



COMPARISON OF CONNECTIVE TISSUE GRAFT AND PLATELET RICH FIBRIN IN THE SURGICAL RECONSTRUCTION OF INTERDENTAL PAPILLA – A RANDOMIZED CLINICAL CONTROLLED TRIAL

Periodontology

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ABSTRACT

One of the main aesthetic obstacles in periodontal plastic surgery may be the creation of "black triangles," which are caused by the absence of the papilla and the opening of the black voids. This is related to the capacity to reconstruct the missing interdental papilla (IDP) in the maxillary anterior region. Soft tissue abnormalities in the interproximal areas have been recommended for treatment with a variety of surgical and non-surgical techniques. While surgical treatments seek to rebuild, maintain, or recontour the soft tissue between teeth, non-surgical approaches alter the interproximal space. **Aim:** The study aimed to reconstruct the lost or blunted interdental papilla using CTG (connective tissue graft) and PRF (Platelet rich fibrin) for esthetic purposes and maintaining oral health. **Material And Method:** Fourteen systemically healthy patients with Black Triangle/Papilla Recession in the maxillary anterior region were included in the study. The clinical parameters, including plaque index, gingival index, probing pocket depth, papillary height, papilla index score, patient esthetic score, and patient post-discomfort score, were measured at baseline, 1 month, and 3 months postoperative. **Result:** CTG and PRF both are effective in increasing IDP-height and improving clinical parameters. While both procedures significantly reduced probing depth and increased papilla presence index, CTG showed slightly better results than PRF. Moreover, patient post-surgical discomfort score and esthetic score were higher for CTG than PRF. **Conclusion:** split-thickness flap surgery with CTG or PRF may effectively increase IDP-height, and CTG may offer better results compared to PRF.

KEYWORDS

black triangle, connective tissue graft, interdental papilla, papillary loss, papilla reconstruction, platelet rich fibrin

INTRODUCTION

Black triangles, commonly referred as "Angulus Nigrens," are the conventional word for the absence of interdental papilla. All that exists in black triangles are the open gaps left by missing interdental papilla. More than one-third of adults have them, and patients who experience bone loss are more likely to develop them.^[1] A number of etiologic factors, including microbial tooth deposit-associated periodontal disease, tooth form and contour, lack of neighbouring teeth, accidental use of oral hygiene maintenance tools, interdental spacing, and incorrect restoration or denture contour, are associated with interdental papillary loss.

One of the most difficult procedures is reconstructing the interdental papilla because insufficient blood flow poses a significant barrier to the successful completion of any regeneration efforts. The literature lists a number of surgical and non-surgical methods for reconstructing the interdental papilla. The surgical methods used to reconstruct and recontour the deficient interdental papilla include the pedicle graft procedure,^[2] an envelope-type flap prepared for the implantation of platelet-rich fibrin at the recipient site, and connective tissue grafts.^[4-8]

There were very few clinical studies for papillary augmentation published, and the majority of the literature consisted solely of case reports and case series. In order to enable the insertion of a CTF/PRF and increase the papillary height, the current study suggests a minimally accessible labial and palatal tunnelling via the interdental gingiva. The study was designed as a randomized controlled clinical trial, with the aim of comparing the role of two different autologous matrices—CTG/PRF—to augment the papilla dimensions and reduces the black triangle height at 1 and 3 months.

MATERIALS AND METHODS

This comparative clinical study was carried out in the Dept. of Periodontics, RUHS College of Dental Sciences, Jaipur, and Rajasthan.

The study protocol was explained to each potential subject, and written informed consent was obtained prior to the commencement of any treatment. This study was approved by the ethical board committee of

RUHS College of Dental Sciences Jaipur, Rajasthan.

