

COMPARATIVE CLINICAL EVALUATION OF HYALURONIC ACID AND MEDPARK
FILL COLLAGEN IN THE MANAGEMENT OF INTERDENTAL PAPILLARY
DEFICIENCY

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ABSTRACT

Purpose: Interdental papillary deficiency, commonly presenting as “black triangles,” is a major esthetic concern in periodontal practice. Minimally invasive approaches such as injectable biomaterials have gained increasing popularity as alternatives to surgical reconstruction. To compare the clinical efficacy of hyaluronic acid and Medpark Fill collagen in the management of interdental papillary deficiency and to evaluate their impact on periodontal esthetics. **Materials and Methods:** A prospective clinical trial was conducted on 30 patients with Class I and II papillary recession (Nordland and Tarnow classification). Patients were divided into two groups: Group A (hyaluronic acid) and Group B (Medpark Fill collagen). Clinical parameters including black triangle height, pain (VAS), and patient satisfaction were assessed at baseline, 3 weeks, 6 weeks, and 3 months. **Results:** Both groups showed a statistically significant reduction in black triangle height over time ($p < 0.001$). However, intergroup comparison revealed no statistically significant difference ($p > 0.05$). Pain scores decreased significantly in both groups, and patient satisfaction levels were comparable. **Conclusion:** Both hyaluronic acid and Medpark Fill collagen are effective, minimally invasive options for papilla augmentation with comparable clinical outcomes.

KEYWORDS: Interdental papilla, black triangle, hyaluronic acid, collagen filler, periodontal esthetics.

INTRODUCTION

Esthetic demands in contemporary dentistry have increased significantly, with greater emphasis being placed on the harmony of the gingival architecture, particularly in the anterior region. The interdental papilla is a key determinant of periodontal esthetics and plays a crucial role in maintaining gingival harmony and function. Loss of papillary height leads to “black triangles,” which can result in compromised smile esthetics, phonetic difficulties, food impaction, and plaque accumulation.^[1] With the increasing emphasis on esthetic dentistry, the management of interdental papillary deficiency has become a significant clinical challenge.

The presence of the interdental papilla is largely dependent on the distance between the contact point and the alveolar crest, as demonstrated by Tarnow et al., who reported that a distance of ≤ 5 mm is associated with

predictable papillary fill.^[2] However, factors such as periodontal disease, traumatic oral hygiene practices, tooth morphology, root divergence, and orthodontic treatment can lead to papillary loss.^[3]

Conventional surgical techniques for papilla reconstruction, including connective tissue grafts and pedicle flaps, are often technique-sensitive and yield unpredictable outcomes due to limited vascular supply and anatomical constraints.^[4] These limitations have led to the development of minimally invasive approaches using injectable biomaterials.

Hyaluronic acid (HA) is a naturally occurring glycosaminoglycan found in the extracellular matrix of connective tissues.^[5] It plays a significant role in wound healing, tissue hydration, and cellular proliferation.

HA possesses a high water-binding capacity, enabling it to provide immediate volumization and improve soft tissue contour. Additionally, it promotes angiogenesis, enhances fibroblast activity, and modulates inflammation, making it suitable for periodontal regeneration.^[6] However, variability in long-term stability and the need for repeated applications have been reported.

Collagen, particularly Type I collagen, is the primary structural protein of gingival connective tissue and plays a crucial role in maintaining tissue integrity. Injectable collagen fillers act as scaffolds that support fibroblast migration and extracellular matrix formation.^[7]

Unlike hyaluronic acid, collagen-based fillers provide structural reinforcement and contribute to long-term tissue stability. Recent biomaterial-based studies have shown promising results in papilla reconstruction using collagen.^[8] Although both hyaluronic acid and collagen fillers have shown promising results individually, their mechanisms differ—HA primarily provides volumetric enhancement, whereas collagen offers structural support. There is limited comparative evidence evaluating their relative efficacy in interdental papilla reconstruction. Hence, this study was undertaken.

MATERIALS AND METHODS

This study was designed as a randomized controlled clinical trial conducted in the Department of Periodontology and Oral Implantology. The study population comprised individuals presenting with interdental black triangles in the maxillary and mandibular anterior regions who reported to the outpatient department. A total of 40 patients were recruited using a convenient sampling technique and were randomly allocated into two groups: Group A, which received injectable hyaluronic acid, and Group B, which received Medpark Fill collagen, with 20 patients in each group. Ethical clearance was obtained from the institutional ethics committee prior to the

commencement of the study, and informed consent was obtained from all participants after explaining the nature and purpose of the study.

