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Aesthetic crown lengthening

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Aesthetic considerations have influenced the management of dental maladies in varying degrees for many years. Patient awareness and expectations have increased recently to the point that less than optimal aesthetics are no longer an acceptable outcome (27). In the 21st century, the dental practitioner must be prepared to meet the challenges necessary to provide care that will result in a true condition of oral health. Current standards dictate the importance of avoiding procedures that will result in aesthetic compromise as well as the concept of providing patients with improved aesthetics whenever possible (14). An essential goal of treatment is long-term stability of the result; for this to be achieved the integrity of the dentogingival junction must be respected, and dental restorations and the periodontium must be in harmony. A predictable, successful outcome can only be expected if a complete and accurate diagnosis is obtained and used to generate an appropriate treatment plan. This chapter discusses crown-lengthening procedures with particular attention to aesthetic considerations.

Collection of data

Prior to developing a suitable treatment plan, it is essential to establish a complete and accurate assessment of conditions with which the patient presents. First, it is important to determine the chief complaint or the patient's reasons for seeking treatment. These could include pain, swelling, impaired function, unsatisfactory aesthetics or a combination of these reasons. Next, the medical status of the patient must be reviewed and vital signs recorded. This will determine the patient's suitability for dental treatment and identify any special precautions that must be taken. A common example of such precautions is premedication for the prevention of bacterial endocarditis (7). Medications having the potential to adversely affect gingival health and aesthetics include phenytoin, cyclosporin and various calcium-channel blockers (25). Poorly controlled diabetes and smoking have been reported to predispose patients to periodontal disease and adversely affect response to treatment (13, 31, 38). Anticoagulant therapy, including low-dose aspirin, often must be modified in order to ensure adequate hemostasis during and after surgical procedures (34, 36). While there is some controversy over the absolute necessity to discontinue aspirin for 1 week prior to surgery, prudent clinical judgment and appropriate medical consultation when needed are in the best interest of the patient (1, 37).

Following thorough review of the patient's medical status, the clinical examination is conducted. This should begin with extraoral conditions, with attention to facial symmetry, face height, lip length and thickness, profile and smile line. The reference point for assessment of facial symmetry is generally the interpupillary line (2). Face height is usually analyzed by dividing the face into thirds. The upper third is often quite variable depending upon the patient's hairstyle. The middle and lower thirds of the face are more involved in aesthetic considerations for the dentist. The midface is measured from glabella, the most prominent point of the forehead between the eyebrows, to subnasale, the point directly below the nose. The lower face is measured from subnasale to soft tissue menton, which is the lower border of the chin. When measured in repose, the length of the middle third of the face should equal the length of the lower third (33). Lip length is measured from subnasale to the lower border of the upper lip and tends to increase with age. In young women average lip length is 20–22 mm, and in young men 22–24 mm. In repose approximately 3–4 mm of the maxilary central incisors are displayed in young women; in young men the amount of display is approximately 2 mm less. The smile line should be observed in a variety of situations, including rest, speech, smiling and laughter. During a normal full smile, the upper lip should rest at the level of the mid-facial gingival margins of the maxillary anterior teeth. The lower lip should rest at the incisal edges of the maxillary anterior teeth; the incisal edges of

the maxillary anterior teeth should be parallel to the curvature of the lower lip during a full smile. When any significant discrepancies exist in one or more extraoral parameters, it may be unrealistic to expect intraoral procedures alone to provide a satisfactory result. In these cases orthognathic and/or plastic surgery procedures may need to be considered, or patient expectations may need to be modified.

Next, a thorough intraoral examination is conducted, combining clinical and radiographic observations. The condition and dimensions of the teeth should be determined, including caries, fractures and pulpal pathoses. The height of the anatomic crown is measured from the cementoenamel junction to the incisal edge, while the height of the clinical crown is measured from the gingival margin to the incisal edge. A comparison of these two measurements will determine whether short clinical crowns are a result of incisal wear or a coronal position of the gingival margin. If excessive incisal wear has occurred, then parafunctional habits must be investigated and dealt with appropriately. Once the cause of the incisal wear has been identified and controlled, then restorative procedures can be planned to replace lost tooth structure. Coronal position of the gingival margin with respect to the cementoenamel junction may be the result of delayed passive eruption or of gingival enlargement. Delayed passive eruption occurs when the dentogingival junction fails to migrate apically to the vicinity of the cementoenamel junction after the tooth has erupted into occlusion. Width of keratinized gingiva may be excessive or within the normal range, and the alveolar crest may be at or 1–2 mm apical to the cementoenamel junction (6). Gingival enlargement is most often due to inflammation caused by dental plaque, but is also associated with medications such as phenytoin, cyclosporin and calcium-channel blockers, and with pathological conditions such as hereditary gingival fibromatosis (9). The width and thickness of keratinized gingiva must be measured as well as probing depths, clinical attachment levels and the level of the alveolar crest with respect to the cementoenamel junction. Interproximal bone levels can be estimated using radiographs taken parallel to the long axes of the teeth. Facial and lingual bone levels can be determined with sounding using local anesthesia, often in conjunction with another procedure which requires local anesthesia, such as scaling and root planing or at the beginning of a surgical procedure. Thickness of alveolar bone and any irregularities of hard or soft tissue should also be recorded. The condition of the teeth must be carefully evaluated and any necessary restorative treatment noted.

