

Survival and Factors Associated with Failure of Pulpectomies Performed in Primary Teeth by Dental Students

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Although endodontic treatment is widely recommended for compromised dental pulp, there is no information regarding the factors associated with failures in primary teeth. The aim of this study was to evaluate the survival and factors associated with failure of pulpectomies performed in primary teeth by dental students. The sample comprised patients treated at a University Dental Service and required endodontic treatment in primary teeth. The study investigated treatment-related variables and patient factors potentially associated with treatment failure. Pulpectomy survival was analyzed by Kaplan-Meier estimator followed by log-rank test ($p < 0.05$). The analysis included 81 pulpectomies performed in 62 children (5.6 ± 1.5 years). The survival reached 62.9% up to 12 months follow-up. Most failures occurred in the first 3 months ($p < 0.001$). Teeth with carious lesions at the start of treatment presented more failures than those with restorations or history of trauma ($p = 0.002$). The survival of endodontically treated teeth restored with composite was higher than the ones filled with GIC ($p = 0.006$). Pulpectomy performed in two or more sessions resulted in more failures ($p = 0.028$). Patients presenting gingivitis had more failures in the endodontic treatment ($p = 0.022$). The failures of root canal treatment in primary teeth were more prone to occur in a short time and when the treatment was performed in teeth presenting carious lesions. The use of composite instead of GIC increased the survival of pulpectomies. Repeated sessions for endodontic treatment and lack of oral hygiene habits had a negative effect on the results.

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Key Words: primary teeth, pulpectomy, survival.

Introduction

The preservation of primary teeth in the arch closer to their physiological exfoliation is fundamental for space maintenance and eruption of the permanent successors (1). Pulpectomy is a technique recommended for the treatment of irreversible pulp inflammation or necrosis caused by dental trauma or caries, and is considered a conservative option compared with tooth extraction (2). The main goal of endodontic intervention is to recover the functional aspects of the affected tooth by healing or preserving the integrity of the periapical tissue, while eliminating the microorganisms from root canals to prevent subsequent reinfection (1,3).

Although most randomized clinical trials (RCT) report a satisfactory success rate for primary tooth pulpectomies (4), it might also have resulted in selection bias with regard to patient enrolment and adherence when patients are motivated towards regular attendance and oral hygiene aspects (5). Moreover, these studies are generally conducted in specific clinical situations by highly skilled professionals, and do not consider other factors that may play a role in the treatment outcome. Recently, two retrospective university-based studies demonstrated the influence of patient's and treatment-related variables in the survival of restorative

treatments performed in primary and permanent teeth of high caries risk children (6,7). Patients with higher amounts of visible plaque (6) and gingivitis (7) were more prone to experience failure in restorations. Moreover, risk factors for failure were identified in multi-surface fillings and in glass ionomer cement restorations (7).

To date, there is no available information concerning the clinical factors potentially associated with failure of pulpectomies performed in primary teeth, especially among high caries risk populations. Therefore, the aim of this prospective university-based study has been to evaluate the survival rate and factors associated with the failure of primary tooth pulpectomies performed by dental students.

Material and Methods

Subjects and Ethical Aspects

This prospective university-based study was conducted from March 2014 to July 2015 at the Children and Youth Dental Clinic of the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil. The convenience sample comprised patients who underwent endodontic treatment in anterior and posterior primary teeth.

The recommendations for pulpectomy included

spontaneous pain in caries-affected or traumatized teeth, intraoral swelling or a sinus tract, inter-radicular and/or periapical radiopacities, with roots exhibiting minimal or no resorption (APPD, 2015) (2). Children with confirmed systemic pathologies or any medical compromising conditions were excluded from the analysis.

The present study was conducted in accordance with the ethical standards of the Resolution of the National Council on Ethics in Research (no. 466/2012) and the Helsinki Declaration (2008). The study protocol was submitted to and approved by the Research Committee (no. 25819) and the local University Ethics Committee (no. 24813613.7.0000.5347). Permission to use patient data was obtained by the consent and signature of parents or guardians.

Clinical Procedures

The clinical procedures were performed by fourth-year undergraduate students and included clinical and radiographic examinations (diagnostic) and interventional procedures. Depending on the behavior and clinical-related characteristics of the patient, pulpectomies required one, two or more visits. Treatment supervision was provided by clinical instructors specialized in pediatric dentistry.