Patients included in the study were above 18 years of age and presented with Class I or Class II papillary recession according to Nordland and Tarnow's classification, with tight proximal contacts.^[9] Patients who smoked or chewed tobacco, were medically compromised, had a history of drug-induced gingival hyperplasia, were pregnant or lactating, exhibited grade II or III mobility, had anterior gingival recession, or showed signs of trauma from occlusion were excluded from the study. Participants were also withdrawn if they were unwilling to continue or chose to exit the study voluntarily.

All patients underwent Phase I therapy, including oral hygiene instructions and scaling and root planing using an ultrasonic scaler. Prior to treatment, standardized intraoral photographs were taken, and baseline clinical measurements of the black triangle were recorded as the distance from the tip of the interdental papilla to the contact point using a UNC-15 periodontal probe. The clinical procedure was performed under local anesthesia (2% lignocaine hydrochloride with 1:80,000 adrenaline).

In Group A, a commercially available cross-linked hyaluronic acid filler (Restylane Lidocaine, Galderma S.A., Sweden) was injected in a volume of less than 0.2 mL using a 30-gauge disposable syringe. The needle was inserted 2–3 mm apical to the tip of the interdental papilla and directed coronally at an angle of approximately 45° to the long axis of the tooth, with the bevel facing apically. After injection, the papilla was gently massaged in an incisal direction for one minute using sterile gauze to ensure uniform distribution. In Group B, Medpark Fill, an injectable sterile cross-linked type I collagen-based dermal filler, was administered using the same technique, angulation, and volume to ensure standardization between groups.



Restylane Lidocaine Hyaluronic Acid Filler



Medpark Fill collagen filler

Postoperative instructions were given to all patients, including avoiding toothbrushing in the treated area on the day of the procedure, resuming gentle brushing with a soft toothbrush the following day while keeping the bristles coronal to the gingival margin, and refraining from flossing in the treated sites for two weeks. Patients were recalled at 3 weeks and 6 weeks for booster

injections of less than 0.2 mL if required, following the same protocol. Follow-up evaluation was carried out at 3 months to assess the stability of papilla fill and overall esthetic improvement.

At each recall visit, clinical measurements of the black triangle were recorded using a UNC-15 probe. Post-

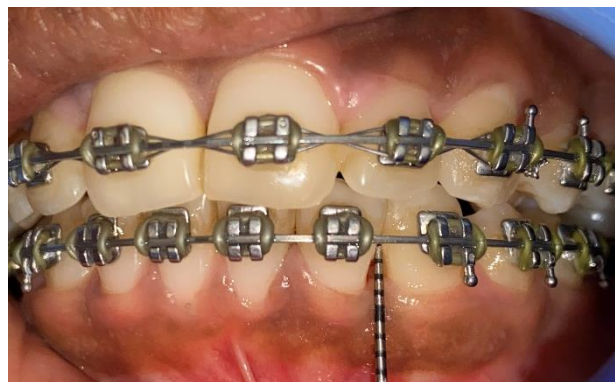
injection pain was assessed using a Visual Analogue Scale (VAS), ranging from 0 (no pain) to 10 (worst pain). Patient satisfaction was evaluated using a four-point questionnaire ranging from completely satisfied to

completely dissatisfied. The collected data were tabulated and subjected to appropriate statistical analysis to determine the efficacy of the two treatment modalities.

