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Case Report

Clinical approaches in management of black stains in children: A case report

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Abstract

Black stains represent extrinsic dental stains frequently observed in children and are caused by chromogenic bacteria. Though it is harmless, they can be of aesthetic concern and may require repeated treatment, presenting a challenge to both clinicians and parents. Notably, black stains have been associated with a lower caries risk, possibly due to its iron content and possess a stable oral microbiome. However, there is a tendency to recur frequently even after good prophylactic treatment. This case report presents the diagnosis, treatment and preventive management of recurrent black stains in children. Two siblings, a boy aged 13 years and a girl aged 10 years, came to the Department of Pediatric and Preventive Dentistry with a complaint of recurrent frequent black stains following previous oral prophylaxis taken three months prior. Treatment included extensive oral prophylaxis, polishing and the application of stain-removal toothpaste. The patients were recalled two months later to evaluate the outcome. This article discusses therapeutic approaches to removal of the black stains and the importance of recurrence prevention with personalized oral hygiene procedures as well as patient education. Other interventions such as dietary modification, prophylactic professional removal and the use of probiotic or antimicrobial agents can further enhance outcomes. An interdisciplinary, preventive approach is vital for long-term success in black stain control especially in children.

Keywords: Black stains, Chromogenic stains, Chromogenic bacteria, Stain removal in children, Prevention.

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1. Introduction

Tooth discoloration or dental dyschromia is a frequent disorder affecting individuals of any age.[1] A change in tooth color, tint or translucency caused by an external source is termed tooth discoloration. Children are predisposed to such altered tooth appearance, which is a normal clinical observation and is a cosmetic issue, as they are conscious about their appearance. Consequently, it plays a very important role in the personality and self-esteem of children. Tooth discolorations can vary in location, origin, appearance and composition. Tooth discolorations can be classified as external, intrinsic and internalized types based on their location.[2]

The phrase "intrinsic discoloration" is an alteration caused by a change in the thickness or structural composition of the dental hard tissues. It occurs when pigmented materials penetrate into the tooth structure, usually during the process of tooth development. Intrinsic tooth discolouration may be caused by developmental anomalies like amelogenesis and dentinogenesis imperfecta. Dental fluorosis, trauma and some drugs (e.g., minocycline and tetracycline) are also responsible for the intrinsic pigmentation of teeth.[1] Deposits and stains that form on the enamel surface or in the acquired pellicle are called extrinsic discolouration.[3] Consumption of tobacco products (smoking and smokeless), food, beverages (tea, coffee, etc.), medicinal materials (iron, iodine, herbal medicines, etc.) and restorative materials (amalgam) can be the other causes of stains.[4] The origin of the stain might be metallic or non-metallic.

One type of extrinsic staining of the teeth caused by specific bacteria that contain color is known as chromogenic staining. Teeth surfaces may become discolored from green to black, brown or orange due to bacterial components. The

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permanent and primary teeth have apparently been affected by such stains.[5] Black stain, exogenous, chromogenic or pediatric staining,[1] is one of the most familiar extrinsic discolorations. The black pigmentation has been postulated to be an insoluble ferric compound, probably ferric sulfide, which is formed as a result of interaction between iron and hydrogen sulfide produced by bacteria from the periodontium in the gingival fluid or saliva.[6]

Black stain is strongly adherent to the tooth surface and presents as a black line or as an incomplete coalescence of dark spots on the cervical third of the tooth, following the contour of the gingival border. It is more frequent in both genders and primarily occurs in the primary teeth.[2,7]

Owing to differences in lifestyle, diet and surroundings, the prevalence of black staining has been found to vary significantly, from 2.5% in Brazilian children aged between 3–5 years[7] to 20% in Swiss children between 7–15 years.[8] Black staining was also found to be 10.23% prevalent in children between 6 to 12 years in India.[9] Research conducted at Indian schools in Udaipur had found that overall, 18% of children had black stains. Compared to children without black stains (60.1%; DMFT 1.77 ± 1.87), the black stains group had a considerably decreased prevalence and experience of caries (45.1%; DMFT 1.12 ± 1.41).[10]

