

# Crown Lengthening: A Clinical Review

Toby R. Talbot, Peter F.A. Briggs and Mary T. Gibson

The use of crown lengthening surgery as an adjunct to restorative therapy was first suggested by Rosen and Gitnick.<sup>1</sup> This technique is designed to increase the clinical crown heights of teeth requiring restoration following extensive wear through attrition, abrasion and erosion. This loss of tooth tissue and resulting clinical crown height may be localized to a few teeth or affect the entire dentition. This clinical problem is reflected by the increasing number of reports of treatment of the worn dentition.

Recent developments in operative techniques have allowed for the restoration of lost tooth tissue, using combinations of resin, resin/porcelain and resin/metal for cosmetic and/or functional reasons. However, when cast restorations are indicated, increased crown height is required to ensure adequate retention and resistance form. Clinical crown height is defined as the distance from the gingival margin to the incisal/occlusal table. The healthy gingival margin appears to maintain a predetermined relationship to its underlying crestal bone. Considerable inter- and intra-subject variations of 4.0-7.00 mm have been demonstrated.<sup>2</sup> This

dimension has been referred to as the 'biological' width and comprises the summation of the supra-crestal connective tissue attachment, the junctional epithelium and the sulcus depth (Figure 1).

Accordingly, any surgical violation of this critical minimal dimension in the pursuit of increased clinical crown height is liable to relapse, thereby thwarting the surgical objective. However, placement of restoration margins that impinge upon the supra-crestal connective tissue produces a persistent inflammatory response. This may represent a plaque-induced experimental gingivitis (as in a ligature-induced experimental gingival inflammation in animal models), or nature's attempt to re-establish the biological width by distancing the marginal tissues from the offending

irritant. The second response would be accompanied by a corresponding resorption of crestal bone. However, this may not be accomplished in the individual resistant to periodontal disease, possibly explaining the persistent painful symptoms complained of by such patients. In such cases therefore, the clinician is faced with replacing the offending restoration and/or gingival surgery coupled with resection of the bone crest to re-establish the biological width. In patients who are more

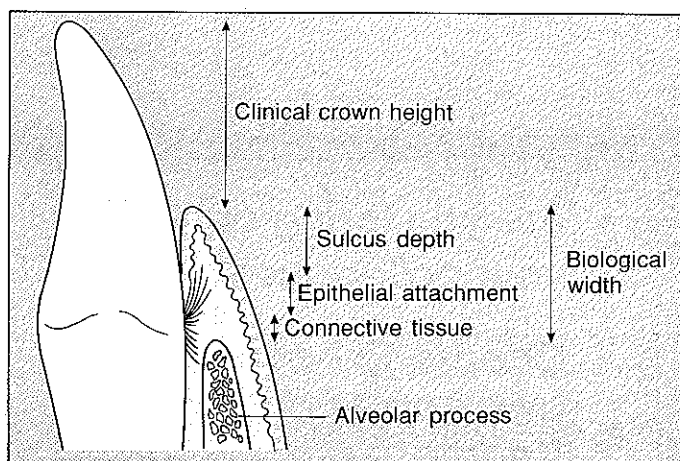


Figure 1. The biological width is the summation of sulcus depth, epithelial and connective tissue attachments.

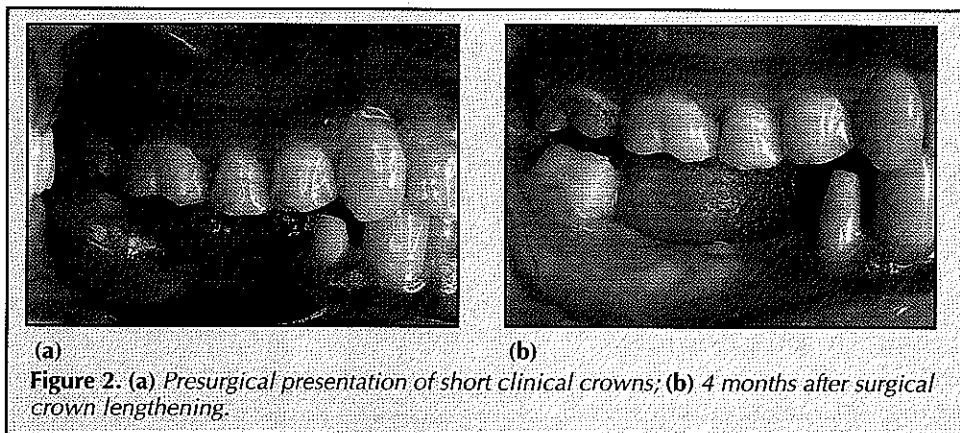


Figure 2. (a) Presurgical presentation of short clinical crowns; (b) 4 months after surgical crown lengthening.

