Comparing povidone-iodine and chlorhexidine varnish in preventing ECC …
Narayan A et al
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A Comparative Study to Test the Efficacy of Two Antimicrobial Agents (10% Povidone-Iodine and Chlorhexidine Varnish) in the Prevention of Early Childhood Caries
Ajay Narayan¹, S Anandraj²

Contributors:
¹Reader, Department of Pediatric and Preventive Dentistry, Al Azhar Dental College, Thodupuzha, Kerala, India; ²Professor, Department of Pediatric and Preventive Dentistry, PMS College of Dental Sciences and Research, Thiruvananthapuram, Kerala, India.

Correspondence:
Dr. Narayan A. Department of Pediatric and Preventive Dentistry, Al Azhar Dental College, Thodupuzha - 685 605, Kerala, India.
Phone: +919562299798. Email: ajaynarayan2001@gmail.com

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Abstract:
Background: To determine the antimicrobial efficacy of 10% Povidone-iodine (PI) and Chlorhexidine (CHX) varnish against Streptococcus mutans and the role of antimicrobial therapy in the prevention of early childhood caries (ECC).

Materials and Methods: A total of 30 children (3-6 years) with ECC reporting to the Department of Pedodontics, KVG Dental College and Hospital, Sullia for treatment were selected as a part of this study. The children were divided into two groups by block randomization. Following full mouth rehabilitation, one group had CHX varnish, Cervitec plus applied to their dentition and to the other group 0.2 ml of 10% PI was applied. Plaque and saliva samples were taken at baseline and at 30, 60, and 90 days following application of 10% PI and CHX varnish, and the presence of S. mutans was evaluated using Dentocult SM strip mutans. The results were evaluated using the manufacturer’s chart.

Results: There was a statistically significant reduction in the S. mutans count in plaque and saliva following application of 10% PI and CHX varnish for a period of 30, 60 and 90 days. The S. mutans count was <10⁸ CFU/ml in both the groups at 30, 60 and 90 days. However, no significant difference in the efficacy of 10% PI and CHX varnish was observed.

Conclusion: The results showed that there was a statistically significant reduction in the S. mutans count following application of 10% PI and CHX varnish for a period of 30, 60 and 90 days. No significant difference between the efficacy of 10% PI and CHX varnish was observed.

Key Words: Cervitec, Dentocult SM strips, plaque, povidone iodine Streptococcus mutans, saliva

Introduction
Dental caries is a major dental disease affecting a large proportion of the inhabitants of the world. It impairs the quality of life for many people, causing pain and discomfort. Early childhood caries (ECC) is a virulent form of dental caries beginning soon after dental eruption, developing on smooth surfaces, progressing rapidly and having a lasting detrimental impact on the dentition.¹ It is characterized by an overwhelming infectious challenge and is associated with unusual dietary practices. It is a public health problem that affects babies and preschool children worldwide, and this type of dental caries can destroy the primary dentition of infants and preschool children.²

ECC is also a contributing factor to other health problems. Infants with ECC grow at a slower pace than caries-free infants. Some young children with ECC may be severely underweight because of associated pain and the disinclination to eat.³

Maintenance of the primary dentition in a healthy condition is important for the well-being of the child as far as a proper masticatory, esthetics, phonetics, space maintenance, and prevention of aberrant habits are concerned.⁴ Treatment of ECC is expensive, often requiring extensive restorative treatment and extraction of teeth at an early age. In addition to these expenses, general anesthesia or deep sedation may be required because such young children lack the ability to cope with the procedures.⁵

Primary oral colonization by Streptococcus mutans coupled with caries promoting feeding behaviors result in accumulation of these organisms to levels exceeding 30% of the cultivable plaque flora which, in turn, leads to rapid demineralization of tooth structure.²

Establishing a preventive routine that impedes the microbial risk component alongside the dietary risk factor would bring about a far-reaching and a successful technique toward prevention of caries.

Various chemotherapeutic agents, such as povidone-iodine (PI) and chlorhexidine (CHX), have shown antimicrobial effect against the most cariogenic S. mutans.⁶,⁷ The advantages of using CHX as a varnish is that it is retained on the teeth over a longer duration of time and minimizes the known side effects of staining of the teeth and bad taste.⁸

This study was done to evaluate the antimicrobial efficacy of CHX containing varnish-Cervitec and 10% PI and to compare
their potency for a period of 90 days in children with ECC. This study also intends to search for an antimicrobial agent that can be a useful adjunct in the fight against the rampant spread of ECC and its recurrence after total rehabilitation.

