

11

# Surgical crown lengthening

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One of the themes of this series has been the changes that take place in the relationship of the teeth as they wear. This creates many of the difficulties that compromise the form of restorations, their occlusal relationships and adequate retention and resistance form. Part 9 described the strategies that were available for altering the occlusal relationships to provide more space and facilitate the restorative procedures.

Relative axial tooth movement not only creates space but reverses the changes in the position of the teeth that accompany wear. This results in the gingival tissues moving with the tooth so that reasonable clinical crown length often results. However, when it is intended to provide restorative treatment at the existing vertical dimension of occlusion, difficulties in providing adequate interocclusal clearance may so compromise the results that surgical crown lengthening becomes necessary. There are, however, finite limits as to how much lengthening of the clinical crowns of teeth can be achieved by surgical means. A further strategy for creating the necessary interocclusal clearance with adequate crown height is by increasing the vertical dimension of occlusion. However, there are again limits as to how much height and clearance can be gained by this technique. This is not so much related to patient tolerance but rather the adverse effect that it can have on the relationship of the anterior teeth. As the vertical dimension is increased, the mandible rotates so that it comes to lie further distally. This increases the overjet and can be sufficient to make contacts between the anterior teeth and hence adequate occlusal stability and anterior guidance difficult to achieve. The net result of the limitations with both techniques is that they are frequently combined to allow adequate crown height with sufficient interocclusal clearance to be achieved in preparations.

The clinical height of the crown of a tooth can be increased by the removal of the coronal portion of the periodontium together with crestal bone, using standard periodontal flap procedures. It is always necessary to use a flap procedure, unless the clinical crown is shorter than the anatomical crown, in which case gingivectomy procedures will suffice.

When planning how much tissue to remove, there must be at least 3 mm between the most apical extension of any restorative margin and

the crest of the alveolar bone. This figure is derived from human autopsy material which showed:<sup>1</sup>

- An average sulcus depth of 0.69 mm
- An average epithelial attachment of 0.97 mm
- An average connective tissue attachment of 1.07 mm.

These proportions between bone crest, epithelium and connective tissue attachment remained constant. The sum of the connective tissue and epithelial attachments ie the distance from the alveolar crest to the base of the gingival sulcus was referred as the 'biological width'.<sup>2</sup> This may vary between individuals but remains constant for one person.

Restorative procedures which encroach upon this always cause resorption of crestal bone and migration of the junction epithelium until the necessary 'biological width' has been re-established. The need to maintain it influences the amount of bone removal required during crown lengthening surgery. Once the clinician has decided on the clinical crown height necessary to restore the tooth, not only must sufficient bone be removed to achieve the desired crown height but the biological width must be taken into account. Failure to do so will result in inflammation. Where gingival tissue is thin, this can lead to recession and exposure of crown margins originally placed within the sulcus with an adverse effect on the aesthetics (fig. 1). Where the gingiva is thick, rather than recession, hyperplasia and chronic inflammation will be the result (fig. 2).

It may not be possible to remove the amount of tissue which is necessary to produce the desired crown height. Anatomical factors may limit bone removal and hence potential crown

**Restoration of worn teeth can be made easier by surgical crown lengthening. It improves appearance and facilitates tooth preparation. Anatomical features can limit the height that can be gained.**

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**Fig. 1 Thin gingivae with resultant recession associated with a maxillary anterior bridge**

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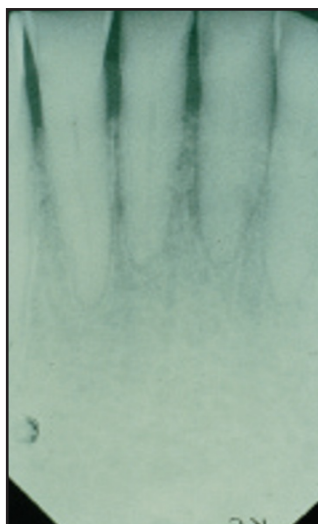
# PRACTICE

## tooth surface loss

**Fig. 2** Maxillary anterior crowns. Thick gingival tissue showing chronic inflammation



**Fig. 3** Radiograph showing cylindrical teeth



**Fig. 4** Metal collars on porcelain fused to metal crowns



**Fig. 5** Anterior view following crown lengthening surgery showing 'black triangles' between the teeth



lengthening. These factors include:

- The shape of single-rooted teeth
- The size of embrasure space and lip height
- Molar root morphology
- The width of interdental bone
- Muscle insertions
- Soft tissue aesthetics.

