

Review Article

Black Triangle- Causes & it's Management

Saikat Chatterjee¹, Soumyadeep Mondol², Priti Desai³, Sayantan Mukherjee⁴, Paromita Mazumdar⁵

^{1,2} Post Graduate Trainee, ³Professor, ⁴Reader, ⁵Professor and HOD, Department of Conservative Dentistry & Endodontics, Guru Nanak Institute of Dental sciences & Research, Panihati, Kolkata-114, West Bengal, India.

ABSTRACT:

In recent years, in clinical practice, patient's demand is increasing for aesthetics. The ultimate goal in modern restorative dentistry is to achieve "white" and "pink" esthetics in esthetically important zones. "White esthetics" means proper natural appearance of dentition or the restoration of dental hard tissues, and "Pink esthetics" refers to aesthetic appearance of soft-tissues surrounding the tooth, which includes the interdental papilla and gingiva that can enhance or diminish the esthetic." Black triangles" means any interproximal soft tissue loss due to periodontal disease, traumatic, mechanical or chemical preparation or crown lengthening procedures"(G.PT-8). Black triangle creates complex aesthetic and functional problems that will negatively affects the smile and functions. Restoration of these tissues with adequate orthodontic, prosthetic, surgical or restorative techniques are a real challenge in esthetic dentistry. Esthetic problems like marginal tissue recession, deficient bone ridges, bone ridge collapse, and esthetic defects around the teeth are associated with the interdental papilla which eventually leads to the formation of Black triangle formation, It has to be corrected in today's scenario which has been discussed in this review article.

Key words: Aesthetics, black triangle, interdental papilla.

Received: 14 December 2018

Revised: 27 December 2018

Accepted: 28 December 2018

Corresponding author: Dr. Saikat Chatterjee, Post Graduate Trainee, Department of Conservative Dentistry & Endodontics, Guru Nanak Institute of Dental sciences & Research, Panihati, Kolkata-114, West Bengal, India.

This article may be cited as: Chatterjee S, Mondol S, Desai P, Mukherjee S, Mazumdar P. Black Triangle- Causes & it's Management. Int J Res Health Allied Sci 2019; 5(1):35-40.

INTRODUCTION

The word aesthetic comes from the Greek word 'aisthētikos'. At the time, it was defined as 'relating to perception by the senses'. This early form of the word was a combination of the Greek words 'aisthēta' meaning 'perceptible things', and 'aisthēthai' meaning 'perceive'.

In our modern competitive society, a pleasing appearance often means the difference between success and failure in both our personal and professional lives. There is globalization and modernization in the growing population in the world. Men and women are very conscious about their appearance. The current generation gives utmost importance to their esthetics in every aspect to improve their personality. Due to the various advancement in dentistry, people are eager to know about how these advanced dentistry would help in enhancing their smiles. Esthetic or cosmetic dentistry strives to combine the beauty and the functional aspects with the individual values and needs of each and every patient. Esthetics is not only

concerned with smile correction, but also the change in facial profile and jaw correction.^[1]

In total esthetics play an important role in one's life in improving their self-confidence. Esthetic dentistry is a blessing to mankind; where a beast can be transformed into a beauty. Everybody wants to get recognized by others, and dental esthetics is making it possible.^[2]

There are many causes for unaesthetic appearance:

1. Gummy smile
2. Gingival recession
3. Abnormal size and shape of anterior tooth
4. Discoloration of anterior tooth.
5. Excessive overjet and over bite
6. Anterior tooth fracture
7. Increased interdental space in anterior teeth etc

Definition-

1. Black triangle can be defined as "Any interproximal soft tissue loss due to periodontal disease, traumatic,

mechanical or chemical preparation or crown lengthening procedures"- G.P.T-8.

2.Open gingival embrasures “black triangles” are defined as the embrasures cervical to the interproximal contact that is not filled by gingival tissues.^[3]

THE COMMON CAUSES OF THE LOSS OF INTERDENTAL GINGIVA ARE LISTED BELOW.

