



RESEARCH ARTICLE

ETIOLOGICAL FACTORS OF BLACK TRIANGLES: A CROSS SECTIONAL STUDY

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ABSTRACT

**Background:** In recent years, esthetic demand in dentistry have increased rapidly, driven by an enhanced awareness of beauty and esthetics. Loss of the interproximal dental papilla may cause formation of black triangle and in maxillary anterior region cause functional, phonetic and esthetic impairment. There are number of factors affecting the papilla fill in embrasure space, they are periodontitis, abnormal tooth shape, history of orthodontic treatment etc. Black triangle may be present when distance from contact point to alveolar crest is more than 5mm. It is important to know the cause of black triangle so that appropriate treatment can be planned.

**Aim:** To determine factors causing the black triangle. Amount of papilla fill in embrasure space.

**Materials and Methods:** A total of 200 sites were examined for amount of papilla fill & the presence of black triangle in 6 maxillary anterior teeth. The distance from contact point to alveolar crest was evaluated using Cone Beam Computed Tomography(CBCT) Clinically, the plaque index was recorded. Individuals were divided into 2 groups: Group A - Patients having 100% papilla fill and Group B - Patients having black triangle.

**Results:** The most common factor causing black triangle is poor oral hygiene. Patients with poor oral hygiene 73.5% of total sites had black triangle whereas in the patients maintaining good oral hygiene, only 2.5% of total sites had black triangle then followed by patients with thin gingival biotype and triangular tooth morphology showed the occurrence of black triangle with 67.5% and 57.5% of total sites respectively. There was no significant difference found in gender for presence of black triangle. 100% papilla fill is present when the distance from CP - AC was  $\leq$  5mm.

**Conclusion:** The most common factor causing black triangles is poor oral hygiene followed by thin gingival biotype, and triangular tooth morphology. It is commonly seen in older age i.e. 35 -50 yr. In the present study, it was also found that when the distance from CP - AC was  $\leq$  5mm, a complete papilla fill was present.

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INTRODUCTION

The interdental papilla, which occupies the interdental space, not only acts as a barrier in protecting the periodontal structures but also plays a critical esthetic role. (Tarnow and Eskow, 1995) A number of studies (Tarnow *et al.*, 1992; Kurth and Kokich, 2001; Wu *et al.*, 2003; Cho *et al.*, 2006; Martegani *et al.*, 2007; Chang, 2006; Chang, 2007; Chang, 2008) were conducted to investigate the factors that influence its presence. It has long been known that the distance from the contact point (CP) to the alveolar bone crest (BC) is a significant factor in determining whether a papilla will fill the interdental space. Tarnow *et al.* reported that interdental papillae were often present when the CP-BC distance was 5mm. Van der Velden (1982) reported that 4.33 mm of soft tissue regenerated 3 years after removing the interdental soft tissue in humans. Age and

interdental distance (IDD) were also cited as potential factor. A rectangular-shaped crown form was shown to be associated with the presence of interdental papillae. (Kurth and Kokich, 2001) Other factors, such as gender, angulation of the adjacent roots, embrasure area and papilla length. However, only a few studies evaluated the presence of interdental papillae from a multifactorial viewpoint. Identifying factors related to the presence of interdental papillae may be useful for preventing or managing loss of interdental papillae. Therefore, the aim of this study is to investigate how demography and interdental area variables, i.e., age, the distance between the CP and BC and crown form, history of orthodontic treatment, prosthesis, history of surgery might affect the presence of interdental papillae in the maxillary anterior region. Also the amount of papilla fill is calculated which will be helpful for appropriate treatment planning.

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## MATERIALS AND METHODS

Patients were selected from OPD of Periodontology who were advised CBCT for different reasons. A total number of 200 interproximal papillae were observed in maxillary anterior region for presence of black triangle with the following

**Inclusion criteria**-1) Patients having black triangle in maxillary anterior region; 2) Patients in age between 15-50 yr; 3) Adults with fully erupted permanent dentition with intact contact point in maxillary anterior region.

**Exclusion criteria** -1) History of medication causing gingival enlargement and pregnant patients; 2) Teeth with attrition and abrasion in maxillary anterior region; 3) Teeth having spacing, intrusion, extrusion in maxillary anterior region. Patients were examined for gingival biotype, tooth morphology, for any history of orthodontic treatment or periodontal surgery, prosthesis and crown. Also plaque index given by Silness and Loe was recorded. All the five interproximal sites were observed for presence of black triangle which were classified according to Tarnow's classification (1998), and distance from contact point to alveolar crest was measured on CBCT.



