



## Graduate and Undergraduate Teaching of Primary Tooth Pulpectomy: A Comparison among Brazilian Dental Schools

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### Abstract

**Objective:** To compare the teaching of the pulpectomy in primary teeth among graduate and undergraduate Brazilian dental schools. **Material and Methods:** From August 2015 to July 2016, an 11-question survey was sent to 44 graduate and 207 undergraduate dental schools. Data obtained were summarized using descriptive statistics. **Results:** The response rate was higher from graduate (56.8%) than undergraduate (41.1%) courses. Pulpectomy was taught by all participating schools. More than 90% of the undergraduate and graduate courses recommend the use of hand instruments for canals debridement, but the widening of root canals was advised in 69.4% of undergraduate and in 84% of graduate schools. Regarding the irrigations, 1% sodium hypochlorite as a single irrigating solution was the most taught for both biopulpectomy and necropulpectomy. The iodoform-based Guedes-Pinto paste as the single indication was the preferred root canal filling material in undergraduate schools (30.6%), while the zinc oxide-thickened calcium hydroxide paste as the single option was the most recommended in graduate courses (36%). Endodontic hand file associated with lentulo drill for filling root canals was recommended by most courses. Overall, biopulpectomy was performed in one session, while necropulpectomy led two sessions. Periapical radiograph for diagnosis and final obturation was the most adopted conduct by undergraduate (68.2%) and graduate (72%) schools. Gutta-percha and glass ionomer cement were preferred materials to seal the entrance of the pulp chamber. **Conclusion:** There was variability in the techniques and materials taught to perform pulpectomy in primary teeth among Brazilian graduate and undergraduate dental schools. Calcium hydroxide paste has been used in similar proportion to iodoform-based paste.

**Keywords:** Pulpectomy; Tooth, Deciduous; Surveys and Questionnaires; Education.

## Introduction

The American Academy of Pediatric Dentistry [1] and the British Society of Paediatric Dentistry [2] developed guidelines to aid the clinicians in decision-making for pulp therapy in primary dentition. Conversely, there is no consensus between both academies regarding materials and techniques when performing pulpectomy in primary teeth [3]. Furthermore, the substantial need for well-designed clinical trials and the lack of consistent results on this matter restrict professional choices [4]. In this sense, the teaching of pulpectomy requires greater attention in dental schools [5].

A questionnaire survey conducted in the United States [6], pointed out that 94% of programs had taught pulpectomy, but there was no unified decision regarding the use of irrigating solution and filling material among professionals belonging to predoctoral pediatric dental programs. Despite this, zinc oxide and eugenol paste (ZOE) had been the medicament most used. An update [7] of the investigation with predoctoral pediatric dental program directors and with diplomats of the American Board of Pediatric Dentistry showed that ZOE remained preference, but calcium hydroxide and iodoform-based pastes were more used from 1997.

In Europe, represented by Ireland and the United Kingdom, a pilot survey with pediatric dentistry staff was performed focused on vital pulp therapy. The pulpectomy was reported as one of the treatments less frequently taught [5]. On the other hand, pulpectomy was taught by 96% of pediatric dentists and 73% of general practitioners questioned in a recent study conducted with Colombian schools. In this study, ZOE was the preferred paste, followed by calcium hydroxide paste [3].

In Brazil, the last survey showed that all participating educational institutions advocated the teaching of pulpectomy, and the iodoform-based paste (Guedes-Pinto paste) was the filling material of choice, followed by calcium hydroxide paste, and finally ZOE [8]. Indeed, Guedes-Pinto paste has achieved success rates when used as root canal filling for primary teeth [9]. However, in early 2011, the removal of one of its components from the market, the Rifocort® ointment (Medley S.A., Campinas, SP, Brazil), restricted the use of Guedes-Pinto paste and it has aroused researches in an attempt to replace this component [10,11]. Currently, there is uncertainty of which filling material is the most currently used in Brazilian dental schools. Moreover, there is a wide variety of techniques and materials for using in the biomechanical preparation of the root canals. In this sense, it is essential to update the teaching profile of this pulp therapy modality.

Therefore, the aim of this study was to compare the teaching of the pulpectomy in primary teeth among Brazilian graduate and undergraduate dental schools.

## Material and Methods

### Dental Schools

Undergraduate and pediatric dentistry graduate programs registered in the Federal Council of Dentistry and in the Ministry of Education and Culture (MEC) were potential participants in this

study, totaling 315 institutions (245 undergraduate; 70 graduate - *Stricto Sensu* and *Lato Sensu*). An inclusion criterion was the possibility of contact by e-mail. E-mail addresses of those responsible for teaching pulp therapy in Pediatric Dentistry in these institutions were requested from the course coordination by telephone or e-mail or were collected from electronic address of school or scientific paper. A cover letter presenting the survey, following by a consent form together with questionnaire, was sent by e-mail to the responsible for teaching pulp therapy in primary teeth.

