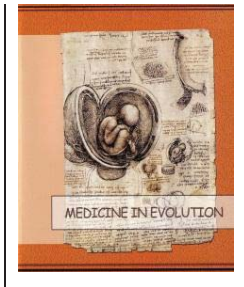


Success rate of pulp capping in primary and first permanent molars – A retrospective study



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Abstract

The aim of this study was the evaluation of the success rate of 3 pulp capping treatment techniques and to compare the results obtained in primary (PM) and first permanent molars (FPM). Material and methods: In this retrospective study we collected data from 194 medical records; 330 PM and immature FPM treated by pulp cappings were analyzed. Results: The success rate of pulp capping treatments in PM was 64.5%, while for FPM this counted for 96.6%. The means of survival time in PM were: indirect pulp capping (IPC) - 59.24±3.92 months, stepwise (SW) - 32.55±3.19 months, and direct pulp capping (DPC) - 32.35±6.6 months; for FPM: IPC - 102.47±3.07 months, SW - 57.31±5.18 months, and DPC - 49.46±17.07 months. When we compared the findings between dentitions, we observed that IPC and SW techniques had superior results in FPM than in PM. Conclusions: Based on our results, IPC and SW methods seem to be better choices in terms of preserving pulp vitality in both PM and FPM. Overall, FPM vital therapy was more successful than that of PM.

Keywords: pulp capping, vital pulp therapies, stepwise, indirect pulp capping

INTRODUCTION

Pulp capping is a dental treatment for deep carious lesions without symptoms of pulp degeneration.[1] A deep carious lesion is considered that one reaching the inner third or quarter of dentine. [2] The treatment itself consists in leaving a small amount of demineralized dentine in the most profound region of the cavity that will be covered with a biostimulatory material. [1]

There are 3 types of pulp capping treatment techniques: indirect pulp capping (one step), stepwise caries excavation (two steps), and direct pulp capping with the minimum opening of the pulp chamber. [2]

Currently, some of the most important focus points in scientific research are vital pulp therapy and selective carious removal with a great comeback for the stepwise excavation technique. [2-5] The scientific community and papers encourage the use of pulp capping and vital pulp therapies in general. [1-6]

Pulp capping procedures are indicated both in primary and immature permanent teeth for deep carious lesions with healthy pulp tissue or with reversible inflammation, [1] with the specification that a correct pulp diagnosis is difficult to establish in these teeth.

The aim of this study is to evaluate the success/failure rate of the different types of pulp capping techniques used in paediatric dentistry and to compare the results obtained in primary and immature permanent molars.

MATERIALS AND METHODS

This retrospective study was carried out over a period of two year (2017-2019), at the Paediatric Dentistry Department of the Carol Davila University of Medicine and Pharmacy, Bucharest.

The study was performed on the following samples of patients and teeth:

The patients study sample - Primary Molars contained 96 Romanian children aged between 2-10 years, mean age 5.86 ± 0.18 years. The patients study sample - First Permanent Molars contained 98 Romanian children, aged between 5-10 years, mean age 7.77 ± 0.09 years.

The primary molars study sample (PM-SS) contained 155 primary molars. The first permanent molars study sample (FPM-SS) contained 175 immature first permanent molars.

The molars study samples were divided based on 2 age groups, as follows: PM-SS, 2-6 years (51%, n=79), 6-10 years (49%, n=76); FPM-SS, 5-8 years (48%, n=84), 8-10 years (52%, n=91).

Among the PM-SS, 50.3% (n=78) were treated by indirect pulp capping (IPC), 45.8% (n=71) by stepwise caries excavation (SW) and 3.9% (n=6) by direct pulp capping (DPC). Among the FPM-SS, 75.4% (n=132) were treated by IPC, 22.3% (n=39) by SW and 2.3% (n=4) by DPC.