Diagnosis

Following collection of data, the findings are analyzed and a concise diagnosis is formulated. This will identify conditions that require treatment and may involve a single discipline, such as restorative dentistry, periodontics, endodontics, orthodontics or oral and maxillofacial surgery. More often, however, conditions will be related to a combination of two or more disciplines. A healthy periodontium and incisal wear with adequate tooth structure for restorations may require only restorative treatment. A sound, intact dentition with gingival hyperplasia may require only periodontal treatment. A tooth that has been damaged by caries or trauma to the extent that there is less than 3 mm of sound tooth structure coronal to the alveolar crest will require periodontal and perhaps orthodontic treatment prior to fabrication of a definitive restoration (15). This should result in approximately 1 mm of connective tissue attachment, 1 mm of junctional epithelium and 1 mm of sulcus depth (12). Failure to respect the integrity of the dentogingival junction is likely to result in chronic inflammation and subsequent attachment loss, which will have adverse aesthetic consequences. When significant discrepancies exist in face height, lip length or lip thickness, periodontal and restorative treatment may need to be coordinated with orthognathic and/or plastic surgery procedures (4, 23, 33). If the patient is unwilling or unable to obtain this additional care, then he or she must be informed that limited improvement may result from periodontal and restorative treatment. It is absolutely essential that a complete, comprehensive diagnosis be developed in order to plan treatment that will predictably produce optimal results with long-term stability. The shortcomings of an incomplete diagnosis are illustrated in case reports describing a simple correction of the gummy smile (22). The reported procedure basically reduced the buccal vestibule by excising alveolar mucosa and binding down the upper lip to restrict gingival display. Long-term follow-up for this procedure was not published; however, a later publication expressed disappointment with the technique and recommended amputation of the levator labii superioris muscles to prevent the lip from elevating and thus reduce gingival display (26). Another report identified the limitations of treating only the lip and suggested a Le Forte I osteo-

tomy to reduce the excessive gingival display (18). It is important to keep in mind that excessive gingival display, often referred to as the "gummy smile" may be the result of several factors, including gingival enlargement, altered or delayed passive eruption, insufficient clinical crown length, vertical maxillary excess and a short upper lip (21). When the cause of the condition is identified and an accurate diagnosis is obtained, a treatment plan can be formulated that will predictably produce optimum long-term results.

Treatment planning

Following the formulation of a complete and accurate diagnosis, a comprehensive plan for treatment is developed. When full-coverage restorations are indicated, it is preferable to avoid placing margins subgingivally; however, in anterior areas margins frequently must be placed within the sulcus for aesthetic reasons. In order to minimize colonization of the sulcus by microorganisms associated with periodontitis, it is important to avoid overhangs and to reproduce the original contours of the tooth as closely as possible (20). Margins should generally be placed not more than 0.5 mm subgingivally. In addition, proper embrasure space must be restored to promote periodontal health and an esthetic appearance (10).

Extensive caries or crown fracture may create a situation where placement of the restoration margin on solid tooth structure would result in violation of the biological width necessary for health and long-term stability of the periodontium. The distance from the restoration margin to the alveolar crest should be at least 3 mm (11, 12). In posterior areas this may be accomplished by surgical resective procedures, as long as sufficient bone support will remain (24). The amount of bone support required will depend upon several factors, such as the opposing occlusion, whether or not the tooth will serve as an abutment for a fixed or removable partial denture, and whether or not the patient demonstrates parafunctional habits. In anterior areas where aesthetic considerations are highly significant, surgical crown lengthening alone may have an unacceptable result. If the gingival margin of the tooth to be restored is in harmony with adjacent teeth and at an acceptable level with regard to aesthetics, then crown lengthening would need to be performed on all of the adjacent anterior teeth, and this could adversely affect aesthetics. In such cases, forced eruption combined with localized fibrotomy and thorough root planing or limited crown lengthening may be indicated (16, 17, 19, 30). When a tooth is extruded, the resulting coronal-incisal height of the restoration that will be placed is less than if only a resective crown lengthening procedure were performed; consequently, the resulting crown–root ratio will be more favorable following extrusion than it would be with surgical crown lengthening alone. Because roots are tapered to varying degrees, a tooth which has been extruded will have a decreased root diameter at the level of the gingival margin. Since the mesiodistal distance between the adjacent teeth remains constant, the restoration of the extruded tooth will exhibit greater taper from the incisal edge to the gingival margin, and particular attention is necessary to avoid overcontouring. Teeth with limited tapering in the coronal third of the root are better candidates for extrusion than those with more pronounced tapering. Proper sequencing of treatment is essential for an optimal result. Complete caries removal and/or the removal of fractured tooth structure should be accomplished first. This will help to determine whether or not the tooth is restorable, and whether or not endodontic therapy is necessary. If endodontic therapy is indicated, it should be performed next. After successful completion of endodontic therapy, appropriate build-up of the tooth should be done, followed by preparation and provisionalization. Whenever possible, the finish line of the preparation for the provisional restoration should closely approximate the margin of the final restoration. It is important to keep in mind the original contour of the cementoenamel junction when preparing teeth for full-coverage restorations so that the resulting margin will be in harmony with the osseous architecture (35). The margin on the mesial and distal aspects of the anterior teeth must be coronal to the facial and lingual aspects, with the magnitude of these differences dependent upon the particular gingival morphotype of the patient (flat, scalloped, pronounced scalloped) (3). If this principle is not observed, a barrel-shaped preparation is created that will result in violation of the biological width interproximally, with subsequent inflammation, pocket formation and attachment loss (28). If it is not possible to accomplish provisional restorations prior to surgical crown lengthening, then the restorative dentist can fabricate a template based on the diagnostic wax-up that will provide guidance in establishing appropriate hard and soft tissue architecture (39). The surgical procedure must be planned based on diagnosis and the principles of wound healing. Flap design must be done with consideration for the width and