- I. Loss of attachment due to periodontal disease.
- II. Age of the Patient.
- III. Gingiva biotype.
- IV. Post orthodontic treatment.
- V. Abnormal tooth morphology and shape.
- VI. Abnormal tooth contact position.
- VII. Post traumatic tooth extraction .

PREVALENCE

One third of adults have unaesthetic black triangles [4]. Other studies found that black triangles were found in 67% of the population over 20 years of age compared with 18% in the population under 20 years of age [5]. A recent study of patient attitudes found patient dissatisfaction with black triangles to rank quite high among aesthetic defects, ranking third following carious lesions and dark crown margins [6].

There are many problem associated with black triangle like

- I. It causes unesthetic profile of a person.
- II. Increased interdental space may lead to food accumulation.

CLASSIFICATIONS:

Nordland and Tarnow classified the loss of papilla height into 4 classes based on three anatomical landmarks: interdental contact point, facial apical extent of CEJ and the interproximal coronal extent of the CEJ (**fig. 1**). They are:

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

Class I : The tip of the interdental papilla is located between the contact point and the most coronal extent of the interproximal cemento-enamel junction (CEJ).

Class II: The crest of the papilla is at or apical to the interproximal CEJ but coronal to the facial CEJ.

Class III: Crest of the papilla is at or apical to the facial CEJ.

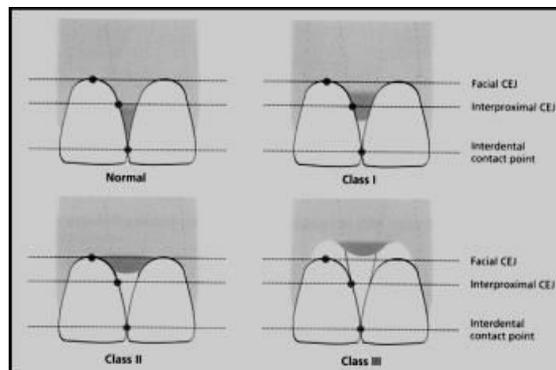


Figure 1

Various classifications have been proposed to describe gingival recession which include

Classifications by Sullivan and Atkins(1968) , Mlineck (1978), Liu and Salt (1980) , Bengue et al (1983) , Preston D Miller Jr (1985) , Mahajan's Modification - A Original Hypothesis (2010) , and the most followed classification being Mliller's classification.

Miller classified gingival recession into the following classes (Fig 2A,B,C,D)

Class I: This includes marginal tissue recession that does not extend to the mucogingival junction. There is no loss of bone or soft tissue in the interdental area.

Class II: Class II consists of marginal tissue recession that extends to or beyond the mucogingival junction. There is no loss of bone or soft tissue in the interdental area.

Class III: In Class III, there is marginal tissue recession that extends to or beyond the mucogingival junction; in addition, there is bone and/or soft tissue loss interdentally or there is malpositioning of the tooth.

Class IV: There is marginal tissue recession that extends to or beyond the mucogingival junction with severe bone and soft tissue loss interdentally and/or severe tooth malposition.

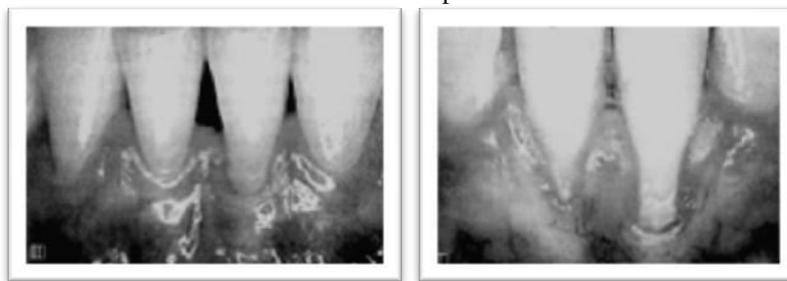


Fig 2A Fig 2B



Fig 2C

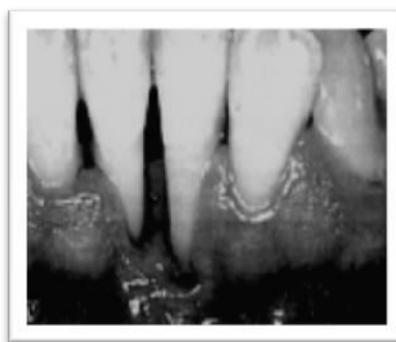


Fig 2D

Ajay Mahajan pointed out some drawbacks associated with the Miller's classification and suggested some changes to the Miller's classification in the year 2010.