#### Data Collection

The questionnaire, adapted from a previous study [6], comprised of 11 multiple choice questions about suitable materials and techniques used to perform pulpectomy in primary teeth. Before answer the survey, the participant was questioned whether the institution advocates the teaching of pulpectomy in primary dentition. The survey was sent up to five times, from August 2015 to July 2016, fifteen days apart at a time, to those schools that did not answer. The database was updated as the new answers were received. Sampling unit was the course. When more than one questionnaire was answer by a course, it was drawn only one questionnaire representing the institution.

#### Data Analysis

Obtained data were summarized using descriptive statistics.

#### Ethical Aspects

This study was approved by the Ethics Committee for Research, Federal University of Santa Maria, Brazil (CAAE: 44724615.2.0000.5346).

### Results

A flow diagram illustrates the application of questionnaire in Brazilian undergraduate and graduate courses (Figure 1). Altogether, were 315 institutions. Sixteen undergraduate courses did not receive the questionnaire because they had not started the discipline of Pediatric Dentistry at the time of the present study, totalizing 299 courses. In addition, 48 undergraduate and graduate courses were not eligible due to the impossibility of contact. In the end, 251 courses were eligible for this study and 110 surveys were obtained comprising 85 and 25 undergraduate and graduate dental schools, respectively (43.8% response rate). Twenty-four teachers of the undergraduate and graduate courses of the same institution answered the survey.

All Brazilian regions were represented in this study (Table 1). Southeastern and southern regions showed greater representativeness. Moreover, most undergraduate courses were private (61.2%), while in graduate programs public (52%) and private institutions (48%) were represented in a balanced form.

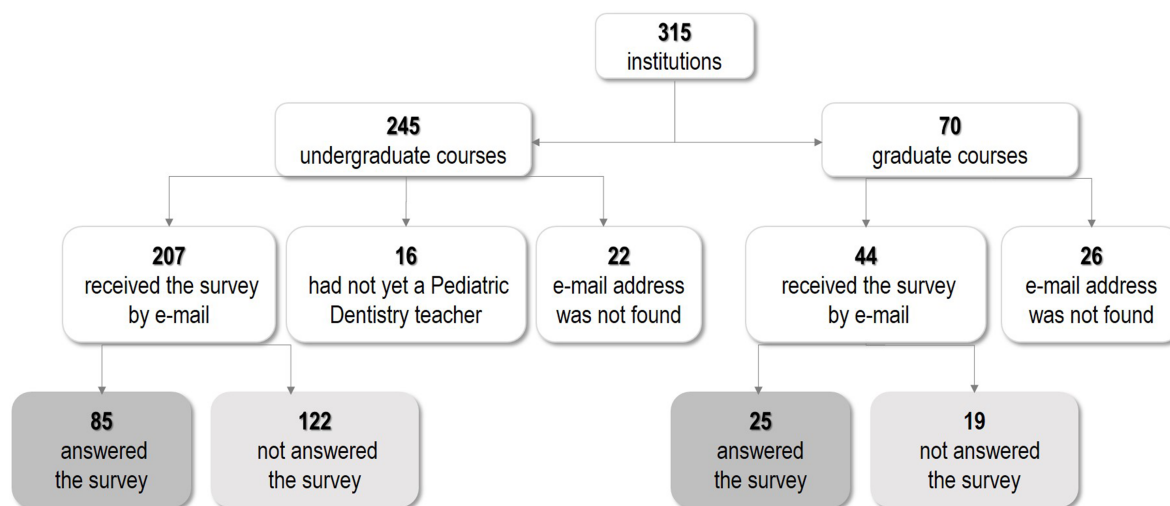


Figure 1. Flow-chart of questionnaire application in Brazilian undergraduate and graduate courses.

Table 1. Distribution by regions of the dentistry undergraduate and graduate courses.

Regions	Undergraduate Courses		Graduate Courses	
	Sent E-mails N	Answered Questionnaires N (%)	Sent E-mails N	Answered Questionnaires N (%)
North	21	7 (8.2)	3	1 (4.0)
Northeast	45	14 (16.5)	6	3 (12.0)
Central-West	17	6 (7.1)	2	1 (4.0)
Southeast	83	34 (40.0)	20	10 (40.0)
South	41	24 (28.2)	13	10 (40.0)
Total	207	85 (100.0)	44	25 (100.0)

Survey results are shown in Table 2. All participating schools taught pulpectomy. Almost all courses recommended the use of hand instruments for root canal disinfection/preparation, but the widening of root canals was advised in 69.4% of undergraduate and in 84% of graduate schools.