The inclusion criteria of the participants were: healthy patients without any chronic diseases who received at least one pulp capping treatment in either primary or immature first permanent molars. The inclusion criteria for teeth: all primary and immature first permanent molars which benefited of either indirect (one step/two steps techniques) or direct pulp capping.

The materials used for pulp capping were calcium hydroxide (Life®, SDS Kerr) and glass-ionomer restorative cement (Fuji IX®, GC).

Clinical success criteria were defined as absence of pain or any symptom of pulp alteration, no sign of necrosis or apical periodontitis, and absence of radiographic alterations.

Data were collected from the patients' medical records, without revealing their identity.

The variables extracted from the patients' medical records were the following: age, gender, type of tooth, duration of treatment supervision and time of failure due to pulpal complications.

Data analysis was performed using Stata® 11IC (StataCorp LP) statistical software. The Kaplan-Meier, Mantel-Cox and Pearson chi-squared methods were used to evaluate the mean survival time according to the pulp capping method and treatment's success rate according to several variables. A *p*-value of 0.05 was considered statistically significant.

RESULTS

The distribution of the PM-SS by age revealed that 51% (n=79) of the molars belonged to children aged 2-6yo and 49% (n=76) aged 6-10yo. In the FPM-SS 48% (n=84) of the molars belonged to children aged 5-8yo and 52% (n=91) to children aged 8-10yo.

The distribution of the PM-SS by type of molar was the following: 71 first molars (45.8%) and 84 second molars (54.2%). Distribution of PM-SS by dental arch: 58 superior teeth (37.4%) and 97 inferior teeth (62.6%).

The distribution of FPM-SS by dental arch was the following: 60 maxillary teeth (34.29%) and 115 mandibular teeth (65.71%).

The success rate of the capping treatment in the PM-SS was 64.5% (n=100), while for the FPM-SS success was 96.6% (n=169).

The success rates of the treatment by type of capping in the PM-SS were as follows: IPC 78.2% (n=61), followed by SW 52.1% (n=37), and DPC 33.3% (n=2) (*p*=0.001). Success rates for the pulp capping methods in the FPM-SS were as follows: 97.7% (n=129) for IPC, 94.9% (n=37) for SW, and 75% (n=3) for DPC (*p*=0.039).

The success rates in PM-SS for the 2-6 years age group were as follows: IPC 71.8% (n=28), SW 44.1% (n=15) and DPC 3.9% (n=2) (*p*=0.028). In the 6-10 years age group, the success rates were as follows: IPC 84.6% (n=33) and SW 59.5% (n=22), (*p*=0.014). In the 5-8 years old age group of the FPM-SS, the following success rates were recorded: 98.3% (n=58) for IPC, 91.3% (n=21) for SW and 50.0% (n=1) for DPC (*p*=0.004). In the higher age group, almost all treatments were reported as successes: IPC 97.3% (n=71), SW 100.0% (n=16) and DPC 100.0% (n=2) (*p*=0.777).

When we compared the findings between dentitions, we observed that IPC and SW had better results in permanent than in primary dentition, the differences being statistically significant: *p*=0,016 (IPC), and *p*=0,030 (SW), while for DPC the differences were not statistically significant (*p*=0,850).

There was no statistically significant difference between the success rates of first and second primary molars (64.8% and 64.3%, respectively) (*p*=0.948).

Statistically significant differences were not recorded between the treatments success rates in maxillary molars and mandibular molars, neither in primary (56.9% vs. 69.1%, *p*=0.125), nor in permanent teeth (98.3% vs. 95.7%, *p*=0.355).

The means of survival time for the three treatment methods in PM-SS were as follows: IPC - 59.24±3.92 months, SW - 32.55±3.19 months, and DPC - 32.35±6.6 months. Statistically significant differences were recorded between IPC and SW (*p*<0.001), as well as between IPC and DPC (*p*=0.038) (**Fig. 1**).