Toby R. Talbot, BDS, MSD, FDS RCS, Locum Consultant, Restorative Dentistry, St George's Hospital, and Senior Registrar, Restorative Dentistry, Eastman Dental Hospital, London, Peter F.A. Briggs, BDS, MSc, FDS RCS, Senior Registrar, Restorative Dentistry, St George's Hospital, London, and Mary T. Gibson, BDS, MSc, FDS RCS, Lecturer in Periodontology, The Dental Institute, The Royal London Hospital.

susceptible to plaque-induced loss of periodontal attachment this supracrestal connective tissue and bone reduction may come about spontaneously over a period of time.

The sequelae described above may be avoided by ensuring that restoration margins remain coronal to, or just within, the gingival sulcus without any violation of the junctional epithelium (and thereby the connective tissue attachment). When crown lengthening is indicated the specific recommendation that crown margins should be placed at minimal distances of between 1.5 mm<sup>3</sup> and 4.00 mm<sup>4</sup> from the crestal bone cannot be reconciled with the wide variations in biological widths observed at different sites and should be determined for each case. Finally, methods of tissue retraction used to facilitate tooth preparation and impression making should avoid damaging the supra-crestal attachment. The risk of this appears to be greatest with electrosurgery, during which any damage sustained may be masked by the concomitant haemostatic effect of the technique. The clinician needs therefore to be especially vigilant when using electrosurgery.

### SURGICAL PLANNING

Assessment before surgery for crown lengthening must include diagnostic casts and intra-oral periapical radiography, with special reference to root length and form and bony and furcation morphology.<sup>5</sup> Pulpal size is critical to the cosmetic and functional demands of the restorative materials and where pulpal integrity would be compromised an increased vertical dimension of occlusion should

be considered. This influences the extent of surgical resection of supporting periodontal tissues. Thus, where an increase in the vertical dimension of occlusion is appropriate, less of the supporting tissue will be sacrificed. The amount of bone removed will be influenced by:

- short tapered root form; and
- the presence of high furcations.

In the first case, the surgical exposure of exaggerated tapering anterior root form would result in unsightly spaces and would therefore limit the amount of interdental tissue resection. The second hazard (of furcation exposure) may cause later difficulties in plaque control. This may have to be accepted as a compromise, although it will ultimately be of little clinical significance because these patients often appear to be highly resistant to plaque-induced periodontal breakdown. Finally, radiographs should be carefully examined for the possible presence of lateral canals in the furcations, the exposure of which may have pulpal complications.

The presence of periodontal pocketing associated with bone loss frequently obviates the need for bone removal. In these instances, and where gingival overgrowth has occurred, simple soft tissue resection will usually suffice.

It should be clear from the above that very close communication between the restorative dentist and the periodontist is fundamental to the successful management of these difficult cases.

### SURGICAL TECHNIQUE

If bone removal is unnecessary, the supra-crestal soft tissues are reduced by resection or apically repositioning;<sup>6</sup> the former would always be performed in the palate but the choice elsewhere depends upon the features of the case. The tissue resection technique is dependent upon operator preference and may be carried using external or internal bevel incisions: the latter minimizes post-surgical connective tissue exposure and ensures optimal interdental mucosal coverage by facilitating an exaggerated scalloping that conforms to the smaller convexity of the root compared to crown. Such scalloping is especially applicable when apical repositioning is used in surgical crown lengthening.

Soft tissue resection not requiring bone involvement may also be carried out by electrosurgery, but great care must be taken to avoid direct contact with bone.<sup>7</sup> In these instances, the preservation of a minimum of 3.00 mm of supra-crestal soft tissue attachment should preclude any such risk. Similarly, with flap surgery the flap margin should not be positioned less than 3 mm coronal to the crestal bone. If, as

