

FORCED ERUPTION

Raising the root with gentle, continuous force in a coronal direction



Procedure performed by David Levine D.D.S. Periodontist.

A new patient comes in for a routine clinical examination. Upon review of his radiographs, you notice extensive recurrent decay in the upper right cuspid which had been previously treated with a root canal post and crown. After a thorough examination, you decide that this tooth must be saved as it is a key abutment for the patients anterior bridge and partial denture.

A patient comes in with a horizontal fracture just above the crest of the bone in tooth #8. Because of the patients high lip line, it is clear that an extraction or osseous surgery would severely compromise an esthetic result.

A 45 year old patient comes in complaining of food impaction on the lower left side between tooth #19 and #20. Clinically, the tooth exhibited an 8mm pocket and probing proved that it was a one wall osseous defect. After a periodontal consult, it was decided that osseous surgery would jeopardize the first molar by exposing the furcation.

One of the primary goals of restorative dentistry is to replace form, function, and esthetics lost due to trauma or disease.¹ As dentists, we constantly face difficult clinical problems like the above mentioned cases. When clinical situations like these arise we must be equipped with alternatives in therapy to maintain a healthy intact masticatory system.² Forced eruption is such a therapy.

INDICATIONS

Often, clinical conditions can make a tooth appear to be unrestorable. Fractures, caries, large old restorations, osseous defects, a poor root to crown ratio, and perforations at or below the level of the crestal bone are just a few of the factors that can contribute to tooth loss.^{3,4}

There are several common methods available to manage a tooth which is severely broken down or periodontally involved. These include extraction of the remaining root followed by a prosthetic replacement and techniques to expose sound tooth structure such as osseous surgery and forced eruption. The restorative and periodontal treatment which is most appropriate depends on the following:

- 1) The predictability of the treatment procedure.
- 2) The position of the tooth in the arch and its strategic restorative value.
- 3) The root to crown ratio after the tooth is restored.
- 4) Whether the periodontium or adjacent teeth will be compromised as a result of periodontal surgery.
- 5) The ability to maintain the periodontium in a state of health.
- 6) The achievement of an esthetic result.²

Extraction

When faced with the difficult clinical situations mentioned above, removing a tooth may appear to be a simple solution. But on a long term basis, tooth removal is an expensive option with many disadvantages for the patient. Replacing the missing tooth with a fixed partial denture is possible, but this may lead to unnecessary compromise of the abutment teeth. Tooth extraction also causes a decrease in the thickness of the alveolar bone. This makes it much more difficult to accomplish an esthetic restorative result regardless of whether you utilize an implant or place a fixed partial denture.⁵

Osseous surgery

Osseous surgery is usually done to correct periodontal defects and to apically position the bone and soft tissue permitting the reformation of a new dentogingival com-

plex. The goal of this procedure is to provide enough sound tooth structure to allow the clinician to restore the tooth without violating the biologic width. This procedure is usually done when an osseous defect is isolated to only one area of involvement and the adjacent bone can be reshaped to establish gradual changes in the bony architecture.

Surgical exposure of sound tooth structure is fraught with compromise. Gingival and osseous surgery cannot be limited to the involved tooth and must be extended to adjacent teeth in order to blend the gingival and osseous contours. The ultimate result is a sacrifice of supporting bone on several uninvolved teeth. This can cause root sensitivity, expose furcations, and in some cases can involve the maxillary sinus.²

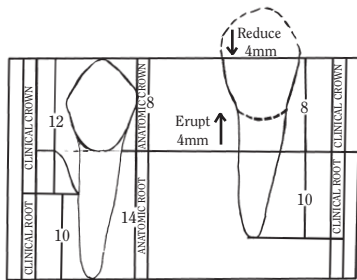
When crown lengthening is done in an anterior region, it can result in unesthetic open embrasures and long clinical crowns. This situation is particularly disadvantageous in patients with a high lip line, that show gingival tissues when speaking or smiling.⁵

Forced eruption

Forced eruption is often a more appropriate alternative when loss of tooth structure is in the region of the alveolar crest. It can be defined as an orthodontic movement in a coronal direction through the application of gentle, continuous forces.² Specifically when a root segment is forcefully erupted, the forces stretch the gingival and periodontal fibers producing a coronal shift of the gingiva and bone. If done slowly, the gingiva and supporting structures will follow to a position that is further coronal than the adjacent teeth. These gingival and osseous changes can be used to manage many restorative problems.

For example, after forced eruption, periodontal surgery can be performed exposing sound tooth structure without sacrificing bone on the adjacent teeth. The soft tissue can then be sutured to blend with the gingival margins of the adjacent teeth to produce an acceptable esthetic result.

