

## CROWN LENGTHENING PROCEDURES IN RESTORATIVE DENTISTRY



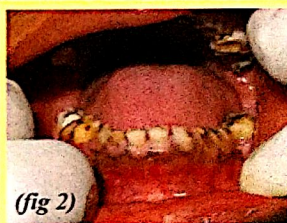
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Have you experienced the frustration of wanting to save a tooth but having no clinical crown with which to work? A good example of this situation was seen recently. In the lower arch all the anteriors including the bicuspid showed severe attrition. Due to this the clinical crown couldn't be restored. All too frequently, attempts to save these teeth are rewarded with deep subgingival margins which cannot be impressed well due to the gingival haemorrhage from periodontal inflammation developed during the preparation of tooth for crown coverage. Retraction of the gingiva around these teeth is extremely difficult. Since there is little crown length as a guide, the laboratory has difficulty creating adequate crown contours. Such a situation may be dealt with best through the use of crown lengthening procedures (CLP). This article provides information about the indications, rationale & advantages of CLP's. The need for CLP is dictated by dental & pt. factors. After CLP it should be possible to put restoration margins above, or at, the gingival margin. It is well documented in the literature that this creates a more favourable condition to allow periodontal health.



(fig 1)



(fig 2)

A 48 year old lady visited the clinic for restoration in relation to all the teeth present showing attrition (figure 1 & 2). CLP was carried out for all the teeth presenting attrition before the full mouth rehabilitation with ceramic crowns.

### CLP is also indicated in:

- Cuspal fractures extending apical to the gingival margin, carious destruction apical to the gingival margin.
- The treatment of endodontic perforations near the alveolar crest.
- To increase a restoration's retention on teeth exhibiting short crown lengths due to gingival hyperplasia, less than full eruption, or severe wear secondary to bruxism.
- Supraerupted teeth can often be reduced to conform to the occlusal plane to allow better prosthetic treatment. These teeth often will need lengthening of the tooth following the shortening process to improve interproximal embrasure spaces as well as regain retentive form for the crown.

What is the rationale & how does one determine the need for CLP's? This question can be answered by considering two factors, the biology of the gingival tissues coronal to the

alveolar crest & the objectives in margin placement.

Subgingival margins will cause the tissues develop additional depth at the base of the crown as well as show constant edema. These reactions could be related to the adaptation of the gingival tissues to the root surface. Beginning at the alveolar crest, the normal gingival unit of the periodontium will have connective tissue inserted into the root of the tooth an average of one mm above the bone crest. This is termed the cemental-fibrous interface & is present even in the diseased state. The distance will be recreated at the expense of alveolar bone if violated during tooth preparation. The recreation of this zone would

reduce the adaptation of the gingival tissues to the tooth at a more coronal level & encourage pocket formation. In the normal state, the epithelial attachment begins at the coronal aspect of the cemental-fibrous interface & extends for an additional millimetre coronally. This is the area where immature epithelial cells are attached to the tooth through chemical bonding. Although it can be much longer, the epithelial attachment averages 1mm in length. If violated, this zone produces a reaction similar to the cemental-fibrous interface. Loss of the integrity of the epithelial attachment by crown margin impingement virtually ensures pocket formation as plaque accumulation at the crown margin is impossible for the pt. to remove. Coronal to the epithelial attachment is the sulcus. Sulcular depths are from 1 to 3mm. For cleansability & the avoidance of irreversible trauma to the epithelial attachment during retraction it has been previously recommended that preparations not be extended into the sulcus more than half of its original depth in the healthy state. Using these distances the requirement for tooth structure above the alveolar crest for subgingival margin placement would be 1.0 mm for the cemental-fibrous interface, 1.0 mm for the epithelial attachment, & 1.0 mm for sulcus penetration of the subgingival margin (one-half penetration of a 2mm sulcus plus 1.0 mm for the tooth structure to prepare the finishing margin. The total of 4mm represents a good guideline for tooth length above the alveolar crest. In anterior teeth, many practitioners would prefer to have a 3mm sulcus when doing subgingival margin preparation to allow for adequate subgingival extension as well as retraction.

