

Minimally invasive treatment for reconstruction of deficit interdental papillae: a pilot study

Pinal Patel¹, Komal Thakkar², Archita Kikani³, Vacha Patel⁴, Ravi Kiran N⁵, Sameer Ahmed⁶

¹PG Student, ⁵Professor, ⁶Reader, Dept. of Periodontics, Darshan Dental College & Hospital, Udaipur, Rajasthan, India ²PG Student, ³Professor, Dept. of Periodontics & Oral Implantology, Ahmedabad Dental College & Hospital, Ahmedabad, Gujarat, India ⁴PG Student, Dept. of Endodontics, Dharamsinh Desai Dental College & Hospital, Nadiad, Gujarat, India.

***Corresponding Author:**

Email: drprinal1488@gmail.com

Abstract

Background and Aim: Black triangles, the open interdental embrasures appear very unaesthetic and may give rise to various concerns chiefly, food impaction, difficulty in phonetics and gradually periodontitis. 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 (non-animal based) for reconstruction of gingival black triangles in anterior esthetic zone.

Materials and Methods: Four systemically healthy adult individuals with at least one anterior site with 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 month, 3 month and 6 month 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.

Results: Each site was individually evaluated. Application of hyaluronic acid for reconstruction of gingival black triangle was successful in a 6-month follow-up period. 5 sites had complete papilla reconstruction and 3 sites had 34-57% of reconstruction rate.

Conclusion: Results from this pilot study are 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, Hyaluronic acid gel, Esthetic zone, Regeneration

Introduction

Gingival black triangles are considered to be esthetically unappealing especially when present in anterior esthetic region in cases with high lip line and have a multifactorial etiology and a variable range of treatment options. There is an increasing demand for perfect esthetics from patients these days. Reconstruction of lost interdental papilla in the anterior esthetic zone is a challenging situation for a clinician. Open gingival embrasures may occur following periodontal treatment and after tooth replacement by an implant/prosthesis due to loss of interproximal papilla volume. In addition gingival black triangles may cause functional and phonetic discomfort to the patient. Several techniques have been proposed for reconstruction of this lost interdental papilla. However, these techniques are invasive and have unpredictable results.^(1,2,3)

A non-invasive technique using hyaluronic acid gel for this purpose has been recently proposed and being administered for management of black triangles. Hyaluronic acid is an extracellular matrix component and a majority of the cells of the system are able to produce it during several phases of the cell cycle. The most important function of hyaluronic acid is its role in tissue repair and healing, tissue resilience and volume.

Hyaluronic acid is also involved in a series of inflammatory reactions including activation and neutralization. It also stimulates cell proliferation, migration and angiogenesis, re-epithelization and proliferation of basal keratinocytes and reduces collagen scar formation. Due to these efficient characteristics of hyaluronic acid, it can be used as an effective medication for treatment of gingivitis, enhancement of tooth extraction socket healing and treatment of recurrent aphthous ulcers.^(2,4,5)

The potential of a hyaluronic acid gel injection to augment the volume of interdental papilla and reduce the black triangle has not been evaluated in a controlled clinical study.^(6,7) The present study evaluates the clinical application of injectable hyaluronic acid gel (non-animal based) for reconstruction of gingival black triangles in anterior esthetic zone.

Materials and Method

In this experimental prospective study, four systemically healthy adult individuals with at least one anterior site with class I or class II interdental papilla loss were recruited. These patients had esthetics as their chief concern. A written informed consent was taken from the patient before enrolling the patient in the

study. The patient was well informed about the procedure and consequent follow-up visits.⁽¹²⁾

The ethical clearance was obtained from the institute for the clinical trial.

Norland and Tarnow⁽⁸⁾ proposed the classification using three reference points, i.e., contact point, facial and apical extent of cemento-enamel junction (CEJ), and interproximal extent of CEJ (iCEJ), and was classified into the following four classes:

- Normal: Interdental papilla occupies embrasure space to the apical part of the interdental contact point.
- Class I: Tip of interdental papilla occupies space between the interdental contact point and the most coronal part of CEJ.
- Class II: Tip of interdental papilla lies at/or the apical to the iCEJ but coronal to the apical most part of the CEJ on facial aspect.
- Class III: Tip of interdental papilla lies at level with or apical to the facial CEJ.

The loss of interdental papilla can be due to multiple reasons including gingivitis, oral hygiene procedures with trauma, tooth shape with abnormal anatomy, improper contour of restoration, following periodontal surgeries and following tooth loss.

Inclusion criteria in the study were:

- Age range: 20-65 years
- Maxillary anterior teeth
- Plaque index less than 20%
- Teeth without caries and prosthesis
- Patients who were non-smokers

- Patient with no systemic diseases effecting the periodontium
- Patient not consuming of drugs that cause gingival overgrowth.⁽⁷⁾

Patients were completely informed about the study.