BLACK TRIANGLE SITE WITH HYALURONIC ACID



Baseline



Baseline measurement



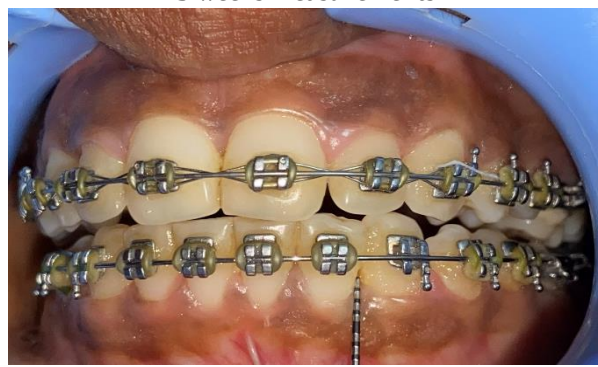
3 weeks



3 weeks measurements



6 weeks



6 weeks measurement



3 months follow up



3 months measurement

BLACK TRAIANGLE SITE WITH MEDPARK FILL COLLAGEN**Baseline****Baseline measurement****3 weeks****3 weeks measurements****6 weeks****6 weeks measurement****3 months follow up****3 months measurement****RESULTS**

The present study evaluated and compared the efficacy of injectable hyaluronic acid and Medpark Fill collagen in the management of interdental papillary deficiency. A

total of 40 patients were included and divided equally into two groups.

The distribution of interdental papilla defects (Class I and Class II) between the two groups showed no statistically significant difference ($p = 0.752$), indicating that both groups were comparable at baseline. In the hyaluronic acid group, 55% of sites exhibited Class I defects and 45% showed Class II defects, whereas in the Medpark Fill collagen group, 60% were Class I and 40% were Class II.

Intergroup comparison of black triangle height at baseline, 3 weeks, 6 weeks, and 3 months using the independent t-test revealed no statistically significant difference between the two groups at any time interval ($p > 0.05$). Although both groups demonstrated a gradual reduction in black triangle height over time, the difference between hyaluronic acid and collagen groups was not statistically significant, suggesting comparable clinical efficacy of both materials.

Similarly, comparison of pain perception using the Visual Analogue Scale (VAS) between the two groups at baseline, 3 weeks, and 6 weeks showed no statistically significant difference ($p > 0.05$). Both groups demonstrated a reduction in pain scores over time, indicating good patient tolerance for both treatment modalities.

Patient satisfaction levels between the two groups also showed no statistically significant difference ($p = 0.815$). In the hyaluronic acid group, 15% of patients were completely satisfied, 40% were partially satisfied, and 45% were partially dissatisfied. In the Medpark Fill collagen group, 30% were completely satisfied, 20%

were partially satisfied, and 50% were partially dissatisfied, indicating comparable subjective outcomes.

Intragroup comparison using repeated measures ANOVA demonstrated a highly significant reduction in black triangle height over time in both groups ($p < 0.001$). In the hyaluronic acid group, mean black triangle height reduced from 2.30 mm at baseline to 0.80 mm at 3 months, while in the Medpark Fill collagen group, it reduced from 2.15 mm to 0.45 mm. Pairwise comparisons revealed statistically significant reductions at all time intervals in both groups, confirming progressive improvement in papillary fill.

With respect to pain perception, the hyaluronic acid group showed a statistically significant reduction over time ($p = 0.017$), although pairwise comparison indicated that significant reduction was primarily observed between baseline and 6 weeks. In contrast, the Medpark Fill collagen group demonstrated a highly significant reduction in pain scores ($p < 0.001$), with significant improvements observed at all time intervals.

Overall, both hyaluronic acid and Medpark Fill collagen were effective in reducing black triangle height and improving interdental papilla fill over a period of 3 months. However, no statistically significant difference was observed between the two groups in terms of clinical outcomes, pain perception, or patient satisfaction, indicating that both treatment modalities are equally effective for the management of interdental papillary deficiency.

Table 1: Difference in interdental papillae between Hyaluronic acid group and Medpark fill collagen group using Mann-Whitney U test.

Groups	Interdental papillae I	Interdental papillae II	P
Hyaluronic acid	11 (55%)	9 (45%)	.752 (NS)
Medpark fill collagen	12 (60%)	8 (40%)	

NS = Not Significant

Table 2: Difference in black triangle height at baseline, after 3 weeks, 6 weeks and after 3 months between Hyaluronic acid group and Medpark fill collagen group using Independent T test.