An additional value of CLP in the anterior teeth is the ability

to control to some degree the thickness of the labial gingival tissues. If these tissues are thin, recession often results after tooth preparation, impressions & temporization. This tendency can be managed if adequate tissue thickness is encouraged during initial incision for the surgical procedure. In many cases pre-restorative gingival bulk can be established through gingival grafting.

Without periodontal pocketing present or at least 3mm of soft tissue coronal to the bone, tooth length can only be altered at the expense of the alveolar bone & requires osseous surgery. Gingival resection would only represent violation of the biologic width & uncleansability of the prosthesis. Electrosurgical techniques have often been recommended for CLP's. When the thickness of gingival tissues above bone exceeds 3mm this may be a viable alternative in the posterior regions of the mouth. Extreme caution is necessary to avoid contact with bone or tooth root when using a rectified current as extensive bone necrosis & pulpal death have been reported. Sounding of gingival depth under L.A would be helpful to determine the need for osseous surgery.

Should the need for CLP occur on the facial or lingual surfaces, the need for bone removal can be confined to that single surface by accentuating the normal soft tissue contour. Without periodontal pockets, interproximal inadequate tooth length always requires osseous reduction. If the reduction will be extensive, the adjoining teeth could experience support loss too severe to justify this approach. The tooth which requires additional crown length could be forcefully erupted orthodontically. This type of movement is rapidly achieved provided the soft tissues can be kept healthy surrounding the root, the alveolar bone will move coronally as the tooth does. This initially produces a vertical bone defect on both the mesial & distal of the supra-erupted tooth.

The osseous structure will slant from a coronal location on the erupted tooth to its original location on the adjoining teeth. Subsequent osseous periodontal surgery can be employed to establish the tooth length & normal bone contours at the same time. The support level on the adjoining teeth is preserved.

There are several areas where crown length can be achieved through surgical intervention. A common area is the distal surfaces of maxillary & mandibular second molars. These teeth often have less than 2 to 3mm of tooth structure between the marginal ridge & the gingival crest making retention form in the preparation very difficult to achieve. A second group of teeth which are candidates for CLP includes those teeth where the subgingival margin of an existing

restoration makes retraction for impressions difficult. Often the base of the restoration can be felt 3mm below the crest of the gingiva. These areas could also be improved through partial reduction of the subgingival extension of the existing restoration by CLP or gingival tissue reduction.

#### Techniques:

**Soft tissue recontouring:** This technique is generally used to improve aesthetics & takes the form of a gingivectomy to excise the soft tissue. Normally, the gingival margin is 1mm coronal to the CEJ. If it is greater, then the clinical crown is shorter than the anatomical crown. In thin tissue biotypes, a gingivectomy will expose more of the crown & improve the appearance. It may be achieved with a scalpel, or with the use of electrosurgery. If there is pigmentation in the tissue, it needs to be determined if the pt. wishes to maintain or lessen this amount. An external bevel incision will remove pigment, & it may be necessary to extend the gingivectomy to the premolar region to stop a marked transition being visible on smiling. This colour change may be

permanent, but occasionally the pigment returns slowly. If the pt. wishes to keep the pigment, then an internal bevel incision is needed to produce an internal gingivectomy.

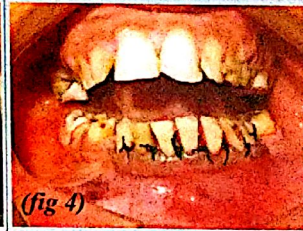
**Soft tissue & bone recontouring:** When there is a thick tissue biotype, especially with a ledge on the crestal bone, an apically repositioned flap and bone recontouring may be preferable. If there is adequate attached gingiva, labially or buccally, then an inverse bevel incision can be

made 2-3mm from the gingival margin, following a scalloped pattern around the gingival margins (fig 3). This would be followed by a 2<sup>nd</sup> incision into the intracrevicular sulcus. The incision should be extended distally 1-2 teeth to blend into the gingival sulcus of the untreated teeth. A 3<sup>rd</sup> incision is then placed interproximally to release the interdental papillae, after which

a full thickness flap is raised to allow bone exposure. If there is inadequate attached gingiva, then a vertical releasing incision should be made & the flap apically repositioned. Vertical releasing incisions are also used if there is a need for increased visibility or to avoid the exposure of a crown margin. Palatally, a scalloped inverse bevel incision using a number 15 blade should be made, again following a scalloped pattern, but this time the scallop is much deeper than the original gingival margins. Alternatively, intra-crevicular incisions can be used & a full thickness flap raised after the bone recontouring, the flap is then recontoured to follow the new position of the bone. Bone recontouring can be carried out using carbide round or (straight or tapered) fissure burs (fig 7) with copious amounts of normal saline irrigation. The bone is thinned until there is a thin layer



