

Surgical Crown Lengthening using Root Reshaping Technique on a Fractured Maxillary Molar: A Case Report

Guo-Liang Cheng¹, Makenna Brienne Thibodeaux² and Pin-Chuang Lai^{3*}

¹Department of Diagnosis and Oral Health, University of Louisville, School of Dentistry, Kentucky, USA

²Department of Dentistry, University of Louisville, School of Dentistry, Kentucky, USA

³Department of Periodontics, University of Missouri-Kansas City School of Dentistry, Missouri, USA

Correspondence should be addressed to Pin-Chuang Lai, Department of Periodontics, University of Missouri-Kansas City School of Dentistry, 650 E. 25th St. Kansas City, MO 64108, Missouri, USA

Received: August 29, 2022; Accepted: September 07, 2022; Published: September 14, 2022

ABSTRACT

A modified crown lengthening procedure (CLP) combining root reshaping and conservative alveolar bone reduction has been proposed to be a feasible alternative to conventional CLP in selective clinical scenarios. Sufficient osseous reduction is critical to the success of this surgical procedure, but it could sometimes result in unfavorable crown-to-root ratio and furcation involvement. Despite being documented in a few case reports and series, this modified surgical procedure was still not widely known. The purpose of this case report is to demonstrate the management of a fractured maxillary 1st molar using this modified surgical procedure and combined with single crown restoration. A 40-year-old Hispanic female presented with a fractured, root canal treated tooth #14. Upon removal of the mobile mesio-palatal cusp, the fracture line was located 2 mm sub-gingivally. While this tooth was deemed restorable, a modified crown lengthening procedure using root reshaping technique was adopted to avoid aggressive osseous reduction and potential furcation exposure. After full-thickness flap elevation, it was evident the fracture surface extended apically to the bone crest level along the mesio-palatal line angle. Root reshaping (odontoplasty) was performed along with minimal crestal bone reduction (1 mm) to provide for a biologically acceptable periodontal-restorative interface. The postoperative healing was uneventful, and the patient was referred to the restorative dentist after the 3-month follow-up. The clinical and radiographic examinations at the 21-month postoperative visit indicated the tooth and supporting tissues were in good health and function. This case report showed that with a comprehensive pre-surgical evaluation, this modified crown lengthening procedure (root reshaping in combination with conservative osseous reduction) could be a feasible alternative to conventional CLP with predictable treatment outcomes for nearly two years.

KEYWORDS

Crown lengthening procedure; Odontoplasty; Root reshaping

Citation: Guo-Liang Cheng, Surgical Crown Lengthening using Root Reshaping Technique on a Fractured Maxillary Molar: A Case Report. Case Rep Dent Sci 3(2): 73-79.

INTRODUCTION

Surgical crown lengthening procedure (CLP) is an effective approach for increasing clinical crown height of the tooth compromised by dental caries and/or fracture, based on restorative or esthetic demands. Typically, the desired clinical crown height can be obtained by apically positioning of gingival tissue and controlled reduction of alveolar bone around the target tooth. Sufficient osseous reduction should be performed to expose enough tooth structure to provide adequate retention and resistance form and prevent impingement of restoration margin into the supracrestal attached tissues [1,2]. If compromised outcomes, such as unfavorable crown-root-ratio, insufficient ferrule effect, poor esthetics, or furcation involvement, are expected following conventional surgical CLP, clinicians should consider other treatment options, including forced tooth eruption, surgical extrusion [3] or implant therapy.

Melker and Richardson [4] proposed an alternative to conventional surgical CLP, by combining the concept of “root reshaping” (i.e., odontoplasty) with conservative removal of the supporting alveolar bone. Such modification allows for not only minimal tissue reduction along with more periodontal tissue preservation, but also diminishing irregular, unfavorable root surface anatomy, leaving a smooth surface more biologically acceptable to

the soft tissue. Although application of this technique is seldom published or discussed in the literature, successful management of teeth with extensive crown destruction and crown-root fracture using combination of odontoplasty and conservative osseous reduction were reported in two retrospective case series [5,6]. The purpose of this case report is to demonstrate the application of this technique as a part of the treatment sequence in saving a fractured maxillary first molar.

