

THE SIZES OF PULP CHAMBERS OF MOLARS WITH SEVERE ROOT CURVATURES – IN VITRO COMPARATIVE STUDY

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Summary. The macromorphology of pulp chambers has been studied in the last few decades, but there is a lack of knowledge on the sizes of the pulp chambers of molars. The aim of the present study was to measure the size of the pulp chambers of upper and lower molars with different root curvatures and to compare them with the same dimensions in molars without root curvatures. Seventy-seven upper and lower molars, matured, fully mineralized and sound were selected in the following groups: two groups, including upper and lower teeth, respectively and three groups, divided as follows: with straight roots up to 25-30°, with severe curvatures up to 45° and with abnormalities 45°-90° from the axial axis. Three dimensions of the crowns were measured for each tooth in mm: one mesio-distal and two bucco-lingual dimensions, one of them being measured from the top of buccal cusp to the top of the mesio-lingual (palatal) cusp. All teeth were submitted to X-rays and were photographed after opening the pulp chambers. Measurements of the pulp chambers were made after opening with horizontal cuts, made 1 mm apically from the equator with a diamond blend. The two buccolingual dimensions were referred to as L1 and L2, the mean value – as L and the mesio-distal – as MD, sizes were measured in the widest part of the pulp chamber with an endodontic file and endo-block in mm. A careful approach to these sizes of the pulp chambers of the molars with severe curvatures can save hard dental tissues during endocavity and pulp chamber preparation. These findings are important for the prevention of crown and root fractures, and teeth losses and for lowering the use of posts and pins and the use of crowns and bridges in young age groups.

Key words: *endodontics, curved root canals, pulp anatomy*

In the last few decades the macromorphology of pulp chambers has been studied [1]. There is a serious lack of knowledge on the sizes of the pulp chambers of molars in different dimensions and non – existing information on the sizes of pulp chambers of teeth with roots with severe curvatures and root abnormalities [2, 3, 9, 13, 15]. This is an important matter for the proper sizes of endodontic cavities and for the prevention of iatrogenic errors [4, 11, 12].

All sizes of the endodontic cavities are usually defined as distance between cusps or mm from the buccal and lingual walls or from the respective walls in relation to the type of the tooth and the sex and age of the patient, not in any relation to the size and anatomy of the particular teeth roots. Very little information is available and completely out of date are data referring some sizes of the crowns and roots of molars in one book of Wetzel from year 1947 [15].

In the dental literature it has been established that there is relation between the size and the shape of the crown and the size and the shape of the pulp chamber in young age and the age changes related to the reduction of the pulp chamber parameters [1]. Unfortunately this fact is not always considered during endodontic cavity preparations, which often leads to iatrogenic errors [5, 6].

A practical review of the sizes of clinical crowns in the last 40 years shows a significant reduction of the mesio-distal and bucco-lingual dimensions of the molars. An important matter is the preparation of the pulp chamber on teeth with massive enamel and dentine losses.

From the literature review and the online cross-database search of the data available from the last 20 years, only 8 articles can be related to the macromorphology of the molars.

Five of these studies were in vitro studies with a large variation of the number of cases from 5 up to 700 root canals. Only in two of these studies, the sizes of the pulp chambers were measured. Only in one study differences were observed between “young” and “old” teeth [1].

AIM OF THE STUDY

The aim of the present study was to measure the range and mean dimensions of the pulp chambers of upper and lower molars with different root curvatures and to compare them with same dimensions of molars without root curvatures.

MATERIALS AND METHODS

Teeth: Seventy-seven upper and lower molars, left and right teeth. All teeth were matured, fully mineralized and sound.

Groups: Two groups, including upper and lower teeth, respectively, and three groups, including teeth with straight roots up to 25-30°, with severe curvatures up to 45° and with abnormalities 45°- 90° from the axial axis were examined.

Measurements of the clinical crown: Three dimensions were measured for each tooth in mm: mesio-distal, from the approximal marginal ridge, bucco-lingual, from the top of the buccal cusp to the top of the mesio-lingual (palatal) cusp. The height of the crown was also measured from the buccal side (H), from the enamel border to the middle part of the line between the cusps.

X-Ray: All teeth were submitted to X-ray examination and were photographed after opening the pulp chambers.

Measurements of the pulp chambers: Pulp chambers were measured under the following technology:

1. The pulp chambers were opened with horizontal cuts made, 1 mm apically from the equator with a diamond blend.

2. After polishing the ridges, the final size of the chamber was 2 mm bellow the equator.

3. Both buccolingual dimensions were measured as L1 and L2, and the mean value – as L, and the mesio-distal dimension – as MD, sizes were measured in the widest part of the pulp chamber.

4. This measurements are performed with endodontic file and endoblock in mm.

Exclusion criteria: non-vital teeth, massive tooth loses, teeth with root caries, incisors and premolars, teeth with hypoplasia and non-caries enamel defects and not matured teeth.

RESULTS

Table 1. Sizes of the pulp chambers of molars

Size	Up to 25-30° n=20		30-45° n=20		45-90° n=37	
	Upper	Lower	Upper	Lower	Upper	Lower
L1	5.58	4.37	5.01	4.80	5.14	4.15
L2	4.91	3.62	4.14	4.15	4.05	3.55
MD	3.16	3.50	2.57	3.30	3.05	3.25

As it is presented in Table 1, all dimensions of the upper molars and most of the lower molars from the group of teeth with root canal curvatures, are smaller than the sizes of the pulp chambers of teeth with straight roots.

Table 2. Sizes of the clinical crowns of molars

Type of tooth	Dimension	Mean	Range (mm)
Upper Teeth n=161	BL	6.5	5.8 – 7.8
	MD	8.1	7.9 – 9.4
	H	4.5	4.0 – 6.2
Lower teeth n=125	BL	5.3	4.0 – 8.0
	MD	9.9	8.0 – 13.0
	H	5.2	3.5 – 7.0

DISCUSSION

The importance of these findings is related to the fact that the bucco-lingual size of the crowns and the pulp chambers are very similar. On the other hand, reducing the preparation of hard dental tissues in this area is very important and directly related to the lower amount of active axial root surface below this area in teeth with severe root canal curvatures.

The lack of available data on the size of the pulp chambers of molars in the literature is a fact. This is the explanation why after endodontic treatment the most common mistake is remaining pulp tissue in retentive lodges in the pulp chamber which becomes a source of infection and periapical lesions, a complication that represents 19.8% of all indications for endodontic retreatments in the Faculty of Dental Medicine in Sofia, shown in our previous study. Not accurate exposure of pulp chambers, failures in working length estimation and poor preparation of root canals are some other mistakes commonly made [14, 16]. Overdone preparation of cavity walls and crown fractures, mostly as a result of overdone preparation of medial and distal walls followed by the use of posts and pins, represents 18.2% of all reasons for endodontic treatments.

In many literature sources it is proved that nearly in 50% of all endodontic treatments there are failures, especially when it is considered that with age all pulp chambers lower their sizes and orifices migrate up on cavity walls [6,12].

CONCLUSIONS

1. There is a need of up-to-date knowledge not only on the pulp anatomy but also on the pulp chamber sizes and crown sizes of molars with curved roots.

2. A careful approach to these sizes can lead to preservation of hard dental tissues during endocavity and pulp chamber preparation .

3. The use of smaller pulp chambers in molars with curvatures can be important in the prevention of crown and root fractures, as well as teeth losses and in lowering extractions, use of posts and pins and the use of crowns and bridges in young age groups.

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