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Topical fluorides: Fight against caries

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Abstract

Dental caries is a public health issue that affects people all over the world. Untreated caries causes progressive tooth destruction, which is frequently accompanied by considerable pain, lowering one's quality of life. Fluoride use so as to reduce the causation of dental caries has been widespread since a long time which involves nearly six to eight decades. Especially in those people who have got the specific type of caries which involve their smooth surfaces only, can have topical fluorides applied at their site, not only smooth surface but also those cases which involves a tremendously increased amount of caries can also have their remedy in the form of application of topical fluorides. In this review we'll analyze the usage and variety of cases in which we can apply topical fluorides in a community and how this practice can help in treating several caries at a widespread level and thus this is how it helps in reduction not only at an individual but also at a community level.

Keywords: Topical fluorides, dental caries, dentition

1. Introduction

If we talk about caries in dentistry we know that this disease isn't caused by one factor but many other factors are involved and it is very common now a days and it lasts longer in people as it is irreversible in nature [1]. The main causative agent as per many studies is a category of streptococcus genus and the species is mutans. The main etiological factor is active because it leads to production of acids in oral microflora. Now a days from cost benefit's point of view, treating dental caries is not an effective option for every class of community [2]. Therefore instead of treating caries we can prevent caries with the help of various prevention methods and fluorides is one of them as it can be given in both the routes of administration i.e. by applying topically or by providing it through systemic route [3].

After several researches it was proven that the element of fluoride was a potent anticariogenic agent. Its mechanism lies by demineralizing the tooth surface against calcium ions and replacing it by its own element. And as it is playing the role of replacing along with substitution hence it is both a remineralizing as well as a demineralizing agent. During an acid challenge, hydroxyapatite is dissolved in a tooth tissue demineralization process, but when pH is restored more than 5.5 this mineral forms on the enamel surface (remineralization) [4, 5].

This elemental form of compound is a potent anticariogenic agent as it has got its mechanism administered by various methods ranging from topical application to systemic application. Fluoride as an element

not only causes remineralization or demineralization but also interferes with the production of acids as acids is produced by the cariogenic bacteria during glycolysis, fluoride interferes with this mechanism and stops the glycolysis and hence it brings a pause to the subsequent chain of etiology of dental caries hence we can say that it is a very potent anticariogenic agent [6].

The topical route of administration can be done by both the ways of having it administered by oneself as well by another professional person administering it. Several examples of topical administration include various forms of dentifrices and in the form of mouth rinses while on the other hand professional administration includes various types varnishes as well as gels and some types of foams. The concentration that is administered is minimally high in the latter [7].

Dental fluorosis can happen and can be severe depending on the fluoride exposure factors (dosage, time & duration) during the enamel forming process. As a result, there is little chance of developing dental fluorosis after expert fluoride application [8].

Fluoride mechanism

- Preventing the outermost layer of tooth to demineralize by affecting the margin where tooth and plaque are present, encouraging the remineralization of those lesion which have initiated in the process of demineralization, and decreasing the solubility of tooth enamel
- Increasing the outermost layer of enamel being mineralized again and then the procedure of continuation of lesions, this mechanism is followed by the acid getting onto the surface and then the fluoride element working on the enamel surface to minimize loss of several minerals present in tooth structure
- Fluoride as an element is highly reactive and it immediately reacts with calcium and phosphate present and leads to production of a compound fluorapatite which is formed only when pH is suitably high
- Fluoride improves this mineral gain and creates a substance that is more resistant to subsequent acid attack.
- Preventing bacteria that are cariogenic from producing the enzyme enolase. While to varying degrees, this happens with all formulations and dosages of topical fluoride [8, 9].

Self applied fluoride

I – Fluoride Dentifrices: Brushing is a crucial step in caries prevention because it disrupts the dental biofilm. Fluoridated toothpaste is the most widely used kind of self-applied fluoride around the world. The active agent was NaF which had been added to a conventional dentifrice containing dicalcium phosphate as the abrasive [10]. Brushing with fluoride toothpaste increases the fluoride concentration in saliva by 100 to 1,000 times. Within one to two hours, this concentration reaches its baseline. It has been suggested that giving children under the age of six dentifrices with low fluoride concentrations (1000 ppm) may lessen their exposure to fluoride and their risk of developing dental fluorosis. Brushing twice a day, when you get up and before you go to bed, is highly recommended for the vast majority of people [11, 12].

