

Survey on Primary and Young Permanent Tooth Pulp Therapy as Practiced by Pediatric Dentists in Karnataka

Richa Lakhotia¹ Pallavi Urs¹ Anisha Jenny¹ Vatsala N. Raghunath¹ Priya Nagar¹ Nupur Ninawe²

¹Department of Pediatric and Preventive Dentistry, Krishnadevaraya College of Dental Sciences, Bengaluru, Karnataka, India

²Department of Pediatric & Preventive Dentistry, Government Dental College and Hospital, Nagpur, Maharashtra, India

Address for correspondence Richa Lakhotia, Post Graduate Student, Department of Pediatric and Preventive Dentistry, Krishnadevaraya College of Dental Sciences, Bengaluru, Karnataka, India (e-mail: richa.lakhotia94@gmail.com).

Dent J Adv Stud 2022;10:32–37.

Abstract

Introduction Maintaining the function of primary teeth until their natural exfoliation is important. Pulp therapy can save the tooth and is always a calculated risk. This study aims to enquire about the current knowledge, attitude, and practice of various pulp therapy options and awareness about it among pediatric dentists of Karnataka.

Method A questionnaire, consisting 21 questions formulated on various pulp therapy techniques, was formulated and forwarded to pediatric dentists through electronic media. Statistical analysis was performed using appropriate software.

Results The results showed 81.2% of participants preferred calcium hydroxide for an indirect pulp-capping base, while only 37.6% preferred calcium hydroxide for direct pulp capping. For pulpectomy, 70.4% preferred iodoform for obturating material. And the most preferred material for apexification and apexogenesis was Mineral Trioxide Aggregate (MTA), that is, 61.4 and 52.3%, respectively.

Conclusion The introduction of newer materials for pulp therapy has increased the quality of treatment. Many differences of opinion still exist in the areas of pulp therapy techniques and procedure selection criteria.

Keywords

- ▶ pulp therapy
- ▶ primary teeth
- ▶ apexogenesis
- ▶ pulpectomy

Introduction

Maintaining the function of primary teeth until their natural exfoliation is unquestionably important for establishing occlusion and function in the permanent dentition. Caries and trauma are considered the primary reason for premature loss of primary teeth. Lesion approaching the pulp may lead to pulpitis or pulpal necrosis.¹ Diagnosing the precise state of affected pulp with the clinical diagnostic tools and predicting

the response of pulp to the treatment is impossible. Therefore, pulp therapy is always a calculated risk. Maintaining the pulp vitality and integrity of the supporting tissues of a tooth is the primary goal.

The permanent tooth requires a favorable crown-to-root ratio, the adequate thickness of the dentinal wall and a closed apex for normal function.² Conservative treatment was considered the gold standard for teeth with pulp having the potential to recover post removal of the irritating agent.

published online
June 27, 2022

DOI <https://doi.org/10.1055/s-0042-1747977>.
ISSN 2321-1482.

© 2022. Bhojia Dental College and Hospital affiliated to Himachal Pradesh University. All rights reserved.

This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

The dental literature is very diverse and perplexing. The treatment plan has to be updated depending on the technological advancement and formulation of newer materials.¹

The purpose of this study was to survey the contemporary philosophies and pulp therapy techniques followed by pediatric dentists in Karnataka. The goal of the survey was not to draw conclusions regarding the standard recommended treatment to be followed. Instead, we hope that clinical practitioners will seek opportunities to improve curriculum and evaluate techniques to improve the quality of treatment delivered to the patients, using the collected data. This study aims to enquire about the current knowledge, attitude, and practice of pulp therapy options and awareness about it among pediatric dentists of Karnataka.

Methodology

A questionnaire regarding the pulp therapy options was formulated using Google forms. The form was specifically only forwarded to pediatric dentists all over Karnataka through electronic media.

Sample Size

Based on the previous study, 55% of the patients would perform pulp therapy, therefore the prevalence rate was 0.55. Hence, the minimum sample required was 97. The sample size for the study was 102.

Questionnaire

The survey consisted of 21 multiple-choice questions, divided into five sections, including demographic data, which would provide the designation of the participant. The other four sections were for indirect and direct pulp capping, pulpotomy, pulpectomy, apexification, and apexogenesis. The questions included various hypothetical clinical-case scenarios and the respondent was asked about the specific techniques followed, choice of preferred treatment, and material. Wherever appropriate, a response entitled "others" with fill-in-the-blank was provided to allow respondents to include selections not considered by the authors.

