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The Use Of Devitalizing Agents In Primary Teeth By Pediatric Dentists – A Questionnaire Based Study

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Abstract

Control of excessive bleeding in teeth with irreversible pulpitis and pulpal hyperaemia can be challenging while performing endodontic treatment in primary teeth. In case of severe pain or bleeding where complete pulp extirpation has not been achieved, pulp devitalization is suggested. Devitalising agents (DA) fix and necrotize hyperaemic pulp which eliminates the pain. This questionnaire-based study aims to assess the knowledge of paediatric dentists regarding use of devitalising agents during endodontic treatment of primary teeth.

Research hypothesis- Pediatric dentists are in favour of using devitalising agents.

Aim: To assess the knowledge, awareness and practices of pediatric dentist regarding the use of devitalising agents in primary teeth**.**

Methodology: This observational, questionnaire-based study was conducted among pediatric dentists. The questionnaire was validated by 10 senior pediatric dentists and distributed among pediatric dentists in Maharashtra. The knowledge, awareness and practice section of questionnaire included 12 questions on devitalising agents used in primary teeth, mechanism of action (MOA), method of application, duration of application, awareness of recommendations, awareness of complications, any complications encountered, alternatives to devitalizing agents.

Results: 57.8% of pediatric dentists were using devitalizing agents.19.8% of participants used polyoxymethylene, followed by Formocresol, and formaldehyde. 12.3% had encountered complications after its use.

Conclusion: Thus, it can be concluded that there is considerable variation in the knowledge, awareness, and practices of pediatric dentists regarding the use of DA. Hence, there is a need to find safer alternatives.

Keywords: Dental pulp devitalisation, Pediatric Dentists, Primary teeth

Introduction

Dental caries is a chronic disease affecting adults and children worldwide, overall prevalence of dental caries was 54.16%, and age-specific prevalence was 62% in people above 18 years and 52% among 3-18 years of age [1]. According to the survey conducted by National Oral Health Survey in 2014 among children aged between 3-5 years, the incidence rate of early childhood caries was 48% [2]. Untreated dental caries eventually progresses into a pulpal infection. Pulpal pain is a part and parcel of dental pathosis. The degree of dental pathology determines the intensity, nature, duration and progress of pulpal pain [3]. It is essential to manage it effectively to ensure the child's overall oral health. The goal of endodontic therapy is

to alleviate dental pain and treat pulpal, periradicular pathologies. Teeth with symptomatic irreversible pulpitis and pulpal hyperaemia are challenging to anesthetize and control of excessive bleeding can also be difficult. Increased tetradoxin-resistant sodium channel results in failure to anaesthetise in such conditions [4]. To overcome such challenges, DA are used by the dentist in routine practice [3]. DA fix and necrotize hyperaemic pulp which eliminates the pain and makes the treat pain-free [5].

Various DA have been used over the years are Formalin, Arsenic compounds, Paraformaldehyde, Cresol, Formaldehyde, Glutaraldehyde and Polyoxymethylene compounds. In 1898, Gysi introduced paraformaldehyde as a pulpotomy medicament [6]. Formocresol was introduced to treat nonvital permanent teeth in the United States by Buckley in 1904. Formocresol has subsequently become a popular pulpotomy medicament for primary teeth [7]. In 1920, Polyoxymethylene was discovered by Hermann Staudinger a German chemist having physical properties like chemical resistance, abrasion-resistant, impact-resistant, low tendency to creep, thermally stable [8].

In 1975, S Graven made used glutaraldehyde and stated that it is the potential to replace Formocresol. In recent years, glutaraldehyde has been proposed as an alternative to Formocresol based on its superior fixative properties, self-limiting penetration, low antigenicity, low toxicity and elimination of cresol [7]. Pediatric dentists use DA regularly in dental practice for uncontrolled bleeding, pain during pulp extirpation [9,10]. Few studies have been carried out to access the knowledge, awareness and practice of dental practitioners about the use of DA but such a study has not been conducted on pediatric dentists. Hence, this study was carried out to assess the knowledge, awareness and practice of pediatric dentists regarding the use of DA in primary teeth.

Research hypothesis- Pediatric dentists are in favour of using devitalising agents.

Materials And Methods

This is an observational, questionnaire-based survey having a sample size of 365 pediatric dentists practicing in Maharashtra conducted over a period of one month. Ethical clearance was obtained from the institutional ethical committee (IREB/2023/05). The study design of this questionnaire-based study is summarised in Figure 1. The sample size was calculated by using the following formula:

n = [DEFF*Np (1-p)/ [(d 2 /Z 2 1-□/2* (N-1) + (1-p)]

Validation of the questionnaire was done by 7 senior pediatric dentists, changes suggested by them were incorporated into the final questionnaire. The final questionnaire consisted of 12 questions that were circulated via emails, combination of both printed forms and Google forms which were distributed manually and online to pediatric dentists practicing in private clinics/ academics/hospitals in Maharashtra. General dentists, dentists with other specializations, and postgraduate students pursuing MDS in Pediatric and Preventive Dentistry were excluded from the study.