The main composition of this particular type of dentifrice has a variety of products which involves main components of a normal dentifrice as well, some of them are abrasives along with binding agents as well as surfactants and humectants and some flavoring agents in normal quantity. Since many years dentifrices have been a potential medium for preventing many oral diseases ranging from halitosis to caries and thus fluoride dentifrices also will fulfill the criteria of having cures or prevented not only caries but several other diseases as well in any age group they are recommended but their maximum potential of action would be seen only in younger age group as the dentition is in the growing stage. The only thing that needs to be considered while administering a fluoride dentifrice is to make sure that the fluoride concentration is below than normal as it might lead to toxicity in younger age group due to their low tolerance for this reactive element [13].

II – Fluoride Mouthrinses: Mouth rinse is a simple and effective method of self-application of fluoride. Fluoride mouth rinses are used to prevent dental cavities. The goal of

fluoride mouth rinse is to provide fluoride to intraoral regions that are prone to caries on a regular basis at relatively low concentrations [14]. Sodium fluoride is the most well-known fluoride component used in mouth rinse. Fluoride from mouth rinse is retained in dental plaque and saliva, preventing tooth decay. Fluoride mouthrinses may contain both APF and stannous fluoride. Fluoride mouthrinses are not recommended for young children since they can induce acute fluoride poisoning if swallowed [15]. Furthermore, these rinses have a harsh, metallic taste that patients dislike. Professional fluoride rinses are not suggested for the prevention of dental caries for all of these reasons, because more effective in-office fluoride solutions are readily available [16].

When we administer these mouthwashes in younger age group through various school oral health programs then because of the supervision they are somehow accepted as they are recommended under the guidance of authorities and along with children at times their parents also attend such programs, hence monitoring can be automatically rendered in such cases. These mouthwashes contain fluoride in the quantity of less than 500 ppm. These mouthwashes play a special role in those children who are mentally handicapped or are victimized and couldn't follow a routinely practice and because their oral cavity can't be cleaner as they couldn't apply a proper brushing technique then rather than asking them to follow a 2 min practice of brushing which involves several steps, giving a fluoride mouthwash would be the need of the hour in severe cases [17].

III – Fluoride Gels: Self applied fluoride gels have become available during recent years as an additional treatment modality for the prevention and control of dental caries. Acidulated phosphate fluoride with 1.23% fluoride ion and 2% sodium fluoride with 0.90% fluoride ion are the most often used fluoride gels. Fluoride gels can be applied with brushes or in a tray. [16] Fluoride gel products include neutral sodium fluoride, acidulated phosphate fluoride, and stannous fluoride with fluoride concentrations of 5000 ppm and 1000 ppm, respectively. The stannous fluorides products are commonly referred to as gels, however they are actually glycerine-based solutions. Self-application can be done once a day or more. Fluoride gels at home are not suggested for children under the age of six [18].

There is a specific way for usage of these gels and until all the measures are followed they can't be effective hence some of them are written as follows (including self application)

1. We should recommend fluoride gels only in those areas or those communities where we could possibly see that their water supply has very low fluoride content and there is no other source for water quality to be improved.
2. While applying the method of custom tray or when using in this particular form of a gel then the parents should monitor and they should make sure that their child is getting the amount required and by making sure that the amount is smaller than the size of a pea while using them on their own in respective cases.
3. While doing brushing no child should be left unsupervised, either a parent or a practitioner should be there.
4. While applying tray method there should be focus on the point that no more than regular amount is used as it might lead to toxicity. Also the duration shouldn't be more than 3-4 minutes. Pre advice of not swallowing the particles should be given. And right after procedure complete expectoration should be allowed irrespective of type of

administration. Until half an hour is passed no activity should be carried out related to mouth. Protocols allow for proper administration right before the child goes to sleep.

5. If we are carrying any of these procedures in children who are less than 5 years should have proper monitoring done at every stage.
6. A practitioner should make sure that these practices are completed in the least amount of time and should make sure that the patient is advised regarding discontinuation of usage or the continuation timely^[19, 20].

Professionally APPLIED FLUORIDES

I – Fluoride Varnishes: Varnish is a highly concentrated type of fluoride that dental experts apply to the tooth surface. Fluoride varnishes that are commonly used are Duraphat, Fluor Protector, and Bifluoride.²¹ The suspension of fluoride's tenacious adherence to teeth is a major property of varnish.²² Varnishes are topically applied and deliver fluoride to the surface and beneath carious lesions by forming calcium fluoride deposits. Application of these varnishes must be done regularly and nearly two applications are considered vital if we want to prevent caries. If we talk about other countries then there this application has been already practiced in the form of an antiseptic especially in North America and Europe. They have a tendency to get dry faster and they retain in contact with the structure of tooth for a longer duration. There isn't any need of them to be cleaned at regular intervals and they aren't sensitive to moisture^[23].