Selection

Inclusion Criteria:

1. Patient between the age group of 18-55 years of either sex (Male/Female).
2. Patient with presence of "Black triangle"/Papilla recession in the maxillary anterior teeth having contact point.
3. Selected teeth must be free of restorations on the cervical (Buccal or Proximal) region
4. Patient having minimal probing depth ≤ 3 mm adjacent to the open embrasure
5. Radiographically the distance between contact points (CP) to alveolar crest was ≤ 5 mm which was confirmed during surgical procedure and papillary height (PH) ≤ 4 mm
6. Dental and Periodontal factors: a full mouth plaque score (FMPS) and a full mouth bleeding score (FMBS) $< 20\%$ at the time of surgery

Exclusion Criteria:

1. Patient having any kind of systemic illness, drug usage, allergy, smoking etc.
2. Patient having trauma from occlusion.
3. Pregnant or lactating women.
4. Patient with habit of tobacco chewing, smoking, and alcohol consumption

Study Design

A clinical randomized comparative study with 3 months follow up was done.

Methodology

This clinical study was carried out on 14 patients with black triangle defects, obtaining the informed consent. Randomization was done by computerised randomization software. Each patient was divided into two groups as under.

Group1 (Test Group): Comprising of 7 subjects in whom loss of interdental papilla treated with connective tissue graft with Robert Azzi Technique.

Group 2(Control Group): Comprising of 7 subjects in whom loss of interdental papilla treated with PRF with Robert Azzi Technique.

The following Pre-Treatment Records were collected -

1. Detailed Medical & Dental history
2. Periodontal assessment using clinical parameters
3. Peri-apical radiographs
4. Clinical photograph
5. Patient models

All the selected patients were informed in detail about the study protocol and were asked to remain complaint and maintain meticulous plaque control measures. All the patients enrolled into study underwent phase I therapy. Occlusal adjustment was done wherever needed.

Clinical Parameter

Clinical measurements were recorded using a periodontal probe (UNC 15) at baseline and 3 months on the selected teeth. The following parameter were corded Plaque index (PI) (Silness and Loe, 1964), gingival index (GI) (Loe H and Silness J in 1963), Probing Depth (PD), Papillary Height (PH) and Papilla Presence Index (PPI)

Surgical Procedure

The surgical procedure involves a detailed process for performing connective tissue grafting and Platelet Rich Fibrin (PRF) membrane preparation. The procedure begins with pre-procedural preparations; including swabbing the extra oral surface of the patient with betadine (10% Povidone-iodine) and accomplishing oral antisepsis using chlorhexidine solution rinse (10 ml of 0.2%). Anaesthesia was then administered using 2% xylocaine with 2% adrenaline to ensure the comfort of the patient during the surgical procedure.

The connective tissue grafting process follows the Robert Azzi technique and involves creating an intra-sulcular incision around the neck of the maxillary incisor. An envelope type split-thickness flap was then elevated to create a second surgical site for obtaining a connective tissue graft double the size of the missing papillary height. The harvested graft was then placed under the buccal and palatal flap and in the interdental papilla area and sutured in place. The donor site was covered using interrupted sutures to achieve primary closure.

In addition to the connective tissue grafting, the procedure includes the preparation of the PRF membrane obtained from the patient's blood using a centrifugation process. The obtained PRF clot was then squeezed to form the PRF membrane for further application during the surgical procedure. (Figure1)



Figure.1 Surgical steps in CT graft placement from pre-operative to follow-ups

Postoperative care was outlined, including the prescription of oral antibiotics and analgesics, along with chlorhexidine rinsing. Periodontal dressing and sutures were removed 7-10 days after surgery, and patients were instructed for oral hygiene maintenance of the surgically treated area.

The post-surgical follow-up plan involves assessing any postoperative complications and recalling patients for the removal of dressing and sutures, as well as for periodic clinical parameter evaluation at 1 month

and 3 months.(Figure.2)



Figure.2 surgical steps in PRF membrane placement

Furthermore, the statistical procedures used for analysing the collected data, including the use of statistical software for descriptive statistics and appropriate statistical tests for inter and intragroup comparisons.

Statistical Procedures

For all the clinical (Papillary Height, Probing Depth, Plaque Index, Gingival Index, Papilla Presence index, Patient Esthetic Score, Patient Post-Surgical Discomfort Score Within 24hrs) parameter, data was compiled on Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States).

Compiled data was subjected to statistical analysis with Statistical package for social sciences (SPSS v 26.0, IBM).

