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CROWN LENGTHENING BY ORTHODONTIC FORCED ERUPTION – A CASE REPORT

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ABSTRACT

Aim: To increase the clinical crown height of the fractured tooth in the maxillary aesthetic zone for successful rehabilitation.

Objective: To utilise the orthodontic forced eruption technique in a single fractured anterior tooth to gain the required clinical crown height for ideal restoration.

Case Description: The article presents crown lengthening of a subgingivally fractured maxillary central incisor by means of orthodontic forced eruption for optimal restoration with the multi-disciplinary approach.

Conclusion: Although clinical crown lengthening can be done for subgingivally or gingivally fractured tooth with various methods, the orthodontic forced eruption technique is best suited in cases where optimal aesthetics is required.

Key Words: Crown lengthening, Biologic width, Orthodontic forced eruption, Gingivoplasty

INTRODUCTION

Tooth fracture or advanced caries at or below the level of the crestal bone poses a periodontal and restorative challenge.⁽¹⁾ These teeth were doomed for extraction because of poor access for restoration. But on the long terms, tooth extraction is an expensive option with multiple disadvantages.⁽¹³⁾ Extraction results in resorption of the alveolar bone, which makes aesthetics difficult to accomplish.⁽¹³⁾ Alternatively, crown lengthening procedure has made retention and restoration of such grossly damaged teeth possible.⁽²⁾

Crown Lengthening:

Crown lengthening is the procedure which increases the supragingival tooth structure for both restorative and or aesthetic purposes.⁽⁴⁾ Crown lengthening that is done for restorative (functional) purposes aims to gain sound tooth structure above the level of the alveolar crest to enhance the retention and resistance form of the tooth.⁽⁴⁾ To restore a damaged tooth by crown lengthening, the coronal extent of the remaining tooth structure should have a minimum length of 3.5-4 mm from the alveolar crest or 1-2mm of sound tooth structure coronal to the epithelial attachment.⁽³⁾ If the tooth

structure is lesser than 3.5mm from the alveolar crest, the preparation needs to be extended subgingivally to obtain at least 1.25 mm of ferrule, and this causes a risk of impingement on the junctional epithelium and the connective tissue attachment.⁽³⁾ In order to prevent this, crown lengthening has to be done. Crown lengthening can be done either surgically or orthodontically.

Surgical Crown Lengthening:

Surgical crown lengthening is the traditional method of treatment of a tooth with caries or trauma extending upto or apical to the alveolar crest. Surgical crown lengthening is done by gingivectomy or apically positioned flap with or without bone recontouring.⁽²⁾

Gingivectomy will suffice if only 1-2mm of crown height needs to be increased and if the tooth has sufficient width of attached gingiva and has a probing depth of 4mm.^(2,4) Apical repositioning of the flap with bone recontouring is done when more amount of crown has to be exposed. The main disadvantage of crown lengthening with apically positioned flap is that supporting bone from adjacent teeth is removed to achieve an even contour, which can compromise their func-

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tion.⁽³⁾ This procedure can also result in loss of the interdental papilla, opening of the embrasures, long clinical crowns and compromises the aesthetics, which the clinician is striving to achieve.^(2,13)

Orthodontic Tooth Extrusion / Forced Eruption:

Orthodontic root extrusion was first introduced by Heithersay and Ingber.⁽⁸⁾ This technique is based on principles of osteophysiology and orthodontics and it uses continuous force.⁽¹⁾

The objectives of orthodontic tooth extrusion include preservation of biologic width, exposure of sound tooth structure for optimal placement of restorative margins, and esthetics.⁽¹⁾ Orthodontic tooth extrusion can be done as a slow or rapid extrusion.⁽¹⁴⁾

In slow orthodontic eruption, the periodontium – gingiva, periodontal ligament and alveolar bone also migrate coronally along with the tooth. The tension created by the light orthodontic force elongates the periodontal fibre bundles and induces osteoblasts to deposit new bone, which results in the coronal shift of the bone as the tooth moves occlusally. Once the desired crown length is achieved, osteotomy is performed in the particular tooth without causing alteration of the periodontium of the other surrounding teeth.⁽¹⁰⁾