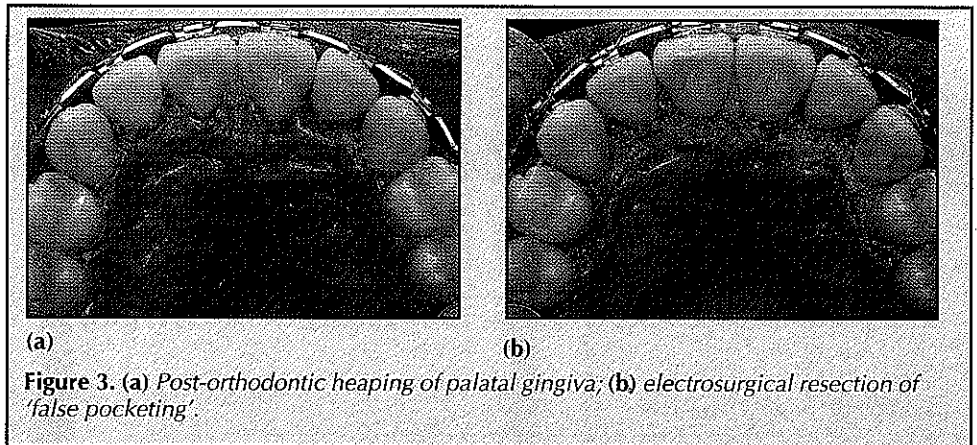


Figure 3. (a) Post-orthodontic heaping of palatal gingiva; (b) electrosurgical resection of 'false pocketing'.

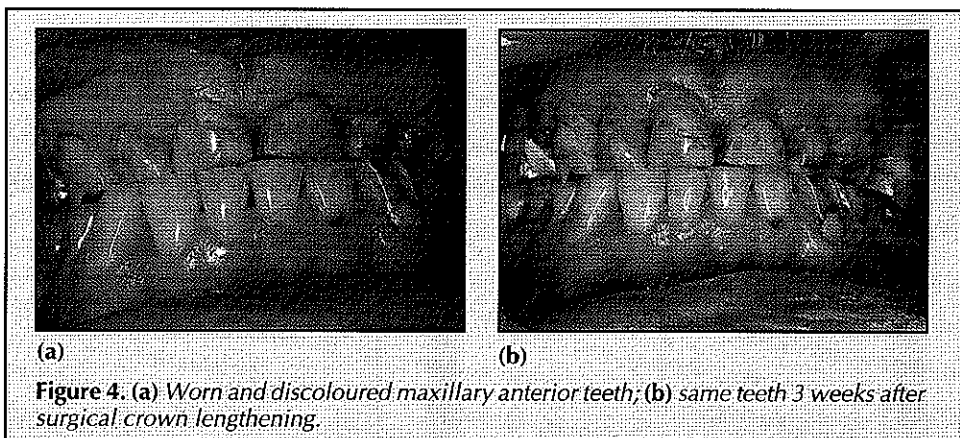


Figure 4. (a) Worn and discoloured maxillary anterior teeth; (b) same teeth 3 weeks after surgical crown lengthening.

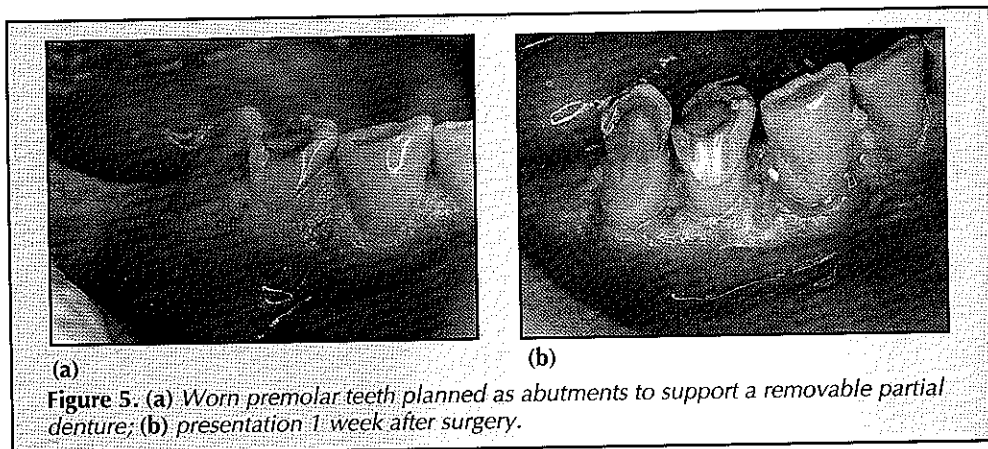


Figure 5. (a) Worn premolar teeth planned as abutments to support a removable partial denture; (b) presentation 1 week after surgery.

often happens, a closer approximation has been carried out, the normal supra-crestal tissue dimensions tend to re-establish themselves. This is manifested by the coronal creeping of the marginal tissues following much crown lengthening surgery.<sup>8</sup>

**Bone Removal**

The removal of bone in any crown lengthening surgery is effected with chisels or burs under continuous irrigation, taking care to avoid direct root contact.

