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Fluoride Varnish For Preventing Dental Caries In Children And Adolescents

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Abstract:
Caries is one of the major ailments faced globally due to increased consumption of refined carbohydrates, despite health education measures taken to curb the initiation and progression of caries in both children and adolescents. Fluoride has been a major factor in the decline in the prevalence and severity of dental caries in the United States and many research studies have proven the safety and benefits of fluoridated water. This research paper aims to evaluate the effectiveness of fluoride varnish on the prevention of dental caries in primary and permanent dentition. A web search was conducted for English papers, using various digital resources (Pubmed, Google Scholar, Cochrane Library, Sage Journal, BMC Pediatrics, Fortune Online, AAPD, and MDPI). The keywords were "fluoride", "professionally applied fluoride", "fluoride varnish", and "caries prevention in children and adolescents" refined through hand-search. The review suggests a substantial caries-inhibiting effect of fluoride varnish in both permanent and primary teeth and professionally applied fluoride varnish showed a significant inhibiting effect on caries in children and adolescents. In the analysis of permanent tooth surfaces, fluoride varnish showed a 43% reduction in tooth decay (D(M)FS) compared to placebo or no treatment. This result had moderate quality and there was significant variation among the studies. In the analysis of primary tooth surfaces, fluoride varnish demonstrated a 37% reduction (CI: 24% to 51%) in tooth decay (d(e/m)fs) based on data from 10 trials. For children below the age of 6, only 2.26% fluoride varnish is recommended.

Keywords: *Fluoride, Fluoride varnish, dental caries, prevention for caries*

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I. Introduction

Dental caries is a highly prevalent chronic disease afflicting a significant proportion of the world population, including around 60% to 90% of school-aged children [1].

Caries in children is a source of pain and can lead to loss of teeth, impaired growth, and failure to thrive, and can affect speech, appearance, self-esteem, and school performance [2]. The repair and replacement of carious teeth is excessively time-consuming and costly, representing a major drain of resources for healthcare systems [3]. Thus, the prevention of dental caries in children is regarded as a priority for dental services.

Fluoride has been a major factor in the decline in the prevalence and severity of dental caries in the United States (U.S.) and other economically developed countries. Many research studies have proven the safety and benefits of fluoridated water. Drinking fluoridated water keeps teeth strong and reduces cavities by about 25% in children and adults [4].

According to CDC, water fluoridation is not the only form of fluoride delivery that is effective in preventing tooth decay in people of all ages in the United States. There are other fluoride products that may lower the risk for tooth decay, especially for people who are at higher risk for decay. They are Fluoride Toothpaste, Fluoride Mouth Rinse, Fluoride Supplements, Fluoride gel and foam, and Fluoride Varnish [6].

Fluoride varnish was developed to increase its contact time with enamel. Fluoride varnish is an effective and proven tool for the prevention of dental caries in children and adolescents [7]. Due to the ease of use, acceptability, and efficacy of the varnish, it makes an important primary preventive measure in high caries-risk children [8]. Also, the Varnish application reduces the risk of fluoride over ingestion and has greater patient acceptance [9].

As mentioned above, the recommendation to use fluoride varnish as a caries preventive measure has been adopted by many nations across the world. This paper aimed to examine and summarize the results of controlled clinical trials, systematic reviews, and meta-analyses regarding professionally applied fluoride varnish for the prevention of dental caries in children and adolescents.

II. Materials & Methods

A web search was conducted for English papers, using different digital resources (Pubmed, Google Scholar, Cochrane Library, Sage Journal, BMC Pediatrics, Fortune Online, AAPD, and MDPI). The keywords used were "fluoride", "professionally applied fluoride", "fluoride varnish", and "caries prevention in children and adolescents" refined through hand-search.

And then, this article selected two review papers and Review of Professionally Applied Fluorides for Preventing Dental Caries in Children and Adolescents also reviews the very previous review journal conducted by Cochrane Oral Health Group.

