Restoration - Orthodontic Extrusion

Evidence Based Dentistry Rounds

Orthodontics

Jenna Guernsey, Alex Merchant, Kyle Coon and Shawn Tipple

7A-1

10/14/2020

Rounds Team

Group Leader: Dr. Rossi

Specialty Leader: Dr. Liu

D4 - Shawn Tipple

D3 - Kyle Coon

D2 - Alex Merchant

D1 - Jenna Guernsey

Patient

Age: 29

Gender: Female

Ethnicity: Hispanic

Chief Complaint: “Want to fill spaces after ortho.”

Medical History

Diagnoses: None

Conditions: Ongoing PT for neck due to accident in April 2019

Medications: None.

Patient previously on Prednisone daily while pregnant (October 2019 - April 2020).

Treatment considerations: Post pregnancy and/or Prednisone implications with extractions

Dental History

First seen at MUSoD 2016

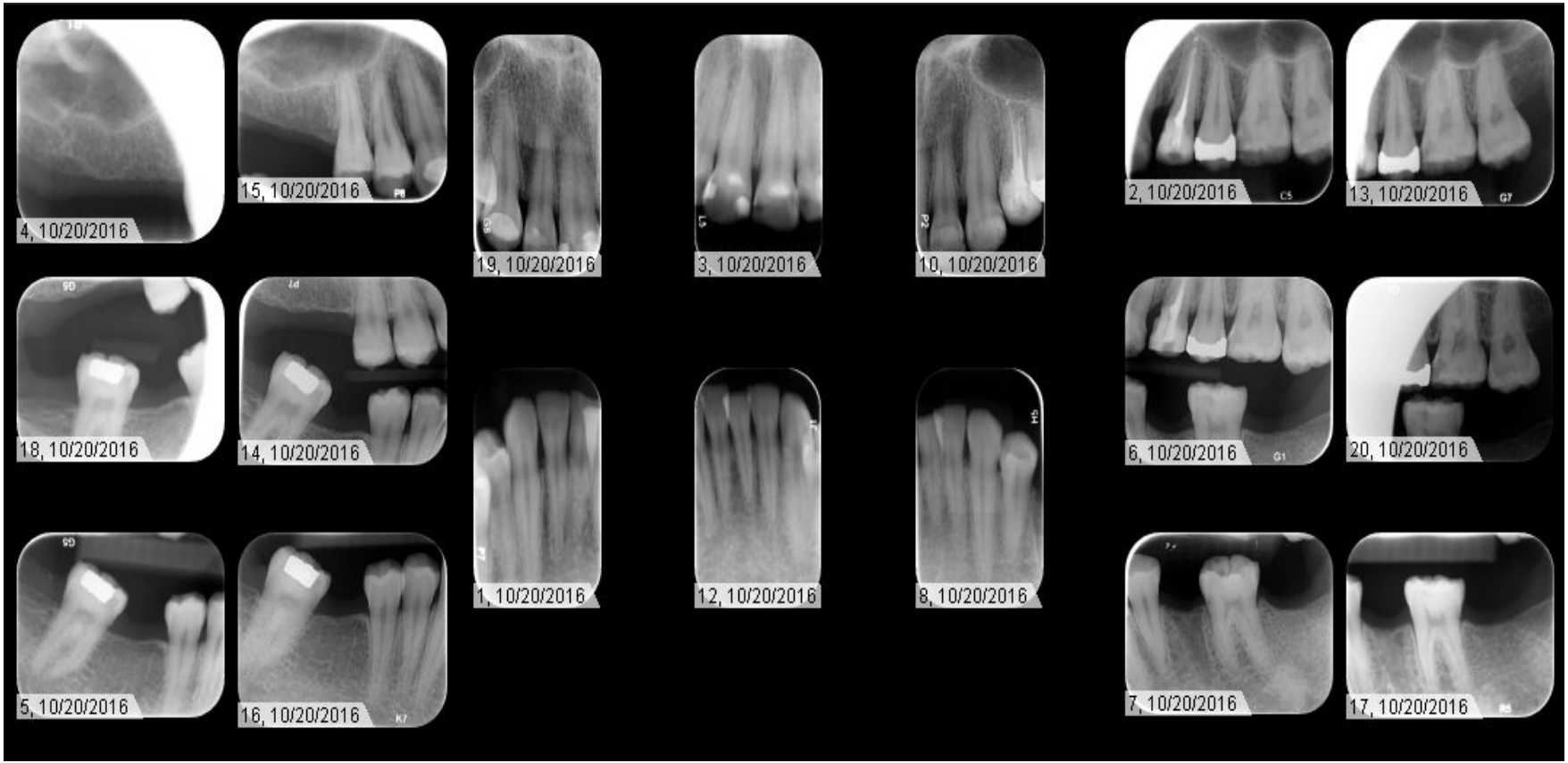
Stage I restorations 2016-2017

#12 fractured 2017 - maintained per request by orthodontist

Orthodontic treatment 2018 to present (Esthetics and Space Management with Dr. Race - external to school clinic)