Class I: Gingival recession defect not extending to the MGJ.

Class II: Gingival recession defect extending to the mucogingival junction/beyond it.

Class III: Gingival recession defect with bone or soft-tissue loss in the interdental area up to cervical 1/3 of the root surface and/or malpositioning of the teeth.

Class IV: Gingival recession defect with severe bone or soft tissue loss in the interdental area greater than cervical 1/3rd of the root surface and / or severe malpositioning of the teeth.

MANAGEMENT OF BLACK TRIANGLES

Interdental papilla (IDP) occupies the space created between two adjacent teeth, which acts as a biological barrier which protects the underlying periodontal structures, apart from playing an important role in esthetics. BLACK TRIANGLE refers to the loss of the interdental papilla, due to periodontal disease, traumatic, mechanical or chemical preparation or crown lengthening procedures. Thus, leading to the formation of open gingival embrasures which often pose complex functional and esthetic problems. It is said that 'Soft tissue always follows the hard tissue', which is undoubtedly evident in active periodontal disease where bone loss leads to loss of the interdental papilla. So while discussing the management of Black Triangles, the main goal is to restore the lost interproximal soft tissue, but if the loss of interdental papillae is accompanied with bone loss then complete restoration is not achieved. However, if the damage is mainly due to soft tissue alone, reconstructive techniques may be useful in restoring the papilla h

The approaches can be basically broadly classified into, 1.) Non Surgical Approach ; 2.) Surgical Approach, which can be further subdivided into,

Non-surgical approach:

- Orthodontic approach
- Periodontal approach
- Restorative approach

- Prosthetic approach

While, Surgical approaches include:

- Papilla recontouring.
- Papilla preservation.
- Papilla reconstruction.

A.) Non-Surgical Approach:-

I.)Orthodontic Approach

Orthodontic movement has several applications in reducing the Black Triangles. The main aim is to reduce the diastema and create a contact point between the adjacent teeth, without periodontal attempts to build up the missing papilla. So for this orthodontic closure of the interdental space is attained with a bodily movement of the two adjacent teeth. Here, treatment should be designed to create a parallelism of the roots and a favorable position of the proximal contact point of the crowns. In cases where incisors are malposed or overlapping they should be up-righted and moved mesially to correct the inclination of the roots. The mesial cementum enamel junctions of each incisor will then be closer to each other thereby causing the stretched transeptal fibers to relax. Orthodontic movement has several applications in reducing the Black Triangles. Closing the interdental contacts by conventional orthodontic movement with or without inter-dental stripping (or proximal stripping) reduces the BC-CP distance. However the length of treatment, the need for appliances and cost are limiting factors. Salama et al suggested that paralleling closed roots with orthodontic movements may be beneficial in supporting the inter-dental papillae. Burke et al, recommend bringing the roots closer by mesial torquing movement to rectify the presence of black triangles. In conjunction with orthodontic treatment, proximal enamel can be recontoured to change the contact area to a broader surface along with relocating the contact more apically. Extrusive and intrusive tooth movement can maintain the alveolar bone level and reduce the black triangles. Cardaropoli et al presented a study evaluating a combined approach of orthodontic-periodontal treatment to reconstruct the inter-dental papillae between upper central incisors, demonstrating that the soft tissues adapted to the

new emergence profiles during intrusion of the teeth as the inter-proximal spaces were reduced.