CLINICAL PRESENTATION

A 40-years old, systemically healthy, Hispanic female presented to the University of Louisville Dental Associates due to tooth fracture of tooth #14 that happened a week prior to the visit. The mobile, fractured mesiopalatal cusp was removed under local anesthesia to allow accurate assessment. The intraoral examination revealed that #14 had probing depth of 4 mm and bleeding on probing at mesiopalatal and mid-palatal sites associated with the oblique tooth fracture extending 2 mm subgingivally (Figure 1A). Based on the fracture pattern, it was diagnosed as complicated crown-root fracture according to WHO classification in 1994 [7]. Tooth mobility and furcation involvement were not detected. The periapical radiograph showed #14 was root canal treated with no periapical radiolucency and had no signs of interproximal bone loss (Figure 1B).

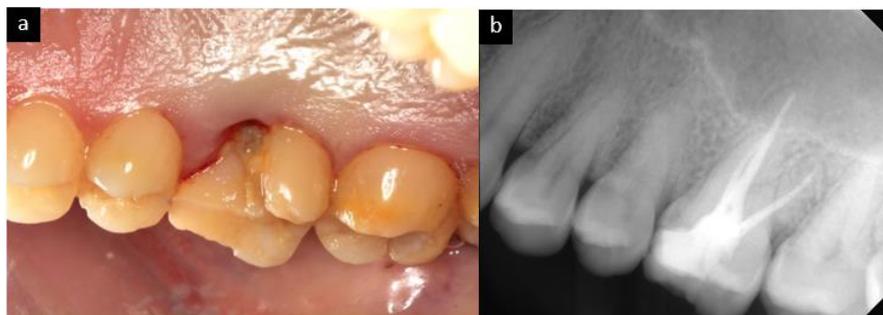


Figure 1: Initial presentation. **A)** Intraoral view and **B)** Radiological views of #14.

CASE MANAGEMENT

After the joint evaluation by the general practitioner and the periodontist, #14 was considered restorable, while

maintaining a fair prognosis, with modified surgical CLP. More specifically, the root reshaping technique would be utilized to create a biologically acceptable periodontal-

restorative interface without excessive bone reduction and furcation involvement [4]. Compared to other potential treatment options including tooth extraction followed by either a dental bridge or a dental implant, the patient preferred to receive CLP and single crown restoration for #14. The benefits and possible postoperative complications of CLP was explained to the patient in detail, and the informed consent was obtained.

Surgical CLP via Root Reshaping Technique

Following profound local anesthesia, submarginal scalloped incision of 2 mm on palatal aspect of #13 and #14 and intrasulcular incision buccally and palatally from #12 to #15 were made, allowing for full-thickness flap elevation on both sides. After debridement of the granulation tissue, it was evident that the fracture surface extended apically to the bone crest level along mesio-palatal line angle (Figure 2A). All edge of the fracture surface and irregularities on exposed root surfaces were smoothed with tapered, fine diamond finishing burs (Figure 2B). More specifically, the tips of the burs were placed at the bone crest, with the burs parallel (or no more

than 10 degrees) to the root long-axis, and then odontoplasty was performed in horizontal directions to establish a slightly tapered but smooth surface from the root to the crown. In Figure 2B, it could be observed that the palatal surface of the disto-palatal cusp was flattened by the burs. A ramp was created between the buccal and palatal alveolar bone at the mesial aspect of #14, to provide the necessary ferrule effect and leave no osseous defect. All of these were achieved with minimal bone reduction (1 mm) at mesial and palatal aspects of #14, and the mesial furcation was not exposed. It was confirmed that sound tooth structure was 4 mm away from the alveolar crest. The flaps were positioned at the alveolar crest and closed with 4-0 polyglycolic acid suture (Figure 2C). Periodontal dressing was placed over the surgical area. The postoperative instructions included use of chlorhexidine gluconate mouthwash twice a day for 2 weeks and the use of 600 mg ibuprofen for pain control. The patient was evaluated at 2 weeks and 4 weeks postoperatively. The healing was uneventful, and all sutures were removed after 2 weeks (Figure 3A and Figure 3B).