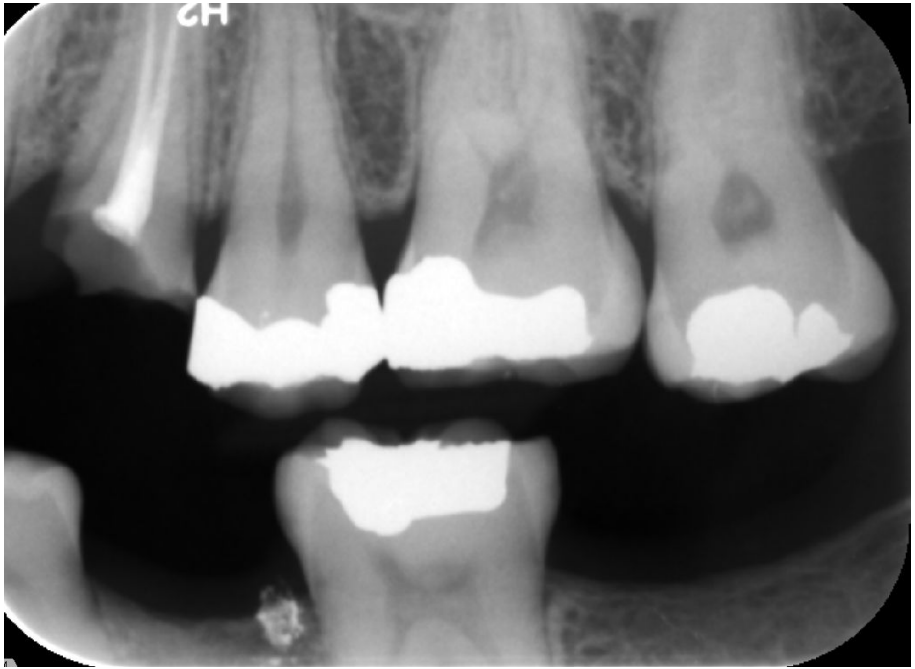
Patient would like implant but orthodontic extrusion may also be an option

