



RESEARCH ARTICLE

ESTHETICS: THE ORTHODONTIC, PERIODONTIC-RESTORATIVE CONNECTION

*Aggarwal Isha and Wadhawan Manu

Department of Orthodontics, Giansagar Dental College and Hospital, Ramnagar Banur, Punjab

ARTICLE INFO

Article History:

Received 27th April, 2016
Received in revised form
15th May, 2016
Accepted 10th June, 2016
Published online 31st July, 2016

Key words:

Orthodontics, Gummy Smile, Gingival
Margin Discrepancies, the Missing Papilla.

Copyright©2016, Aggarwal Isha and Wadhawan Manu. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Aggarwal Isha and Wadhawan Manu, 2016. "Esthetics: The orthodontic, Periodontic-restorative connection", *International Journal of Current Research*, 8, (07), 35194-35199.

ABSTRACT

The objectives of orthodontic therapy are to establish a good occlusion, enhance the health of the periodontium, and improve dental and facial esthetics. Although tooth contact is important, the interrelationship between orthodontics, periodontics, and esthetics, should not be deemphasized. The common unaesthetic situations that may develop during orthodontic treatment are the gummy smile, gingival margin discrepancies, and the missing papilla. This article describes these situations during orthodontic treatment and how to overcome them.

INTRODUCTION

The objectives of orthodontic therapy are to establish a good occlusion, enhance the health of the periodontium, and improve dental and facial esthetics (Kokich V. Esthetics, 1996). Orthodontic literature, research, and training emphasize the importance of the final occlusal result following orthodontic treatment. In the past less emphasis has been placed on periodontal health and the esthetic appearance of the teeth after appliance removal (Kokich V. Esthetics, 1996). Although tooth contact is important, the interrelationship between orthodontics, periodontics, and esthetics, should not be deemphasized. Orthodontists treat patients who do not have ideal tooth morphology and periodontal health. Poor oral hygiene, worn or abraded teeth, fibrotic tissue, missing papillae, and uneven crown lengths will jeopardize the esthetic appearance of the teeth and the smile after treatment. The common unaesthetic situations that may develop during orthodontic treatment are: the "gummy" smile (Thomas C. Waldrop, 2008), gingival margin discrepancies (David P. Mathews and Vincent G. Kokich, 1997), and the "missing papilla" (Fernando Inocencio and Harinder Sandhu, 2008). In some of these situations, alteration of tooth position is preferred to correct the esthetic problem. In other patients gingival surgery is the optimal

treatment plan for enhancing the esthetic appearance of the teeth (Kokich V. Esthetics, 1996). Before discussing common unaesthetic situations concept of smile arch is discussed which make discussion of Gummy Smile, Gingival margin discrepancies and missing papillae simpler to understand.

The Smile Arc (Roy Sabri, 2005)

The smile arc is defined as the contour of the incisal edges of the maxillary anterior teeth relative to the curvature of the lower lip during a social smile. For best appearance the contour of these teeth should match that of the lower lip. If the lip and dental contours match, they are said to be consonant. Good evidence exists now that a consonant smile arc is an important aspect of smile esthetics. Lay observers significantly prefer an ideal smile arc, and a flattened smile arc decreases the attractiveness of a male or female smile. A flattened smile arc can pose either or both of two problems: It is less attractive and it tends to make the patient look older. The characteristics of the smile arc must be monitored during orthodontic treatment because it is surprisingly easy to flatten it in the pursuit of other treatment objectives. The data indicate that this is much more important as a factor in smile esthetics than buccal corridor width.

*Corresponding author: Aggarwal Isha

Department of Orthodontics, Giansagar Dental College and Hospital,
Ramnagar Banur, Punjab.



