

COMPARATIVE EVALUATION OF CLINICAL APPLICATION OF HYALURONIC ACID GEL AND INJECTABLE PLATELET RICH FIBRIN(I-PRF) FOR RECONSTRUCTION OF INTERDENTAL PAPILLA AT THE ESTHETIC ZONE.

Periodontology

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ABSTRACT

Context: The Gingival Black Triangles are cosmetic deformities which refer to an absence of papilla resulting in open embrasures which impair esthetic features, phonetic problems and food accumulation. Among nonsurgical approaches proposed for papilla reconstruction, the injection of various fillers and biological preparations has been investigated. The purpose of this study is to show the efficacy of i-PRF in reconstruction of the lost interdental papilla in comparison to Hyaluronic acid gel. **Aims:** The aim of the present study is to compare and evaluate the efficacy of clinical application of injectable Hyaluronic Acid Gel and injectable Platelet Rich Fibrin (i-PRF) for reconstruction of lost interdental papilla at the esthetic zone by using an image analysis system. **Methods And Material:** The Single Blinded Randomized Clinical Trial included 30 sites of 23 patients. Patients were treated with application of Hyaluronic Acid (HA) Gel injection and injectable Platelet Rich Fibrin (i-PRF) in the lost interdental papilla. The image analysis software was used to measure Black Triangle Height (BTH), Black Triangle Width (BTW), Black Triangle Area (BTA) and Percentage of Reduction in Black Triangle Area. These parameters were measured at Baseline, 10 days, 1 month and 3 months. Statistical analysis used: Repeated measures ANOVA was used with 'Scheffe' Post Hoc analysis for examination of mean differences. **Results:** The result of this study showed improvement in the regeneration of recession defects at 3 months in both groups. mean reduction seen in BTH, BTW, BTA and percentage of reduction in black triangle area at 3 months in both groups. **Conclusions:** i-PRF and HA Gel can be used for non-invasive approach in reconstruction of lost interdental papilla.

KEYWORDS

interdental papilla, i-PRF, HA Gel

INTRODUCTION:

The interdental papilla represents large significance from an esthetic perspective, especially in the anterior dentition, because it is almost universally displayed during smile.¹ The Gingival Black Triangles are cosmetic deformities which refer to an absence of papilla resulting in open embrasures which impair esthetic features, phonetic problems and food accumulation.² Amongst dermal fillers, injectable fillers such as liquid silicone and bovine collagen were used in the past to replace or enhance the volume of subcutaneous tissue.

The most commonly used fillers in dentistry are hyaluronic acid products such as Juvederm and Restylane. Hyaluronic acid is an anionic, simple nonsulfated glycosaminoglycan widely found throughout connective, epithelial, and neural tissues.³ Choukroun and Ghanaati et al. (2016)⁴ studied that reduction of relative centrifugation force within injectable platelet-rich-fibrin (i-PRF) concentrates advances patients' own inflammatory cells, platelets and growth factors: a new Low Speed Centrifugation Concept (LSCC) of injectable platelet-rich fibrin (i-PRF) by modifying spin centrifugation forces. On centrifugation, two types of i-PRF are available: Upper Layer - Yellow i-PRF; Lower layer - Red i-PRF. If i-PRF is to be used mainly as filler material or enhancement stability and handling of grafting material, the yellow and red i-PRF may achieve a similar outcome.⁵

So, the Aim of the present study is to compare and evaluate the efficacy of clinical application of injectable Hyaluronic Acid Gel (HA Gel) and injectable Platelet Rich Fibrin (i-PRF) for reconstruction of lost interdental papilla at the esthetic zone by using an image analysis system.

