BLACK STAIN MANAGEMENT IN CHILDREN

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Abstract

Black stain (BS) is a form of extrinsic staining localized at the tooth enamel, following the contour of the gingiva, firmly attached to the tooth surface. This issue can affect the buccal and palatal surfaces of primary and permanent teeth. BS prevalence vary from 2% to 20%, and they are more frequent in children than in adults. The stains are usually difficult to remove because there is more calcium and phosphate content in the microbial biofilm as compared to simple dental plaque /1, 7/.

Etiology

In literature, BS microflora is dominated by chromogenic bacteria but the etiology is not completely understood. Chen et al. observed BS on the lingual surfaces of anterior and inferior teeth, in these areas the salivary secretion is greater quantity, which can lead to BS formation. The authors /Chen and al./ notice that the consumption of vegetables, fruits dairy products, eggs and soy sauce can play a role in BS formation /4/. On the other hand, Chen et al. found that children with a history of pneumonia or severe respiratory diseases had more BS on the teeth than those without ($p<0.001$). However, Durand and Sotomayor in their cross-sectional study, found no significant association between diet and the formation of BS ($p=0.406$) /4/. In one study, Zyla et al. found no relationship between oral hygiene,socioeconomic environment, age of the child and the formation of a chromogenic microbiota /4/.

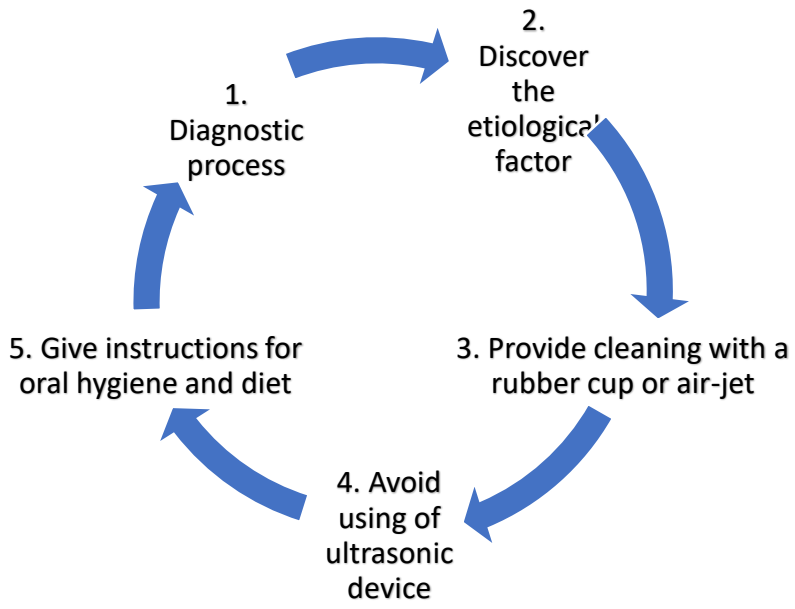
According to literature data, iron in drinking water, medicines that contain ferric salts, and frequent consumption of iron-rich food can be the main causes of BS. Hydrogen sulfide from chromogenic gram-positive bacteria from dental plaque has an important etiological role in BS formation because it chemically reacts with iron in the saliva /3/.

Management

The treatment of BS is difficult for dental practitioners because of the high quantity/proportion of calcium and phosphate in the biofilm. The BS is usually and hardly removed by professional prophylaxis and polishing. However, it tends to reappear within 30 days with this type of treatment. This fact makes manual toothbrushing impossible to remove the BS /4/.

A combination of simple scaling and polishing with pumice paste is often sufficient to remove the stain. Black stain deposited on pitted grooved areas can often prove extremely difficult to remove. However, overuse of the ultrasonic scaler should be avoided as this may lead to undesired micro- or macrodamages /7/.

