

## **EVALUATION OF ROOT AND CANAL MORPHOLOGY OF MANDIBULAR PREMOLARS TEETH IN EGYPTIAN SUB POPULATION USING CLEARING AND STAINING**

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**Introduction:** Root canal morphology of lower premolars varies greatly among ethnicities; By making the root canal morphology visible and familiar with its complex inter-canal connection, lateral canals, and apical ramification, allows us to realize the critical relevance of disinfection procedures, whether mechanical or chemical.

**Aim:** evaluate root canal morphology of mandibular premolars teeth in Egyptian sub population using Clearing and staining.

**Materials and methods:** 300 extracted lower permanent premolars were used in this study with a total number of 150 mandibular first premolar and 150 second mandibular premolar, access for these teeth were done, these teeth were cleared, and water insoluble blue ink was injected into the access cavity, where it diffused throughout the root canal system, allowing for direct visualization of its three-dimensional anatomy.

**Results:** the presence of second root is rare in mandibular premolars and there is considerable presence of second canal in both mandibular first and second premolars in the Egyptian population.

**Conclusion:** Within the limitations of the current study, it was found that the most common type present in both mandibular first and second premolars is type I then Type V.

**Keywords:** Premolar, Clearing and staining, Egyptian population

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## Introduction

A proper shaping and cleaning of the canal is required to ensure elimination of most of the bacterial flora present. In order to achieve such a goal the operator must know the root canal anatomy and its normal variation. Mandibular premolars has one of the most complex root canal systems in the whole dental arch.(1)

Ethnicity is a fundamental factor causing the variation of dental morphology of whole dental arch (1–3), where some ethnic groups have different root canal classifications of definite teeth than others so it is important to know the normal morphology of root and root canal system and its variations for each ethnic group to provide a baseline knowledge to dentists providing health care for such ethnic group to increase the success rate of endodontic treatment.(3–8)

Conventional and digital radiography (9,10), CBCT (11–13), micro CBCT (14–16) and clearing and staining technique (17) are among many methods used to identify the root canal morphology and root canal system. Historically, conventional radiography was used but it had many limitations including the fact that it compresses the 3D object into a 2D image leading to multiple superimpositions and that it is technique sensitive. (18,19)

According to present literature, very rare studies were performed to evaluate the morphology of mandibular premolar teeth in a modern Egyptian population using Clearing modality (20–22). Therefore, the aim of the current study was to use the clearing method in assessing the morphology of mandibular premolars.

## Materials and methods

Sample size calculation: Based on previous studies (4,22), sample size was calculated using the G power analysis software version 3.1 .Utilizing power 80% and  $\alpha$  error probability 0.05, it was found that three

hundred freshly extracted mandibular premolar teeth was an appropriate sample size for the current study.

Sample selection: (150) mandibular first premolars, (150) mandibular second premolars were collected from hospitals and dental universities. The age, gender and the reason for extraction weren't recorded. All teeth were left in 5.25% NaOCl for 15 minutes followed by washing and scrapping under running water to remove any attached tissues, any crown decay was totally removed then stored in saline until processing (17).

### Inclusion criteria:

Mature mandibular first and second premolar teeth with intact roots, whether the crowns are intact or not.

### Exclusion criteria:

- a- Presence of cracked root.
- b- Presence of fractured root.
- c- presence of tooth resorption.
- d- presence of any root filling or posts in root.

Teeth were visually examined to identify type of tooth (either 1<sup>st</sup> or 2<sup>nd</sup> premolar) and to identify the type of external root morphology according to Turner classification ( Apical splitting of root with length less than (15-20%) of root length considered as a single rooted tooth).(23,24)

Teeth were classified into 2 groups according to the type of the involved tooth, identification was done based on the crown morphology as follows:

First group: 150 Mandibular first premolars.

Second group: 150 Mandibular second premolars.

All teeth were accessed using # 2 carbide round burs and diamond tapered stones with rounded end under the magnification of endodontic loupe 5x. The orifices were examined by endodontic explores under magnification endodontic loupe 5x and illumination of bright loupes light source.

Canals were then explored using a k file #10 to confirm patency.

