


Fluoride Varnish Intervention for Caries Prevention in Resource-Limited African Settings- A Review

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ABSTRACT:

Background: Fluoride may not be available to some children in African countries due to the non-use of fluoride containing toothpaste, parental perception and awareness of the benefits of fluoride in caries prevention and non-availability of fluoride in community and school water. Fluoride may also not be affordable for children of low socio-economic status in remote areas, slums areas and rural areas. Topical and systemic sources of fluoride, like fluoride drops, fluoride gel, fluoride solution, fluoride mouthrinses, fluoride tablets, and fluoride lozenges, may not be available in resource-poor countries.

Method: An electronic literature search in Google Scholar, African journals online, Science direct and Google was done in August, 2023 using the Population, Concept and Context framework. Search terms and keywords were combined by Boolean operators. Two independent investigators screened titles, abstracts and accessible full texts of publications on fluoride varnish use among African children.

Results: Full text was screened using inclusion criteria. Three articles were included as they were assessed to meet the aim of the review. They were hospital based and school-based studies with comparative, prospective, interventional, and randomized clinical trial and cluster-randomized controlled community trials, respectively

Conclusion: Fluoride varnish can be an intervention for underserved children with white spot carious lesion in remote areas, slums areas and rural areas, and for non-cavitated carious lesions in resource poor settings. It is simple to use with simple armamentarium. More studies from diverse ethnic population in African countries will fill the gaps in knowledge.

KEYWORDS: African children, Fluoride varnish intervention, Caries prevention, Access to fluoride

INTRODUCTION:

Dental caries is a biofilm mediated, multifactorial¹ and dynamic oral disease, when untreated, it can progress to clinical conditions associated with pain like irreversible pulpitis, reversible pulpitis and dentoalveolar abscess.² Epidemiologic studies in resource rich and resource limited countries have reported distinct patterns³ of dental caries incidence and prevalence globally. The need for preventive approaches and programs for dental caries like professional fluoride application among children is recommended. Fluoride can be a non-invasive treatment⁴ and intervention for non cavitated, white spot carious lesion. It can help in remineralising non cavitated, white spot carious lesion and changing carbonated apatite⁴ to a fluoroapatite-like form that is more acid-tolerant to cariogenic acids. Fluoride can be delivered topically and systemically in recommended dose among children to avoid fluoride toxicity¹ and dental fluorosis. Fluoride varnish adheres to the tooth surface and prolongs the contact time¹ between fluoride and enamel. Fluoride varnish is easy to apply in resource poor settings with simple armamentarium. The aim of this article is to review the available studies on fluoride varnish use among African children.

LITERATURE SEARCH METHOD

An electronic literature search in Google Scholar, African journals online, Science direct and Google was done in August, 2023 using the Population, Concept and Context framework.⁵

Population: Children

Concept: Fluoride varnish use among children

Context: Studies carried out in Africa continent, published in English language and in electronic databases

The keywords used were fluoride varnish, deciduous teeth, Africa continent, primary tooth, Africa countries, sub-Saharan Africa, school children, sub-Saharan countries, permanent teeth, African region, African children and Africa. Search terms and keywords were combined by Boolean operators. Two independent investigators screened titles and abstracts of publications on fluoride varnish use among children studies, and potential references to identify which studies met the inclusion criteria of this review. Information was extracted from the full texts of articles regarding the location of the research and the main content. The inclusion criteria were original research articles, case report, case series with information on fluoride varnish use among children carried out in Africa countries, published in English and in electronic databases. While review articles, systematic reviews, viewpoints, books, letters, thesis, editorials, book chapters, dissertations, perspectives, and news related to fluoride varnish use among African children were excluded. Original research articles and review articles with information on fluoride gel use, fluoride drops use, fluoride foam use, fluoride containing toothpaste use, fluoride mouthrinses use among African children were also excluded. Original research articles, case report, case series without access to the full text was also excluded. Original research articles involving teeth (in-vitro studies) were also excluded. Study data of the included articles were extracted and collated in a table, including study details (author(s), year of publication, study design, study location or country, study participants, study objective). No time frame was used during the search and all identified studies in Africa countries that met the inclusion criteria and had accessible full text were included. If relevant data were missing, the authors of the articles were not contacted for additional information via e-mail. Any additional studies carried out in Africa continent, identified from the reference lists of published papers were retrieved from the web using Google scholar and Google search engines.

RESULTS

Twenty articles were identified during literature search; six duplicates were removed during screening. Abstract and full texts were screened using inclusion criteria by two independent investigators. Eleven articles were excluded because they did not meet the inclusion criteria. Three articles with accessible full text were included as they were assessed to meet the inclusion criteria. Two studies were carried out in Egypt (66.7%) and one from South Africa (33.3%) respectively, and they were hospital based and school based study respectively. The study designs were cluster-randomised

controlled community trial, randomised clinical trial and comparative, prospective, interventional study respectively.