First, preoperative radiographs were obtained and the length of the working area was set at 1–2 mm short of the radiographic apex (3,8,9). Treatment was performed in a single visit for vital and non-infected teeth and a minimum of two appointments for teeth with abscesses, swellings or periapical and/or inter-radicular radiopacities. Following the administration of local anesthetic and rubber dam isolation, the diagnosed carious lesions were completely removed from the cavity walls and floor by round burs low speed. The same procedure was performed for the pulp walls and pulp chamber access was achieved by a No. 6/8 round diamond point at high speed under refrigeration. When the coronal pulp tissue presented irreversible pulpitis, it was removed with a spoon excavator. If the pulp tissue was necrotic, copious irrigation with 1% sodium hypochlorite was employed. The canals were cleaned and shaped using K-files, sequentially introduced into the canals. In some cases, final irrigation was performed with ethylenediaminetetraacetic acid (17% EDTA) for 2 min. An intra-canal medicament (calcium hydroxide propylene glycol paste) was placed into the canals of teeth with abscesses, swellings or periapical/inter-radicular involvement, remaining for approximately 15–30 days. They were restored with temporary filling material (glass ionomer cement - GIC). Root canal filling was completed using calcium hydroxide paste with zinc oxide (3:1 weight rate), mixed to the desired consistency (toothpaste) and introduced into the root canal with a K-file

and/or lentulospiral or Centrix syringe (anterior teeth). The pulp chamber was filled with plastic gutta-percha and the teeth were restored with resin-modified glass ionomer cement (RMGIC; Vitremer, ESPE 3M, Minneapolis, MN, USA) or composite resin (CR; Adper Single Bond/Filtek Z-350, ESPE 3M). Immediate postoperative radiographs were made to determine the extent of the filling material. Roots in which the endodontic paste reached the apex or stayed short of 1–2 mm, were considered "acceptable"; those in which the filling material was more than 2 mm short of the radiographic apex were scored as "underfilled"; and in cases of extravasation of material to the periapex, as "overfilled" (10).

Data Collection

The following information regarding treatment-related variables was retrieved from the dental records: tooth type, presence of dental pain, tooth status (restored, carious, traumatized), pulp diagnosis (based on APPD clinical-radiographic criteria), use of EDTA after chemomechanical preparation, use of intra-canal medication, quality of root canal filling (adequate, underfilled, overfilled), type of used restorative material (CR, RMGIC), number of visits and appointment duration.

Factors potentially associated with treatment failure were also investigated, including gender, age, visible plaque (VPI) and gingival bleeding (GBI) indexes (11), the decayed missing filled teeth index (dmft) and patient behavior during endodontic treatment (12).

VPI and GBI were used to evaluate the plaque control routine of the patients. The number of dental surfaces was divided by the number of surfaces with visible plaque or gingival bleeding. For analysis, the values of both indexes were dichotomized (<20% and >20%). The biofilm control was considered satisfactory when VPI and GBI were <20% (13). Caries were classified as moderate and high, the median value used as the threshold.

Outcomes

The survival of endodontically treated teeth was set as the main outcome. Clinical criteria for success were defined as the absence of pain, swelling, fistula or sensitivity to percussion and no pathologic mobility. Radiographic criteria (10) for success included the analysis of inter-radicular and/or periapical radiopacities (stabilization, regression) and periodontal ligament integrity. A single examiner, blinded for the treatment, performed the evaluations. The Cohen's kappa coefficient for intra-examiner reproducibility of radiographic evaluations was 0.86.

Data Analysis

Data collected from patient records was included in

a database, analyzed using Stata 11.2 software (College Station, TX, USA) and expressed as frequencies and percentages according to the independent variables.

Survival curves were assessed using Kaplan–Meier analysis. Differences in survival rates according to the clinical and demographic characteristics were tested by the log-rank test and the significance level was set at 5%. The annual failure rate (AFR) was calculated using the formula $(1-y)^z=(1-x)$, where “y” is the mean AFR and “x” is the total failure rate at “z” years.

Results

All 81 pulpectomies performed in 62 high caries risk children (dmft=6.1±3.7; age=5.6±1.5 years) were analyzed in this study. The mean VPI and GBI were 33.7±34.3% and 30.1±34.3%, respectively. Most teeth (65.4%) had no root resorption at the time of endodontic treatment, while 34.6% showed initial resorption (around a third of the root length). The pulp status at the time of diagnostic examination revealed pulp necrosis in 61.7% teeth, followed by irreversible pulpitis (22.3%). Re-treatments comprised 16% of the sample. Table 1 shows the distribution of pulpectomies according to the demographic and clinical characteristics of the sample.

