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Research Article

Comparative Evaluation Of Reconstruction Of Interdental Papilla In Anterior Region Using Subepithelial Connective Tissue Graft Versus Hyaluronic Acid Gel: A Clinical Study

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ABSTRACT

Introduction: Loss of interdental papilla has multifactorial etiology and several surgical and nonsurgical approaches have been attempted to restore the loss of interdental papilla. Hence, the purpose of present study was to evaluate the efficacy of Sub-epithelial connective tissue graft versus Hyaluronic acid gel in treatment of class I and class II loss of interdental papillary height (Nordland and Tarnow). **Materials and Method:** A total of fourteen sites with Class I and Class II interdental papilla defects were assigned to two groups (Group A – Han and Takie technique + SCTG and Group B – Hyaluronic acid gel). Parameters such as Vertical Component (VC), Horizontal Component (HC), Wound healing index (WHI), Visual analog scale (VAS), distance from the tip of papilla to bone crest (TP-BC), Plaque index (PI), Modified gingival index (MGI) were measured at baseline and after three and six months. The significance of difference within and between the groups was evaluated with paired and unpaired *t*-tests. **Result**: The mean PI, MGI, VC, HC, WHI, VAS, and TP-BC showed a statistically significant difference from baseline to three and six months ($p \leq 0.01$) interval and a non-significant difference at 3–6 months ($P \geq 0.05$) in Group A as well as in Group B. **Conclusion:** Both the techniques were effective in the treatment of Nordland and Tarnow Class I and/or Class II Interdental papilla loss; however, on comparison none of the technique was superior over the other. The effect needs to be further investigated using long-term clinical and histological studies.

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INTRODUCTION:

Interdental papilla (IDP) is the extension of gingiva which fills the embrasure space between teeth. Loss of interdental papilla and gingival recession (GR) are two main concerns regarding periodontal esthetics. Loss of interdental papilla results in esthetic deformities like gingival black triangle (GBT), especially in maxillary anterior region.[1]

The absence of interdental papilla causes food lodgements, formation of black triangles and problems in phonetics as well. It can be due to various reasons such as plaque associated problems; trauma and post periodontal surgical therapy.[2] Regeneration of interdental papilla is one of the most demanding periodontal treatments.

So, several surgical and non surgical techniques are used to restore loss of interdental papilla over the years. Hence, a nonsurgical and less invasive technique using hyaluronic acid (HA) gel for this purpose has been recently proposed and being administered for management of black triangles.[3] Hyaluronic acid is a non animal based and nonsulphated glycosaminoglycan present in connective tissue.[4] **Becker et al.**[5] published the first case report on the use of hyaluronic acid injections (Restylane®) to treat black triangles and obtained promising results.

Han and Takie[6] **in 1996** proposed an approach for papilla reconstruction (semilunar coronally repositioned papilla) based on the use of subepithelial connective tissue graft and very predictable and stable result were found. The success rate of this technique was attributed to the dual blood supply from the underlying connective tissue base and overlying recipient flap.

Therefore, the purpose of the present study is to clinically compare and evaluate the efficacy of Sub-epithelial connective tissue graft versus Hyaluronic acid gel in treatment of class I and class II loss of interdental papillary height (Nordland and Tarnow).

Material and Methods:

This randomized comparative clinico-radiographic study was carried out on the patients aged 18–55 years, visiting out-patient department of periodontology, Narsinhbhai Patel Dental College and Hospital, Visnagar.

A sample size of fourteen patients with Nordland and Tarnow class I and/or class II Interdental papilla loss in any one maxillary anterior tooth were selected for study. Patients were randomized into Group A: consisted of seven patients where the Interdental Papilla loss was treated with subepithelial connective tissue graft (SCTG) and Group B: consisted of seven patients where the Interdental Papilla loss was treated with Hyaluronic acid (HA) gel.

