systemic diseases and/or on drug therapy which may interfere with healing were excluded. Any known drug allergies to any medication, patient with habit of smoking, tobacco chewing, and any other habit that might influence the diseases were not taken in consideration for the purpose. Pregnant and lactating mothers and patients of aggressive periodontitis were all excluded from the study.

For selected patients, full mouth scaling and root planing was undertaken and oral hygiene instructions were given. Plaque index and periodontal findings were recorded. Pre-operative photographs and OPG/ IOPA were taken. Lastly, they were advised to visit after 4 weeks for evaluation followed by surgical procedure intervention after analysing the condition.

A single surgeon performed the procedure in a selected sextant and following parameters were evaluated with periodontal probe:

1. Plaque Index (Silness and Loe, 1964): Evaluated pre-operatively and post-operatively at 1 month and 3 month interval.
2. Simplified healing index (Sumit and Bhumit 2016): Recorded at postoperative 1 month and 3 month interval.
3. Roll test: Recorded at post-operative 1 month and 3 month interval.

Surgical Method and Autologous Fibrin Glue Preparation

Before starting surgical procedure, required nerve block and locally infilteration was given using local anesthetic agent of 2% lignocaine with adrenaline 1:80,000 concentration. On the buccal and lingual aspects of the selected site, a conventional non-displaced muco-periosteal flap was elevated, exposing 1-2 mm of alveolar bone. Thorough debridement of root surfaces was performed using gracey curettes and cumin to remove local irritants and diseased granulation tissue and altered cementum. The periodontal flap margins were trimmed with a tissue nibbler, repositioned to achieve maximum interproximal closure and adapted using autologous fibrin glue.

For autologous fibrin glue preparation, 10 ml blood is withdrawn by veni-puncture from anti-cubital fossa using a 23G disposable syringe. Collected blood was transferred to 0.9% sodium citrate-containing vacutainers (light blue head vacutainers) and centrifuge at 3000 rpm for 10 minutes, separating whole blood into three layers: platelet-poor plasma (topmost), plasma-rich plasma (middle), and RBCs (bottom). After 1st centriguation, RBCs containing section is discarded after drawing the platelet-poor and rich plasma into another vacutainers (red head vacutainer). To this red vacutainer, 1 part of protamine sulfate (10 mg/ml) is added to precipitate fibrinogen from plasma and centrifuged again at 1000 rpm for 5 minutes to separate thrombin (autologous serum) and fibrinogen. Fibrinogen is separated in bottom layer and autologous thrombin in top layer. 0.5ml of autologous thrombin is used to activate the fibrinogen and is drawn in a separate syringe. Calcium chloride in equal parts as of autologous thrombin and fibrinogen was taken in separate syringe. Both the syringe solutions are applied at the surgical site together in same amount. Under digital pressure, hold the flap in position for 2-3 minutes for adaptation.

Post-Operatively, patients are motivated to maintain good oral hygiene. They are advised to avoid trauma at the surgical sites. Following medications are prescribed include: Analgesics (ibuprofen + paracetamol) twice daily for 3 to 5 days, Antibiotics (amoxicillin + clavulanic acid) three times daily for 5 days, Omeprazole capsule for gastritis once daily, taken half an hour before breakfast for 5 days,

Chlorhexidine mouthwash three times daily for 30 days.

Case

Sextant Seatant Sealed with Autologous Fibrin Glue after Open Flap Debridement in Relation to 45, 46.

FIGURE 1: Flap was raised, through debridement was done.

FIGURE 2: AFG was applied at the site for adapting the flap at its position.

FIGURE 3: After applying digital pressure for 2-3 mins, flap was adapted.

Post Operative

FIGURE 4: AFTER 1 MONTH

FIGURE 5: AFTER 3 MONTH

Autologous Fibrin Glue Preparation

FIGURE 6: 10 ml blood withdrawn by venipuncture in anti cubital fossa.

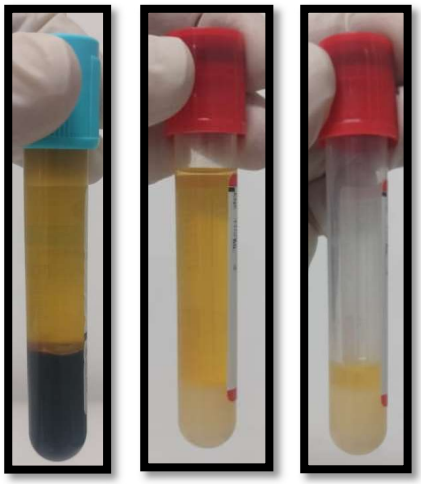

FIGURE 7: Firstly whole blood separate into plasma and RBCs, secondly fibrinogen and thrombin is separated, thirdly 0.5ml of thrombin and fibrinogen is taken.

FIGURE 8: Fibrinogen and thrombin activated with equal parts of calcium chloride.

Statistical Analysis

All the data recorded are entered in excel sheet and evaluated using SPSS version. Descriptive statistical analysis has been carried out in the present study. Results are presented as mean score, standard deviation and results on categorical measurements are presented in number (c/o). T –test paired and unpaired was performed to assess the association between variables. The statistical significance was considered at $p<0.05$.

RESULT

For a total 30 patients out which 12 females and 18 males readings were recorded. All the recorded indices were evaluated by SPSS version 26.