The follow-up period ranged from 1 to 12 months (Figs. 1 and 2). Among the 81 teeth, 18 (22.2%) were evaluated for 1 month, 14 (17.3%) for 3 months, 24 (29.6%) for 6 months and 25 (30.9%) for over 12 months. The majority of failures (24; 80.0%) occurred in the first three months and six failures between 6 and 12 months (20.0%). The failure rate was significantly associated with time ($p<0.001$). Among the pulpectomy failures, 14 teeth underwent re-treatment and the other 16 had to be extracted. Overall, the survival rate of the pulpectomies in 12 months reached 62.9% and AFR was 37.1%. Figure 3 shows the Kaplan–Meier survival curves over the follow-up period.

The failure of root canal treatment was higher for children presenting more than 20% marginal gingival bleeding ($p=0.022$); for teeth presenting carious lesion as reason for pulp therapy ($p=0.002$); for teeth treated in multiple appointments ($p=0.028$); and for teeth restored with RMGIC ($p=0.006$). The use of intra-canal medication showed a borderline association with failures ($p=0.049$). There were no significant differences in the failure rates according to the other individual and clinical parameters (Table 2).

Discussion

This prospective university-based study involved the clinical and radiographic evaluation of endodontic treatment performed in primary teeth by dental students and the factors associated with the treatment failures.

Table 1. Distribution of pulpectomies performed in primary teeth according to individual and tooth-level variables.

Variables	n	%
Gender		
Female	40	49.40
Male	41	50.60
Tooth position		
Anterior	15	18.50
Posterior	66	81.50
Arch type		
Manillary	41	50.61
Mandibular	40	49.38
Tooth type		
First molar	22	27.16
Second molar	44	54.30
Incisors	15	18.51
Dental pain		
Absent	53	65.40
Presented	28	34.60
Tooth status		
Restored	23	28.40
Carious	53	65.40
Traumatized	5	6.20
Periapical/furcation lesion		
Absent	39	48.10
Present	42	51.90
EDTA treatment		
No	28	34.57
Yes	53	65.43
Intra-canal medicament		
No	16	19.80
Yes	65	80.20
Quality of endodontic filling		
Inadequate	37	45.70
Adequate	44	54.30
Restorative material		
Resin	18	22.20
RMGIC	63	77.80
Child behavior		
Cooperative	62	76.50
Non-cooperative	19	23.50
N. appointments		
1	13	16.00
2 or more	68	84.00
Variables	mean	SD
Age (months)	67.11	18.47
Visible plaque index	33.70	34.34
Gingival bleeding index	30.11	34.38
DMF-T	6.15	3.74
Consultation time (min)	197.16	90.01

Assessments were made based on the postoperative clinical symptoms and signs, as well as periapical radiographic evaluation. The overall survival rate for the pulpectomies was 62.9% after 12 months follow-up, most of the failures occurring in the first 3 months. Tooth status at the start of treatment, number of endodontic treatment appointments, type of restorative material and gingivitis were associated with failures of the treatments.

Epidemiological studies have shown that caries still represent an important public health problem in Brazil, affecting children at early ages (14). According to a survey performed in Brazilian dental schools, the recommendations for pulpectomy include irreversible pulp inflammation or necrosis caused by dental trauma or caries (15).

In the present study, deep carious lesions were the main reason for endodontic treatment in posterior primary teeth, which mostly presented pulp necrosis associated with periapical/furcation involvement. The initial condition of the teeth had an association with the outcome of endodontic treatment ($p=0.002$). The endodontic treatment of teeth with deep carious lesions was associated with a higher level of failures, compared with traumatized endodontically teeth or those presenting previous restorations.

Although there is no consensus regarding the endodontic protocol for primary teeth, recent studies have demonstrated the importance of using an intra-canal medicament between sessions in order to decrease the microbial contamination of root canals (16). Similarly, clinical research found that smear layer removal from symptomatic teeth with pulp necrosis is associated with a higher success rate for endodontic therapy (3). From these perspectives, the primary tooth pulpectomy protocol taught and practiced at UFRGS contemplates the use of an intra-canal dressing (calcium hydroxide) between sessions and smear layer removal using 17% EDTA in cases of fistula, swelling, suppuration and pulp necrosis, with or without furcation/periapical involvement.

There was no difference in the failure rate following EDTA for dentin treatment after chemomechanical preparation. However,

there was a significant difference about the number of appointments required to complete endodontic therapy

Table 2. Status (%) of the pulpectomies performed in primary teeth according to clinical and demographic characteristics.