Smile arc

The Gummy Smile (Thomas C. Waldrop, 2008)

During smiling, the upper lip moves apically to expose the anterior teeth. Ideally, the lip should rise to a level at or slightly apical to the gingival margins of the maxillary central incisors. In this situation, about 1 to 2mm of gingiva will be apparent when the patient smiles (Vig and Brundo, 1978). However, some patients show more than 2 mm of gingival tissue. Although this situation does not produce any pathological sequelae, it may appear unaesthetic. The "gummy" smile has three potential causes. It may be the result of excessive maxillary growth and occurs in patients with longer than normal facial heights, shorter than normal upper lips, and more than normal eruption of the maxillary teeth (Willmar, 1974). If all maxillary teeth have overerupted, treatment requires a combination of orthodontics and orthognathic surgery to move the entire maxilla apically (Proffit and Phillips, 1988; Rosen, 1988; Sarver and Weissman, 1991). A second cause of the "gummy" smile is delayed apical migration of the gingival margin over the maxillary anterior teeth. In most adults, the gingival margin is positioned about 1 mm coronal to the cementoenamel junction (Garguilo *et al.*, 1961; Maynard and Wilson, 1979). Usually this level is reached during late adolescence. However, in some patients the gingival tissue may be thick and fibrotic. Thicker tissue tends to migrate more slowly than thin gingival tissue. If this situation exists during orthodontics, it is important to recommend the appropriate treatment in the correct sequence. If an adolescent patient shows excessive gingiva during smiling, the first step is to probe the gingival sulci of the maxillary anterior teeth (Fig. 1). The sulcular depth should be about 1 mm, and the cementoenamel junction should be located at the depth of the sulcus (Wilson and Maynard, 1981). If the sulcular depth is 3 to 4 mm, and the tissue is fibrotic, several years may elapse before the gingival margin migrates toward the cementoenamel junction.

The timing for esthetic gingival surgery depends on the presence of wear at the incisal edges of the centrals and laterals. If the incisal edges are unworn and level with one another, the cementoenamel junctions of the two central incisors should be at the same height. In this situation, gingival surgery may be delayed until after orthodontic appliances have

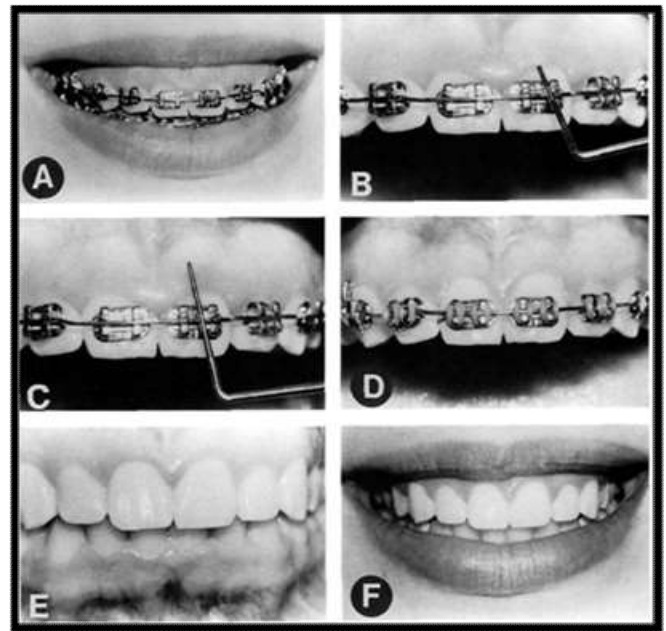


Figure 1. During the finishing stages of orthodontic treatment, this patient complained about her "gummymile (A). Probing of the sulci over the maxillary anterior teeth showed no bleeding (B), and the sulcular depths were excessive at about 4 mm (C). An excisional gingivectomy and frenectomy were performed to increase the clinical crown length (D, E), which resulted in a more esthetically pleasing smile after bracket removal (F)