This research paper follows the study characteristics outlined in a review conducted by

1. The Cochrane Oral Health Group. The review, which was current up to 13 May 2013, contained 22 trials published between 1975 and 2012.
2. Review of Professionally Applied Fluorides for Preventing Dental Caries in Children and Adolescents. The review, which was current up to 20 January 2022, had web searched for English papers published between 2000 and 2021, using different digital resources (Pubmed, Google Scholar, Cochrane Library, and ResearchGate). The keywords used were "professionally applied fluoride", "fluoride gel", "fluoride varnish", "fluoride foam", "fluoride mouth rinses", and "non-cavitated caries lesions", refined through hand-search.

III. Results

[Intervention Review] Fluoride varnishes for preventing dental caries in children and adolescents

A total of 22 trials with 12,455 participants (9595 participants considered in the analysis) were included in the study.

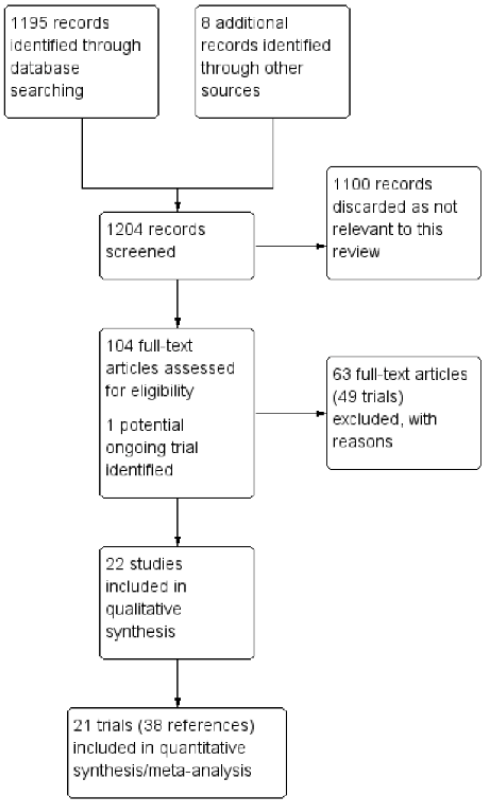

Figure 1: Study flow diagram from 2013 search

In the analysis of permanent tooth surfaces, fluoride varnish showed a 43% reduction (with a confidence interval of 30% to 57%) in tooth decay (D(M)FS (Decayed, Missing, Filled Surfaces)) compared to placebo or no treatment. This result had moderate quality and there was significant variation among the studies.

In the analysis of primary tooth surfaces, fluoride varnish demonstrated a 37% reduction (with a confidence interval of 24% to 51%) in tooth decay (d(e/m)fs) based on data from 10 trials. This result also had moderate quality and showed some variation among the studies.

1. Review of Professionally Applied Fluorides for Preventing Dental Caries in Children and Adolescents.

A meta-analysis performed by Gao et al. (2016) on four studies about the effect of 5% NaF varnish on early enamel caries showed that the overall percentage of remineralised enamel caries was 63.6% (95% CI: 36.0–91.2%; $p < 0.001$) [10]. Moreover, Mishra et al. (2016) systematically reviewed the role of fluoride varnish in the prevention of early childhood caries. They found a caries preventive fraction of 6.4% to 30% when 1% varnish was applied, and 5% to 63% when the 5% concentration of fluoride was used [11].

In 2013, Marinho et al. performed a meta-analysis on topically-applied fluoride varnishes: 13 trials for permanent teeth and 10 trials for primary teeth. The pooled D(M)FS PF estimate comparing fluoride varnish with placebo or no treatment was 43% (95% confidence interval (CI) 30% to 57%; $p < 0.0001$). The pooled d(e/m)fs PF estimate was 37% (95% CI 24% to 51%; $p < 0.0001$) [12]. Marinho et al. (2013) found that the caries protection benefit brought by fluoride varnish use is independent of baseline caries risk and severity, previous administration of fluorides, earlier prophylaxis, commonness of applications, and concentration of topical agent [13].

Many studies from the literature showed that professionally applied fluoride varnishes are effective for preventing dental caries in both dentitions (Table 1).

Table 1. Comparative data about professionally applied fluoride varnishes in RCTs.