Fig. 1 Diagram: Management of BS in children for general dental practitioners



Explanation of the diagram

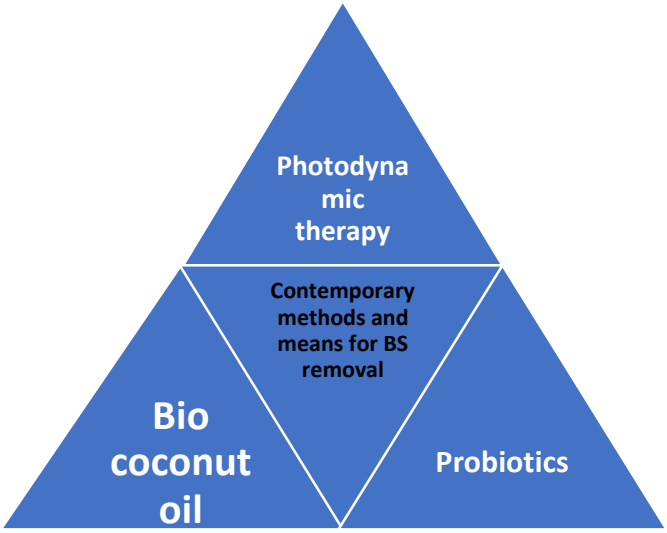
The first step of one successful treatment includes explaining the mechanism of BS formation to both the patient and parent as well as - asking about the different kinds of reasons to detect the etiological factors of the formation. Patients are often reassured, knowing the BS is not permanent and is in fact a common occurrence in the developing dentition. Particular advice should include instruction to avoid 'over scrubbing' the teeth when brushing, as this is unlikely to remove the stain and may cause abrasion cavities. Black stain can unfortunately commonly reoccur despite complete removal and patients should be advised this is a normal occurrence.

Selective polishing with a rubber cup and an abrasive paste, or air-jet polishing with powder removes these stains. It is preferable to avoid using ultrasonic devices.

The necessity of developing less invasive clinical procedures or methods is clear

A search was performed to summarize the evidence behind the contemporary means that can contribute to the effective treatment of extrinsic stains, including the use of photodynamic therapy for the elimination of pathogenic bacteria, oral probiotics providing a balanced microbiota, virgin coconut oil to kill Gram-positive and Gram-negative microorganisms whose cell membranes contain lipids, and their advantages and disadvantages to be discussed. In Bulgaria, there is no research on this topic.

Fig. 2 Diagram: Contemporary methods for BS removal



Photodynamic therapy

Photodynamic therapy (PDT) has demonstrated positive results in the treatment of several clinical pathologies through the photochemical reaction caused by the combination of a photosensitizer and a light source. PDT is an alternative therapy for the elimination of pathogenic bacteria for the treatment of periodontitis, peri-implantitis and other infections. Non-toxic photosensitisers can be preferentially located in certain tissues and subsequently activated by light of an appropriate wavelength to generate singlet oxygen and free radicals that are cytotoxic to cells of the target tissue. This is the operating principle of PDT. Oral bacteria seem to be susceptible to PDT in planktonic cultures and plaque scrapings /8/.

A study by Pessoa et al. shows the treatment of one patient with PDT, that consists of applying the same non-toxic photosensitizer (toluidine blue) to the tooth surface and then exposing it to light with a wavelength of 660 nm. This generates singlet oxygen and free radicals, which are cytotoxic to the target tissue, and reduce the number of microorganisms. After PDT, the remaining stains were removed with a Gracey curette and professional prophylaxis. This treatment was carried out once a week for 5 weeks, until the pigments had completely disappeared. The results showed no recurrence within 7 months. Moreover, after treatment, the authors noted a net reduction in the overall prevalence of bacteria (22%) /8/.

The main advantage of PDT is to cause bacterial killing which can reduce the microbial count 10-fold when toluidine blue or indocyanine green is used as a photosensitiser /8/.

The disadvantage of this method is a negative collateral effect reported by the patients is the development of postoperative hypersensitivity, probably related to the effect of enamel demineralisation by the laser, with toluidine application. To avoid this complication topical fluoride can be applied to the treated teeth for 1 min at postoperative follow-up /8/.