Once the surveys were submitted, summary tabulations were calculated to create a percent distribution of responses for each question. The questions, where the "others" option was selected, were also considered while tabulating the results. All results were analyzed using a Chi-square test for significance with a *p*-value.

Results

All the questions for the survey were marked compulsory to respond to, thereby yielding a 100% response rate. Out of 102 participants, 35% of them were staff in dental college, 31% were clinical practitioners, and 33% were postgraduate (PG) students (→ Fig. 1).

Direct and Indirect Pulp Capping

The questions were regarding the base of direct pulp capping, three options were provided, out of which, biodentine was

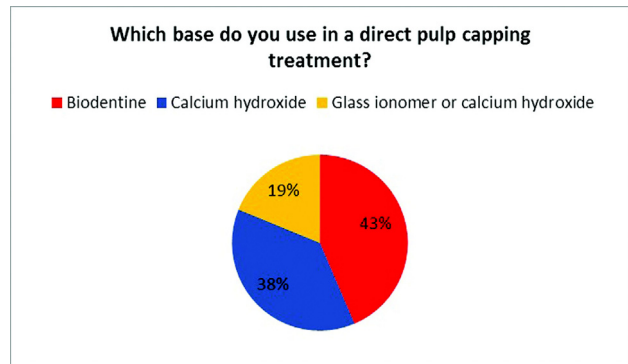


Fig. 1 Designation of the participants.

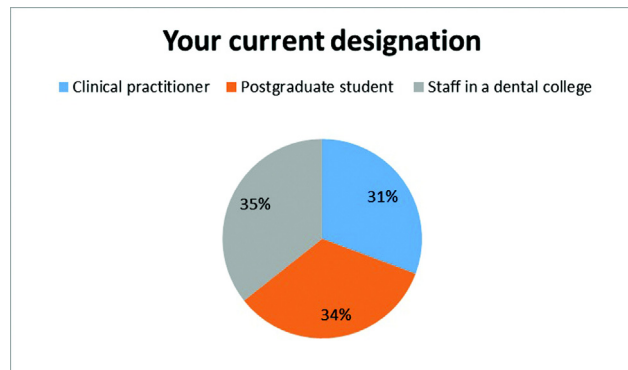


Fig. 2 Result of choice of base for direct pulp capping treatment.

selected by 45.2% of clinical practitioners, 26.5% of PG students, and 58.3% staff in dental college, an overall 43% of participants selected biodentine (→ Fig. 2).

Similarly, a question for the base of indirect pulp capping was also asked with options of calcium hydroxide, glass ionomer cement (GIC), and zinc oxide eugenol (ZOE). Calcium hydroxide was selected by 74.2% clinical practitioners, 85.3% PG students, and 83.3% staff in dental college, with an overall 81% participants choosing calcium hydroxide, 11% ZOE, and 8% GIC (→ Fig. 3).

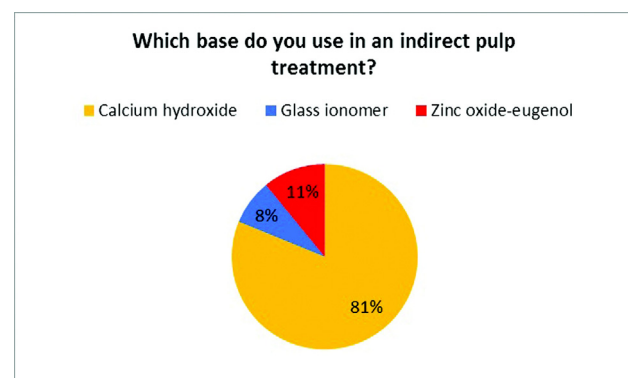


Fig. 3 Result of choice of base for indirect pulp capping treatment.