Authors (Year)	Country	Sample	Age	Comparison	Dentition	Follow-up	Results	Reference
Autio-Gold & Courts (2001)	USA	142	3–5 yr.	5% NaF varnish vs. no treatment	primary	9 mo.	dEs = 1.20 vs. 3.05 ($p < 0.001$)	[39]
Latifi-Xhemajli et al. (2019)	Kosovo	504	6–30 mo.	0.1% NaF varnish applied 4 times/year vs. no treatment	primary	2 yr.	PF = 49%	[45]
Turska-Szybka et al. (2016)	Poland	419	1–5 yr.	resin infiltration (RI) and fluoride varnish (FV) vs. fluoride varnish	primary	1 yr.	92.1% of the infiltrated lesions (RI + FV) vs. 70.6% of the FV lesions had not progressed ($p < 0.001$)	[46]
Honkala et al. (2015)	Kuwait	147	3 yr.	sealants applied to occlusal surfaces of primary molars compared to fluoride varnish applications	primary	1 yr.	varnished surfaces were significantly more likely to develop new caries lesions than the sealed ones (OR = 2.92, 95% CI = 1.82–4.71)	[47]
Sonesson et al. (2020)	Sweden	182	12–18 yr.	1.5% ammonium fluoride varnish applied in orthodontic patients (TG) vs. placebo (PG)	permanent	1 yr.	prevalence of WSLs on subject after debonding was 41.8% (TG) vs. 43.8% (PG); the no. of patients with more severe lesions (score 3 + 4) was higher in PG ($p < 0.05$)	[48]
Xhemnica et al. (2008)	Albania	92	11.7 yr.	5% NaF varnish vs. no treatment	permanent	7 mo.	dEs = 0.87 vs. 3.90 ($p < 0.05$)	[49]
Oliveira et al. (2014)	Brazil	200	1–4 yr.	5% NaF varnish vs. placebo varnish	primary	2 yr.	PF = 28%	[50]
Arruda et al. (2012)	Brazil	379	7–14 yr.	5% NaF varnish vs. placebo	permanent	1 yr.	PF = 40%	[51]

dEs—decayed surfaces with initial enamel lesions; WSL—white spot lesions; PF—preventive fraction.

All these RCT studies and meta-analyses concluded that fluoride varnishes exhibited an important caries-inhibiting effect in both permanent and primary dentitions, with reductions in caries ranging from 28 to 70%.

IV. Discussion

1 [Intervention Review] Fluoride varnishes for preventing dental caries in children and adolescents.

The main question addressed by this review is how effective the use of fluoride varnish for the prevention of caries in children is compared to placebo or no treatment. In this updated review, there are now 22 trials published between 1975 and 2012 in which a total of 12,455 children were randomized to treatment with either fluoride varnish or placebo/no treatment.

The evidence from a meta-analysis of the 13 trials assessing the effect of fluoride varnish on permanent dentition is that the use of fluoride varnish is associated on average with a 43% (95% CI 30% to 57%) reduction in decayed, missing, and filled tooth surfaces. The meta-analysis of the 10 trials assessing the effect of fluoride varnish on the primary dentition suggests a 37% (95% CI 24% to 51%) reduction in decayed, missing, and filled tooth surfaces. There was considerable statistical heterogeneity in both these estimates.

2. Review of Professionally Applied Fluorides for Preventing Dental Caries in Children and Adolescents.

Professionally applied fluoride varnish is useful and recommended for caries prevention in patients with an elevated risk of dental decay.

Prevention of dental caries in temporary and permanent dentition can be done effectively using APF gel or fluorinated varnishes. For children under the age of 6, only 2.26% fluoride varnish is recommended.

Among professionally applied fluoride products, fluoride varnish is the most adequate regarding safety and acceptability, as well as regarding caries prevention in high-risk children and adolescents, orthodontic patients, and the elderly.

V. Conclusions

Professionally applied fluoride varnish showed a significant inhibiting effect on caries in children and adolescents. Fluoride varnish is effective and can be recommended for caries prevention in primary and permanent teeth.

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