been removed. However, if the incisal edges of the centrals have been abraded, the cementoenamel junctions may be at different levels even though the incisal edges are aligned. In this situation, gingival surgery should be performed before orthodontic bands and brackets are removed (Kokich, 1993). In this way, if any discrepancy exists between the gingival margins after surgery, the longer tooth can be extruded slightly, and the incisal edge can be equilibrated to level the gingival margins. In most adults, the alveolar crest is about 2mm from the cementoenamel junction (Garguilo *et al.*, 1961). To determine the bone level, the surgeon pushes the periodontal probe past the bottom of the sulcus, through the epithelial attachment and connective tissue and stops at the bone level. If the bone level is 2 mm from the cementoenamel junction, excisional surgery would be appropriate to apically position the gingival margins. However, if the bone level is within 0.5 mm of the cementoenamel junction, an apically positioned flap with recontouring of the alveolar crestal bone may be the most appropriate surgery (Orban, 1941; Goldman, 1950; Ramfjord, 1952; Prichard, 1961; Kokich, 1993). These decisions are made at the time of the surgical procedure. In either case, moving the gingival margins apically to expose the complete crown length of the anterior teeth not only enhances the esthetic appearance of the incisors and canines, but reduces the display of gingiva when the patient smiles. Occasionally, the "gummy" smile is caused by tooth malposition (Fig 2). In this situation, gingival surgery is inappropriate. The ideal plan is to move the tooth and its gingival margin to a more esthetic position. This is especially true in adult patients with deep anterior overbites. If a patient has a "gummy" smile, the clinician must identify whether it is apparent anteriorly or posteriorly. If the problem only exists anteriorly, this may be caused by overeruption of

the maxillary incisors with concomitant movement of the gingival margin coronally as the teeth erupt. In this situation, the clinician must first probe the sulci of the centrals and laterals to determine if there is excess gingiva that can be excised. If the sulcular depth is 1 mm, gingival surgery would not be sufficient to improve the esthetics without adversely affecting the crown to root ratio.

However, intrusion of the overerupted teeth would reposition the gingival margins to esthetic level (Fig 2). In this situation, either the lateral incisors or the maxillary canines serve as a guide for repositioning the gingival margins of the central incisors. The gingival margins of the canines and centrals should be at the same level (Kokich *et al.*, 1984). As the centrals are intruded, an incisal restoration may be necessary to restore original crown length if the centrals have been abraded at their incisal edge (Fig. 2)

In the appropriate situation, tooth intrusion and restoration are the correct method for eliminating the "gummy" smile. The clinician must identify those patients who would benefit from gingival surgery and those who would be more ideally treated with orthodontic leveling of the gingival margins.

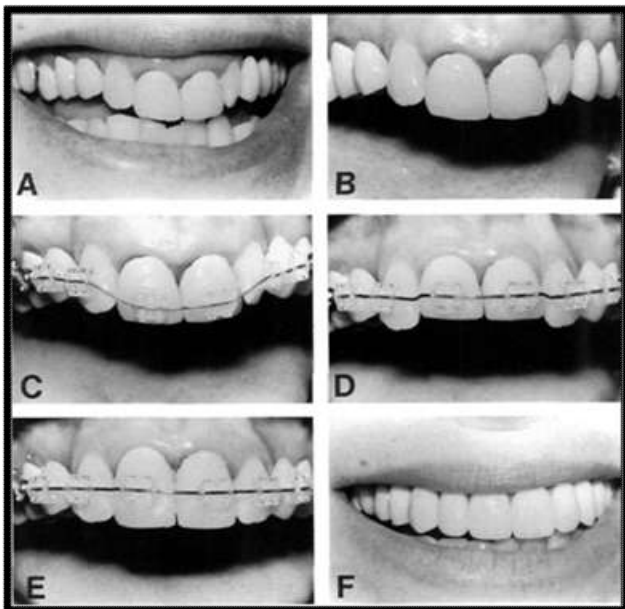


Figure 2. This adult patient was concerned about the unesthetic display of gingiva when she smiled (A). She was being treated orthodontically to improve tooth position before restorative treatment to replace bilateral missing maxillary canines (B). Because the gingival margin over the central incisors was positioned coronally relative to the lateral incisors (B), the central incisor brackets were placed near the incisal edge (C), to permit relative intrusion of the central incisors (D) during orthodontic alignment. As the centrals moved apically, the gingival margin discrepancy was corrected (D) and provisional restorations were constructed to correct the crown length and incisal edge position (E). Intrusion of the central incisors to move the gingival margins apically eliminated the "gummy" smile after maxillary restoration (F)

