

Black Triangles and its Management-A Review

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ABSTRACT

In the modern, fast-paced world the concept of aesthetics is very important to all people. The degree of aesthetic value may vary from person to person but the basic idea of it is more or less equivalent in all people. Similarly, in dentistry, the value of aesthetics is very high. Open gingival embrasures or black triangle cause complex functional and aesthetic problems. Management of such problems requires careful evaluation of the underlying causes. In today's aesthetic environment where both the dentist and the patient are aware of aesthetic value, the real challenge was to reconstruct this lost papilla and moreover to obtain stable and sustainable results. This review was carried out after electronic searches in databases such as PubMed, PubMed Central, MEDLINE, Google Scholar, and MeSH. Manual searches of hard copies were also done. Studies included ranged from a time period of 1992–2016 and included clinical trial researches. A total of 19 articles were chosen for this review. These articles satisfied the various inclusion criteria and were taken after a detailed assessment of the full-length articles. Black triangles pose multiple problems both to the dentist and patients. The causes of Black triangles are multifactorial and they can occur after various dental therapies. A strong connection is found between their occurrence and post-orthodontic treatment patients. Various methods to treat these problems are present. The clinician and the patient should discuss these problems and solutions in depth before starting the treatment.

Key-words: Aesthetics, Black triangles, Open gingival embrasure, Periodontal treatment, Patient satisfaction

INTRODUCTION

The importance of aesthetics in modern dentistry is paramount. Aesthetics has its different values and perceptions, which may be different from the eyes of the patient and those of the clinician ^[1]. It is dependent on the socio-economic status and the upbringing and mentality of each individual person. In spite of this, there are certain universal standards of aesthetics that must be maintained while performing any dental procedure ^[2,3].

Various aesthetic factors have to be considered while performing dental treatment which include shade of teeth, contour of teeth, positioning of appliances, occlusal level, and absence of high points, gingival color and contour, contour of lips, outline of mouth and smile line ^[1,4-6].

One of the factors that hamper proper aesthetics is the presence of "Black Triangles" ^[2,7,8]. It is referred to as the gap seen at the cervical embrasure, below the contact point of some teeth, which are cervically located with respect to the interproximal contact point and not occupied with gingival tissue ^[9-11]. This gap has many causes including gingival recession and periodontal disease. Hence, these areas present some unique aesthetic and functional problems ^[12,13]. These problems include the fact that they are noticeably unaesthetic which negatively affects the smiling profile. They also

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lead to retention of food debris and also to the aggregation of dental plaque [14-17].

Prevalence– One third people were affected by black triangles [18]. Some studies reported that the preponderance of black triangles were [1,10,13,18].

- >67% of people above 20 years
- ≤ 18% of people under 20 years

A recent study conducted by Geld *et al.* [4] of patient attitudes found patient displeasure with black triangles to rank quite high among aesthetic flaws, ranking 3rd following cariogenic lesions and dark crown margins. Fig. 1 depicts the aesthetic concerns caused by black triangles.



Fig. 1: Black Triangles in incisors

Interdental Papilla - The interdental papilla is formed by a dense connective tissue covered by oral epithelium and it occupies the physiological space between the teeth. Interdentally, the gingiva that occupies the space coronal to the alveolar crest is known as interdental gingiva [2,19,20]. It presents as a pyramidal shape in the interdental area with the tip located immediately below the contact point, is narrower and called as dental papilla. It is broader in the posterior region. In the absence of a contact point or when interdental papilla migrates apically as a result of inflammation, the contouring disappears and interdental papilla takes on a pyramidal shape, which is dysfunctional and unaesthetic. Loss of interdental papilla leads to different problems, which include aesthetics, enunciation and food lodgement [7,21-23].

Etiological Factors- There are multiple causes as to the etiology of open gingival embrasures. These include aging, periodontal disease, loss of height of alveolar

bone relative to interproximal contact, length of embrasure area, root angulations, interproximal contacts and triangular-shaped crowns [6,23,24]. However, black triangles may also arise following periodontic and orthodontic therapy [7,9,25].

Its management varies depending on the etiological factor but is favourably managed by teamwork usually including restorative, orthodontic and periodontic treatment. Sometimes, the correction of these problems is not straightforward and may increase both the complexity and duration of treatment. [1,2,5,16]

Sometimes, the decision to close the embrasures or not is difficult especially when the open embrasures are small, as displayed in Fig. 2.



Fig. 2: Small embrasure openings affecting the smile line

Classification of loss of Interdental Papilla - Nordland and Tarnow put forward a classification using 3 reference points- Contact point, Facial apical extent of CEJ, and Interproximal CEJ (iCEJ) [24].

By these 3 cardinal points, they gave the following classification-

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

Class I: The tip of interdental papilla lies between the interdental contact point and the most coronal extent of CEJ.

Class II: The tip of the interdental papilla lies at/or the apical to the iCEJ but coronal to the apical extent of the facial CEJ.

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

Management of Black Triangles - The treatment of open gingival embrasures requires the reconstruction of interdental papilla. This is usually achieved by the following methods [20,26-28].

Non-surgical methods- Orthodontic treatment is used to close interdental spaces. The forced eruption can also be done.