The questionnaire consisted of 3 questions related to the demographics of respondents such as age, years of experience after masters in pediatric and preventive dentistry and type of practice. Questions regarding various aspects of DA were included on the knowledge about the mechanism of action (MOA), alternatives to DA, awareness about the recommendation for the use of DA were asked. Questions regarding the DA they used, duration of use in primary teeth, cases in which they used DA were asked along with the complications if any, faced in pediatric patients after the use of DA. The above-mentioned questions were open-ended and few were multiple-choice questions Figure 2.

Statistical analysis was done with Statistical Package for Social Sciences (IBM SPSS Statistic for window, version 21.0. Armonk, NY: IBM Corp.). Descriptive statistics was drawn with respective percentages to have comparisons. p-value of 0.05 or less was considered for statistical significance.

Results

Total 365 responses were received in our study. The demographic data revealed that 52.3% of practitioners had 5-10 years of experience, whereas 25.5% of them had 1-5 years of experience, followed by 21.4% of practitioners who had 10 -15 years of experience.61.4 % of practitioners had private practice, 42.2 % were academicians and 22.7% of pediatric dentists had hospital-based practice.

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In the present study, 57.8% of pediatric dentists were using DA whereas 42.2% were not using it. It was observed that 19.8% of participants used polyoxymethylene, 12.9% of participants used formocresol, 9.6% of participants used formaldehyde and 5.2% of participants used Glutaraldehyde and 5.2% of participants used paraformaldehyde as shown in Table 1.

When enquired about the mechanism of action of the devitalising paste, 48.5% of pediatric dentists responded positively to coagulation necrosis as the mechanism of action. 59.5% of pediatric dentists responded as mummification, 31.8 % of pediatric dentists responded as protein denaturation.

Based on case selection, 52.3% of pediatric dentists used them in bleeding canals, 37.5% of pediatric dentists used them for pain during pulp extirpation and 36.7% of respondents used it in all cases with vital pulp. 35.1% of pediatric dentists used the paste when the patient presented with pain, while 21.9% of the study population used it even in nonvital pulp cases.

Very few respondents (32.9%) had knowledge about the recommendation regarding the use of DA and 67.1% of pediatric dentists were not aware of the use of DA.

Regarding the duration of use of DA, 54.5% of respondents kept the damp cotton pellet of DA inside the pulp chamber for 3-4 days, 25.2% of them kept it for < 1 day, 14.5% of pediatric dentists kept it for more than 10 days and 5.8% of them kept it for 8-10 days as shown in Table 2.

On asking whether the use of DA in primary teeth leads to complications, 65.7 % of the practitioners agreed to this, 29% of the practitioners disagreed and 25.8 % of the practitioners gave a neutral response.

12.3% had encountered complications after its use whereas 87.7% of the respondents did not encounter any complications.

In our study, we also asked about the knowledge of any alternatives to DA. 72.1% of pediatric dentists suggested the use of copious sodium hypochlorite irrigation paste as the alternative to DA, 69.6% of pediatric dentists suggested the use of proper & effective local anaesthesia, 60% of participants suggested the use of polyantibiotic paste, 40.3% of pediatric dentists suggested the use of paraformaldehyde free agents.19.7% of them suggested all of the following alternatives to DA as seen in Table 3.

Discussion

Based on the clinical presentation and duration of infection, infectious diseases can be broadly classified into acute and chronic. An acute infection develops rapidly and lasts for a relatively brief period whereas chronic infection persists over an extended period of time. The 5 signs of inflammation are rubor, calor, dollar, tumor and loss of function [11]. When the progress of acute infection in the form of dental caries affects the pulp, increased inflammatory activity may lead to pulpal hyperaemia, pain and excessive bleeding from root canals. The effect of local anaesthetic agents is affected by the acidic tissue pH in patients with infections [12]. In such cases, routine use of DA by dental practitioners is fairly common.

The commonly used DA by pediatric dentist in our study were similar to the study conducted by Kaushik et al in 2021 in which the most widely used DA were Devitec (polyoxymethylene based)36.3%, followed by Caustinerf forte (paraformaldehyde based).

Most of the pediatric dentists in our study used DA for 3-4 days which is in accordance with the study conducted by Walimbe et al. in 2015 in which 47% of the general dentists uses DA for a duration of 3-5 days. In a study conducted by Kaushik et al. in 2021, 75% of the general dentists keeps DA for a duration between 1-7 days.

DA have varied M.O.A depending on the composition.Formocresol acts by preventing tissue autolysis by binding the peptide group of the side chain of amino acid. Gluteraldehyde has a cross-linking property superior to that of formocresol. Polyoxymethylene is a coagulant that acts on albumin and confers the required fibrous consistency to the pulp to facilitate its subsequent extirpation. Formaldehyde use results in Cross-linking reaction with cell proteins and DNA, and this can result in degeneration and necrosis. [13]

In this study, very few (32.9%) respondents were aware of the recommendations regarding the use of DA. Most of the pediatric dentists followed the manufacturer's instructions for use of DA.

