



Surgical crown lengthening - building a solid foundation for restorative excellence

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Severely worn teeth, or teeth that are badly broken down, with little tooth structure remaining, can provide a significant challenge for restoration. Additionally, when such teeth are present in the anterior, they often pose an aesthetic problem. Surgical crown lengthening can be a very useful treatment in such cases. Crown lengthening can help ensure that the marginal placement of restorations remains supra or equigingival, thereby not causing problems for the health of the marginal gingiva.^{1,2} As periodontal health is paramount to the long term success of any restorative treatment, careful consideration should always be given to the interrelationship between restorative dentistry and the periodontal tissues. In basic terms, crown lengthening involves moving the dentogingival complex (gingival tissues/marginal bone) apical relative to the tooth, thereby exposing more of the tooth/root supragingivally.

Biologic width considerations

One of the more difficult concepts that needs to be grasped in relation to surgical crown lengthening is that of biologic width. In basic terms, it refers to the dimension between the crestal bone height and the free gingival margin. Studies have shown that the average dimensions for the biologic width is around 2.75-3.00mm.³ This allows for the establishment of a stable dentogingival complex, which consists of the sulcus depth, epithelial and connective tissue attachments to the tooth

root surface above the crest of the bone. A restorative margin should never be placed within less than 3mm from the crestal bone height, otherwise the margin will invade the space occupied by the biologic width. Violation of the biologic width can result in chronic inflammation/irritation of the marginal gingiva which can be uncom-

to the same proportion as it was prior to surgery, but with the dentogingival complex, more apically following the surgical crown lengthening.⁵

Anatomical considerations

When a patient is being assessed for surgical crown lengthening, it is important

Table 1. Indications for crown lengthening

Restorative/functional crown lengthening

- To access to subgingival caries
- To increase the clinical crown height reduced by tooth wear, caries or a fracture extending subgingivally
- To assist in creating a 'ferrule' effect
- Correcting the position of the restorative margin when there has been invasion of the biologic width
- Access to superficial root perforations (e.g. following pin placement)

Aesthetic crown lengthening

- Correction of short clinical crowns due to wear or altered passive eruption
- Creating gingival symmetry in the smile line
- Correcting irregular/uneven gingival margins
- Correcting for excessive gingival "Gummy smile" or hyperplastic tissue overgrowth

fortable for the patient, lead to bleeding, poor aesthetics and ultimately periodontal breakdown.⁴ There are some variations on the recommendations of ideal biologic width dimensions within the literature and it is important to remember that it is likely that individual variations may play a role in this variability. Lanning *et al.* found that the biologic width dimension on a particular individual would reestablish itself

to consider a number of key points prior to surgery. The first of these is length and shape of the root. Only patients with a favourable crown:root ratio should be considered and the root shape should not be so tapered as to predispose the tooth to pulp exposure during tooth preparation. The height of the furcation is also critical.⁶ Molar teeth that have a longer root trunk are preferable to



Figure 1. Functional crown lengthening required to assist restoration of this 35. Preoperative view from the buccal. Note insufficient tooth structure to allow predictable restoration.



Figure 2. Preoperative view of the 35. The tooth has been previously root filled and was restored with a full crown which failed.



Figure 3. Two weeks post surgery. Note significant tooth structure now supragingival. Crown lengthening was undertaken circumferentially around the tooth.



Figure 4. Occlusal view post crown lengthening surgery. Tooth will now be restored with custom cast-post-core and full crown. The supragingival tooth structure exposed by the surgery will allow for a good ferule effect to be created.

those teeth with a high furcation as the latter will be predisposed to surgically opening up the furcation, which may compromise the long term periodontal health and stability of the tooth.

In aesthetic cases, the height of the upper lip (smile line) needs to be carefully considered. In cases where patients present with a severe 'gummy smile', it is important to also assess the possibility of vertical maxillary excess (skeletal). Cases with skeletal vertical maxillary excess cannot be treated with crown lengthening alone and may also require discussions about orthognathic surgery and maxillary impaction. Examination of the lip position is also very important with aesthetic crown lengthening cases. Patients with hyper-mobility of the lip may also benefit from the judicious use of botulism toxin (botox), thereby limiting the degree of retraction of the upper lip.

A further consideration is the interdental space. Reduction of interdental bone can be very difficult due to space restrictions for instrumentation, surgical access and the risk of causing damage to the adjacent root surfaces.

Finally, it is important to also ensure that the crown lengthening surgery is not going to result in the loss of all the attached gingival tissue. Ideally, a zone of 2-3mm of attached gingival tissue should

be preserved around teeth. In cases with little attached gingival tissues prior to surgery, it may be preferable to consider apically repositioning the gingival margin rather than just resecting it away.

Indications for crown lengthening surgery

Crown lengthening can be indicated for both restorative or aesthetic needs. The long-term success of tooth supported fixed prosthetics (crowns/ bridges) is at least in part related to the amount of sound tooth structure available for restoration. Table 1 table highlights the key indications for both.

Surgical techniques

Soft tissue recontouring (Gingivectomy)

This technique is indicated in cases where there is excess gingival tissue. It consists of a gingivectomy procedure where a collar of marginal gingiva is removed to expose more of the crown of the tooth. As such, this is only indicated where the CEJ is more than 2mm below the free gingival margin. This is commonly encountered in patients with altered passive eruption (where the adult teeth do not appear to have fully erupted and there is excess gingival tissue covering the clinical crown. It is also



Figure 5. A 'gummy smile' pre-treatment.