Descriptive statistics like frequencies and percentage for categorical data, Mean & SD for numerical data has been depicted.

-Inter group comparison (2 groups) for age was done using t test.

- Frequency comparison of categories of variables with groups was done by chi square test.

Normality of numerical data was checked using Shapiro-Wilk test & was found that the data did not follow a normal curve; hence non-parametric tests have been used for comparisons.

Inter-group comparison (2 groups) was done by Mann Whitney U test.

Intra group comparison was done using Wilcoxon Signed rank test (upto 2 observations)

Intra group comparison was done using Friedman's (for >2 observations) followed by pair wise comparison using Wilcoxon Signed rank test.

Comparison of frequencies of categories of variables with groups was done through chi square test.

For all the statistical tests, $p < 0.05$ was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%.

RESULTS AND OBSERVATION

The Maximum age was 50 years and minimum age was 27 years. The mean age of participants was 35 ± 8.092 in table 1, table 2 explains the gender-wise distribution of participants amongst the 14 participants included 3 males (21.4%) and 11 females (78.6%), Table 3 show the intergroup comparison of distribution as sex. There was a statistically non-significant difference seen for the frequencies between the groups ($p > 0.05$), Table 4 show the intergroup comparison of mean age. Table 5 show Group and time wise comparison of mean and standard deviation of Papillary Height at baseline, 1 month and 3 months in Group 1 and in Group 2. Table 6 shows Group and Time wise comparison of mean and standard deviation of probing depth at baseline, 1 month, and 3 months in Group1 and in Group 2. Table 7 show Group and Time wise comparison of mean and standard deviation of plaque index at baseline, 1 Month and 3Months in Group 1 and in Group 2. (Figure.3)

Table 1: Distribution of study participants according to age					
AGE (Years)	N	Minimum	Maximum	Mean	Standard Deviation
14	27	30	35.36	0.002	

Table 2: Distribution of study participants as per Gender		
Gender	Frequency	Percent
Female	11	78.6
Male	3	21.4
Total	14	100.0

Table 3: Inter group comparison of Distribution as per Gender				
Gender	Groups	Total	Chi-Square value	p value of Chi-Square
Female	0	5	11	
Male	1	2	3	0.424
Total	7	7	14	0.519

Table 4: Inter group comparison of mean Age			
Group	Mean	Std. Deviation	p value
1	37.14	8.417	
2	33.57	7.976	0.431

Table 5: Group and Time wise comparison of Papillary Height					
Time Group	Mean	Std. Deviation	P value		
Baseline	1	1.80	.016	0.728	
	2	3.14	.000		
1 month	1	4.71	.004	0.728	
	2	4.14	.000		
3 months	1	5.71	.004	0.728	
	2	5.14	.000		

Table 6: Group and Time wise Comparison of Probing Depth					
Time	Group	Mean	Std. Deviation	P value	
Baseline	1	2.47	.515		0.290
	2	2.71	.400		
1 month	1	2.00	.000		0.141
	2	1.71	.000		
3 months	1	2.00	.000		0.141
	2	1.71	.000		

Table 7: Group and Time wise Comparison of Plaque Index					
Time	Group	Mean	Std. Deviation	P value	
Baseline	1	.0514	.03000		0.743
	2	.0429	.02875		
1 Month	1	.0471	.03707		0.841
	2	.0700	.04040		
3 Months	1	.0500	.03014		0.471
	2	.0500	.03007		

Figure.3 Image showing different comparisons

The above data indicates that there is no statically significant difference in Plaque Index at baseline, 1 Month and 3 Months postoperatively in between both groups.

Table 8, 9, 10, shows Group and Time wise comparison of mean and standard deviation of GI, PPI, and patient aesthetic zone at baseline at 1 Month and 3Months, Table 11 data indicates that there was statically significant difference Patient Post-surgical Ethernic Score within 24 hrs In between both groups ($p < 0.05$).