thickness of keratinized tissue, the amount of attached keratinized tissue, vestibular depth, existing osseous topography and anticipated osseous levels following the procedure. As with soft tissue, a three-dimensional assessment must be done when evaluating bony architecture, noting both the height and the thickness of bone. Obvious examples of increased bone thickness are tori and exostoses, but it is also important to recognize areas of thin radicular bone in order to more accurately predict the course of healing. Depending upon the thickness of alveolar bone and assuming that the bone is treated kindly during surgical therapy, it is reasonable to expect slightly less that 1 mm of crestal resorption following osseous resective surgery (29). If the width of keratinized tissue must be preserved or augmented, then the flap may be apically positioned at or slightly apical to the alveolar crest. As the site heals, the dentogingival junction will reform, with approximately 1 mm of supracrestal connective tissue attachment, 1 mm of junctional epithelium and 1 mm of sulcus depth. Thus, if 1 mm of crestal resorption occurs, there will still be an overall increase of 2 mm in the width of keratinized tissue. While the new junctional epithelium will form in approximately 2 weeks, formation and maturation of the underlying connective tissue attachment takes considerably longer (40). The degree of maturation must be taken into consideration when planning restorative treatment following periodontal surgery. In areas where margins will be supragingival and tissue is reasonably thick, restorative treatment may be performed 2 months postsurgically, though it must be kept in mind that coronal migration of the gingival margin may occur during subsequent months. In cases with a very thin periodontium it is reasonable to expect some apical migration of the gingival margin during healing. These changes may also be related to age, with younger patients showing a greater tendency for coronal migration of the gingival margin postsurgically. In areas where aesthetics is critical, a healing period of at least 6 months is recommended following periodontal surgery (5). The restoration margin should then be placed 0.5 mm subgingivally. With effective, atraumatic plaque control, a stable gingival margin and optimal aesthetics can then be achieved (8). In cases with extremely thin gingival tissue, soft tissue grafting procedures may be used to increase the thickness of keratinized tissue 6 to 8 weeks prior to surgical crown lengthening (32). In anterior areas where there has been loss of interdental bone height, care must be taken to avoid any surgical procedure that would compromise the blood supply to the interdental papilla, as this is likely to result in loss of papilla height. In some cases it may be possible to reflect soft tissue from only the palatal or buccal aspect and utilize a tunneling approach for any interproximal osseous recontouring. In other cases it may be necessary to perform surgical treatment separately from the buccal and lingual aspects with a 6- to 8-week healing interval between procedures in order to avoid compromise of the blood supply to the interdental papilla. Restoration of lost interdental papilla height is usually unpredictable, though it may be accomplished in some cases using orthodontic extrusion; it is preferable, therefore, to plan treatment that will preserve the interdental papilla.

Fig. 1. A 16-year-old girl had completed orthodontic treatment, but was dissatisfied with the aesthetic outcome due to excessive gingival display.

Case reports

Case 1

A 16-year-old girl presented to the dental service at a large teaching hospital with a chief complaint of an unacceptable aesthetic result following orthodontic treatment. The patient was in excellent general health with no known allergies, did not take any medication and denied use of tobacco. Traditional nonsurgical orthodontic treatment had been performed over a period of 3 years, resulting in favorable tooth alignment, but excessive gingival display in the maxillary arch significantly compromised the aesthetic outcome (Fig. 1). The patient's orthodontist referred her to the hospital dental service, believing that orthognathic surgery might be necessary. A thorough examination revealed face height and lip length to be within normal range; a combination of delayed passive eruption and gingival enlargement

Fig. 2. Delayed passive eruption and gingival enlargement were determined to be the cause of excessive gingival display.

Fig. 4. One year following crown lengthening, the patient continues to maintain the health, function and aesthetics of the periodontium.

Fig. 3. Gingival architecture before (A) and 6 months after (B) surgical crown lengthening in the maxillary anterior sextant

Fig. 5. 26-year-old woman with chief complaint of a "gummy smile"

Fig. 6. Poorly contoured restorations, gingival inflammation and loss of interdental papillae

were determined to be responsible for the excessive gingival display (Fig. 2). Surgical crown lengthening was performed in the maxillary anterior sextant under local anesthesia; weekly follow-up visits for the first month and biweekly visits for the next 5 months ensured that meticulous plaque control was

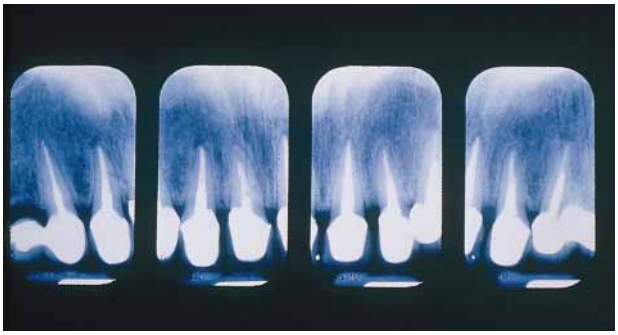

Fig. 7. Existing restorations were impinging upon the biological width of the periodontium.