Table 2. Results regarding definitions of procedures presented in the survey.

Questions	Courses	
	Undergraduate (N=85) N (%)	Graduate (N=25) N (%)
1. By what method do students mechanically debride the root canal(s)?		
Hand instruments§	81 (95.3)	23(92.0)
Hand and rotary instruments	2 (2.35)	1 (4.0)
Others¥	2 (2.35)	1 (4.0)
2. Does your institution recommend that the root canal(s) be enlarged?		
Yes	59 (69.4)	21 (84.0)
No	26 (30.6)	4 (16.0)
3. What solutions do students use to irrigate the root canal(s) in the Biopulpectomy?		
1% sodium hypochlorite§	20 (23.5)	7 (28.0)
0.5% sodium hypochlorite§	9 (10.6)	2 (8.0)
Saline solution§	9 (10.6)	3 (12.0)
2% chlorhexidine§	1 (1.2)	-
0.5% sodium hypochlorite and/or saline solution	6 (7.1)	3 (12.0)
Others¥	40 (47.0)	10 (40.0)

4. What solutions do students use to irrigate the root canal(s) in the Necropulpectomy?		
1% sodium hypochlorite§	24 (28.2)	8 (32.0)
0.5% sodium hypochlorite§	9 (10.6)	2 (8.0)
2.5% sodium hypochlorite§	6 (7.1)	2 (8.0)
Saline solution§	2 (2.35)	1 (4.0)
0.5% sodium hypochlorite and/or saline solution	2 (2.35)	2 (8.0)
Others¥	42 (49.4)	10 (40.0)
5. What material does your institution advocate for the obturation (filling) of the root canal(s)?		
Guedes-Pinto paste*§	26 (30.6)	5 (20.0)
Calen®(S.S. White) paste tickened with zinc oxide§	19 (22.4)	9 (36.0)
Zinc oxide and eugenol paste§	4 (4.7)	1 (4)
Others¥	36 (42.3)	10 (40.0)
6. What technique does a student use to place the filling material into the root canal of anterior teeth?		
Endodontic hand file and lentulo spiral§	21 (24.7)	6 (24.0)
Endodontic hand file§	13 (15.3)	1 (4.0)
Endodontic hand file and syringe§	12 (14.1)	2 (8.0)
Endodontic hand file and lentulo spiral, cotton pellet§	4 (4.7)	2 (8.0)
Others¥	35 (41.2)	14 (56.0)
7. What technique does a student use to place the filling material into the root canal of posterior teeth?		
Endodontic hand file and lentulo spiral§	21 (24.7)	7 (28.0)
Endodontic hand file§	20 (23.5)	2 (8.0)
Endodontic hand file and syringe§	15 (17.6)	5 (20.0)
Endodontic hand file and cotton pellet§	10 (11.7)	5 (20.0)
Others¥	19 (22.4)	6 (24.0)
8. How many appointments are advocated for completion of a biopulpectomy procedure?		
1	53 (62.4)	17 (68.0)
2	5 (5.8)	2 (8.0)
1 or 2	27 (31.8)	6 (24.0)
9. How many appointments are advocated for completion of a necropulpectomy procedure?		
1	14 (16.5)	3 (12.0)
2	44 (51.7)	14 (56.0)
Others¥	27 (31.8)	8 (32.0)
10. What periapical radiographs are performed during the pulpectomy?		
To diagnosis and to final obturation	58 (68.3)	18 (72.0)
To diagnosis, to working length and to final obturation	24 (28.2)	7 (28.0)
Others¥	3 (3.5)	-
11. What material is used to seal the entrance of the root canals in the pulp chamber?		
Gutta percha stick§	25 (29.4)	7 (28.0)
Glass ionomer cement§	23 (27.1)	7 (28.0)
Calcium hydroxide cement§	3 (3.5)	2 (8.0)
Others¥	34 (40.0)	9 (36.0)

§is the one option; ¥more than one option or other options/associations; \*iodoform, camphorated parachlorophenol (PMCC), Sodium rifamycin SV + 21 prednisolone acetate [substitute for Rifocort® (Medley S.A.)]