Children with black stains have been found to have less caries. Available literature has shown that the interaction between the microbiota of extrinsic stain, cariogenic bacteria and caries is still not known. Black stains were commonly seen in children aged 7–11 years. When compared to children with non-discolored plaque, children with black stains were seen to have a lower total caries experience. Compared to the non-discolored plaque, the black stains contained significantly fewer cariogenic bacteria, namely *Streptococcus mutans* and Lactobacillus species, as per this microbiological culture analysis. Actinomyces naeslundii, *Aggregatibacter actinomycetemcomitans* and *Fusobacterium nucleatum* were more common among the Indian population, indicating a positive correlation between black stain plaque and a low caries index.[11]

Black stains are classified in various parameters. The first classification was developed by Shourie in 1947[9] and it comprised three scores; 1. with no pigmentations; 2. Partial coalescence of pigmented spots, and 3. A continuous line of pigmented spots. In 2001, Koch et al. included a new criterion in the system: at least two teeth separate from each other with enamel cavitation should contain pigmented linear patches parallel to the gingival margin.[10] Gasparetto et al. also modified the classification in 2003 by including further requirements according to the extension of the damaged tooth's surface area. Black stains were classified by Gasparetto into three scores. Score 1: Pigmented spots or narrow lines parallel to the gingival border but not completely coalescing; score 2: Pigmented continuous lines covering only half of the cervical third of the tooth; and score 3: Pigmentation covering over half of the cervical third of the tooth. Zerman's classification of black stains relies on the connection between the scores identified in specific clinical situations and their correlation to various clinical problems, as well as the corresponding treatment approaches required. Score A: Pigmented patches or lines on the buccal surface that are longer. Score B: Both the lingual and buccal surfaces feature pigmented patches or lines. Score C: Pigmented lines or patches present. Score D: Repeated patches of lines of pigmentation.[12]

2. Case Presentation

A case was described in two siblings, a 13-year-old boy and a 10-year-old girl, who reported to the outpatient department of the Department of Pediatric and Preventive Dentistry, Yenepoya Dental College, Mangalore, with a chief complaint of repeated black pigmentation on their teeth. The parents reported that the same pigmentation had appeared about five months before, for which oral prophylaxis was done, but the pigmentation recurred afterward. The discoloration of the occlusal surfaces of the molars was assessed by visual inspection and probing with a dental explorer, which supported the pit and fissure caries without catch or softness. The lesions were inactive and non-progressive; hence no intervention (like caries indicator dye) was indicated. No other significant oral findings were present. Clinical diagnosis in both children yielded generalized black pigmentation on the middle to incisal third of the buccal and the cervical third of the palatal and lingual surfaces which correspond to Score 3 according to Gasparetto classification (**Figure 1**A & **Figure 3**A). Dietary history excluded the consumption of iron foods or supplements, and neither of the children presented with any unusual oral habits. Brushing was described as once a day. Treatment involved oral prophylaxis with an ultrasonic scaler and polishing with a rotary brush and prophylactic paste. The treatment session lasted approximately 45 minutes each, and all the pigmentations were successfully removed from the teeth (**Figure 1**B & **Figure 3**B). Post-procedure, the parents were educated regarding the probable etiology of the recurring stains and reassured regarding the benignity of the condition and the efficacy of the treatment protocol. Both children were instructed to apply commercially available anti-stain toothpaste Dente 91 toothpaste (Manufactured by ENAVANT RESEARCH LLP) twice a day to help reduce recurrence. Reduced recurrence of the stains at the three-month follow-up with Gasparetto classification Score 1 was noted, indicating a positive short-term outcome for the treatment regimen (**Figure 2**A & **Figure 4** A). Another session of oral prophylaxis using the same protocol followed during Session 1 was done for both the patients and will be followed up further on.

3. Discussion

There is a significant lack of evidence-based, standardized protocols in the available literature addressing specifically the management of chromogenic bacterial staining, especially in pediatric patients. The main clinical dilemma is the recurrence of stains within a few months after standard treatments due to their resistance to mechanical debridement and persistence in the oral biofilm environment.[6]

