

Black Triangle and its Management

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Abstract

In recent years, clinician and dentist’s aesthetic demand in dentistry have been increased rapidly. The primary goal in the modern restorative dentistry is to achieve “white” and “pink” aesthetics in aesthetically important zones. “White aesthetics” is the natural dentition or the restoration of dental hard tissues with suitable materials. “Pink aesthetics” refers to the surrounding soft-tissues surrounding it, which includes the interdental papilla and gingiva that may improve or diminish the aesthetic effect. The reconstruction of the lost interdental papillae is one of the most challenging and least predictable problems. Treatment of marginal tissue recession, excessive gingival display, deficient ridges, ridge collapse, and aesthetic defects around teeth and implants are some of the aesthetic problems associated with the interdental papilla. This review article covers the aetiology and management of the lost interdental papillae, highlighting the importance

of considering the options currently available when treating a lost dental papilla. A lack of longitudinal studies investigating the long-term outcomes of the options in management of gingival black triangles presence is identified.

Keywords: Gingival Black Triangle (Gbt), Interdental Papillae, Pink Aesthetics, White Aesthetics.

Introduction

The presence or absence of the inter-dental papilla is of great concern to periodontists, restorative dentists, and to the patients. The loss of papilla can lead to cosmetic deformities such as gingival black triangle (gbt), phonetic problems, and lateral food impaction. Missing papillae may also be the result from periodontal surgery, as the soft tissues usually contract during the healing period. The interdental papilla is a structure with minor blood supply. So that, it was left more or less untouched by clinicians. The reconstruction of the lost interdental papilla is one of

the most challenging and least predictable problem in the dentistry. So that it is very important to respect papillary integrity during all dental procedures. Various cases as well as presentations have been published describing various surgical and prosthetic techniques to rebuild lost papillae. But, studies shown that no long term results are available to recommend any particular technique over another for correcting lost interdental tissues completely and predictably.

Management techniques to rectify black triangle have been inconsistent among clinicians. Limited blood supply to the papilla is always a problem in response of the tissue to any trauma or intervention. Low blood supply to interdental papillae makes them very fragile and vulnerable to recession, making restoration of receded papillae unpredictable.

The purpose of this review is to discuss all the currently available non-surgical and surgical treatment modalities that are recommended for the papilla preservation and reconstruction, around natural teeth, in past and present.

What Is Interdental Papillae?

According to prato et al, interdental papilla is formed by a dense connective tissue covered by oral epithelium and occupies the physiological space between the teeth. (1)

The shape is determined by the contacts between the teeth, the width of the adjacent tooth surfaces and the course of the cemento-enamel junction. Cohen was the first who described the morphology of the interdental papilla. Interdentally, the gingiva that occupies the space coronal to the alveolar crest is known as interdental gingiva. It has a pyramidal shape in the incisor region with the tip located just below the contact point and it is thinner and referred as a dental papilla. It is broader in the posterior region and was historically described as having a concave col or bridge shape.(2) however, when there is no contact point or when interdental papilla migrates apically due to

inflammation, the col disappears and interdental papilla takes on a pyramidal shape, which is unesthetic and dysfunctional.(3)

Causative Factors For The Presence Of Gingival Black Triangles

Many studies stated that the aetiology of the black triangles is multifactorial.

Interproximal Space between the Teeth

The size of inter-dental width is a relevant factor for the presence of black triangles. But a greater inter-dental width helps to improve the blood supply to the papilla tip, which may be helpful to maintain a full papilla. Also a very wide interdental width increases the risk of the presence of a gingival black triangle possibly due to stretching the papilla.(4) Martegani et al. Studied measurement of the interproximal width with periapical radiographs.(5) Their statistical analysis concluded that when inter-radicular distance is more than 2.4 mm the presence of full papillae in maxillary anterior teeth becomes less likely. This is regardless of the distance from contact points to the bone surface. Closer root approximation increases the likelihood of full papillae, while the occurrence of full papillae is not predicted if the interdental range is greater than 4 mm.

