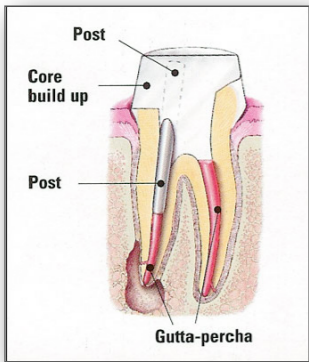


**FERRULE:  
HOW MUCH AND WHERE?**

A ferrule is a metal band or ring intended for strengthening. With regard to teeth, the effect of the ferrule is based on “parallel walls of dentin extending coronally from the crown margin ... which after being encircled by a crown provides a protective effect by reducing stresses within a tooth.” JOE 2012. If stresses are excessive, this leads to tooth or root fracture, or debonding of restorations. The ferrule is more important in decreasing cervical stress levels than preparation design or coronal restorations as per finite element analysis. But also very important is the post which can further decrease stress coronally.



Taken from: Google Images

Individual studies vary widely in experimental design, so finding an absolute answer with regard to how much ferrule is necessary is difficult. However, a recent systematic review concluded that 1.5-2mm of ferrule circumferentially is ideal. However, even if it cannot be obtained 360 degrees around the tooth, some ferrule will still help reduce fractures of the root, or at least lead to more favorable fracture patterns that are more easily restored (oblique vs vertical). Facial and lingual ferrule is also more important than interproximal ferrule. The more ferrule the better, as this lowers the impact of post and core systems, luting agents and the final restoration on the performance of endodontically restored teeth.

**LACK OF CORONAL TOOTH  
STRUCTURE**

A lack of coronal tooth structure for restoration can be due to several causes: dental trauma usually in the form of a crown fracture, caries, bruxism leading to super-eruption, or short tooth crowns exacerbated by altered eruption where the bone is at the CEJ rather than several millimeters apical to it. There are multiple factors with regard to esthetics, as well as the structural integrity and retention of a restoration, that will dictate what steps are taken to restore the teeth if they are savable. This can include clinical crown lengthening, orthodontic extrusion, endodontic treatment with post and core placement, and the type of final coronal restoration.



Crown Fracture

Taken from: Dental Traumatology 2012

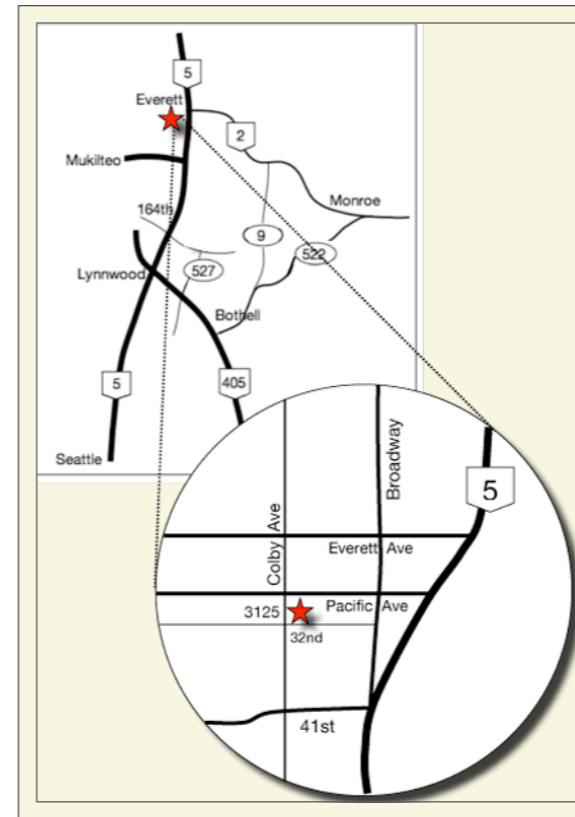
One of the biggest concerns for treating teeth with lack of coronal tooth structure has to do with the longevity of the restoration. Will the coronal restoration stay in place under the occlusal stresses? Will the root fracture from the post needed to maintain a core to ensure retention of the coronal restoration? What is the best post material to use? What type of cement? How much ferrule?

This issue of **ProbeTips** will review the most current literature for managing lack of coronal tooth structure when restorations are necessary, as well as expected long term outcomes.

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**PROBE TIPS**

A QUARTERLY PERIODONTAL  
NEWSLETTER

BY PAMELA NICOARA DDS MSD

**Ferrule Effect**



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# Treatment of Teeth with Lack of Coronal Structure

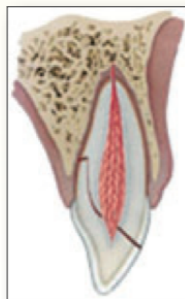
## BRUXISM AND SUPER-ERUPTION

For a patient who has a bruxism habit, teeth and restorations will wear. Compensatory eruption is a normal consequence. With the tooth in occlusion, there is not enough coronal tooth structure for restoration, particularly when the tooth is shortened occlusally to allow for restorative space. If the root is long enough, a canine for example, then simple clinical crown lengthening will suffice, as depicted below. Typically, there is also compensatory deposition of dentin into the pulp space, so endodontic treatment may not always be necessary.



## TOOTH FRACTURE OR DEEP CARIES

If crown fracture or caries involves a portion of the root as well as the crown, a decision must be made regarding the depth of the fracture or caries, and restorability. Fractures or caries of the root that are more than 2mm below the osseous crest are difficult to manage without clinical crown lengthening or orthodontic extrusion. If the fracture is too deep, where there would be involvement of the furcation or a very poor crown to root ratio because of a short root with concomitant mobility, an extraction may be necessary.



