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**REVIEW ARTICLE** **OPEN ACCESS**

# Comparative Evaluation of Effectiveness between Pit and Fissure Sealant and Topical Fluoride Gel Application among Children and Adolescents Aged 6-18 Years- A Systematic Review

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**ABSTRACT**
*Children who suffer from poor oral health are 12 times more likely to have more restricted-activity days, including missing school, than those who do not. Annually, more than 50 million hours are lost from school due to oral diseases. Several studies about prevalence of dental problems have been done in different parts of India, which shows that there is an increase in dental caries prevalence among the school-going children. The high prevalence rate shows that further awareness regarding dental caries and dental hygiene among teachers- the role model for students is needed to educate children. The aim of this systematic review was to comparatively analyze the existing literature on the effectiveness of preventive dental materials. The materials and methods included search strategy through the data bases of PubMed, Cochrane, LILACS, Science direct were searched up to January 2019 for the related topic. Article search was narrowed upon the pre-stated inclusion and exclusion criteria. A total of 42 articles were included in the systematic review for detailed evaluation. Based on the findings of the study, it can be concluded that that ionomer reinforced pit and fissure sealants are effective anticariogenic agents as they release fluoride with maximum retention potential.*
***Key words:*** *Pit and Fissure Sealants, Topical Fluoride Gel, Children, Adolescents, Dental Caries Prevention.*

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## INTRODUCTION

Oral Health is the fundamental human right. It is an integral portion of overall general health. Poor oral health is commonly associated with many systemic diseases [1-4]. A complication of dental caries, malocclusion, periodontal diseases or oral cancer diminishes the quality of life of individuals causing orofacial discomfort, pain and loss of teeth.

Oral diseases qualify as a global and major public health problem owing to their high prevalence and incidence in all regions of the world. India is no exception and due to its large population size, the absolute burden of oral diseases is immense [5].

Oral health is not usually considered as an issue with priority by the public health sector in most of the developing countries. Despite the fact that oral diseases are largely preventable, oral healthcare is still remains as an area which is neglected with least concern [6].

People living in developing countries, especially those belonging to lower socio- economic status has lacunae in oral health awareness mirrored in their practice of oral hygiene habits [7]. Oral diseases hence create burden mainly on such disadvantaged population groups of society [8].

Lack of knowledge on the consequences of delayed treatment and available modalities, ignorance, poverty, preoccupation, financial constraints, inaccessibility to dentists, inappropriate guidance and care, self-medication are the factors that affect dental care. Other reasons are fear, anxiety, misinterpretation and misconception about effects of dental treatment and dissatisfaction with the quality of oral health care services [9-10].

In addition to variations in the numerous factors like gender, age, races, geographical locations, accessibility to oral health care services and dietary habits responsible for oral

diseases, the World Health Organization has affirmed that nutritional status, hygiene, stress, smoking and alcohol habits and so on are linked to a wide range of dental problems and forms the fundamental basis of the common risk factor approach to prevent the oral diseases [11]. Among these, oral hygiene is the most significant factor in terms of prevention of oral disease, accessible to personal control. Hence it is a modifiable risk factor of oral problems affecting one's esthetics, communication, biologic, psychological and social projection.

The World Health Organization in 2003 indicated that the focus of oral health education should have actions on behaviors to create conditions that improve oral health or reduce the risk of oral diseases plus health promotion at schools by encouragement of children for routine tooth brushing appropriately under supervision, consumption of fluoride, balanced nutrition, among other strategies [12, 13].

Inability to maintain proper oral hygiene practices will result in an increase in the prevalence of dental diseases. Moreover, health service is one of the human basic and social rights of an individual and it is the duty of each respective Government to provide it and increase further [14]. Effective utilization of services is a concept of expressing the enhanced interaction extent between the service provider and the people for whom it is indented [15].

The role of Public Health dentists is imperative since they play a crucial role in bridging the gap between various sections of people and health sector. Dentists with good communicating skills are in a unique position serving as role models to educate inculcating minds to adopt healthy lifestyle.

Preservation, restoration and promotion of public health with equitable distribution is the prime duty of every healthcare provider .Hence health professionals, policy makers and insurance organizations must work communally so that different strategies could be adopted to address various influencers of social disparities to resolve and result in fair distribution of services through a suitable planning .Thus Provision of "appropriate services in the right place and at the right time" is the true meaning of creating good access to health services [16].

Several studies about prevalence of dental problems have been done in different parts of India, which shows that there is an increase in dental caries prevalence among the school-going children [17-23].