Previous FMX 2016

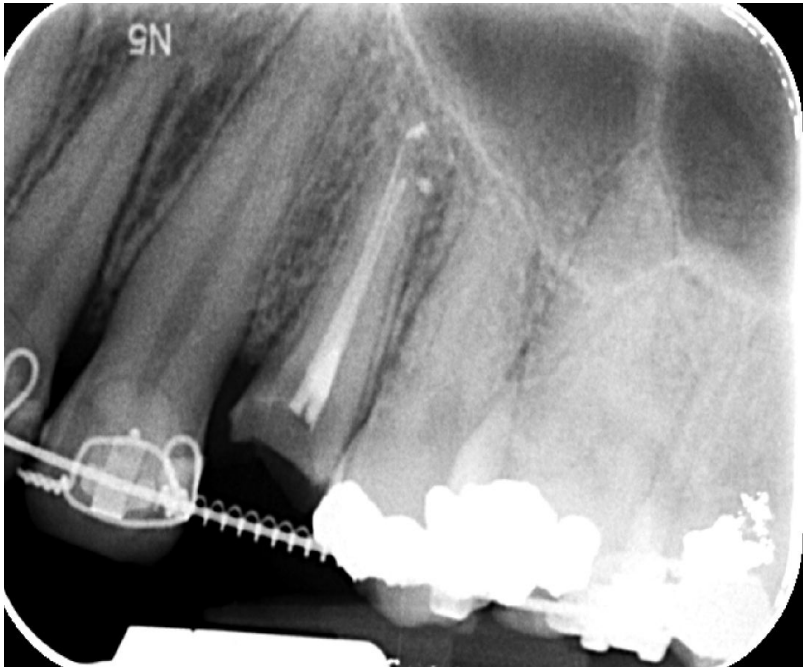


Previous Radiographs

Left BWX 2017

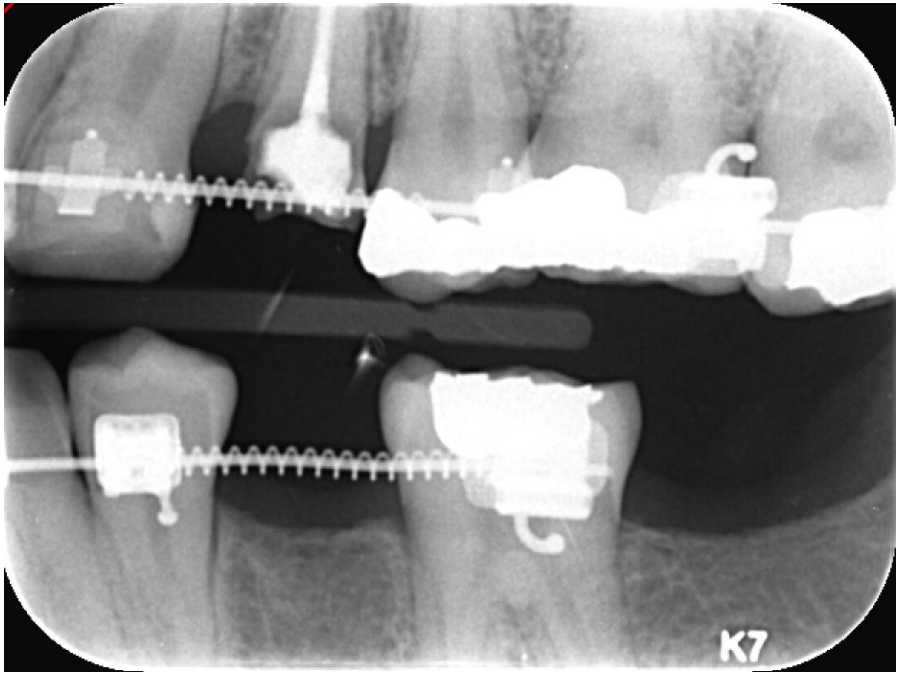


UL PAX 2019

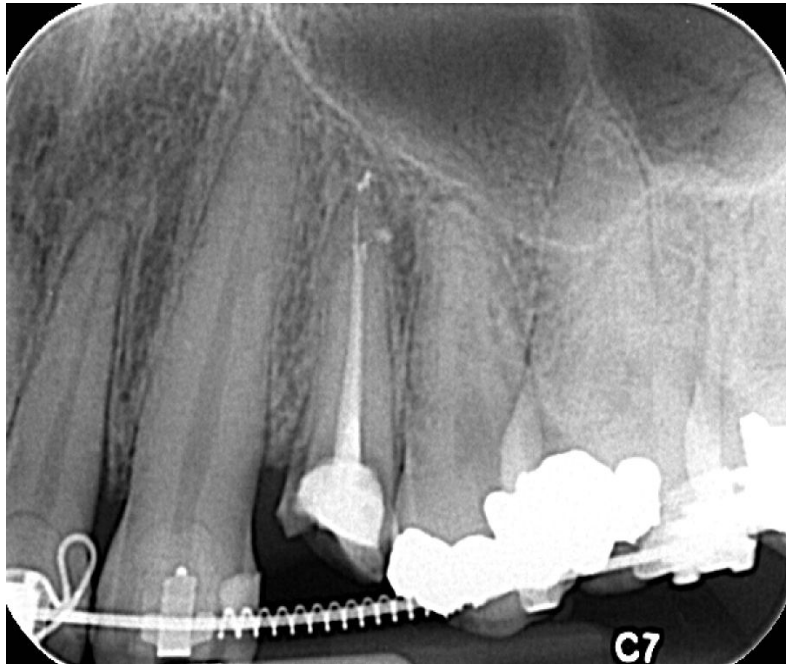


Current Radiographs

Left BWX Oct 2020



UL PAX Oct 2020

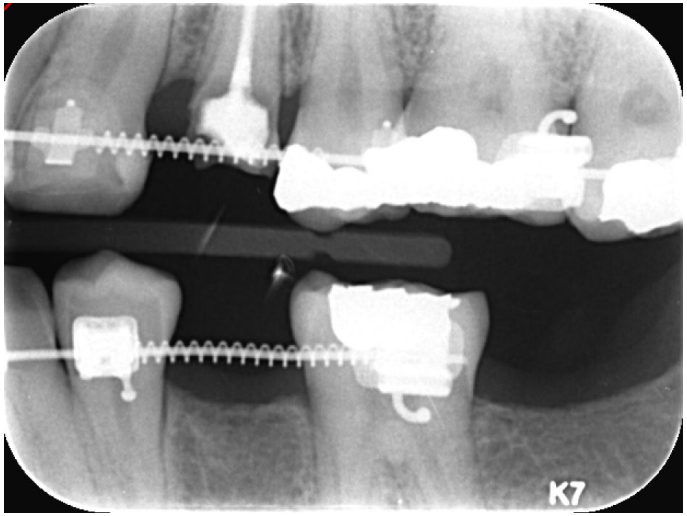


Radiographic Findings

Extruded sealer emerging from apex #12

Root length approx.: _____???

Tooth structure above alveolar crest approx.: 2-3mm



Clinical Findings

Occlusal composite resin placed previously to remove carious lesions and seal coronal portion of #12

No furcation involvement #12

Pocket Depths: 2s and 3s site #12

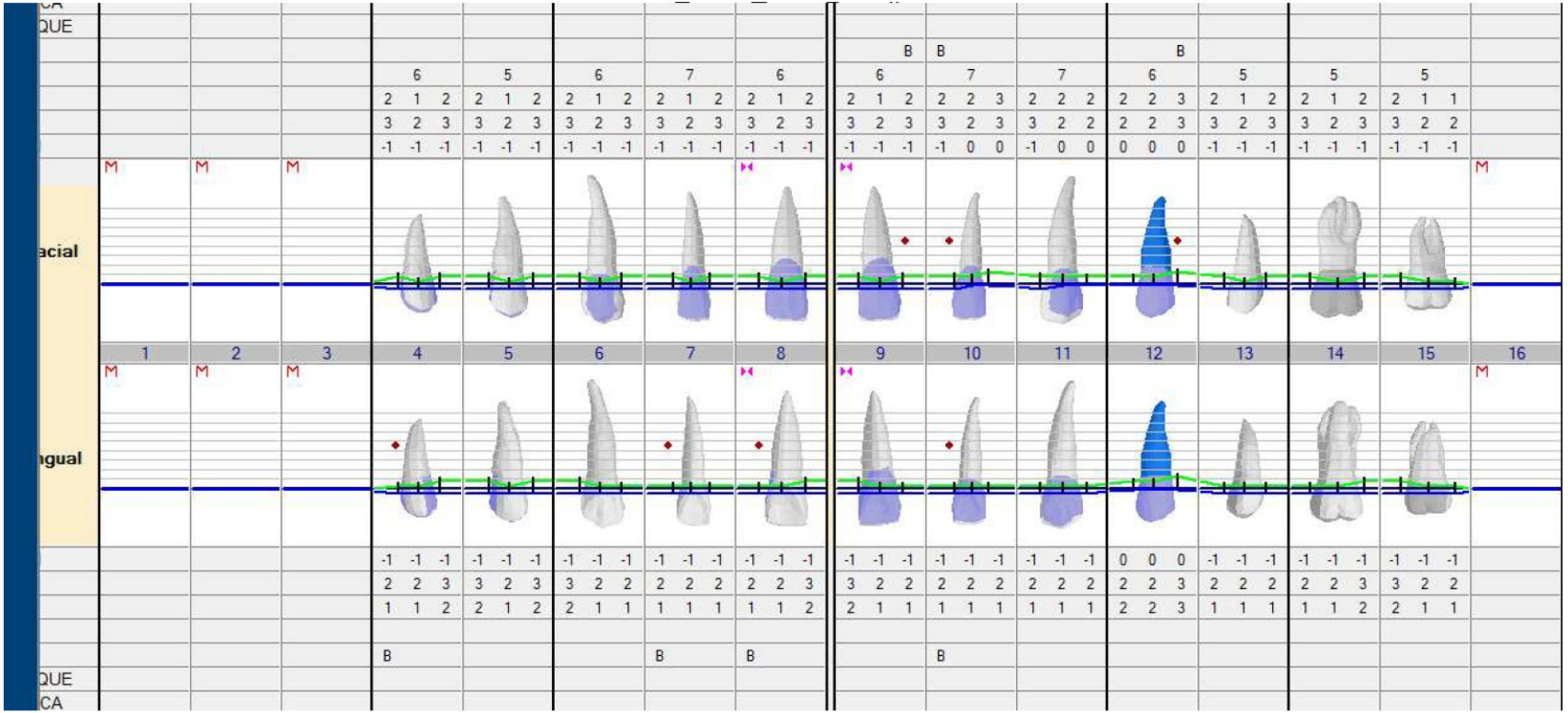
Specific Findings

Due to root length and remaining dentinal height/thickness tooth may be viable for orthodontic extrusion