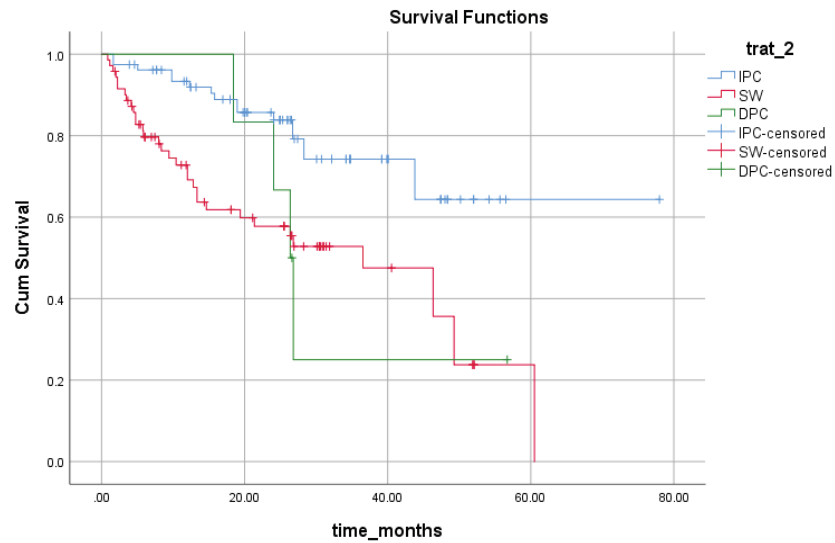


Figure 1. Kaplan-Meier survival curves for the pulp capping methods in primary molars

The mean survival time for the three treatment methods in immature FPM-SS were the following: IPC - 102.47 ± 3.07 months, SW - 57.31 ± 5.18 months, and DPC 49.46 ± 17.07 months. Statistically significant differences were recorded only between IPC and DPC ($p=0.027$) (Fig. 2).

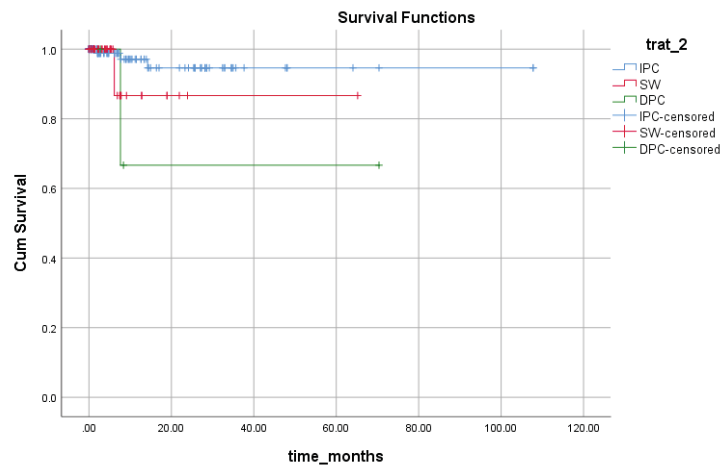


Figure 2. Kaplan-Meier survival curves for the pulp capping methods in immature first permanent molars

The overall success rate of pulp capping was greater in immature FPM-SS (96.6%, $n=169$) than in PM-SS (64.5%, $n=100$) ($p<0.001$). The mean survival time was, as well, greater in immature FPM-SS (99.75 ± 3.24 months) than in PM-SS (43.95 ± 3.69 months) ($p<0.001$) (Fig. 3).

