

## USE OF FORMOCRESOL BY THE PEDIATRIC DENTISTS ACROSS INDIA - A QUESTIONNAIRE SURVEY

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### HOW TO CITE THIS ARTICLE:

Swati Goyal, Indushekar KR. "Use of formocresol by the pediatric dentists across India - A questionnaire survey". Journal of Evolution of Medical and Dental Sciences 2013; Vol2, Issue 32, August 12; Page: 5943-5951.

**ABSTRACT: BACKGROUND:** Various Pulpotomy medicaments like Formocresol, Glutaraldehyde, Ferric sulfate, Calcium-hydroxide, MTA, Bone Morphogenic proteins, Collagen, Bioactive glass and Laser have been advocated for use in treatment of pulpally involved primary teeth but the Formocresol pulpotomy technique is the universally taught & preferred pulp therapy for primary teeth. Despite years of apparent successful use as a pulpotomy agent, Formocresol has come under the attack for research & documentation in the literature which have shown it to be toxic, mutagenic & carcinogenic. This debate over the use of Formocresol solution & other formaldehyde containing preparations in children's dentistry continues. The determination of the actual effective dose and concentration for clinical application for pulpotomy in primary teeth is an important area of further research & a thorough clinical, radiographic & histologic investigation in human subjects is very much needed with various dilutions of Formocresol. **AIM:** To inquire about the use of Formocresol for primary as well as permanent tooth pulpotomy and to know the awareness about the diluted formulations of Formocresol among Indian Pediatric dentists. **MATERIALS & METHODS:** The questionnaire to know the use of Formocresol by the Pedodontists across India was e-mailed to 165 pediatric dentists out of whom only 120 replied/responded. Thirty eight respondents were academicians and faculty in the field of pediatric dentistry and the remaining 82 were the post graduates students. **RESULTS:** The results showed that 95% of the respondents use Formocresol for routine pulpotomy procedure in primary teeth. Of those, 42% use full strength Formocresol, 40% use dilute Formocresol & 18% do not know what concentration they are using. **CONCLUSION:** The study concludes that Formocresol remains the most popular medicament in use for primary tooth pulpotomy followed by calcium hydroxide and MTA, glutaraldehyde and ferric sulphate in the field of Pediatric Dentistry across the country. There is a need for the diluted Formocresol to be made commercially available.

**KEYWORDS:** Formocresol, dilute Formocresol, survey

**INTRODUCTION:** No area of treatment in pediatric dentistry has been more controversial than pulp therapy. In particular the vital pulpotomy procedure and the medicaments have been the topic of debate for decades<sup>1</sup>. Various Pulpotomy medicaments like Formocresol, Glutaraldehyde, ferric sulfate, calcium-hydroxide, MTA, Bone Morphogenic proteins, collagen, bioactive glass and laser have been advocated for use in treatment of pulpally involved primary teeth. Buckley in 1904 first introduced the Formocresol as a medicament since then the Formocresol pulpotomy technique is considered the most universally taught & preferred pulp therapy for primary teeth<sup>2</sup>. Formocresol, though the center of much controversy, is still the most widely used medicament for primary teeth pulpotomy & an intracanal medicament which has undergone a lengthy evolution to shorten the Formocresol application time & reduce the concentration of Formocresol exposure to the pulp

tissue<sup>3,4</sup>. The fact that only micrograms of formaldehyde is applied to pulp tissues during pulpotomy for mere minutes means pediatric pulp therapy should be considered as a “low exposure condition”<sup>5</sup>. The first reports recommending the dilution of Formocresol for use in pulpotomies came more than 42 years ago. Loos & Han in 1971 reported comparable tissue fixations with 1:5 dilutions as well with full strength in rats<sup>6</sup>. This study was followed by Morawa & others in 1975, who reported an effective result with 1:5 dilutions in a clinical study in children. Despite this long history & recommendations for the use of a diluted formula of Formocresol, it does not appear to be available commercially. Hence this study was surveyed among the practicing & aspiring Pedodontists all over India about the concentration of Formocresol that they use to perform pulpotomies in primary as well as in permanent teeth and, if they use dilute Formocresol, where & how they obtain it.