Table 12 shows that is considerable difference in parameters in both the Group 1 and Group 2 when compared from baseline at 3 month time interval. Table 13 show Pairwise comparison of Group 1 and Group 2 there was a statically highly significant difference between baseline and 1 month and 1 month and 3 months seen for the value between the time interval ($p < 0.01$) with higher values at 3rd time interval. (Figure.4)

Time	Group	Mean	Std. Deviation	P value
Baseline	1	.0670	.127718	0.010
	2	.0204	.150341	
1 Month	1	.0414	.13001	0.241
	2	.0400	.13003	
3 Months	1	.0500	.101421	1.000
	2	.0800	.125057	

Time	Group	Mean	Std. Deviation	P value
Baseline	1	2.000	.000	1.000
	2	2.000	.000	
1 Month	1	2.71	.000	0.791
	2	2.87	.515	
3 Months	1	3.14	.000	0.114
	2	2.87	.515	

Time	Group	Mean	Std. Deviation	P value
1 Month	1	2.00	.000	0.007
	2	4.29	.400	
3Months	1	2.00	.000	0.007
	2	3.29	.400	

Time	Group	Mean	Std. Deviation	P value
Patient Post Surgical Discomfort Score within 24 hrs	1	4.29	.591	0.025
	2	3.14	.000	

Time	Papillary Height	Probing Depth	Plaque Index	Gingival Index	Papilla Presence Index	Patient Ethnic Score
Group 1	Baseline	3.00	2.40	0.0514	0.0670	2.00
	3 Month	5.71	2.00	0.0429	0.0704	3.14
Group 2	Baseline	3.14	2.71	0.0424	0.0201	2.00
	3 Months	5.14	1.71	0.0500	0.0800	2.87

GROUP	TIME	MEAN ± SD	p-VALUE
GROUP 1	0	3.00±0.014	0.014
	1	4.71±0.011	
	3	5.71±0.011	
GROUP 2	0	3.00±0.014	0.014
	1	4.14±0.000	
	3	5.14±0.000	
GROUP 2	0	3.14±0.000	0.000
	1	4.14±0.000	
	3	5.14±0.000	

Figure.4 Group ant time wise comparison at 1 and 3 months

Further pairwise comparisons are shown in Figure 5a and b.

Table 14: Pairwise Comparison of Papillary Height in Group 1 and Group 2 at Baseline, 1 Month and 3 Months.					
GROUP	TIME	MEAN ± SD	p-VALUE		
GROUP 1	0	3.00±0.014		0.014	
	1	4.71±0.011			
	3	5.71±0.011			
GROUP 2	0	3.00±0.014		0.014	
	1	4.14±0.000		0.000	
	3	5.14±0.000		0.000	
GROUP 2	0	3.14±0.000		0.000	
	1	4.14±0.000		0.000	
	3	5.14±0.000		0.000	

Table 15: Pairwise Comparison of Patient Ethernic Score in Group 1 and Group 2 at 1 Month and 3 Months.					
GROUP	TIME	MEAN ± SD	p-VALUE		
GROUP 1	0	2.00±0.000		0.000	
	1	2.71±0.000		0.000	
	3	3.14±0.000		0.000	
GROUP 2	0	4.29±0.000		0.000	
	1	4.29±0.000		0.000	
	3	3.29±0.000		0.000	

Figure 5a. Pairwise comparison

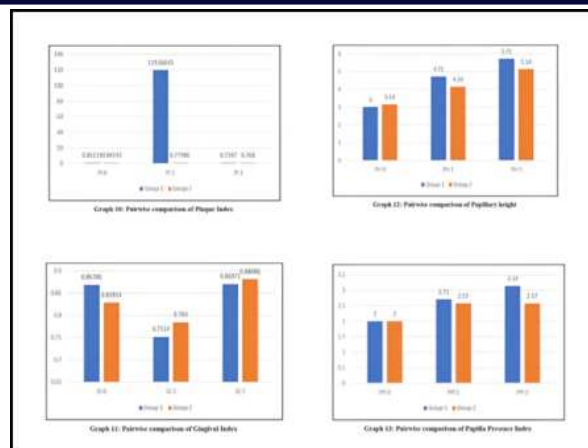


Figure 5b. Graphical representation of pairwise comparison

DISCUSSION

A healthy aesthetic smile increase the self confidence of a person. Reconstruction of lost interdental papilla is one of the major aesthetic challenges in periodontal plastic surgery.^[8] Black triangles generally seen in the anterior teeth are a point of aesthetic concern. The periodontal literature offers a variety of non-surgical and surgical methods to achieve acceptable interdental papilla restoration. The non surgical approaches modify the interproximal spaces whereas the surgical approaches aim to recontour, preserve or reconstruct the soft tissue between the teeth.^[9]