Rates of healing following the use of both slow and fast handpieces are similar: with the fast handpiece, the hazard of surgical emphysema must be avoided. The ultrasonic scaler is particularly useful in the final stages of bone removal when likelihood of damage to the root surfaces is greatest and in confined interdental spaces.

**Postoperative Care**

Postoperative care is the same as for any periodontal surgery but greater pain, presumably as a consequence of bone involvement, may be experienced. The patient must be warned of this before surgery; also that dentinal sensitivity is to be expected. This is managed by a neutral pH fluoride (such as Fluoriguard from Colgate-Palmolive) daily mouth rinse or by placement of the provisional restorations.

briefly presented.

**Inadequate Retention and Resistance Form**

*Short Clinical Crowns (Fig.2)*

● Conventional bridgework failure may be attributed to a short clinical crown, long edentulous spans and parafunctional activity. Surgical crown lengthening of the abutment teeth is

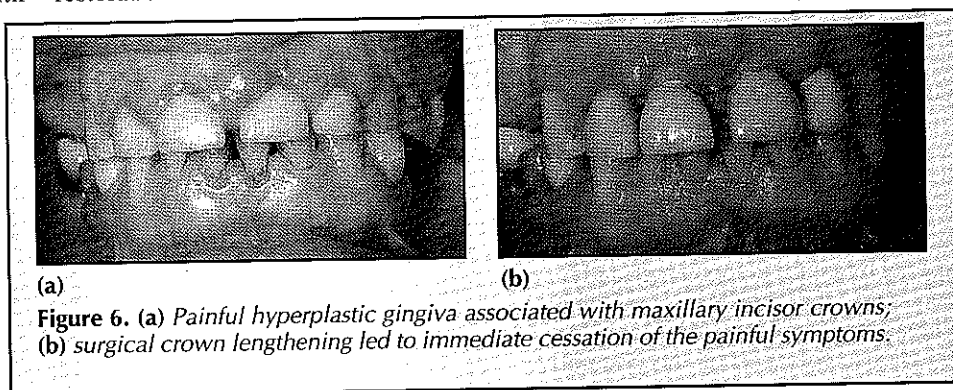


Figure 6. (a) Painful hyperplastic gingiva associated with maxillary incisor crowns; (b) surgical crown lengthening led to immediate cessation of the painful symptoms.