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To our knowledge there are no specific guidelines regarding the recommendation for the use of DA hence the manufacturer's recommendations should be followed.

This study showed that 65.7 % of the practitioners had knowledge about the complications that can be encountered after its use in primary teeth. Kaushik et al. in 2021 stated that 60.02% of dentists are aware of the complications caused by these agents. In a case report by M S, Girish et al in 2015, non-squeezed cotton pellet soaked in Formocresol led to the accidental soaking of operator's gloves in DA, and contact with the labial mucosa of a 9-year-old male child results in ulceration of oral mucosa and skin [14]. There might be accidental ingestion of DA in a highly uncooperative child, resulting in irritation of the oral mucosal linings, oesophagus and causing gastric erosions, and ulcerations [15]. Hence, we introduced a question about alternatives to the use of DA.

We have got varied responses from the use of copious sodium hypochlorite irrigation, proper & effective local anaesthesia, complete cleaning & shaping in 1st appointment to Poly-antibiotic paste and paraformaldehyde free agents. These options given were similar to those in the study conducted by Kaushik et al. in 2021 where proper and effective local anaesthesia 27.17%, intra-pulp-anaesthesia 18.47%, complete extirpation of pulp in 1st appointment 13.04%, Copious Sodium Hypochlorite irrigation 13.04%, Formocresol 5.43% and anticoagulants 5.43% are suggested.

Conclusion

Pediatric dentists use DA in routine dental practice but 67.1% of the study population were not aware of the recommendations. There is no standardisation on indication and duration of use. Hence, instructions given on the material container by the manufacturer are generally followed. There is considerable variation in the knowledge, Awareness, and Practice of pediatric dentists regarding the use of DA. Hence, there is a need to standardize the use, make pediatric dentists aware of the side effects/complications and find safer alternatives. This leads us to the mind-boggling question – which scenarios would warrant the use of DA in children and for what duration ?. The search for an ideal devitalising agent is far from over.

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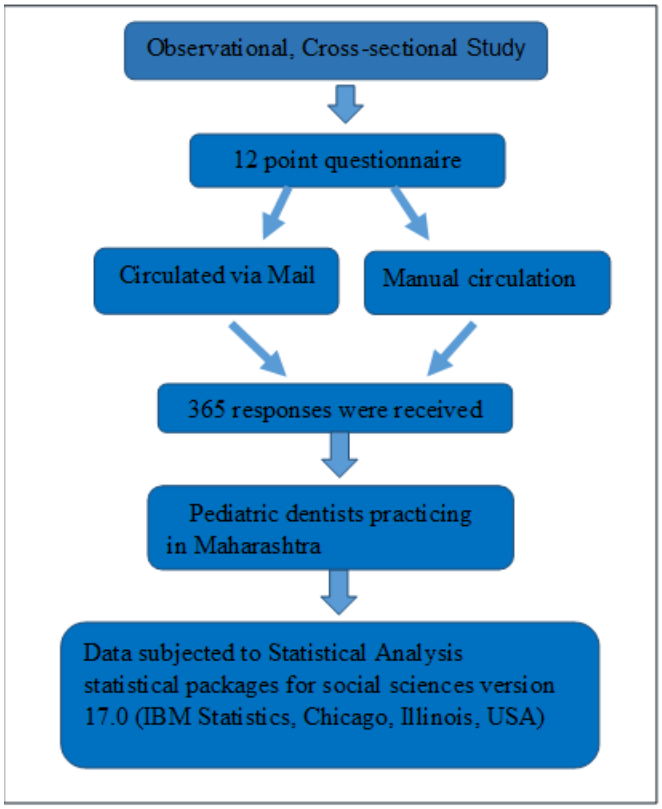
Figure 1: Study design flow chart"



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"Figure 2: Questionnaire used in this study"

"Table 1: Distribution of study participants according to devitalizing agents used"

Composition	Frequency	Percentage
Polyoxymethylene 56%	72	19.8
Formaldehyde and cresol	35	9.6
Formocresol	47	12.9
Glutaraldehyde	19	5.2
Paraformaldehyde	19	5.2
Others	1	0.3

"Table 2: Distribution of study participants according to the duration of use devitalizing agent"

No. of days	Frequency	Percent
< 1day	92	25.2
3-4 days	199	54.5
8-10days	21	5.8
>10days	53	14.5
Not applicable	92	25.2

"Table 3: Distribution of study participants according to the alternative to a devitalizer

Alternatives	Frequency	Percentage
Poly-antibiotic paste	219	60.0
Proper & effective local anaesthesia	254	69.6
Copious sodium hypochlorite irrigation	263	72.1

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Complete cleaning & shaping in 1st appointment	250	68.5
Paraformaldehyde free agents	147	40.3
All of the above	72	19.7
None of the above\ Not aware	21	5.8
Others	12	3.3

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