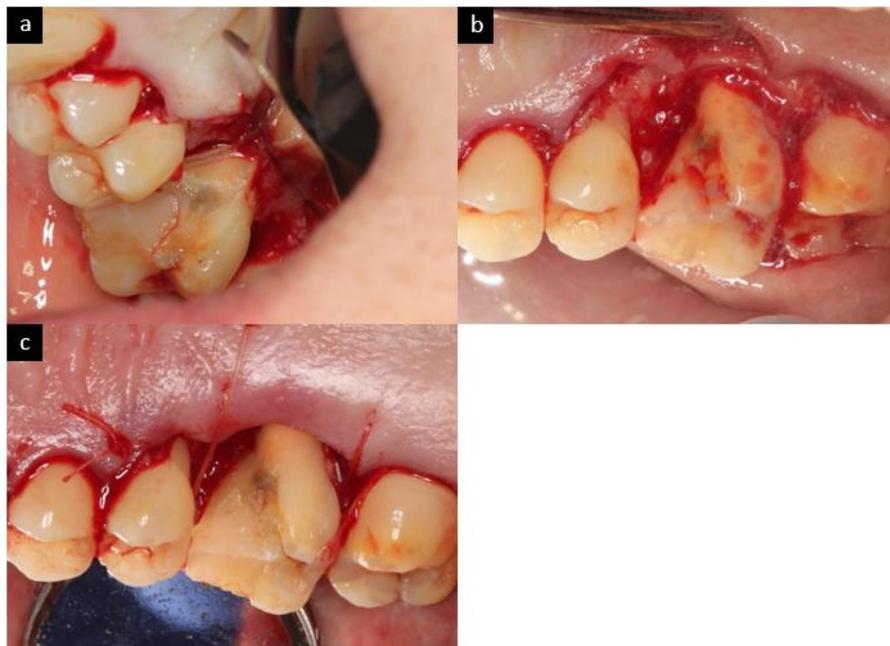


Figure 2: Surgical crowning lengthening using root reshaping technique. **A)** Flap elevation on #14 palatal side, **B)** Odontoplasty for root reshaping along with minimal osseous reduction, **C)** Suture.

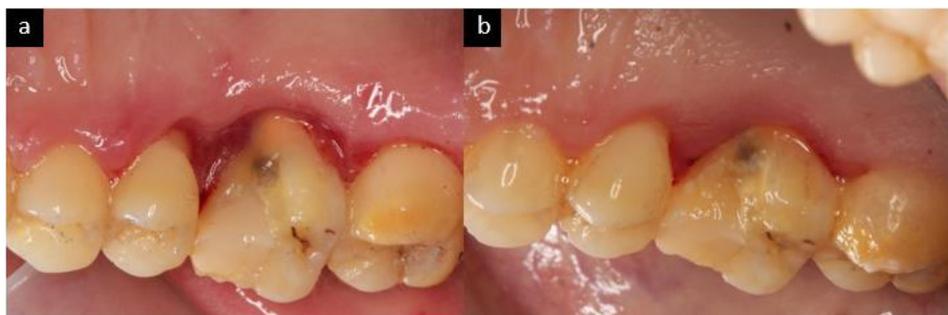


Figure 3: Post-operative follow-up. **A)** 2 weeks, **B)** 4 weeks.

Restoration with Fixed Prosthesis

The healing of surgical area was last evaluated at the 3 months postoperative visit and the periodontal condition was deemed acceptable. The firm gingival texture implied the reestablishment of supracrestal tissue attachment had completed. Hence, the patient was referred to the

restorative dentist for tooth preparation and impression taking. She was sent home with a temporary crown (Dentsply Sirona Integrity®), and the final porcelain fused to metal crown was delivered two weeks later with minor occlusal adjustments (Figure 4A and Figure 4B). Oral hygiene reinforcement was given, and maintenance visits of every 6 months were suggested.

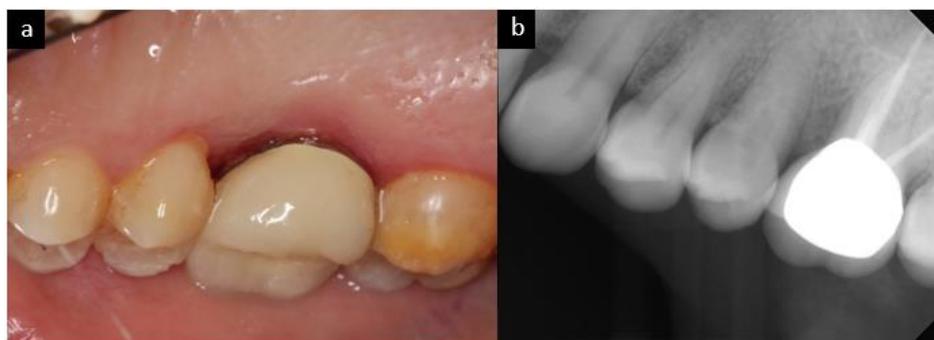


Figure 4: Permanent crown delivery. **A)** Intraoral and **B)** Radiological views.