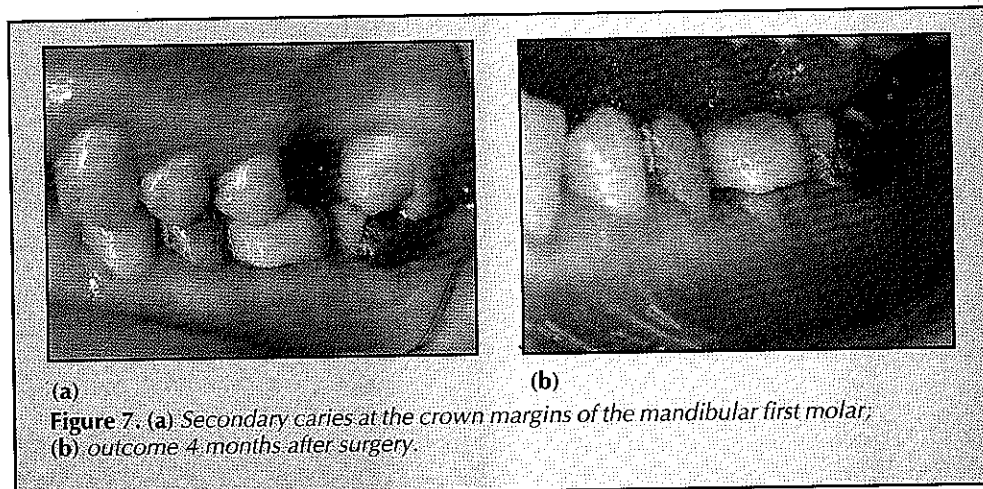


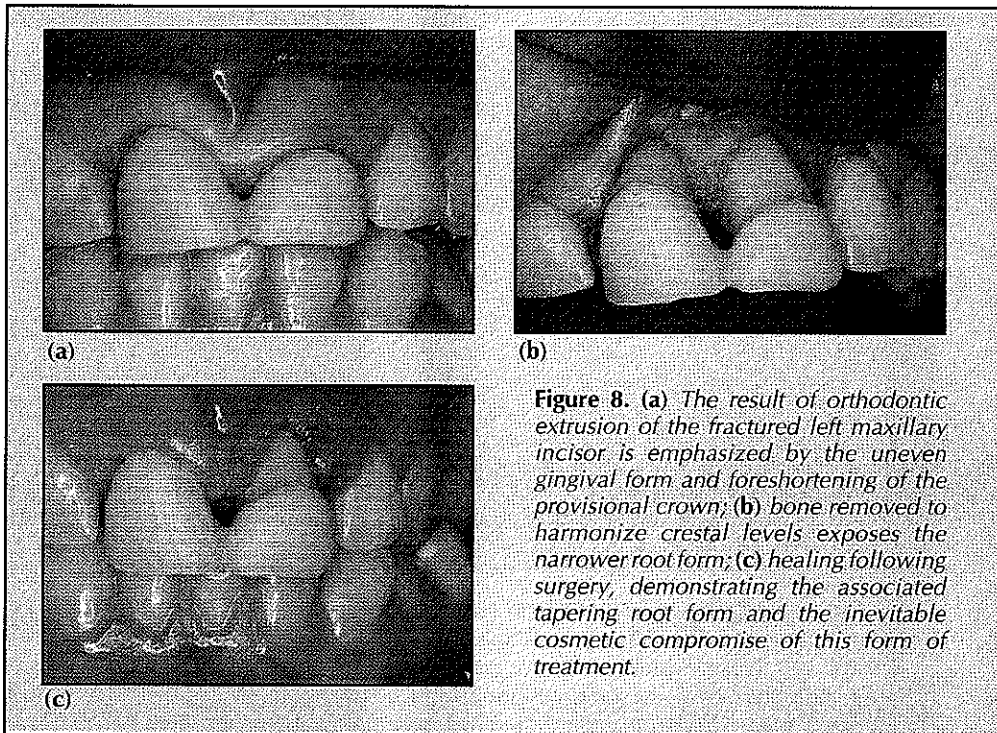
Figure 7. (a) Secondary caries at the crown margins of the mandibular first molar; (b) outcome 4 months after surgery.

necessary for bridge replacement or for individual crowns in conjunction with a removable prosthesis or implants.

● Resin-retained post orthodontic splinting of maxillary anterior teeth is frequently complicated by a palatal gingival plaque induced hyperplasia and may be aggravated by 'heaping' of the mucosa associated with tooth movement. The resulting problem of reduced crown height is resolved by surgical resection of the hyperplastic tissue (Fig 3)

**Occlusal Wear**

● Restoration of worn maxillary teeth necessitates



**Figure 8.** (a) The result of orthodontic extrusion of the fractured left maxillary incisor is emphasized by the uneven gingival form and foreshortening of the provisional crown; (b) bone removed to harmonize crestal levels exposes the narrower root form; (c) healing following surgery, demonstrating the associated tapering root form and the inevitable cosmetic compromise of this form of treatment.

● *Subgingival root fracture (Fig 8).* Root fractures extending apical to the crestal bone and involving the pulp present a therapeutic dilemma. Extraction and surgical exposure (with or without orthodontic extrusion) may be considered.<sup>9</sup> The last option invariably necessitates surgical crown lengthening to provide adequate retention and resistance form and to correct the resultant, inevitably displeasing, uneven gingival contour. The associated exposure of the narrower tapering root form represents shortcomings of this treatment and the final aesthetic compromise must always be considered during treatment planning.

surgical crown lengthening; (Fig 4) the existing vertical dimension of occlusion must be maintained and, to compensate for the necessary tooth surface reduction to accommodate the restorative materials.

