

Minimally Invasive Technique Salvaging the Black Triangle: A Case Series of Papilla Reconstruction

¹Dr Shilpa Jaryal, MDS Post Graduate Student, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali, Punjab

²Dr Gurpreet Kaur, HOD, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali, Punjab

Corresponding Author: Dr Shilpa Jaryal, MDS Post Graduate Student, Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Mohali, Punjab

Citation of this Article: Dr Shilpa Jaryal, Dr Gurpreet Kaur, “Minimally Invasive Technique Salvaging the Black Triangle: A Case Series of Papilla Reconstruction”, IJDSIR- March - 2021, Vol. – 4, Issue - 2, P. No. 01 – 08.

Copyright: © 2021, Dr Shilpa Jaryal, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background and Aim: The black triangle can result in unaesthetic appearance while smiling and can result in food impaction and phonetic problems. Gingival black triangles have a multifactorial etiology and a range of treatment options. The aim of this study was to evaluate the clinical application of injectable hyaluronic acid gel for reconstruction of gingival black triangles in anterior esthetic zone.

Materials and Methods: Five systemically healthy adult individuals with anterior site, class I or class II interdental papilla loss were recruited. Following local anesthesia, 0.2 ml of hyaluronic acid gel was injected directly into the base of papilla 2-3 mm apical to the coronal tip of the involved papilla using 23 gauge needle. The injection was repeated after 20 days. The patients were monitored for the results in the subsequent follow-ups. Lost papilla surface area was calculated using clinical photographs taken at baseline, 1 week, 3 weeks and 6 weeks.

Differences in the lost papillary surface area between baseline and post-operative clinical photographs were statistically analyzed using SPSS 19.0 version using ANOVA test.

Results: Each site was individually evaluated. Application of hyaluronic acid for reconstruction of gingival black triangle was successful in a 6 weeks follow-up period. 3 sites had complete papilla reconstruction and 2 sites had 34-57% of reconstruction rate.

Conclusion: Results from this pilot study were encouraging and present the evidence that class I and class II gingival black triangles can be enhanced by injecting hyaluronic acid gel. Thus injectable hyaluronic acid gel may be a promising treatment for enhancing gingival papillary esthetics.

Keywords: Interdental papilla, Black Triangles, Hyaluronic acid gel, Esthetic zone.

Introduction

The interdental papilla is the gingival portion that occupies the proximal area underneath the contact between two adjacent teeth. It has distinctive anatomical, histological and molecular characteristics with tremendous significant importance from an esthetic perspective, especially in the anterior region since it is almost universally displayed during smiling[1]. Black triangles are defined as the embrasures cervical to the interproximal contact that are not filled by the gingival tissue[2]. The presence or absence of the interproximal papilla is of great concern to periodontists, restorative dentists, and to the patients. The loss of papilla can lead to cosmetic deformities (so-called “black triangle disease”), phonetic problems (space allows passage for the air or saliva), and lateral food impaction[3]. Reconstruction of papillary insufficiency is one of the most difficult and challenging periodontal treatments. This is because the interdental papilla is a small, fragile area with minor blood supply which seems to be the major limiting factor in all surgical and augmentation techniques aiming at reconstructing the interdental papilla [4][5].

Several surgical approaches using traditional periodontal plastic and augmentation procedures have been proposed to overcome this problem. However, these techniques were found to be invasive with increased patient morbidity, limited success and long-term stability [6][7]. Non-surgical attempts to treat papillary deficiencies include orthodontic, restorative approaches or a combination of both. However, these methods are invasive, but time-consuming [8]. The present study evaluates the clinical application of hyaluronic acid gel for reconstruction of black triangles in esthetic zone.

Table 1: Etiology Of Black Triangles

1. Loss of Periodontal support due to the plaque associated periodontal diseases.
2. High renal pull
3. Abnormal tooth shape
4. Improper prosthetic contour
5. Traumatic oral hygiene procedure

Table 2: Classification of Papillary Height

Nordland and Tarnow (1998) based on anatomic landmarks.

Normal: Interdental papilla fills embrasure space to the apical extent of the interdental contact point/area.

Class I: Tip of interdental papilla lies between the interdental contact point and most coronal extent of interdental CEJ (space between interproximal CEJ is not visible).