Variable	n (%) of pulpectomies	Success (%)	Failure (%)	*P-value
Sex				
Male	41 (50.6)	25 (60.9)	16 (39.1)	0.640
Female	40 (49.4)	26 (65.0)	14 (35.0)	
Age				
< 5 years	24 (29.63)	17 (70.83)	7 (29.17)	0.665
5 years or more	57 (70.37)	34 (59.64)	23 (40.36)	
Tooth group				0.713
Anterior	15 (18.52)	10 (66.67)	5 (33.33)	
Posterior	66 (81.48)	41 (62.12)	25 (37.88)	
Dental Pain				
Absent	53 (65.4)	32 (60.37)	21 (39.63)	0.964
Present	28 (34.6)	19 (67.85)	9 (32.15)	
Pulp Diagnosis				
Pulpitis	18 (22.3)	11 (61.1)	7 (38.9)	0.238
Necrosis	50 (61.7)	29 (58.0)	21 (42.0)	
Re-treatment	13 (16.0)	11 (84.6)	2 (15.4)	
Periapical/furcation lesion				
Absent	39 (48.1)	27 (69.23)	12 (30.77)	0.809
Present	42 (51.9)	24 (57.14)	18 (42.86)	
Tooth status				
Restored	23 (28.39)	20 (86.95)	3 (13.05)	0.002*
Carious	53 (65.43)	26 (49.05)	27 (50.95)	
Traumatized	5 (6.18)	5 (100.0)	0 (0.0)	
EDTA treatment				
Yes	53 (65.43)	32 (60.38)	21 (39.62)	0.735
No	28 (34.57)	19 (67.85)	9 (32.15)	
Intra-canal medicament				
Yes	65 (82.2)	38 (58.46)	27 (41.54)	0.049*
No	16 (19.8)	13 (81.2)	3 (18.8)	
Quality of endodontic filling				
Adequate	44 (54.3)	27 (61.36)	17 (38.64)	0.910
Inadequate	37 (45.7)	24 (64.86)	13 (35.14)	
Restorative material				
Resin	18 (22.2)	18 (100.0)	0 (0.0)	0.006*
RMGIC	63 (77.8)	33 (52.39)	30 (47.61)	
Child behavior				
Cooperative	62 (76.5)	38 (61.29)	24 (38.71)	0.946
Non-cooperative	19 (23.5)	13 (68.42)	6 (31.58)	
N. appointments				
1	13 (16.0)	13 (100.0)	0 (0.0)	0.028*
2 or more	68 (84.0)	50 (73.53)	18 (26.47)	
Visible Plaque index				
<20%	32 (47.06)	22 (68.75)	10 (31.25)	0.887
>20%	36 (52.94)	20 (55.55)	16 (44.45)	
Gingival bleeding index				
<20%	39 (57.35)	30 (76.92)	9 (23.08)	0.022*
>20%	29 (42.65)	12 (41.37)	17 (58.63)	
DMFt				
<4	16 (25.39)	11 (68.75)	5 (31.25)	0.163
≥4	47 (74.61)	31 (65.95)	16 (34.05)	
Consultation duration (min)				
Until 190 min	45 (55.55)	27 (60.0)	18 (40.0)	0.152
> 190 min	36 (44.45)	24 (66.67)	12 (33.33)	

