Final Thesis Defense Examination

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The Effect of Gates Glidden Bur Size on Residual Dentin Thickness in Mandibular Molars

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University
Overview

- Abbreviations / Acronyms
- Terminology
- Introduction
- Materials and Methods
- Results
- Discussion
- Conclusions
Abbreviations / Acronyms

- **A**: Apical
- **C**: Coronal
- **GGb / GGbs**: Gates Glidden bur(s)
- **M**: Middle
- **RDT**: Residual dentin thickness
Terminology

- **Apical**: This referred to the level of sectioning 7 mm apical to the furcation
- **Canal**: When in tables, this referred to the facial or lingual canal
- **Level of sectioning**: The place where the saw traveled through the root specimen
Terminology

- (Canal x level of sectioning): One of the canals at that level of sectioning
- Ledge: A slang term for a defect in a canal that disrupted its flow.
Introduction

• Clinical Relevance:
  • Instrumentation most important (Weine 1975).
  • Design objectives include developing a smooth tapering funnel (Schilder 1974).
  • Instrumentation should conserve healthy dentin in order to avoid perforations and weakening of tooth structure (Gutmann 1977)
Introduction

• Clinical Relevance:
  • Instrumentation should conserve healthy dentin in order to avoid perforations and weakening of tooth structure (Gutmann 1977) (Sorensen 1984) (Felton 1991) (Trope 1992)
Introduction

- Clinical Relevance:
  - Gates Glidden bur has been used for over 100 years (Ottolengui 1892).
  - Step-Down or Crown-Down has advantages
  - Gates Glidden bur strip perforation can result in a poor prognosis (Fuss 1996)
  - Prevention is the key
Table 1. Advantages of step-down or crown-down techniques over pure step-back techniques.

1. Straight-line access to the apical region is achieved sooner. (Goerig 1982, Morgan 1984)
2. Interferences in the coronal two-thirds of the canal are eliminated. (Goerig 1982, Morgan 1984)
3. The bulk of the pulp tissue, debris, and microorganisms are removed before apical instrumentation. (Goerig 1982, Morgan 1984)
4. Less debris is forced apically with crown-down. (Ruiz-Hubarb 1987)
5. The enlargement during radicular access allows better irrigation. (Goerig 1982, Morgan 1984)
6. The working length is less likely to change later in the procedure. (Goerig 1982, Morgan 1984)
7. Early flaring provides better apical size and tactile apical awareness. (Morgan 1984, Contreras 2001)
Introduction

• Clinical Relevance:
  • Prevention
    • Use smaller instruments based on radiograph (thickness of root)
    • Dentin/cementum was 1/5 less than it appeared on radiograph (Berutti 1992)
    • Anticurvature filing (Abou-Rass 1980)
    • Cut on withdrawal stroke (Weine 1975)
Introduction

- Review of the Literature
  - Kessler and Peters 1983
  - Gegauff et al. 1988
  - Luebke and Brantley 1990
  - Berutti and Fedon 1992
  - Isom, Marshall and Baumgartner 1995
  - Pilo et al. 1998
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• Review of the Literature
  • Kessler JR, Peters DD, Lorton L 1983
    • Compared the relative risk of molar root perforations using various techniques
    • Results: Thinning of dentin was greater in the bifurcation area
    • Gates Glidden bur technique had more thin sections than circumferential hand filing
    • Burs used should be used in anticurvature manner
    • Level of sectioning 2.8 mm apical to bifurcation had greatest number of thin sections
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• Review of the Literature
  • Gegauff et al. 1988
    • Conducted comparative study of post preparations using Para-post and Gates Glidden burs
    • Results: The size 3, 4, and 5 GGbs had mean diameters of .90, 1.10 and 1.25 respectively
    • The respective diameter of Gates Glidden canal preparation averaged .13 mm greater than the largest drill diameter used
    • The diameter of the post space is operator dependent
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Introduction

- Review of the Literature
  - Luebke and Brantley 1990
    - Studied physical dimensions and torsional properties of GGbs. One brand was Union Broach.

<table>
<thead>
<tr>
<th>Gates Glidden bur size (Union Broach)</th>
<th>Mean of maximum head width (mm)</th>
<th>SD (mm)</th>
<th>ISO standard nominal size</th>
</tr>
</thead>
<tbody>
<tr>
<td># 2</td>
<td>0.744</td>
<td>0.014</td>
<td># 70</td>
</tr>
<tr>
<td># 3</td>
<td>0.894</td>
<td>0.028</td>
<td># 90</td>
</tr>
<tr>
<td># 4</td>
<td>1.135</td>
<td>0.027</td>
<td># 110</td>
</tr>
<tr>
<td># 5</td>
<td>1.226</td>
<td>0.068</td>
<td># 130</td>
</tr>
</tbody>
</table>
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- Review of the Literature
  - Berutti and Fedon 1992
    - Studied thickness of dentin/cementum of 15 molars
    - Results showed that at 1.5 mm below the bifurcation, the thickness of the dentin/cementum was the least (1.2 to 1.3 mm)
    - It was concluded that this was the zone of greatest risk for stripping
  - Berutti had a different starting reference point than our study
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• Review of the Literature
  • Isom, Marshall, and Baumgartner 1995
    • Evaluated root thickness in the curved canals of mandibular first and second molars after flaring.
    • Compared sized 2 and 3 GGbs to M-Series Canal Openers
    • Results showed GGbs used in a straight up and down motion removed more dentin than canal openers in the same fashion
    • Used in anticurvature fashion, GGBs removed more than other instrument types
    • Recommended using in anticurvature fashion coronally, and straight up and down in the apical portion of the canal
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• Review of the Literature
  • Pilo et al. 1998
    • Studied RDT of mandibular premolars prepared with hand and rotary instruments.
    • Results showed the difference in RDT was significant with regard to: 1) the instrument used, 2) the level of sectioning, and 3) the surface from which the dentin was removed.
    • A size 2 GGb removed significantly less than a size 4 GGb.
    • Dentin removed in a mesiodistal direction was greater than in a buccolingual direction.
Introduction

- **Purpose**: To evaluate mandibular molar root anatomy characteristics and Gates Glidden bur size as related to the outcome of: 1) residual dentin thickness, or 2) perforations. A new CAD software application (DesignCAD 3000) was used for this purpose for the first time.
Materials and Methods

- Study Design
- Specimen Preparation
- Canal Instrumentation
- Photos and Computer Imaging
- Manipulation of Images with Software Program
- Data Collection and Statistical Analysis
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  • Cleaning and storage
  • Radiographs
  • Root length and curvature
  • Muffle system
  • Level of sectioning
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- Manipulation of Images with Software Program
  - Images of pre- and post operative photos were imported into DesignCAD 3000
  - Templates drawings were made