Gingival Margin Discrepancies

The relationship of the gingival margins of the six maxillary anterior teeth plays an important role in the esthetic appearance

of the crowns (Kokich, 1990; Chiche *et al.*, 1994; Kokich, 1993). Four characteristics contribute to ideal gingival form. First, the gingival margins of the two central incisors should be at the same level. Second, the gingival margin of the central incisors should be positioned more apically than the lateral incisors and should be at the same level as the canines. Third, the contour of the labial gingival margins should mimic the cemento-enamel junctions of the teeth. Last, there should be a papilla between each tooth, and the height of the tip of the papilla is usually halfway between the incisal edge and the labial gingival height of contour over the center of each anterior tooth. Therefore, the gingival papilla occupies half of the interproximal contact, and the adjacent teeth form the other half of the contact. However, some patients have gingival margin discrepancies between adjacent teeth. These discrepancies may be caused by abrasion of the incisal edge (Fig 3) or delayed migration of the gingival tissue (Fig 4). When gingival margin discrepancies are present, the clinician must determine the proper solution for the problem: orthodontic movement to reposition the gingival margin or surgical correction of gingival margin discrepancies. To make the correct decision, it is necessary to evaluate four criteria. First of all, the relationship between the gingival margin of the maxillary central incisors and the patient's lip line should be assessed when the patient smiles. If a gingival margin discrepancy is present, but the patient's lip does not move upward to expose the discrepancy, it does not require correction. If the gingival margin discrepancy is apparent, the next step is to evaluate the labial sulcular depth over the two central incisors. If the shorter tooth has a deeper sulcus, excisional gingivectomy may be appropriate to move the gingival margin of the shorter tooth apically (Fig 4). However, if the sulcular depths of the short and long incisors are equivalent, gingival surgery will not help. The next step is to evaluate the relationship between the shortest central incisor and the adjacent lateral incisors. If the shortest central is still longer than the lateral incisors, the other possibility is to extrude the longer central incisor and equilibrate the incisal edge. This will move the gingival margin coronally and eliminate the gingival margin discrepancy. However, if the shortest central incisor is shorter than the laterals, this technique would produce an unesthetic relationship between the gingival margins of the central and lateral incisors. The fourth step is to determine if the incisal edges have been abraded. This is best appreciated by viewing the teeth from an incisal perspective. If one incisal edge is thicker labiolingually than the adjacent tooth, this may indicate that it has been abraded, and the tooth has overerupted. In this situation, the best method of correcting the gingival margin discrepancy is to intrude the short central incisor (Kokich, 1984; Kokich, 1990; Chiche, 1994; Kokich, 1993; Reitan, 1959) (Fig 3). This method will move the gingival margin apically, and permit restoration of the incisal edge. The intrusion should be accomplished at least 6 months before appliance removal. This will allow reorientation of the principle fibres of the periodontium and avoid re-extrusion of the central incisor after appliance removal (Reitan, 1959; Reitan, 1967). The relationship between the gingival margins of adjacent teeth is even more important for patients who require restorations after orthodontic therapy (Fig 4). If patients are congenitally missing maxillary lateral incisors, and space is opened for resin-bonded

bridges, the orthodontist must position the centrals and canines appropriately so that an esthetic bridge may be placed (Fig 4).