In rapid orthodontic extrusion, the alveolar bone is left behind temporarily and to prevent the bone from moving coronally, circumferential fiberotomy is performed.⁽¹⁴⁾ Circumferential fiberotomy is the procedure where scalpel blade is used to sever the supracrestal connective tissue fibers around the tooth.⁽¹⁵⁾ The supracrestal connective tissue fibers of the tooth are stretched as the tooth is extruded.⁽¹⁾ These fibres are resected by supracrestal fiberotomy in order to remove the tensile stress on the alveolar crest, which in turn prevents the gingiva and bone from following the tooth.⁽¹⁾ Fiberotomy also maintains inflammation in the area near the marginal bone and this inflammation does not allow the marginal bone to follow the tooth coronally and the procedure is performed every 7-10 days.⁽⁵⁾

Orthodontic extrusion is not possible in:

- a) Unfavourable axial tooth position.
- b) Compromised periodontal health.
- c) Short roots that would result in inadequate crown-to-root ratio (8)
- d) Tapered roots.
- e) Wide internal root form.

Orthodontic tooth eruption is the preferred mode of treatment to avoid the negative consequences of surgical crown lengthening, especially in aesthetic areas. Whenever orthodontic extrusion is decided as the means for crown lengthening, rapid extrusion is preferred to slow extrusion as it obvi-

ates the additional surgical procedure which is needed when a tooth is slowly extruded.

It is an interdisciplinary treatment that requires the expertise of the endodontist, periodontist, orthodontist and prosthodontist.

CASE REPORT

A 36-year-old male patient was referred from the Department of Conservative Dentistry and Endodontics for crown lengthening of endodontically treated 11. On examination, it was found that the patient had Ellis class III fracture of 11 and the fractureline was present subgingivally. The gingiva was healthy with the probing depth of 2mm.

IOPA radiograph revealed an intact root canal filling in 11 with normal bone architecture. There was no root fracture or periapical pathology in 11.

Considering aesthetics and the amount of tooth structure available, the case was planned for rapid orthodontic extrusion of 11 along with supracrestal fiberotomy. Post space was prepared and the fabricated cast post and core was cemented with glass ionomer cement to enable orthodontic banding of the tooth. Subsequently, 11 was banded with Begg's bracket and 0.016 inch Nickel titanium wire was tied within the bracket slot and secured with lockpin. The appliance was activated every 7 days and circumferential supracrestal fiberotomy was performed in 11 under local anesthesia after every activation.

The appliance was activated till 4 mm of tooth structure was extruded. This was achieved in a span of one month and the tooth was stabilized in place for 4 months.

On removal of the appliance, the marginal gingiva on the labial aspect was noted to be enlarged and unesthetic and the probing depth was 4 mm. Scaling and root planning was done in 11 but when the patient reported after 4 weeks, gingival hyperplasia was persistent with a probing depth of 4mm. Hence gingivoplasty was done on the labial aspect of 11 under local anesthesia to achieve an aesthetic gingival margin.

On review after 2 weeks, the healing was satisfactory. Probing depth was 2mm and bone sounding measurement was 3 mm. The patient was then referred back to the Department of Conservative Dentistry and Endodontics for restoration of 11 with ceramic crown.

DISCUSSION

Crown lengthening is a procedure that is done to increase the clinical crown length to permit aesthetic restoration of the

tooth without violating the biologic width.⁽¹¹⁾ It is mandatory that sound tooth structure be available coronal to the tooth's attachment apparatus to optimally restore a tooth.⁽¹⁹⁾ Several techniques are available for crown lengthening. Each technique has its unique indications, contraindications, advantages and disadvantages. This case describes the successful and optimal restoration of the tooth 11 that was fractured at the subgingival level.⁽¹⁰⁾

As the tooth 11 was fractured at the subgingival level, there were three options for restoration of 11 – post and core with crown, surgical crown lengthening, orthodontic forced eruption.

Whenever a tooth is prepared to receive a crown, the margins should remain on sound tooth structure for the restoration to be stable and have a good prognosis. This requires a ferrule of 1.25 to 2.5 mm. The fracture resistance of the restoration increases when the ferrule length is 1.5 to 2.0 mm.⁽¹⁸⁾ However, a tooth with root canal filling and post and core demands for a ferrule of at least 2 mm to resist fracture.⁽¹⁷⁾ Since the tooth was fractured at the subgingival level and the probing depth was 2 mm, placement of a subgingival crown margin to achieve the desired ferrule was not possible as it will violate the biologic width. So the first option of restoring the tooth using post and core with crown was eliminated.