SUBJECTS AND METHODS:

The Single Blinded Randomized Clinical Trial included 30 sites of 23 patients within the age group of 20-55 years referred to the Department of Periodontology, College of Dental Sciences and Research Centre, Manipur, Ahmedabad, Gujarat. Ethical clearance was obtained from

Ethical Committee of the Institute. written informed consent was from all patients. All the patients were in good health, good oral hygiene, At least one interdental papilla loss with the presence of a contact point between adjacent teeth in the maxillary anterior region, esthetically & orthodontically treated teeth, Patients with PIS-1 or PIS-2 score. (Figure 1)⁶

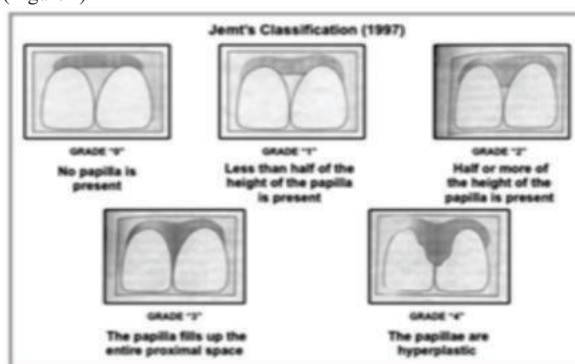


Figure 1: Papilla Index Score (PIS)

Patient with Inflammatory periodontal disease, on medication which increase the risk of Gingival Overgrowth, with systemic diseases, Pregnancy and lactation, allergic to Hyaluronic acid, habit of Tobacco use (in any form), anti-platelet and anti-coagulant drugs were excluded. All the patients underwent oral prophylaxis. Patients were treated with application of HA Gel injection and injectable Platelet Rich Fibrin (i-PRF) in the lost interdental papilla in the anterior esthetic zone. The image analysis software (Adobe Photoshop CS6) was used to measure Black Triangle Height (BTH)[Distance between base to the apex of the triangle], Black Triangle Width (BTW)[Distance between two opposite angles on the base of the triangle], Black Triangle Area (BTA)[BTH x BTW/2] and Percentage of

Reduction in Black Triangle Area[(Baseline area – Post operative area) x 100/ Baseline area](Figure 2). These parameters were measured at Baseline (Before injection of HA Gel and/or i-PRF), 10 days, 1 month and 3 months of injection of HA Gel and/or i-PRF. All the patients, that met the inclusion criteria were divided into two groups:

1. Group A: Patients receiving injectable Platelet Rich Fibrin (i-PRF).
2. Group B: Patients receiving Hyaluronic Acid (HA) Gel injection.

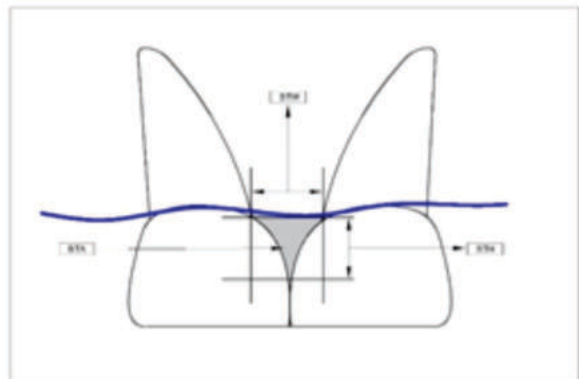


Figure 2: Schematic Diagram of Clinical Parameters

Procedure:

For i-PRF patients, 5 ml of whole blood was centrifuged at 700 rpm for 3 min (60g) at room temperature by a Remi R-4C Centrifuge in plastic vacutainer without anticoagulants. The upper liquid layer was collected as i-PRF was immediately collected into insulin syringe. After administering the LA spray, the i-PRF was then injected by inserting the needle at a 45° angle in an area 2 to 3 mm apical to the interdental papilla tip. Injection was followed by gentle massage of the area for 1 min. And for Patients with HA Gel injection, after administering the LA spray, 0.2 ml of HA Gel filled in insulin syringe was injected in the selected sites 2-3 mm apical to the coronal tip of the interdental papilla. Injection was followed by gentle massage of the area for 1 minute.



Figure 3: i-PRF

Image Analysis Of Photograph:

All measurements were recorded by a single blinded surveyor. The image analysis software (Adobe Photoshop CS6) is used to measure Black Triangle Height (BTH), Black Triangle Width (BTW), Black Triangle Area (BTA) and Percentage of Reduction in Black Triangle Area. These parameters are measured at Baseline (Before injection of HA gel and/or i-PRF), 10 days, 1 month and 3 months of injection of Hyaluronic Acid gel and/or i-PRF.