Table 1 Results obtained for the “choice of medicament for pulpotomy”

Options for the question (choice of medicament for pulpotomy)	Your current designation			p-Value
	Clinical Practitioner (%)	PG student (%)	Staff (dental college; %)	
Ferric sulfate	3.2	2.9	5.6	0.001
Formocresol (1:5 dilution)	51.6	76.5	77.8	
Formocresol (full strength)	22.6	20.6	0.0	
Glutaraldehyde	3.2	0.0	0.0	
Do not believe in pulpotomy for teeth with caries	0.0	0.0	5.6	
Laser	0.0	0.0	5.6	
MTA	19.4	0.0	5.6	
Total	100.0	100	100	

Abbreviation: PG, postgraduate.

Pulpotomy

The questionnaire included the choice of a medicament for the pulpotomy procedure which had a controversial response. Out of all the participants, 5.6% of the staff of dental college stated that they don't believe in pulpotomy and 77.8% of them used formocresol at 1:5 dilution. The results obtained were statistically significant (→Table 1). For the choice of base, 66.7% of staff, 48.4% of clinical practitioners, and 44.1% of PG students selected ZOE.

practitioners responded for 1:5 sodium hypochlorite dilution (→Table 3), then for the choice of obturating material for which 93.5% of clinical practitioner, 72.2% of staffs in dental college, and 47.1% of PG students selected iodoform + calcium hydroxide (→Table 4). The results obtained were statistically significant.

Pulpectomy

Scenario-based questions were asked, like would they recommend the root canal(s) to be enlarged in primary teeth for which 58.3% of staff in dental college, 58.8% of PG students, and 54.8% of clinical practitioners responded “yes” (→Table 2). Then was for irrigation for which 55.6% of staff in dental college, 44.1% PG students, and 51.6% clinical

Apexification and Apexogenesis

The last section was based on apexification and apexogenesis which included a choice of material for both the procedures which included three options, biodentine, calcium hydroxide, metapex, and MTA. Out of all the participants, 58.1% of clinical practitioners, 50% of PG students, and 50% of staff in dental college selected MTA as the choice of material for apexogenesis, and 58.1% of clinical practitioner, 52.9% of PG students, and 72.2% of staff in dental college selected MTA as the choice of material for apexification (→Tables 5 and 6).

Table 2 Result obtained for choice for enlargement of canals in primary teeth

Options for the question (enlargement of canals in primary teeth)	Your current designation			p-Value
	Clinical practitioner (%)	Postgraduate student (%)	Staff in a dental college (%)	
No	45.2	41.2	41.7	0.940
Yes	54.8	58.8	58.3	
Total	100.0	100.0	100.0	

Table 3 Result obtained for choice of irrigant for primary teeth

Options for the question (choice of irrigant for primary teeth)	Your current designation			p-Value (%)
	Clinical practitioner (%)	Postgraduate student (%)	Staff in a dental college (%)	
1:2 dilution sodium hypochlorite	9.7	14.7	8.3	0.863
1:5 dilution sodium hypochlorite	51.6	44.1	55.6	
Sterile water/saline or local anesthetic solution	38.7	41.2	36.1	
Total	100.0	100.0	100.0	

Table 4 Result obtained for choice of material for obturation

Options for the question (choice of material for obturation)	Your current designation			p-Value
	Clinical practitioner (%)	Post graduate student (%)	Staff in a dental college (%)	
Calcium hydroxide	3.2	14.7	0.0	< 0.001
Iodoform + calcium hydroxide	93.5	47.1	72.2	
Zinc oxide eugenol paste	3.2	38.2	27.8	
Total	100.0	100.0	100.0	

Table 5 Result obtained for choice of material for apexification

Options for the question (choice of material for apexification)	Your current designation			p-Value
	Clinical practitioner (%)	Postgraduate student (%)	Staff in a dental college (%)	
Biodentine	32.3	23.5	25.0	0.343
Calcium hydroxide	9.7	26.5	22.2	
Metapex	0.0	0.0	2.8	
MTA	58.1	50.0	50.0	
Total	100.0	100.0	100.0	

Abbreviation: MTA, Mineral Trioxide Aggregate.

Table 6 Result obtained for choice of material for apexogenesis

Options for the question (choice of material for apexogenesis)	Your current designation			p-Value
	Clinical practitioner (%)	Postgraduate student (%)	Staff in a dental college (%)	
Biodentine	25.8	20.6	13.9	0.535
Calcium hydroxide	12.9	26.5	13.9	
Metapex	3.2	0.0	0.0	
MTA	58.1	52.9	72.2	
Total	100.0	100.0	100.0	

Abbreviation: MTA, Mineral Trioxide Aggregate.