The second option was surgical crown lengthening with osteotomy. The advantage of this procedure is that the length of the crown can be immediately increased. But the major drawback is that crown lengthening would need to be performed from 13 to 23 to achieve an even aesthetic contour. This will necessitate unnecessary removal of supporting bone from several teeth.

The third option was orthodontic forced eruption. The length of the root as measured from the radiograph was 14 mm. 4 mm of tooth was planned to be extruded and it was calculated that after 4 mm extrusion, adequate root length will still remain to provide favourable crown-to-root ratio of more than 1:1.⁽¹⁹⁾

Crown-to-root ratio serves as an aid to predict the prognosis of the tooth.⁽¹²⁾ Ideally the ratio should be 1:2 or a bare minimum of 1:1 in extreme cases.⁽⁶⁾ When the ratio is higher, the crown portion of the prosthesis will have greater leverage and the root will have lesser resistance, which will ultimately affect the prognosis of the tooth.⁽⁶⁾

The root form of 11 as noted from the intra oral periapical radiograph was broad and cylindrical and hence favourable for forced eruption. Generally there is a significant tendency for the roots to taper from the cervical margin to the apex, especially in the maxillary anteriors.⁽³⁾ When the root has a marked taper, the cervical diameter becomes lesser as the

root is extruded.⁽³⁾ This will cause the crown restoration to have bulky unphysiologic cervical margins or crown will have a distinctly narrow cervical dimension causing excessively wide, unaesthetic embrasures.⁽³⁾

The canal space of 11 was narrow and hence indicated for forced eruption. If the root canal is wider, the root structure between the root canal filling and the external root surface will be narrow. In such a scenario, crown preparation will result in much thinner root structure, which may result in fracture of the tooth.⁽¹⁴⁾

The tooth 11 met all the criteria for crown lengthening by forced eruption. When faced with the option of slow and rapid extrusion, rapid extrusion was decided because extrusion can be done as rapid as 1 mm per week.^(7,16) Forced eruption coupled with fiberotomy is the most preferred option when crown lengthening is required for a single tooth as it is easier, fast and cost effective.

After 4 mm of crown was extruded, the tooth was stabilized in place for 4 months to allow for proper reorganization of periodontal fibres. This is because the periodontal fibers are stretched and obliquely oriented as the root is moved coronally and these fibres take about 6 weeks to 6 months to reorient themselves.⁽¹⁴⁾ Also, in the 4 – 6 months period, bone remodeling and maturation occurs which prevent reintrusion of the tooth.⁽⁷⁾

During fixed appliance treatment, there is an increase and change in the microbial load with a substantial increase in motile rods supragingivally and spirochetes subgingivally.⁽²⁰⁾ Hence, most of the patients treated with fixed orthodontic appliance experience moderate gingivitis and varying degrees of gingival hyperplasia. The gingival hyperplasia can be managed nonsurgically and surgically. As the nonsurgical interventions such as scaling and root planning failed to resolve the hyperplasia, gingivectomy was done and physiologic gingival contour was obtained.

After a healing period of 2 weeks ceramic crown was fabricated and cemented with glass ionomer cement in 11 and the patient's smile was made aesthetically pleasing.

CONCLUSION

Multiple treatment options are available for restoring a tooth with gingival or subgingival fracture. An important criterion which the clinician has to bear in mind is preservation of the biologic width. Though the choice of treatment depends upon several tooth related factors and also the clinician's preference, this novel multidisciplinary technique of forced eruption is the best choice when clinical crown lengthening

is required in the aesthetic zone for a single tooth, provided the tooth has favourable root length and taper.