TABLE 1 : Demographic details of Participants.

	N	Mean age	Std. Deviation	Maximum	Minimum
AGE	30	37.13	10.647	56	20

Assessment of full mouth plaque score which recorded pre and post operatively.

TABLE 2: Plaque scores evaluation at pre-operative, 1 month post-operative, 3 month post-operative

	Mean	Std. Deviation	N
Pre-operative plaque score	2.2433	.35300	30
Plaque score at 1 month	1.6133	.40063	30
Plaque score at 3 months	1.1633	.44682	30

Pre–operative mean value is 2.24 and standard deviation of 0.35, indicating moderate plaque accumulation according to plaque index in patient oral cavity and plaque scores were close to mean

score. Plaque score at 1 month has mean value of 1.61 and standard deviation of 0.40, representing significant improvement from pre – operative score with moderate level of variability among participants response. At 3 month, mean score is 1.16 and standard deviation of 0.45, shows improvement from the 1 month post-procedure average scores.

Assessment of simplified healing index (SHI) score recorded post operatively at 1montha and 3 month interval

Table 3: SHI scores intragroup comparison (paired T test)

Group	N	At 1 Month		At 3 Month		P value
		Mean	S.D	Mean	S.D	
Sextant treated with autologous fibrin glue	30	1.83	0.379	1.00	0.00	<0.001*

The mean Simplified Healing Index score at 1 month post-procedure was **1.83**, with a standard deviation of **0.379**, indicating less variability in healing progress among participants compared to the control group. By the 3-month mark, the mean score significantly decreased to **1.00**, with no variability (S.D = **0.00**). The p-value is **less than 0.001**, indicating that the decrease in the healing index score from 1 month to 3 months is statistically significant.

This suggests that the participants showed significant healing progress over the 3-month period, and their healing was more consistent. Indicative of enhanced healing process after periodontal flap surgery with the use of autologous fibrin glue which has hasten the healing process at 1 month interval by providing necessary growth factors require soft tissue healing.

Assessment of roll test score recorded at 1 month and 3 months.

Table 4: INTRAGROUP DIFFERENCE (PAIRED T TEST)

Group	N	At 1 Month		At 3 Month		T statistics	P value
		Mean	S.D	Mean	S.D		
Sextant treated with autologous fibrin glue	30	2.20	0.407	1.03	0.183	16.858	<0.001*

The **roll test** evaluates the stability and adhesion of periodontal flaps. Lower roll test scores indicate better flap adhesion. Significant reduction in mean score from 1 month to 3 month i,e from 2.20 to 1.03 is indicative enhancement of tissue stability and adaptability with time. The average mean score value at 1 month signifies improved flap adhesion with the use of autologous fibrin glue. Significant p-value is indicative of this enhanced and improved tissue healing with AFG use in flap adaptation after thorough open flap debridement of selected site.

DISCUSSION

In severe case of periodontitis, surgical intervention i.e open flap debridement is a surest way to remove sub-gingival deposits and diseased granulation tissue from hard-to-reach areas due to curette limitations in deeper pockets.[8] The outcome of surgical procedure is dependent on the proper closure and stabilization of wound margins in their desired position. Suture provide primary retention, helps in clot stabilization.[9] On the positive side, suturing can reduce wound dehiscence, promote healing, and results in less post-operative gingival recession. However, it can make plaque control difficult, lead to discomfort, and carry a risk of infection. Additionally, repositioning flaps apically my expose sensitive cervical areas of the teeth. These factors should be carefully considered when deciding whether to use suture. [10]

To overcome the shortcomings of sutures, tissue adhesives came into existence. Commercial and autologous tissue adhesives are increasingly being used as alternatives to sutures for periodontal flap closure. Commercial tissue adhesives such as **N-butyl cyanoacrylate** and **Iso-amyl cyanoacrylate, Tisseel**, are fibrin adhesive sealant, has shown good results in parameters like hemostasis, fixation of tissues, reduction in plaque and gingival index, and probing depth postoperatively. [11] Autologous fibrin glue offers several advantages over commercial bio-adhesives. It reduces contamination risk and immunological responses, acts as a growth factor-rich scaffold with hemostatic properties and stimulates tissue repair. Economically, it's advantageous compared to ready-to-use fibrin glues. However, specific benefits depends on preparation and application [12]

In our current study, soft tissue healing post-surgical procedure was evaluated using simplified healing index. The results were in favour of autologous fibrin glue. These results were supported by Pradhan and colleagues study (2023). They evaluated healing with early wound index and concluded that the AFG had significantly improved clinical parameters, making it a valuable tool in periodontal flap closure.[13] Similarly study conducted by Subashree soundarajan in 2021, studied post-operative healing in papilla after flap surgery and roll test was conducted to check for adaptation. There results were in support of results of our study. We evaluated tissue adaptation using roll test and results were in support of AFG use for flap closure.[12] Very few studies has been conducted to study the post-operative effect of autologous fibrin glue, as concluded by Mounsif M, Smouni FE, and Bouziane based on systemic review conducted in 2022. They recommended that more interventional and multicentric studies be carried out to validate and reinforce the findings of the studies they reviewed.[14]

CONCLUSION

Autologous fibrin glue can be opted for effective healing option for mucoperiosteal flap closure after open flap debridement procedure. It serves as an efficient, fruitful and economical method, with positive patient outcome and improved comfort post-surgical.

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