### Shape of single-rooted teeth

In order to fabricate metal-ceramic crowns it is generally necessary to remove a minimum of 1.3 mm of tooth to accommodate the restorative material. In thin teeth, because of the narrowness of the dentine at the level of the amelo-cemental junction it may not be possible to reduce the tooth by such an amount without either exposing the pulp or leaving the technician insufficient width to accommodate the materials used for a metal-ceramic crown. This results in over-contouring compromising plaque control.

Where single-rooted teeth tend to be cylindrical (fig. 3), if there is sufficient room at the level of the amelo-cemental junction to make the preparation, then extending the length of the clinical crown in an apical direction will still allow a reasonable crown preparation to be made. If there is insufficient room at the amelo-cemental junction, or if the tooth tapers significantly from that point, then metal-ceramic crowns can only be used without overcontouring if they have metal cervical collars. These require bevelled margins which need less tooth reduction in the marginal areas (fig. 4). The use of a metal collar has aesthetic implications if the patient has a high lip-line.

### Size of embrasure space and lip height

Where the tooth root tapers from the amelo-cemental junction to the apex, after crown lengthening the post-surgical aesthetics may be poor because of the appearance of the very wide embrasure spaces that leave black triangles between the teeth (fig. 5). This will be especially noticeable where the patient has a high lip-line. This effect can be partially reduced by either modifying the surgical technique in order to preserve the papilla or by over-building the neck of the crowns to reduce the size of the interdental area. The latter is difficult to do without compromising plaque removal.

### Molar root morphology

Single-rooted conical posterior teeth can be treated like anterior teeth provided the root does not have marked developmental grooves. Removing bone from the coronal end of a groove may leave gutters along which plaque can track in an apical direction. If this is anticipated odontology may be required to eliminate them.

Deliberate bone removal around multi-rooted teeth can result in exposure of the furcation entrance leading to problems in plaque

control which may encourage future loss of bone. Where a tooth has a short root 'trunk', crown lengthening all around the tooth will not be feasible. This is a diagnosis made from a radiograph (fig. 6). In this situation it may be possible to remove bone from the mesial and distal regions of a lower molar without compromising bone in the furcation area. This is less than ideal but may still be useful. If the radiograph (fig. 7) shows the tooth has a long root 'trunk', provided the need to maintain 3 mm. width between the most apical extension of the crown and the crest of the alveolar bone is recognised, bone may be removed around the circumference of the tooth.

A similar problem may exist in premolar teeth, especially in the maxillary arch. About 40 per cent of first maxillary premolar teeth have two roots, one buccal and one palatal. The result of this is a mesio-distal bi-furcation. Even if there are not two distinct roots, there may be a very distinct groove, usually on the mesial aspect. When removing bone, ideally it should be removed interdentially to give not only increased clinical crown height on the proximal surfaces but also to allow sufficient room for the re-positioned interdental soft tissue. In the multi-rooted bicuspid, it may not be possible to satisfy these aims.

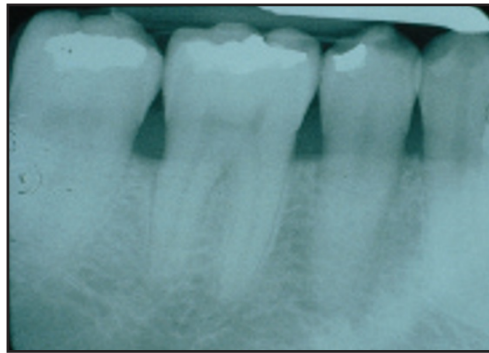
#### **Width of interdental bone**

When extending the height of the clinical crown it is not sufficient to remove bone only on the buccal or labial surface. It must also be removed interproximally as well as lingually or palatally. Failure to remove interdental bone may compromise the increase in crown height and consequently retention and resistance form of the restoration as well as leaving insufficient room to accommodate the interdental soft tissue.

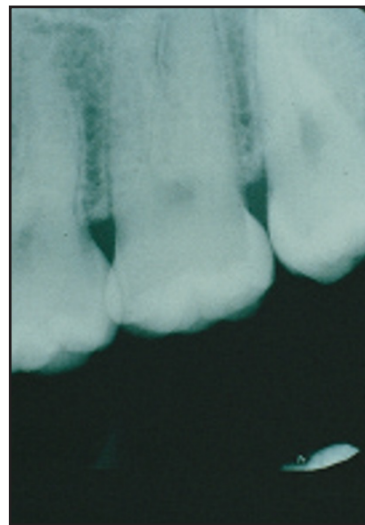
If a pre-operative radiograph shows very narrow interdental bone as a consequence of there being little space between adjacent teeth (fig. 8) it may be impossible to use instruments, either hand or rotary, to remove the interdental bone without damaging the adjacent tooth surfaces. In this situation consideration should be given to whether removal of the tooth and replacement with a pontic might be preferable.