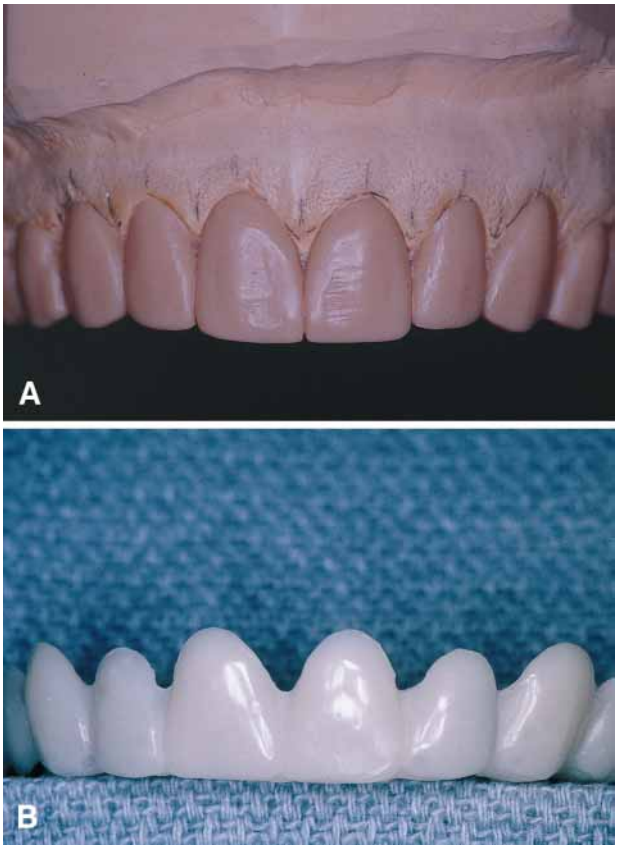

Fig. 8. Diagnostic wax-up (A) and surgical guide (B) demonstrating the location of future restoration margins

maintained and optimum healing occurred (Fig. 3). Subsequent recall visits at 3-month intervals during the next year revealed that the patient continued to perform highly effective plaque control, and was very pleased with the aesthetic result (Fig. 4).

Case 2

A 26-year-old woman presented to the advanced periodontology department of our school of den-

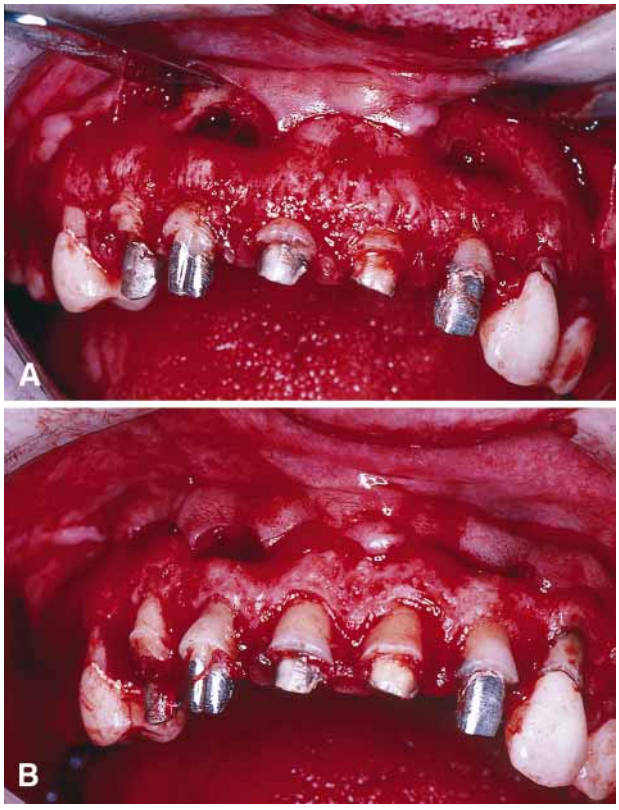

Fig. 9. Before (A) and after (B) ostectomy and osteoplasty

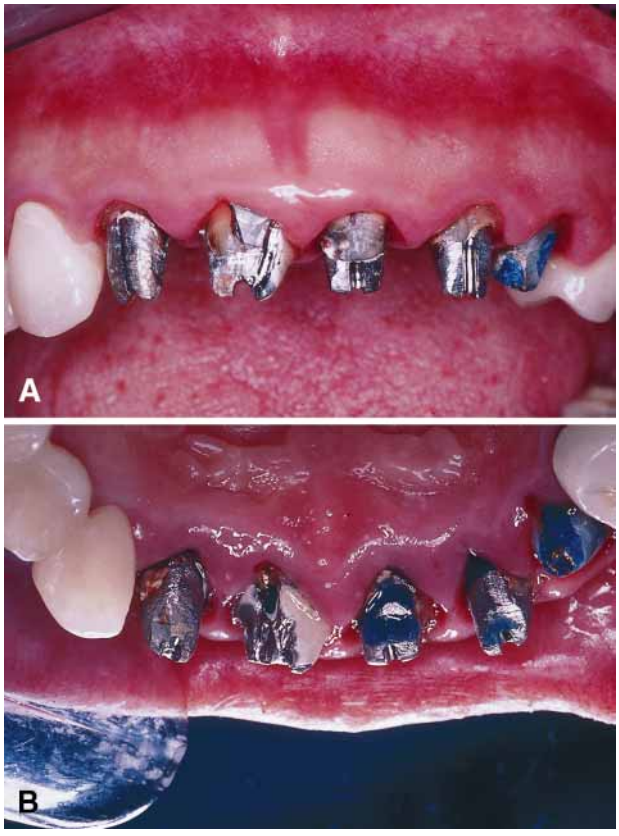

Fig. 10. Stable gingival contours 6 months after surgical crown lengthening: buccal (A) and palatal (B) views

Fig. 11. Final restorations (A); periodontal health and ideal gingival display have been accomplished (B). Courtesy of Kian Kar and James Kim.

