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Are there any differences between first and second primary molar pulpectomy prognoses? A retrospective clinical study

ABSTRACT

Aim *To determine if there are any significant differences between the prognoses of pulpectomies done on first and second primary molars of the upper and lower dental arch.*

Materials and methods *Study Design: The clinical study included 55 children who had undergone 86 pulpectomy treatments, 41 on the first molars and 45 on the second molars. The root canal filling material consisted of a paste based on Walkhoff's formula, containing Kri-1, calcium hydroxide and meta-cresol formaldehyde. The same clinician carried out all pulpectomies.*

Results *After the analysis there were a total of 7 treatment failures (3 in the upper arch and 4 in the lower). Four of the 7 failures were first primary molars and three were second primary molars. Statistics: There were no significant differences in the prognoses of the different kinds of primary molars.*

Conclusions *The anatomy of the primary molars changes considerably. Significant differences were not observed in the prognosis of different types of primary molars after pulpectomy.*

Keywords *First primary molar pulpectomy; Second primary molar pulpectomy; Prognosis*

Introduction

Despite advances in the prevention of dental caries in paediatric dentistry, the appearance of primary teeth with pulp involvement and premature loss continues to be a frequent problem [Ahmed, 2013].

Pulpectomy of primary teeth with irreversibly inflamed or necrotic pulp is a treatment with a variable prognosis that allows the correct eruption of the successor and maintenance of the space [Ahmed, 2013]. Many discussions have taken place regarding this treatment on deciduous teeth, due to anatomical root variations and their complex canalicular system, which make the canals difficult to approach, clean, remodel, and fill [Ahmed, 2013].

As for the number of roots, literature shows that primary upper molars may have two to four roots. Most upper first molars have two roots as the distobuccal and the palatal are fused, and most upper second molars have three roots [Barker et al., 1975; Sarkar and Rao, 2002; Bagherian et al., 2010; Zoremchhingi et al., 2005]. Primary mandibular molars may have two to three roots; the double root variant can be found in both the first and second molars [Gupta and Grewal, 2005; Song et al., 2009]. Nevertheless, when describing RCT, many authors found a greater variety in the number of canals [Tu et al., 2010; Liu et al., 2010].

The prevalence of a mesiobuccal second canal varies considerably in primary upper molars. Some authors have observed a difference between 75% and 95% in the roots of these molars [Sarkar and Rao, 2002; Liu et al., 2010]. Furthermore, three mesiobuccal canals have also been documented [Ahmed, 2013]. On the other hand, Aminabadi et al. [2008] observed no second mesiobuccal canals in 76 maxillary primary molars, and Zoremchhingi et al. [2005] only found a second mesiobuccal canal in 6.67% and 53.3% in the first and second primary maxillary molars, respectively.

However, other authors [Bagherian et al., 2010] have described anatomical differences between first and second upper primary molars. They observed two second mesiobuccal canals in the first upper molars, while none were found in the second upper primary molars. The distobuccal root in upper molars normally has only one radicular canal; however, the appearance of a second distobuccal canal has been reported in up to 27.8% of cases [Aminabadi et al., 2008]. Furthermore, the palatal root usually has only one radicular canal. However, the presence of a second palatal canal in the second upper primary molars may rarely occur [Zoremchhing et al., 2005].

Regarding lower primary molars, mesial roots usually have two root canals. Bagherian et al. [2010] observed two canals in all of the mesial roots of the mandibular molars that were studied. However, Sarkar and Rao [2002] observed a high prevalence of three canals in the mesial roots of first mandibular molars. Furthermore,

a single canal in the mesial roots of lower molars has been documented, although less frequently [Sarkar and Rao, 2002; Bagherian et al., 2010; Zoremchhing et al., 2005]. The distal root of mandibular molars tends to have one or two [Ahmed, 2103] and even three root canals [Sarkar and Rao, 2002; Zoremchhing et al., 2005; Song et al., 2009].

Different studies have described how these anatomical variations have an influence on the prognosis of the pulpectomy, especially in the first primary molars [Koch and Poulsen, 2001], observing complicated anatomy and reduced accessibility to the distobuccal ducts in both the upper and lower, with regard to the second molars [Aminabadi et al. 2008]. Nevertheless, substantial controversy is found in the literature, as other clinical studies have described a positive prognosis when pulpectomy treatment is performed either in first or second upper or lower primary molars [Barr et al., 1991].

Therefore the objective of the present study is to clarify whether any differences exist regarding the prognosis of the pulpectomy treatment performed in the first and second primary molars.

Materials and methods

Subject selection

Fifty patients in a private clinic in Seville (Spain) with first and second molars present in the mouth (with ages ranging from 4 to 7 years old) were invited to participate in this retrospective study. Ethics Committee approval was obtained, as well as written informed consent from all parents of participants. A total sample of 98 pulpectomy treatments, 43 first primary molars and 55 second primary molars, were analysed. All subjects were clinically and radiographically monitored at 6, 12 and 18 months after the pulpectomy. Any subject who failed to attend one or more of the scheduled appointments was excluded from the study.