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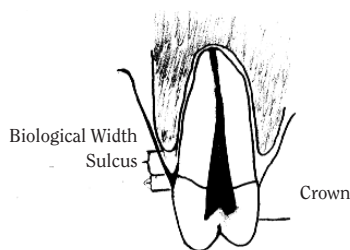


Forced eruption can be used to improve the root to crown ratio.

Drawing A

Forced eruption also has an effect on the root to crown ratio. For example, an upper bicuspid has an anatomic root to crown ratio of 14 to 8. But because of a 4mm osseous defect, this tooth's actual clinical root to crown ratio is an unfavorable 10 to 12. By erupting the tooth 4mm to correct the osseous defect and removing 4mm from the crown as it is erupted the root to crown ratio can be improved. After eruption, the clinical root will remain the same length at 10, but because of reduction in the crown, its length will be 8, giving you a substantial improvement in the root to crown ratio. (see drawing A)

Biologic Width



Drawing B

Regardless of the technique used, adequate bone must be removed during surgery, not only to expose sound tooth structure for the restoration, but to accommodate the reformation of the connective tissue attachment and the epithelial attachment. The combined dimensions of the connective tissue attachment and the epithelial attachment averages 2.04 mm and is described as the biologic width.⁶ This dimension is critical. The restoration of a tooth without regard to the biologic width results in the clinician burying the margins of the crown in an attempt to secure sound tooth structure. A tooth restored in this manner usually results in a poor gingival response because the connective tissue and epithelial attachments have been violated. Before any restorative procedures are performed, a minimum of 3mm to 4mm of tooth structure coronal to the alveolar crest of bone must be provided for the reformation of the biologic width and to allow the final

restoration to embrace at least 1 to 2 mm of solid tooth structure.^{1,2,3,4,7} (see drawing B)

DESCRIPTION OF APPLIANCES

There are several methods for erupting teeth. The dentist can choose either a fixed or removable appliance depending upon the clinical situation.

The attachment unit

The attachment unit is the part of the appliance that attaches to the tooth needing eruption. The preferred method is bonding an attachment to natural tooth enamel. However, if there is no labial enamel to bond to then the next best option is a temporary or final post and core and a temporary crown. A temporary crown offers several advantages; it is more esthetically pleasing and retains the tooth's original position. After the temporary crown has been constructed, an orthodontic bracket is bonded to its surface as far to the gingival as possible.

Fixed appliances



When using a fixed approach, the equivalent of two teeth on either side of the tooth to be erupted must be available. For example, with a second premolar, the first premolar and canine on one side and a multi-rooted first molar on the other will provide adequate anchorage. Using three or four teeth in this manner for anchorage eliminates any movement of the anchorage unit.

By direct etching and bonding, brackets are placed on the anchor teeth. It is important to align these brackets in the same horizontal plane. A stainless steel orthodontic wire - 0.018 inch by 0.025 inch is then tied into place with elastic ligatures. This wire has been bent, by the laboratory, to the general labial contours of the anchorage teeth and the crown of the tooth to be extruded. An occlusal offset has been placed in the wire over the tooth to be extruded. This wire, when properly positioned inciso-gingivally, will provide the needed extrusion distance between the wire and the attachment on the tooth needing eruption.⁸ After placing the arch wire, you can activate the appliance. An elastic is placed from the attach-

ment, looped over the wire and back to the attachment to initiate eruption.

Removable appliances



There are times when bracketing teeth for anchorage is either inappropriate or not possible. For example, placing brackets on porcelain veneers or crowns is contraindicated as the bonding process will damage their finish. Sometimes patients do not have enough teeth to use as an anchor. This happens quite frequently in partially edentulous patients where one of the remaining abutment teeth needs to be restored. In both these cases, a removable appliance allows you to use the soft tissue, teeth, and the appliance to form an anchor. Appliance design will vary. In some cases you may be able to use a patient's existing partial by simply adding a hook over the tooth needing eruption.¹⁰ In other cases, a simple acrylic orthodontic appliance with an activating spring arm can be used. This type of appliance works by simply engaging the spring over the attachment bracket. Though not the solution for all cases, removable appliances can expand the clinician's options to initiate forced eruption.

TREATMENT PROCEDURES

1. As always, proper appliance selection and application requires a well thought out and thorough diagnosis and treatment plan. This is especially true when you are dealing with a compromised dentition. Your diagnostic records should consist of the following:

- a. A complete medical and dental history.
- b. A thorough clinical exam. This should include:
 1. An oral cancer screening.
 2. Documentation of any abnormalities in the oral mucosa and gingiva.
 3. Radiographic evaluation of all necessary films (FMX, PAN, CEPH).
 4. Charting of all existing restorations and carious lesions.
 5. A thorough periodontal evaluation.
 6. An occlusal analysis.
 7. A TMJ evaluation.