Fluoride varnishes that are commonly used are:

Duraphat: The Food and Drug Administration (FDA) has approved its usage as a root desensitizer and cavity liner. Duraflor, the first fluoride varnish, is a 5% NaF varnish that comes in 10 mL tubes. To promote patient acceptance, it contains xylitol and bubblegum flavouring.

Fluor Protector: Flour protector is a fluoride-based protective varnish. The varnish spreads widely and quickly due to its characteristics. Dries rapidly and has good tooth adherence. Fluor Protector, unlike Duraphat, includes 0.7% fluoride in a polyurethane varnish and has acidic qualities.

Bifluoride: Bifluorid 10 is appropriate for fast remineralisation and fluoridation of dental materials. It also helps to avoid secondary caries.

Carex: Fluoride varnish with a low fluoride content but the same caries-prevention efficacy as duraphat.

II – Fluoride Foam: They find their usage quite frequent in dentistry but somehow they aren't much widely used in clinical applications as their efficiency is quite less in comparison with other routes of administration especially by gels^[24]. Availability of them ranges in the components of APF whose concentration authorized is 1.23% and either APF or NaF can be administered in the concentration of 2%. When both of them were compared then it was seen that amount of fluoride released was same not the quantity taken to fill the tray wasn't the same. Gels showed that it took a less amount but it was equally effective at a minimal concentration so the side effect of indigestion is less frequent in administration of gels making it more effective than foams. The kind of trays used are sponge lined and duration of upto 5 minutes is involved and this is followed by applying fluoride powder^[25].

An additional advantage associated with it is by applying it topically we can have the product in less than 1/5th of the normal amount we take for other applications^[26].

III – Fluoride Prophylactic Paste: While any treatment adjunct to preventing caries is given while administering oral prophylaxis then we can recommend a paste to the patient for regular usage which involves fluoride. Right after treatment the prognosis will be good and it will lead to a better structure of the tooth by having fluoride in the enamel layer making it more strong and more resistant to caries.²⁷ If we talk about the composition of such pastes they are more or less similar to the normal dentifrices recommended but the main aim being rendering strength to the enamel and recovering the loss of the layer with the absence being fulfilled by administering fluoride in form of toothpaste. A drawback that is witnessed is that at times more than regular usage can lead to the surface being abraded and rough so it should be used cautiously^[28].

Fluoride toxicity

When proper monitoring is not done or when proper dosages aren't given then those children who take dosages at a frequent level face various disadvantages and also those who take fluoride supplements at a dosage which isn't monitored by any other dentist^[29]. Any dosage which exceeds normal dosage of 4mg per kg of body weight is extremely toxic for all the age groups and especially for the younger ones as their body couldn't metabolize it and it may present as an oral manifestation in the form of enamel disorders. A dosage that is considered way beyond toxic/dangerous ranges between 7-20 mg/kg body weight and must be immediately monitored^[30]. If any dentist is prescribing supplements based on composition of elements of sodium and fluorine as NaF then that dentist should make sure that those supplements are discontinued after the duration of 4 months has passed. Any administration shouldn't be done in the absence of the parents of children and while at home those children should never be given an access to any of fluoride supplements as they might ingest them leading to unnecessary toxicity^[31].

Conclusion

The fluoride and its application has long term benefits and some associated risks along with it. The main mechanism which makes it a potent anticariogenic agent is that it gets attached with the outermost layer of our tooth structure. Enamel once formed can't be altered hence only an element or more appropriately a reactive element can bind to the outermost layer and make it anticariogenic in structure. Also when it comes to giving fluoride or administering it, applying it the best usage can be done at administering it at a younger stage but while administration dosage should be kept in mind as toxicity of this element has several drawbacks as well. The dosage that should be administered should be in the required dosage protocols provided by the authorized agencies. Currently its value lies under concentration of 1000 ppm for younger age group. This administration can be coupled with recommending fluoridated supplements in forms of paste, gels, foams. We can also provide several mouthrinses for a better prognosis

Conflict of Interest

Not available

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Not available

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