Time interval	Groups	Mean	Standard Deviation	Mean Difference	95% Confidence Interval for the Mean Difference		t	p
					Lower	Upper		
Baseline	Hyaluronic acid	2.3000	.97872	.15000	-.44430	.74430	.511	.612 (NS)
	Medpark fill collagen	2.1500	.87509					
3 weeks	Hyaluronic acid	1.6000	.99472	.15000	-.47093	.77093	.489	.628 (NS)
	Medpark fill collagen	1.4500	.94451					
6 weeks	Hyaluronic acid	1.1000	.85224	.15000	-.34533	.64533	.613	.543 (NS)
	Medpark fill collagen	.9500	.68633					
3 months	Hyaluronic acid	.8000	.76777	.35000	-.09243	.79243	1.601	.118 (NS)

	Medpark fill collagen	.4500	.60481					
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Table 3: Difference in VAS score at baseline, after 3 weeks and after 6 weeks between Hyaluronic acid group and Medpark fill collagen group using Mann-Whitney U test.

Time interval	Groups	Mean	Standard Deviation	Mean Difference	95% Confidence Interval for the Mean Difference		t	p
					Lower	Upper		
Baseline	Hyaluronic acid	.6500	.67082	-.40000	-.83443	.03443	-1.864	.070 (NS)
	Medpark fill collagen	1.0500	.68633					
3 weeks	Hyaluronic acid	.4000	.50262	-.10000	-.42510	.22510	-.623	.537 (NS)
	Medpark fill collagen	.5000	.51299					
6 weeks	Hyaluronic acid	.2500	.44426	.00000	-.28440	.28440	.000	1.000 (NS)
	Medpark fill collagen	.2500	.44426					

Table 4: Difference in patient satisfaction level between Hyaluronic acid group and Medpark fill collagen group using Mann-Whitney U test.

Groups	Level 1	Level 2	Level 3	p
Hyaluronic acid	3 (15%)	8 (40%)	9 (45%)	.815 (NS)
Medpark fill collagen	6 (30%)	4 (20%)	10 (50%)	

Table 5: Difference in black triangle height at baseline, after 3 weeks, 6 weeks and after 3 months in hyaluronic acid group using repeated measures ANOVA test.

Groups	Mean	Standard Deviation	95% Confidence Interval for the Mean		F	p
			Lower	Upper		
Baseline	2.3000	.97872	1.842	2.758	48.059	.000 (HS)
3 weeks	1.6000	.99472	1.134	2.066		
6 weeks	1.1000	.85224	.701	1.499		
3 months	.8000	.76777	.441	1.159		

HS = Highly significant ($p < 0.001$)

Pairwise Comparison for table 1.

Time interval		Mean Difference	95% Confidence Interval for Difference		p
			Lower bound	Upper Bound	
Baseline	3 weeks	.700*	.393	1.007	.000 (HS)
	6 weeks	1.200*	.955	1.445	.000 (HS)
	3 months	1.500*	1.178	1.822	.000 (HS)
3 Weeks	Baseline	-.700*	-1.007	-.393	.000 (HS)
	6 weeks	.500*	.260	.740	.000 (HS)
	3 months	.800*	.474	1.126	.000 (HS)
6 Weeks	Baseline	-1.200*	-1.445	-.955	.000 (HS)
	3 weeks	-.500*	-.740	-.260	.000 (HS)
	3m months	.300*	.080	.520	.010 (VS)
3 Months	Baseline	-1.500*	-1.822	-1.178	.000 (HS)
	3 weeks	-.800*	-1.126	-.474	.000 (HS)
	6 weeks	-.300*	-.520	-.080	.010 (VS)

VS = Very significant ($p < 0.01$)

Table 6: Difference in black triangle height at baseline, after 3 weeks, 6 weeks and after 3 months in medpark fill collagen group using repeated measures ANOVA test.

Groups	Mean	Standard Deviation	95% Confidence Interval for the Mean		F	p
			Lower	Upper		
Baseline	2.1500	.87509	1.740	2.560	57.731	.000 (HS)
3 weeks	1.4500	.94451	1.008	1.892		
6 weeks	.9500	.68633	.629	1.271		
3 months	.4500	.60481	.167	.733		

HS = Highly significant (p<0.001)