Regarding the irrigating solution, 1% sodium hypochlorite (NaOCl) as a single irrigating solution was the most used for both in biopulpectomy and in necropulpectomy. The other responses were represented by more than one option recommended by a teacher from the same school or associations of materials such as 0.5% NaOCl or 1% NaOCl, NaOCl with 17% ethylenediaminetetraacetic acid (EDTA) or 6% citric acid (CA), and chlorhexidine with saline solution. EDTA was indicated as chelating solution in biopulpectomy (11.7%) and in

necropulpectomy (17.6%) by undergraduate courses and by 12% of graduate courses in both treatment types. CA was indicated in biopulpectomy and in necropulpectomy, by one and two undergraduate schools, respectively. Only one graduate program recommended 2.5% NaOCl with CA in both treatments.

The iodoform-based paste [Guedes-Pinto = iodoform; camphorated paramonochlorophenol (PMCC); Sodium rifamycin SV + 21 prednisolone acetate (substitute for Rifocort®; Medley S.A.)] as single indication was the root canal filling material of choice in undergraduate schools (30.6 %), while the calcium hydroxide paste (Calen®; S.S. White, Rio de Janeiro, RJ, Brazil) thickened with zinc oxide as the single option was the most commonly recommended in the graduate courses (36%).

Some schools recommended other paste or more than one paste for filling root canals of primary teeth. Among the pastes were an iodoform-based paste containing calcium hydroxide (Vitapex®, Neo Dental Chemical Products Co., Tokyo, Japan) and modified Guedes-Pinto pastes in which or Omcilon-A® ointment (Bristol-Myers Squibb S.A., São Paulo, SR, Brazil) or Nebacetin® ointment (Nycomed Pharma, Santo Amaro, Brazil) replaced the Rifocort® (Medley S.A.). Moreover, some calcium hydroxide-based pastes were cited such as Ultracal® XS (Ultradent Products Inc., Indaiatuba, SP, Brazil), Calen® paste (S.S. White) and a calcium hydroxide paste with zinc oxide (calcium hydroxide P.A, polyethylene glycol, zinc oxide). Overall, teachers indicated an endodontic hand file associated with lentulo drill for filling anterior and posterior root canals, but other techniques and variations also have been reported.

Biopulpectomy was performed in one session, while necropulpectomy led two sessions in the most courses. Periapical radiographs for diagnosis and for final obturation were recommended by 68.2% of undergraduate and 72% of graduate schools. Gutta-percha and glass ionomer cement were preferred materials to seal the entrance of root canals in the pulp chamber.

## Discussion

The pulpectomy is the root canal treatment indicated when the pulp is irreversibly infected or necrotic due to tooth decay, trauma or other injuries. This treatment is a conservative option in preventing of premature primary tooth loss. As a consequence, the shape of the arch is preserved, incorrect tongue positioning and phonetic changes are prevented, normal masticatory function and aesthetics are maintained [1,2]. Brazil has the highest number of dentists in the world and has more dental schools and students than the United States and all of Europe, second only to India [12]. All the Brazilian institutions investigated in the present study affirmed to teach the pulpectomy technique, in accordance with previous Brazilian study [8] and in contrast with the North American study [7]. Conversely, there was still no consensus on the teaching of pulpectomy in primary teeth in Brazil, in agreement with previous studies in South America [3,8], in the United States [7] and in Europe [5].

The division of survey into what is taught to undergraduate students and graduate students of Pediatric Dentistry may be useful since the teaching does appear to differ [5]. In the present

study, teaching in undergraduate and graduate programs showed little disagreements. In addition, many pediatric dental educators recommended a wide variety of options in some operative steps of the pulpectomy in primary teeth, not following a guideline, making it difficult to follow-up and control the pulpectomies performed in their schools.

The iodoform-based Guedes-Pinto paste was proposed by Brazilian researchers in 1981 and has since been used in Brazilian Dental Schools [9]. This study showed that Guedes-Pinto paste was still the preferred material in undergraduate courses (30.6%), being the second most indicated by graduate teachers (20%). Although the unavailability of Rifocort® ointment (Medley S.A.), this iodoform paste was still used in many schools. Some teachers reported as substitutes the use of Omcilon-A® ointment (Bristol-Myers Squibb S.A.), or Nebacetin® ointment (Nycomed Pharma) which was a possibility already investigated in previous studies [10,11]. Likewise, zinc oxide-thickened calcium hydroxide paste was also recommended as the single option in several graduate (36%) and undergraduate (22.3%) courses. This paste presents antimicrobial activity, biocompatibility and clinical and radiographic success in primary teeth [13]. Therefore, it may be suggested that this paste was a good alternative due to the unavailability of one component of the Guedes-Pinto paste.