2. Before initiation of forced eruption, the restorability of the tooth after the

orthodontic phase must be considered. The following steps are advised:

- a. Estimate the length of the healthy root embedded in bone from the radiograph.
 - b. Estimate the space available for the clinical crown. Articulated diagnostic casts may be used as a guide.
 - c. Calculate the amount of eruption necessary to give you 3-4mm of sound tooth structure coronal to the alveolar crest. For example, if the pathosis is below the alveolar crest the dentist must add the distance from the pathosis to the alveolar crest plus the biological width (2mm) plus 1 to 2 mm to avoid placement of the restoration at the base of the sulcular crevice.
 - d. Calculate the effective root length remaining after root extrusion and divide it by the clinical crown height as measured in step b. If the result is 1 or more, then favorable conditions exist for the completion of the restorative procedures. If the result is less than 1, then root extrusion will not provide the necessary basis for a properly constructed cast restoration.⁷
3. Select the appropriate appliance technique. Use your mounted study casts to evaluate the bite relationship, the number of teeth available for anchorage, and their position in relation to the tooth needing extrusion. This will allow you to select the appropriate appliance. For example, in a deep bite, clearance does not exist for bracket placement on lower anteriors. Here a removable appliance with a bite plane to open the vertical would be the appliance of choice.
4. Select the method of attachment to the tooth needing eruption (e.g. bonded bracket, temporary post and crown, permanent post and temporary crown.)
5. Deliver the appliance. Bonding brackets is not difficult. We recommend a self cured composite called Rely-a-bond because it gives you plenty of working time. However any orthodontic bracket cement will work to bond these brackets in place as long as you follow the manufacturers instructions.
6. Activate the appliance. Once the appliance is properly placed, the actual tooth movement is the easiest part. A simple elastic tie is placed to join the attachment and anchorage units. To maintain the tension, the elastic will need to be changed by the doctor on a weekly basis. When a removable appliance is used the spring arm should be engaged over the anchorage bracket. This spring should be adjusted weekly as well. The forces used must be light as extrusion requires only 20-30g of force.^{3,9,10}
7. Normal extrusion proceeds at about 1mm a week. Therefore at the patient's weekly appointments, the occlusion must

be relieved at least 1mm to allow the extruding tooth to move occlusally. If the occlusion is not relieved, the tooth will be placed in traumatic occlusion.



8. When the tooth is sufficiently erupted it should be stabilized to prevent relapse from occurring. This can be done by tying the attachment and anchorage units together with passive elastic chain or ligature wire.³ The occlusion must be relieved carefully to avoid centric or eccentric interferences during normal functioning. Excessive occlusal contact during the retention phase will prevent the periodontal ligament from returning to its normal width. As the periodontal ligament returns to normal, the mobility of the extruded tooth will return to normal. In most instances a stabilization period of 2 months is adequate.¹⁰
9. If periodontal surgery is required to match the bony and gingival contours of adjacent teeth, the orthodontic appliance must be left on during and after surgery to further stabilize the tooth. Another month of retention before starting prosthetic treatment is usually adequate.⁵
10. Finally, when it's time to begin final restoration of the erupted tooth, you can feel free to remove the appliance. This is easily done with a direct bond bracket removing plier and a 12-fluted composite finishing bur in a high speed handpiece.

ADJUSTMENT TIPS

1. Having predetermined the appropriate extrusion distance, the lab can fabricate an anchorage wire that when properly positioned inciso-gingivally will provide the needed extrusion distance between the wire and the attachment on the tooth. This allows you to accurately observe the amount of extrusion and when eruption is complete, the wire and the attachment unit will be at the same level. Although it may seem simplistic to build in the amount of extrusion into the appliance, the gingival and bony tissues extrude as well and it becomes difficult to determine how much the tooth has extruded.
2. The clinician should minimize the influence of trauma associated with normal function or parafunctional habits by reducing heavy contacts in maximum intercuspation and excursions.

LAB REQUIREMENTS

1. An accurate set of dental casts poured in stone. Air bubbles, holes, excess stone or any other imperfections are unacceptable as they will effect the fit of the appliance.
2. Provide a carefully taken occlusal record. This will allow us to fabricate any additional appliances needed for disarticulation purposes (e.g.mandibular eruption deep bite case).
3. Fill out your prescription slip thoroughly. Indicate the following:
 - a. The type of appliance desired.
 - b. The amount of eruption needed.
 - c. Whether or not you will need a guide for bracket placement.