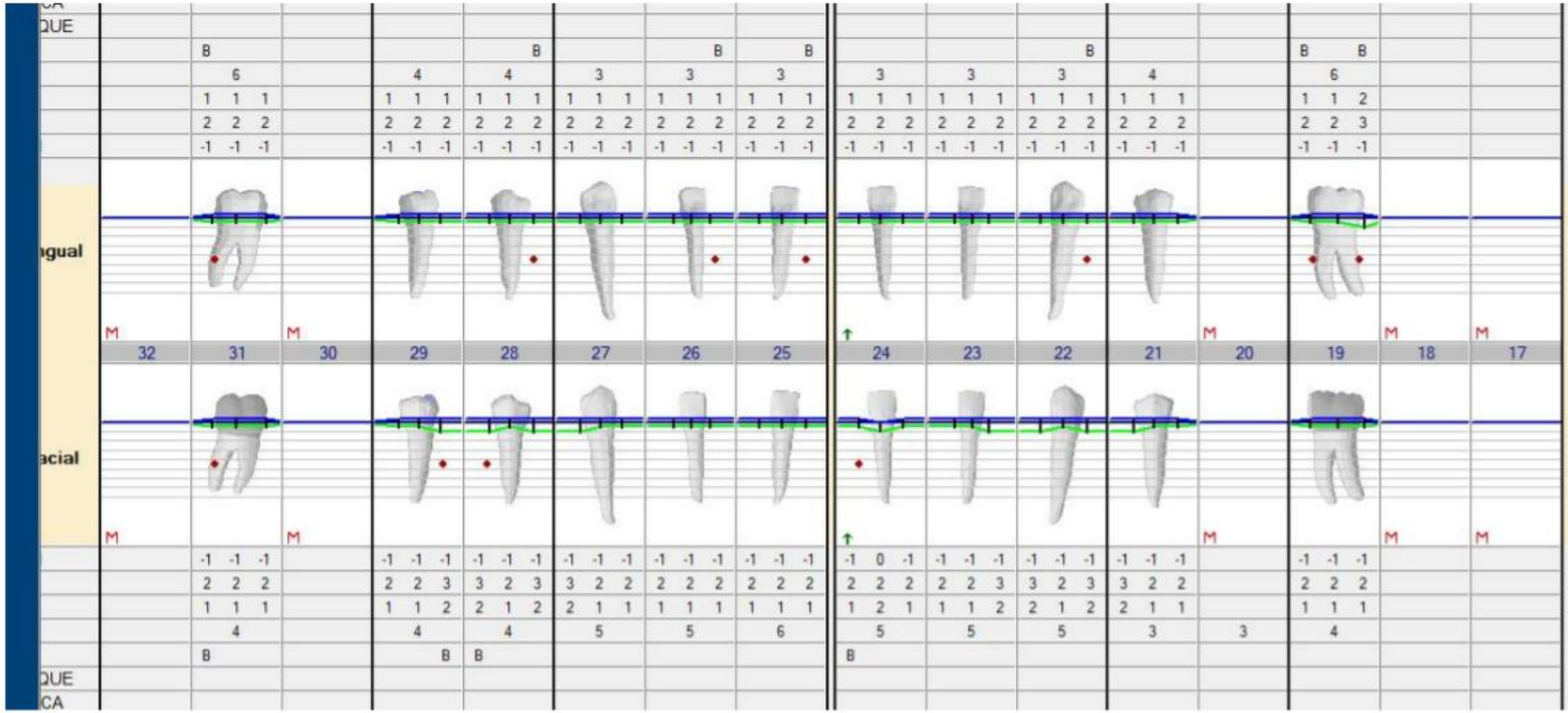
Current brackets and wires can assist in this therapy

Furcation involvement due to extrusion is possibility. Must assess during treatment

Periodontal Charting



Periodontal Charting



Diagnosis

#12 Gross Caries - Broken off at gingival margin

Problem List

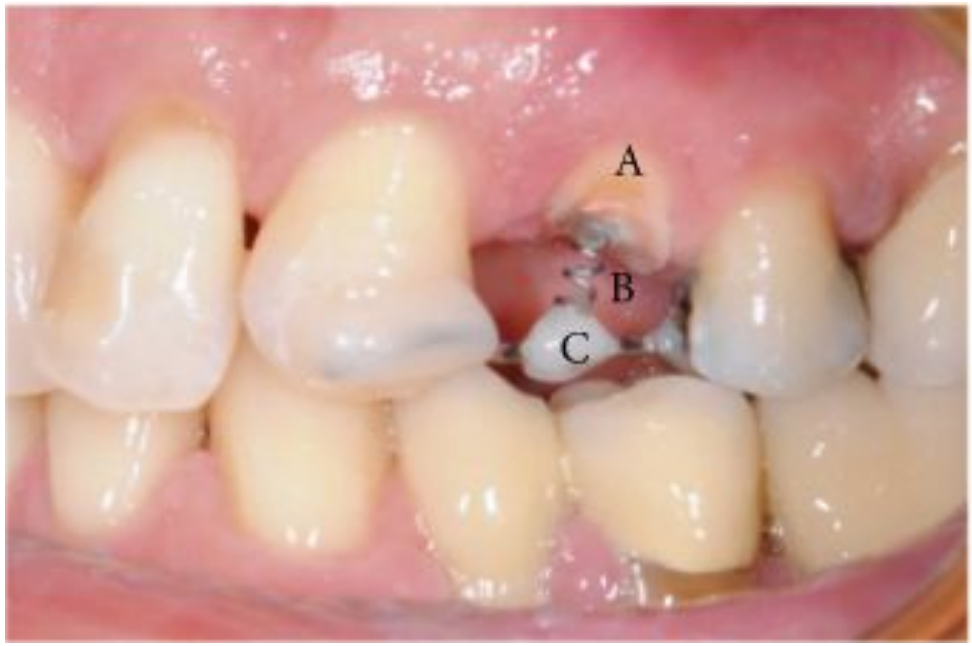
Defective Restorations (31)

Esthetics

Gross Caries (12)

Missing teeth

What is orthodontic extrusion?