The inclusion criteria were as follows: Presence of one interdental papilla loss (Nordland and Tarnow Class I or II) in any one maxillary anterior tooth, Age range of 18-55 years, systemically healthy patients and adequate width of keratinized gingiva. 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. Patient's 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, 3 months and 6 months postsurgery for all the sites:

1. Turesky- Gilmore- Glickman modification of the Quingly- Hein plaque index (Turesky et al, 1970)[7]
2. Modified gingival index (Lobene et al, 1986)[8]
3. Vertical component (VC) – Distance from apical point of the contact area to gingival margin.
4. Horizontal component (HC) – measured at line angles of adjacent teeth at the gingival margin.
5. Wound Healing Index (WHI) (Haung et al, 2005)[9] - (1^{st}, 2^{nd}, and 3^{rd} week postoperatively)
6. Visual Analog scale (VAS) (Shanmugam M. et al, 2012)[10] - Visual analog scale (esthetics)

photograph was assessed comparing baseline and 6-month postoperative

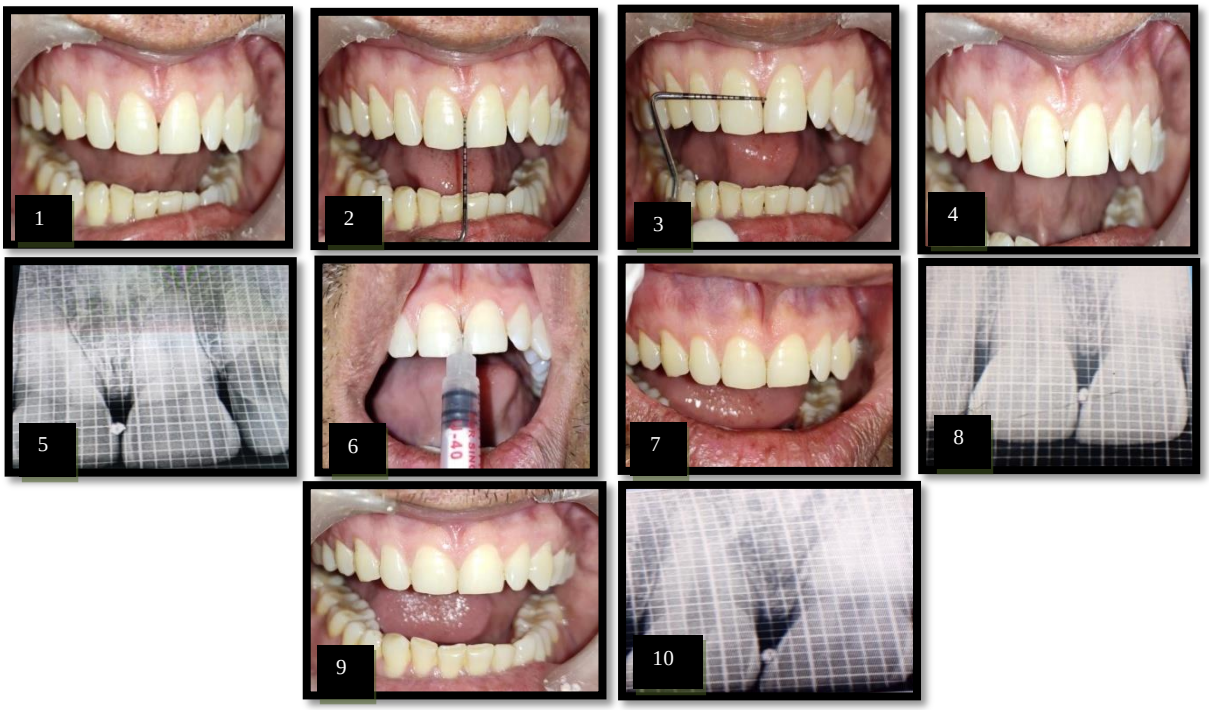
7. Distance from the tip of papilla to bone crest measured by placing a radiopaque material on the top of the papilla in order to calculate the most coronal portion of the crestal bone to the radiopaque material measured by using Radiovisiography (RVG) with grid.