- Individuals with parafunctional activity are liable to differential wear of teeth in the presence of opposing porcelain due to the inherent abrasive nature of the material. An increase in crown height is a prerequisite for the cosmetic restoration of such teeth.
- *Inadequate crown height for surveyed crowns (Fig 5)* Wear may be restricted to only a few teeth. When these teeth are required to support a removable partial denture the mechanical demands upon the retentive capacity of castings will be greater. Crown lengthening should be restricted, in these cases, to the premolars only.
- *Iatrogenic gingival inflammation (Fig 6)* The development of persistent inflammation following placement of subgingival restoration margins in individuals who normally perform careful oral hygiene suggests a plaque-induced 'experimental gingivitis' or the physical violation of the supracrestal periodontal attachment. If inflammation continues despite

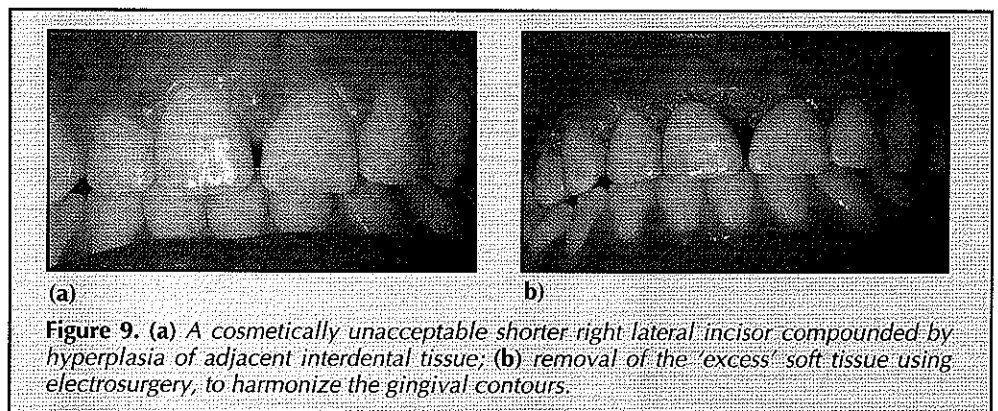
modified oral hygiene and professional cleaning and if the patient is no longer prepared to tolerate the gingival tenderness, surgical relocation of the supracrestal tissues away from the offending restoration margins is indicated. Any subsequent crown replacement in such cases should be located just within the gingival sulci to satisfy cosmetic demands.

#### *Subgingival Lesions*

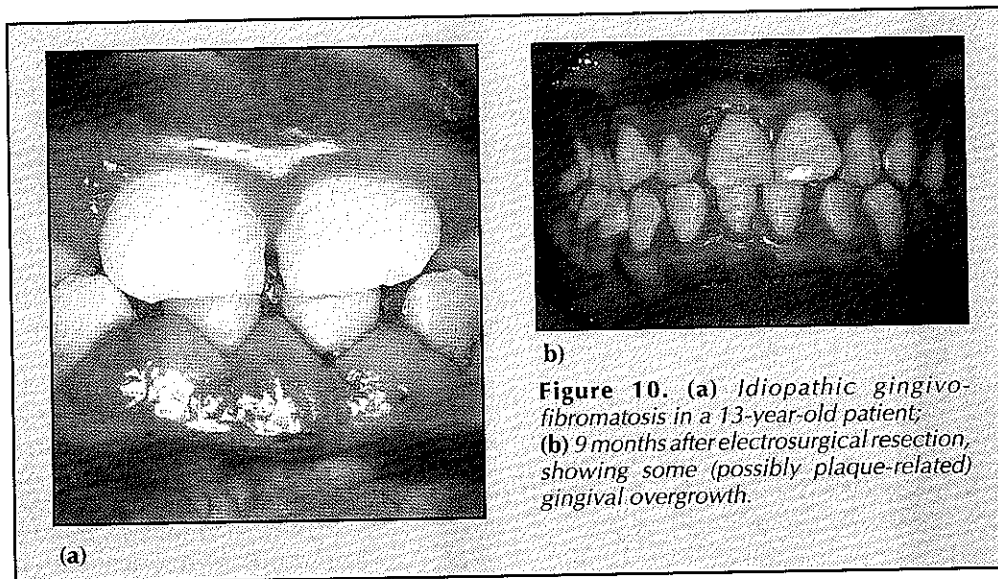
- *Subgingival root caries (Fig 7)* Root caries associated with inflammatory gingival hyperplasia or loss of attachment presents great difficulties in restorative treatment and necessitates the surgical exposure of these lesions.