II.) Periodontal Approach

Usually, plaque accumulation and gingivitis are probably higher in people with crowding, but host susceptibility and other factors may also play a contributory role in the occurrence of open gingival embrasures i.e, black triangles, especially in patients who have been previously treated for periodontal disease. Such patients does need to increase their efforts to enhance periodontal maintenance and oral hygiene to avoid further bone loss and recession. Thus, this does becomes an eminent treatment approach. Apart from this, diffuse erythema and denudation of attached gingiva throughout the mouth may be a striking sequelae of overzealous brushing. Improper use of dental floss may damage the interdental papilla. Thus traumatic interproximal hygiene procedures must be initially discontinued and successively modified.

Re-epithelialization of the traumatic lesion can restore the papilla completely. The following approaches were followed for this purpose.

i) Repeated curettage every 15 days for 3 months to recreate papillae destroyed by necrotizing gingivitis, induce a proliferative hyperplastic inflammatory reaction of the papilla. About 9 months after initial treatment, regeneration of interdental papillae is seen. It is seen that some papillae shows complete regeneration, while others did not respond to the periodic curettage.

ii) Using an injectable, non-animal-based, hyaluronic acid gel. Hyaluronic acid gel preparations, long used as dermal fillers, have been recently used to treat interdental/interimplant papilla loss. Hyaluronic acid is a polysaccharide (glycosaminoglycan) and has a high molecular weight (≥ 105 Da) polymer consisting of disaccharide repeats of N-acetylglucosamine and glucuronic acid, with several thousand sugar molecules in the backbone. For treatment purposes, patients are given local anesthesia and then approximately 0.2 ml hyaluronic acid clear gel is to be injected directly into the middle of the papilla, 2–3 mm apical to the tip of the papilla, using a 23-gauge needle. Injection is followed by gentle massage of the area for 1 min. After this initial treatment, the hyaluronic acid injection is to be repeated at 21 days and then at 42 days. After each treatment session, patients are to be given postoperative instructions that includes (a) a 24-h abstinence from mechanical plaque control in the area, (b) the use of soft toothbrush after the first 24 h, and (c) resumption of routine mechanical oral hygiene after 2 weeks.

III.) Restorative Approach

Sometimes, abnormal tooth shape may contribute to a “missing” papilla, which does leads on to formation of black triangles, thus to counter this an appropriate restorative technique is indicated to favor the creeping of

the interdental tissues. By a restorative reshaping of the contours of the teeth, the contact point may be lengthened and located more apically; the embrasure is reduced, thus allowing coronal displacement of the interdental gingiva. The methods implied in this approach are as follows:-

i) Use of porcelain laminate veneers:- Porcelain laminate veneers can be extended into the gingival sulcus, to restore and compensate for a compromised tooth structure resulting into formation of black triangles. However, care must be taken not to impinge on the interdental tissue or violate the biological width.

ii) Use of Composite Resin:- Clark presented a feature case of management of black triangle that includes restorative treatment followed by papilla regeneration. He used flowable composite resin rather than conventional composite paste for the first increment since paste composite would be nearly impossible to place in such “claustrophobic” area without voids and without disturbing the anatomically shaped matrices. In an attempt to reduce the interproximal space and improve esthetics and phonetics.

IV.) Prosthodontic Approach

When the patient cannot undergo repeated surgical procedures, a prosthodontic approach is adopted. The distance between the contact point and the crest of bone determines the existence of the interdental papilla. If there is an inter dental defect with > 5 mm gap between contact point and alveolar crest a removable mask or prosthesis that aesthetically and functionally camouflages lost gingival tissues can be indicated. If a prosthodontic approach is adopted to recontour the morphology or relocate the contact point apically, then interproximal spaces can be closed. Thus, clinically we can make use of a provisional prosthesis to induce the interdental papilla to undergo creeping papilla formation. A removable gingival mask can be considered for this. The gingival mask usually adapts to a wide range of teeth cervical area shapes. Clinicians can create convenient interproximal shapes if the coverages are smooth and without sharp marginal ledge. To accomplish this approach, various materials that can be used are: i) Auto and heat polymerizing acrylic resins- a. Rigid, b. flexible ; ii) Copolyamide ; iii) Soft silicone materials. Advantages of using flexible materials over rigid materials are that they are more comfortable, easy to be made distal to canines, more retentive and less chances of breakage. On the other hand, advantages of rigid materials are that they are more resistant to staining, economical and more resistant to discoloration.