What is orthodontic extrusion?

Distance of extrusion and length of time depends on necessary ferrule height and maintenance of biologic width

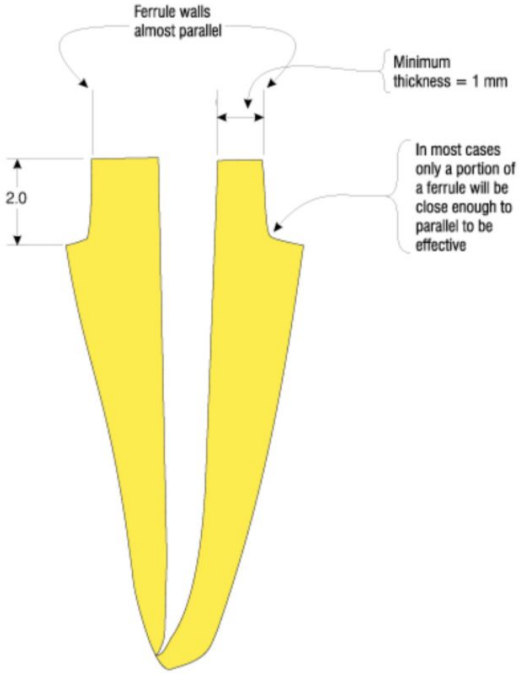
Must keep in mind favorable/minimal crown to root ratio (2:3/1:1) and any potential furcation involvements for extrusion to have good prognosis

D1 Basic Science - What is Ferrule?

- Metal band that encircles tooth to support a restoration

- Can use a ferrule if healthy tooth structure meets height and width requirements
  - Minimum = 1 mm
  - Most beneficial = 1.5-2 mm
  - Width minimum = 1 mm
  - **Greater amount of tooth height = greater chance of success and resistance to fracture**

- Biologic Width -
  - Crown margin = 2 mm from alveolar crest



What is Ferrule in Dentistry? (n.d.). Retrieved from https://dentagama.com/news/what-is-ferrule-in-dentistry

D1 Basic Science - What is Ferrule?

- If not enough ferrule length, can consider orthodontic extrusion or crown lengthening
  - ⇧Supragingival tooth structure = ⇧ tooth length for ferrule

- When used effectively:
  - Helps hold tooth together
  - Helps tooth avoid fracture
  - Helps tooth resist fracture

- Supporting endodontically treated teeth

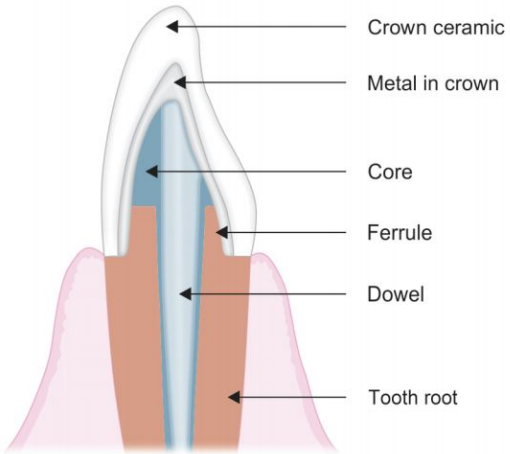


Fig. 1: Tooth-post and core system

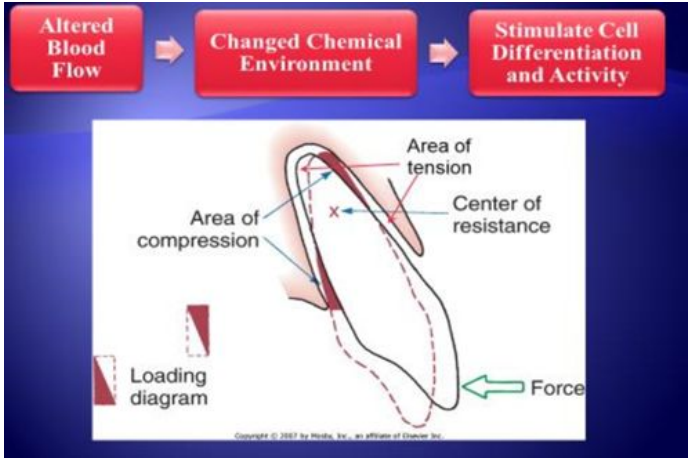
A ferrule. (*Image courtesy of Dr. Gerald Barrack.*)

Benefit of Ferrule or Post in Endodontically Treated Teeth: BC Endo. (2019, September 14). Retrieved from https://www.bcendosolutions.ca/2019/07/10/endo-newsletter-july-2019/

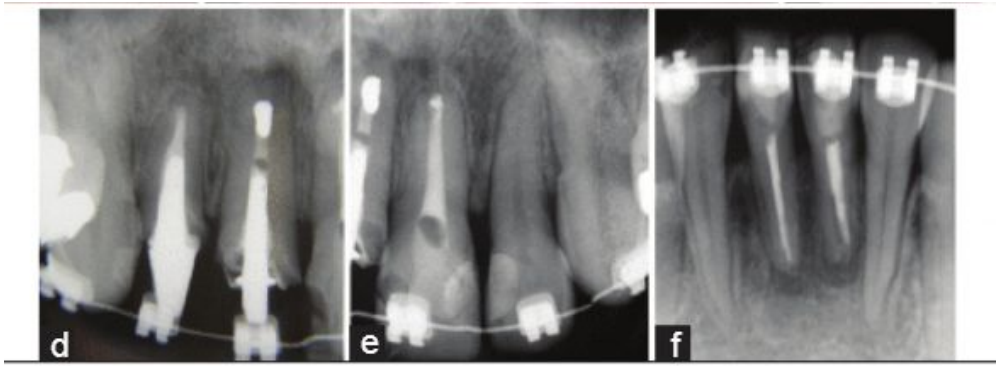
Venkatesan, S. M., Abraham, A. J., Koshy, C. R., Narayanan, S., Ashok, V., & Sundaran, R. M. (2019). Ferrule: A Literature Review. Journal of Operative Dentistry & Endodontics, 4(2), 92-95. doi:10.5005/jp-journals-10047-0078

D2 Pathology - Does Endodontically Treated Teeth Affect Orthodontic Movement?