Pairwise Comparison for table 1

Time interval		Mean Difference	95% Confidence Interval for Difference		p
			Lower bound	Upper Bound	
Baseline	3 weeks	.700*	.433	.967	.000 (HS)
	6 weeks	1.200*	.955	1.445	.000 (HS)
	3 months	1.700*	1.357	2.043	.000 (HS)
3 Weeks	Baseline	-.700*	-.967	-.433	.000 (HS)
	6 weeks	.500*	.260	.740	.000 (HS)
	3 months	1.000*	.660	1.340	.000 (HS)
6 Weeks	Baseline	-1.200*	-1.445	-.955	.000 (HS)
	3 weeks	-.500*	-.740	-.260	.000 (HS)
	3m months	.500*	.260	.740	.000 (HS)
3 Months	Baseline	-1.700*	-2.043	-1.357	.000 (HS)
	3 weeks	-1.000*	-1.340	-.660	.000 (HS)
	6 weeks	-.500*	-.740	-.260	.000(HS)

Table 7: Difference in VAS score at baseline, after 3 weeks and after 6 weeks in hyaluronic group using repeated measures ANOVA test.

Groups	Mean	Standard Deviation	95% Confidence Interval for the Mean		F	p
			Lower	Upper		
Baseline	.6500	.67082	.336	.964	6.909	.017 (S)
3 weeks	.4000	.50262	.165	.635		
6 weeks	.2500	.44426	.042	.458		

S = significant (p<0.05)

Pairwise Comparison for table 1

Time interval		Mean Difference	95% Confidence Interval for Difference		p
			Lower bound	Upper Bound	
Baseline	3 weeks	.250	-.007	.507	.056
	6 weeks	.400*	.081	.719	.017 (S)
3 Weeks	Baseline	-.250	-.507	.007	.056
	6 weeks	.150	-.021	.321	.083
6 Weeks	Baseline	-.400*	-.719	-.081	.017 (S)
	3 weeks	-.150	-.321	.021	.083

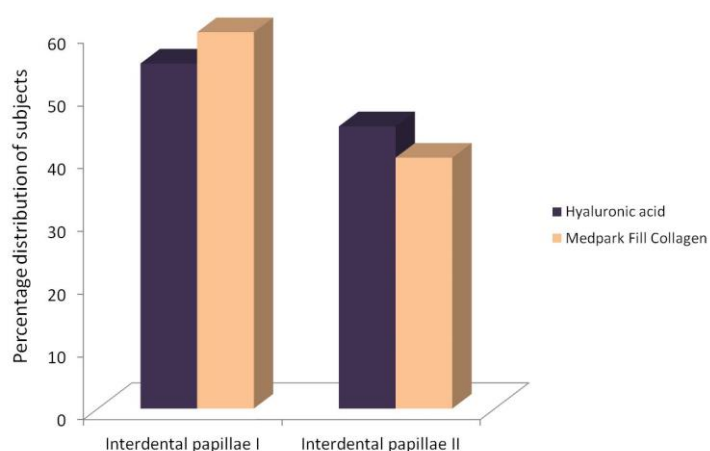
Table 8: Difference in VAS score at baseline, after 3 weeks and after 6 weeks in medpark fill collagen group using repeated measures ANOVA test.

Groups	Mean	Standard Deviation	95% Confidence Interval for the Mean		F	p
			Lower	Upper		
Baseline	1.0500	.68633	.729	1.371	21.335	.000 (HS)
3 weeks	.5000	.51299	.260	.740		
6 weeks	.2500	.44426	.042	.458		

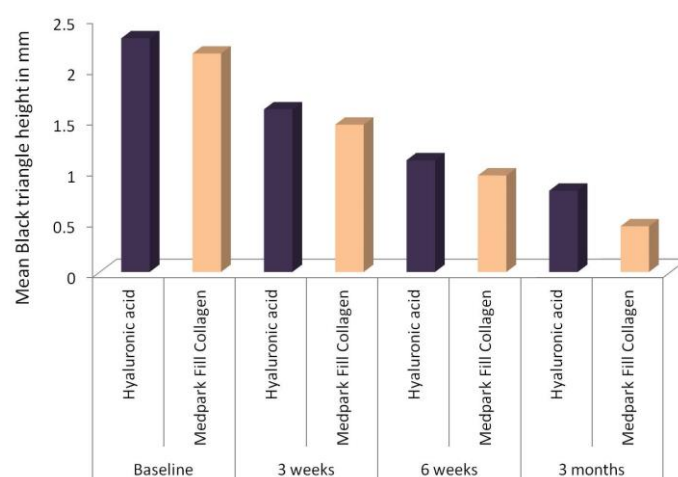
Pairwise Comparison for table 1.