Surgical methods- Free gingival grafts, flap pedicles and guided bone regeneration are different methods used. However, free gingival grafts have a low success rate due to the minor blood supply in the interdental papilla.

Prosthetic methods- Prosthetic or operative dentistry is used to change the morphology or relocate the contact point apically. As a result, interproximal spaces can be closed. This method is followed when periodontal defects are too extensive or region of missing teeth is too large. [29,30]

The treatment benefits are appropriately highlighted in Fig. 3, which shows a significant post-treatment enhancement of aesthetics.



Fig. 3: Correction of black triangles leading to marked improvement in smile design

A comprehensive literature search was carried out in the electronic databases available such as PubMed, PubMed Central, MEDLINE, Google Scholar, and MeSH. The keywords used in this search included “black triangles”, “open gingival embrasure”, “orthodontic role”, “orthodontic problems”, “periodontic role”, “periodontal problems”, “aesthetics”, “patient evaluation”. In addition to this, manual search of hard copies of journals was carried out. Studies were included from a time period ranging from 1992–2016. Various studies and clinical trial studies were included for this review.

A total of 19 studies were taken for the purposes of this review. These studies satisfied all the criteria and were chosen after a thorough check of the full-length articles.

Review of Literature- Kokich and Kurth [7] were conducted a study in 2001 to examined post-treatment open gingival embrasures in adult orthodontic patients and to examine the association of different etiological

factors that they considered important with open gingival embrasures. Post-treatment intraoral photographs of 337 adult orthodontic patients were examined to determine the prevalence of open gingival embrasures. Digital images of the pre-treatment maxillary models and post-treatment maxillary central incisor periapical radiographs were made to measure the pre-treatment and post-treatment variables. The prevalence of post-treatment open gingival embrasures in adult orthodontic patients was 38%. Pre-treatment maxillary central incisor rotation and overlap were found to not be statistically significant when related to post-treatment open gingival embrasures. A post-treatment alveolar bone-interproximal contact distance greater than 5.5 mm as well as short, incisively placed post-treatment interproximal contacts were found to be statistically significant and associated with occurrence of black triangles. Increased divergence of root angulations, more divergent or triangular-shaped crown forms and embrasure areas larger than 5.09 mm² and also correlated with open gingival embrasures. Furthermore,

black triangles found in this study were seen to have the greatest association with increased alveolar bone-interproximal contact distance and increased root angulation. This investigation indicated that black triangles are common in adults, who had undergone orthodontic treatment and that post-treatment results were expressive in their formation.

Kokich and Kurth ^[7] further examined whether the approximal contact point to the crest of bone distance affected the amount of the interproximal papilla. Through his study, the following data was received-

- 5 mm or less- Interdental papilla always present
- 6 mm- Papilla present 56% of the times
- 7 mm or more- Papilla usually missing

Kokich and Kurth ^[7] found that the mean prevalence of cervical diastemas in post-treatment adult orthodontic patients is about 38%. Tanaka *et al.* ^[8] found in 2008 that the prevalence of open gingival embrasures were greater in orthodontic patients over 20 years of age, and also that the resorption of the alveolar crest is much more likely to lead to this problem. Open gingival embrasures were found in 43.7% of the subjects undergoing orthodontic treatment. On radiographic examination, it was found that patients who had undergone orthodontic treatment had decidedly more bone loss than the subjects who were not given such treatment. Thus, this study indicated that the occurrence of open gingival embrasure is significantly related to alveolar bone loss secondary to orthodontic treatment.

Ko-Kimura *et al.* ^[9] conducted a study including 80 orthodontic patients (33 males, 47 females) between 15 and 31 years of age. Open gingival embrasures were found in 43.7% of all subjects, with the prevalence being 66.7% in subjects over 20 years. The amount of crowding was taken into consideration and it was found that the occurrence of black triangles was related to it in the following manner:

- Less than 4 mm crowding- 42.8%
- 4 mm to 8 mm crowding- 41.2%
- 8 mm and more crowding- 50%

The period of orthodontic treatment was also considered and was found not to be statistically significant at 42% of patients in shorter treatment and 44.4% of patients in the longer treatment group had the problem. In conclusion, it was reported that black triangles were

more frequently found in patients over 20 years of age than in younger patients, and were associated to a greater degree with the resorption of the alveolar crest. Agarwal *et al.* ^[10] conducted a case series which included reconstruction of open gingival embrasures; the distance between the tip of interdental papilla and incisal edge were measured at follow-up visits. Distance between interdental papilla and incisal edge at 3 months and 6 months remained stable. Results showed an increase in sulcus depth by about 1.19 mm and improvement in the contour of interdental tissues in 51% of cases and in 38.46%, the interdental papilla completely obliterated the open embrasures.

CONCLUSIONS

In conclusion, open gingival embrasures or black triangle pose complex design and functional problems that are noticeably unaesthetic and negatively affect the smile pattern. A multidisciplinary approach involving restorative, prosthodontic and orthodontic specialities must be considered if a successful clinical outcome is to be achieved. Non-surgical methods are also important if the amount of loss was minimal and periodontal health is good. All etiological factors and treatment alternative must be discussed with the patient before starting the treatment.

CONTRIBUTION OF AUTHORS

Research concept- Dr. Roy

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