Following administration of 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 patient was instructed not to brush following 48 hours post-treatment. After 48 hours of study, tooth brushing was advised in anterior esthetic zone on the surgical site using soft bristle toothbrush and start their routine oral hygiene measures except on the treatment site. The injection was repeated after 20 days. The patients were monitored for the results in the subsequent follow-ups. Measurement of black triangle reconstruction was done using clinical photographs. Photographs were taken at end of three months and the clinical photographs were compared.

Lost papilla surface area was calculated using clinical photographs taken at baseline, 1 month, 3 month and 6 month 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.



Fig. A: Pre-Operative intraoral clinical photograph showing gingival recession in maxillary central incisors, B: Application of hyaluronic acid gel injection in the deficit interdental papilla, C: 1-month post-operative follow-up on the deficit interdental papilla which shows improvement, D: 3-months post-operative follow-up on the deficit interdental papilla which shows improvement, E: 6-months post-operative follow-up on the deficit interdental papilla which shows improvement

Results

Each site was individually evaluated. A total of 8 interdental papillae in 4 patients including 2 males and 3 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 first follow up (1 month) following the treatment, 1-15% improvement in the papilla reconstruction was observed. In the second follow up (three months later) 12-83% improvement and at the third follow up (6 months after the injection), 22-100% improvement was noted. In the second follow up, approximately 2 subjects showed 50% improvement; while in the third follow up (at 6 months), about 2 subjects demonstrated improvement in interdental papilla reconstruction by over 50%. 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-month follow-up period. 5 sites had complete papilla reconstruction and 3 sites had 34-57% of reconstruction rate.

Table 1: 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	2	2	7	77
Patient 2	2	3	8	82
Patient 3	3	2	6	62
Patient 4	2	1	9	97

Discussion

Use of 0.2% hyaluronic acid gel gave significant improvement for reconstruction of lost interdental papilla. Additionally the technique illustrated is non-invasive 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 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.⁽¹⁾

Vedamurthy reported hyaluronic acid to be dermal filler and applied it for soft tissue augmentation, observing significant improvements.⁽¹⁰⁾ Monheit et al. discussed the inherent properties of hyaluronic acid that make them ideal for cosmetic surgeries.⁽¹¹⁾ Prato et al. studied gingival augmentation with an autologous cell hyaluronic acid and reported significant results with the complete coverage.⁽¹²⁾ 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.⁽¹³⁾ Ballini et al. stated enhanced accelerating capacity of new bone formation in the intra-bony defects when combined with autologous bone graft.⁽¹⁴⁾

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 non-surgical 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. Becker W, Gabitov I, Stepanov M, Kois 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.
2. Sadat M, Ghasemi M, Salami Z, Shams N. Clinical Application of Hyaluronic Acid Gel for Reconstruction of Interdental Papilla at the Esthetic zone. J Islamic Dent Assoc Iran. 2013;25(3):208-13.
3. Awartani FA and Tatakis DN. Interdental papilla loss: treatment by hyaluronic acid gel injection: a case series. Clin Oral Invest. 2016;20(7):1775-80.

4. Yoichi Y, Sayaka N, Minoru U, Kenji I. Papilla regeneration by injectable stem cell therapy with regenerative medicine: long-term clinical prognosis. *J Tis Eng and Reg Med.* 2015;9(3):305-309.
5. Ziahosseini P, Hussain F, Millar BJ. Management of gingival black triangles. *Br Dent J.* 2014;217:559-563.
6. Won-Pyo L, Hee-Jung K, Sang- Joun Y. Six Month Clinical Evaluation of Interdental Papilla Reconstruction with Injectable Hyaluronic Acid Gel Using an Image Analysis System. *J Est Rest Dent.* 2016;28(4):221-230.
7. Tanwar J, Hugund SA. Hyaluronic Acid: Hope of lights of black triangles. *J Int Soc Pre Com Dent.* 2016;6(5):497-500.
8. Nordland WP, Tarnow DP. A classification system for loss of papillary height. *J Periodontol.* 1998;69:1124-6.
9. Dahiya P1, Kamal R. Hyaluronic Acid: A Boon in Periodontal Therapy. *N Am J Med Sci.* 2013;5:309-15.
10. Vedamurthy M. Soft tissue augmentation: Use of hyaluronic acid as dermal filler. *Indian J Dermatol Venereol Leprol.* 2004;70:383-7.
11. Monheit GD, Coleman KM. Hyaluronic acid fillers. *Dermatol Ther.* 2006;19:141-50.
12. 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.
13. 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.
14. 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.