Evaluation: Each tooth was placed separately in a labeled test tube. First decalcification was done. Teeth were soaked in 5% nitric acid HNO<sub>3</sub> (Gomhorya company. Cairo. Egypt) solution at room temperature for 48 hours. The HNO<sub>3</sub> solution was changed and stirred every 8 hours until the teeth become completely decalcified and rubbery in consistency; as confirmed by the ease of bending using a tweezer (25).

After complete decalcification, running water was used to remove any acid residues. For dehydration, teeth were immersed in alcohol starting by 70% concentration, followed by 95%, then absolute alcohol (100%), so that teeth were kept for 24 hours in each concentration. Teeth were then immersed in the clearing solution which is methyl salicylate (Gomhorya company. Cairo. Egypt) solution, and the teeth were kept inside this solution for about 12 hours until becoming completely transparent.

Finally, a plastic disposable syringe with a 23-gauge needle was inserted into coronal third of the canal, to inject a water-insoluble blue ink (Flower endorsing ink, China) until the ink extruded from the apex. Teeth were then viewed using transmitted light to observe the root configuration according to Vertucci's classification; being the most commonly used classification in literature (3).

## Results

Using One-way Anova test, it was observed that type I canal configuration had the highest percentage for both mandibular 1<sup>st</sup> and 2<sup>nd</sup> premolars (66%). The distribution of canal configuration was statistically significant ( $P < 0.05$ ) for both first and second lower premolar as shown in table 1,2

Table 1 Canal configuration of lower first premolar.

Vertucci's Classification	Number	Percentage
I	99	66% <sup>a</sup>
II	3	2% <sup>c</sup>
III	5	3% <sup>c</sup>
IV	6	4% <sup>c</sup>
V	37	25% <sup>b</sup>
P-Value		<0.05 *

Values with different superscript letters within the same column are significantly different  
\*: significant ( $P \leq 0.05$ ), ns; non-significant ( $P > 0.05$ )

Table 2 Canal configuration of lower second premolar.

Vertucci's Classification	Number	Percentage
I	141	94% <sup>a</sup>
V	9	6% <sup>b</sup>
P-Value		<0.05 *

Values with different superscript letters within the same column are significantly different  
\*: significant ( $P \leq 0.05$ ), ns; non-significant ( $P > 0.05$ )

## Discussion

Clearing and dye injection technique has been used for many decades. The technique has many virtues including preservation of the original root form. Also, it keeps external tooth contour and the inner root surfaces relationship and the ability to clearly see the canal tiny details. Specimens can be preserved for a long time and failure in their preparation is rare. Therefore, in the current study clearing and dye injection technique was utilized to provide a more descriptive examination of the root canal system.(25–27) Samples were stored in different concentrations of alcohol (70%, 95% & 100%) before clearing where each sample remained for 24 hours in each concentration. This step was important for penetration of clearing agents into the next stage.(28)

For clearing, Nitric acid and methyl salicylate were used in the current study, since they performed the best despite the fact of teeth discoloration (yellowish) caused by nitric acid, little clogging was observed in nitric acid samples. In comparison to other agents used for clearing, methyl salicylate (MS) showed improved performance in terms of clarity and haziness.(29)

Vertucci et al discovered that nearly all mandibular first premolars were single-

rooted, with only a single canal in 75.8% of the teeth. In the anatomic examinations of second premolars, 99.6% were single rooted 91% with a single canal. Vertucci's classification has been frequently used by many authors, therefore we relied on it for assessment of the root canal in our study. (26) Concerning first premolar teeth, the results of the current study showed a 69% incidence of one canal, 31% of two canals and 0% of three canals. Similarly, percentage of 69.3–86% one canal, 14–25.5% two canals, and 0.5% three canals had been reported (26,30,31). Regarding root canals number, 96% of the second premolars had one canal, 4% had two canals and 0% had three canals. These findings fall in compliance with the previous studies that reported an incidence of 97.5% of one canal, 2.5% of two canals, and 0–0.3% of three root canals (32). Regarding the number of roots, all teeth analyzed in our study had one root (100%). This finding was inconsistent with the results of Park et al (33) who found that in mandibular 1<sup>st</sup> premolars, the most common root morphology was 69% single root followed by 31% double roots. The disparities between studies might be justified by the difference in sample sizes and the actual variances across ethnic groups.

### Conclusion

Within the limitations of the current study, it was found that the most common type present in both mandibular first and second premolars is type I then Type V.

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