**MATERIALS & METHODS:** A questionnaire survey (appendix 1) containing 10 questions inquiring the use of Formocresol for routine pulpotomy procedure was mailed to 165 Pediatric Dentists all over India. Survey questions requested information about whether the practitioners used full-strength or diluted Formocresol, the brand/formulation they use & if they use diluted Formocresol, how the diluted form was obtained. Responses were tabulated as frequencies & analyzed.

**RESULTS:** One- hundred & twenty questionnaires were returned. “Do you use Formocresol for primary tooth pulpotomy?” indicated that 95% do so. Of those who use Formocresol for primary tooth pulpotomies 42.5% use full-strength, 40% diluted & 17.5% did not know the concentration that they are using (Fig. I, II).

Responses to the question “If you are using the diluted form, how do you obtain it?” indicated 47.5% prepare it themselves (Chair-side), 37.5% buy it & 15% of them responded it to be not available (Fig III). Responses to the question “what is the formulation of the diluted Formocresol?” indicated 47.8% use 1:5 concentration while 42% did not know what concentration they are using!, only 7.2% & 2.9% were using 1:25 & 1:125 concentration respectively (Fig IV). It is also commonly used intracanal medicament as 59.2% of the respondents use it routinely but use of Formocresol for pulpotomy in permanent teeth is by only 32.5% of the pedodontists (Fig V, VI). Formocresol was also the most preferred medicament for primary tooth pulpotomy procedures by 60.8% of the respondents; both MTA & calcium hydroxide had 12.5% preference, 7.5% glutaraldehyde & 6.7 % for ferric sulfate (Fig VII). Those who did not use Formocresol commented the reason to be its hazardous effects. When questioned about any research/ clinical trials done on the use and effect of diluted Formocresol, it was surprising that only 3.3% of respondents had conducted such clinical trials (Fig VIII).

**DISCUSSION:** King et al<sup>7</sup> conducted a survey on the concentration of Formocresol used by pediatric dentists in Texas for primary tooth pulpotomy, according to which majority of pediatric dentists are not only still using Formocresol for primary tooth pulpotomy, but they are also using full strength Formocresol, either knowingly or unknowingly which indicates that there is as much confusion among practitioners about Formocresol as there is variation in their technique. Similarly another survey study showed 61% of respondents used Formocresol for primary tooth vital pulpotomies. 28% used undiluted and 33% used diluted. The results of this survey suggest that the majority of dentists who used Formocresol were not concerned with any adverse effects<sup>8</sup>.

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The responses to this survey indicate that there is much confusion among practitioners about the concentration of Formocresol as there is variation in their technique. It is interesting that more than half of the respondents know & reported that they are using full strength Formocresol in spite of the fact that the standard technique accepted today recommends the diluted form.

What is unknown is whether they are using full strength because they don't know of the dilution recommendation, they know, but they are reluctant to change, or they know a diluted product is not commercially available. Also there is no standardization in the concentration of Formocresol available commercially as some of the respondents who buy the diluted form of the medicament commercially but do not know what is its concentration supplied by the manufacturer. Pediatric Dentists who wish to continue to use Formocresol should apply the lowest dose possible using a standardized size cotton or foam pellet for the least possible time to obtain the desired effect. When used judiciously, Formocresol is a safe medicament<sup>5</sup>. Hence, it would be wise to use diluted Formocresol to lower the formaldehyde exposure to the children.

## CONCLUSION:

1. Formocresol remains the most popular medicament of choice in the field of Pediatric Dentistry across the country. This is widely used & preferred in Primary teeth.
2. Though aware of the diluted formulation, it is less commonly used as compared to full strength Formocresol. It may be because it's appropriate procedure of preparation is not known to all.
3. It is time for the manufacturers of Formocresol products to develop and market a dilution of this medicament to replace the "full-strength" formulation available.