SUPPLY LIST

- ☐ Alginate
- ☐ Mixing bowl and spatula
- ☐ Dental stone
- ☐ Impression trays*
- ☐ Articulation paper
- ☐ Diamond burs
- ☐ Acrylic burs*
- ☐ 139 Bird beak pliers*
- ☐ Cheek retractors*
- ☐ Pumice
- ☐ Etchant
- ☐ Composite resin for bonding fixed brackets eg.(rely-a-bond)*
- ☐ Forced eruption kit (individually set up for each case,includes brackets, arch wire, bonded hooks, elastics).
- ☐ Cotton pliers or bracket placement tool*
- ☐ Elastic ligatures*
- ☐ Needle nose hemostat or ligature tie placement forceps*
- ☐ White utility comfort wax or brace relief*
- ☐ Direct bond bracket removing plier*
- ☐ High speed finishing burs
- ☐ Abrasive polishing discs

* available through Success Essentials catalog.

LAB FEE

The average lab fee for this type of appliance therapy will vary between \$40 and \$80 depending upon the appliance needed and whether fixed or removable therapy is utilized.

CARE FOR THE APPLIANCES

Removable appliances should only be taken out while eating. The appliance should be scrubbed thoroughly with a brush and toothpaste, then rinsed in cool water.

Excellent oral hygiene is essential for patients wearing fixed appliances. Food

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debris is easily trapped and must be removed after eating.

Fixed appliances can be very irritating to the cheek and tongue, especially when they are first delivered. I recommend that you give your patient some utility wax or brace relief to protect their soft tissues.

CONTRA INDICATIONS AND CONCERNS

Inflammation must be controlled prior to initiating tooth movement. If it is not, forced eruption may contribute to the deepening of an osseous defect.⁴

Only the tooth to be extruded should move. Choosing the appropriate set up is critical. If the brackets are not carefully placed, the anchorage teeth will move, changing the occlusion.

The amount of extrusion is important. If the tooth is not sufficiently extruded, the margin of the final restoration will be too close to the alveolar crest, violate the biologic width and require excess osseous surgery. Excess surgery will negate one of the advantages of orthodontic extrusion, i.e. preserving bone support and producing a normal gingival margin with adjacent teeth. Over extrusion results in decreased osseous support for the treated tooth and can create an unhealthy root to crown ratio.

Make sure your root to crown ratio will be one or more once forced eruption is complete. If it is not, then root extrusion is contraindicated as it will not provide the necessary basis for a properly constructed cast restoration.⁷

Ideally, the restoration margin should be placed coronal to the gingival margin for adequate plaque removal. However, the ideal cannot always be obtained. On anterior teeth of patients who show gingiva when they smile, showing the gingival margin is not always esthetically pleasing. For these patients, the margin should be placed in the sulcus. This can be done as long as you respect the biological width.

Restorative procedures after forced eruption require extra attention by the restorative dentist. When a tooth is erupted, the diameter of the root decreases as the preparation moves apically. This leaves you with a smaller diameter tooth in the same fixed mesiodistal space which a new crown must now occupy. Tooth preparation of this smaller root will demand greater attention if one is to achieve a healthy blending of restorative materials, gingival health, and esthetics.^{2,10}

Posteriorly in the dental arch, surgical crown lengthening may be more appropriate because flared molar roots may present proximity problems if extruded and esthetics is less important.³

To use a removable appliance the patient must have the dexterity to engage and disengage the activating spring.¹¹

The bulk of an acrylic resin orthodontic removable appliance may effect the patients speech and phonetics. It will take time for a patient to adapt to wearing this appliance.¹¹

Patients undergoing this type of treatment must be anxious to save their teeth and at the same time be prepared to accept the time, costs, and inconvenience involved.¹⁰

CUSTOMARY FEES

Your fee for this procedure will depend upon the type and number of appliances, and the estimated length of treatment time. Fees of course will vary depending on your area. Remember that there will usually be a surgical procedure needed as well. In talking with doctors around the country, fees for this procedure range between \$300 and \$600.

INCOME POTENTIAL

Adding forced eruption to your restorative skills will give you the flexibility to treat those tough cases which would otherwise be unrestorable. General dentists usually find the orthodontic eruption part of this procedure to be easy and predictable. But most of us are uncomfortable performing esthetic periodontal surgeries. This offers you a great opportunity to work closely with your periodontist. What you will find is that your periodontist will become one of your best referral sources. Together, you will create esthetic results that you just could not achieve on your own. The results will be beautiful smiles and happy patients who will spread the good word about your work.

By Rob Veis D.D.S.
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