Figure 4: Photograph Showing Measurements Of Clinical Parameters

Photography: In order to maintain the uniformity of photographic angles,

- Patient Position: Sit upright, look ahead.
- Camera lens axis: Positioned horizontal

X-axis: The base of the Black triangle was used to measure the BTW.

Y-axis: The mid-point on the X-axis to apex of the Black Triangle was used to measure BTH. The Black Triangle Area was the area occupied within the X-axis and Y-axis. (Figure 3)

Post-operative Instructions:

1. Do not brush in the injected area for 24 hours. Brushing in the injected area can be resumed with soft bristled tooth brush.
2. Do not floss in the injected site.



Figure 5: Pre-operative At Baseline for i-PRF



Figure 6: Injecting i-PRF



Figure 7: i-PRF at 10 days in interdental papilla in relation to 11,21



Figure 8: Reduction In BTA At 1 Month In Interdental Papilla In Relation To 11,21



Figure 9: Complete Fill Of Interdental Papilla After 3 Months In Relation To 11,21



Figure 10: Black Triangles at Baseline for HA Gel Injection Site In Relation To 11,12; 11,21; 21,22



Figure 11: Injecting HA Gel in interdental papillary sites in relation to 11,12; 11,21; 21,22



Figure 12: HA Gel At 10 days

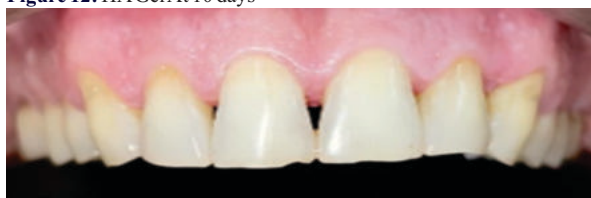


Figure 13: Reduction in papillary height in relation to 11,12; and 11,21 at 1 month



Figure 14: Complete Fill in interdental papilla in relation to 11,12; and 21,22. Note the reduction in BTA in relation to 11,21 compared to baseline

STATISTICAL DATA ANALYSIS

Statistical analysis was performed using a statistical software package Statistical Package for Social Science [SPSS], Version 20.

Repeated measures ANOVA was used with 'Scheffe' Post Hoc analysis for examination of mean differences between baseline, 10 days, 1 month, and 3 months for intergroup and intragroup comparisons.

RESULTS:

The result of this study showed improvement in the regeneration of recession defects at 3 months in both group (Figures 9 and 14). For mean reduction in black triangle height, statistically significant difference seen at baseline to 3 months, and there is no statistically significant difference at baseline to 10 days and 1 month for Group 1. There is statistically significant difference at baseline to 1 month and 3 months and there is no statistically significant difference at baseline to 10 days for Group 2 (Table 1). For mean reduction in black triangle width, statistically significant difference at baseline to 3 months and there is no statistically significant difference at baseline to 10 days and 1 month for Group 1. There is no statistically significant difference at baseline to 10 days, baseline to 1 month and baseline to 3 months for Group 2 (Table 2). for mean reduction in black triangle area, statistically significant difference at baseline to 3 months and there is no statistically significant difference at baseline to 10 days and baseline to 1 month in Group 1. There is statistically significant difference at baseline to 1 month, baseline to 3 months, and there is no statistically significant difference at baseline to 10 days for Group 2. (Table 3). for percentage of reduction in black triangle area, statistically significant difference at 10 days to 1 month, 10 days to 3 months for Group 1 and Group 2. (Table 4)

Table 1: Mean Reduction In Black Triangle Height (BTH)

Clinical parameter	Group	Time of assessment	Mean $\pm$ SD (in mm)	Difference from baseline	p value
BTH	Group 1 (iPRF)	Baseline	0.932 $\pm$ 0.472		
		10 days	0.922 $\pm$ 0.475	0.010	1.000
		1 month	0.580 $\pm$ 0.326	0.352	0.406
		3 months	0.265 $\pm$ 0.247	0.667	0.001*
	Group 2 (HA Gel)	Baseline	0.962 $\pm$ 0.497		
		10 days	0.610 $\pm$ 0.329	0.352	0.406
		1 month	0.256 $\pm$ 0.163	0.705	0.000*
		3 months	0.151 $\pm$ 0.141	0.810	0.000*