NONSURGICAL TECHNIQUE:

After the administration of local anesthetic agent, less than 0.2 ml of the hyaluronic acid gel was injected at the respective sites 2-3 mm apical to the coronal tip of the papilla. The patients were discharged and requested not to brush their teeth at the day of injection and resume oral hygiene the day after, using a soft toothbrush at the anterior teeth and place it coronal to gingival margin. The patients were asked not to use dental floss at the treatment sites. Three weeks later the treatment area was photographed again and utmost effort was made to use the same distance and horizontal and vertical angles during photography:

A. If the black triangle was not observed at the interdental space, the patient was followed up at three and 6 months and photographed again at the mentioned time points.

B. If the black triangle was observed at the interdental space, another gel injection was performed and in case of no improvement, was repeated once more (injections can be performed for a maximum of three times according to the manufacturer's instructions). Patients was followed up and photographed at 3 and 6 months.



FIGURES: *(1) Pre treatment photographs. (2) Vertical component (VC). (3) Horizontal component (HC). (4) Placement of radiopaque material. (5) Radiographic measurement of tip of papilla to bone crest. (6) Gel injected. (7-8) Follow-up after 3 months. (9-10) Follow-up after 6 months.*

SURGICAL TECHNIQUE:

After administration of local anesthestic agent, 3–5 mm semilunar incision was given using ophthalmic tunnel blade (0.2 mm) at approximately 6 to 10 mm apical from the gingival margin and it was extended into the alveolar mucosa and just over the papillary region. An Intrasulcular incision was given over the teeth neighboring the defect extending from the buccal aspect to the palatal aspect keeping the existing papilla preserved. The gingivopapillary unit was freed from the underlying bone using an orban knife extending toward the palate. The tissue was completely released from the root as well as bone, so which allowed the coronal displacement of the gingivopapillary unit. A

buccal/palatal dead space was established between the soft tissue and the bone structure. Then this space was filled with the connective tissue graft in order to maintain the whole gingivopapillary unit coronally.

The SCTG was harvested by a "trap-door approach" from the palate. The subepithelial connective tissue graft was trimmed to the desired size and shape and Patients were recalled for the removal of sutures and every month for oral hygiene maintenance. Clinical

placed under the flaps to fill the dead space and to maintain the gingivopapillary unit coronally and stabilized over the recipient site using 5-0 vicryl sutures. To preserve this new papillary tissue position, a **"suspensory suture"** is used. The area was irrigated and covered with sterilized tin foil followed by periodontal dressing.

and radiographic measurements were repeated after 3 months and 6 months interval

Figure 2: *(11) Pre treatment photographs. (12) Radiographic measurement of tip of papilla to bone crest. (13) Tunnel preparation. (14) Incision given (Trap door Tech.). (15) SCTG was tucked into recipient site. (16) Graft secured with suspensory sutures. (17) Sutures taken (palatal side). (18-19) Follow-up after 3 months. (20-21) Follow-up after 6 months.*

Statistical data analysis:

Data were tabulated and analyzed using SPSS Version 23 software. For the intergroup comparison, an unpaired *t*-test was used, whereas a paired *t*-test was applied for intragroup comparison. The mean and standard deviation values of all the parameters were calculated at baseline, 3 and 6 months postoperatively. Differences were considered statistically significant at $P < 0.05$ and $P \leq 0.001$ was considered very highly statistically significant.

RESULTS:

In this randomized controlled clinical trial, both the groups showed improvement in all the clinical recorded parameters.

The mean value results from paired t test (Intra group) showed statistically significant difference in PI, MGI, VC, HC, WHI, VAS and TP-BC in both the groups at three months and six months postoperatively as compared to Baseline but the results showed no stastically significant difference in VC, HC and TP-BC in both the groups at three months to six months postoperatively.

