FREQUENCY OF ROOT CURVATURES IN MOLARS – AN IN VITRO STUDY

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Summary. Root canal curvatures are often the main reason for a poor root canal treatment. The clinical x-ray images often do not give a precise view of the degree of the root curvature from the axial axis. The aim of the present study was to measure the severe curvatures > 25º separately for upper and lower jaw in representative number of extracted human molars. The length of each root was measured from the respective cusp for all 771 roots. All deviations were measured in the apical half of the roots, and registered when higher then 25-30º. The data shows that 47 of 461 upper teeth (10%) and 49 of 312 lower teeth (15.7%) were with severe curvatures. The highest numbers were found in lower third molars – 19.2%. In Bulgaria, root lengths are lower, than in the commonly used tables. This two findings are proving the higher risk of iatrogenic mistakes during root canal treatment. We found diagnostic x-rays and a working hypothesis for curvatures of each root after the first half essential.

Key words: *root, curvatures, molars*

One of the most frequent reasons for insufficient root canal preparation are their curvatures. X-ray images often don't give right impression of the degree of root curvatures. Electrometric tests are not representative for this purpose. Classifications of the curvatures have a 66-year history, back in year 1944 with Pucci, Reid [8]. The next one comes in 1971 from Schneider, who classified them in tree groups: severe 25-70º, moderate 10-20º (fig. 1), straight up to 5º, [9]. In 1985, two new classifications appeared, of Ingle and Taintor, Zidell [6, 7]. In the first one, similar to Pucci and Reid, the curvatures are divided into 5 groups: apical, degrees, dilacerations, bayonets and sickle. In the second one, the groups are: severe, dilacerations, bayonets, furcations, apical and accessory root canals. After that comes the classification of Southard (1987) and Backman (1992) [3, 7]. Generally, the curvatures are separated in three groups: straight up to 5º, moderate 6-14º and severe, more than 15º.

Nagy (1992) published a survey on 450 roots and made a mathematical model, which included the frequency of each type of curvatures. In Bulgaria, this problem was only mentioned once by Stransky in 1959, who defined all root canal curvatures more than 30º as “heavy abnormalities”. This not very accurate, and quite global definition unfortunately persists so far in our teaching programs: lecture courses and practicals.

AIM: The aim of the present study was to investigate the frequency of severe root canal curvatures> 25º, for upper and lower molars of representative number of extracted teeth.

MATERIALS AND METHODS

TEETH: This in vitro study includes 331 teeth with 771 roots, of which 270 extracted lower and upper, first and second permanent molars. These were all extracted, sound and as follows: 166 upper with 439 roots and 104 lower with 208 roots. All teeth were fully mineralized and from the same geographical area. Sixty one third molars with 124 roots were measured too.

MEASUREMENTS: The length of each root was measured from the respective cusp in mm. For the lingual roots of upper molars, the measurements were from the top of the lingual cusp, buccally – from the mediobuccal and distobuccal cusps. For the lower teeth, the measurements were from the mediobuccal and distobuccal cusps. Lowest, highest, average scores and average deviations in each group were registered.

ROOT CURVATURES: Deviations of all roots in the apical and middle third were measured from the axial axis of each tooth. Deviations higher than 25-30º were classified as severe curvatures. The data was compared with findings of Nagy (1995) [8] , Schneider (1971) [10] and Backman (1992) [5].

EXCLUSION CRITERIA: Teeth with fractures of the clinical crown, abrasion with exposed dentin, and dental hypoplasia were excluded from the study.

RESULTS

Measurements of root lengths are shown bellow in tabl. 1 and 2.

Tabl. 1. Lengths of roots of upper teeth

Roots	MB	MB	MB	DB	DB	DB	P	P	P
Author	Ingle	Weine	Boteva	Ingle	Weine	Boteva	Ingle	Weine	Boteva
Min.	18.2	–	17.6	17.5	–	14.8	18.5	–	15.2
Aver.	20.0	20.5	19.1	19.4	17.0	18.5	20.7	24.2	19.4
Max.	22.0	–	23.6	21.2	–	22.8	22.5	–	24.2

Tabl. 2. Lengths of roots of lower teeth

Roots	Medial	Medial	Medial	Distal	Distal	Distal
Author	Ingle	Weine	Boteva	Ingle	Weine	Boteva
Min.	19.0	–	18.0	19.1	–	16.8
Aver.	20.9	19.0	19.9	20.9	24.2	19.1
Max.	22.6	–	22.2	22.6	–	22.0

The measurements of root curvatures have shown severe curvatures higher than 25º (fig. 2) in 47 of 461 roots of upper teeth and 49 of 312 roots of the lower molars. This is 10% for upper molars and 15.7% of the lower molars. The highest scores and degrees over 45º are among lower third molars – 19.2%.

In the practical endodontics, this means that problems in root canal preparations can be expected in 15% of the cases in first and second upper molars, 25% in the treatment of lower first and second molars, and in more than one third of the lower third molars.

Fig. 1

Fig. 2

DISCUSSION

Based on the found frequencies of root canal curvatures (between 10-19.2%), it is difficult to be accepted that the classification “abnormalities of dental roots”!!! is

up to date. Probably this can be used for curvatures higher than 45º. In this group, we have observed in lower third molars degrees near to 90º, the frequency of these is 1 -2% (fig. 3).

Fig. 3

The differences of root lengths shown in tabl.1 and 2 in Bulgaria and in English language literature are from 3.3 mm in the minimal scores to 1.0-1.8 mm, compared with Ingle and up to 4.8 mm compared with Weine [10]. For the highest scores, the differences are small and not significant in the lower teeth. In all upper teeth, the differences in the highest scores are higher in our teeth from 1.6 mm in MB and DB roots to 1.7 mm in lingual roots.

Most of the found curvatures were observed in the apical third, and in shorter roots, which means that the curvatures start near to the second half of the root length. The significance of this fact is related to prevention of iatrogenic errors during root canal preparation, like instrument fractures, via falca, perforations, etc. [4].

These frequencies can be expected to be higher in the clinics. This is related to the fact that the teeth used in the study were used for the practical exam during the preclinical undergraduate course, where students always avoid the most complicated, from anatomical point of view, teeth.

CONCLUSIONS

In Bulgaria, the average lengths of roots of molars are lower than the ones commonly used in the tables from the USA or Germany.

Frequency of root curvatures in molars is between 10-20%, which is a high risk for iatrogenic errors during root canal preparation.

As the clinical x-rays often don't give the right impression for the degree of curvatures, it is important to preparate root canals with the working hypothesis for a curvature in each root canal.

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