Number of roots and canals in maxillary first premolars: study of an Andalusian population


Abstract - A study of 150 extracted maxillary first premolars from citizens of Seville, Andalusia, southern Spain, revealed 60 teeth with one root (40.0%), 85 teeth with two roots (56.7%) and five teeth with three roots (3.3%). The distribution of root canal shapes in the sample showed that all teeth with two or three roots had type I root canals (each canal had one apical foramen). Conversely, most of the single-rooted maxillary first premolars had root canal shape type II (two canals converging in the same apical foramen). Only 1.3% of the teeth had a unique orifice in the pulp chamber and only one root canal. These results emphasized the importance of good knowledge of the root canal morphology and the need for a careful radiographic examination as part of competent root canal therapy of maxillary first premolars.

The genetic determination of dental morphology is well established (1, 2) and the anthropological association of certain dental characteristics with certain racial groups well known (3).

Root canals are sometimes left untreated because the dentist fails to identify their presence, particularly in teeth that have anatomical variations or additional root canals. An awareness of root canal morphology and careful interpretation of preoperative radiographs is necessary for success in endodontic therapy. However, radiographs are two-dimensional images of a three-dimensional object, and the clinician must be aware of this limitation during radiographic interpretation. Thus, the endodontist must be familiar with the root canal morphology of teeth to be treated.

Of the premolars, the maxillary first premolar ex-

![Fig. 1. Sections of maxillary first premolars obtained with a transverse mid-root cut.](image1)

![Fig. 2. Classification of root canal morphology by Weine (12).](image2)
Table 1. Root morphology of 150 Andalusian maxillary first premolars

<table>
<thead>
<tr>
<th>Number of roots (%)</th>
<th>Root-section shape type</th>
</tr>
</thead>
<tbody>
<tr>
<td>One (40.0%)</td>
<td>Type 1.A (1.3%)</td>
</tr>
<tr>
<td></td>
<td>Type 1.B (38.7%)</td>
</tr>
<tr>
<td>Two (56.7%)</td>
<td>Type 2.A (38.7%)</td>
</tr>
<tr>
<td></td>
<td>Type 2.B (18.0%)</td>
</tr>
<tr>
<td>Three (3.3%)</td>
<td>Type 3.A (0.66%)</td>
</tr>
<tr>
<td></td>
<td>Type 3.B (1.33%)</td>
</tr>
<tr>
<td></td>
<td>Type 3.C (0.66%)</td>
</tr>
<tr>
<td></td>
<td>Type 3.D (0.66%)</td>
</tr>
</tbody>
</table>

Note: Root sections are classified in Fig. 1.

Table 2. Root canal system of 150 Andalusian maxillary first premolars

<table>
<thead>
<tr>
<th>Canals and foramina</th>
<th>Single-rooted</th>
<th>Double-rooted</th>
<th>Three-rooted</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>One canal, one foramen</td>
<td>1.3%</td>
<td>0</td>
<td>0</td>
<td>1.3%</td>
</tr>
<tr>
<td>One canal, two foramina</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Two canals, one foramen</td>
<td>37.3%</td>
<td>0</td>
<td>0</td>
<td>37.3%</td>
</tr>
<tr>
<td>Two canals, two foramina</td>
<td>1.3%</td>
<td>56.7%</td>
<td>0</td>
<td>58.0%</td>
</tr>
<tr>
<td>Three canals, three foramina</td>
<td>0</td>
<td>0</td>
<td>3.3%</td>
<td>3.3%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40.0%</td>
<td>56.7%</td>
<td>3.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Results

Of the 150 maxillary first premolars studied, 60 had one root (40%), 85 had two roots (56.7%) and five had three roots (3.3%) (Table 1). The single-rooted teeth had two types of root sections: most of them (38.7%) were type 1.B (a 'kidney'-shaped section), but two were oval (type 1.A). Of the double-rooted teeth, 58 (38.7%) had a type 2.A root section, showing two roots fused at the midpoint between the cemento-enamel junction and the root apex but separated at the apical third, each with one independent apex. The remaining 18.0% had a type 2.B root section, showing two separate roots at the midpoint of the root length. Five maxillary first premolars of the study sample had three roots (3.3%). The root sections of the three-rooted teeth varied.

The number of root canals and foramina in the sample are shown in Table 2. All teeth with two or three roots showed type I root canals (12), i.e., each canal had a unique apical foramen. Most of the single-rooted maxillary first premolars showed a root canal shape type II (12), i.e., two canals converging in the same apical foramen. Of the single-rooted maxillary first premolars, only two (1.3%) showed two canals with independent apical foramina (type III root canals) (12). Most of the teeth (95.3%) had two orifices in the pulp chamber, 3.3% had three, and only 1.3%, the two single-rooted teeth with type I root canals, had a unique orifice.

Discussion

Previous studies of the number of roots and canals in maxillary first premolars have obtained different results. One of the first studies on this topic was by Hess (13), who found 19.5% with one root, 79.3% with two roots and 1.2% with three roots. Later, Kuttler (9) found that 50.1% had one root, 49.4% two roots, and only 0.5% three roots. Carris & Skidmore (14) studied the configurations and deviations of root canals of maxillary first premolars, finding that 9% had one root, 85% two roots and 6% three roots. Weine (12) reported 60% with two roots and one root canal and 38% with one root and two root canals.
Finally, Walton & Torabinejad (15) referred to the existence of 50% with two roots and one root canal in each one, 20% with one root and two roots canal with the same apical foramen (type II), 10% with one root and one root canal (type I), and 10% with one root and two root canals (type III).

Our results are in good agreement with those of Weine (12) and Walton & Torabinejad (15). Thus, it is not obvious that racial differences exist in the root canal morphology of the maxillary first premolars of Andalusian and North American people.

The presence of 3.3% of maxillary first premolars with three roots in our study is in accordance with the results of other authors (14, 16, 17). However, two reports on the morphology of maxillary first premolars in a Turkish population found lower percentages of three-rooted teeth. Çaliskan et al. (18) found no three-rooted maxillary first premolars and Kartal et al. (5) found only 1.66%. A significantly increased number of double-rooted and three-rooted variants of maxillary first premolars have been found in patients with Turner syndrome (19).

The low incidence of teeth with only one orifice in the pulp chamber corresponding with one root canal (1.3%) was in accordance with the results of Mueller (20) who found only 1.5% of maxillary first premolars with a single root canal.

In conclusion, the results presented in this paper emphasize the importance of a good knowledge of root canal morphology and the need for a careful radiographic examination of these teeth prior to endodontic therapy.

References

15. Barret MT. The internal anatomy of teeth with special references to the pulp with its branches. Dent Cosmos 1925;67:581-92.