- Compression and Tension sides due to forces exerted on the teeth from orthodontic brackets (3)
- Orthodontic External Apical Root Resorption is a result of orthodontic treatment (1)



(Nimeri, G)

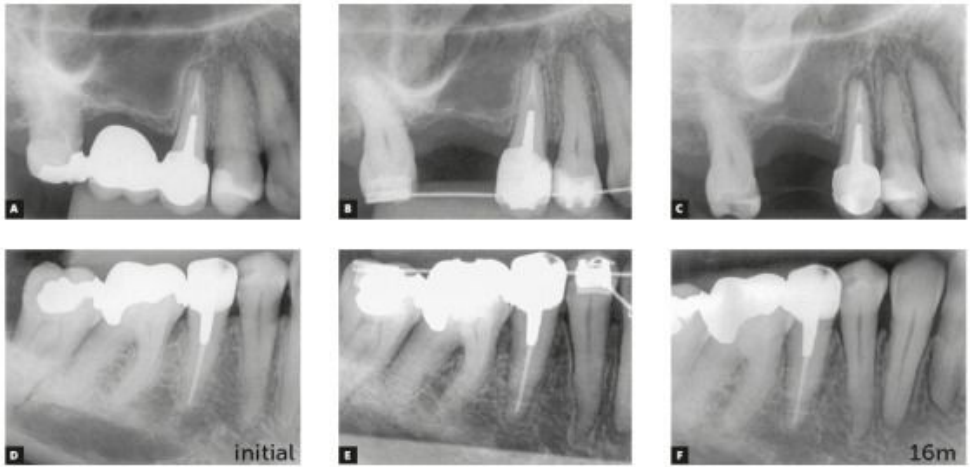


(Orlando, T., & Filho, J.)

D2 Pathology - Does Endodontically Treated Teeth Affect Orthodontic Movement?

- There were not any statistically significant differences in Root Resorption between root-filled teeth and vital teeth. (1)
- A tooth that needs endodontic treatment should receive the endodontic treatment before orthodontic movement (1)
- Endodontic treatment is not a contraindication for orthodontic treatment (2)

(González-Martín O)



(Consolaro, Alberto et al.)

References

1. Orlando, T., & Filho, J. (2013). Orthodontic treatment in an endodontically treated maxillary incisors. *European Journal of General Dentistry, 2*(1). doi:10.4103/2278-9626.106823
2. Consolaro, Alberto et al. “Orthodontics and Endodontics: clinical decision-making.” *Dental press journal of orthodontics* vol. 25,3 (2020): 20-29. doi:10.1590/2177-6709.25.3.020-029.oin
3. Nimeri, G. (2020, February 9). *Tooth Movement Histology*. Lecture presented at Marquette University School of Dentistry.
4. González-Martín O, Solano-Hernandez B, González-Martín A, Avila-Ortiz G. Orthodontic Extrusion: Guidelines for Contemporary Clinical Practice. Int J Periodontics Restorative Dent. 2020 Sep/Oct;40(5):667-676. doi: 10.11607/prd.4789. PMID: 32925996.