Table 1: Intragroup comparison of difference in clinical and radiographic parameters from baseline to 6 months in Group A (subepithelial connective tissue graft) and Group B (Hyaluronic acid gel)

Parameters	Group	Mean difference	P
PI	Group A	0.69	≤0.05**
	Group B	0.72	≤ 0.001****
MGI	Group A	0.29	≤0.01***
	Group B	0.44	≤0.01***
VC	Group A	2.14	≤ 0.001****
	Group B	1.57	≤ 0.001****
HC	Group A	1.43	≤ 0.001****
	Group B	0.99	≤ 0.001***
TP-BC	Group A	1.86	≤ 0.001****
	Group B	1.57	≤ 0.001****

Test applied: Paired *t*-test, Very Highly significant (p≤0.001)****, Highly significant (p≤0.01)***, Significant (p≤0.05)**, Nonsignificant (p>0.05)*, PI – Plaque index; MGI – Modified Gingival index;VC- Vertical component, HC – Horizontal component, TP-BC – Distance from the tip of papilla to bone crest, SD – Standard deviation; *P* – Probability

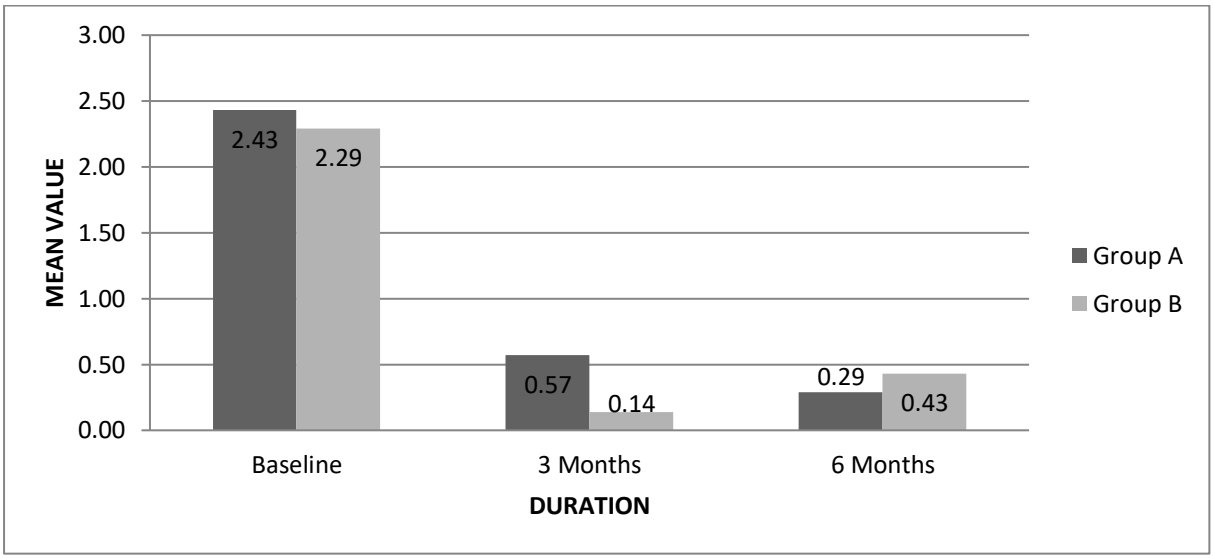
The results from Un-paired t test (Inter group) showed no statistical significant difference in mean PI, MGI, VC, HC, VAS and TP-BC between both the groups at three months and six months postoperatively but statistically significant difference was found in mean Wound Healing Index (WHI) between both the groups at seven days (p≤0.001). However, in the present study, most of the cases had steady results between three and six months, while minute relapse had occurred in a few cases in Group B.

Table 2: Intergroup comparison of clinical and radiographic parameters at baseline, 3 months and 6 months between Group A (subepithelial connective tissue graft) and Group B (Hyaluronic acid gel)