Distance Between Inter-Proximal Contact Positions To Alveolar Bone Crest

The length from the bone crest (BC) and the contact point (CP) is a frequently discussed variable in the natural appearance of the teeth, restorations and implantology. Tarnow conducted a study to explain this factor. He examined 288 papillae in 30 patients and gathered data from anterior, premolar and molar papillae, based on periodontal sounding. He concluded that if the distance from BC to CP is 5 mm or less, presence of full papillae is almost expectable (98%). (6)

Periodontal Biotype

The morphologies of interdental papilla and the osseous architecture can be categorized in to thin and thick periodontal biotype. The thin periodontal biotype are friable, and increase the risk of recession following crown preparation and periodontal or implant treatment. Due to the fragility of the thin tissue, delicate management is essential for avoiding recession and hence visibility of subgingivally placed crown margins at the restoration/tooth interface. (7) the thick biotype is better than thin biotype. Thick biotype is resistant to surgical procedures because it is fibrotic and resilient. Although the interdental gingival tissue has biological tissue memory, rebound of the gingival tissue is more likely than thin. Therefore, a thick biotype is more conducive for implant placement, resulting in favourable aesthetic outcomes.(8)

Tooth Morphology

The basic tooth forms are, circular, square, or triangular. They determine the degree of gingival scallop. The triangular teeth form a pronounced scallop and predisposes to the “black triangles”. The square teeth yield better interproximal papilla maintenance due to a smaller interproximal distance from the osseous crest to the contact point.

Contact Points

The maxillary teeth contact points are relevant to ensure optimal “pink aesthetics” for high smile line patients (or visible cervical margins). The chances for “black triangles” are small for square shaped teeth with large contact points when compared with triangular teeth with narrow contact points, which means more incisally positioned contact points. The iconic study by Tarnow *et al*, states that when the distance from the contact point to the interproximal osseous crest is 5 mm or less, there is complete fill of the gingival embrasures with an

interdental papilla. This is ‘5 mm rule’. For every 1 mm above 5 mm, the chance of complete fill is progressively reduced by 50 %.(6)

Patient Age

Systemic health such as osteoporosis as well as age have been suggested as generalised risk factors for the presence of black triangles. Ageing results in thinning oral epithelium and reduced keratinisation, which can result in reduced papillae height. Van der Velden presented the changes in the periodontal tissue due to ageing and concluded there is insufficient evidence for physiological gingival or papillae apical migration during ageing. However, he highlighted that periodontal tissue recession increases with age due to plaque, inflammation and trauma and also suggested that periodontal breakdown develops more faster due to a slower rate of wound healing.(9)

Periodontal Disease And Loss Of Attachment And Bone Level

Marginal inflammation causes the loss of inter-dental papillae. The biologic width decreases as a result of severe, generalised chronic periodontitis, leading to loss of papillae.(10)

Classification of Papillae Loss

The classification system to identify and describe the severity of papillae loss is very helpful or useful during the examination of patient, keeping patient records and facilitates monitoring of papillary reconstruction techniques.

Nordland And Tarnow Classification:

Nordland and Tarnow introduced a classification using three reference points.

- (a) The inter-dental contact point (IDCP),
- (b) The facial apical extent of cemento-enamel junction (CEJ),
- (c) The interproximal coronal extent of CEJ(11)

According to this classification, papillae were described as;

I. Normal: The tip of papillae extends to the apical of the contact point.

II. Class 1: The tip of the papillae presents between IDCP and the most coronal extent of inter proximal CEJ

III. Class 2: The tip of the papillae presents at or apical to the inter proximal CEJ but coronal to the apical extent of the facial CEJ

IV. Class 3: The tip of the papillae presents level with or apical to the facial CEJ.

Nemcovsky Classification

Nemcovsky put forward a classification system as a papillae index score (PIS) based on a comparison with the adjacent teeth.(12)