**Materials and Methods**

A total of 30 children aged 3-6 years with ECC reporting to the Department of Pedodontics, KVG Dental College and Hospital, Sullia, for the treatment were selected. The study groups consisted of two experimental groups; the children were divided into the two groups by block randomization. Written informed consent was taken before the study from their mothers/caretakers.

**Inclusion criteria**

1. No significant medical history
2. The presence of full complement of primary teeth
3. Diet chart which reveals exposure to sugar more than 4 times daily
4. The presence of 1 or more decayed, missing or filled tooth surfaces in any primary tooth in a child 3-6 years of age.

**Exclusion criteria**

1. Patients whose parents do not give consent for examination
2. Children who do not cooperate for examination
3. Children with systemic diseases
4. Children who were on antibiotic or medications that might affect oral flora or salivary flow taken within the previous 3 months
5. History of fluoride treatment in the last 3-4 weeks.

Written informed consent was taken before the study. Child’s medical and dental history was taken. The clinical examination was done for 30 children with mouth mirror and explorer.

The study group was later divided into two groups:

- Group 1: 15 children with ECC following full mouth rehabilitation and CHX varnish, Cervitec plus applied to their dentition
- Group 2: 15 children with ECC following full mouth rehabilitation and 0.2 ml of 10% PI applied to their dentition which was immediately wiped off.

Salivary samples were collected from each participant for bacterial assessment at baseline, 30, 60 and 90 days. *S. mutans* count in each plaque and saliva sample was determined using Dentocult SM strip method of Jensen and Bratthall.9

The plaque was collected with a sterile tooth pick 1-2 h after eating or brushing. The site for collection of plaque was the buccal surface of maxillary second molars and the lingual surface of mandibular molars (Figure 1). This was then spread thoroughly but gently on the four sites of the rough surface of the plaque strip. For salivary assessment of *S. mutans* count, the rough surface of the Dentocult SM saliva strip was pressed against the saliva on the tongue, and the strip was removed gently through closed lips so as to remove excess saliva (Figures 2 and 3).

Using a needle or forceps, a bacitracin disc was placed in the selective culture broth about 15 min before sampling for making the media selective for *S. mutans*. The selective culture vial was then gently shaken for even distribution of bacitracin.
The plaque and saliva samples placed on the Dentocult SM strip were incubated at 37°C for 48 h in the selective culture media given by the manufacturer. After incubation, the presence of \textit{S. mutans} was evidenced by the detection of light blue to dark blue raised colonies on the inoculated surface of the strip (Figure 4). Inspection of the growth was done with the strip held sideways and with a magnifying glass.

Results were evaluated according to the manufacturer’s chart (Figure 5). The data thus obtained were statistically evaluated using Mann–Whitney \textit{U}-test, Chi-square test, and Wilcoxon signed ranks test.

\textbf{Results}

On comparing the \textit{S. mutans} count between CHX varnish and 10% PI treatment groups at baseline (pretreatment), the difference in the \textit{S. mutans} count was found to be insignificant ($P = 0.69$) at baseline for plaque and for saliva ($P = 1.0$) (Table 1).

The \textit{S. mutans} count in plaque and saliva was found to be 10$^4$–10$^5$ CFU/ml (i.e., <10$^5$ CFU/ml) in both CHX varnish and 10% PI treatment groups at 30, 60 and 90 days. This indicates that there was no significant difference in the efficacy of both CHX varnish and 10% PI on \textit{S. mutans} count in plaque and saliva at 30, 60 and 90 days (Tables 2-4).

\begin{table}
\centering
\begin{tabular}{|c|c|c|}
\hline
\textbf{Group} & \textbf{Material} & \textbf{Total} \\
\hline
\textbf{Plaque} & & \\
\textbf{Pre} & CHX & PI \\
\textbf{100,000-1,000,000} & 5 & 4 \\
\textbf{> 1,000,000} & 33.3 & 26.7 \\
\hline
\textbf{Saliva} & & \\
\textbf{Pre} & CHX & PI \\
\textbf{100,000-1,000,000} & 7 & 7 \\
\textbf{> 1,000,000} & 46.7 & 46.7 \\
\hline
\end{tabular}
\caption{Comparison of \textit{S. mutans} count between CHX varnish and 10% PI in plaque and saliva at baseline (pretreatment).}
\end{table}

