Comparative evaluation of efficacy of subepithelial connective tissue graft versus platelet-rich fibrin membrane in surgical reconstruction of interdental papillae using Han and Takie technique: A randomized controlled clinical trial

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Abstract:
Background: Platelet-rich fibrin (PRF) has emerged as one of the promising regenerative materials in the field of periodontics. Hence, this study evaluated the efficacy of subepithelial connective tissue graft (SCTG) and PRF in surgical reconstruction of interdental papillae using Han and Takei technique. Materials and Methods: A total of 20 sites with Class I and Class II interdental papilla defects were assigned to two groups (Group 1 – Han and Takie technique + SCTG and Group 2 – Han and Takie technique + PRF). Parameters such as papillary height (PH), distance from the contact point to the tip of papillae (CPTP), papilla presence index (PPI), pocket probing depth (PPD), relative clinical attachment level (RCAL), plaque index (PI), gingival index (GI), and distance from contact point to alveolar crest (CP-BC) were measured at baseline and after 3 months. The significance of difference within and between the groups was evaluated with paired and unpaired t-tests. Results: The mean PI, GI, PPD, RCAL, PPI, and CPTP distance decreased significantly, whereas the mean PH increased significantly in Group 1 as well as in Group 2. After 3 months, mean reduction in CPTP distance and mean gain in PH were statistically significant in Group 1 as compared to Group 2. However, there was no significant difference in mean CPBC distance between baseline and 3 months in Group 1 as well as in Group 2. Conclusion: Both the techniques were effective in the treatment of papillary recession defects; however, more significant clinical papillary enhancement was achieved after the surgical reconstruction with SCTG.

Key words: Interdental papilla reconstruction, platelet-rich fibrin, subepithelial connective tissue graft

INTRODUCTION

In today's modern era, dental esthetics is based on the harmonious association of two types of esthetics, namely “white” and “pink” esthetics, which refer to the adjoining hard and soft tissues, respectively. The interdental papilla and gingiva refer to the pink esthetics.[1]

The interdental papilla inhabits the embrasure space between the teeth. Gingival black triangles (GBTs) are cosmetic deformities characterized by the loss of papilla resulting in black open spaces, which is linked with the problem of food accumulation, impaired esthetics, and phonetics. It can be due to numerous reasons such as plaque-associated lesions, traumatic oral hygiene procedure, improper contours of the restoration, spacing between teeth, abnormal tooth space, loss of teeth, and postperiodontal surgical therapy.
The lost interdental papilla reconstruction is one of the most difficult and least predictable treatments.[5]

Several nonsurgical and surgical techniques have been used to reconstruct the interdental papilla over the years. These surgical techniques aim to preserve, recontour, or reconstruct the papillary tissue. Predictable outcome of surgical reconstruction is based on the rationale of using the most profitable pattern of blood supply to the newly formed tissue.[5]

Therefore, Han and Takie[4] in 1996 described a technique using subepithelial connective tissue graft (SCTG). The use of SCTG for papilla reconstruction depends on the dual blood supply, thus improving the survival of the graft and enhancing the predictability of the surgical technique. However, acquisition of connective tissue graft is technique sensitive, time-consuming and it involves the second surgical site.[5]

Recently, platelet-rich fibrin (PRF) has emerged as one of the promising regenerative materials in the field of periodontics. It is a second-generation platelet concentrate having various beneficial properties such as easier preparation, cost-effectiveness, and good patient acceptability. It is enriched with various growth factors, platelets, and cytokines that promote wound healing.[6]

Therefore, this study was primarily designed to compare the clinicroadiographic efficacy of PRF and SCTG for interdental papilla reconstruction.

MATERIALS AND METHODS

This randomized controlled clinical trial of 3 months was carried out on the patients aged 18–50 years, visiting the outpatient’s department after getting the approval by the Institutional Ethical Committee. Sample size was calculated using software OpenEpi Open Source Epidemiologic Statistics for Public Health, version 2.3, developer name- AG Dean, KM Sullivan, MM Soe. Cambridge, United States with a statistical formula having 5% α value, 80% power, and 95% confidence interval.

A total of 20 sites with Class I and Class II interdental papilla defects (Nordland and Tarnow classification system[7]) in the maxillary anterior region were included in this study. The sites with adequate width of keratinized gingiva and marginal recession <2 mm were selected. The black triangles due to caries and requiring orthodontic treatment were not included. The individuals who were smokers, taking any medication known to influence the periodontium, and having systemic illness and pregnant and lactating mothers were excluded from the study.

The individuals were randomly divided into Group 1 (control group – 10 sites treated with Han and Takie technique[4] using SCTG) and Group 2 (test group – 10 sites treated with Han and Takie technique[4] using PRF [Figure 1]. Patients’ written informed consent was taken. Before the surgery, all patients received thorough supragingival and subgingival scaling and root planing.