tistry with a chief complaint of a "gummy smile" (Fig. 5). The patient was in excellent general health with no known allergies, took no medication and denied use of tobacco. Examination revealed poorly contoured ceramometal restorations, gingival inflammation and loss of interdental papillae (Fig. 6). Existing restorations were violating the biological width of the periodontium (Fig. 7), a factor which contributed to chronic inflammation. A diagnostic wax-up was performed to establish the desired end result of periodontal and restorative treatment (Fig. 8a). Using this wax-up, a surgical guide was fabricated to facilitate the crown-lengthening procedure (Fig. 8b). Use of the surgical guide is essential in cases where provisional restorations are not prepared prior to crown lengthening so that the surgeon can accurately identify the future location of the restoration margins and ensure that at least 3 mm of clearance exits between the margin and the crest of alveolar bone (Fig. 9). After allowing at least 6 months for healing and stabilization of gingival margins (Fig. 10), final restorations were placed, providing a remarkable improvement in periodontal health and aesthetics (Fig. 11).

Case 3

An 18-year-old woman presented to the restorative department of our dental school with a defective restoration margin on tooth 9 (Fig. 12a) that had received prior endodontic therapy (Fig. 12b). The patient was in excellent general health with no known allergies, took no medication and denied use of tobacco. In order to establish a sound margin for the new restoration, it was necessary to extend the preparation apically in close proximity to the alveolar crest. If crown lengthening alone were performed a discrepancy would result between the height of the gingival margins on teeth 8 and 9. To avoid this outcome, the existing full coverage restoration on tooth 9 was removed and reduced in height, a cast post and core was constructed, and the original restoration was provisionally cemented. Orthodontic brackets were then placed, and tooth 9 was extruded

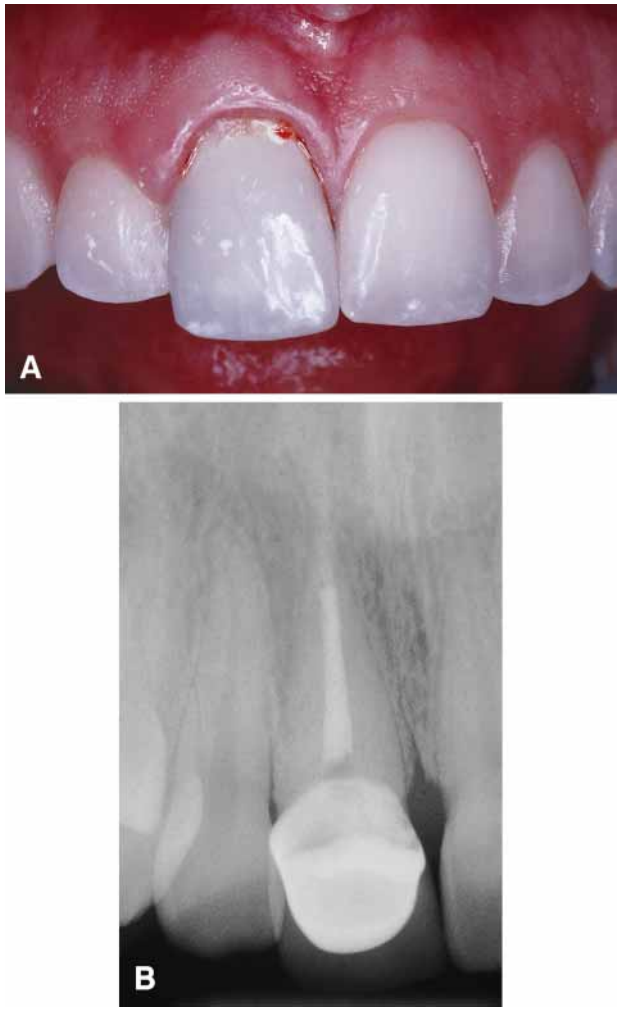

Fig. 12. 18-year-old woman with defective restoration on tooth 9 (A) that has received prior endodontic therapy (B)

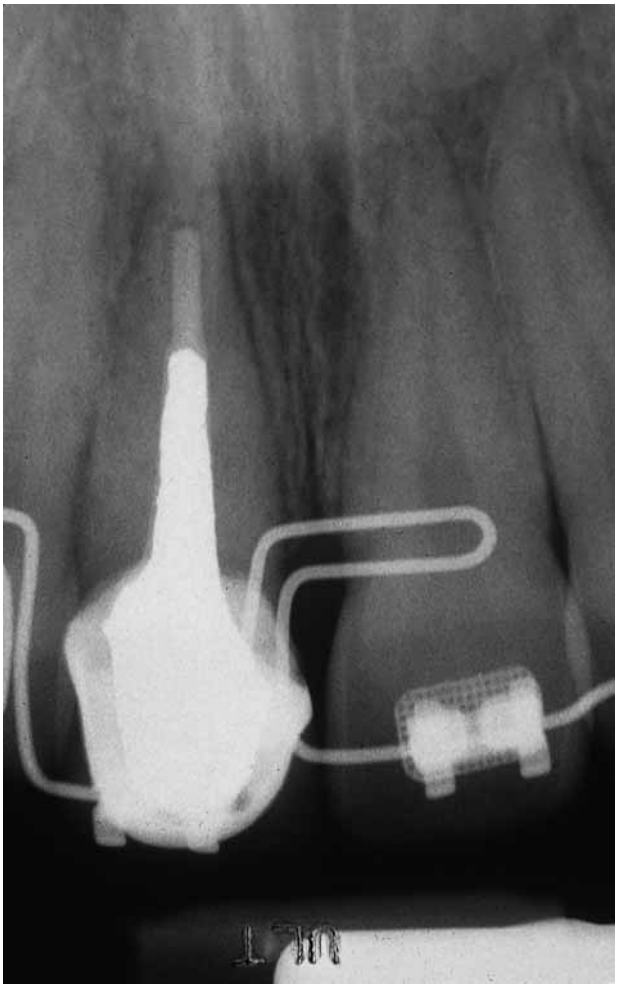

Fig. 13. After placement of a cast post and core, incisal reduction and provisional cementation of the original restoration, tooth 9 is orthodontically extruded and retained for 5 months.