Discussion

A survey conducted by Primosch et al in 1997 highlighted the lack of uniformity in pulp treatment that was being taught and practiced by the dentists. The survey pointed out the disagreements among the dental educators concerning the best pulp therapy options for primary dentition. Newer pulp therapy techniques were practiced, and more studies were published since 1997. These newer studies have brought a change in the institutional guidelines for pulp therapy.³

According to the American Academy of Pediatric Dentistry (AAPD) guidelines in 2020, indirect pulp capping (IPC) is indicated in a tooth that has a carious lesion near the dental pulp.¹ The survey conducted in 2005 showed 71% participants opting for IPC and a deep carious lesion approaching pulp, 30% of directors and 19% of the diplomates performed IPC, indicating a conflict of interest depending on the situation for pulp approaching deep caries,⁴ despite being indi-

cated in the AAPD guidelines.¹ The other reason for IPC could be the systemic absorption of formocresol after pulpotomy was performed. In the current study, 44.6% of participants opted for IPC when asked in a scenario-based question where the options provided were indirect pulp capping, pulpotomy, and pulpectomy.⁵

The other question put forward was regarding the choice of base for direct and indirect pulp capping. For direct pulp capping (DPC), the most chosen base was biodentine, while for IPC, it was calcium hydroxide. The base for both in the 1997 survey was calcium hydroxide which clearly shows that newer material and advances are practically being used to increase the treatment quality.³

Pulpotomy is taught in all dental institutes but the medicament choices vary from dentist to dentist. According to the 2005 survey, 75% of diplomates used 1:5 or full-strength formocresol for pulpotomy which is less compared with the 1997 survey where almost 94.5% of participants

used formocresol, full strength or diluted to 1:5.^{4,6} This could be due to the increasing trend of use of ferric sulfate which was considered to yield a similar result as formocresol pulpotomy.^{7,8} Therefore, the percentage for the usage of ferric sulfate was 3.8% in 1997 and 18% in 2005, thereby highlighting the switch. The current study observed a great mixture and comprehensive selection of results for the question of choice of medicament. The answers are described in the results. There appeared to be a disagreement as to when a pulpotomy was indicated in its clinical scenario. The AAPD guidelines¹ clearly state that when homeostasis cannot be achieved, while doing a pulpotomy, the tooth is not a candidate for pulpotomy. Pulpectomy or extraction would be the alternate treatment. Therefore, the answers observed in this study highlight that slowly but surely the pediatric dental treatment is changing toward a better future.

Pulpectomy has the least amount of conflicts among educators which is practiced by almost all pediatric dentists. In the 1997 survey, only 2% of participants opted for rotary files for canal debridement, and in 2005, 11% opted the same.⁴ Comparatively, in this survey, there was an increase, as 27% of participants opted for rotary and 72% opted for hand instruments, and 1% also opted for sonic and ultrasonic methods for canal debridement. For enlargement of canals, 42.6% of participants were not in favor of enlargement, while 57.4% recommended enlargement of the canal. According to the AAPD guidelines, root enlargement is advocated for nonvital teeth.¹ And Casas et al⁹ do not recommend root enlargement for pulpectomy in vital teeth. However, the question did not signify whether the tooth was vital or nonvital. The next question was for irrigation of primary teeth for which 1:5 dilution of sodium hypochlorite was the most accepted irrigant with 50.5% and saline was advocated by 38% of participants and 10% of participants also recommended 1:2 dilution of sodium hypochlorite. NaOCl when combined with water produces sodium and hypochlorite ions, thereby establishing equilibrium with hypochlorous acid which is responsible for the antibacterial activity and it also has the ability to remove organic components by dissolving pulpal remnants and collagen. Researches are still going on to produce an irrigating solution that has all the ideal properties.¹⁰ Therefore, all the selected options are ideal for the irrigation of the primary teeth. The next question was regarding the choice of obturating material; in 1997, 92% of directors advocated ZOE which declined in 2005 due to only 66% ZOE, and it further declined in this study due only 23.8% participants. This may reflect the concern that ZOE may be retained after a pulpectomy when the tooth is exfoliated.¹¹

The next section was apexogenesis and apexification. There was a limited number of literature available regarding these pulp therapy methods. The first question was in regard to the material choice. For both the methods, MTA was the most opted material with 52.5% for apexogenesis and 61.4% for apexification. MTA appears to induce the formation of a dentine bridge at a faster rate than CaOH.¹² Biodentine is also a great material for apexification and apexogenesis but it is expensive as compared with MTA.