Time interval		Mean Difference	95% Confidence Interval for Difference		p
			Lower bound	Upper Bound	
Baseline	3 weeks	.550*	.267	.833	.001 (VS)
	6 weeks	.800*	.512	1.088	.000 (HS)

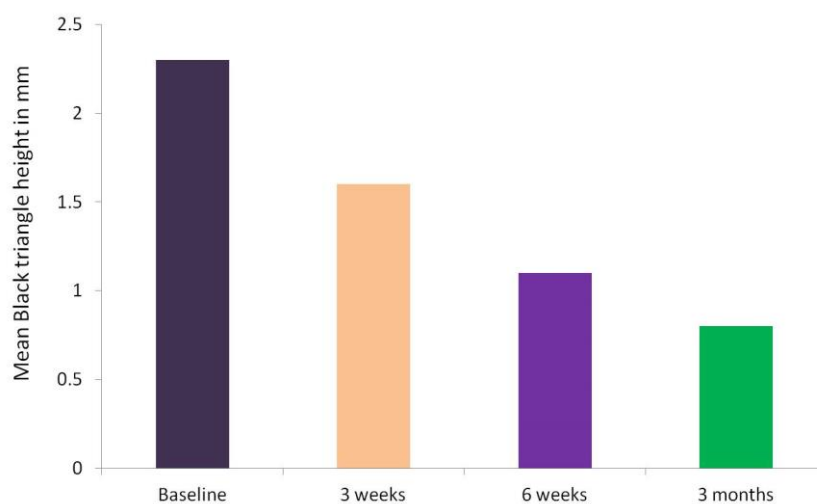
3 Weeks	Baseline	-.550 [*]	-.833	-.267	.001 (VS)
	6 weeks	.250 [*]	.042	.458	.021 (S)
6 Weeks	Baseline	-.800 [*]	-1.088	-.512	.000 (HS)
	3 weeks	-.250 [*]	-.458	-.042	.021 (S)



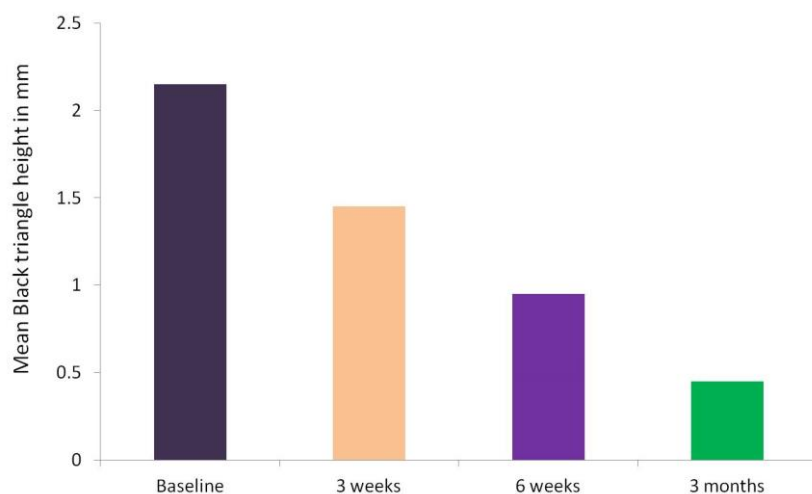
Graph 1: Percentage distribution of subjects.



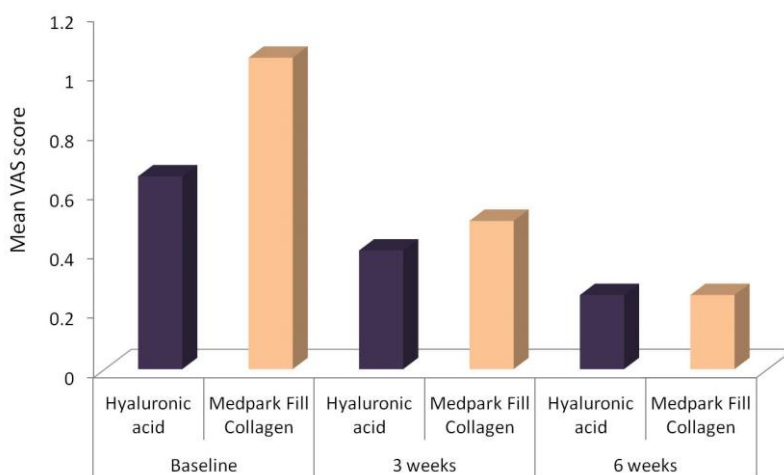
Graph 2: Mean black triangle height in mm.