Clinical and radiographic measurements

The following clinical and radiographic measurements were recorded at baseline and 3 months postsurgery for all the sites:

1. The papillary height (PH) (in mm) measured from the tip of papillae to an imaginary line connecting most apical point of gingival zenith of adjacent teeth
2. The distance from the contact point to the tip of papillae (CPTP) (in mm) was measured using a digital Vernier caliper
3. The mean reduction percentage in CPTP distance was measured from the formula:
   \[
   \text{CPTP (3 months)} - \text{CPTP (baseline)} \times 100
   \]
4. Papilla presence index (PPI) by Cardaropoli et al[8]
5. Pocket probing depth (PFD) (in mm) was measured by UNC 15 probe
6. Relative clinical attachment level (RCAL) (in mm) was measured from the cementoenamel junction to the base of the pocket
7. Plaque index (PI) by Turesky–Gilmore–Glickman modification of Quigley Hein PI[9]
8. Gingival index (GI) by Loe and Silness[10]
9. The distance from contact point to alveolar crest (CP-BC) (in mm) was measured on radiograph/RVG with standardized paralleling technique. Radiographic analysis was done using a VistaScan DBSWIN software Dürr dental se, Bietigheim-Bissingen, Germany.

Surgical technique

The surgical technique employed in this study was Han and Takie technique[4] for papilla reconstruction. For recipient site preparation, after local anesthesia (2% xilocaine, 1:200,000), a 15 no. blade was used to make a semilunar incision at a distance of 6–10 mm in the apical direction from the marginal gingiva in the interdental region and 12 no. blade was used to make intrasulcular incisions around the two adjacent teeth, to create a split-thickness pouch. The interdental papillary unit was coronally advanced. To decrease the dead space, in the test group, PRF was inserted into the pouch-like space, whereas in the control group, SCTG was placed. The semilunar incision was sutured with the interrupted suture, whereas the gingival-papillary unit was sutured coronally using suspensory suture technique (Mersilk® 4-0) [Figures 2a-i and 3a-g]. The SCTG was harvested by a “trap-door approach” from the palate.[11]

PRF was prepared according to Choukroun’s protocol[12] in which a blood sample was taken without anticoagulant in 10 mL of glass tube and immediately centrifuged at 3,000 rpm for 10 min (REMI R-8C®).

Postoperative care

Routine postsurgical instructions were given and systemic antibiotics (amoxicillin 500 mg thrice daily) were prescribed for 7 days and analgesic (ibuprofen twice daily) for 3 days. A rinse with 10 ml of 0.2% chlorhexidine mouthwash twice daily for 6 weeks was recommended for all the patients. Patients were advised to refrain from brushing and using any interdental cleansing aids for 4 weeks. Patients were recalled at the end of 2 weeks for the removal of sutures and every month for oral hygiene maintenance. Clinical and radiographic measurements were repeated after 3-month interval.
Sharma, et al.: Treatment of gingival black triangle using platelet concentrates

Statistical analysis
The collected data were sent for statistical analysis. Data were analyzed using the SPSS Inc. SPSS for Windows, Version 16.0. Chicago, United States. For the intergroup comparison, an unpaired t-test was used, whereas a paired t-test was applied for intragroup comparison. Differences were considered statistically significant at $P < 0.05$.

RESULTS
In this randomized controlled clinical trial, both the groups (test and control) showed improvement in all the clinical recorded parameters. None of the treated patients reported any adverse effect following perioplastic surgery.

On intergroup comparison between the test and control groups, there was no statistically significant difference among the clinical and radiographic parameters at baseline. However, after 3-month follow-up, mean reduction in CPTP distance and mean gain in PH were statistically significant from baseline to 3 months in Group 1 as compared to Group 2 [Tables 1, 2 and Graphs 1, 2]. The mean PI, mean GI, mean PPD, mean RCAL, mean PPI, and mean CPTP distance decreased significantly, whereas the mean PH increased significantly from baseline to 3 months in both the groups [Table 3]. The mean CPBC distance showed no significant difference between baseline and 3 months in both the groups. In comparison to Group 2, Group 1 showed a higher percentage of mean reduction in CPTP distance [Table 4 and Graph 3].

DISCUSSION
The treatment of GBT is quite difficult and challenging. PRF has evolved as one of the potential regenerative additives in the field of periodontics. Hence, this study was done to compare and evaluate the efficacy of PRF and SCTG in the surgical reconstruction of lost papillary tissue by Han and Takie technique.[4]

In the present study, a significant decrease in the mean PI score was observed at 3 months compared to the baseline values for both the study groups. This is in accordance with Kaushik et al.,[13] who reported an overall reduction
in plaque scores at various intervals. The mean GI score decreased significantly from baseline to 3 months for both the groups. Similar results were obtained in the study done by Shruthi et al.[14] This could be due to repeated oral hygiene instructions at follow-up visits and good oral hygiene care by the patients during the study.