Fig.1. Black triangle

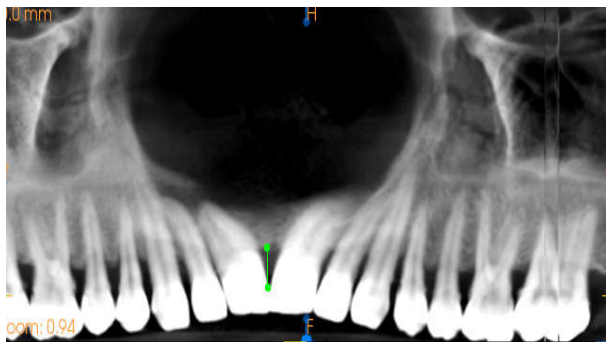


Fig.2. Distance bet<sup>n</sup> CP-AC on CBCT

## RESULTS

When the distance from the contact point to the bone crest on CBCT was 5 mm or less, the papilla was present almost 100% of the time. When the measurement was 6 mm and 7 mm the papilla was present 54% and 25% respectively (Table 1). A total of 40 patients (200 sites) included in the study having 20 males and 20 females patients where males patients were shown to have 50.56% and females shown 49.43% black triangle sites i.e. no significant difference in sex criteria as shown (Table 2). Table 3 shows that patients in 15-25 year and 25-35 year age group had 10% ,37.5% of black triangle sites

respectively. These sites were seen more i.e. 52.5% in the patients with 35-50yr age group. Patients with poor oral hygiene 73.5% of total sites had black triangle whereas in the patients maintaining good oral hygiene, only 2.5% of total sites had black triangle (Table 4). Patients with thin gingival biotype and thick gingival biotype showed the occurrence of black triangle with 67.5% and 32.5% of total sites respectively (Table 5). The black triangle sites were more i.e. 57.5% in patients with triangular tooth morphology as compared to patients with square tooth morphology showing 42.5% (Table 6).

Table 1. Association of CP-AC & papilla fill percentage

Distance from CP-AC	≤ 5	6	≥ 7
No. Of sites	111	60	29
% Papilla fill	100%	54%	25%

Table 2. Association of gender & black triangle percentage

Sex	No.of sites	% black triangle
Male	100	50.63%
Female	100	49.36%

Table 3. Association of age & black triangle percentage

Age	No. of sites (n=200)	% black triangle
15-25 yr	20	10%
25-35 yr	75	37.5%
35 -50 yr	105	52.5%

Table 4. Association of plaque index and black triangle percentage

Plaque index	No. of sites (n=200)	% black triangle
Good	5	2.5%
Fair	48	24%
Poor	147	73.5%

Table 5. Association of gingival biotype & black triangle percentage

Gingival biotype	No. of sites (n=200)	% black triangle
Thin	135	67.5%
Thick	65	32.5%

Table 6. Association of tooth morphology & black triangle percentage

Tooth morphology	No. of sites n=200	% black triangle
Triangular	115	57.5%
Square	85	42.5%

## DISCUSSION

In the present study papillae were found to present 100% when the distance from contact point to alveolar crest was ≤ 5 mm and when the distance was 6mm papillae were present 54% of times, and when the distance was 7mm or more papillae were present 25% of the time. Tarnow *et al.* in 1992 showed that when the measurement from the contact point to the crest of bone was 5 mm or less, the papilla was present almost 100% of the time, which correlated highly with the results of our study. However, at 6 mm, the papilla was present 56% of the time, and at 7 mm only present 27% of the time. Their study included both anterior and posterior teeth, and did not exclude those teeth with proximal restorations nor define patients who

had had previous surgery. Wu *et al* in 2003 revealed that when the distance from the contact point to the bone crest on standardized periapical radiographs was 5 mm or less, the papillae were almost 100% present. When the distance was 6 mm, 51% of the papillae were present, and when the distance was 7 mm or greater, only 23% of the papillae were present. In the present study we observed patients in 15-25 year and 25-35 year age group had 10%, 37.5% of black triangle sites respectively. These sites were seen more i.e. 52.5% in the patients with 35-50yr age group. Vandana and Savitha (2005) observed that the gingiva of older individuals were significantly thinner than those of younger individuals. Hence ultimately causing formation of black triangle. In the present study patients with poor oral hygiene 73.5% of total sites had black triangle whereas in the patients maintaining good oral hygiene, only 2.5% of total sites had black triangle. Jaiswal *et al* (2010) stated that most common reason for black triangle in the adult population is plaque associated loss of periodontal support as well abnormal tooth shape or traumatic oral hygiene. This study shows patients with thin gingival biotype and thick gingival biotype showed the occurrence of black triangle with 67.5% and 32.5% of total sites respectively. Oschbein and Ross (1969) were the first to document the relation of flat thick gingival form with square tooth form and thin gingival biotype with tapered tooth form leading to more papilla loss. Studies by Morris, Lindhe (Kan *et al.*, 2010) documented that individuals with tapered crowns have a thinner biotype, making them more susceptible to gingival recession hence forming more papilla loss. In the present study black triangle sites were more i.e. 57.5% in patients with triangular tooth morphology as compared to patients with square tooth morphology showing 42.5%. Olsson *et al.* (Morris, 1958; Olsson and Lindhe, 1991) documented that the central incisors with narrow tooth form had greater amount of recession having more papilla loss when compared to incisors with square form. Chow and Wang (2010) in their review article stated the presence of long narrow form with thin gingival tissue making it more susceptible for papilla loss. Joo-Hee Kim *et al.* (2013) reported a triangular tooth shape carries a higher risk of recession of the interproximal papilla because the proximal contact point is positioned more incisally and the bone crest is positioned more apically. This results in an increase in recession of the interproximal papilla and flat papilla tip form resulting black triangle.

## Conclusion

The most common factor causing black triangles is poor oral hygiene followed by thin gingival biotype, and triangular tooth morphology. It is commonly seen in older age i.e. 35 -50 yr. In the present study, it was also found that when the distance from CP - AC was  $\leq$  5mm, a complete papilla fill was present.

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