The prosthodontic approach though is Economical, Non-invasive and while slight splinting action on the teeth can be provided, it can be easily maintained, it can't be used on patients with poor or unstable periodontal health, and maintains poor oral hygiene. It is also contraindicated on patients with high caries activity. It is to be remembered

that prosthetic solutions should be used only when other alternatives have been exhausted.

B.)Surgical Approach

Many surgical methods are used in the reconstruction of the interdental papilla. However, they fail to achieve long-term stability and predictability mainly because of the minor blood supply in the interdental papilla. Surgical approaches included following three treatment modalities.

1. Papilla re-contouring.
2. Papilla preservation.
3. Papilla reconstruction

Papilla re-contouring

In the presence of gingival enlargement, the excess tissue should be eliminated to remodel the soft tissue architecture. In cases of drug-induced and idiopathic gingival enlargement, a gingivectomy may be performed. Gingivectomy associated with a free gingival graft may be indicated in case of localized gingival lesions, such as peripheral giant cell granuloma.

Papilla preservation

Specific surgical approaches have been reported to prevent or reduce an excessive apical displacement of the gingival margin in the treatment of periodontal defects. Restricting flap elevation can minimize the amount of bone resorption, thus, helping in preservation of interdental papilla. Various soft-tissue surgical procedures have been introduced in an attempt to recreate and preserve the interdental papilla.

1. Papilla preservation flap: In this technique, the facial surface is prepared with sulcular incision around each tooth with no incision being made through the interdental papilla. The lingual or palatal flap design consists of a sulcular incision along the lingual or palatal aspect of each tooth with a semilunar incision made across the each interdental papilla. This can be elevated intact with the facial flap. In posterior areas with a narrow interdental space, trim-off the tip of the papilla in order to preserve the intact papilla through the embrasure space.

2. Modified papilla preservation flap: This technique was a variation of the papilla preservation technique. This was modified to achieve and maintain primary closure of the flap in the interdental space over the GTR membrane. A buccal and interproximal intrasulcular primary incision to the alveolar crest, involving the two teeth neighboring the defect, was performed. A horizontal incision with a slight internal bevel was given in the buccal gingiva at the base of the papilla, just coronal to the bone crest, and the papilla was elevated towards the palatal aspect.

3. Simplified papilla preservation flap: Technique is indicated in narrow interdental space (less than 2 mm) in anterior and posterior region. This approach includes a first

oblique incision across the associated papilla, starting from the gingival margin at the buccal-line angle of the involved tooth to reach the mid-interproximal portion of the papilla under the contact point of the adjacent tooth. This oblique interdental incision is continued intrasulcularly in the buccal aspect of the teeth neighboring the defect. Thus, flap pedicles have been shown to have better results than free gingival grafts.

4. Cortellini and Tonetti:[27] Further improved the results by using microsurgical approach. Surgeries were performed with the aid of an operating microscope at a magnification of $\times 4-16$. Microsurgical instruments and blades were utilized for the procedure. The advantage includes improved illumination, access and magnification of the surgical field.

Papilla reconstruction:

After elimination of the inflammation, specific techniques have been proposed to reconstruct the interdental tissues.

1. Pedicle flap: Technique basically combined the roll technique and papilla preservation technique. In correspondence to the lost interproximal papilla, a palatal split-thickness flap is dissected and labially elevated. The flap is folded on itself and sutured to create the new papilla between the two incisors.
2. Semilunar coronally repositioned flap: This approach is based on a flap design reported previously by Tarnow. In their modification for papilla reconstruction, they recommended placing the semilunar incision in the interdental region. Intrasulcular incisions are also made around the mesial and distal half of the two adjacent teeth to free the connective tissue from the root surfaces to allow the coronal displacement of gingivo-papillary unit. To maintain position, the measured amount of the sub epithelial connective tissue obtained from the palate is stuffed further into the semilunar incision and in to the pouch like space coronal to the incision.
3. Envelop type flap: An intrasulcular and buccal incision is made across the interdental papilla to be reconstructed, at the level of CEJ. An envelope type split thickness flap is elevated buccally and palatally. The buccal portion of flap is dissected well beyond the mucogingival line, leaving the periostium and a thin layer of connective tissue on the bone. The palatal portion of flap, is also split thickness, includes the interdental papilla. A connective tissue graft of adequate size and shape was placed under the flaps in recipient site.
4. Autogenous osseous and connective tissue grafts: This technique involves an intrasulcular incision is made around the neck of the lateral and central