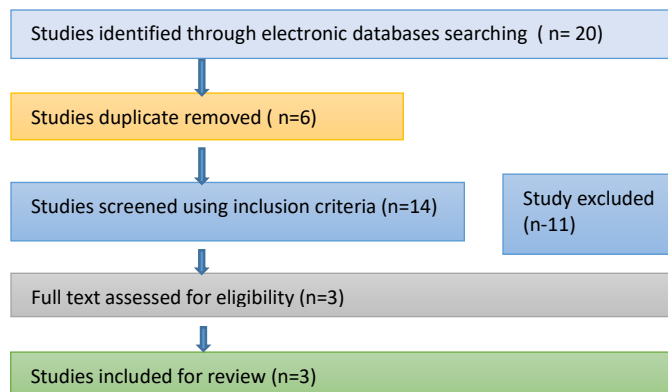


Figure 1: Flowchart of articles process

Table 1: Summary of identified studies on fluoride varnish use among children in Africa continent.

Author/ Year of publication	Study participants	Study objective	Study design	Country of study
ElSayed et al,2020 ⁶	6 to 8 years old children	To evaluate and compare the effects of fluoride varnishes, propolis-based chitosan varnish and Salvadorapersica varnish on <i>Streptococcus mutans</i> and <i>lactobacilli</i> count.	A Comparative, prospective, interventional study	Egypt
Mekki et al,2021 ⁷	3 to 5 years old children	To evaluate and compare the effectiveness and therapeutic effect of intensive application of casein phosphopeptide amorphous calcium phosphate fluoride (CPP-ACPF) varnish (MI varnish) and fluoride varnish (Duraphat) on the activity of enamel white spot lesions (WSLs) in primary teeth over a 6 weeks follow-up period	A randomised clinical trial	Egypt
Effenberger et al,2021 ⁸	4–8 years old school children	To assess the efficacy and costs of fluoride varnish (FV) application for caries prevention in a highrisk population in South Africa.	A cluster-randomised controlled community trial	South Africa

DISCUSSION

Fluoride is available for children from many sources like community and school water supplies, fluoride containing toothpastes, fluoride drops, fluoride gel, fluoride solution, fluoride foam, fluoride mouthrinses, fluoride tablets and fluoride lozenges. It promotes enamel remineralisation of non-cavitated carious lesions,⁴ reduces enamel demineralisation of white spot lesions and inhibits bacterial metabolism¹⁰ of cariogenic diet and acid production. Fluoride has both topical and systemic mechanism of action, but the topical effect is the most important.¹⁰The concentration of fluoride in 5%NaF(sodium fluoride) varnish is 22.6mg F-/ml, 22 600 ppm⁹ (2.26% fluoride ion) and it is a simple preventive approach³ for children in underserved and un-served locality. Study from Egypt reported fluoride varnish had significant antibacterial effect⁶ against *Streptococcus mutans* and *Lactobacillus* bacteria, which are part of the cariogenic bacteria biofilm. Another study from Egypt reported that fluoride varnish was superior⁷ to casein phosphopeptide amorphous calcium phosphate fluoride (MI varnish) in remineralisation of white spot lesions. In this review, studies were identified from South Africa and Egypt respectively and this will not reflect the diverse ethnic population in Africa. The burden of dental caries among African children is high² and fluoride varnish can be an intervention for non-cavitated carious lesions in resource limited settings.³It can be applied on initial carious lesion/white spot lesion⁸ with a microbrush or applicator after isolating with cotton wool roll or gauze for moisture control and dry operating field.⁶Children may not accept the taste of the fluoride varnish and parents may have concerns of its clinical and cost effectiveness.⁷Africa has 54 countries with about 3000 ethnic groups with various socio-cultural practices and beliefs. More studies from other African countries will guide clinical practices and evidence based recommendations on fluoride varnish use among African children.

CONCLUSION

The different patterns of dental caries prevalence in Africa and globally requires the need for a preventive approach like professional fluoride varnish application among children with risk of dental caries. Fluoride varnish can be an intervention for non-cavitated carious lesions/ white spot carious lesion in resource poor settings. Studies identified from South Africa and Egypt will not reflect the diverse ethnic population in Africa. More studies from diverse ethnic population in Africa continent will fill the knowledge gaps and add to existing literature.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

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DATA AVAILABILITY STATEMENT: The data presented in this study are available on reasonable request from the corresponding author.

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