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BROCCOLI AND ITS ANTI CARIOGENIC EFFECT- REVIEW

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ABSTRACT:

Dental caries is considered to be a global burden. Apart from the regular usage of fluoride and maintaining good oral hygiene, one of the most important prophylactic approaches against the occurrence of caries is the sealing of pits and fissures. However, the rapid progress as a pit and fissure sealant in the market and application for sealing it has made its usage in atraumatic restoration. Broccoli is considered to be a cruciferous vegetable. It is a good source for fibres, vitamin C, vitamin K, iron etc. It has a good antibacterial and antioxidant activity. Thus, antibacterial property disables pathogens to invade the caries formation in pits and fissure areas. Application of broccoli extract as the pits and fissure sealants manufacturing will enhance the longevity of the material and hence it can be used as a permanent restorative material. Certain compounds like sulforaphane are extensively studied plant compounds in broccoli which protects against various types of cancer.

All the articles were collected from various search engines like PubMed, google scholar etc. The articles were based on the review topic. More than 30 articles were used for the review.

The conclusion states that the addition of broccoli in the dental sealant (pit to fissure sealant) will enhance their antimicrobial nature. Thus, these sealants can be used as a permanent restorative material. This review aims to assess the beneficiary effect of broccoli in case of pit and fissure sealants.

INTRODUCTION

The decay of teeth occurs when there is a breakdown of teeth due to acid attack made by the bacteria present in the oral cavity which is known as dental caries [1]. The cavities may be present in a varied range of colors from yellow to black (depending on the extent of caries)[2]. Dental caries reached its climax in the 19th and 20th centuries due to the increased availability of sugar for the general population of various developed countries[3]. Only with the extensive use of fluorides in the 1970s did the rapid rise of the disease of dental hard tissue begin to diminish[4]. Nevertheless, dental caries is considered to be one of the most common diseases, with serious consequences for both the individual and for the public in terms of medical, social and economic concern[5]. The individual patient suffers from pain, dysfunction of the oral system, difficulty in eating, and reduced quality life[6]. Thus, a middle class patient has to bear the cost of treatment, which has led dental caries to be an important global health burden[7].

A pit is considered to be a small depression on the surface of the tooth, whereas fissures are the grooves that naturally occur in all biting surfaces of teeth. Most of the time, the posteriorly placed teeth like premolars and molars have most grooves, however the teeth at the front (incisors and canines) can also have pits and fissures [8].

Dental sealants (also known as pits and fissure sealants/ simply fissure sealants) is a dental treatment intended to prevent tooth decay. The posterior teeth have fissures (grooves) and some anterior teeth have cingulum. Fissure sealants are a safe and painless way of protecting children's teeth from tooth decay. These sealants are widely used in case of Atraumatic Restoration in case of Public Health Dentistry. This is possible because of its ease in application without my cavity preparation.It is a plastic coating which covers the chewing surfaces of the back adult teeth or the posterior teeth. The pit and fissure sealant forms a thick hard shield on the surface of the tooth, that keeps food and bacteria from getting into any tiny grooves[9].

Unfortunately, caries predominantly attack the occlusal (pits and fissure) surface of premolars and molars after their eruption[10]. On the other hand, smooth surface caries have shown a significant decline in its occurrence, likely a result of increased world wide access to fluoride[11]. The presence of narrow and deep fissures on the occlusal surfaces are considered to be the zone area for increased caries susceptibility[12]. A more obvious explanation could be the dental plaque can start maturing inside the pits and fissures of teeth in eruption; as a result; enamel will be dissolved by the unimpeded repeated acid attacks, accelerating the slow growth for caries formation[13]. This is also the reason which explains why fluorides are not effective in pits and fissure systems as smooth surfaces. Fluorides are effectively used to inhibit demineralization, promote remineralization of the tooth. This helps in prevention from recurrent acid formation. Bacteria during tooth eruption

inside the oral cavity, natural cleaning mechanisms through the tongue, lips and cheeks during chewing and swallowing are absent.
Broccoli is a green cruciferous vegetable that belongs to the cabbage family. It is a good source for vitamin C and K thereby, building up the collagen fibers which form body tissue and bones. Broccoli is considered to have good antioxidant and antibacterial properties, thus adding the broccoli extract at the time of manufacturing to the pit and fissure sealant will enhance its life span. The antibacterial property will prevent from pathogenic attack inside the oral cavity and enable the pit and fissure sealant to be used as a permanent restoration.