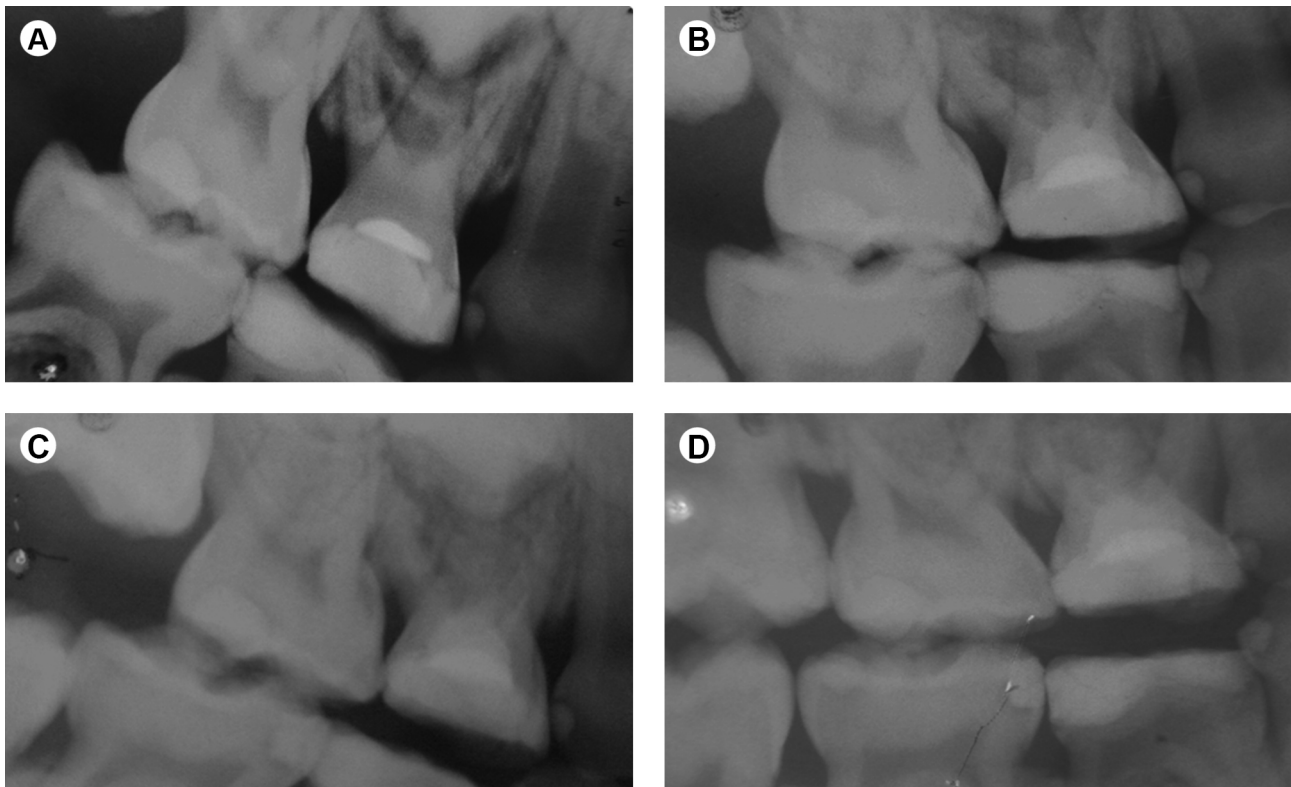


Figure 1. Radiographs of a maxillary first primary molar (54) considered as treatment success at 12-month follow-up. (A) Pre-operative radiograph showing slight thickening of the periodontal ligament and furcation radiolucency. (B) Post-operative radiograph after endodontic treatment using calcium hydroxide paste with zinc oxide (3:1 weight proportion). (C) Radiograph taken 6 months postoperatively showing improvement of furcation radiolucency. (D) The tooth was judged success at 12 months, showing absence of inter-radicular radiolucency and periodontal ligament integrity.