*The mean difference is statistically significant at the 0.005 level

Table 2: Mean Reduction In Black Triangle Width (BTW)

Clinical parameter	Group	Time of assessment	Mean $\pm$ SD (in mm)	Difference From Baseline	p value
BTW	Group 1 (iPRF)	Baseline	0.599 $\pm$ 0.360		
		10 days	0.590 $\pm$ 0.361	0.008	1.000
		1 month	0.396 $\pm$ 0.278	0.203	1.000
		3 months	0.174 $\pm$ 0.204	0.425	0.004*
	Group 2	Baseline	0.615 $\pm$ 0.258		

	(HA Gel)	10 days	0.415±0.189	0.200	1.00
		1 month	0.209±0.151	0.406	0.994
		3 months	0.123±0.109	0.492	0.982

* The Mean Difference Is Statistically Significant At The 0.005 Level

Table 3: Mean Reduction In Black Triangle Area (BTA)

Clinical parameter	Group	Time of assessment	Mean ± SD (in mm ²)	Difference From Baseline	p value
BTA	Group 1 (iPRF)	Baseline	0.353±0.359		
		10 days	0.347±0.357	0.005	1.000
		1 month	0.151±0.157	0.202	0.445
	Group 2 (HAGel)	3 months	0.043±0.061	0.310	0.031*
		Baseline	0.337±0.251		
		10 days	0.127±0.086	0.210	0.394
		1 month	0.312±0.029	0.306	0.036*
		3 months	0.014±0.016	0.323	0.020*

*The Mean Difference Is Statistically Significant At The 0.005 Level

Table 4: Percentage Of Reduction In Black Triangle Area

Clinical parameter	Group	Time Of Assessment	Mean ± SD (in %)	Difference from baseline	p value
Percentage of Reduction in Black Triangle Area	Group 1 (iPRF)	10 days	3.456±2.580		
		1 month	62.460±16.085	59.004	0.000*
		3 months	91.500±8.394	88.044	0.000*
	Group 2 (HA gel)	10 days	58.590±17.235		
		1 month	91.318 ± 7.187	32.727	0.000*
		3 months	95.814 ± 6.384	37.223	0.000*

*The Mean Difference Is Statistically Significant At The 0.005 Level

DISCUSSION:

The Gingival Black Triangles are cosmetic deformities which refer to an absence of papilla resulting in black spaces or open embrasures which impair esthetic features, phonetic problems and food accumulation.²

Surgical approaches for papilla reconstruction are: Pedicle flaps, Free Gingival Grafts, Connective Tissue Grafts and even repeated Subgingival curettage have been used in attempts to surgically regenerate the interdental papilla. Unfortunately, the frail interproximal papillary tissue and lack of adequate blood supply results in the necrosis of any graft material used to augment interproximal papilla. Among nonsurgical approaches proposed for papilla reconstruction, the injection of various fillers and biological preparations has been investigated either with or without concomitant access flap.²

Hyaluronic acid is an anionic, simple nonsulfated glycosaminoglycan widely found throughout connective, epithelial and neural tissues. The natural Hyaluronic acid contributes to tissue repair via cell hydration and lubrication. Mechanism of action of Hyaluronic Acid (HA): The use of hyaluronic acid stimulates cell proliferation, migration, angiogenesis, and re-epithelialization, and reduces collagen and scar formation.⁷ Hyaluronic acid products do not require pre-injection testing and produce relatively reproducible, longer-lasting results.

i-PRF is able to release different growth factors and has its influence on the behavior of fibroblasts and osteoblasts. Such information enables better elucidation on the beneficial effects of i-PRF in the healing process of both soft and mineralized tissues.^{8,9} Mechanism of action: i-PRF provides a three-dimensional fibrin network embedding platelets, leukocytes, Type I collagen, osteocalcin, and growth factors. The physicochemical characterization of i-PRF remains an important step forward to the understanding of their clinical effects. The idea of a slower centrifugation is to allow some cellular and growth factor components to stay in the final product.¹⁰