MATERIALS AND METHODS

All the articles collected have complete relevance to the topic, that is the role of broccoli in pits and fissure sealant. They have been collected from search engines such as PubMed, Google Scholar, Elsvier etc. All the articles collected had information about pit and fissure sealing, different types of fissures, caries formation, caries prevention, broccoli based pits and fissure sealant, antibacterial effect of broccoli, drawbacks of broccoli etc. All the articles which were irrelevant to the topic were excluded from the list. The results for this review article are based on previous studies done by other esteemed and honoured authors and journals.

DENTAL CARIES

Dental caries in the pit and fissure of the posterior teeth are diagnosed adequately with the help of intraoral radiographs rather than CBCT(Cone-beam Computed Tomography)[14]. Caries can also occur due to trauma to the tooth[15]. Pit and fissure sealants are being disinfected with the help of chlorhexidine solution. Various herbal disinfectants like that of neem and tulsi are also popularly preferred[16][17] .
Veneers are also used for protection from caries. They are thin coverings which are placed over the anterior (visible) part of the tooth in the oral cavity. [18]
Tooth decay has become a very common issue on a worldwide scale as people from all ages get it as the tooth starts erupting in the oral cavity. Young children are at greater risk for “early childhood caries”, also termed as baby bottle tooth decay[19].
In case of adults, they experience receding gums, This allows decay process-causing bacteria in the mouth to come into contact with the tooth's root, they can invade inside and expose the root surface of the tooth[20][21]. The small enamel caries are placed under a well- mineralized surface layer. It has four histological zones, the translucent zone, the dark zone, the body of the lesson and the surface zone. This was described for the first time by LM Silverstone. Figure 1 and figure 2 illustrate these zones.

CAUSES

Dental caries are caused by the action of aids on the enamel surface of a tooth[22]. The acid is produced when sugars (mainly sucrose) in foods or drinks react with these bacterias present in the dental biofilm (plaque) on the tooth surface. The acid produced leads to a loss of calcium and phosphate from the enamel. This process is termed as demineralization.

SALIVA AND ITS MECHANISM

Saliva acts to dilute and neutralize the acid which initiates the decay, thus it causes demineralisation and is an important natural defence against caries[23]. Aside from buffering plaque acids and halting the demineralisation of enamel, saliva provides a reservoir of minerals adjacent to the enamel which it can remineralise and heal "come the acids have been neutralised. It is when the balance between remineralization and demineralization is upset and demineralisation exceeds remineralisation that carries progresses.

When the process of demineralisation occurs frequently and exceeds remineralisation over many months, the initiation of breakdown of the enamel surface starts which leads to a cavity[24]. Cavities, even in children who do not have their permanent teeth, have certain serious lasting complications like pain, tooth abscess, tooth loss, broken teeth, chewing problems, inflammation and serious infection[25][26].

TREATMENT

If caries involves the pits and fissure groove then, a spoon excavator is used to scoop out the caries. After this procedure pit and fissure sealant is used for the application on those fissures. In case of deep caries the decay is cleaned, cavity prepared, followed by restoration [27]. Extensive tooth decay may necessitate for a crown, root canal treatment or even extraction of the decayed tooth[28][29]. The treatment of carious teeth ranges from a minimal restoration and it can get complicated when elaborate procedures such as root canal treatment is undertaken to save the tooth which has its own procedural difficulties[30][31][32]. So the best and easiest mode of treatment is prevention of caries for which pits and fissure sealant comes handy.

PITS AND FISSURE SEALANT

Among children, tooth decay occurs most commonly on pits and fissures of posterior teeth. Pits and Future sealants are considered to be safe and effective ways to prevent dental caries on these venerable surfaces. These dental sealants are recommended for high caries risk children and should be applied as soon as the posterior teeth are efficiently erupted to allow sealing. They are being used for high caries and risk children. These sealants can also be used by the adults[33]. Pits and fissure sealants create a thin barrier preventing the access of plaque and plaque acids to the enamel surface. Other than the use of broccoli different researchers have come up with certain new technologies of sealing the pit and fissure of the occlusal surface. Resin based fissure cements are widely used in the market because of its dimensional stability and longevity[34][35].