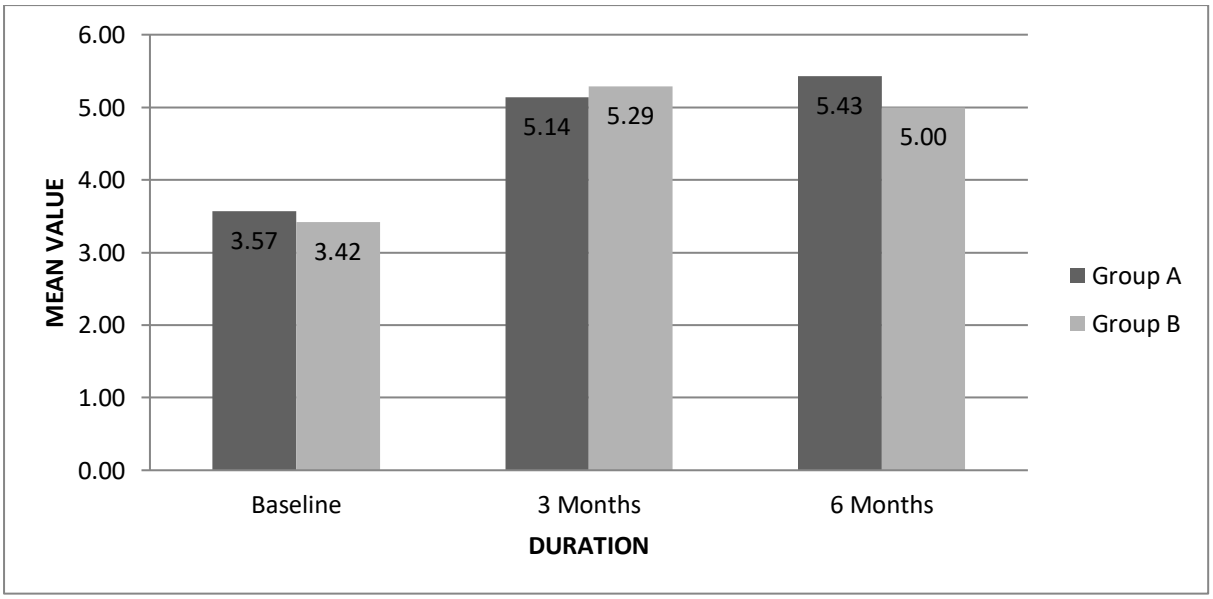
Parameter	Duration	Group A		Group B		P value
		Mean	SD	Mean	SD	
PI	Baseline	1.69	0.40	1.64	0.15	>0.05*
	3 months	1.00	0.068	1.09	0.057	>0.05*
	6 months	1.00	0.00	0.92	0.098	>0.05*
MGI	Baseline	1.14	0.37	1.05	0.20	>0.05*
	3 months	1.00	0.139	0.71	0.053	>0.05*
	6 months	0.85	0.37	0.61	0.080	>0.05*
VC	Baseline	2.43	0.535	2.29	0.756	>0.05*
	3 months	0.57	0.535	0.14	0.378	>0.05*
	6 months	0.29	0.488	0.43	0.535	>0.05*
HC	Baseline	1.71	0.48	1.42	0.44	> 0.05*
	3 months	0.57	0.535	0.14	0.378	>0.05*
	6 months	0.29	0.488	0.43	0.535	>0.05*
TP-BC	Baseline	3.57	0.534	3.42	0.449	>0.05*
	3 months	5.14	0.690	5.29	0.488	>0.05*
	6 months	5.43	0.787	5.00	0.577	> 0.05*

Test applied: Unpaired *t*-test; Values expressed as means±SD. *P*>0.05 was considered as not significant; **P*<0.05 was considered as significant. PI – Plaque index; MGI – Modified Gingival index;VC- Vertical component, HC – Horizontal component, TP-BC – Distance from the tip of papilla to bone crest, SD – Standard deviation; *P* – Probability

Graph 1: Mean Vertical Component (VC) between Group A and Group B at baseline, 3 months and 6 months



Graph 2: Mean Distance from the tip of papilla to bone crest (TP-BC) between Group A and Group B at baseline, 3 months and 6 months



DISCUSSION:

To the best of our knowledge, this is the first clinical study evaluating the comparison of subepithelial connective tissue graft (Han and Takei Technique) and Hyaluronic acid gel in the reconstruction of deficient interdental papilla.