Children who suffer from poor oral health are 12 times more likely to have more restricted-activity days, including missing school, than those who do not. Annually, more than 50 million hours are lost from school due to oral diseases [24]. Schools provide an ideal setting for promoting oral health it offers an efficient and effective way to reach over 1 billion children worldwide. It is place where most influential stages of children's lives are spent during which lifelong beliefs, attitudes and skills are developed. Oral health messages can be reinforced throughout the school years and it is a period during which children are particularly receptive. Teachers play a vital role in modeling the behavior and complete comprehensive development of school children. The benefit of using school personnel is lowered cost of the service [26]. Earlier the habits are established, the longer lasting the impact.

Oral health knowledge is considered to be an essential prerequisite for oral health related behavior [27]. The oral health literacy status deserves recognition as an important determinant of oral health.

Early caries detection is the key to the practice of minimally invasive dentistry and is essential to plan programs focusing appropriate treatment procedures followed by preventive.

Abundant literature exists on the effectiveness of preventive dental treatments. With this background the systematic review is carried out to comparatively evaluate the effectiveness between pit and fissure sealant and topical fluoride gel application among children and adolescents aged 6-18.

## MATERIAL AND METHODS

### Structured Question

How effective is pit and fissure sealant compared with topical fluoride gel application in prevention of dental caries?

### PICO analysis

**Population** - Children and adolescents or teenagers between 6-18 years.
**Intervention** - Pit and Fissure Sealant
**Comparison** -Topical Fluoride Gel Application
**Outcome** **-** Prevention of Dental Caries in terms of the retention efficacy of the preventive materials and incidence of new carious lesion measured by using standardized criteria and recording indices respectively.

**Inclusion Criteria**

The search was then narrowed down manually by the reviewer according to the inclusion criteria of the present systematic review.
-Clinical trials or randomized control trials assessing the effectiveness of pit and fissure sealants and topical fluoride gel applications which were based on spilt mouth designs that measured the retention efficacy through analyses of shear bond strength and determined the incidence of carious lesions by dental explorers, CAOD index, ,RYGE and SNYDER criteria for surface characteristics, DIAGNODENT examination, World Health Organization recommendation and criteria prior the commencement and during the study, observations obtained using scanning electron microscopy and polarizing microscope post-operatively as well

**Exclusion Criteria**

The exclusion criteria for the present study contained
-Literature in other languages that could not be translated by the examiner.
- Those trials in which the intervention involved cross over trials.

**Sources Used**

PubMed
Cochrane database
Google Scholar
LILACS
Science Direct
HAND SEARCH
Reference list of the identified studies also checked for possible additional studies.

**Search Methodology:**

A systematic search strategy in English literature on comparative evaluation of the effectiveness between Pit and Fissure Sealant and Topical Fluoride Gel Application among Children and Adolescents aged 6-18 years was carried out. In the initial phase of the review, a computerized literature search for studies were on the oral health status among school going children, oral health literacy status and oral component in school syllabi was performed in the above-mentioned sources of database till January 2018.
In addition, a hand search was carried out in:

- Community dentistry and oral epidemiology
- Journal of Public Health Dentistry

No limits and language restriction were applied during the electronic search to include all the potentially relevant articles in the systematic review. Further the reference list of reviews and the selected articles were checked for possible additional studies.

**Data Collection and Analysis**

**Screening and Selection**

Electronic search was carried out using the key words in the search engines PubMed (1), Science Direct (7), Cochrane (3), LILACS (6) and Google scholar (25) which yielded a total of 42 articles. Manual search was done in Oral epidemiology research which did not yield articles. Based on preset inclusion and exclusion criteria the titles of the studies identified from the search were assessed independently by two review authors (S. Shreelakshmi, Dr. I. Meignana Arumugham Indiran). Conflict concerning inclusion of the studies were resolved by discussion, 42 titles were identified from the search after excluding duplications. Abstracts of selected articles were reviewed independently. 12 articles were excluded after reading abstract. Full text articles were retrieved for 29 relevant studies. After reviewing the articles independently articles 17 were included after full text reading. Finally, 6 articles were selected based on eligibility criteria. The reference list of the full text articles was reviewed for identifying additions studies. Titles of articles relevant to the review were selected by discussion.