DEFINITIONS-

PIT-

A small pin point depression located at the definition of developmental grooves or at the terminals of those grooves[36].

FISSURES –

A deep left between adjoining cusps that provides areas of retention of caries producing agents.

TYPES OF FISSURES-

Occlusal fissures are classified into five types U, V, Y, I and IK based on fissure morphology. Among these types the shallow wide V as well as U shaped fissures tend to have the self cleansing ability and are somewhat caries resistant. The deep narrow I and IK Shaped fissures are prone to caries[37]. This is being illustrated in figure 3.

PIT AND FISSURE SEALANT

Pits and fissures which occur on the occlusal surfaces (molars and premolars) are occluded by the application of fluid materials which are then polymerised.

CLASSIFICATION OF PIT AND FISSURE SEALANTS

These are classified on the basis of their generation. They are-

1. 1^{st} Generation-

It is being cured by UV light at 365 nm.
e.g.- Aiphaseal

2. 2^{nd} Generation –

It is being self-cured sealants
e.g.- Concise white sealant

3. 3^{rd}Generation –

They are cured by Blue -light at 400nm.

4. 4^{th}Generation-

These sealants have fluoride releasing property.

INDICATIONS-

1. Newly erupted primary molars and permanent bicuspids and molars[38].
2. Stained pit and fissures
3. No sign in dentin involvement
4. Tooth erupted less than four years ago.
5. Moderate caries risk individuals

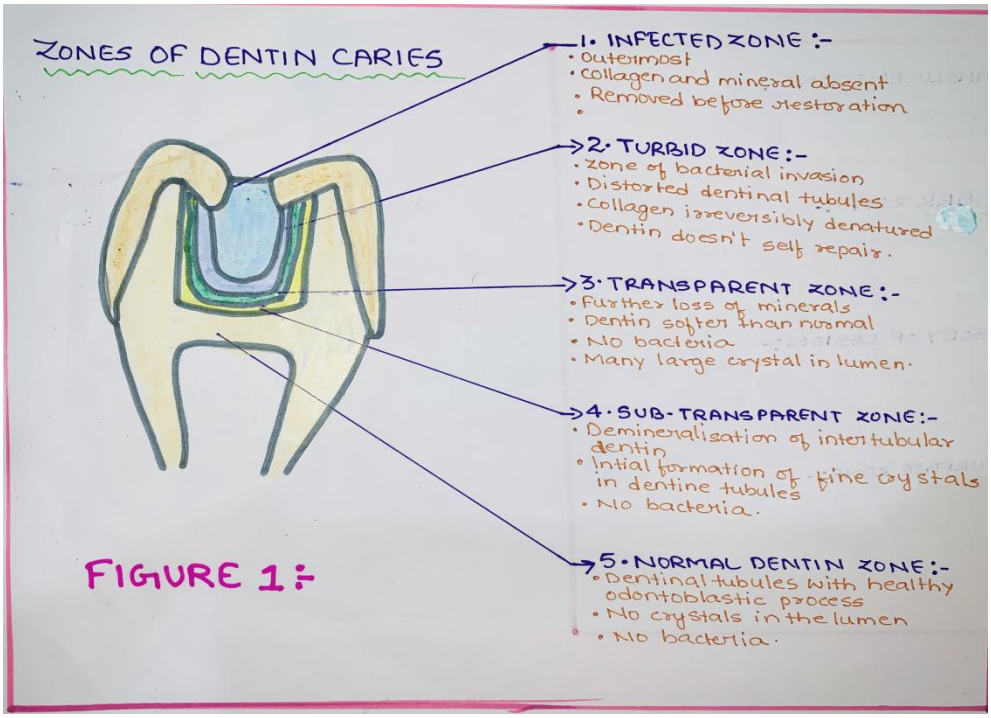

Figure 1: Zones of dentine caries, have five different zones namely- infected zone, turbid zone, transparent zone, sub-transparent zone and normal dentine zone.

