

Comparision of Root Canal System Configuration in Primery Teeth

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Abstract: The aim of this study was to evaluate the root canal system of primary incisors and molars to do the best pulpectomy. About 80 primary teeth were divided equally into 8 groups after cleaning the teeth and access cavity preparation, Indian ink was injected in all of the root canals. Teeth were placed in HCl 7% for decalcification, Ethyl alcohol for dehydration and methylsalicylate solution for transparentation. All of the teeth were examined by 2 manners: naked eye and using stereomicroscope 10x. Significant difference was found between prevalence of lateral canals in molars with prevalence in incisors and canines. Prevalence of lateral canals was more in lower molar than upper's. Fusion of DB and P roots was more significantly found in the 1st upper molars than 2nd upper molars. Roots with 2 or more canals were more prevalent in lower molars than upper's. So, root canal system of primary molars was more complex than that of primary incisors. The presence of the roots containing 2 or more canals is considerably more probable in mandibular molars than in maxillary molars.

Key words: Root canal, pulpectomy, primary teeth, incisors, methylsalicylate

INTRODUCTION

One of the most significant goals in pediatric dentistry is preserving primary teeth until the eruption of their substituting permanent teeth in order to maintain the arch length, establish true phonetics, esthetics and mastication, prevent inappropriate tongued habits and psychologic disturbances in a child due to loss of teeth (Pinkham *et al.*, 1999; Braham and Morris, 1990; Andlaw and Rock, 1996).

Ideally a necrotic tooth must be treated by a complete pulpectomy which include 3 stages known as cleaning, shaping and obturation (Zoremchhingi *et al.*, 2004). Years ago, this technique (complete pulpectomy) has not been used routinely as a result of inadequate information about the morphology of pulp canal in primary teeth, incomplete access to the root canals particularly in primary molars, presence of the narrowed canals therefore, there was doubt about their complete cleaning which lead to the use of non vital pulpotomy technique to treat primary necrotic teeth (Pinkham *et al.*, 1999; Cohen and Cohen's, 2011). Although, this treatment seemed to be successful clinically, progressive bone loss often could be seen radio graphically (Gould, 1972). Later on, development in delicate or miniature and flexible instruments together with powerful detergents, lubricants, antibacterial agents and root canal filling materials inclination to perform complete pulpectomy in primary teeth increased gradually so that

the majority of pediatric dentists, considered pulpectomy as the elective treatment strategy for many necrotic primary teeth, rather than their extraction (Barker *et al.*, 1975). In order to perform a successful treatment, it is obvious that a complete information about the root's shape and number, morphology of the existing canals in each root, presence of variation in the number and morphology of canals is required. This study was carried out to investigate root canal's number and morphology in primary teeth separately by applying clearing technique.

MATERIALS AND METHODS

This study was performed on 80 extracted primary teeth which had been collected from private dental offices and public dental clinics in Iran-Shiraz. Caries, trauma or orthodontic needs were the reasons for extracting these teeth. In this study, the selection was based on these conditions:

- At least two third of the root length must be remained and no more root resorption is needed
- A complete loss of tooth crown caused by caries or trauma was not that important
- No evidence of fracture or developmental anomalies on the roots were observed
- The teeth did not have to undergone root canal therapy

The teeth were divided into 8 main groups and in each group, 10 teeth were examined

Group 1	Maxillary incisors
Group 2	Mandibular incisors
Group 3	Maxillary canine
Group 4	Mandibular canine
Group 5	Maxillary first molar
Group 6	Mandibular first molar
Group 7	Mandibular second molar
Group 8	Maxillary second molar

At first the preserved teeth in normal saline were cleaned completely by means of a scaler before being applying the clearing steps then coronal caries were removed completely by using a high-speed handpiece and a round diamond bur, later the roof of the pulp chamber was removed thoroughly by a fissure bur in order to create a standard access cavity in each tooth. After removing the pulp, the root canal path way was checked with a low-number file (No. 10) to be open. Then, Indian ink was injected through the orifice by using an insulin syringe and the injection was repeated to make sure that the ink has penetrated into the canal completely. After that the crown of all teeth were restored by cavity. These teeth were preserved in the large pieces of moist gas and then placed in 7% chloridric acid solution for 48-60 h to become decalcified.