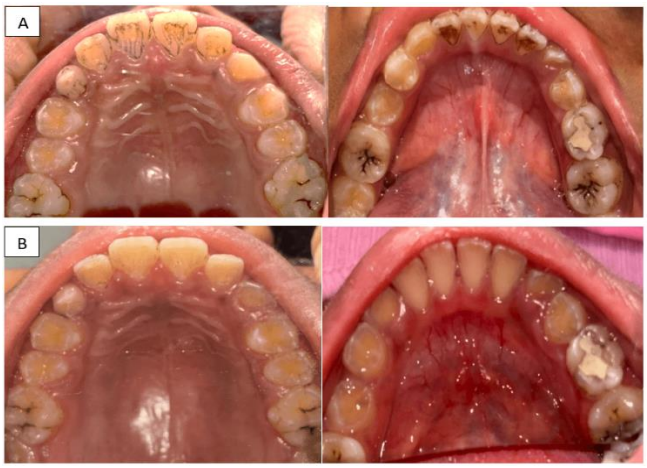

Figure 1: **A**): Pre prophylaxis pictures of 10 yrs old girl; **B)**: Post prophylaxis pictures of 10 yrs old girl

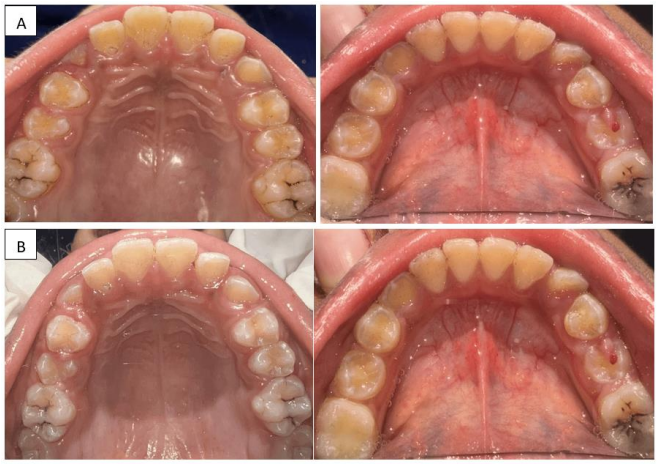

Figure 2: **A**): Three months follow up pre prophylaxis of 10 yrs; **B)**: Three months follow up post prophylaxis of 10 yrs old girl

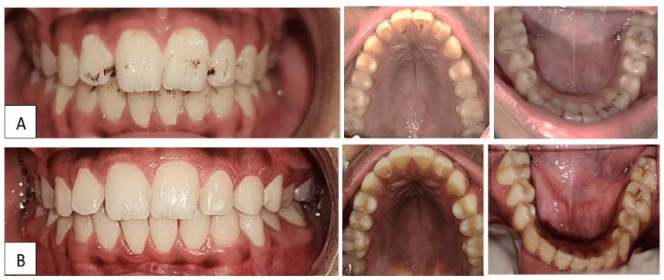

Figure 3: A): Pre prophylaxis pictures of 13 yrs old boy; **B):** Post prophylaxis pictures of 13 yrs old boy

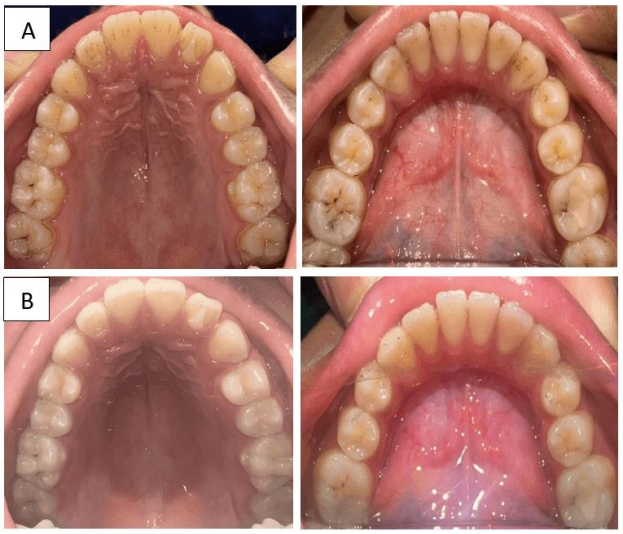

Figure 4: **A):** Three months follow up of 13 yrs old boy pre prophylaxis; **B**): Three months follow up of 13 yrs old boy post prophylaxis