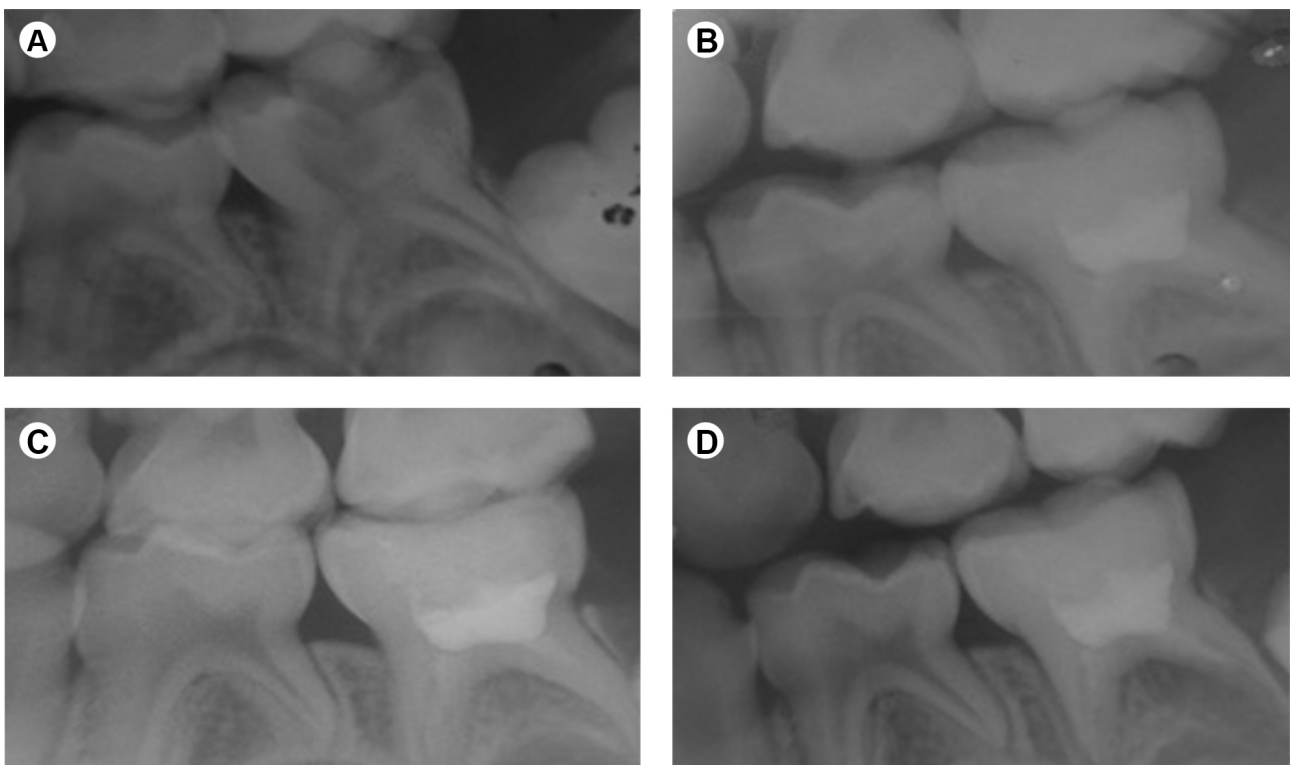


Figure 2. Radiographic images illustrating an endodontic treatment failure at 6-month follow-up. A: Pre-operative radiograph of a lower second primary molar (75) presenting deep dentin carious lesion and an initial furcation lesion. B: Post-operative radiograph taken after root canal obturation with calcium hydroxide and zinc oxide. C: After 3 months of root canal filling, there was an initial resorption of endodontic filling. D: Treatment failure at 6 months by the increase in the size of the inter-radicular radiopacity, absence of lamina dura and resorption of the distal root.

and a borderline association for the use of an intra-canal medicament. The failure rate was higher when two or more visits were required and when an intra-canal medicament was used. This probably represents a confounding factor, because in most cases two or more appointments were required for "challenging cases" with severe microbial contamination and pulp necrosis, while teeth with less contaminated root canals (irreversible pulp inflammation) were treated in a single visit and without intra-canal medicament.

The success of endodontic treatment also depends on appropriate restorative procedures that provide hermetic sealing of the cavity preparation and prevent microleakage. The results of a study on 1010 endodontically treated permanent teeth demonstrated that the quality of the coronal restoration was significantly more important than

the quality of the endodontic filling, considering the apical periodontal health as the outcome (17).

Although it has been demonstrated that stainless steel crowns improve the success rate of pulpectomies of primary teeth (18), direct tooth-colored restorative materials such as glass ionomer cement (GIC) and composite resin (CR) are widely used in Brazil to restore primary and permanent teeth in children and adolescents (19). A previous study on fracture strength of adhesively restored pulp-tomized primary molars demonstrated that bonded restorations may be an alternative restorative procedure for stainless steel crowns (20).

GIC-based materials have several advantages for use in pediatric dentistry and the ease of the technique, which reduces chair time is particularly important for the treatment of uncooperative patients (21). The restoration of