Class II: Tip of interdental papilla lies at or apical to interproximal CEJ but coronal to apical extent of facial CEJ.

Class III: The tip of interdental papilla lies level with or apical to facial CEJ.

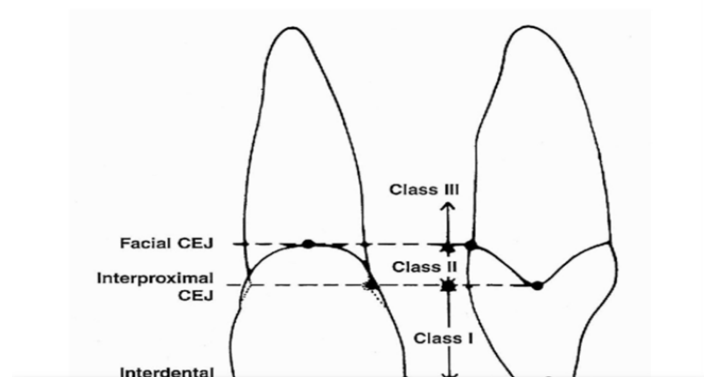


Figure 1: Classification of papillary height

Hyaluronic Acid

Hyaluronic acid is an ionic, nonsulfated, high molecular weight glycosaminoglycan that forms a critical component of the extracellular matrix and contributes significantly to tissue hydrodynamics, cell migration and proliferation.

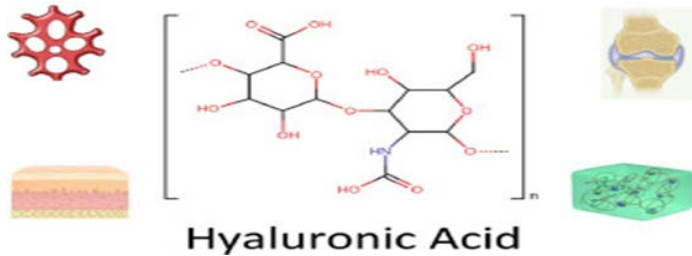


Figure 2: hyaluronic acid – chemical structure.

Properties of Hyaluronic Acid

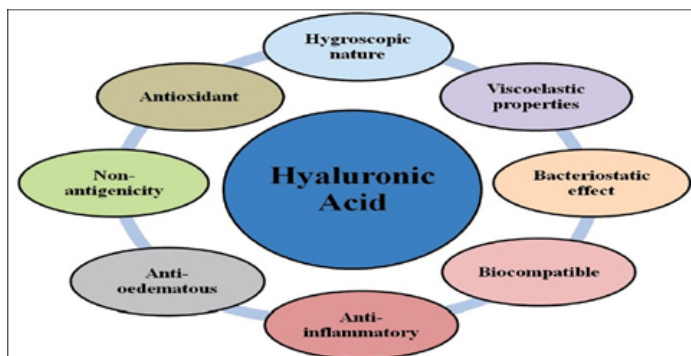


Figure 3: hyaluronic acid properties

Hyaluronic acid has been widely used in the treatment of osteoarthritis knee and in combination with cataract surgery. In the field of dentistry it has shown anti-inflammatory and antibacterial effects for the treatment of gingivitis and periodontitis. HA gel (GENGIGEL) used as local drug delivery and HYALOSS MATRIX for osseous defects has shown clinical benefits. Recently HA has been used for regeneration of the interdental papilla and has shown promising results.

Hyaluronic Acid Gel

The product used in this trial was GENGIGEL hyaluronic acid (2018 Dent –O-Care Ltd. GENGIGEL©) It is a registered trade mark owned by Ricerfarma s.r.l.

GENGIGEL is a non-animal stabilised cross-linked HA filler with an HA concentration of 0.2%. The longevity of GENGIGEL in tissues is approximately 6 months incorporated into the syringe itself [9].

Mechanism of Action

High molecular weight hyaluronic acid (HA) is a natural physiological constituent of connective tissue. Made up mostly of collagen, it is one of the major components of the human body. HA is the most abundant high molecular weight glycosaminoglycan of healthy soft periodontal tissues.[10] It is active in tissue regeneration and influences the migration of fibroblasts and fibrinogenesis, thus making the healing of tissue easier.