In the present study, mean reduction in Black Triangle Height (BTH) for Group 1 (i-PRF) at Baseline, 10 days, 1 month and 3 months was 0.932±0.472, 0.922±0.475, 0.580±0.326 and 0.265±0.247 mm

respectively. The difference is not statistically significant at baseline to 10 days and 1 month. There is statistically significant difference at baseline to 3 months for Group 1. (Table 1)

The mean reduction in BTH for Group 2 (HA Gel) at Baseline, 10 days, 1 month and 3 months was 0.962±0.497, 0.610±0.329, 0.256±0.163 and 0.151±0.141mm respectively. The difference is not statistically significant at baseline to 10 days. There is statistically significant difference at baseline to 1 month and 3 months for Group 2. (Table 1)

The study performed by **Abdelraouf et al. (2019)**¹¹ shows statistically significant decrease in Black Triangle Height (PT-CP distance) measurements after 3 months in which HA gel used as test group and normal saline as control group.

In the present study, mean reduction in Black Triangle Width (BTW) for Group 1 (i-PRF) at Baseline, 10 days, 1 month and 3 months was 0.599±0.360, 0.590±0.361, 0.396±0.278 and 0.174±0.204 mm respectively. The difference is not statistically significant at baseline to 10 days and 1 month. There is statistically significant difference at baseline to 3 months for Group 1. (Table 2). These results are in accordance with the study reported by **Bertl et al. (2017)**¹² They assessed the efficacy of HA gel as test group and Normal Saline as control group, in reconstruction of lost interdental papilla. They reported no statistically significant difference between the two groups. In the present study, mean reduction in Black Triangle Area (BTA) for Group 1 (i-PRF) at Baseline, 10 days, 1 month and 3 months was 0.353±0.359, 0.347±0.357, 0.151±0.157 and 0.043±0.061 mm² respectively. The difference is not statistically significant at baseline to 10 days and baseline to 1 month. There is statistically significant difference at baseline to 3 months in Group 1. (Table 5) These results are in contrast with the study reported by **Bertl et al. (2017)**¹². The mean reduction in Black Triangle Area (BTA) at 3 months was 0.47±0.20 mm².

In the present study, Percentage of Reduction in Black Triangle Area for Group 1 (i-PRF) at 10 days, 1 month and 3 months was 3.456±2.580, 62.460±16.085 and 91.500±8.394 % respectively. Percentage of Reduction in Black Triangle Area for Group 2 (HA Gel) at 10 days, 1 month and 3 months was 58.590±17.235, 91.318±7.187 and 95.814±6.384 % respectively. There is statistically significant difference at 10 days to 1 month, 10 days to 3 months for Group 1 and Group 2 (Table 6). This is in accordance to the study by **Abdelraouf et al. (2019)**¹¹ They assessed the efficacy of HA gel as test group and Normal Saline as control group, in reconstruction of lost interdental papilla. The mean Percentages of Reduction in Black Triangle Surface Area in the HA group were 36.5±24.4% from baseline to 3 months.

Oswal P. et al. (2020)¹³ in their case report on interdental papilla reconstruction with repeated injections of i-PRF over a period of 3 months until favorable results were obtained. The results seemed to be satisfactory and stable till a period of 6 months follow-up.

From the above discussion, it is shown that i-PRF is better compared to HA Gel. i-PRF is easy to prepare. i-PRF is cost-effective when compared to HA Gel. i-PRF is autologous can be used in all the patients unlike HA Gel, which cannot be used in patients who are allergic to HA Gel. i-PRF has better regeneration potential over longer period of time. According to **Miron R.J. et al. (2017)**¹⁴ i-PRF forms a small clot which acts as "Dynamic Hydrogel" containing cells that can release Growth Factors. i-PRF also has antibacterial properties.

CONCLUSION

Hence, the findings of this study indicate i-PRF showed statistically significant and clinically satisfactory results at 3 months, while HA Gel showed statistically significant and clinically satisfactory results at relatively early duration of time. Thus, i-PRF and HA Gel can be used for non-invasive approach in reconstruction of lost interdental papilla.

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