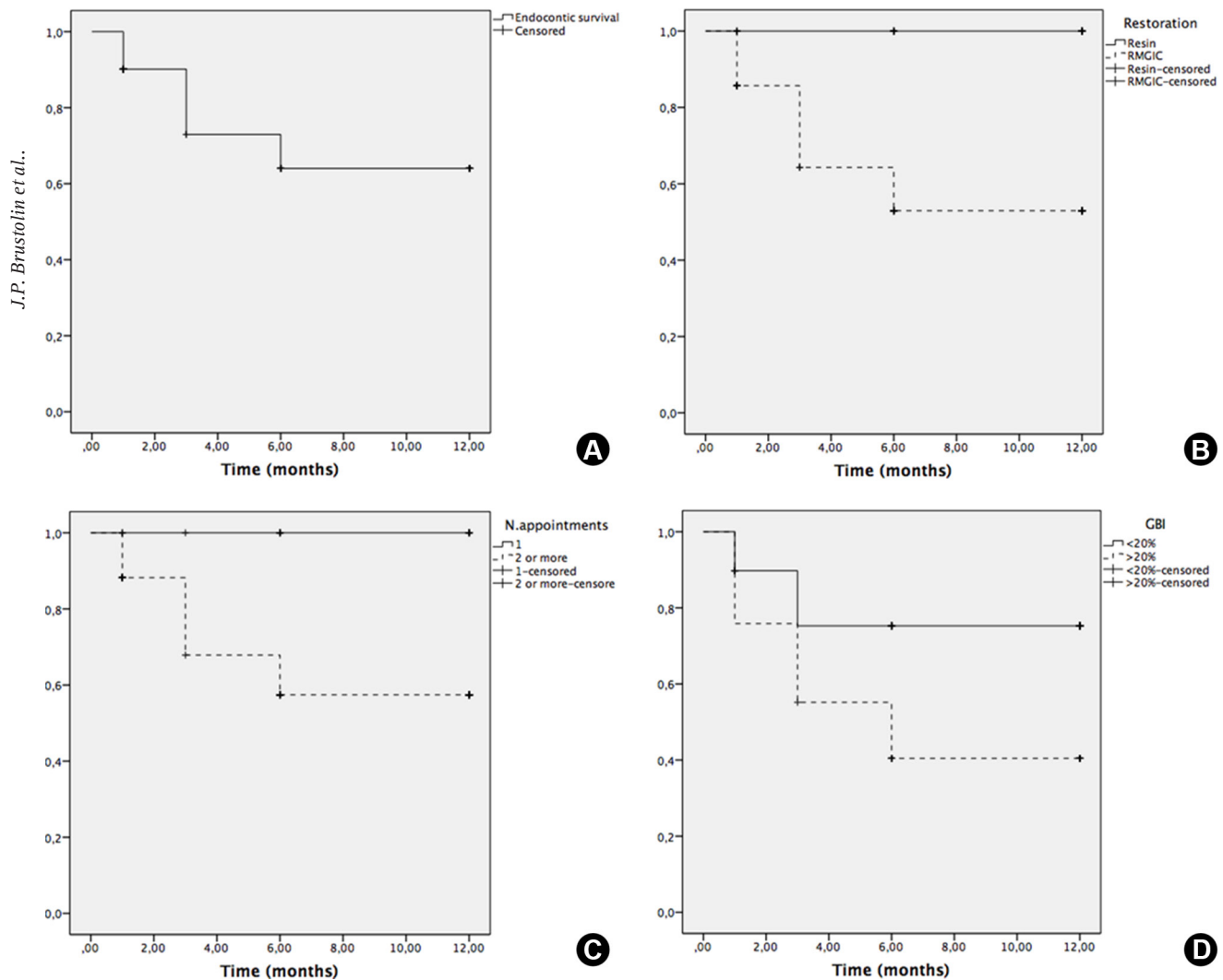


Figure 3. Kaplan-Meier survival curves. Differences between the curves were tested by the log-rank test (significance level 5%). A: Overall survival of pulpectomies performed in primary teeth (62.9%). B: Endodontically treated primary teeth restored with (RMGIC) presented more failures than Composite Resin (CR) (p=0.006). C: Two or more appointments to perform endodontic treatment resulted in more failures compared to single visit (p=0.028). D: Patients with gingivitis (GBI>20%) experienced more failures in their endodontic treatment (p=0.022).

primary teeth after endodontic treatment is another specific clinical indication for the use of GICs, with GICs preferred over CRs because of the reduced working time. However, the comparison of several materials regarding the microleakage in pulpotomized primary molars has shown that reinforced glass ionomer material restorations do not appear to be leakage-resistant material for pulpotomies (22).

On the other hand, CRs present higher resistance to wear, greater microhardness and smoother surfaces compared with GICs, which aid in the functional recovery of caries-affected posterior teeth and the esthetic restoration of anterior teeth. A recent study demonstrated a significantly higher survival of CR restorations compared to GIC when placed in primary molars of patients from poor socioeconomic backgrounds. Moreover, children with a history of pulpal intervention presented higher risk of failure (23).

In the present study, the failure rate was higher when RMGIC was used in pulpectomies, compared to CR. The superior mechanical properties of CRs, such as better adhesion and sealing capacity, may be responsible for this outcome, particularly in teeth with extensive crown loss. Moreover, the design of the present study can drive to some "confounding factors" that were not possible to control, as the distribution of pulpectomies among the used materials. Usually, in the pediatric dental practice of the UFRGS, the utilization of RMGIC is generally preferred in cases where there was no clinical time for restoration with composite and in non-cooperative children. Such conditions could influence the clinical performance of the materials.

The trajectory of dental plaque from childhood to adult life has been considered a strong risk factor for dental diseases and problems such as caries, failure of restorative procedures and tooth loss (24). GBI has been generally used as a clinical parameter for the evaluation of the oral hygiene routine of patients, because gingival bleeding is an indicator of inadequate dental cleaning. In the present study, failure was more frequent for patients with a GBI of >20%.