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REFERENCES

1. Shyammohan A. Forced eruption: An adjunct to prosthodontic treatment planning. *Indian J Stomatol.* 2011; 2(4) : 260-62.
2. Liudvikas Planciunas, Alina Puriene, Grazina Mackeviciene. Surgical lengthening of the clinical tooth crown. *Stomatologija, Baltic Dental and Maxillofacial Journal.* 2006; 8: 88-95.
3. Ayush Razdan Singh, Ruchita Verma. Crown lengthening versus forced eruption. *Orthodontic Journal of Nepal.* 2011; 1(1) : 52-55.
4. Marianne Ong, Shin-Chang Tseng, Hom-Lay wang. Crown Lengthening Revisited. *Clinical Advances in Periodontics.* 2011; 1(3).
5. CC Hung Biologic Width (III): Surgical Crown Lengthening 2012; <https://hungdentalis.wordpress.com>.
6. Gary Greenstein, John S Cavallaro Jr. Importance of Crown to root and Crown to Implant Ratio's. *Dent Today* 2011Mar; 30(3):61-2,64,66 passim;quiz71,60. www.ncbi.nlm.nih.gov/pubmed/21485881.
7. Monira Uddin, Natia Mosheshvili, Stuart L Segelnick. A new appliance for Forced Eruption. *NYSDJ* 2006; 46-50.
8. Georgia K, Johnson, Joan E. Sivers. Forced eruption in crown lengthening procedures. *J Prosthet Dent* 1986;56(4):424-27.
9. Amit Smidt, Gleitman, Joseph Dekel, Mikhal Steinkeller. Forced eruption of a, solitary non-restorable tooth using mini-impants as anchorage: Rationale and Technique. *Int J Prosthodont* 2009; 22(5):441-446.
10. Rafael Scafde Molon, Erica Dorigatti de Avila, Joao Antonio, Chaves de Souza, Andressa Vilas Boas Nogueira, Rogerio M et al. Forced orthodontic eruption for augmentation of soft and hard tissue prior to implant placement. *Contemp Clin Dent* 2013; 4(2):243-47.
11. Ramya Nethravathy, Santhana Krishnan Vinoth, Ashwin Varghese Thomas. Three different surgical techniques of Crown lengthening: A comparative study. *J Pharm Bioall Sci. (serial online)* 2013 (cited 2014 APR 19); 5:14-6. Avail at <http://www.ipbsonline.org/text.asp?2013/5/5/14/113281>.
12. Grossmann Y, Sadan A – The prosthodontic concept of crown-to-root ration: A review of the literature. *J Prosthet Dent* 2005; 93:559-62.
13. Rob Veis. Forced eruption – Raising the root with gentle, continuous force in a coronal direction. *The Practice Building Bulletin* 1993; 1(9) Chatsworth California.
14. Newman, Takei, Carranza. Editors. Carranza's clinical periodontology. 11th ed. New Delhi: Elsevier; 2012.
15. Jan Lindhe, Thorkild Karring, Niklaus P. Lang. Editors. *Clinical Periodontology and Implant Dentistry* ; 5th ed. Oxford: Blackwell Munksgaard; 2008.
16. Ashu Sharma, G.R. Rahul, Poduval.T, Karunakar Shetty, Bhavna Gupta. Short Clinical crowns (SCC) – Treatment considerations and techniques. *J ClinExp Dent* 2012;4(4): e230-6.
17. Maduri R, Seshu K, Gash C.L. Multidisciplinary Management of a Fractured Premolar: A case Report with Follow up. *Case Rep Dent* 2012;2012:192912<http://dx.doi.org/10.1155/2012/192912>.
18. Kantheti Sirisha Yalawarthy N.S, Suneetha K. Management of crown root fractures : A novel technique with multidisciplinary approach. *J NTR Univ Health Sci* 2013; 2(1): 72-77.
19. Luis Antonio Felipe, Sylvio Monteiro Jr, Luis Clovis Cardoso Vieira, Elioto Araujo, Re-establishing biologic width with forced eruption. *QuintessenceInt* 2003; 34(10).
20. Michael Florman, A softtissue maintenance during orthodontic treatment. www.rdhmag.com/index.html 2007; 27(10).



Figure 1: Fractured 11 at subgingival level



Figure 2: Orthodontic forced eruption with fixed appliance



Figure 3: Supracrestal fiberotomy done



Figure 6: Gingivectomy done to achieve physiologic gingival contour



Figure 4: 4mm crown extruded



Figure 7: 2 weeks after gingivectomy



Figure 5: Sufficient crown structure extruded



Figure 8: Ceramic crown cemented