#### **Muscle insertions**

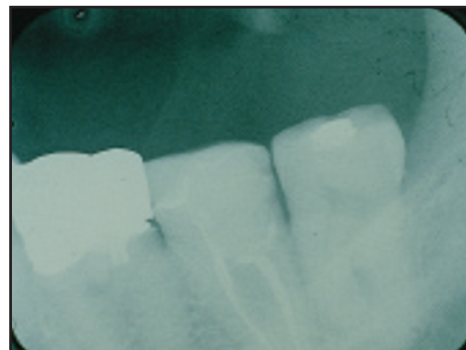
The depth of the vestibular fornix is determined by the underlying muscles. For example, in the mandibular anterior region, mentalis muscle is inserted at the maximum concavity of the labial surface of the mandible. When apically re-positioning a muco-gingival flap after bone removal to partially expose the root of the tooth, the space available to accommodate the flap is determined by the muscle insertion. A shallow vestibule due to the attachment of buccinator and mentalis muscles limits the space available to accommodate the re-positioned



**Fig. 6 Radiograph of a mandibular first molar showing a 'short trunk'**



**Fig. 7 Radiograph of a maxillary first molar showing a 'long trunk'**



**Fig. 8 Radiograph showing thin interdental bone between three mandibular molars**



**Fig. 9 View of maxillary anterior teeth showing unacceptable aesthetics**

muco-gingival flap which will in turn limit the amount of coronal extension possible. This is particularly a problem in those patients with an Class II occlusion. The nearer the gonial angle is to 90° the shallower will be the depth of the mandibular fornix in the anterior region.

**Soft tissue — aesthetic considerations**

Substantial re-contouring around a single tooth is rarely aesthetically successful in areas which show on smiling. Following healing, the contrast in soft tissue shape between the treated tooth and the untreated adjacent teeth may be noticeable, especially in the mid-line. A minimum of two central incisor teeth and often all six anterior teeth may need to be crown lengthened so as to produce acceptable aesthetics (fig. 9). If only one tooth requires crown lengthening, in order to gain even gingival heights, consideration should be given to forced eruption by means of orthodontics which is then followed by surgery. The latter is important to re-establish normal gingival contour as the periodontal attachment is erupted along with the tooth.

Following surgery, the gingival margin will not heal to its final position for 20 weeks. Wise showed that following crown lengthening procedures there was initially coronal movement of the marginal tissue following which there was apical shrinkage which continued until 20 weeks after surgery.<sup>3</sup> Therefore, if restorations are to be placed with their margins just sub-gingival, it is prudent to wait until 6 months after surgery to be certain that no further change in the position of the gingival margin takes place.

Having analysed all the anatomical factors

and decided on the amount of crown lengthening that is possible, if the clinician undertaking the restorative stage of treatment is not the same person who will undertake the surgery, it is essential that this information is communicated by trimming a set of stone casts to show the surgeon the final tissue contour required.

Finally, crown lengthening procedures, where the tissue is healthy, hurt! It is an essential part of treatment planning that the patient should be advised of this prior to surgery, so pain control measures can be undertaken. They should be advised pain does not indicate poor healing. Transient tooth mobility may occur and the use of a periodontal dressing on the labial and buccal surfaces is normal. This may mean scheduling appointments to fit in with social engagements.

Surgical crown lengthening procedures can form an essential adjunct to the restorative management of teeth affected by tooth surface loss. There are occasions when the restorative procedures cannot be completed without them. A previous paper in this series showed how orthodontic treatment could be of assistance in creating interocclusal space prior to restorative procedures in people with worn teeth. Periodontal surgery is another adjunctive procedure that must be considered at an early stage in planning restorative care. It is one of the frequently indicated strategies for assisting in creating adequate mechanical, occlusal and aesthetics outcomes in restorative treatment. The final article in this series will deal with reconstruction of the dentition damaged by tooth surface loss such that conservative methods are not appropriate.

- 1 Gargiulo A, Wentz F M, Orban B. Dimensions and relations of the dentogingival junction in humans. *J Periodontol* 1961; 32: 261-267.
- 2 Cohen D W. Current approaches to periodontology. *J Periodontol* 1964; 35: 5-18.
- 3 Wise M D. Stability of gingival crest after surgery and before anterior crown placement. *J Prosthet Dent* 1985; 53: 20-23.

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