#### **Dentogingival Aberrations**

- *Gingival disharmony (Fig 9)* Developmentally uneven gingival margins at adjacent teeth may be made worse by marginal gingival recession or hyperplasia. If the resulting gingival asymmetry poses a cosmetic problem, supracrestal soft tissue surgical correction of the tissue excess is indicated. This is most readily effected by a conventional gingivectomy procedure. These cases are amenable to resection with either the scalpel or electro-surgical device, according to operator preference. There does appear to be some risk of coronal relapse of the



**Figure 9.** (a) A cosmetically unacceptable shorter right lateral incisor compounded by hyperplasia of adjacent interdental tissue; (b) removal of the 'excess' soft tissue using electro-surgery, to harmonize the gingival contours.



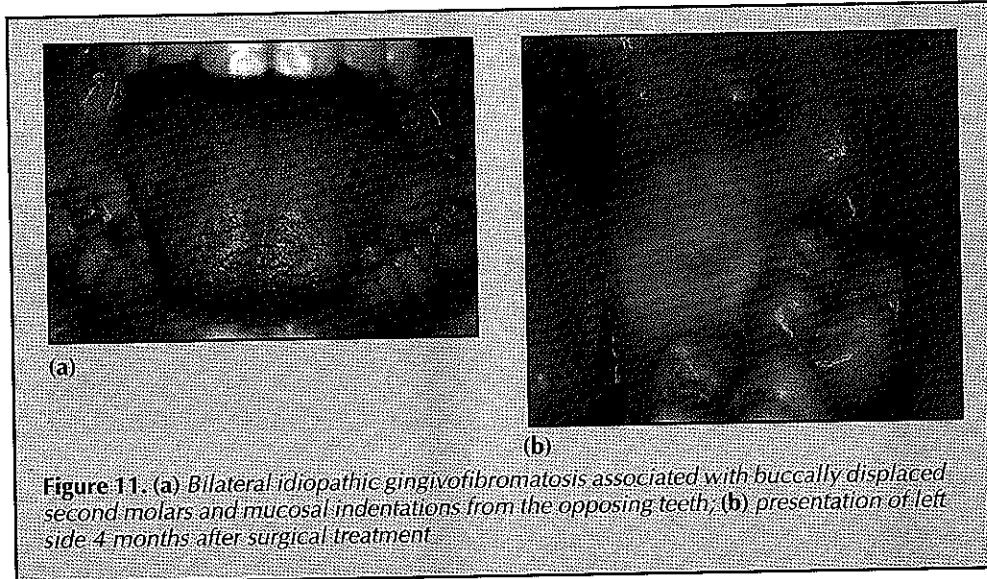
**Figure 10.** (a) Idiopathic gingivofibromatosis in a 13-year-old patient; (b) 9 months after electro-surgical resection, showing some (possibly plaque-related) gingival overgrowth.

marginal tissues in these cases.

- **Periodontal/restorative cosmetic interface** An aesthetically displeasing display in class II div. 2 anterior tooth relationships present a difficult treatment problem. Orthodontics and orthognathic surgery and tooth extraction may not be acceptable solutions. Gingival and osseous surgery coupled with coronal restorations offers a viable alternative.
- **Developmental gingival overgrowth (Fig 10)** Idiopathic gingivofibromatosis is characterized by considerable overgrowth of the supracrestal tissues and the resulting foreshortened crowns may necessitate surgical intervention

for cosmetic reasons. An inherent risk of relapse exists in such cases, although a bacterial plaque-induced exaggerated proliferative tissue response cannot be discounted. This may be controlled by effective oral hygiene.

- **Idiopathic gingivofibromatosis (Fig 11)** A retromolar developmental gingivofibromatosis may be associated with altered tooth eruption and position and could cause functional disturbances. Surgical resection is invariably indicated and may be required before any orthodontic realignment. An inverse bevel resection, which allows close adaptation of the remaining mucosa about the necks of the teeth, is preferred in such cases.



**Figure 11.** (a) Bilateral idiopathic gingivofibromatosis associated with buccally displaced second molars and mucosal indentations from the opposing teeth; (b) presentation of left side 4 months after surgical treatment

**SUMMARY/  
CONCLUSIONS**

As the general caries rate declines it becomes more normal to retain teeth 'for life', great challenges are posed by the worn dentition for the restorative dentist. Traditional treatment has often necessitated selective extraction and provision of overdentures. Pre-restorative crown lengthening procedures allow increased clinical crown heights to improve the retention and resistance form of the tooth preparations for placement of cast restorations. Close dialogue between the periodontist and restorative dentist is essential.

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