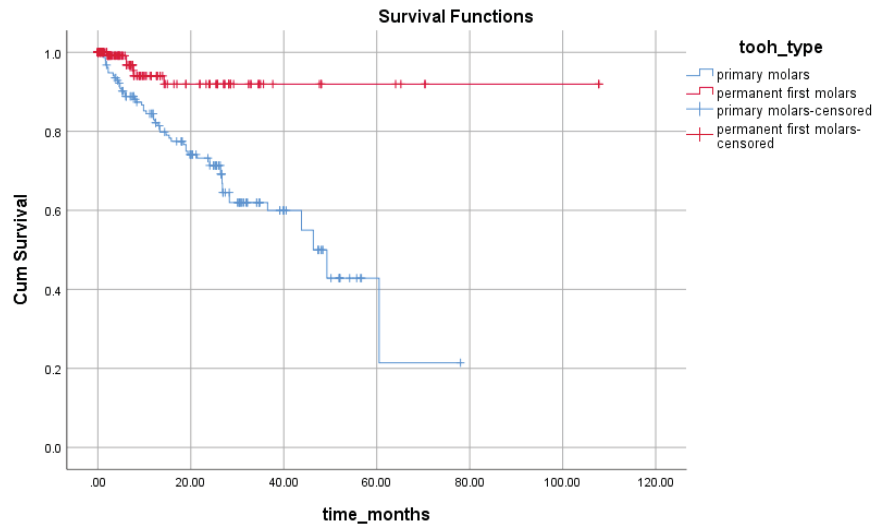


Figure 3. Kaplan-Meier survival curves for pulp capping in primary molars and immature first permanent molars

DISCUSSIONS

Our retrospective study's findings regarding the IPC success rate for PM-SS of 78.2% is lower than that of Al Zayer's, who estimated a 95% rate or that of Coll's systematic review and Meta-analysis (94.4%). [7,8] Still, the difference becomes smaller when comparing only our 6-10 yo group result - 84.6% success rate, a more appropriate comparison with Al Zayer's study that comprised children of 8y 6m mean age. [7] Meanwhile, Casagrande's et al. success rate of IPC in primary teeth, of 78%, is in accordance with the results with our study. [9]

Gurcan et al conducted a prospective clinical trial and evaluated the success rate for IPC. Their study revealed an 84.6% success rate for calcium hydroxide pulp capping. Though their study evaluated both primary and permanent teeth, they concluded that there was no statistically significant difference between primary and permanent teeth regarding success. Our 97.7% success rate for IPC is in discordance to this study. [11]

A success rate for SW technique of 52.1% found in our study is much lower in comparison with that of 90% in Coll's literature review. [10] This can be related to the fact that our research included a great number of very small children, the majority of them being difficult to cope with.

The DPC's success rate resulted in our research, of 33.3%, is lower than that in Coll's systematic review and Meta-analysis, which was 88.8%. [10] The number of DPC on PM-SS evaluated in our study is small, therefore in a larger sample the results might be different. DPC in the FPM-SS registered a success rate of 75%, with higher values recorded in the 8-10 years old age - 100%. Our findings are similar to those of Raedel et al. [12], with a 79.7% success rate, and Auschill et al. with 76.4%. [13]

While our study found no significant difference between the success rates of pulp capping in first and second primary molars, Al Zayer's et al. study found a statistically significant difference and stated that the first molar was 4.4 times more likely to fail than the second primary molar.[7] Casagrande's study did not find a statistically significant difference between the success rate of pulp capping in first and second primary molars but, similarly to the present study, recorded a slightly higher success rate in the first than the second primary molar.[9]

Gruythuysen et al. evaluated both primary and permanent teeth. While the success rate in permanent teeth was similar to ours, the one in the primary dentition was higher. They found no significantly statistical difference between the two dentitions, while the findings in our study favoured the permanent teeth. [14]

CONCLUSIONS

The results of our study suggest that all efforts should focus on minimising the risk of pulp exposure, in both dentitions. As such, when there is great risk of exposure, and complete excavation of the carious lesion cannot be done, stepwise excavation technique can be a viable solution of treatment. This conclusion is supported by the favourable results we found in immature FPM-SS.

IPC and SW methods seem to be better choices in terms of preserving pulp vitality in both PM and FPM. Overall, FPM vital therapy was more successful than that of PM.

Acknowledgement

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