The current study was designed to evaluate autologous PRF and autogenous CTG in Inter Dental Papilla reconstruction with buccal and palatal Split Thickness Flap by Robert Azzi technique.

After screening, a total of 14 participants were ultimately enrolled in the current study. The trial was successfully completed by all 14 patients (11 females and 3 males), and both test groups—PRF and CTG—showed excellent recovery following surgery.

No alveolar crest apposition or changes to the contact area were noted during the duration of the investigation. Hence, the mean change in position Inter Dental Papilla resulted from mean gain of papillary height.

The clinical parameter included were Probing Depth, Plaque Index, Gingival Index, Papillary Height, Papilla Presence Index, Patient Aesthetic Score, Patient Post Discomfort Score.

The p value of the pairwise comparison of probing depth of Group 1 and Group 2 was >0.05 that shows statically non-significant difference in both groups at baseline, 1 month, 3 months (see table 14 and Graph 9) these finding coincided well with the study done in 2009 that also showed statically non-significant difference in probing depth in both the groups.^[10]

In a study Efficacy of Platelet-rich Fibrin in Interdental Papilla Reconstruction as Compared to Connective Tissue Using Microsurgical Approach there was increase in PIS at both 1 month and 3 months as compared to baseline in both groups. There was a significant early, (1 month) increase in PIS in Group I (1.3) that remain unchanged till 3 months, whereas in Group II (1.5), constant significant increase in PIS was observed. Increased in VAScore (discomfort) in Group II may result from comparatively more invasive procedure (donor surgical site) during CTG procedure s as compared to PRF preparation.^[11]

The P value of the pairwise comparison of Patient Ethernic score Group I&II was <0.05 that shows that statically significant difference in both groups at 1 month and 3 months.

One of the study also reported that the use of CTG and subepithelial connective pedicle graft propitiated a satisfactory improvement in the esthetics.^[12] The current patient-centered study reported that the reconstructed Inter Dental Papilla almost reaches its normal level (95% with CTG and 90% with PRF), solving the esthetic problem posed by its absence.

Since PRF has biologic properties similar to fibrin glue in addition to mechanical adhesive properties, it provides a dependable solution in the current study. It also promotes neoangiogenesis, lessens necrosis and shrinking, and keeps the flap in a stable position. PRF has several advantages, including eliminating the requirement for a donor site, making the treatment less invasive, reducing postsurgical discomfort, and promoting faster soft-tissue recovery with less edema compared to CTG. CTG with STF-treated sites outperformed PRF with Split Thickness Flap for Inter Dental Papilla repair.

CTG graft survival depends on a sufficient blood supply originating from the vascular recipient bed adjacent to the lost Inter Dental Papilla and covering flap. The use of CTG for the resolution of the Inter Dental Papilla loss at the increasing the Papillary height is based on its excellent biomimetic capacity, highlighting the induction potential of two fundamental characteristics.

CTG beneath the Inter Dental Papilla reported adequate thickening of the existing gingiva and successful reconstruction of Inter Dental Papilla.

Limitations:

Small sample size affects the statistical analysis of finding of study and hence results change.

Short-term follow-up with fair dental hygiene, rather than thorough plaque management among individuals.

Lack of histologic evaluation,

Lack of radiographic parameter assessment

Lack of model analysis.

CONCLUSION

Within the confines of the present study, it can be concluded that subepithelial connective tissue graft is better as compared to platelet rich fibrin for interdental papilla reconstruction. However, PRF has too shown promising results and future research is paramount so that its properties could be utilized in a more beneficial way. The results obtained from the current study need to be verified through multicentre trials and longer follow up periods.

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