(fig 3)



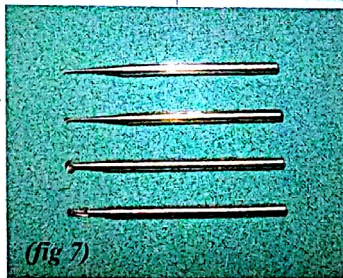
(fig 4)



(fig 5)



(fig 6)



(fig 7)



(fig 8)

remaining over the surface. To reduce the risk of damaging the root surface, that this final thin layer of bone should be removed by using a bone chisel, files or an ultrasonic scaler. Then any bone ledges should be smoothed to aid the repositioning of the flap. Enough bone is removed to create a 3mm space between the crest of the bone & the new restoration's margin (fig 8). This can be measured using a periodontal probe, or a surgical stent can be made in the laboratory to show the restoration's expected margin. If the last tooth to be CLP is the most distal tooth, then the incision needs to blend into a wedge flap to reduce the bulk of the tissue distal to the last tooth.

**Sutures & dressing:** Continuous, fig of 8 (fig 4) or interrupted sutures can be used. The continuous sutures are particularly useful if there have been several teeth with apically repositioned flaps. The use of a periodontal dressing is one of personal preference. The clinicians usually use them & prefer to achieve prior full bone coverage with the soft tissue flaps before placing the periodontal pack.

**Complications:** As with any procedure, the pt. needs to be informed of any potential complications. For CLP these include: > Possible poor aesthetics due to 'black triangles' > Root sensitivity > Root resorption > Transient mobility of the teeth

**Restoration of the teeth:** The gingival margin does not stabilize until at least 20 weeks postsurgery. This is of particular importance when in the anterior region as the aesthetics may be more crucial. After a 2-3 week post surgery period, temporary crowns may be used until there has been full healing & the gingival margin is in a stable position (fig 6).

**Contra-indications:** CLP of a single tooth or teeth with

long clinical crowns may yield unfavourable aesthetic results, such as a 'black triangle'. As with any treatment, CLP is contraindicated in patients with poor oral hygiene. There should also be caution when treating a smoker. Medical or psychological factors contraindicating routine periodontal surgery would also apply. In addition, CLP would be contraindicated in teeth already weakened by extensive periodontal involvement. Projected exposure of furcations would cause one to look for other alternatives. Unfortunately, extensive caries in the furcation region of molars cannot be effectively treated through CLP. As in pocket reduction surgery, one must weigh the value of the individual tooth if its retention means extensive reduction of adjoining tooth support. While each case is an individual study, the wider the interproximal space, the more osseous reduction which can be tolerated.

The alveolar bone surrounding one tooth will naturally surround an adjacent tooth, & removing bone for a CLP will effectively damage the bony support of adjacent teeth to some inevitable extent, as well as unfavorably increase the crown-to-root ratio. Additionally, once bone is removed, it is almost impossible to regain it to previous levels, & in case a pt. would like to have an implant placed in the future, there might not be enough bone in the region once a CLP has been completed. Thus, it would be prudent for patients to thoroughly discuss all of their treatment planning options with their dentist before undergoing an irreversible procedure such as CLP.

CLP should be within the capabilities of a GDP. The most likely specialist to perform this procedure has been shown to be a periodontist. There is no reason why GDP's who are comfortable with surgical dentistry should not perform crown lengthening. However, if this procedure lies outside their 'comfort zone' then a referral to a specialist is appropriate. To conclude surgical crown lengthening has an important role in restorative dentistry &, in dentitions that are restored with fixed prosthesis, it is a necessary consideration when treatment planning is being undertaken.

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