Treatment Protocol

The present study aimed the reconstruction of the interdental papilla with hyaluronic acid gel. A total number of 5 sites both maxillary and mandibular were included in the study. 0.2ml hyaluronic acid was injected 2mm apical to papilla tip and this procedure was repeated 3 times for the evaluated areas. The treatment protocol was divided into 3 phases: the pre-operative phase, where patients were examined for eligibility, the injection phase and the follow up phase.

In the pre-operative phase, the 1st visit started by collecting detailed personal information, medical and dental history. Initial periodontal therapy including full mouth supragingival scaling and subgingival debridement was performed, and patient motivation and education for proper oral hygiene instructions were reassured.

The distance between the contact area and inter-proximal bone crest (CP-BC) was then measured for eligibility at the sites of papillary deficiency using peri-apical radiographs with the paralleling technique and confirmed by bone sounding. Only sites with CP-BC distance ≤ 7 mm were eligible for the study

After 6 weeks, re-evaluation was performed, and the degree of papillary deficiency according to Nordland and Tarnow classification [11] as well as plaque and gingival indices were assessed for eligibility. Alginate impression was taken for the involved arch/arches for the construction of study casts and fabrication of customised stents. Only patients with deficient papilla site/sites fulfilling the inclusion criteria were recalled, scheduled for the 1st injection after 1 week and signed the informed consent. In the injection phase, 3 injections were given at each papilla site: at baseline, 3- and 6-weeks intervals. At the first injection visit, before attempting to inject, clinical measurement of the height of the black triangle was done by measuring the distance between the deficient papilla tip and contact area (PT-CP distance) to the nearest 0.5 mm (baseline). This was done using a graduated periodontal probe and the fabricated customised stent for proper and standardised positioning of the probe at each measurement interval, as shown in Figure 1.



Figure 4
Pre-Operative Intraoral clinical photograph showing gingival recession in mandibular central incisors.



Figure 5
Measuring the height of the black triangle (PT-CP distance)

Also, standardised digital clinical photographs were taken for the eligible deficient papillae for the baseline measurement of the surface area of black triangles.

Every injection procedure starts with the administration of short-acting local anaesthesia using infiltration technique. The deficient papilla was injected with 0.1 mm of HA gel or saline solution using a 30-gauge disposable insulin syringe. Hyaluronic acid and saline were pre-loaded in insulin plastic syringes before injection for patient blinding.

The needle was inserted 2-3 mm apical to the tip of the interdental papilla and directed coronally with an angulation of 45° to the long axis of the tooth, and the bevel directed apically (Figure 3).

Then, the papilla was lightly moulded in an incisal direction for 1 minute using gauze. Finally, post-injection instructions were prescribed where 24-hour abstinence from mechanical plaque control in the area and the use of mouthwash twice daily only was advocated.

The use of a soft toothbrush, together with the use of mouthwash, was indicated after the first 24 hours. Routine mechanical oral hygiene was resumed after 2 weeks.



Figure 6

Injection technique



A

B



C

D

Figure 7

Hyaluronic acid A) BT at baseline; B) BT at 1 week C) BT at 3 week D) BT at 6 weeks. Continuous Improvement Shown with Clinical Measurement (mm) using stent And Photographic Measurement (area) using image at different intervals.