In the present study, intragroup mean scores of PPD and RCAL reduced significantly for both the groups. No significant difference was found in mean RCAL between Group 1 and Group 2 at baseline and 3 months. A similar study was done by Inocencio and Sandhu[15] who found a significant reduction in PPD and gain in clinical attachment level with combined periodontal and orthodontic treatment.
Papillary dimensions were constructed on the basis of the classification of PPI. There was no significant difference in mean PPI between Group 1 and Group 2 at baseline and 3 months. The mean difference in PPI score from baseline to 3 months in Group 1 was 0.50 mm. The study done by Kaushik et al.\[13\] reported 0.40 ± 0.51 mm mean difference in PPI from baseline to 3 months after using SCTG in papilla reconstruction.

A statistically significant reduction in mean CPTP distance was found in Group 1 (0.87 ± 0.38 mm) in comparison to Group 2 (0.35 ± 0.26 mm). A similar result was obtained in a study by Kaushik et al.\[13\] who reported 0.80 ± 0.94 mm mean difference in CPTP distance from baseline to 3 months after the surgical reconstruction with SCTG. The percentage of mean reduction in CPTP distance was significantly more in Group 1 (59.49%) in comparison to Group 2 (25.81%). A similar study was done by Sharma et al.\[16\] who showed that the percentage of reduction of vertical component from baseline to 3 months in their study was 30.19%.

The mean gain in PH was significantly more in Group 1 (0.77 ± 0.41 mm) as compared to Group 2 (0.35 ± 0.26 mm). The mean PH increased significantly from baseline to 3 months in both the groups. A significant gain in PH and reduction in CPTP were achieved in the present study, and it could be due to the fact that the pedicle flap design with the SCTG was associated with the abundant blood supply and nutrition from all directions and good flap support. It may be one reason for the clinical improvements and excellent esthetic results. A similar study done by Jaiswal et al.\[17\] who reported mean gain of 2.6 ± 0.00 mm in soft-tissue (papilla) height after the surgical reconstruction of interdental papilla using SCTG with a coronally advanced flap. Another similar study done by Singh et al.\[18\] reported an average gain of 1.63 mm ± 1.36 mm in the PH after 6 months.

In our study, the mean CPBC distance at baseline for Group 1 and Group 2 was 5.91 ± 0.21 mm and 5.89 ± 0.24 mm, respectively. According to Tarnow et al.\[19\] if the distance from bone crest to contact point was ≤5 mm, then only the complete interdental papilla fill can be achieved. This could be the probable reason that the mean gain in PH in our study was lesser than that of the abovementioned studies. On intra- and intergroup comparison, no significant difference in mean CPBC was found, and this is consistent with the study done by Jaiswal et al.\[17\].

In the present study, a combined approach of SCTG and semilunar coronally repositioned flap technique was found to be an effective method of achieving predictable and stable results for treating papilla loss. The graft was harvested from palate using trap-door technique by Edel.\[11\] Greater reflectivity, accessibility, and simplicity make this technique better than the other techniques.
The present study showed that both the techniques were successful in the treatment of papillary recession defects. However, more significant clinical papillary enhancement was achieved after the surgical reconstruction with SCTG. A recent study by Abirami et al.\textsuperscript{[23]} also found a significant reduction in black triangle height in the SCTG group as compared to the PRF group.

A similar study by Culhaoglu et al.\textsuperscript{[23]} who used coronally advanced flap (CAF) procedure and reported that the reduction in recession depth was significantly higher in the SCTG group as compared to the PRF group 6 months postoperatively. The study conducted by Öncü\textsuperscript{[24]} reported significant root coverage in the SCTG group as compared to the PRF group (84% and 77.12% for the SCTG + CAF and PRF + CAF groups, respectively). In our study, as we had selected the patients with more than 5 mm of the interdental papillary defects, so it could be the possible reason that PRF could not give better clinical result as compared to SCTG.

A recent systematic review and meta-analysis by Chambrone et al.\textsuperscript{[25]} showed SCTG plus CAF to be a “gold standard” procedure for the treatment of recession-type defects. Moreover, the literature recommends that among the other surgical approaches, the use of SCTG provided better marginal stability to gingiva and certain amount of creeping attachment over time.

There are, however, a few limitations of this study in terms of a smaller sample size and shorter follow-up period, and also, a split-mouth design could be preferred to provide a more unbiased comparison of the surgical techniques. Hence, further studies with larger numbers of patients and longer evaluation periods are needed to be carried out to validate the results.

CONCLUSION

Both Han and Takie technique with SCTG and Han and Takie technique with PRF were effective in the surgical reconstruction of interdental papillary recession defects. Although SCTG technique provided a better result in terms of interdental papilla fill, PRF avoids the second donor site, thus decreasing...
the patient’s morbidity. Therefore, PRF could be considered an alternative to the “gold standard” SCTG. The effect needs to be further investigated using long-term clinical and histological studies.

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Conflicts of interest
There are no conflicts of interest.

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