1 mm per week for 3 weeks and then stabilized for 5 months (Fig. 13). Surgical crown lengthening was then performed, consisting of full-thickness mucoperiosteal flap reflection (Fig. 14a), ostectomy in order to provide harmony with adjacent teeth and at least 3 mm clearance between the final restoration margin and the alveolar crest (Fig. 14b). Palatal and interproximal soft tissue was not manipulated in order to preserve the interdental papillae. Ostectomy and osteoplasty in interdental areas were performed using a tunneling technique. The buccal flap was replaced with interrupted sutures (Fig. 15); after 2 months the preparation was refined and a new provisional restoration constructed, which remained for an additional 4 months (Fig. 16) prior to placement of the final restoration. Gingival health, comfort and optimum aesthetics were achieved and maintained (Fig. 17).

Case 4

A 28-year-old woman presented for periodic examination. The patient was in excellent general health with no known allergies, did not take medication and denied tobacco use. Clinical, radiographic and microbiological data were used to arrive at a diagnosis of early-onset periodontitis (Fig. 18). Oral hygiene instruction, scaling and root planing, antimicrobial therapy and periodontal surgery were performed to

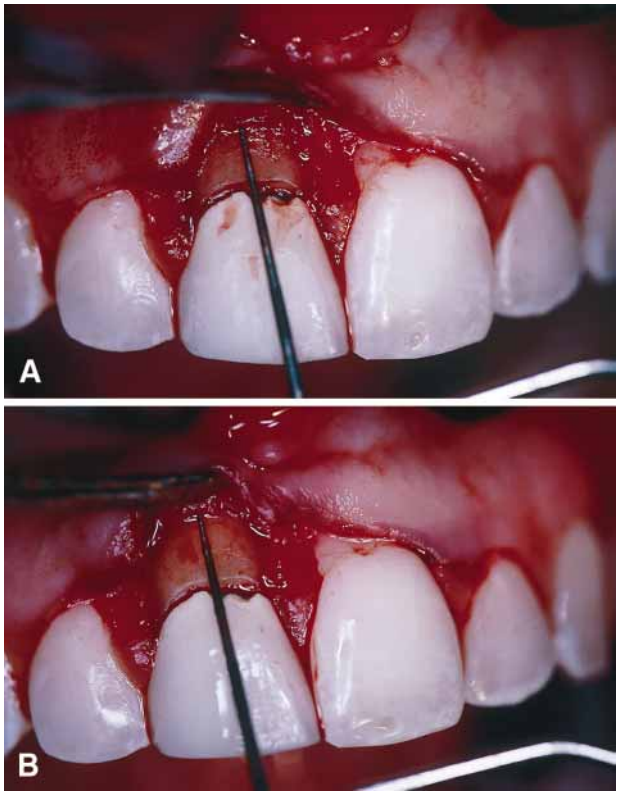

Fig. 14. Mucoperiosteal flap reflected, pre-ostectomy (A) and post-ostectomy (B)

Fig. 15. Flap sutured

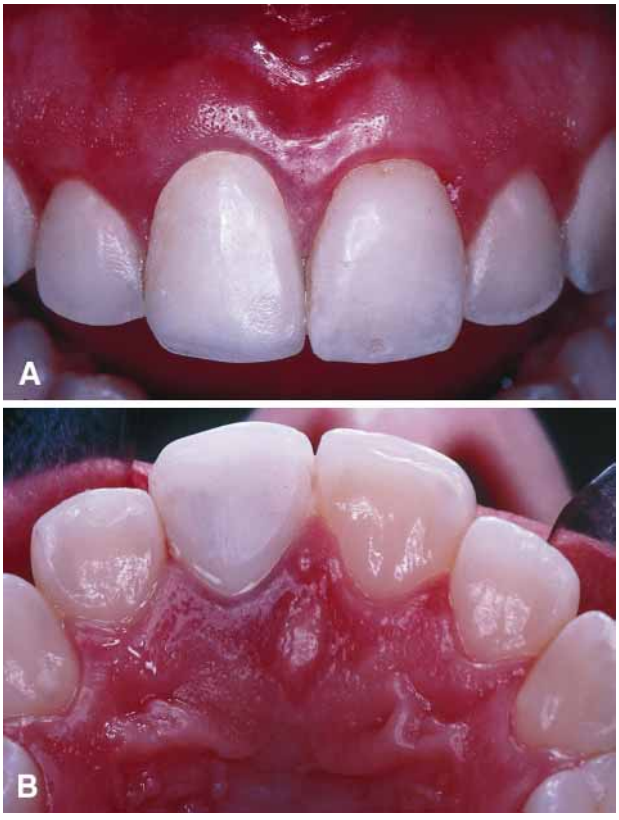

Fig. 16. Healing at 6 months with new provisional restoration: buccal (A) and palatal (B) views

Fig. 17. Final restoration 18 months after crown lengthening

reduce inflammation and allow for healing and repair of osseous defects. Resulting soft tissue contours were less than ideal from an aesthetic perspective (Fig. 19). Orthodontic extrusion was performed on tooth 8 (Fig. 20), using gentle forces in order to bring the periodontium coronally with the tooth (Fig. 21). Tooth position was stabilized for 6 months prior to fabrication of a new restoration on tooth 8, resulting in an aesthetic long-term result (Fig. 22).