All cases are patients of Dr. Pamela Nicoara unless otherwise specified

## ENDODONTIC FACTORS AND POST & CORE OPTIONS

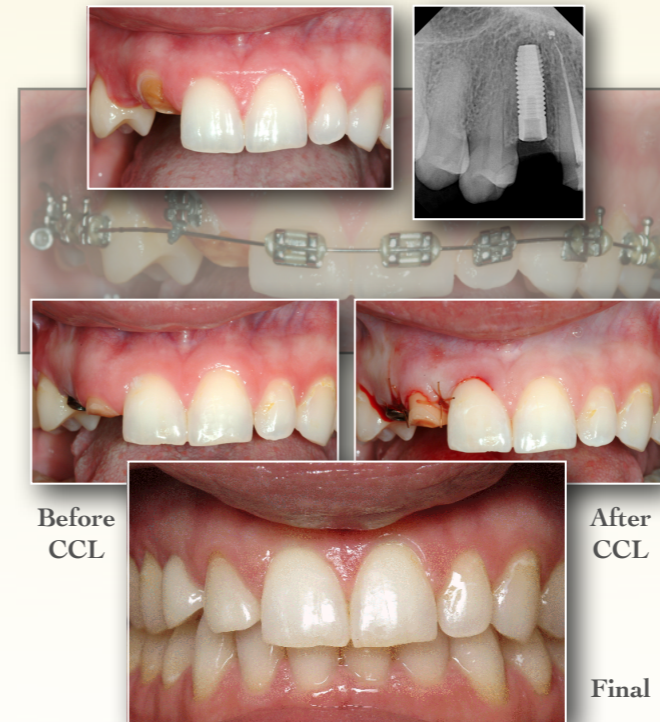
When endodontic treatment is necessary, it should be as conservative as possible to maintain dentin for increased ferrule strength and fracture resistance. Fracture risk is also influenced by occlusal loads and the overlying crown in terms of choosing a more conservative preparation design when possible.

Posts are used when there is insufficient crown structure to retain a crown. When a post is used, there should remain 4-5mm of gutta percha in the root for apical seal. The length of the post is generally not critical with regard to fracture rates, so using a shorter post is acceptable if good retention is possible with the root length available. The type of post and core material used is a controversial subject. We know that the more ferrule present, the less important those materials are. It is more clear that in general, luting the post with resin cement leads to less fractures, and luting the crown with resin cement was better than glass ionomer or zinc phosphate. With these facts, then it is possible to consider using more esthetic materials (fiber posts and composite cores) in the anterior with more confidence. However, prefabricated stainless steel posts cemented with resin with a composite core may be the best in situations with the least amount of ferrule (Thu: awaiting publication).

## ORTHODONTIC EXTRUSION

Orthodontic extrusion is the controlled occlusal movement of a tooth, usually 1mm per month. It results not only in displacement of the tooth, but of the supporting periodontal structures as well. In fact, there appears to be no change in the level of the osseous crest relative to the CEJ, and the mucogingival junction also remains unchanged. The free gingiva follows the tooth by 90%, and the attached gingiva by 80%. To prevent this, extrusion can be done rapidly (1mm per week) and circumferential fiberotomy is

necessary every two weeks during extrusion with a longer retention period (3 months or more). Faster or greater force than this may cause root resorption or ankylosis, although rare. Regardless, clinical crown lengthening may be necessary at the end of extrusion to idealize gingival margins, as shown below: Canine substitution for congenitally missing #7. A cantilever bridge replaced teeth #6 and 7, which fractured. An implant replaced site #6, and the canine in the #7 site was kept as the lateral, since two adjacent implants prevent papilla formation between #6 and 7).



Patient shared with Dr. Ryan Johnstun, Darrington and Dr. Michael George, Everett (orthodontist)

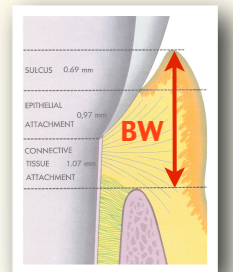
Not only can extrusion produce interproximal papilla more predictably than periodontal regeneration, it may also correct periodontal pockets.

Similar to crown lengthening, extrusion is limited in situations where roots are flared, furcation involvement would occur, or short roots may cause mobility.

## CLINICAL CROWN LENGTHENING

Clinical crown lengthening is the removal of bone and soft tissue from around a tooth in order to expose more of the tooth or root. This can be done for esthetic or prosthetic reasons. We will focus here on crown lengthening for prosthetic or functional purposes.

Of fundamental importance is understanding biologic width. Biologic width (BW) is the genetically predetermined distance that the gingiva maintains over the bone, from free gingival margin to osseous crest. Although this dimension varies per patient, it is generally 3mm in thickness, as illustrated in the diagram. If the BW is violated, either uncontrolled bone loss results with an iatrogenic pocket, or chronic inflammation and irritation develop, which can be painful, and unsightly when in the anterior sextants.



Ideally, a healing time of at least 3 months (or 6 months for anterior cases) is necessary to verify that there will be no further soft tissue change, as sometimes can occur.

Limitations of clinical crown lengthening are increased crown root ratio which can lead to more fractures, damage to adjacent teeth by reducing their periodontal support, reduced esthetics via uneven gingival margins, mobility, and the risk for furcation involvement.

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\*complete references available on request\*