Clinical procedure

The same experienced clinician (AMM) performed the pulpectomy in every case, following identical treatment protocol on the same day [Mendoza et al., 2010]. Following the apical x-ray, anaesthesia, and rubber dam isolation, the pulp chamber was accessed and the canals were instrumented with Kerr files cut to 16 mm (2 mm tip) to prevent apical perforation; canals were irrigated with 5% sodium hypochlorite and dried with paper points. Then the canals were filled with iodoform paste.

The root canal filling material consisted of a paste based on Walkhoff's formula [Castagnola and Wirz, 1976], which is a combination of Kri-1 (80.8% iodoform, 2.025% parachlorophenol, 1.215% menthol, 4.68% camphor and excipient 15 mg), calcium hydroxide and meta-cresol formaldehyde (meta-cresol 20 mg, formaldehyde 20 mg, eugenol 20 mg, eucalyptus 6 mg, and excipient 40 mg). Equal parts of Kri-1 and calcium hydroxide were mixed and a small quantity of meta-cresol formaldehyde was added. The three components were mixed until a smooth paste was obtained. This paste is reabsorbable and radiopaque, with a semi-fluid consistency and antimicrobial properties. Finally, a stainless steel crown was placed in every case.

Clinical and radiographic monitoring

The same clinician did all monitoring at 6, 12 and 18 months after treatment, carrying out clinical and radiographic examinations. Monitoring variables were checked at all appointments.

1) Clinical criteria: Gingival inflammation or fistula; purulent exudate in the marginal edge; mobility due to their normal exfoliation; presence of pain.
2) Radiographic criteria: Pathological signs of external root canal resorption or continuation of resorption already present preoperatively; no resolution of the radiolucency in the radicular furcation; formation of postoperative periapical radiolucency.

Treatment failure was considered when one or more of the above-mentioned criteria were encountered.

Statistics

Descriptive statistics (mean and standard deviation) was calculated. The normality distribution of the sample was not found and therefore the chi-squared test was used to determine any potential difference of the clinical or radiographic failures between first and second molars. A p value of .05 was considered as statistically significant.

Results

From the total sample of pulpectomies, only 7.14% (n: 7) showed clinical or radiographic signs of failure. Therefore, the success rate of the pulpectomies in the present total sample was 92.85%. When considering the pulpectomy in the lower or upper molars, there were no statistically significant differences regarding the failure rate observed in the treated primary molars ($p>.05$). Moreover, when considering whether any of the first or second primary molars presented differences regarding the clinical or radiographic failure, no statistically significant differences ($p>0.05$) were found.

Moreover, when analysing other potential factors influencing the failure of the pulpectomy treatment in the primary molars, gender was not associated with any predisposition to pulpectomy failure ($p>0.05$).

Clinical signs of failure were found to be a fistula in 2.04% (n: 2) of the treated molars, purulent exudate in two molars (2.04%), mobility in two molars (2.04%), and pain in two molars (2.04%). Radiographic signs of failure were found in four molars (4.08%), furcation radiolucency in one molar (1.02%) and periapical

Molar	First (n=6)	Second(n=4)	Total (N=10)
Upper	3	1	4
Lower	3	3	6

TABLE 1 Total number of pulpectomies that showed clinical or radiographic signs of failure.

Sex	Failed pulpectomies (N=10)
Male	4
Female	6

TABLE 2 Sex differences in the failed pulpectomies.

	Molar with failed pulpectomy
Clinical signs (N=15)	
Fistula	4
Purulent exudate	3
Mobility	5
Pain	3
Radiographic signs (N=14)	
Root resorption	7
Furcation radiolucency	4
Periapical radiolucency	3

TABLE 3 Clinical and radiographic signs of failure found in this study.

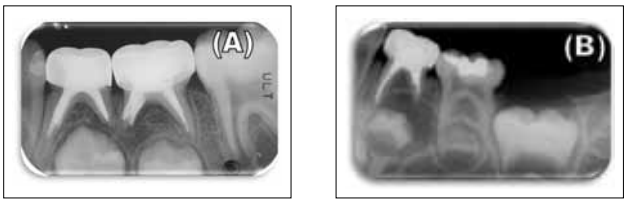


FIG. 1 A Pulpectomy success in primary lower left first and second molars at the 12 month-checkup. B Pulpectomy failure of a primary lower left first molar. Checkup at 6 months, The extraction was planned and 6 months later a crown and loop space maintainer was placed.