In the present study, full mouth PI and MGI scores remained low throughout the study period. This reduction in scores could be attributed to the regular

oral hygiene instructions given to the patients thereby enabling improved plaque control efficiency and better patient compliance, generally observed following periodontal surgery. Similar results were obtained in the study done by **Kaushik A et al.[11] in 2014, Shruthi *et al.*[2] in 2015 and Sharma P et al.[12] in 2020.**

In the present study, very high statistically significant difference exists in mean Vertical Component (VC) and horizontal component (HC) scores in comparison at 3 months and 6 months from baseline ($p \leq 0.001$) among both Group A and Group B and no statistically significant difference exists in comparison at 3 months to 6 months among both Group A and Group B ($p > 0.05$). A similar study done by **Jaiswal *et al.*[13] in 2010**, **Sharma *et al.*[14] in 2017**, **Sing *et al.*[15] in 2018, Sharma P et al.[12] in 2020** who showed more significant clinical papillary enhancement was achieved after the surgical reconstruction with SCTG. Result of the present study is also supported by the finding of similar studies conducted by **Becker *et al.*[5] in 2010**, **Mansouri *et al.*[16] in 2013**, **Lee *et al.*[17] in 2016**, **Pi *et al.*[18] in 2017**, **Habashneh and Khaleel[19] in 2018**, **Singh and Vandana[20] in 2018**, **Kapoor S et al[21] in 2020, Pitale U. et al[22] in 2021** who showed that percentage of reduction from baseline to 6 months.

In the present study, statistically significant difference in mean Wound Healing Index (WHI) was seen between both the groups at 7 days ($p \leq 0.001$) and statistically significant difference in mean Visual Analogue Scale (VAS) was seen between both the groups at baseline.

In the present study, very high statistically significant difference exists in mean tip of Papilla to Bone Crest (TP-BC) for Group A was at baseline 3.57±0.53mm which increase to 5.14±0.69mm at 3 months, 5.43±0.78mm at 6 months. A recent study was done by **Sharma P *et al.*[12] in 2020** who showed that the percentage of reduction of CPTP was from at baseline 1.50±0.46 to 0.63±0.47 at 3 months.

In the present study, very high statistically significant difference exists in mean tip of Papilla to Bone Crest (TP-BC) for Group B which baseline was 3.42±0.44mm which increase to 5.29±0.48 at 3 months and 5.00±0.57 at 6 months postoperatively. A recent study done by **Pitale U. et al[22] in 2021** reported that mean Contact point to gingival margin (CP-GM) was 1.7200± 1.17331 at baseline which reduced to 0.5600±0.86987 at 3 months and 0.6400±0.95219 at 6 months.

In our study, the mean TP-BC distance at baseline for Group A and Group B was 3.57±0.53mm and 3.42±0.44mm, respectively. According to **Tarnow *et al.*[23]** if the distance from bone crest to contact point was ≤5 mm, then only the complete interdental papilla fill can be achieved.

Both techniques had positive effect on papilla reconstruction and the outcome was similar in both the groups and no technique was superior to the other. However, in the present study, most of the cases had steady results between three and six months, while minute relapse had occurred in a few cases in Group B. There were no significant difference both stastically and clinically.

There are a few limitations of this study in terms of negative impact on the sample size of study; delayed in data collection and follow-up period due to COVID pandemic. But still more number of studies with larger sample size and for longer duration are needed to be conducted to evaluate the potential of SCTG in terms of clinical advantages. Further, long-term and histologic studies using HA with larger sample size are required to assess the mechanism of hyaluronic acid action.

CONCLUSION:

Both the techniques were effective in the treatment of Nordland and Tarnow Class I and/or Class II Interdental papilla loss; however, on comparison none of the technique was superior over the other. Although, the application of SCTG has been considered as a gold standard in the treatment of papilla reconstruction; there are some situations in which SCTG cannot be performed like in patients having systemic diseases, pregnant and lactating women, the ones who do not want second surgical site; in those cases application of HA gel can be considered as a suitable alternative. The effect needs to be further investigated using long-term clinical and histological studies.

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