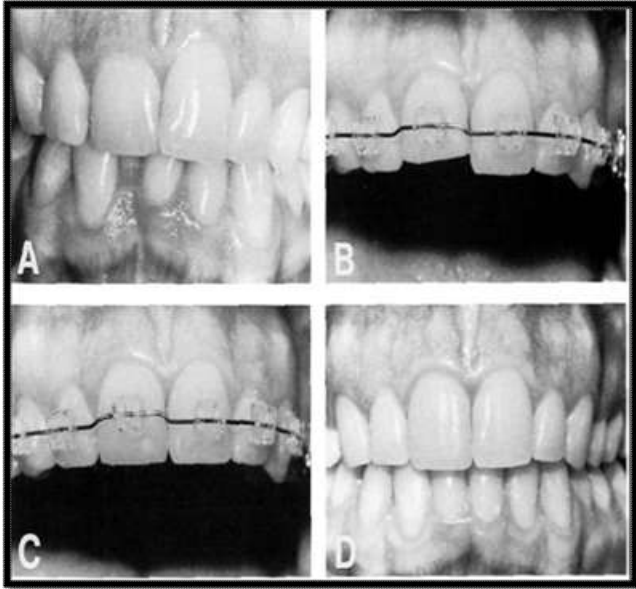


Figure 3. This patient had moderate crowding of the maxillary and mandibular incisors. In addition, the clinical crown length of the maxillary right central was shorter than the left central (A). Because the sulcular depths were normal, the crown lengths were corrected by intruding the right central (B) and restoring the incisal edge with composite (C). After debracketing, the esthetic appearance of the teeth has been improved by alignment and correction of the crown length discrepancy (D)

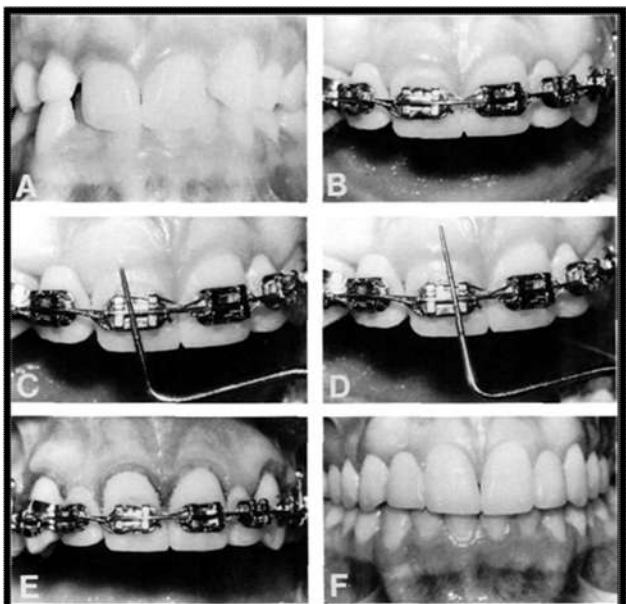


Figure 4. This patient was congenitally missing both maxillary lateral incisors, and the maxillary right canine was impacted palatally (A). The canine was moved out of the palate, and space was opened for two plastic pontics to replace the lateral incisors (B). The gingival esthetics in the maxillary anterior region was unacceptable (B). Probing of the sulcular depths (C, D) showed a 4 mm depth labial to the centrals (C, D). An excisional gingivectomy (E) was performed to improve the gingival margin relationship between the centrals, laterals and canines (E). Proper gingival margin relationships resulted in more esthetic final bridges (F)

The gingival margin relationship between the central incisor, the lateral incisor pontic and the crown of the natural canine, must be correct. During the finishing stages of orthodontics, the orthodontist must evaluate this relationship. If the crowns of the central incisors are too short, and the incisal edges have not abraded, the gingival margins may require surgery (Fig 4). By probing the labial sulci of the incisors, the clinician can determine if the sulcular depth is excessive. If so, gingival surgery is recommended during orthodontic treatment so that the final position of the gingival margins of the two central incisors will be equivalent.

The Missing Papilla

Presence of a papilla between the maxillary central incisors is a key esthetic factor after orthodontic treatment.