Figure 6. Pre-treatment clinical picture prior to surgical crown lengthening. Upper incisors were previously restored with composite resin veneers.



Figure 7. Immediately post surgical crown lengthening with submarginal incisions, full thickness flap, osseous recontouring and apically repositioning the marginal gingiva.



Figure 8. All-ceramic crowns on 13, 12, 11, 21, 22, 23 three months after crown lengthening surgery.



Figure 9. Final smile post treatment. Significant reduction in gummy smile and better proportioned crowns.

seen in patients that have gingival hyperplasia, which can be related to inflammation, drug induced (e.g. antihypertensive mediations, antiepileptic) or hereditary. The gingivectomy is undertaken to excise excess tissue and allow the establishment of a normal gingival margin about 1mm coronal to the CEJ. A

gingivectomy should only be undertaken where there is adequate attached gingival tissues. If tissue is removed to the level of the bone, soft tissue rebound will be likely as the gingival tissues heal. This is a result of the re-establishment of the biologic width during wound healing.

Soft tissue recontouring can be undertaken using conventional surgery with a scalpel using either an external bevel incision or internal bevel (also sometimes referred to as an internal gingivectomy). Electrosurgery can also be used although extreme caution needs to be exercised when using this around the tooth roots. The use of electrosurgery for crown lengthening has largely been superseded by dental lasers. A simple diode laser can be a very useful instrument for performing an external bevel gingivectomy. The main advantages of using a dental laser over conventional surgery include minimal or no bleeding, detailed control of tissue removal, rapid wound healing and minimal post-operative discomfort.

Soft tissue and osseous recontouring

On the facial aspects of teeth, a submarginal incision is made following the shape of the gingival margin. A full thickness mucoperiosteal flap is then raised and the collar of tissue around the necks of the teeth is removed. This allows access to the marginal bone for osseous recontouring. If there is insufficient

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attached gingival tissues, intrasulcular incisions are made instead of submarginal, preserving the attached gingival tissue and the flap is then apically repositioned following osseous reduction.

If palatal lengthening is required, a scalloped inverse bevel incision is made and full thickness flap raised. Osseous recontouring is undertaken and the palatal tissues are repositioned to approximate the new position of the bone, apical to the original position.

Osseous recontouring can be carried out using hand instrumentation, periodontal bone files, back action chisels or rotary burs under irrigation with sterile saline. The technique typically involves smoothing/removing bone around the tooth roots and coming in close to the adjacent tooth roots but leaving a very thin layer. This is then removed with either an ultrasonic scaler or hand instruments, such as a surgical curette or chisel. Any bony ledges should also be removed at the time of surgery as this will assist with good adaption of the overlying flap. Osseous reduction should allow for a minimum of 3mm of exposed tooth root between the crest of the bone and the new restoration's margin.

With the advent of hard/soft tissue lasers such as the Er,Cr:YSGG laser, a less invasive approach to the crown lengthening process has been proposed by some authors.⁷ Both open and closed surgical techniques have been described. The former still involves raising a full mucoperiosteal flap and using the laser to recontour the bone instead of a rotary instrument. The closed surgical technique involved using the laser tip through the gingival sulcus to remove the bone. With the latter technique, great care needs to be exercised as the clinician is essentially working 'blind' with only tactile feedback providing a guide as to the position of the bone crest. Furthermore, in patients with thicker bone plates, frequently encountered posteriorly, there is the risk of troughing or creating intrabony defects when adopting a close surgical approach.

Dental lasers are also very useful in the weeks following surgical crown lengthening to undertake gingivoplasty for corrections of minor irregularities/discrepancies that can appear during healing.

When undertaking crown lengthening in the aesthetic zone, it is necessary to extend the incisions 1-2 teeth distal to the last tooth that is being lengthened to ensure there is a blending of the gingival margin height from anterior to posterior. If this is not done, there will be a step effect of the gingival margin height, which will detract from the overall treatment result. Patients that consider surgical crown lengthening also need to be aware of the side effects or complications, which can include root surface sensitivity, loss or blunting of the interdental papilla and very rarely, root resorption.

Definitive restoration following crown lengthening

The rate of healing following surgical crown lengthening will drive the timing of the restoration of the case. As a general rule, the longer you can leave the tissues to mature post surgery, the more stable the gingival margin will become. When crown lengthening involves both soft tissue and osseous reduction, the gingival margin can take up to 20 weeks to stabilize.⁸ Thus, the

preparation of the definitive margin and final impression should be deferred. However, it is common practice to proceed with some preparation and temporary crown placement 2-4 weeks post surgery and to leave these until tissue maturation is complete. This is particularly relevant in the aesthetic zone but not as critical posteriorly where the definitive restoration can normally be undertaken 8-10 weeks later. Also, when a gingivectomy has been undertaken (i.e. no osseous reduction), healing times are also generally on the shorter side as the gingival margin will stabilize more quickly, allowing the definitive restoration to commence at 8-10 weeks.

Summary

Crown lengthening can be beneficial to enhancing the aesthetics as well as facilitating the predictable restoration of heavily worn or broken down teeth. It can improve the ability of the restorative dentist to provide a well-retained fixed restoration with improved longevity. Perhaps the most significant advance in performing surgical crown lengthening in the past decade has been the introduction of the dental laser. Although laser assisted crown lengthening involving osseous resection is technically demanding, this new surgical tool does provide very precise surgical control for the operator and is generally more patient-friendly than conventional surgery.

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