Endodontics
Mandibular Premolars: Teeth not to underestimate

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The success of endodontic treatment depends on removing microorganisms from root canal system, three dimensionally sealing and the placement of a good coronal seal to prevent communications between oral cavity and the periradicular tissues (1-4).

The operator should be able to assess the endodontic case and know about tooth anatomy and the suspected anatomical variations one may face during treatment.
Mandibular premolars Anatomy.

1st premolar. (5)
- Root anatomy

<table>
<thead>
<tr>
<th></th>
<th>1 root</th>
<th>2 roots</th>
<th>3 or 4 roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>98%</td>
<td>1.8</td>
<td>0.1-0.2%</td>
</tr>
</tbody>
</table>

- Canals anatomy

<table>
<thead>
<tr>
<th></th>
<th>1 canal</th>
<th>2 or more canals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>75.8%</td>
<td>24.2%</td>
</tr>
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</table>

- Number of foramen

<table>
<thead>
<tr>
<th></th>
<th>1 apical foramen</th>
<th>2 or more apical foramen</th>
</tr>
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<tbody>
<tr>
<td>Percentage</td>
<td>78.9%</td>
<td>21.1%</td>
</tr>
</tbody>
</table>

2nd premolar. (6)

- Canals anatomy

<table>
<thead>
<tr>
<th></th>
<th>1 canal</th>
<th>2 canals</th>
<th>3 canals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>97.5%</td>
<td>2.5%</td>
<td>0%-0.4%</td>
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</table>

Fig. 1 – These number and percentages show that these situations or these anatomies already exist but the clinician should be aware of any abnormalities or any deviation from these situations. Few studies report ethnic difference regarding canal numbers in mandibular premolars. Trope et al. found ethnic differences in their study of mandibular premolars: 2 or more canals present is 32.8% of patients while its 13.7% in Caucasian (7). Amos also reported Bifurcated canals 21% in African American and 16% in Caucasian (8). Caliskan et al. found 2 or more canals in around 36% in Turkish people (9). Zaatar et al. found 2 or more canals in 40% in Kuwaiti patients (10).

Fig. 2  
Img. 2 – C-shaped anatomy; Micro CT evaluation of mandibular first premolar in Brazilian subpopulation showed that C-shaped canal configuration of the root canal system was found in 67% of extracted mandibular premolars with radicular groove, C-shaped cross sections were more prevalent in the middle third with the presence of apical delta as a common feature in the apical third (11). In 3D morphological analysis of roots in mandibular first premolar in Chinese population It was found that the incidence of C-shaped anatomy was high when roots exhibit a radicular groove on its outer surfaces compared to roots without radicular groove(12). The presence of radicular groove on the outer root surface from the proximal aspect play an important role on having anatomical variations as sometimes we have one or two developmental grooves which exhibit 2 or more roots or root canals which is more common in mandibular first premolar as dentin deposition and calcification by age will show many anatomical variations and more challenges during root canal treatment in such cases (11). We can understand that the mandibular premolars can exhibit complex canal system morphology which if not considered during root canal treatment might lead to poor prognosis and subsequently failure of the treatment. Management: knowledge about root morphology and the nature of root canal systems and suspected deviation as well as rare conditions.

The RED Arrows just show a common radiographic feature of mandibular Premolars with multiple canals (sudden disappearance of pulp space at different levels), The YELLOW Arrows showing the presence of two or three separate roots.  
(3) Courtesy of Karina Hamid

Fig. 3  
Img. 3 – Assessment to preoperative radiographs: preoperative radiograph is of great significance in determination of root canal configuration, canal numbers and curvatures. At least 2 radiograph should be taken preoperatively. One parallel and the other one with horizontally angulated cone as it will reveal more details about the anatomy we’re dealing with. One of the common radiographic feature in mandibular premolars with 2 or more canals is the absence of continuity of pulp space at different levels (cervically, mid root and apically). Tracing of periodontal ligament space around the tooth could diagnose multiple roots, bifurcated roots or aberrant anatomy. Tracing of sinus tracts if present could reveal presence of more than one root. Presence of radiolucent lesion un centered with the radiographic apex might be indication of presence of multiple roots of multiple POEs. Radiographic appearance of neighboring or contralateral teeth might be an indication of suspected aberrant root canal anatomy. CBCT is also a great tool for preoperative assessment (13).
Careful analysis to the preoperative radiograph and negotiation to root canal system will allow easier detection of the root canals which is main component of the system therefore more predictable cleaning and shaping ending by optimising the root canal treatment outcome.

Fig. 4 – Access opening
Access opening of mandibular premolars usually is oval shape extended buccolingually with orifices located under B,L cusps.
Floor anatomy: visualization of floor anatomy and map will help in detection of extra canal orifices if exist. Either the use of long shafted bur mounted on low speed hand piece or ultrasonics could be used to detect hidden or extra canal orifices with less damaging to tooth structure (14). The use of Dental Operating Microscope with good illumination will significantly improve the access cavity preparation and allow easier detection of canal orifices (15).
This case was presented symptomatic after pulpectomy was done, after proper access opening and extension of the outline buccolingually the 2nd canal detected then RCT done, After one week patient came asymptomatic.

**Fig. 5**

During Canals negotiation
The Use of EDTA during negotiation will allow easier movement of the files along canal walls (16). The operator should be aware of any stoppage for the negotiating files during the gentle movement on the canal walls which might be an indication of presence of another canal or split. Careful moving of the precurved files along the canal walls in multiple direction without any estimation the extra canal should be here or there will allow easier detection of the entrance if canal located in unsuspected place. (Precurving also should be tried at smooth and sharp angles).
During negotiation of the root canal system of the tooth no.45, The Distobuccal canal orifice was found 2 mm deeper apically in the Lingual canal.

**Fig. 6**

Img. 6 – During Bio Mechanical Preparation

RCT is a dynamic process. Extra canals could be detected during any phase of treatment. The Operator should be aware of any slippage of rotary or reciprocating files in different direction during this process. Controlled Memory files is a great tool for managing canal splits and deep divisions as it's prependable so it can be used to mechanically clean and shape these canals without the need of sacrificing more coronal dentin (17).
This case treated by Dr. Antonis Chaniotis representing the Management of C-Shaped canal in mandibular 2nd premolar and the use of 10/05 EDM in the apical c-shape and guttaflow bioseal obturation.

**Fig. 7**

Careful reading to Radiographic image at that time is so important for inspection of seepage of obturation material in different direction could indicate the presence of extra canals (the operator should be able to differentiate between lateral or accessory canals and missed main canal).
In the 1st radiograph the outline of the root canal filling doesn’t conform the external root outline, Periodical lesion exist so case for retreatment.

**Fig. 8**

Img. 8 – Placement of root canal filling

If the root canal filling outline doesn’t coincide with or conform the external root geometry or the periodontal ligament space, this might be an indication of missed anatomy. In these situations, Retreatment might be considered.

**Conclusions**

Mandibular premolars can exhibit complex and aberrant root canal anatomy which is of a great challenge to diagnose and to manage during root canal treatment.