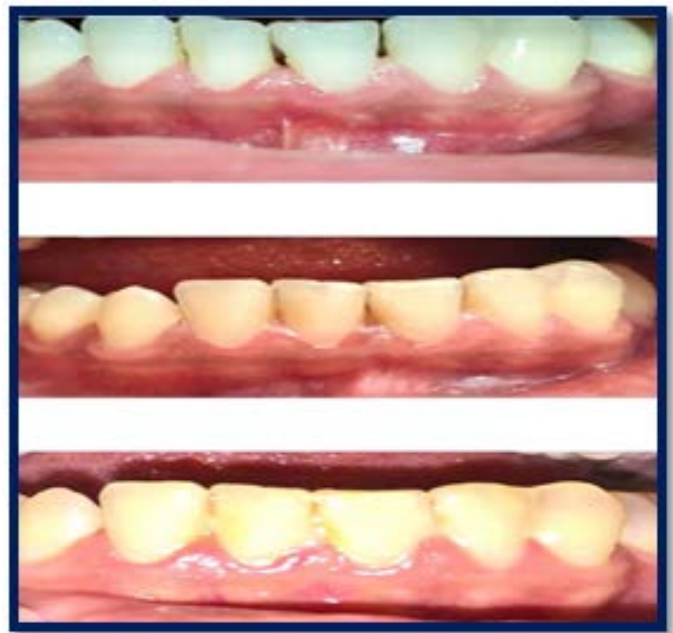


Figure 8

Clinical results A) BT at 1 week B) BT at 3 week C) BT at 6 weeks

Results

Assessment of Patient's Satisfaction

Lost papilla surface area was calculated using clinical photographs taken at baseline, 1 week, 3 weeks and 6 weeks post-operative follow-ups. Differences in the lost papillary surface area between baseline and post-operative clinical photographs were statistically analyzed using SPSS 19.0 version using ANOVA test. This technique resulted in significant improvement of papillary volume and thus esthetics. Therefore, desired result was attained by hyaluronic acid gel.

Each site was individually evaluated. A total of 5 interdental papillae in 5 patients including 3 males and 2 females with mean age of 27.3 years were evaluated. All the subjects were medically healthy and were considered ideal according to the inclusion criteria. All the subjects were followed until the end of the treatment and no associated complication, hypersensitivity or allergy was noted.

According to the periodontal status, all sites were classified as Class I. In the follow-up phase, patients were recalled after 3 and 6 weeks from the first injection where clinical re-measurement of the black triangles and standardised digital clinical photographs were retaken.

In the first follow up (1 weeks) following the treatment, 1-15% improvement in the papilla reconstruction was observed. In the second follow up (3 weeks), 83% improvement and at the third follow up (6 weeks after the injection), 22-100% improvement was noted. In the second follow up, approximately 2 subjects showed 50% improvement; 3 subjects demonstrated improvement in interdental papilla reconstruction by over 100%. In a 6

Table 3: Number of gel applications, total months followed and percentage change for deficit interdental papillae in 4 patients included in the pilot study.

Identification	No. of Applications	No. of Sites	Total months followed	Percentage Change
Patient 1	3	1	6 weeks	34
Patient 2	3	1	6 weeks	100
Patient 3	3	1	6 weeks	100
Patient 4	3	1	6 weeks	57
Patient 5	3	1	6 weeks	100

Discussion

Use of 0.2% hyaluronic acid gel gave significant improvement for reconstruction of lost interdental papilla. Additionally, the technique illustrated is noninvasive and patient friendly with reduced surgical procedures for regeneration. The main advantage of this study is that it is nontoxic to the patient and there is reduced discomfort after the procedure as compared to other surgical procedures proposed. Furthermore, this study can be elaborated by more number of patients depending upon the size and type of the black triangle. Several studies

weeks follow-up period. 3 sites had complete papilla reconstruction and 2 sites had 34-57% of reconstruction rate.

The effect of underlying factors such as gingival recession, periodontal status, bone crest-contact point distance, tight or loose contact and age was also evaluated and statistical analyses revealed that interdental papilla reconstruction did not have significant correlation with the above mentioned factors except for age. Application of hyaluronic acid for reconstruction of gingival black triangle was successful in a 6 weeks follow up period. 5 sites had complete papilla reconstruction with 70% of reconstruction rate.

have been proposed regarding the effects of hyaluronic acid on periodontium. Becker et al. concluded that hyaluronic acid gel is a synthetic material and can be used with no drug interference and is a safe material, which significantly decreases the interdental black triangle in the esthetic zone. The Food and Drug Association have also approved it. (12)

Vedamurthy reported hyaluronic acid to be dermal filler and applied it for soft tissue augmentation, observing significant improvements. (13) Monheit et al. discussed the inherent properties of hyaluronic acid that make them

ideal for cosmetic surgeries.(14) Prato et al studied gingival augmentation with an autologous cell hyaluronic acid and reported significant results with the complete coverage. (15)

Pendyala et al. found that antioxidant capacity of hyaluronic acid is inversely proportional to the severity of inflammation and can be used as a biomarker in periodontitis. It is acceptable that injecting hyaluronic acid to periodontal wound sites had shown significant effects in periodontal tissue regeneration. Engström et al. reported bone regenerative effects of hyaluronic acid in nonsurgical and surgical groups and showed no statistical difference when evaluated on radiographs in the nonsurgical group; however, there was remarkable decrease in the height of alveolar bone after oral prophylaxis in both the nonsurgical and surgical group. There was also decrease in pocket probing depth after surgical treatment and also with scaling and root planing. Hyaluronic acid when involved with soft and hard tissues showed negligible effect on the immune system of the patient.(16) Ballini et al. stated enhanced accelerating capacity of new bone formation in the intra-bony defects when combined with autologous bone graft.(17)