Therefore, the results showed that 26.7% of participants selected biodentine for apexogenesis and 19.8% for apexification. Also, 19.8% chose calcium hydroxide for apexogenesis and 17.8% for apexification. Only 1% of the participants selected metapex for apexification and apexogenesis. In a case report,¹³ there was the resolution of periapical radiolucency and root-end closure after 6 months. Metapex had shown good clinical and radiographic success in promoting continued root growth and inducing root end closure even in immature necrotic young permanent teeth. Therefore, metapex could be used but might take a longer duration. However, for the patients who might not be able to afford the treatment cost, metapex could be an ideal material.¹³

More number of participants would add to the benefit of the study, therefore more studies should be conducted.

Conclusion

The survey results can be summarized as follows:

- The newer materials like MTA and biodentine are being applied in the regular dental practice in respect to pulpotomy, apexification, and apexogenesis.
- A dilution of formocresol at 1:5 for 2 to 4 minutes is still the most preferred technique in a pulpotomy procedure.
- Iodoform + calcium hydroxide is the most frequently selected obturating material for pulpectomy procedures.
- Many differences of opinion still exist in the areas of pulp therapy techniques and procedure-selection criteria.

Conflict of Interest

None declared.

References

- 1 American Academy of Pediatric Dentistry. Pulp therapy for primary and immature permanent teeth. Accessed March 2, 2022 at: https://www.aapd.org/media/Policies_Guidelines/BP_PulpTherapy.pdf
- 2 Fuks AB. Current concepts in vital primary pulp therapy. *Eur J Paediatr Dent* 2002;3(03):115–120
- 3 Primosch RE, Glomb TA, Jerrell RG. Primary tooth pulp therapy as taught in predoctoral pediatric dental programs in the United States. *Pediatr Dent* 1997;19(02):118–122
- 4 Dunston B, Coll JA. A survey of primary tooth pulp therapy as taught in US dental schools and practiced by diplomates of the American Board Of Pediatric Dentistry. *Pediatr Dent* 2008;30(01):42–48
- 5 American Academy of Pediatric Dentistry. Guideline on pulp therapy for primary and young permanent teeth. *Pediatr Dent* 2006;28:144–148
- 6 Myers DR, Shoaf HK, Dirksen TR, Pashley DH, Whitford GM, Reynolds KE. Distribution of 14C-formaldehyde after pulpotomy with formocresol. *J Am Dent Assoc* 1978;96(05):805–813
- 7 Huth KC, Paschos E, Hajek-Al-Khatat N, et al. Effectiveness of 4 pulpotomy techniques—randomized controlled trial. *J Dent Res* 2005;84(12):1144–1148
- 8 Nadin G, Goel BR, Yeung CA, Glenny AM. Pulp treatment for extensive decay in primary teeth. *Cochrane Database Syst Rev* 2003;1(01):CD003220
- 9 Casas MJ, Kenny DJ, Johnston DH, Judd PL. Long-term outcomes of primary molar ferric sulfate pulpotomy and root canal therapy. *Pediatr Dent* 2004;26(01):44–48

- 10 Kashyap N, Upadhyay M, Sharma J, Das SJ, Katlam T. Irrigating solutions in pediatric dentistry: a big deal in little teeth. *EC Dent Sci* 2019;18:1620–1626
- 11 Sadrian R, Coll JA. A long-term followup on the retention rate of zinc oxide eugenol filler after primary tooth pulpectomy. *Pediatr Dent* 1993;15(04):249–253
- 12 Shabahang S. Treatment options: apexogenesis and apexification. *Pediatr Dent* 2013;35(02):125–128
- 13 Sridhar N, Tandon S. Continued root-end growth and apexification using a calcium hydroxide and iodoform paste (Metapex): three case reports. *J Contemp Dent Pract* 2010;11(05):063–070