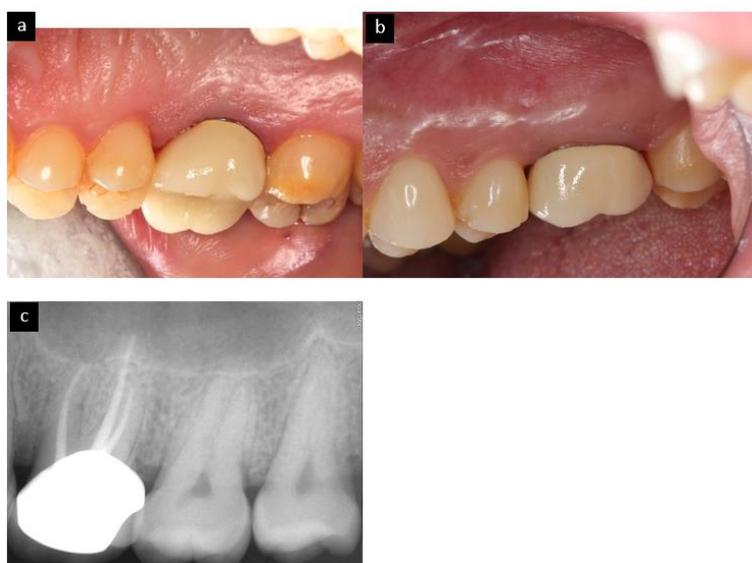


Figure 5: Twenty-one months post-operative follow-up. **A)** Palatal, **B)** Buccal, and **C)** Radiological views.

CLINICAL OUTCOMES

The patient only returned once for prophylaxis around 20 months after the surgery. The oral hygiene was fair to poor with signs of biofilm-induced gingivitis. The entire dentition was meticulously cleaned, and oral hygiene instruction was given again. The patient was asked to return one month after the prophylaxis appointment for a final assessment.

The 21 months follow-up revealed successful outcome. Probing depth ranged 3 mm to 4 mm, and the peri-apical radiograph showed stable crestal bone level (Figure 5A and Figure 5B). Although dental plaque was detected by scraping with a periodontal probe, bleeding on probing was not detected.

The patient felt satisfied with the final restoration and reported no problem on eating and brushing. She was advised to continue a 6 months maintenance schedule.

DISCUSSION

This case report documents a successful application of root reshaping technique in combination with fixed prosthesis restoration for saving a fractured tooth. The fractured tooth received minimal bone reduction and root reshaping to obtain sufficient ferrule effect and biologically acceptable root surface, and then restored with a single crown restoration to reestablish its occlusal function.

Advantages	<ul style="list-style-type: none"> • Minimal alveolar bone reduction • Minimal risk of iatrogenic furcation exposure • Minimal attachment loss of adjacent teeth
Disadvantages	<ul style="list-style-type: none"> • Relatively reduced tooth strength • Potential risk of irritation to vital pulp • Enhanced complexity of crown design (emergency profile)
Indications	<ul style="list-style-type: none"> • Mild initial furcation involvement (grade I) • Strong/favorable residual crown structure • Non-esthetic area
Contraindications	<ul style="list-style-type: none"> • Unfavorable crown-root ratio (>1:1) • Vertical root fracture • Severe furcation involvement (grade III) • Esthetic area

Table 1: Advantages, disadvantages, indications and contraindications of root reshaping technique for surgical crown lengthening.

Table 1 summarized the advantages, disadvantages, indications, and contraindications of root reshaping technique for surgical CLP. As opposed to conventional surgical CLP, root reshaping creates sufficient surface area for biological width and ferrule effect via odontoplasty [4,8]. This allows for minimizing the amount of crestal bone reduction. With that, risk of iatrogenic

furcation exposure and attachment loss of adjacent teeth could be reduced as well. However, this technique could result in reduced strength of tooth structure and irritation to the pulp when it is vital [9]. The design of restorations could be more complicated in teeth managed with this modified procedure if the furcation areas are involved. Fluting and barreling of the furcation should be considered to obtain better accessibility for plaque control [10].