D3 PICO

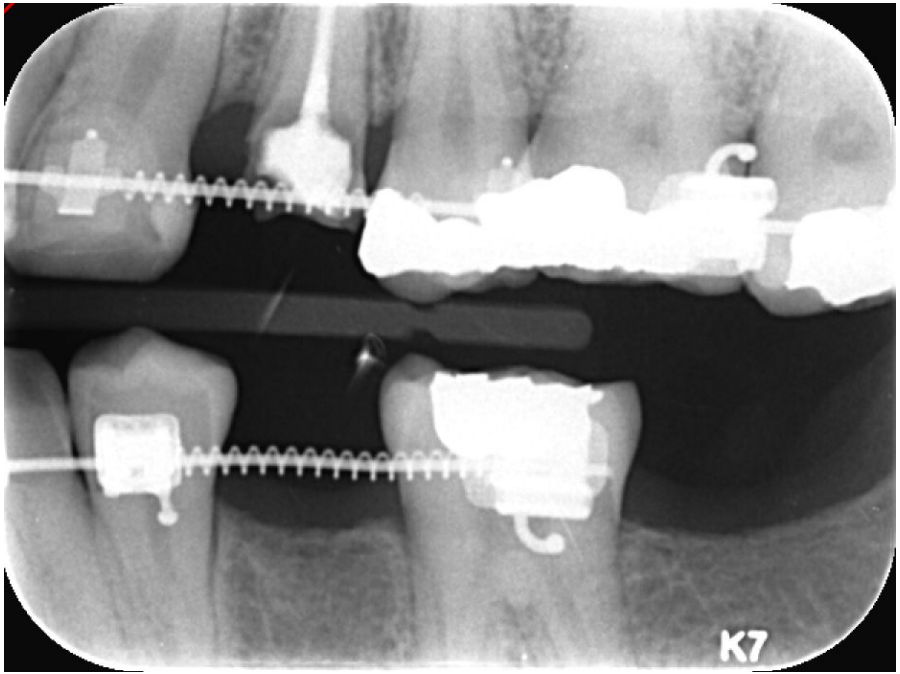
- **Clinical Question:**

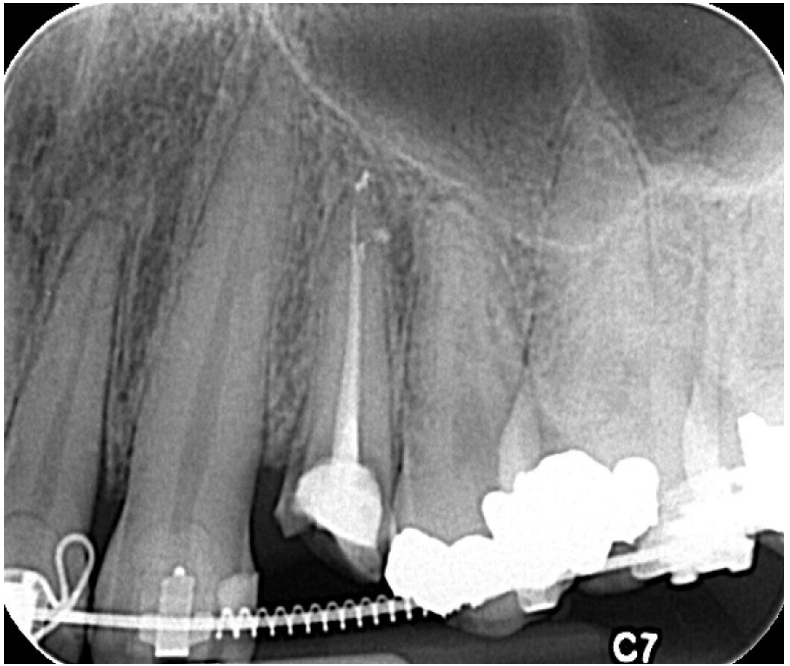
Is there a difference in the amount of ferrule required based on the different types of posts available?

Why this PICO??

- **#12 needs a crown but there's little coronal tooth structure left to build off of:**
  - **Goal**: be conservative with preparation yet utilize an adequate amount of dentin for enough ferrule height to support a crown
    - **Considerations**:
      - minimize amount of orthodontic extrusion required to maintain root stability
      - ensure post can seat deep enough in canal for stability
        - bifurcation could pose challenges

PA and BW of #12





PICO Format

P: Pt has minimal residual coronal tooth structure available for crown

I: cast metal post

C: prefabricated metal post or fiber post

O: utilize a post with a high level of stability on a minimal ferrule

PICO Formatted Question

- For patients with minimal coronal tooth structure and dentin remaining to prepare for a crown ferrule, which type of post can provide adequate stability for the restoration while requiring the least amount of dentin for the ferrule.

Clinical Bottom Line

- Which kind of post allows us to utilize as little remaining dentin as possible yet shows adequate support for a crown?

Search Background

- **Date(s) of Search:** 10/01/2020
- **Database(s) Used:** AAE website, PubMed
- **Search Strategy/Keywords:** post, core, ferrule, failure
- **MESH terms used:** post, core, ferrule, failure

Article 1 Citation, Introduction

- **Citation:** Dr. Richard S. Schwartz, Restoration of Endodontically Treated Teeth: The Endodontist's Perspective, Part 1, American Association of Endodontics, 2004, Spring/Summer.
- **Study Design:** Clinical Guideline
- **Study Need / Purpose:** provide restorative options from an endodontist's perspective

Endodontically Treated Teeth: The Endodontist's Perspective, Part 1

- Clinical Guideline
- 4 Types of Posts Available for Restoration
  - 1. Cast metal posts
    - Pros: custom, easy to remove for re-tx, cast gold shows high success rate
    - Cons: time consuming, lab fees, temporization, generally underperform
  - 2. Prefabricated metal posts
    - Pros: convenience, post/core 1 appt, strong = thinner, easily removed
    - Cons: titanium alloy weaker/ less radiolucent
  - 3. Ceramic, Glass, and Zirconia posts
    - Pros: esthetic – mainly anteriors
    - Cons: difficult removal if possible, recommend to avoid
  - 4. Fiber posts
    - Pros: elastic modulus similar to dentin, easy removal
    - Cons: may be prone to leakage

Article 1 Selection – "the foundation"

- Provided info about posts available for use and their strengths/weaknesses
  - Consider: cast metal, prefabricated metal, fiber post

Article 2 Citation, Introduction

- **Citation:** Fontana PE, Bohrer TC, Wandscher VF, Valandro LF, Limberger IF, Kaizer OB. Effect of Ferrule Thickness on Fracture Resistance of Teeth Restored With a Glass Fiber Post or Cast Post. Oper Dent. 2019 Nov/Dec;44(6):E299-E308.
- **Study Design:** randomized trial, in vitro research
- **Study Need / Purpose:** "To investigate the influence of ferrule thickness on fracture resistance after mechanical cycling of teeth restored with different intracanal posts."

Article 2 Synopsis

- **Method:** 125 bovine incisors were randomized into 6 study groups of either fiber or cast posts and the amount of ferrule – no ferrule, 0.5mm or 1mm thickness, and retaining unaltered 2mm ferrule. Posts and metal crowns cemented using adhesive cement. Samples were subjected to mechanical cycling at varying directions, forces, and rates. Fracture load tests at a speed of 0.5mm/min at 45 degree slope were also applied until failure occurred. Failure were classified as favorable or unfavorable.

Article 2 Synopsis

- **Results:** for the cast post and core group the 1mm ferrule thickness group showed higher fracture resistance than the non-ferrule group($p=0.001$). The glass fiber groups showed no significant difference in fracture resistance. Overall, 96.7% of the specimens survived the mechanical cycling.

Article 2 Synopsis

- **Conclusions: "**A thicker ferrule statistically increased the fracture resistance only for cast post and core when it was at least 1 mm thick, despite causing more unfavorable failures. Thus, ferrule thickness should be considered when choosing different intracanal posts, to reduce the occurrence of unfavorable failures. In the absence of a ferrule, the use of a cast post and core presents more favorable failures, and in the presence of a 1-mm-thick ferrule, the use of a glass fiber post seems to be the best clinical decision."
- **Limitations:** used bovine incisor teeth, classification of failure/non-failure seems subjective

Article 2 Selection

- **Reason for selection:** head to head comparison of two posts types in consideration based on ferrule thickness
- **Applicability to your patient:** not strong enough evidence to warrant making a decision on post type solely on this article
- **Implications:** ferrule – consider a cast post, at least a 1mm ferrule – consider a glass fiber post

Article 3 Citation, Introduction

- **Citation:** Sendhilnathan D, Nayar S. The effect of post-core and ferrule on the fracture resistance of endodontically treated maxillary central incisors. Indian J Dent Res. 2008 Jan-Mar;19(1):17-21.