## CLINICAL SIGNIFICANCE:

1. Pediatric Dentists who wish to continue to use Formocresol should apply the lowest dose possible for the least possible time to obtain the desired effect.
2. The determination of the actual effective dose and concentration for clinical application for pulpotomy in primary teeth is an important area of further research.
3. There is limited research with Diluted Formocresol; hence clinical human trials with least possible dilution of Buckley's Formocresol should be directed.

**ACKNOWLEDGEMENT:** All the respondents who participated in this survey are acknowledged for their co-operation.

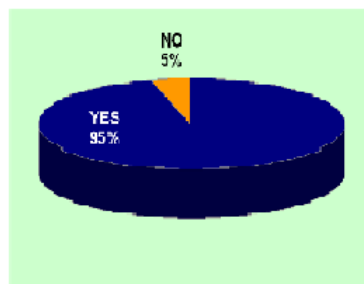
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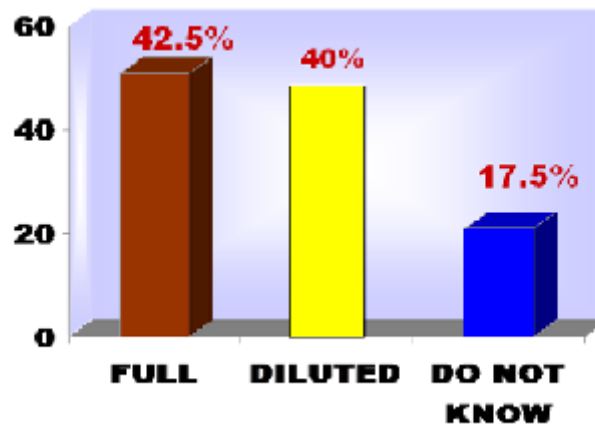
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### FIGURES:



**Fig 1: Use of Formocresol for routine pulp therapy procedures in primary teeth**



**Fig 2: Concentration of Formocresol used?**

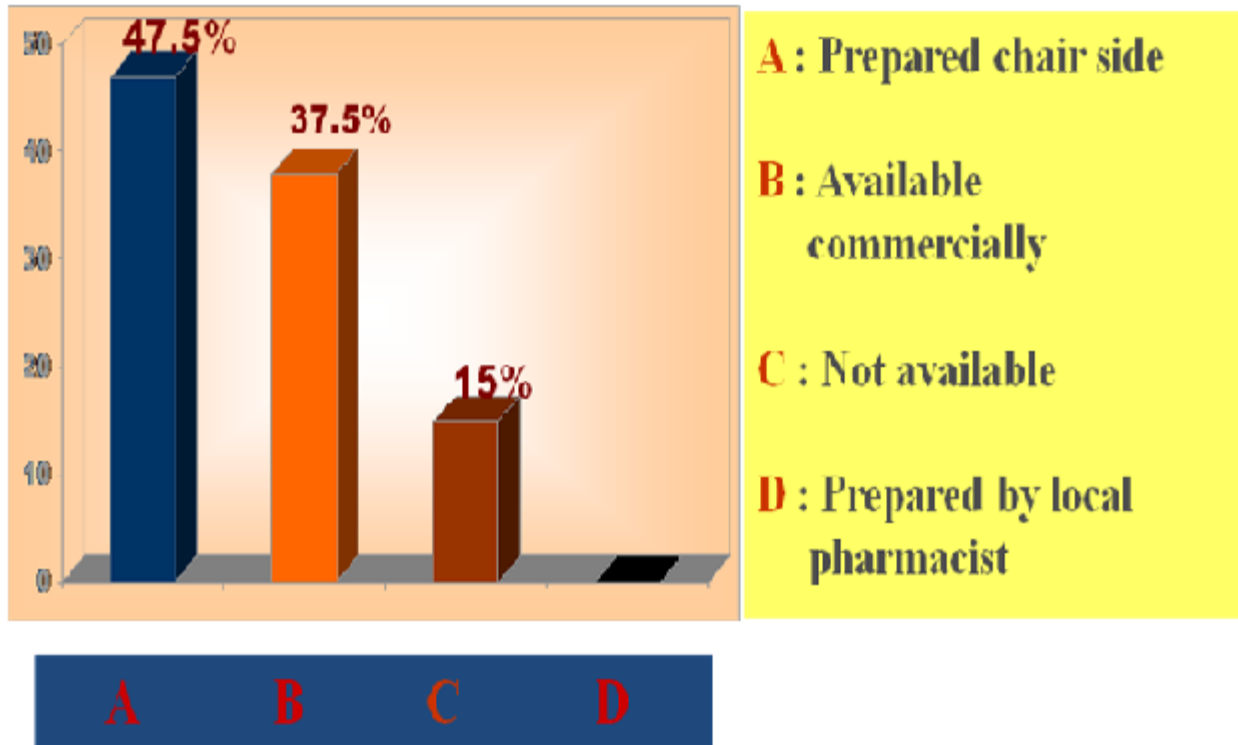


Fig 3: How is the Diluted formulation made available?

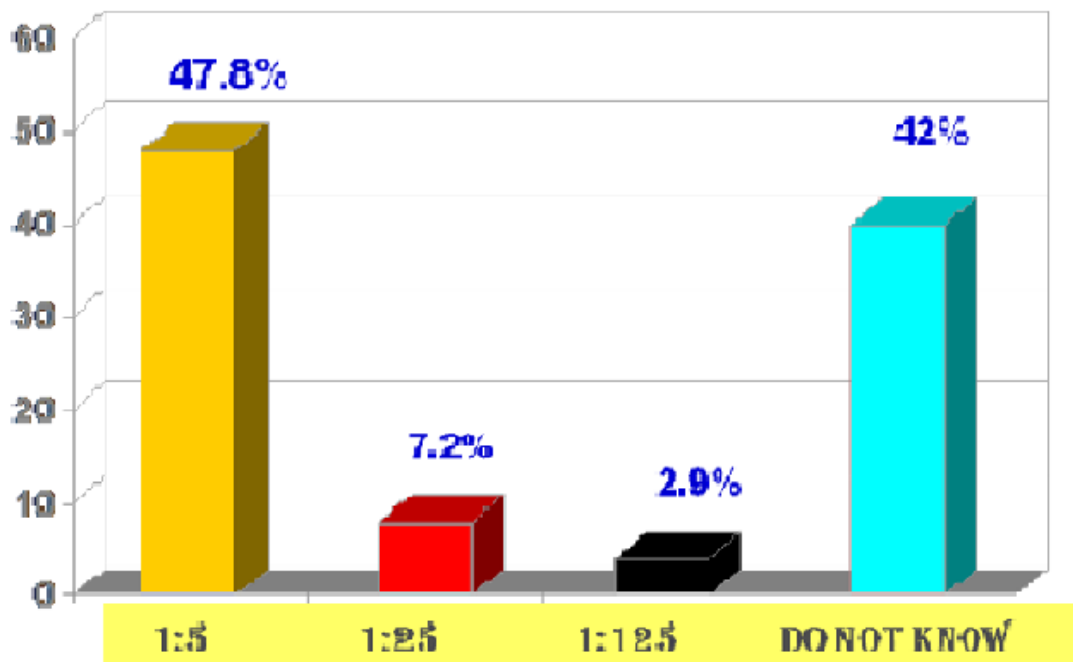


Fig 4: What is the formulation of Diluted Formocresol Used?