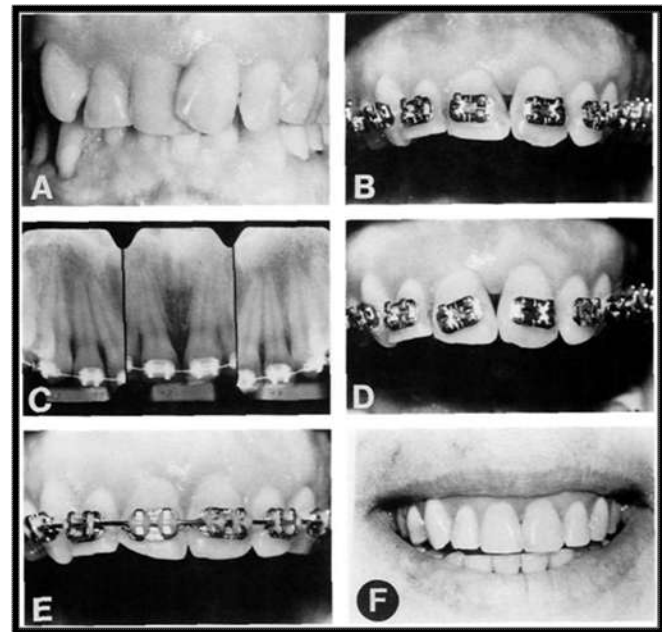


Figure 5. This patient had severe crowding and overlap of the maxillary central incisors (A). As the centrals were aligned, a space occurred between the contact and papilla (B). Although the incisal edges of the teeth were aligned (B), the roots of the centrals diverged (C), which produced the unesthetic gap above the papilla. To produce proper root alignment, the brackets on the centrals were repositioned (D) and the roots were tipped mesially. This tooth movement not only corrected root position, but eliminated the unesthetic space (E). The incisal edge discrepancy produced by uneven wear of the right central incisal edge (E) was restored to recreate normal incisal form (F)

However, in some patients, the papilla is absent. The presence of a space above the central incisor interproximal contact may be caused by one of three factors. The first possible cause is diverging roots of the maxillary central incisors (Fig 5A). This is usually caused by improper bracket placement. In patients with overlapped and abraded maxillary central incisors, brackets may be placed inadvertently at an angle that is not perpendicular to the long axis of the central incisor. As the teeth are aligned (Fig 5B), the roots may diverge distally (Fig 5C). To identify this cause, the clinician should evaluate a periapical radiograph.

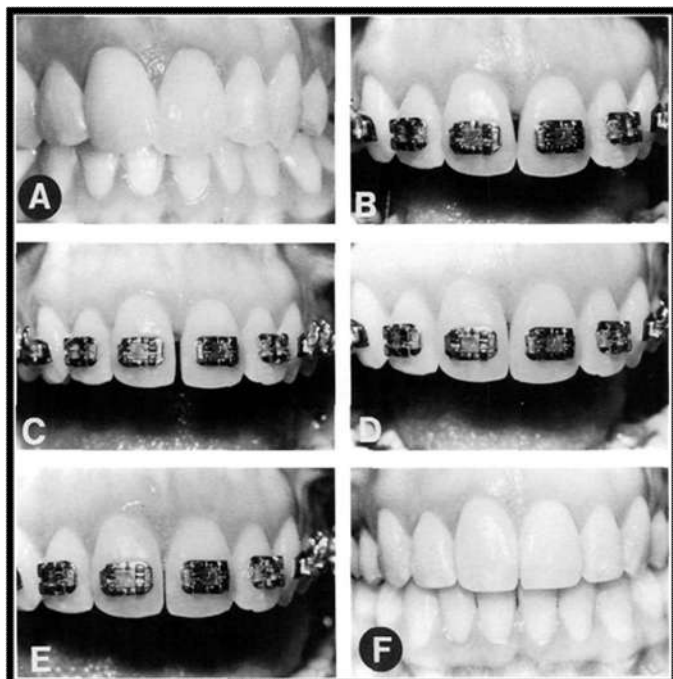


Figure 6. This patient had mild crowding and overlap of the maxillary central incisors (A). As her incisors were aligned, a space occurred between the central incisor papilla and contact (B). This gap was caused by "fan-shaped" morphology of the centrals which placed the interproximal contact near the incisal edge (B). To eliminate the unesthetic space, the mesial surfaces of the centrals were reshaped to lengthen the contact and move it toward the papilla (C, D, and E). By reshaping the mesial surfaces, the contact was lengthened, and the gap was eliminated, producing a more esthetic final result (F)