Pre-surgical evaluation of the tooth structure is very crucial. This evaluation should take several factors into consideration: crown-to-root ratio, esthetic outcome, initial furcation condition, and fracture pattern if indicated [4,11,12]. Crown-to-root ratio of the restored tooth can significantly affect its long-term survival rate, and this ratio should be controlled no higher than 1:1 [11]. Molars with moderately deep grade II and III furcation involvement may not be an indication for root reshaping technique since the strength of tooth structure after root reshaping may not be favorable [4,13]. Moreover, the increased clinical crown heights after surgical CLP may negatively impact the symmetry and harmony of gingival line in the esthetic zone [12]. Alternative treatment options, such as extraction, surgical extrusion, and orthodontic extrusion [14], should be considered when the condition is contraindicated for surgical CLP.

In conclusion, root reshaping technique enables the performance of surgical CLP with minimal crestal bone reduction and the avoidance of intragenic furcation exposure, which may contribute to the long-term stability of the tooth and its restoration; however, a thorough pre-surgical evaluation on tooth structure and esthetic as well as the design of restoration is the key for successful treatment.

CONFLICTS OF INTEREST

The authors report no conflicts of interest associated with this study.

FUNDING STATEMENT

This research did not receive any specific funding.

REFERENCES

1. Deas DE, Moritz AJ, McDonnell HT, et al. (2004) Osseous surgery for crown lengthening: A 6-month clinical study. *Journal of Periodontology* 75(9): 1288-1294.
2. Pilalas I, Tsalikis L, Tatakis DN (2016) Pre-restorative crown lengthening surgery outcomes: a systematic review. *Journal of clinical periodontology* 43(12): 1094-1108.
3. Cordaro M, Staderini E, Torsello F, et al. (2021) Orthodontic Extrusion vs. Surgical Extrusion to Rehabilitate Severely Damaged Teeth: A Literature Review. *International Journal of Environmental Research and Public Health* 18(18): 9530.
4. Melker DJ, Richardson CR (2001) Root reshaping: An integral component of periodontal surgery. *International Journal of Periodontics & Restorative Dentistry* 21(3): 296-304.
5. Da Cruz MK, Martos J, Silveira LFM, et al. (2012) Odontoplasty associated with clinical crown lengthening in management of extensive crown destruction. *Journal of Conservative Dentistry: JCD* 15(1): 56-60.
6. Zhen M, Wang C, Hu WJ, et al. (2017) Periodontal evaluation of crown-root fractured teeth following modified crown lengthening surgery. *British Dental Journal* 222(1): 21-25.
7. Andreasen JO, Andreasen FM (1994) Textbook and color atlas of traumatic injuries to the teeth. Munksgaard.
8. Juloski J, Radovic I, Goracci C, et al. (2012) Ferrule effect: A literature review. *Journal of Endodontics* 38(1): 11-19.
9. Yavorek A, Bhagavatula P, Patel K, et al. (2020) The incidence of root canal therapy after full-coverage restorations: A 10-year retrospective study. *Journal of Endodontics* 46(5): 605-610.
10. Jameson LM, Malone WF (1982) Crown contours and gingival response. *The Journal of Prosthetic Dentistry* 47(6): 620-624.
11. Patil K, Khalighinejad N, El-Refai N, et al. (2019) The effect of crown lengthening on the outcome of endodontically treated posterior teeth: 10-year survival analysis. *Journal of Endodontics* 45(6): 696-700.

12. Nobre CMG, de Barros Pascoal AL, Albuquerque Souza E, et al. (2017) A systematic review and meta-analysis on the effects of crown lengthening on adjacent and non-adjacent sites. *Clinical Oral Investigations* 21(1): 7-16.
13. Hamp SE, Nyman S, Lindhe J (1975) Periodontal treatment of multi rooted teeth. Results after 5 years. *Journal of Clinical Periodontology* 2(3): 126-135.
14. Kozlovsky A, Tal H, Lieberman M (1988) Forced eruption combined with gingival fiberotomy: A technique for clinical crown lengthening. *Journal of Clinical Periodontology* 15(9): 534-538.