I. PIS 0: Presence of no papillae and no soft tissue curvature

II. PIS 1: Present papillae height is less half than the present papillae in adjacent teeth within a convex curvature of the soft tissue

III. PIS 2: Presence of at least half the papilla that was not similar with the inter-dental papillae of the proximal teeth and there is no complete harmony with the interdental papillae of the proximal teeth

IV. PIS 3: Papilla completely fills the inter-proximal embrasure to the same level as in the adjacent teeth with a complete harmony with the adjacent papillae.

Cardarpoli's Classification

Cardarpoli et al put forward another scoring system as papillae presence index (PPI) based on the visibility of CEJ (13)

• **PPI 1:** The papilla is completely present and at the same height of the neighbouring tooth

• **PPI 2:** The papilla is not fully present but interproximal CEJ is not visible

• **PPI 3:** The papilla is not completely present and interproximal CEJ is visible

• **PPI 4:** The papilla is not fully present and CEJ is visible from buccal and interproximal.

Management of Black Triangles

Correction of traumatic oral hygiene procedure. Faulty brushing can cause diffuse erythema and denudation of attached gingiva throughout the mouth. Improper use of dental floss can cause damage to the interdental papillae. All traumatic interproximal hygiene procedures should be initially discontinued and successively modified. Reepithelialization of the traumatic lesion can restore the papillae completely. (14)

Prosthetic Restorations Abnormal tooth shape may contribute to a “missing” papillae and a proper restorative technique is indicated to favour the creeping of the interdental tissues. The contact point can be lengthened by a restorative or prosthetic reshaping of the contours of the teeth. Thus the embrasure is reduced and allows the coronal displacement of the interdental gingiva.(15)

Orthodontic treatment The orthodontic approach for the closure of the interdental space should be attained with a bodily movement of the two adjacent teeth. The aim is to reduce the diastema and create a contact point between the adjacent teeth, without periodontal attempts to build up the missing papillae. However the length of treatment, the need for appliances and cost are limiting factors. Burke et al recommend bringing the roots closer by mesial torquing movement to rectify presence of GBTs.(16) Salama and Salama suggested that paralleling closed roots with orthodontic movements may be beneficial in supporting the inter-dental papillae.(17)

Gingival veneer It is a removable acrylic or silicone that can be used to mask gingival black triangles. This removable prosthesis can also be used to cover the exposed root surfaces due to advanced bone loss

particularly in patients with a high smile line and to prevent food impaction and phonetic disability. Poor oral hygiene and limitation in manual dexterity are the primary contraindications to consider in using this technique.(4)

Pink restorative materials to mask the gingival black triangles. Composite resins are available in pink shades for gingival reproduction. It can be used on restorations to replace the missing soft tissue. Although pink porcelain can mask the loss of inter-dental papillae, the shades and optical properties are limited, and therefore this pink composite resin is considered to be more realistic than pink porcelain.

Repeated curettage of the papillae Repeated curettage after every 15 days for 3 months to recreate papillae destroyed by necrotizing gingivitis, induce a proliferative hyperplastic inflammatory reaction of the papillae. Regeneration of interdental papillae was observed for about 9 months after initial treatment. Some papillae showed complete regeneration, while others did not respond to the periodic curettage.(2)

Surgical Techniques

The interdental papilla is a small area with small blood supply. This seems to be the major limiting factor in all surgical reconstructive and augmentation techniques. Most surgical techniques published involved gingival grafting, but shown only limited success because of insufficient blood supply. Surgical techniques includes following 3 treatment modalities.

- I. Papillae re-contouring
- II. Papillae preservation
- III. Papillae reconstruction

Papillae Re-Contouring

The excess tissue should be removed to remodel the soft tissue architecture if there is any presence of gingival enlargement. In cases of drug-induced and idiopathic gingival enlargement, a gingivectomy must be performed.