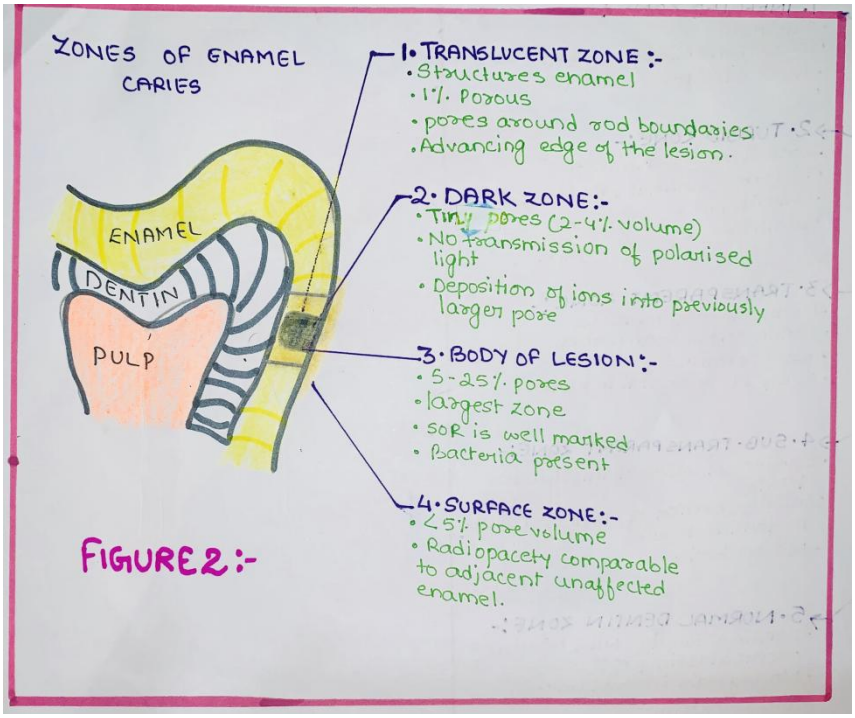

Figure 2: Zones of enamel caries, have four different zones namely- translucent zone, dark zone, body of lesion and surface zone

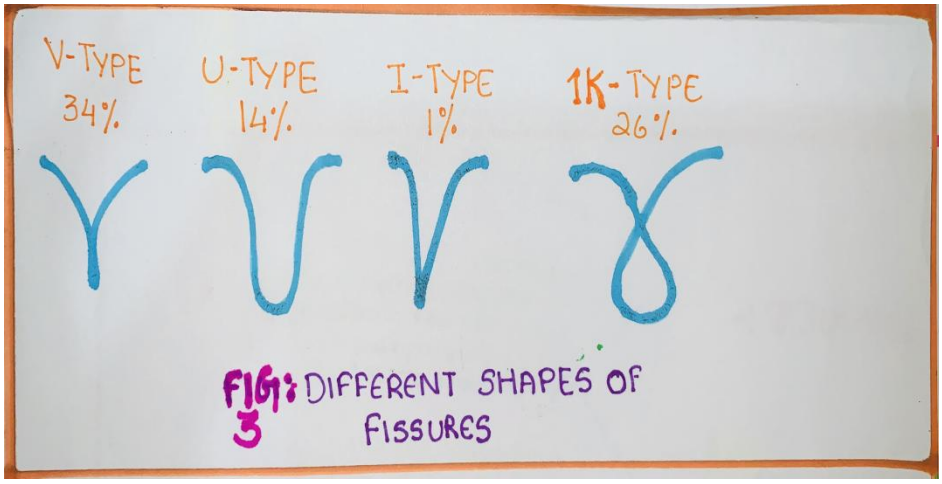

Figure 3: Different shapes of Fissures, includes V-type, U-type, I-type and IK-type.

BENEFITS / ANTIMICROBIAL ACTIVITY OF PTS AND FISSURE SEALANT

Sealants are considered to have the bactericidal as well as bacteriostatic effect from past decades in the beginning of its usage. Some of the sealants have this antibacterial effect against Streptococcus mutans. The lactobacillus, CONS species as well as Streptococcus resides in the oral cavity. streptococcus mutans initiates tooth decay. There are certain resin based sealants that are considered to be bactericidal. Usage of silver nitrate as a selants in the pits and fissure, provides good intention and prevents microleakage from them. Recent advancements are broccoli based sealants that not only provide good intention but also enhance the lifespan of the dental sealant by preventing bacterial growth.