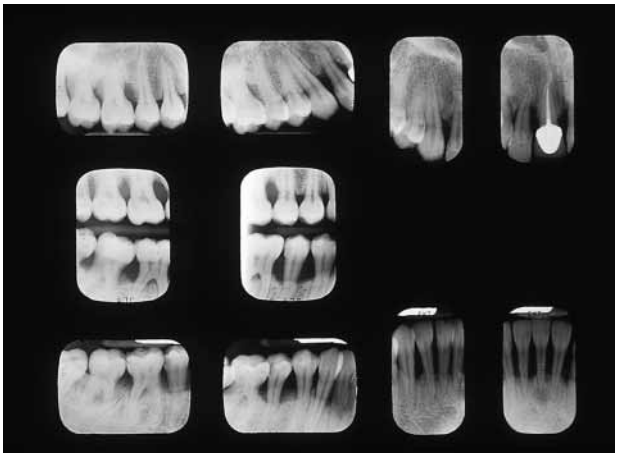

Fig. 18. Radiographic findings consistent with early-onset periodontitis

Fig. 19. Following definitive periodontal treatment, the gingival margin of tooth 8 is apical to the gingival margin of tooth 9.

Fig. 20. Orthodontic extrusion is performed on tooth 8.

Fig. 21. Following extrusion, gingival margins of teeth 8 and 9 are in harmony.

Fig. 22. Final restoration on tooth 8 after 2 years

Fig. 23. 32-year-old woman with loss of interdental papillae and chronic gingival inflammation

Case 5

A 32-year-old woman presented for periodontal consultation following extensive restorative treatment with an unsatisfactory aesthetic result. The patient was in excellent general health with no known allergies, took no medication and denied use of tobacco. Loss of interdental papillae and chronic gingival inflammation were noted (Fig. 23). Treatment consisted of a combination of orthodontic extrusion, to bring the periodontium coronally and help restore lost interdental papilla height, and surgical crown lengthening, to establish proper biological width and optimal gingival contours. Eight months following surgical treatment, final restorations were placed, providing the patient with a highly aesthetic result. Effective daily plaque control performed by the patient and periodic recall appointments ensure continued periodontal health, comfort and aesthetics (Fig. 24).

Case 6

A 40-year-old woman presented for periodontal consultation with a chief complaint of "gummy smile"

Fig. 24. A combination of orthodontic extrusion and surgical crown lengthening produced a stable, functional and aesthetic result, shown here 18 months following placement of final restorations.

Fig. 25. 40-year-old woman with a chief complaint of "gummy smile"

Fig. 26. The condition was diagnosed as delayed passive eruption.

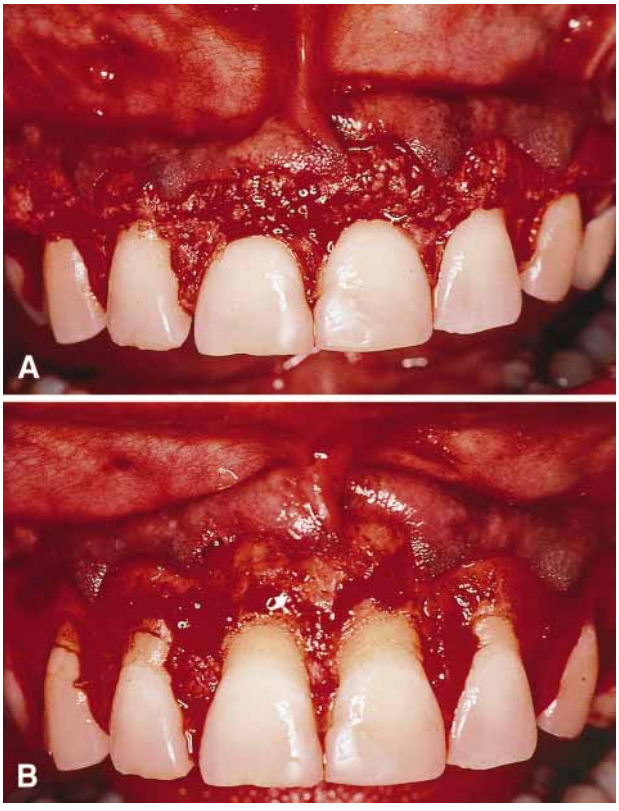

Fig. 27. Crestal bone was at the level of the cementoenamel junctions (A) and was subsequently recontoured (B) to permit healing of the dentogingival junction with an optimum display of the clinical crowns.

(Fig. 25). The patient was in excellent general health, took no medication and denied use of tobacco. After clinical and radiographic examination a diagnosis of delayed passive eruption was determined (Fig. 26). Mucoperiosteal flap reflection from the buccal aspect revealed alveolar bone to the level of the cementoenamel junctions (Fig. 27a). Neither palatal nor interdental soft tissue was reflected in order to ensure maintenance of interdental papillae. Osseous recontouring was performed on the buccal aspect to locate the alveolar crest 3 mm apical to the cementoenamel junction (Fig. 27b). This allowed the dentogingival junction to heal with the gingival margin at the level of the cementoenamel junction. A stable, aesthetic result is seen 18 months following the crown-lengthening procedure (Fig. 28).