**Data Extraction**
Data extraction for general characteristics of studies and variables of outcome was done.
For each trial the following data was recorded:
Author and Journal
Study Design
Sample Size
Participants and Group
Methodology
Parameters
Statistical Analysis

**RESULTS**
There were two variables of interest where were effectiveness of pit and fissure sealants as well as topical fluoride gel application. A total of about 42 articles were found with 6 studies in LILIACS 3 in COCHRANE, 1 in PUBMED, 25 in GOOGLE SCHOLAR and 7 studies in SCIENCE DIRECT. The articles were subjected to title reading from which a total of 13 articles were excluded with 1 in PUBMED, 3 in Cochrane, 1 in SCIENCE DIRECT and 2 in LILIACS. At this stage, there were about 29 articles.
There were no articles eliminated after trying to remove duplication of published trials and thus 29 articles were read for abstract screening following which 17 were subjected to full-text reading. There were about 9 articles excluded after full-text reading. However, there were no reduction in the total number of articles even after screening of titles from cross references eliminated after reading abstracts. Thereby, the number of full text articles assessed for eligibility is 6.
The search strategy in **Pubmed- Search** was (((Children) AND adolescents) OR "teenagers")) AND "6 18 years old")) AND ((((((“Pit and fissure sealant application)) OR (“pit and fissure sealant”)) OR (pit and fissure sealant application application)) OR (pit and fissure sealant treatment)) OR ( pit and fissure sealant intervention))) AND ((((“topical fluoride gels”) OR “topical fluoride gel intervention)) AND ((((((((((((((“prevention of dental caries”) OR “caries prevention”) OR “cariostatic”) OR “cariostatic ability”) OR “ cariostatic action”) OR “cariostatic activities”) OR “cariostatic activity”) OR “cariostatic agent”) OR “cariostatic agents”) OR “cariostatic potential”) OR “cariostatic property”) OR “cariostatic effect”) OR “cariostatic efficacies”) OR “Cariostatic effects”) OR “caries protective”) OR “caries protective agent”) OR “caries protective effect”)OR “Caries protective effects”)
**Science direct**-(children and adolescents or teenagers and 6 -18 years old and pit and fissure sealant application or pit and fissure sealant” or pit and fissure sealant application or pit and fissure sealant treatment or pit and fissure sealant intervention and topical fluoride gels or topical fluoride gel intervention and prevention of dental caries or caries prevention or cariostatic or cariostatic ability or cariostatic action or cariostatic activities or cariostatic activity or cariostatic agent or cariostatic agents or cariostatic potential or cariostatic property or cariostatic effect or cariostatic efficacies or cariostatic effects or caries protective or caries protective agent or caries protective effect or caries protective effects)
**LILACS** – Search ((children)) AND ((adolescents)) OR ((teenagers)) AND ((6 -18 years old)) AND ((pit and fissure sealant application)) OR ((pit and fissure sealant)) OR ((pit and fissure sealant treatment)) OR ((pit and fissure sealant intervention)) AND ((topical fluoride gels)) OR ((topical fluoride gel intervention)) AND ((prevention of dental caries)) OR ((caries prevention)) OR ((cariostatic)) OR ((cariostatic ability)) OR (( cariostatic action)) OR ((cariostatic activities)) OR ((cariostatic activity)) OR ((cariostatic agent)) OR ((cariostatic agents)) OR ((cariostatic potential)) OR ((cariostatic property)) OR ((cariostatic effect)) OR ((cariostatic efficacies)) OR ((cariostatic effects)) OR ((caries protective)) OR ((caries protective agent)) OR ((caries protective effect)) OR ((caries protective effects)).
A study aimed at evaluating fissure sealant applied to topical fluoride treated teeth found that there was no significant statistical difference was observed between the groups clinically or in vitro. The outcome was that topical fluoride application prior to acid etching does not have a deleterious effect on sealant retention. However, the limitation of this study necessitated further studies to examine the effect of using different types of fluoride on sealant retention before traditional practices are altered [28].