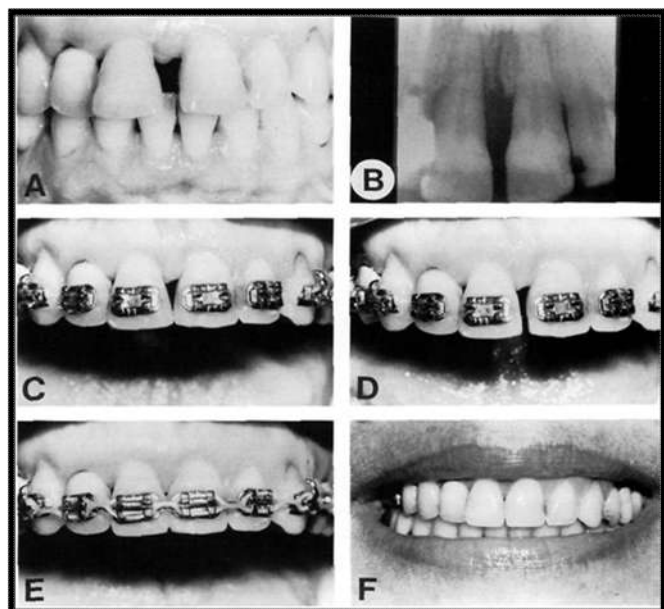


Figure 7. This patient had had significant periodontal disease resulting in interproximal bone loss and loss of the papilla between her maxillary central incisors (A, B). Although the diastema was closed, a space persisted between the central incisor papilla and contact (G). By reshaping the mesial surfaces of the centrals (D) and moving the teeth together (E), the papilla was "squeezed" into the contact area eliminating the unesthetic gap between the central incisors (F)

If the roots diverge, the brackets should be removed and repositioned with the bracket slots perpendicular to the long axes of the roots (Fig 5D). As the roots align, the contact point lengthens and moves apically toward the papilla. Usually, the distal incisal corners of the centrals also move apically (Fig 5E). This reflects the amount of incisal wear that had occurred before orthodontic treatment. A second possible cause of space above the interproximal contact of central incisors is abnormal tooth shape (Fig6). In some patients, the crowns of the centrals are much wider at their incisal edge than at the cervical region. In these situations the contact between the incisors is located in the incisal 1 mm between the two centrals. This is an unusual contact relationship. Most contact areas between central incisors are 2 to 3 mm long. The best method of correcting this problem is to recontour the mesial surfaces of the central incisors (Fig 6C). After this diastema has been created, the space between the teeth is consolidated. As this occurs, the contact is lengthened and moved toward the papilla (Fig 6F). In patients with advanced periodontal disease and destruction of the crestal bone between the central incisors, the papilla may be absent (Fig 7). This produces an unesthetic large gap after orthodontics. However, if the mesial surfaces of the central incisors are recontoured or flattened to lengthen the contact (Fig 7D), the contact will move apically toward the interproximal gingival (Fig 7E). Although this may not eliminate the space completely, it may improve the situation substantially (Fig 7F).

Summary

Gummy smile, gingival margin discrepancies and missing papilla adversely affect orthodontic esthetics and require interdisciplinary diagnosis and management by the orthodontist, periodontist, and often the restorative dentist. The key is to look for these unesthetic problems not only before orthodontic bracketing, but also during the finishing stages of treatment to determine if the solution will require additional tooth movement or periodontal surgery to achieve the most esthetic outcome.