Probiotics

Probiotics are food supplements based on selected bacteria, they are a possible therapeutic strategy to recolonize oral microflora and replace the bacteria responsible for BS formation. The use of probiotics is an undeveloped strategy for the prevention and treatment of BS. The mechanism of action of traditional probiotics leads to the normalization of the oral bacterial flora and the modulation of the immune response. To conduct their effect in the oral cavity, probiotics must be able to resist environmental defense mechanisms, adhere to saliva-coated surfaces, and multiply to inhibit oral pathogens. They can make alterations to the ability of the pathogen to adhere or invade the host, they can modify the gene expression program of the pathogens in such a way as to inhibit

the expression of the virulent effect and the pH, the mucus layer, and other local factors. The action of probiotics is therefore based on the modifications of the bacteria present in the biofilm, interfering with the growth and development of biofilm and replacing microorganisms with beneficial bacteria thus preventing colonization by periodontal pathogens or BS-related bacteria through competition for nutrients or sites of adhesion. *Lactobacillus reuteri* is one of the most common probiotic food supplements used in dentistry, this sparked the interest of the authors to test if it can prevent or treat the patient with BS. The survival and resistance to environmental factors in the oral cavity of probiotics can be measured after they are exposed to saliva. Salivary proteins (lysozyme, lactoferrin, histatin, salivary peroxidase, and IgA) can influence the vitality of probiotics such as their adhesion to oral surfaces and metabolic activity /2,6/.

Advantages: They can be used as food supplement in the children's diet. The obtained results demonstrate a potent antagonistic ability of probiotics to reduce the growth of microorganisms associated with black tooth stains /6/.

Disadvantages: The side effects of probiotics are usually minor. The parents have busy schedules, however regularly intake is very important. Even though they may be rare, some of the children can have allergic reactions, like rash, itching, red or peeling skin. All drugs may cause side effects /6/.

Virgin coconut oil

Antibacterial agents may be derived from chemical compounds or natural ingredients, such as coconuts. Processed coconuts can be made into therapeutic compounds, including coconut oil or virgin coconut oil (VCO), because of the high content of lauric acid. This acid is a natural antibacterial agent that can kill cell membranes of microorganisms which contain lipid acids, such as Gram-positive or Gram-negative bacteria. The action of lauric acid enables it to penetrate the bacteria's cell membrane, damaging the phospholipid bilayers, and causing cell lysis /5,9/.

One experimental study determined the antibacterial effect of VCO on the microbiome, which cause Black stain in children, such as Actinomyces spp. The VCO made using the fermentation method is the agent included in this scientific work /9/.

Although the use of medicaments helps to treat various oral conditions, some of these have adverse effects. Due to this, there is a constant search for and use of natural resources to prevent disease and maintain oral health, especially in developing countries, where people use natural oils as oral rinses through a technique called "Oil Pulling". Generally, the practice involves putting a tablespoon or a teaspoon (for children 5 years and older) of coconut oil in the mouth before breakfast and swishing or holding the oil in the mouth for 3 to 20 minutes. When pulling is complete, the oil is spit out and the mouth is rinsed with warm water. One of the most commonly used oils in this technique is coconut (Cocus nucifera) oil which contains predominantly medium-chain saturated fatty acids that are metabolized more easily and quickly than long-chain fatty acids. Coconut oil contains 50% lauric acid which has antibacterial, antiviral and antiprotozoal properties /9/.

Advantages: VCO is a natural antibacterial agent with the ability to kill microorganismis whose cell membranes contain lipids. VCO significantly reduced the viability of chromogenic bacteria, such as Actinomyces spp. and Prevotella spp /5,9/.

Disadvantages: The side effects of VCO are very few. Daily intake is needed to achieve the effect, which is difficult for children. Moreover, the majority of youthful patients don't like the flavor of the VCO.

Conclusion

This issue can cause significant concerns for parents and can lead to low self – esteem issues in children.

The etiology of BS is not completely understood. However, it is essential to understand the nature of BS and know how to realize the correct management. BS can reappear but frequent professional care causes iatrogenic damage to the enamel. New clinical protocols can be applied as

options for therapy, but they are not completely evidence-based, due to the small number of research in this area.

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