The acid was changed every day and the samples were being mixed at least once a day to make sure that all parts of the roots were in contact with the acid solution. One tooth was selected out of each study group and was radiographically examined to make sure that the whole mineralized content of the teeth has been solved in the acid. After passing the determined time (48-60 h), the explorer must be able to penetrate the samples and the teeth must indicate rubbery consistency. After this stage, all teeth were cleaned under the flowing water and placed in the solutions of various purity degrees to undergo (receive) dehydration stages in this turn:

- Placed in 70% ethylic alcohol for 76 h (the solution was replaced each 8 h)
- Placed in 80% ethylic alcohol for 8 h
- Placed in 90% ethylic alcohol for 8 h
- Placed in 100% ethylic alcohol for 24 h (the solution was replaced each 8 h)

After the 4th stage, all samples were transfered into methylsalicylate which was able to penetrate completely in the demineralized and waterless teeth in 24 h and make them observable by complete clearing of the teeth.

Two operators studied the root form and also the number of canals in each root with naked eye at first and then the teeth were examined with stereomicroscopy to determine the accurate number of canals, inter canal

communications and lateral canals. Finally, the findings were collected and analyzed statistically by using Pearson χ^2 -test, non-parametric χ^2 -test and fisher's exact test ($p < 0.5$) which were considered to be significant statistically.

RESULTS AND DISCUSSION

The findings of this study were as follows:

- About 40% of maxillary incisors had a s-shaped root which was bent buccally in third apical portion. All of these teeth had just one root canal and in 20% of them had lateral canals and apical ramifications
- About 30% of mandibular incisors had a s-shaped root which was bent buccally in apical portion. These teeth had one root canal in 90% of cases and 2 canals in the remaining 10 and in 30% of them lateral canals were seen
- Apical portion of maxillary canines had a buccal curve in 50% of cases and 10% of these teeth had lateral canals
- 30% of mandibular canines had a buccal curve in their apical portion and in 20% teeth had lateral canals
- All maxillary and mandibular canines had just one root canal
- There was a communication between Distobuccal (DB) and Palatal (P) root canal systems in 37.5% of maxillary first molars whereas in the other 62.5% DB and P root canal systems was separated

Apical curve was present in 20% of Mesio Buccal (MB) and 10% P roots. Lateral canals were found in 40% of MB, 30% of DB and 20% of P roots. About 60% of MB roots had one root canal and 40% of them had 2 related root canals whereas all DB and P roots had just one root canal. The 100% of maxillary 2nd molars showed related DB and P root canal systems. Apical curve was observed in 40% of MB, 30% of DB and 27.2% of P roots. Lateral canals were present in half of the MB, 20% of DB and 27.2% of P roots.

The 30% of MB roots had just one root canal but the remaining 70% had two root canals related in half of these cases. One case was reported to have 3 root canals in its MB root. The 10% of DB roots had 2 root canals and the other 90% had just one root canal. There was one canal in 63.6% of P roots and 2 canals in the others. All the roots of mandibular first molars were straight with no curve, 90% of Mesial (M) roots and 60% of Distal (D) roots showed lateral canals. The 70% of M roots had 2 canals while the other 30% had 3 canals. D roots had one root canal in 40% of cases and 2 root canals in the other 60%.

The 20% of M roots and 40% of D roots had a curve in mandibular 2nd molars while their remaining roots were straight.

Lateral canals were observed in almost all of the roots. The 70% of M roots had 2 root canals and 30% of them had 3 canals. D root had 1 canal in 20% and 2 canals in 80% of cases. In this study, no significant statistical difference was found between the prevalence of lateral canals in maxillary and mandibular incisors and canines. Whereas, lateral canal prevalence in the primary molars was significantly more than primary incisors and canines. Also, the difference between lateral canal prevalence in the upper and lower molars was statistically significant.

The difference between prevalence of existing a second canal in D root of the first and second mandibular molars was not statistically significant. The prevalence of relationship between DB and P roots of upper 1st molars was related more than that of upper 2nd molars. There was no correlation between communicated DB and P roots in upper molars and the probability of existing a communicated root canal system in these teeth.

Also, two or more canals present in each root of the molars have no correlation with probability of existing a communicated root canal system in that root although, the difference between the prevalence of roots having two or more canals was statistically significant between upper and lower molar teeth.

Limited studies have been performed regarding primary root canal system and different findings have been reported. Each study has examined special teeth or special aspects of their root canal system. This study is a rare one that has investigated all types of primary teeth and also different aspects of their root canal system. In this study, we found that maxillary incisors and canines' roots had an obvious curve in their apical one third in 40 and 50% of cases, respectively. Also, mandibular incisors and canines showed the same curve in the same place in 30% of the cases. The mentioned curve was buccally in all cases.

According to this point that the root canal form follows that of the external root surface, it's necessary to use more flexible files specially at the beginning of the canal filling. In addition, in order to fill these root canals completely, it is preferred to use more flowable root canal filling materials such as KRI or Vitapex. When using ZOE for this purpose, this material must be prepared in an order to be able to penetrate the canal's curve and to have increased anti-bacterial effect on this site of the canal. In addition, it is recommended to make the primary curvature in the files to help passing through the canal's pathway completely and to prevent breaking instruments in the curved canals.