- **Study Design:** in vitro research

- **Study Need / Purpose:** " To evaluate the effect of post reinforcement, post type and ferrule on the fracture resistance of endodontically treated maxillary central incisors."

Article 3 Synopsis

- **Method:** 60 human, central incisors were grouped into 6 categories (A-F). A was the control with no tx. B was endo treated and crowned with no post. Cast posts groups were C(2mm ferrule) and D(no ferrule). Prefabricated metal post groups were E(2mm ferrule) and F(no ferrule). All groups were subjected to load testing at 135 degrees to the lingual surface with a universal machine until fracture occurred. Fracture loads and mode of fracture were recorded. One-way analysis of variance was utilized with Tukey honestly significant difference procedure for the significant difference among the groups at a 5% level ($P < 0.05$).

Article 3 Synopsis

- **Results:** Among the 6 groups there was a significant difference($p<0.0001$). Group C(cast w/2mm) recorded the highest fracture strength. Groups A(no tx) and D(cast w/o ferrule) showed significant difference versus B(endo + crown), E(prefab w/2mm) and F(prefab w/o ferrule). No significant difference was found between B, E, and F. Cervical fracture was most common source of failure in all groups besides A.
- **Conclusions:** Custom cast posts with 2mm ferrule were as strong as the control group. Teeth with custom cast posts were more resistant to fracture than the prefabricated metal posts. Ferrule was more of a significant factor in cast posts than prefab posts.
- **Limitations:** in vitro research on incisors with only one direction of force

Article 3 Selection

- **Reason for selection:** head to head comparison of two posts types in consideration based on ferrule availability
- **Applicability to your patient:** not strong enough evidence to warrant making a decision on post type solely based on this study
- **Implications:** consider a cast post if there is ferrule available. If there's no ferrule a prefabricated metal post is equally as effective as a resin core build-up with no post. Cast posts were more resilient in both categories than prefabricated metal posts.

Article 4 Citation, Introduction

- **Citation:** Marchionatti AME, Wandscher VF, Rippe MP, Kaizer OB, Valandro LF. Clinical performance and failure modes of pulpless teeth restored with posts: a systematic review. Braz Oral Res. 2017 Jul 3.

- **Study Design:** systematic review

- **Study Need / Purpose:** "The aim of this systematic review was to compare the clinical performance and failure modes of teeth restored with intra-radicular retainers."

Article 4 Synopsis

- **Method:** Inclusion criteria consisted of two elements: 1) study must be an RCT and 2) it must compare at least two types of interradicular retainers. 341 studies were identified and narrowed down to 11 that met criteria and were reviewed. The types of posts reviewed were prefabricated and custom fiber and prefabricated and custom metal with follow-ups ranging from 6mo to 10yrs.
- **Results:** Ranges of survival rates for fiber retainers was 71 to 100% and 50 to 97.1% for metal. The studies showed no differences in survival amongst the different types of metal posts and most showed no difference between fiber and metal posts. Two studies notes factors such as remaining dentin height, number of walls, and ferrule increased restorative longevity.
- **Conclusions:** Metal and fiber posts showed similar clinical success for short and long term follow-ups and remaining coronal structure and ferrule increase the survival.
- **Limitations:** only a few studies noted ferrule as a factor for success

Article 4 Selection

- **Reason for selection:** systematic review of RCTs – high level of evidence
- **Applicability to your patient:**
- **Implications:** post type is less of a factor in longevity of restorations than residual coronal structure, number of walls available, and ferrule.

Levels of Evidence

- ☐ **1a** – Clinical Practice Guideline, Meta-Analysis, Systematic Review of Randomized Control Trials (RCTs)
- ☐ **1b** – Individual RCT
- ☐ **2a** – Systematic Review of Cohort Studies
- ☐ **2b** – Individual Cohort Study
- ☐ **3** – Cross-sectional Studies, Ecologic Studies, "Outcomes" Research
- ☐ **4a** – Systematic Review of Case Control Studies
- ☐ **4b** – Individual Case Control Study
- ☐ **5** – Case Series, Case Reports
- ☐ **6** – Expert Opinion without explicit critical appraisal, Narrative Review
- ☐ **7** – Animal Research
- ☐ **8** – In Vitro Research

Strength of Recommendation Taxonomy (SORT)

☐	**A** – Consistent, good quality patient oriented evidence
	B – Inconsistent or limited quality patient oriented evidence
☐	**C** – Consensus, disease oriented evidence, usual practice, expert opinion, or case series for studies of diagnosis, treatment, prevention, or screening

Conclusions: D3

- **Consider/weigh:**
  - **Literature:** good, current research on humans that includes a comparison of the different types of posts and ferrule dimensions is hard to find
  - **Patient circumstances & preferences:** Cost, esthetics, expediency of treatment

Based on the above considerations, how will you advise your D4?

- Ferrule is always desirable and improves the chances of success in all types of posts. Try to achieve a minimum of 1mm ferrule before you consider a post type because the post is less vital to success than the ferrule. If you cant achieve enough ferrule advise pt. of the increased rate of failure and consider a cast post, extrusion to increase ferrule, or an implant.

Conclusions: D4

Upon Orthodontic evaluation your tooth may be viable for restoration utilizing orthodontic extrusion, assuming no furcation involvement occurs during treatment

Previous Root Canal Therapy should not affect the outcome of orthodontic movement

Upon completion of extrusion your tooth will need a post and core to improve resistance to fracture and adequately support/retain your crown. We would recommend a cast custom post and core but alternative options are available and show similar levels of success

Questions?

THANK YOU