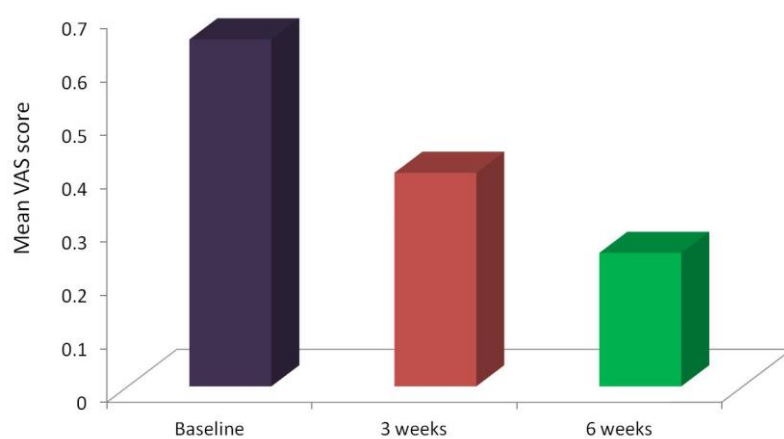
Graph 3: Mean black triangle height in mm of Hyaluronic acid.



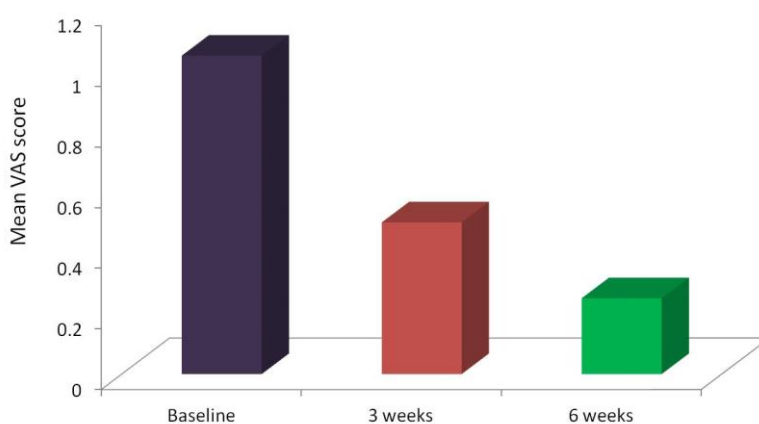
Graph 4: Mean black triangle height in mm of Medpark Fill Collagen.



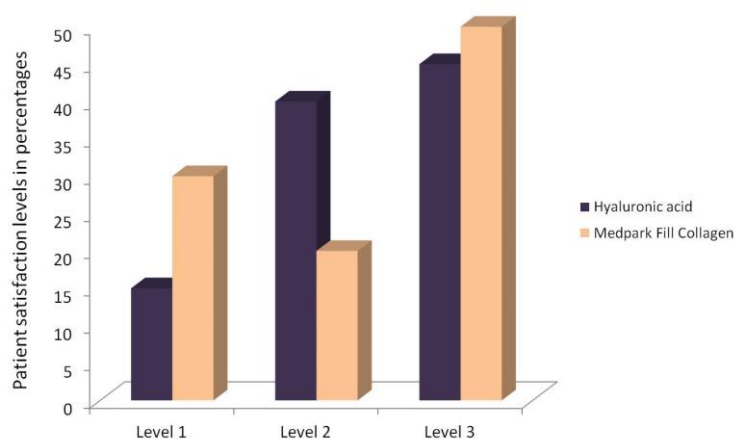
Graph 5: Mean VAS score.



Graph 6: Mean VAS score of Hyaluronic acid.



Graph 7: Mean VAS score of Medpark Fill Collagen.



Graph 8: patient satisfaction level at the end of three months.