\begin{table}
\centering
\begin{tabular}{|c|c|c|c|}
\hline
\textbf{Group} & \textbf{Material} & \textbf{Total} \\
\hline
\textbf{Plaque} & & \\
\textbf{CHX} & 15 & 15 & 30 \\
\textbf{Saliva} & & \\
\textbf{CHX} & 15 & 15 & 30 \\
\hline
\end{tabular}
\caption{Comparison of \textit{S. mutans} count between CHX varnish and 10% PI in plaque and saliva at 30 days.}
\end{table}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{figure4.png}
\caption{Streptococcus mutans growth on strips.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{figure5.png}
\caption{Manufacturer’s model chart.}
\end{figure}
The reduction in \( S. mutans \) count from baseline (pretreatment) to 90 days was found to be very highly significant in both CHX varnish and 10% PI treatment groups (Table 5).

The reduction in the \( S. mutans \) count from pretreatment to 30 days in CHX varnish, and 10% PI treated groups was found to be statistically significant (Table 6).

**Discussion**

Dentistry has undergone transformation from the dental profession being once centered on restorative work, and extractions is now driven by way of prevention. Our goal today should be to preserve and promote dental health as dental caries continues to be one of the chronic debilitating diseases in children.

The remedy of ECC is especially targeted on preventing progress of lesions with the aid of restorations, diet counseling, educating parents regarding decay promoting feeding behaviors, maintain good oral hygiene, and the use of preventive agents like topical fluorides.\(^{10}\)

Enhanced outcomes can be achieved by way of recognizing the infectious nature of this disease and incorporating antimicrobial therapy as part of caries prevention and treatment. Topical antimicrobial agents that have been examined to suppress oral populations of \( S. mutans \) include antibiotics such as vancomycin, kanamycin, stannous fluoride, the bisbiguanides (CHX and alexidine), PI and a combination of these agents.\(^{11}\)
Tanzer et al., Caufield and Wannamuehler observed that iodine has super penetrability into dental plaque, and those characteristics make it a remarkable chemoprophylactic agent for oral use.6,12

Topical application of iodine has shown to suppress oral populations of S. mutans for prolonged durations. This can be justified by the fact that demineralized enamel is more permeable to iodine which accounts for extended retention and antibacterial activity.

The oral milieu of children with ECC even after full mouth rehabilitation continues to be more favorable for the growth of pathogenic microorganism like S. mutans and recurrence of lesions. In our study, we evaluated the topical impact of 10% PI on salivary count of cariogenic S. mutans for 30, 60 and 90 days on children with ECC after full mouth rehabilitation and observed that the use of 10% PI notably reduced the S. mutans in saliva for a duration of 30, 60 and 90 days. This is accordance with the results of Berkowitz et al.10

CHX has been used effectively for the prevention of dental caries as it suppresses the growth of cariogenic S. mutans. It has the disadvantage like staining of teeth and unpleasant taste which is overcome as it obtainable as in the varnish form. Cervitec, a varnish containing 1% CHX and 1% thymol has the advantages that it’s far retained on the tooth for an extended time also it can be applied on the interproximal and cervical areas and in fissures of teeth.13

In our study using the Dentocult Strip technique, we found a statistically significant reduction in salivary S. mutans following application of CHX varnish after 30, 60 and 90 days. The findings of this study are in agreement with Petersson et al. and Attin et al. who found a reduction in salivary S. mutans for a period of 3-month.14,15

Studies by Berkowitz et al., Zhan et al., Twetman and Petersson, Joharji and Adenubi have confirmed the efficacy of 10% PI and CHX varnish in lowering S. mutans counts thereby preventing ECC.10,16-18

However, there is no study till date to compare the efficacy of these two agents. In our study, we also compared the antimicrobial efficacy of 10% PI and CHX varnish in children with ECC after oral rehabilitation to assess which of the two has a more beneficial effect. We found no significant difference between the efficacy of 10% PI and CHX varnish on S. mutans count in plaque and saliva. Both agents have shown to be equally effective in preventing the recurrence of ECC, and the use of both chemoprophylactic agents can be recommended in the preventive protocol of ECC.

Conclusion
A statistically significant reduction in S. mutans in plaque and saliva was observed with the use of CHX containing varnish, Cervitec. A statistically significant reduction in S. mutans in plaque and saliva was observed with the use of 10% PI. No statistically significant difference in the efficacy of 10% PI and CHX varnish was observed on comparison. About 10% PI and CHX varnish can be used as a chemoprophylactic agent against the devastating oral disease like ECC and prevents its recurrence.

References