incisors on the buccal and palatal aspects, retaining as much gingiva as possible. A horizontal incision starting at the mucogingival junction, extending in to the alveolar mucosa and apically up to the labial vestibular fold, is performed to elevate a split-thickness flap. The entire gingivo-papillary unit is displaced coronally. Reshape the osseous graft obtained from the maxillary tuberosity to form a saddle that will fit over the interdental crest and stabilized with a titanium screw. Crushed cancellous bone is packed around the grafted bone in the shape of the reconstructed interdental bone. A large connective tissue graft harvested from the palate is placed on top of the bone graft to cover the entire augmented area.

CONCLUSION

Open gingival embrasures resulting into black triangles often pose complex functional and esthetic problems. Management of open embrasures requires careful evaluation of the underlying causes. A multidisciplinary approach is critical. A multidisciplinary approach must be considered mandatory if a successful clinical outcome is to be achieved. All the etiological factors and treatment alternative must be discussed with the patient before starting the treatment.

REFERENCES

1. Akarslan ZZ, Sadik B, Erten H, Karabulut E .Dental esthetic satisfaction, received and desired dental treatments for improvement of esthetics. *Indian J Dent Res* 2009 ; 20(2):195-200.
2. Spear FM, Kokich VG, Mathews DP .Interdisciplinary management of anterior dental esthetics. *J Am Dent Assoc* 2006; 137(2):160-9.
3. Ko-Kimura N, Kimura-Hayashi M, Yamaguchi M, et al. Some factors associated with open gingival embrasures following orthodontic treatment. *Aust Orthod J* 2003;19(1):19-24.
4. Kokich VO Jr, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 1999;11(6):311-324.
5. Ahmad I. Anterior dental aesthetics: Gingival perspective. *Br Dent J* 2005;199(4):195-202. 8
6. Dr. Manvi Agarwal, Dr. Mudit Mittal, Dr. Shalabh Mehrotra, Dr. Ashish Agarwal. Black triangle and its reconstruction: A Review. *Journal of Dental Sciences & Oral Rehabilitation*2011:55-56
7. B. K. Al-Zarea, M. G. Sghaireen, W. M. Alomari, H. Bheran, I. Taher.Black Triangles Causes and Management: A Reviewof Literature2015;6(1): 1-7
8. Santhanakrishnan Muthukumar, Suresh Rangarao.Surgical augmentation of interdental papilla - A case series.*Contemp Clin Dent*2015;6:S294-8.
9. Fatin A. Awartani, Dimitris N. Tatakis. Interdental papilla loss: treatment by hyaluronic acid gelinjection: a case series.*Clin Oral Invest* 2016;20:1775–1780
10. Y. Ravishankar, Kalluri Srinivas, Sumeet Kumar Sharma, Shameen Kumar P.Management of Black Triangles and GingivalRecession: A Prosthetic Approach.*Indian Journal of Dental Sciences* 2012; 1(4): 141-146
11. Vijendra P. Singh, Ashita S. Uppoor, Dilip G. Nayak, Dipen Shah.Black triangle dilemma and its management in esthetic dentistry. *Dental Research Journal* 2013; 10 (3): 296-301
12. P. Ziahosseini, F. Hussain, B. J. Millar.Management of gingivalblack triangles.*British Dental Journal* 2014; 217: 559-563
13. Iyer Satishkumar Krishnan, Mohit G. Kheur. “Esthetic considerations for the interdental papilla: Eliminatingblack triangles around restorations: A literature review. *The Journal of Indian Prosthodontic Society* 2006 ; 6 (4): 164-171