Another study included for assessment which aimed at determining the effectiveness of fissure sealants in child population at high risk of caries found that the application of occlusive fissure sealant in the first permanent molar of an infant high-risk population has a protective effect on dental caries. This study recommended that occlusive fissure sealant should be offered to all scholars because those without neither the preventive program nor occlusive fissure sealant had a significantly higher risk of caries [29].
Research that focused on determining the effect of topical fluorides on fissure sealants concluded that combine use of topical fluorides and sealants may cause deterioration of filled sealants and glass-ionomer sealant material, but not unfilled sealants and this study stated that in-vivo studies are needed to determine the effects of APF gel and Fluoride Varnishes on restorative materials [30].
It was found in another study that helioseal clear showed a better clinical behavior than Helioseal Fluoride regarding the retention to occlusal pits and fissure, marginal discoloration and presence of air bubbles in the material. This characteristic feature makes HC the material more suitable to the prevention of dental caries for recently erupted first molar. This paper emphasized on further studies about HF pit and fissure sealant as they are required to confirm or reject the hypothesis its injector tip diameter caused the formation of air bubbles that contributed to the negative results obtained with this material [31].
Another study revealed that Clinpro had the greatest fracture resistance, followed by Conseal F and Helioseal F. The limitation of this study included Minor errors occurred while impressions were being taken. Future studies comparing sealants after a longer post-application period with advanced evaluation techniques were suggested [32].
The glass ionomer PFS exhibited highest anticariogenic efficacy in a randomized control trial [33].
As per the Oxford Level of Evidence 2016, it was two for split mouth designed study, 3 for prospective cohort study, 2 for In-vitro study, 3 for longitudinal study and 2 for Invitro and randomized control trials. Randomization was done for all studies. There were 50% of randomized control trials, 33% of invitro studies and 17% of studies with split mouth design. The allocation concealment and assessor blinding were not applicable for the included studies. The drop outs were described in all studies and the risk of bias was found to be low. Assessment for risk of bias as per minor criteria included no justification for sample, baseline comparisons with statements regarding inclusion as well as exclusion criteria with no method of error.

**DISCUSSION**

This review reveals existing published literature regarding comparatively evaluate the effectiveness between pit and fissure sealant and topical fluoride gel application among children and adolescents aged 6-18 years.
AzzaA.El-Housseiny *et al* [28] concluded that topical fluoride application prior to acid etching does not have a deleterious effect on sealant retention.
Tapias Ledesma MA *et al* [29] concluded that the application of occlusive fissure sealant in the first permanent molar of an infant high-risk population has a protective effect on dental caries.
BetülKargül *et al* [30] concluded that the surfaces of the specimens immersed APF gel showed more particle loss. Following treatment with APF gel, a honey comb appearance of a flat matrix was evident. Small particles totally eroded.
Tatiana Yuriko Kobayashi *et al* [31] concluded that the results of this study showed that HC has a better clinical behavior than HF regarding to the retention to occlusal pits and fissure, marginal discoloration and presence of air bubbles in the material. All these characteristics make the material more suitable to the prevention of dental caries for recently erupted first molar.
KristleeSabrin Fernandes *et al* [32] concluded that Clinpro had the greatest fracture resistance, followed by Conseal F and Helioseal F.
AR Prabhakar *et al* [33] concluded that the glass ionomer pit and fissure sealant exhibited highest anticariogenic efficacy and hence can be advocated as a means of preventing dental caries

**Report on quality of evidence looked upon**

There are many articles published on the effectiveness of pit and fissure sealants and topical fluoride gel, still longitudinal studies are not available. Studies with different study designs should also be conducted to study the effectiveness of pit and fissure sealants and topical fluoride gel. The level of evidence of these articles included in this review is of moderate quality.

**Summary**

The aim of the systematic review was to systematically access available literatures on the effectiveness between pit and fissure sealant and topical fluoride gel application among children and adolescents aged 6-18 years.

An electronic search was carried out on PubMed, Google Scholar, Cochrane, LILACS and Science Direct database for the articles which could be used for evaluating the oral health status among school going children, oral health literacy status among school teachers and oral health component in school syllabi.

Article search was narrowed upon the pre-stated inclusion and exclusion criteria. A total of 42 articles were included in the systematic review for detailed evaluation.

In the studies, the effects of topical fluoride and fissure sealant were analyzed, the commonly preferred between the two among dental professionals was determined and its efficacy when used with other dental material is detected.

Based on the findings of the study, it can be concluded that ionomer reinforced pit and fissure sealants are effective anticariogenic agents as they release fluoride with maximum retention potential.

## CONCLUSION

High prevalence of dental caries among school children necessitates the need for effective preventive programs. Creation of awareness regarding preventive dental materials among the community is essential to decrease the oral disease burden. Dentists should emphasize the importance of preventive dental treatments in comprehensive care and practice choosing the appropriate and effective materials. Glass ionomer reinforced pit and fissure sealants are effective anticariogenic agents as they release fluoride with maximum retention potential so that a high-risk population could be benefited of a protective effect from dental caries.

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