In case of localized gingival lesions, such as peripheral giant cell granuloma, gingivectomy combined with free gingival graft may be suggested.

Papillae Preservation

Various soft-tissue surgical procedures have been introduced in an attempt to recreate and preserve the interdental papillae.

a) Papillae preservation flap: In this technique, the facial surface is prepared with sulcular incision around each tooth with no incision being made through the interdental papillae. (18) 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 papillae. In posterior areas with a narrow interdental space, trim-off the tip of the papillae in order to preserve the intact papillae through the embrasure space.

b) Modified papillae preservation flap: This technique was a variation of the papillae preservation technique. This was modified to achieve and maintain primary closure of the flap in the interdental space over the GTR membrane.(19) A buccal and interproximal intrasulcular primary incision to the alveolar crest, involving the two teeth neighbouring the defect, was performed. In the buccal gingiva at the base of papillae, a horizontal incision with a slight internal bevel was given just coronal to the crest of bone and the papillae were elevated to the palatal aspect.

c) Simplified papillae preservation technique :(20) this technique is indicated in narrow interdental space in anterior and posterior region. This procedure requires an oblique incision across the associated papillae from the gingival margin at buccal line-angle of the involved tooth to the mid interproximal portion of the papillae under the contact point of the adjacent tooth. This oblique

interdental incision is continued intra-secularly in the buccal aspect of the teeth neighbouring the defect.

Papillae Reconstruction

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

a) Pedicle flap :(21) in this technique, in correspondence to the lost interproximal papillae, a palatal split-thickness flap is dissected and labially elevated. The flap is folded on itself and sutured to create the new papillae between the two incisors. This technique basically combines the roll technique and papillae preservation technique.

b) Semilunar coronally repositioned flap :(22) in this technique, semilunar incision is made in the interdental region. Intrasulcular incisions are then 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.

c) Envelop type flap :(23) an intrasulcular and buccal incision is made across the interdental papillae to be reconstructed, at the level of CEJ. Then 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 periosteum and a thin layer of connective tissue on the bone. The palatal portion of flap, is also split thickness, includes the interdental papillae. A connective tissue graft of adequate size and shape was placed under the flaps in the recipient site.

d) Autogenous osseous and connective tissue grafts :(24) This Technique involves an intrasulcular incision, that 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. The osseous graft which is obtained from the maxillary tuberosity is reshaped to form a saddle that will fit over the interdental crest and stabilized with a titanium screw. The crushed cancellous bone is then 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

Thorough treatment planning is essential for maintenance of the height of the interproximal papillae following tooth removal. Black triangles are caused by lack of presence of the inter-dental papillae, which is multifactorial including the position of the alveolar crest and the teeth. Rebuilding the pink gingival aesthetic is an important issue in modern aesthetic dentistry. An increased cosmetic demand from the profession and patients has resulted in more emphasis on the gingival aesthetic. In aesthetically compromised cases, restorative intervention can mask the loss of tissues but, rarely can they achieve the ideal aesthetics. Once the potential problems are known, additional procedures can be carried out or anticipated. It has been proven that by maintaining or trying to correct the height of bone in the interproximal area, an aesthetic reconstruction of the papilla can thus be achieved.

Rebuilding the pink gingival aesthetic is a crucial issue in modern aesthetic dentistry. An increased cosmetic demand from the profession and patients has resulted in additional emphasis on the gingival aesthetic. Thorough treatment planning is important for maintenance of the peak of the interproximal papillae following tooth removal. Periodontal plastic procedures are often wont to enhance

the last word outcome. In aesthetically compromised cases, restorative intervention can mask the loss of tissues but rarely can they achieve ideal aesthetics. Once the potential problems are known, additional procedures are often performed or anticipated. It has been proven that by maintaining or trying to correct the peak of bone within the interproximal area, an aesthetic reconstruction of the papilla is often achieved.

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