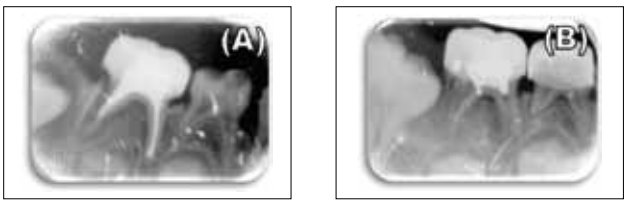


FIG. 2 Pulpectomy failure of a primary lower right second molar. A Checkup at 6 months. B Checkup at 12 months, in which the extraction was planned.

radiolucency in three molars (3.06%) (Fig. 1, 2).

Discussion

In this clinical study, a high success rate was observed in the treatment of pulpectomies in primary molars, sealing the canals with a paste based on Walkhoff's formula [Castagnola and Wirza, 1976], containing Kri-1 (80.8% iodoform, 2.025% parachlorophenol, 1.215% menthol, 4.68% camphor and excipient 15 mg), calcium hydroxide and meta-cresol formaldehyde (meta-cresol 20 mg, formaldehyde 20 mg, eugenol 20 mg, eucalyptus 6 mg and excipient 40 mg).

There are studies [Mendoza et al., 2010; Reyes and Reina, 1989] with the same procedure and sealing material with similar results, observing resolution of pain, of the inflammation and fistulas at 6 months and gradual/progressive remission of radiolucent areas.

Garcia-Godoy [1987] considered Kri-1 a suitable sealing material in pulpectomies performed on primary teeth that were checked every 6 months. He observed that pain, fistula, and mobility disappeared between 6 and 24 months after treatment. Other authors [Ahmed, 2103] used Vitapex® (30.3% calcium hydroxide, 40.4% iodoform, 27.4% silicone oil, 6.9% inert matter) in primary necrotic teeth, also in 6-month clinical and radiographic reviews over a period of 38 months, clinical and radiographic success was observed, finding no damage to the permanent teeth. Nevertheless the topic continues to be tremendously controversial as other authors, such as Coll et al. [1985] and Massler [1968] have suggested that in primary non-vital teeth, root canal treatment was inappropriate due to the difficulty of cleaning them.

Along this line, several factors have been proposed as predisposing to the differences reported in the literature [Aminabadi et al., 2008; Kargul at al., 2010; Caleza et al., 2016]. Aminabadi et al. [2008] reached the conclusion that it was the accessibility to the canals what made treatment difficult. However, although the first molars have poorer accessibility and a more variable and irregular anatomy, they did not find any statistical differences ($p>0.05$) that might interfere with the success of the endodontic treatment.

Similarly, there are numerous studies that did not find any difference between the success ratio and the favorable prognosis in the first or second molars [Barcelos et al., 2012; Louwakul and Prucksathamrongkul, 2012; Bawazir and Salama, 2006; Holan and Fucks, 1993]. Notwithstanding, the present study found a slightly increased frequency of failures for the first compared to the second molars. The results are coherent with previous

data finding no statistically significant differences (p>0.05) between them. Contrary to the present findings, Moskovitz et al. [2005] observed statistically significant differences in the failure rate between the first and the second primary molar pulpectomies. These authors found that second molars yielded a higher failure rate than the first molars. Moreover, the same authors determined that a greater number of failures were associated within the mandibular than in the maxillary primary molars.

The results from the present study in agreement with others [Payne et al., 1993; Ozalp et al., 2005; Kargul at al., 2010; Nakornchai at al., 2010], also seem to contradict those findings regarding lower and upper molars where we did not find any difference (p>0.05).

Apart from the root canal filling material, the anatomy of the root canal, and the accessibility to canals of different types of primary molars, another factor that might affect the success rate could be the type of coronal tooth restoration. The positive results obtained in our study were also due to the fact that all treated molars were restored with stainless steel crowns, obtaining optimum sealing and avoiding any kind of microfiltration. Moskovitz et al. [2005] published a clinical study where the majority of teeth (70.5%) that were restored with a stainless steel crown had a success rate of 96%, while only 28.6% of the teeth left with primary restoration showed a successful RCT. This difference was statistically significant (p>0.05).

Clinical success is generally higher than the radiographic success [Payne et al., 1993; Ozalp et al., 2005; Trairatvorakul and Chunlasikaiwan, 2008; Kargul et al., 2010; Nakornchai et al., 2010; Kargul et al., 2010; Nakornchai et al., 2010; Iglesias-Linares et al., 2016], and the results of our study are in agreement with it. This confirms the importance of postoperative radiographs, even in the absence of clinical signs and symptoms of failure. Although the American Academy of Pediatric Dentistry's guideline on pulp therapy states that the radiographic signs should heal within 6 months, a long-term follow-up at 6 months intervals is necessary, because there are cases of delayed healing or late failure detected at longer follow-up periods.

Conclusions

The number of roots and the anatomy of the root canals in primary molars change considerably, which must be taken into account when performing pulpectomies. Significant differences were not observed in the prognosis of different types of primary molars after pulpectomy. Gender was not associated with any predisposition to pulpectomy failure.

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