Case 7

A 30-year-old woman presented for routine periodic examination. The patient was in excellent health, took no medications and denied use of tobacco. Radiographic examination revealed extensive caries on the distal aspect of tooth 12, which had been previously treated endodontically (Fig. 29). In order to achieve harmony of the periodontium with the adjacent teeth without performing osseous resection on the cuspid and second bicuspid, tooth 12 was orthodontically extruded approximately 1 millimeter per week for 4 weeks (Fig. 30). By moving the tooth

Fig. 28. A stable, aesthetic result is seen intraorally (A) and extraorally (B) 18 months following the crown-lengthening procedure.

Fig. 29. Endodontically treated maxillary first bicuspid with extensive caries on the distal aspect

Fig. 30. Orthodontic extrusion is performed so that crown lengthening can be performed only on tooth 12, thereby preserving aesthetics.

Fig. 31. After 4 mm of extrusion and 4 months of stabilization, orthodontic brackets are removed.

closer to the occlusal plane, the overall length of the tooth was reduced, resulting in a more favorable crown–root ratio. After 4 months of stabilization, the brackets were removed (Fig. 31). After post-and-core cementation and provisionalization, mucoperiosteal flaps were reflected (Fig. 32a) and osseous recontouring was performed resulting in adequate biologi-

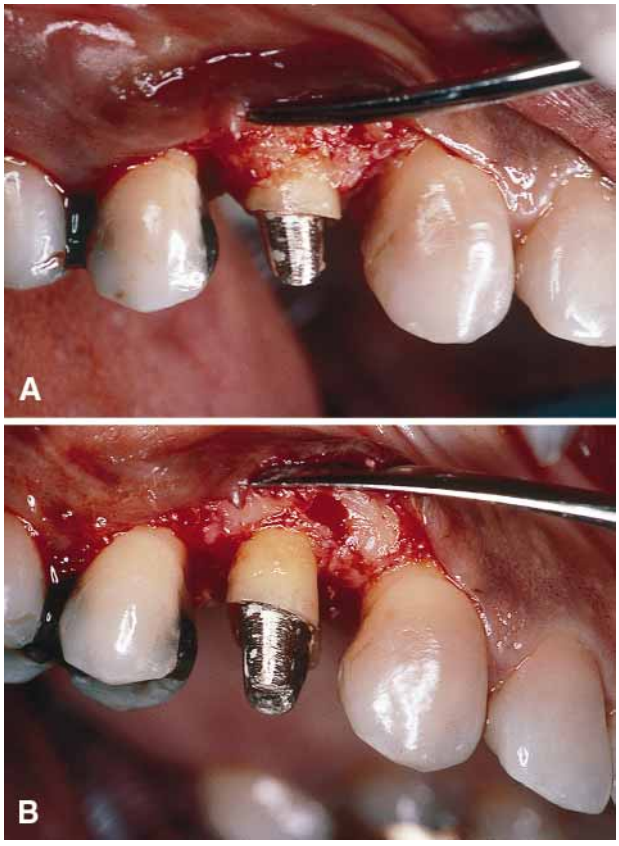

Fig. 32. Mucoperiosteal flaps were reflected (A) and osseous recontouring was performed (B).

Fig. 33. Clinical appearance 1 year following crown lengthening

cal width while preserving aesthetics (Fig. 32b). The final restoration was placed 6 months later and is seen here clinically (Fig. 33) 1 year following the crown-lengthening procedure.

Summary and conclusions

Contemporary dental treatment must result in true oral health, incorporating comfort, function and aesthetics. The key to a successful outcome with long-term stability is the establishment of an accurate diagnosis and subsequent development of a comprehensive treatment plan. The astute clinician will recognize underlying skeletal variations that may not be corrected by periodontal and restorative procedures alone. Understanding the cause of the condition to be treated will facilitate selecting and sequencing procedures that will produce a stable result. Attention should be given to facial symmetry, face height, lip anatomy, profile and smile line when performing the extraoral examination. Intraorally, important considerations include condition and dimensions of the teeth; height of the anatomic crowns versus height of the clinical crowns; thickness, width, position and contour of gingival tissue; root anatomy; and topography of the alveolar bone. The integrity of the dentogingival junction must be observed by ensuring adequate biological width. Harmony must exist between soft and hard tissue and between the periodontium of adjacent teeth. Often a combination of orthodontic extrusion and surgical crown lengthening can be employed to minimize the need for resective therapy on adjacent teeth, improve the crown–root ratio and facilitate a more aesthetic outcome. Orthodontic extrusion is also invaluable as a means to regain lost height of interdental papillae. Margin placement during tooth preparation for full coverage restorations should be guided by the position of the cementoenamel junction; hence, interproximal margins, particularly on anterior teeth, will be more coronal than buccal and lingual margins. This will help ensure adequate biological width and maintenance of healthy, intact interproximal papillae. When periodontal surgical procedures are performed in anterior areas, it is necessary to defer placement of final full coverage restorations for approximately 6 months in order for the level of the gingival margin to stabilize. In patients with particularly thin buccal alveolar bone and gingiva, it may be prudent to monitor maturation of the healing tissue for a longer period of time, and in patients with relatively thick buccal alveolar bone and gingiva it may be reasonable to place final restorations less than 6 months following periodontal surgery. Effective daily plaque control and periodic recall are essential to maintain long-term stability. By following the guidelines outlined in this chapter, the clinician will promote a stable, comfortable and functional periodontium and provide the patient with an optimal aesthetic result.

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