In the present case, the two siblings were treated with professional oral cleaning employing ultrasonic scalers and polishing agents and later with the application of DENTE91 Anti-Stain toothpaste twice a day. The toothpaste was selected based on its multi-purpose ability to remove extrinsic stains and improve oral health. A recent paper documented that DENTE91 reduced stains by more than 63% within three days, in addition to enhanced tooth brightness and remineralization when compared to other available commercial brands. Important active ingredients consist of hydrated silica (mild abrasive facilitating mechanical stain removal), sodium hexametaphosphate (anti-stain ingredient that prevents pellicle formation), fluoride (stimulates remineralization), xylitol (has antibacterial action) and essential oils (broad-spectrum antimicrobial action). Its antimicrobial effectiveness against Streptococcus mutans and Candida albicans forms the basis of its promise in inhibiting plaque biofilm formation and chromogenic staining recurrence.[12]

Black stain management is holistic in nature. It is not just a professional endeavour, but also home care and diet modification effectively guided by caregivers. Patterns of diet and hygiene should be assessed by caregiver questionnaires that tended to disclose unsupervised brushing habits and heavy intake of high-sugar processed foods. Initial therapy includes mechanical removal of stains with polishing discs, cups, rubbers as well as ultrasonic scaling, and recording by photographic imaging for comparison during follow-up. Caregivers should be instructed in proper brushing, flossing and tongue cleaning. Nutritional guidance should consist of the avoidance of high-iron and simple sugar foods. Application of amorphous calcium phosphate mousse weekly at home is recommended to facilitate remineralization. A 15-day dietary diary can keep to determine food-related stain precipitants and to facilitate improved eating, especially for overweight patients. A return

visit after 15 days consists of examination of dietary logs, clinical re-check and plaque assessment.[11]

3.1. Recent advances in treatment modalities

Adjunctive and alternative treatment modalities are efficacious in literature. Air abrasion with aluminium oxide has been proven to have superior removal of stain and debris from hard-to-access locations with the least effect on bonding of the teeth.[13-15]

Photodynamic therapy (PDT), particularly when employing Indocyanine Green with 808 nm laser or Methylene Blue with 660 nm laser, has been able to successfully eliminate chromogenic bacteria and attain long-term remission of stain.[16]

Antimicrobial treatment with lactoferrin and lactoperoxidase acts on major pathogens by sequestering iron and interfering with microbial membranes, with encouraging results in the control of black stain-related microbiota like *Porphyromonas gingivalis* and *Prevotella intermedia*.[17,18]

Probiotics, and specifically *Lactobacillus reuteri* and *Streptococcus salivarius* M18, have been found to prevent the inhibition of hydrogen sulfide-producing chromogenic bacteria. Clinical trials have shown decreased recurrence of staining within 2–3 months when using probiotics, confirming use in preventive treatments.[19,20]

Nano-hydroxyapatite (n-HAP) with its anti-adherent characteristics and remineralizing ability assists with the recovery of enamel integrity and can inhibit chromogenic bacteria attachment without changing oral microbiota in general.[21,22]

Finally, ozone therapy, being bactericidal and remineralizing in action, has presented itself as a minimally invasive adjuvant treatment. It inhibits bacterial membranes and promotes repair of enamel, holding possible advantages in treating chromogenic stains.[23,24]

4. Conclusion

Black stains in children, although not being harmful to health, can have a great psychological effect on both the patients and their families. A more holistic and multidisciplinary treatment strategy comprising professional debridement, behaviourally reinforced oral hygiene and supportive dietary counselling can be useful in obtaining optimal results in the pediatric population. With advances in preventive and therapeutic agents like antimicrobial agents, remineralizing products and new therapies like probiotics and photodynamic therapy, the promise to control and minimize recurrence is improving steadily. Ongoing research and clinical use of these agents are necessary to improve treatment results, facilitate long-term stain prevention, and ultimately enhance the quality of life of involved children.

5. Authors Contribution

Ashovardhini P S and Bharati Honnekeri conceived the idea, conducted the literature search and drafted the initial manuscript, as contributed to the critical analysis of the literature, interpretation of findings, and assisted in manuscript preparation. Sundeep Hegde K reviewed and revised the manuscript critically for important intellectual content and contributed to the final version. Sham S Bhat, Ajay Rao HT, and Sharan Sargod as mentors, provided critical guidance throughout the development of manuscript. They also contributed to the refinement of the article through comprehensive review, constructive suggestions and intellectual input that enhanced the clarity of the work. All authors read and approved the final manuscript for submission.

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None.

7. Conflict of Interest

None.

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