Conclusion

This study indicates possible clinical improvement in reconstruction of lost interdental papilla and thus removal of gingival black triangle by injecting hyaluronic acid into the deficit papilla using a nonsurgical approach. This approach reduces the surgical procedures of elaborative regenerative techniques and hence it is non-invasive and it also reduces the patient discomfort. This study demonstrates hyaluronic acid gel to be a nonsurgical noninvasive approach for regenerating lost papilla and also gave significant and satisfactory clinical improvement. To overcome the limitations of this study, the study can be extended to wider number of patients

depending on the lost interdental papilla volume and size of gingival black triangle.

References

1. Csiszar A, Wiebe C, Larjava H, Hakkinen L. Distinctive molecular composition of human gingival interdental papilla. *J Periodontol.* 2007;78:304–314.
2. Black triangle dilemma and its management in esthetic dentistry.
3. Prato GP, Rotundo R, Cortellini P, Tinti C, Azzi R. Interdental papilla management: A review and classification of the therapeutic approaches. *Int J Periodontics Restorative Dent.* 2004;24:246–55.
4. Singh VP, Uppoor AS, Nayak DG, Shah D. Black triangle dilemma and its management in esthetic dentistry. *Dent Res J.* 2013;10:296–301.
5. 6. Al-Zarea BK, Sghaireen MG, Alomari WM, Bheran H, Taher I. Black Triangles Causes and Management: A Review of Literature. *British Journal of Applied Science & Technology.* 2015;6:1–7.
6. Georgieva I, Peev S, Gerova T, Mitteva M, Bazitova-Zlazitova-Zlateva M. Interdental papillae height assessment in the aesthetic zone of the maxilla. *Scripta Scientifica Medicinae Dentalis.* 2017;3:11–16. <https://doi.org/10.14748/ssmd.v3i1.2179>.
7. 8. Alahmari F. Reconstruction of Lost Interdental Papilla: A Review of Nonsurgical Approaches. *J Dent Medical Sciences.* 2018;17:59–65.
8. Lee W, Kim H, Yu S, Kim B. Six Month Clinical Evaluation of Interdental Papilla Reconstruction with Injectable Hyaluronic Acid Gel Using an Image Analysis System. *Journal of Esthetic and Restorative Dentistry.* 2016; 28: 221–230.
9. Mansouri Y, Goldenberg G. Update on hyaluronic acid fillers for facial rejuvenation. *Cutis.* 2015;96:85–88

10. Hyaluronic Acid: Molecular Mechanisms and Therapeutic Trajectory.
11. Assessment of Hyaluronic Acid Gel Injection in the Reconstruction of Interdental Papilla: A Randomized Clinical Trial.
12. Becker W, Gabitov I, Stepanov M, Kojs J, Smidt A, Becker B. Minimally Invasive Treatment for Papillae Deficiencies in the Esthetic Zone: A Pilot Study. *Clin Implant Dent Relat Res.* 2010;12:1-8
13. Vedamurthy M. Soft tissue augmentation: Use of hyaluronic acid as dermal filler. *Indian J Dermatol Venereol Leprol.* 2004;70:383–7.
14. Monheit GD, Coleman KM. Hyaluronic acid fillers. *Dermatol Ther.* 2006;19:141–50.
15. Prato GP, Rotundo R, Magnani C, Soranzo C, Muzzi L, Cairo F. An Autologous Cell Hyaluronic Acid Graft Technique for Gingival Augmentation: A Case Series. *J Periodontol.* 2003;74:262–7.
16. Engström PE, Shi XQ, Tronje G, Larsson A, Welander U, Frithiof L, et al. The effect of hyaluronan on bone and soft tissue and immune response in wound healing. *J Periodontol.* 2001;72:1192–200.
17. Ballini A, Cantore S, Capodiferro S, Grassi FR. Esterified hyaluronic acid and autologous bone in the surgical correction of the infra-bone defects. *Int J Med Sci.* 2009;6:65–71.