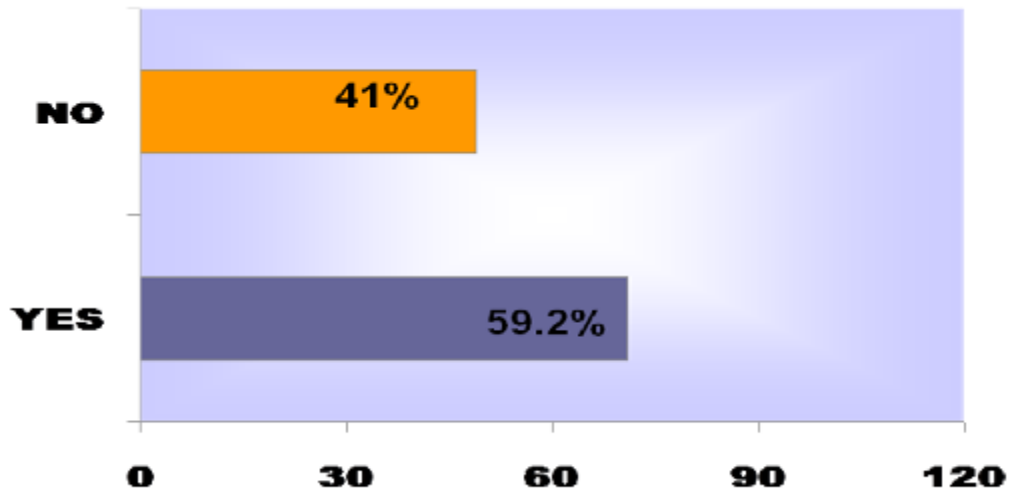


Fig 5: Formocresol as an intracanal medicament

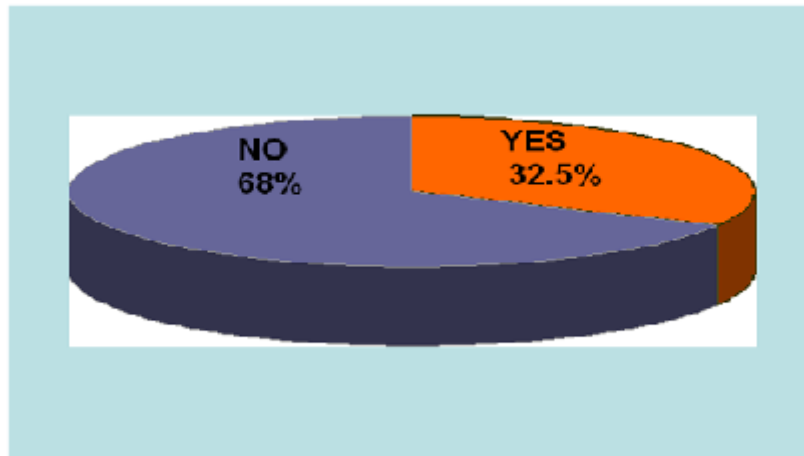


Fig 6: Formocresol for pulpotomy in Permanent teeth

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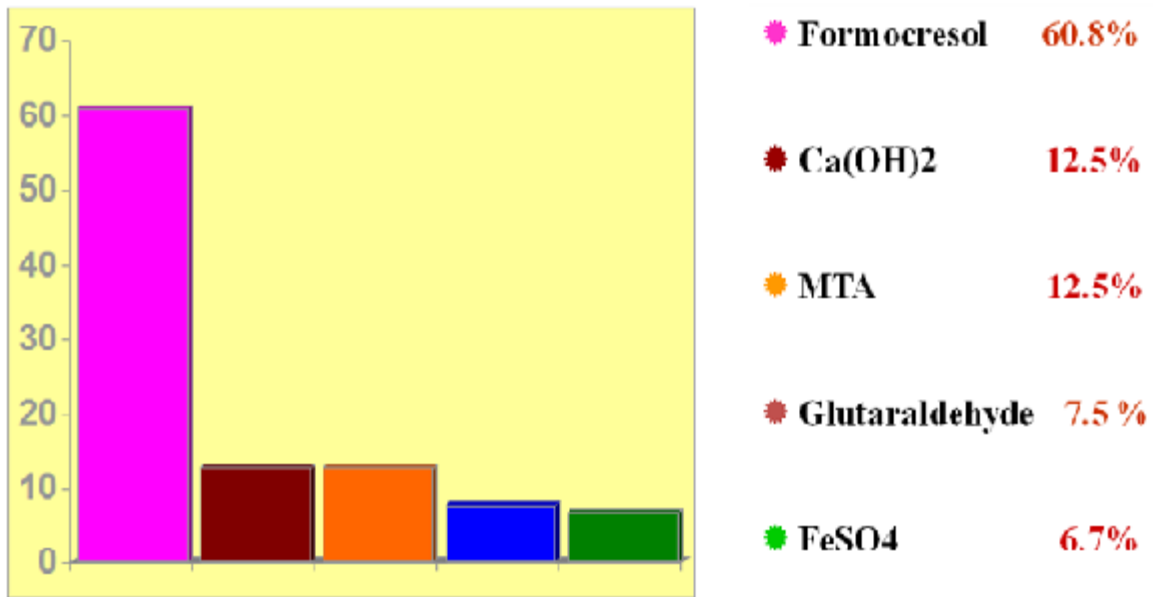


Fig 7: Order of preference of various medicaments

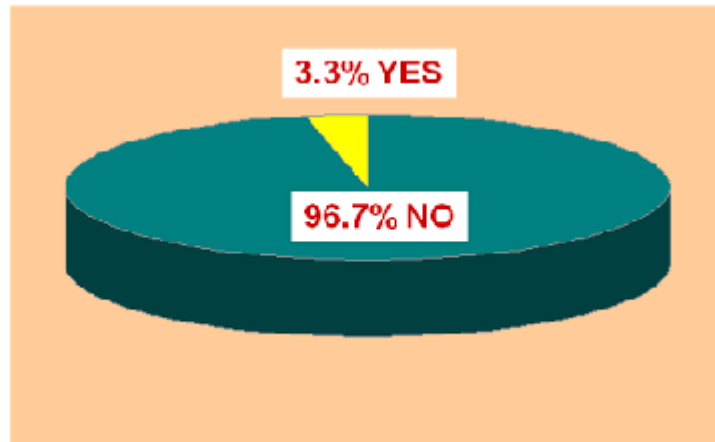


Fig 8: Research on Formocresol & its Dilution

## Appendix 1

### “Use of Formocresol by the Pediatric dentists across India-A questionnaire Survey”

1. Are you using Formocresol for routine pulp therapy procedure in primary teeth?
  - a) Yes
  - b) No
2. If No, mention the medicament used and why?  
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3. Do you use Formocresol as an Intracanal medicament?
  - a) Yes
  - b) No
4. Do you use Formocresol for pulpotomy in permanent teeth?
  - a) Yes
  - b) No
5. Do you know about the diluted formulations of Formocresol?
  - a) Yes
  - b) No
6. What concentration of formocresol do you use and why?
  - a) Full concentration
  - b) Diluted concentration
  - c) Do not know
7. If you are using the diluted concentration of Formocresol, what is its formulation?
  - a) 1:5
  - b) 1:25
  - c) 1:125
  - d) Do not know
8. If you are using the diluted formulation of Formocresol, how it is made available to you?
  - a) Available commercially
  - b) Prepared chair side
  - c) Prepared by local pharmacist
  - d) Not available
9. Which medicament will you prefer for routine pulpotomy procedure? (Mention your preference in order)
  - a) Formocresol
  - b) Glutaraldehyde
  - c) Ferric sulfate
  - d) Calcium Hydroxide
  - e) MTA
  - f) Others
10. Have you done any clinical trials on the use and effect of diluted formocresol?
  - a) Yes
  - b) No



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Date of Submission: 16/07/2013.  
Date of Peer Review: 18/07/2013.  
Date of Acceptance: 02/08/2013.  
Date of Publishing: 07/08/2013