REFERENCES

- Chiche G, Kokich V, Caudill R. 1994. Diagnosis and treatment planning of esthetic problems : Pinault A, Chiche G, Esthetics in Fixed Prosthodontics. *Quintessence*, 33- 52.
- David P. Mathews and Vincent G. Kokich: 1997. Managing treatment for orthodontic patients with periodontal problems. *Semin Orthod.*, 3:21-38
- Fernando Inocencio, Harinder S.Sandhu: 2008. Interdental papilla reconstruction combining periodontal and orthodontic therapy in adult periodontal patients: A case report. *JCDA*, 74:531-534.
- Garguilo A, Wenz F, Orban B. 1961. Dimensions and relation at the dentogingival junction in humans. *Journal of Periodontology*, 32:261-267.
- Goldman H. 1950. The development of physiologic gingival contour by gingivoplasty. *Oral Surg.*, 3:879.
- Kokich V, Nappen D, Shapiro E. 1984. Gingival contour and clinical crown length: Their effects on the esthetic appearance of maxillary anterior teeth. *Am J Orthod.*, 86:89-94.

- Kokich V. 1996. Esthetics: The Orthodontic-Periodontic Restorative Connection. *Semin Orthod.*, 2:21-30.
- Kokich VG. 1990. Enhancing restorative, esthetic, and periodontal results with orthodontic therapy. In: Schlunger S, Youdelis R, Page R, Johnson R, editors. *Periodontal Therapy*. Philadelphia, PA: Lea and Febiger, 433- 460.
- Kokich VG. 1993. Anterior dental esthetics: An orthodontic perspective I. Crown Length. *J Esthet Dent*, 5:19-23.
- Kokich VG. 1993. Anterior dental esthetics: An orthodontic perspective II Vertical relationships. *J Esther Dent*, 5:174-178.
- Kokich VG. 1993. Anterior dental esthetics: An orthodontic perspective III. Mediolateral relationships. *J Esthet Dent*, 5:200-207.
- Maynard J, Wilson R. 1979. Physiologic dimension of the periodontium fundamental to successful restorative dentistry. *Journal of Periodontology*, 50:170-174.
- Orban B. 1941. Indications, technique and postoperative management of gingivectomy in the treatment of periodontal disease. *Journal of Periodontology*, 12:88-91.
- Prichard J. 1961. Gingivectomy, gingivoplasty, and osseous surgery. *Journal of Periodontology*, ;32:257-262.
- Proffit W and Phillips C. 1988. Adaptations in lip posture and pressure following orthognathic surgery. *Am J Orthod Dentofac Orthop.*, 93:294-302.
- Ramfjord S. 1952. Gingivectomy its place in periodontol therapy. *Journal of Periodontology.*, 23:30-35.
- Reitan K. 1959. Tissue rearrangement during retention of orthodontically rotated teeth. *Angle Orthod.*, 29:103-105.
- Reitan. 1967. Clinical and histologic observations on tooth movement during and after orthodontic treatment. *Am J Orthod.*, 53:721-745
- Rosen H. 1988. Lip-nasal aesthetics following LeForte 1 osteotomy. *Plast Reconstr Surg.*, 81:171-179.
- Roy Sabri, 2005. The eight components of a balanced smile. *Journal of Clinical Orthodontics*, 3:155-167.
- Sarver D, Weissman S. 1991. Long-term soft tissue response to LeFort I maxillary superior repositioning. *Angle Orthod.*, 61:267-276.
- Thomas C. Waldrop, 2008. Gummy Smiles: The challenges of gingival excess: prevalence and guidelines for clinical management. *Semin Orthod.*
- Vig R, Brundo G. 1978. The kinetics of anterior tooth display. *J Prosthet Dent*, 39:502-504.
- Wilson R, Maynard J.1981. Intracrevicular restorative dentistry, *Int J Periodont Restor Dent*, 4:35-50.