BROCCOLI

Broccoli (Brassica oleracea) is a cruciferous vegetable related to cabbage, kale, cauliflower and Brussels [39]. These vegetables are known for their numerous beneficial health effects in the body. Broccoli is high in many nutrients, including fibre, Vitamin K, vitamin C, and potassium. It also boats more protein than most other vegetables. They are considered to have high glucosinatecontent present in them . Broccoli has different excellent properties like bacteriostatic as well as bactericidal. The application of this cruciferous vegetable Broccoli) to the pits and fissure sealant at the time of the sealant manufacturing will prevent the attack of bacteria to approximately 90% [40]. The usages of these kinds of herbal sealants are an increasing demand in the market. Due to its herbal composition, the presence of broccoli will also inhibit chemical exposure to the tooth surface. Thus, it enables to increase the lifespan of the restorative material and its prevention from bacteria like S. mutans. that initiate caries formation on the occlusal surface of the tooth.

BROCCOLI: Antimicrobial Nature in Pit and Fissures sealant

Broccoli has gained attention in the society because of its tremendous effect on patenting[41]. This is done because of the high concentrations of glucosinolates that shows a clearly positive effect in the most fatal disease-Cancer. Brassica oleracea is an edible green plant that belongs to the cabbage family. The vegetable has a large prominent flowering head and a bottom stalk. China is considered to be the top world producer for the vegetable broccoli, according to FAQ statics. Broccoli has a good antimicrobial effect, as it is very effective in prevention of colonization[42]. Due to its herbal characteristic, it presents the liberation of toxic chemicals which are hazardous to the human body. Thus, demolishing the growth of streptococcus mutans is seen by broccoli on the pits and fissure sealant. As a herbal product in the market these sealants well have greater efficacy. They (Broccoli) will prevent micro leakage from these sealants as will[43]. Thus its application along with the sealant will increase the lifespan of the restorative material.

OTHER ADVANTAGES OF BROCCOLI

There are numerous constituents in broccoli that add on to its health benefits. Sulforaphane is one of the most abundant and extensively studied plant compounds in broccoli. It prevents formation of cancerous cells. Indole -3-Carbinol is also present as a compound in broccoli that again prevents cancer[44]. Carotenoids are present in bulk. Compounds like lutein, zeaxanthin and beta carotene help in the betterment of eye related disso disorders. Kaempferol is an antioxidant present in broccoli with a large number of health benefits. They protect the body from heart diseases, cancer, inflammation and allergies. Blood pressure is also regulated by quercetin which is a constituent of broccoli. Broccoli can be synthesised from various nanoparticles (AuNPs) to treat certain fungal diseases[45]. Antioxidant Activity of oral broccoli consumption is related to an overall improved antioxidant status. Antioxidants are molecules that inhibit or neutralize cell damage which is being caused by certain free radicals. This enables reduced inflammation and an overall health-protective effect. The human system is considered to be very complex and requires certain nutrients to function efficiently. Vitamin C plays a role in both prevention and treatment of various illnesses and broccoli is overloaded with the same. It is also considered to be a good source of folate which is an essential nutrient for the development of the fetal brain and spinal cord. Therefore, broccoli is being recommended for pregnant womens.

GENERAL POTENTIAL DOWNSIDES OF BROCCOLI

1. Thyroid **problems-**

Broccoli is considered a goitrogen (a goiter causing agent). The high amount of broccoli in sensitive individuals may lead to thyroid problems[46].

2. Blood **Thinner-**

High Vitamin K interacts with the patient consuming warfarin and leads to problems in the later half.

3. Colour-

Colour of the sealant changes by the usage of broccoli at times. There are certain adverse actions like allergy due to Brassica oleracea

CONCLUSION

This review has assessed the properties of broccoli especially its antibacterial effect as compared to different cruciferous vegetables. The addition of Brassica Oleracea in the pit and fissure sealant will enhance their antimicrobial effect. Further research can be done by addition of broccoli extract in various toothpaste and mouthwash to regulate the bacterial count in the oral cavity. There should be development of newer generation pits and fissure sealant with better Curing ability as well as with longer life span. In addition to this elaborated articles on the usage of broccoli in the field of dentistry is required mostly.

AUTHORS CONTRIBUTION

AkanshaKishen has contributed for, execution of the work, data collection and drafting of manuscript. Dr. Jayalaksmi has contributed for, concept and design of the study, validation of the data collection, revision and proof-reading of the review. Dr. Muralidharan has contributed for, validation of the data collection, revision and proof-reading of the review.

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CONFLICTOF INTEREST

No potential conflict of interest relevant to this article was reported.

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