DISCUSSION

The present study was undertaken to comparatively evaluate the clinical efficacy of injectable hyaluronic acid and Medpark Fill collagen in the management of interdental papillary deficiency, commonly referred to as “black triangles.” The results demonstrated that both biomaterials resulted in significant improvement in papillary fill over time, with no statistically significant difference between the two groups. These findings highlight the growing relevance of minimally invasive, biomaterial-based approaches in periodontal esthetic therapy.

Given the anatomical limitations, limited vascularity, and restricted surgical access in the interdental region, reconstruction of the papilla remains one of the most challenging procedures in periodontics.^[4] This has led to the exploration of alternative approaches such as injectable biomaterials that aim to enhance soft tissue volume without surgical intervention.

Minimally invasive procedures have gained widespread acceptance in periodontal therapy due to reduced morbidity, improved patient comfort, and enhanced esthetic outcomes. Injectable fillers, widely used in

dermatology, have recently been introduced into periodontal practice for soft tissue augmentation.

The rationale behind using injectable materials lies in their ability to:

- Provide immediate volumization
- Stimulate cellular activity
- Improve soft tissue contour
- Enhance patient satisfaction

Both hyaluronic acid and collagen represent biologically compatible materials with regenerative potential, making them suitable for interdental papilla reconstruction.

In the present study, the hyaluronic acid group showed a statistically significant reduction in black triangle height from baseline to 3 months ($p < 0.001$), which is consistent with previous findings. The progressive reduction observed at each time interval suggests that HA not only provides immediate volumization but also contributes to gradual tissue remodeling.

Similar findings were reported by Kaur et al. who demonstrated a significant decrease in black triangle height and area following hyaluronic acid injections,

confirming its effectiveness as a minimally invasive treatment modality.^[10] Furthermore, a prospective clinical study by Alhabashneh et al. reported significant improvement in papillary fill following hyaluronic acid injections, with progressive reduction in black triangle dimensions over time.^[11]

However, one of the limitations of HA is its susceptibility to enzymatic degradation, which may necessitate repeated injections to maintain the desired outcome.^[15] This was addressed in the present study through booster injections at 3 and 6 weeks, which likely contributed to sustained improvement.

In the present study, the Medpark Fill collagen group showed a highly significant reduction in black triangle height from baseline to 3 months ($p < 0.001$). The magnitude of reduction was comparable to that observed in the hyaluronic acid group, indicating that collagen fillers are equally effective in papilla augmentation.

The sustained improvement observed in the collagen group may be attributed to its ability to provide structural support and promote tissue remodeling. Additionally, the cross-linked nature of the collagen filler used in this study likely contributed to its durability and resistance to degradation. A randomized controlled trial by Sharma et al. showed that a volume-stable collagen matrix significantly improved papillary height and reduced contact point-to-papilla distance, with outcomes comparable to subepithelial connective tissue graft.^[12]

Recent advancements also include the use of collagen matrices such as Fibro-Gide in papilla augmentation procedures. A prospective clinical trial has been initiated to assess the effectiveness of collagen matrices using tunneling techniques for the treatment of black triangles, further emphasizing the growing interest in collagen-based minimally invasive therapies.^[13]

Pain perception, assessed using the Visual Analog Scale, showed a significant reduction over time in both groups, with no significant intergroup difference. This indicates that both materials are well tolerated and associated with minimal discomfort. The minimally invasive nature of the procedure, combined with the use of local anesthesia and fine-gauge needles, likely contributed to improved patient comfort.

Patient satisfaction is an important parameter in esthetic dentistry. In this study, both groups demonstrated comparable levels of satisfaction, with most patients reporting partial to complete satisfaction.

However, certain limitations must be considered. The sample size was relatively small, and the follow-up period was limited to 3 months. Long-term stability of the results could not be assessed.

CONCLUSION

Injectable hyaluronic acid and Medpark Fill collagen were both found to be effective in the management of interdental papillary deficiency, producing significant reduction in black triangle height and noticeable improvement in periodontal esthetics. The clinical outcomes between the two materials were comparable, with no statistically significant difference observed.

These findings highlight that minimally invasive injectable biomaterials can serve as reliable and predictable alternatives to conventional surgical approaches for papilla reconstruction. While hyaluronic acid primarily enhances soft tissue volume through its hydrophilic and biologically active properties, collagen contributes to structural support and tissue stability, ultimately yielding similar therapeutic results.

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