Overall, the quality of endodontic fillings was considered adequate in 54.3% patients, while the survival rate for the pulpectomies was 62.9%. There is no other report in the literature about the quality and outcomes of endodontic treatment performed in primary teeth by undergraduate students. The principles of endodontic treatment in primary teeth are very similar to those for the treatment of permanent teeth. When compared with endodontic treatment performed in permanent teeth, the results of the present study showed similar findings (25).

Pulp therapy for primary teeth is taught in the fourth year of the undergraduate course at UFRGS dental school. The students are taught using dummy teeth and clinical demonstrations. Before they can perform primary

tooth pulpectomy, the students are required to fulfill all preclinical and clinical requirements for permanent teeth, accumulated over four semesters of practice. Although operator experience cannot be a significant influence over the treatment of adults, this may not be true for the treatment of children. More experienced professionals have produced restorations with longer survival in chair-side-treated children (26). The reduced ability to manage a child's behavior in association with lack of technical experience could contribute to the restricted survival of endodontic treatment.

With regard to the limitations of this study, it must be considered the variability in terms of patient's clinical features and relatively short-term clinical follow-up. Nevertheless, the literature demonstrates that primary tooth pulpectomies generally fail within a short period of time, frequently in association with difficulties in accurate diagnosis and case selection based on the peculiarities of primary teeth, such as root resorption, frequently undetected by radiographic assessment. Moreover, the patients' oral habits and their high caries risk profile may have a negative impact on the outcomes, accelerating the "aging" of the treatments and providing important information for clinicians and researches about the risk factors that play an important role in treatment survival.

A convenience sample of patients attending a specific dental clinic was followed, so the results presented here should be considered with caution. Notwithstanding, one may argue that the achieved sample size could also have impacted the obtained results, especially due to the power of the statistical test in demonstrating some of the associations. However, in an RCT that evaluated the effect of smear layer removal on the success of pulpectomy performed in primary teeth, the sample size calculation yields a sample of 80 teeth, including expected drop out. The sample size was very similar to the present prospective observational study where, after applying the exclusion criteria, 81 teeth were included in the analysis. It is important to highlight that even in a convenience sample, it was possible to observe some clinical factors associated with failures.

Within its limitations, this study suggests that endodontic treatment of primary teeth performed by dental students presented restricted survival, most of the failures occurring in the first 3 months after treatment. Teeth presenting carious lesions as a reason for endodontic treatment, presence of gingival bleeding >20%, type of restorative material and number of treatment appointments were associated with the failure of pulpectomies.

Resumo

Embora o tratamento endodôntico seja amplamente recomendado para polpa dentária comprometida, não há informações sobre os fatores

associados às falhas nos dentes decíduos. O objetivo do trabalho foi avaliar a sobrevida e os fatores associados à falha de pulpectomias realizadas em dentes decíduos por estudantes de odontologia. A amostra foi constituída por pacientes atendidos em um Serviço Odontológico Universitário e necessitaram de tratamento endodôntico em dentes decíduos. O estudo investigou variáveis relacionadas ao tratamento e fatores do paciente potencialmente associados à falha do tratamento. A sobrevivência das pulpectomias foi analisada pelas curvas de Kaplan-Meier seguido do teste de log-rank ($p < 0,05$). A análise incluiu 81 pulpectomias realizadas em 62 crianças ($5,6 \pm 1,5$ anos). A sobrevida atingiu 62,9% em até 12 meses de seguimento. A maioria das falhas ocorreu nos primeiros 3 meses ($p < 0,001$). Os dentes com lesões cariosas no início do tratamento apresentaram mais falhas do que aqueles com restaurações ou história de trauma ($p = 0,002$). A sobrevida de dentes endodonticamente tratados restaurados com compósito foi maior do que os preenchidos com cimento de ionômero de vidro ($p = 0,006$). Pulpectomias realizadas em duas ou mais sessões apresentaram mais falhas ($p = 0,028$). Os pacientes com gengivite apresentaram mais falhas no tratamento endodôntico ($p = 0,022$). As falhas do tratamento do canal radicular em dentes decíduos foram mais propensas a ocorrer em um curto período de tempo e quando o tratamento foi realizado em dentes com lesões cariosas. O uso de compósito em vez de cimento de ionômero de vidro aumentou a sobrevivência pulpectomias. Sessões repetidas para o tratamento endodôntico e a falta de hábitos de higiene bucal tiveram um efeito negativo sobre os resultados.

Acknowledgements

The authors are grateful to Bruna R. Lima for her assistance in patient recall appointments.

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Received April 29, 2016
Accepted November 1, 2016