Calcium hydroxide and iodoform-based pastes are being increasingly used for filling primary teeth [3,6,8]. Furthermore, a combination of iodoform and calcium hydroxide paste [2] may yield better results than ZOE [4]. Since the root canal filling materials should allow correct root resorption without interfering with the integrity of the permanent tooth, the material needs to be reabsorbed at the same time as the root and easily reabsorbed if inserted beyond the apex. Therefore, the preference for ZOE has decreased due the concern with its slower resorption and possible retention in the periapical area after root resorption [2,8].

The use of rotatory instruments has increased in the last years since this approach reduces instrumentation time. However, further investigations are needed to assess the effect of the less chair time on the efficacy of the chemo-mechanical procedure and clinical outcomes [14]. In this survey, hand instruments remained the preferred method, in line with previous reports [3,6,8]. Widening the root canals was recommended by 69.4% of undergraduate and 84% of graduate courses, although current guidelines [1,2] did not recommend this procedure.

Regarding root canal irrigating solutions, many institutions have opted for more than one irrigating solution or an association of materials, stating a wide variety of the responses. Despite the importance of the disinfection of root canal system in the success rate of pulpectomies, there was no agreement about the most effective root canals irrigating solution for use in primary teeth, probably due to insufficient evidence to support this issue [15]. However, it is known that sodium hypochlorite solutions are used as the main irrigatings. Intracanal microbiota reduction is achieved either with 5% or 0.5% NaOCl [16], however 0.5% solution was not efficient in complete organic matter dissolution [17]. Therefore, due to the high performance in controlling microbiological

activity within the parameters of cytotoxicity, the use of 1-2.5% concentrations might be recommended [16].

In the present study, 1% NaOCl was more commonly taught for biopulpectomy, followed by 0.5% NaOCl and saline solution, associated or not. For necropulpectomy, 1% NaOCl was also the most used and 2.5% NaOCl, associated or not to EDTA or CA, was the option of some undergraduate and graduate institutions. Chelating solutions used as adjunct irrigating solutions shown to be effective in removing the smear layer [16]. A recent study showed that smear layer removal with CA could benefit the pulpectomy in primary teeth with clinical signs and symptoms or pulp necrosis status [18]. Furthermore, chlorhexidine solution had been the option of few courses, mainly undergraduate courses. These results are in line with the recommendations of guidelines, which stated 1% NaOCl [1], chlorhexidine solution or normal saline [2] as irrigating agents.

Endodontic hand file associated with lentulo was the filling technique more usually taught in this survey, as reported in a Colombian study [3]. Lentulo spiral was considered the best root filling technique compared to syringes, since produced optimal obturation, reaching the total root canal length [19,20], mainly in primary molars. Root canals of posterior teeth are narrow and curved and lentulo spiral has the design and flexibility to carry properly the paste into them [20]. Techniques for insertion the filling material were not reported in the pulp therapy guidelines [1,2].

Regarding the number of appointments, biopulpectomy has been taught to be performed in single-visit, while necropulpectomy has been made in two-visit. This scenario was according to a previous Brazilian study [8] and the British guideline [2] that recommends a two-stage procedure to necrotic teeth with abscesses, swellings or periapical/inter-radicular radiopacities. Nevertheless, some studies showed that professionals choose the single-visit pulpectomy [3,6], since it may result in a higher success rate, less chair time, being a suitable option for treatment of primary teeth with apical periodontitis [21].

Whereas effects of radiation exposure accumulate over time, the children's exposure must be minimized [22]. The radiographs usually taken in the pulpectomy in primary teeth are one of diagnosis, by which is determined the working length, and one immediate postoperative radiograph [23,24]. This conduct was the most commonly adopted by the schools participating in this study. In contrast, there was a similar percentage (28%) of undergraduate and graduate schools recommending a radiograph to working length. This additional radiograph increases the chair time and radiation exposure. The guidelines reported that must be performed a pre-operative radiograph showing completely all root canals [2], and there should be radiographic evidence of successful filling [1].

The materials more cited for seal the entrance of the root canals in the pulp chamber after filling were gutta-percha and glass ionomer cement. Some teachers advised both materials. Although clinical trials have reported the use of glass ionomer cement [23] or gutta-percha [24] for sealing pulp chamber, there was no clinical study assessing the influence of different sealant materials for the pulp chamber on the success of pulpectomies in primary teeth. Moreover, the guidelines did not address this operative step [1,2].



## Conclusion

Undergraduate and graduate courses demonstrated similar teaching practical. Despite that, there was still a lack of consensus on the best choice of materials and techniques to perform pulpectomy in primary teeth; but calcium hydroxide paste has been used in similar proportion to the iodoform-based Guedes-Pinto paste.

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