We found two root canals in 10% of mandibular incisors in this study. Although, the prevalence of the second canal was too low in these teeth, it is necessary to look for the additional canal while performing pulpectomy treatment.

Barker *et al.* (1975) reported that the maxillary incisors had more s-shaped roots than the mandibular incisors. This finding is very similar to the findings of this study. In Barker's study, upper incisors had shown more apical ramification than the lowers while this study finds apical ramification tube more prevalent in mandibular incisors.

Salama *et al.* (1992) reported the existence of root curve in the apical one third of many upper incisors which is similar to the results of the study. Salama *et al.* (1992) and Barker *et al.* (1975) had reported the presence of a root curve in the apical one third of maxillary and mandibular canines in 1975 which was confirmed in 50% of the maxillary and 30% of the mandibular canines in the present study. Regarding, this root form can reduce the fracture risk of apical one third during tooth extraction. In this study, the prevalence of lateral canals or apical ramification in canine teeth was less than maxillary and mandibular incisors which is the same as Barker's study. In addition, having a single root canal in all canine teeth was similar to Barker *et al.* (1975)'s study.

In the present study, 60% of MB roots and 100% of DB and P roots of max. First molars had a single canal while these teeth have a root canal therapy, the presence of a second canal in MB root is more probable than the two other roots. This result is somehow similar to Sarker and Rao (2002)'s finding reported 100% of DB and 75% of P roots to have one root canal and is completely the same as Zoremchhingi *et al.* (2004)'s finding reported 100% of DB and P roots have one root canal. But Zoremchhingi *et al.* (2004) found that 93% of MB roots have one canal whereas 60% of them had one canal in this study. In this study, an interaction was found between DB and P roots in 20% of maxillary second molars and in all of these cases, DB and P root canal systems were related.

In Barker *et al.* (1975) and Zoremchhingi *et al.* (2004)'s study, the prevalence of this communication between DB and P roots was reported to be 58 and 0%, respectively. According to the findings of the study, it is possible to find additional canal in all roots of an upper second primary molar. Therefore considering this point, pulpectomy treatment is more successful in these teeth. The DB root in upper 2nd molars presents less probability to have additional canals in comparison with the two other roots and 90% of DB roots showed just one canal in the study which is approximately like Zoremchhingi *et al.* (2004)'s study which found 73.3% of DB roots to have

one canal. On the other hand, the MB root presents more probability to have additional canals in comparison with the two other roots and even in one case this root showed 3 root canals.

In none of the mandibular first molars in this study, root curve was observed and less than half of the mandibular second molars showed roots with obvious curve in their apical portion. The root canal number in lower primary molars was variable between 3-5 canals in the present study.

In Gupta and Grewal (2005)'s study, 100% of MB and D canals and 93.3% of ML canals were reported to be straight in mandibular primary molars. Moreover, the mentioned study reported the number of root canals in each mandibular primary molar to be 5. Salama *et al.* (1992) reported that mandibular first molars have 3-4 canals, most of them (80%) had 4 canals. Zoremchhingi *et al.* (2004) found that approximately 93.3% of M and 60% of D roots have two root canals. Sarkar and Rao (2002)'s study held in 2002 showed the prevalence of the third canal in the M roots of the mandibular first primary molars to be about 70% whereas this prevalence was 30% in the present study. M root of the mandibular second primary molar had two canals in 70% of cases in this study while Sarker and Rao (2002) and Zoremchhingi *et al.* (2004) reported the prevalence of this to be 85 and 100%, respectively.

D root of the mandibular second primary molar had one canal in 20, 87 and 40% of cases in this study (Sarkar and Rao, 2002; Zoremchhingi *et al.*, 2004), respectively; even a tooth having 3 canals in its D root was reported. Based on the findings of this study, the prevalence of roots having 2 or more canals in the upper molars indicated a significant statistical difference ($p < 0.05$) compared with the lower molars. It means that the presence of roots with >1 canal in mandibular molars is significantly more probable than in maxillary molars. So, it is important to look for additional canals during pulpextomy treatment of specially mandibular molars.

CONCLUSION

It is observed from the results of this study that the prevalence of lateral canals and apical ramification in the maxillary primary incisors and canines is the same as

mandibular primary incisors and canines. Lateral canals and apical ramification are considerably more prevalent in mandibular molars compared with maxillary molars. The probability of the second canal presence in D root of mandibular molar is similar to the first and second molars. The presence of the roots containing two or more canals is considerably more probable in mandibular molars than in maxillary molars.

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