

Black staining: an overview for the general dental practitioner

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Key points

'Black stain' is a poorly understood form of tooth discolouration by dental professionals.

Its aetiology is not completely understood, although the black pigmentation is likely to be an insoluble ferric salt precipitate, produced by chromogenic bacteria.

Treatment should involve a combination of reassurance to the patient/parents, with a minimally invasive approach to remove staining, while avoiding iatrogenic damage.

Abstract

'Black stain' is a form of extrinsic staining affecting the buccal and palatal surfaces of primary and permanent teeth. It presents as an incomplete line of dark dots formed at the cervical third of the tooth, typically following the gingival margin and not extending to the proximal areas. There is no consensus on its prevalence, though it appears to vary between 2–20%, with an equal male and female distribution. Although the aetiology is not completely understood, its microflora is dominated by chromogenic bacteria, such as *actinomyces* and *prevotella melaninogenica*, and there appears to be a low incidence of caries in the presence of the stain. The cause of the dark pigmentation seems to be from iron deposits such as ferric sulphate, present due to a reaction with the products of bacterial metabolism. This paper aims to provide information on the diagnosis, aetiology and treatment considerations for black stain. A patient case report is also explored.

Introduction

Tooth discolouration is a common problem affecting patients, often causing aesthetic concerns. A particular poorly understood yet common type of extrinsic staining is known as black stain. Its characteristic appearance is of a black pigmentation which occurs along the cervical third of the buccal and/or lingual surfaces of teeth. Other names that have been used to describe black staining include: chromogenic or paediatric staining and exogenous tooth discolouration. Often found in paediatric patients, its perceived unsightly appearance can have a negative effect on a child's self-esteem.

There is no consensus in the literature as to the prevalence of chromogenic staining, with studies suggesting a prevalence of between 2–20%. A prevalence as high as 19.9% has been reported for school children from Switzerland (aged 7–15 years)¹ and as low as 2.5% for Brazilian children (aged 3–5 years).² Further studies suggest a prevalence range within these figures³ and there is no apparent sex predilection.^{4,5}

Aetiology

The aetiology of black stain is not entirely understood. Ultrasonic investigation suggests that this stain is due to a specific type of dental plaque with tendency to calcify.^{4,6} Its microbial composition is thought to consist of chromogenic bacteria, such as *actinomyces* and *prevotella melaninogenica*.^{3,7} The literature suggests a decreased caries prevalence in the presence of black staining.⁸ The nature of the black pigmentation is suggested to be a form of bacterial plaque with an insoluble ferric salt, most likely ferric sulphide, which is formed by

the reaction between the hydrogen sulphide produced by the bacteria and iron in the saliva or gingival exudate.⁴ It is perhaps for this reason that some studies suggest an increased prevalence in black stain with the consumption of particular vegetables, dairy products and fruits high in iron.⁹

Clinical features

Black staining is a specific type of extrinsic discolouration affecting the buccal and palatal/lingual⁵ surfaces of the teeth. Its characteristics are a non cavitated,¹⁰ incomplete line of dark dots formed at the cervical third of the tooth. It typically follows the gingival margin⁹ and does not extend to the proximal areas.⁴ Studies suggest the sites of highest prevalence are the lingual surfaces of the mandibular teeth. This is likely related to its close proximity to the mandibular salivary glands and the role of saliva in the aetiology of black staining.⁵ The clinical features of black staining are summarised in Box 1. Figure 1 shows a typical presentation of black staining in a paediatric patient.

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Fig. 1 Typical clinical presentation of black staining on a paediatric patient



Fig. 2 Illustrates the use of the black stain classification on a paediatric patient

Classification

Black stain can be classified based on the surface area of the tooth affected.³ As summarised in Box 2, score 1 corresponds to the presence of pigmented dots or thin lines with incomplete coalescence parallel to gingival margin; score 2 corresponds to continuous pigmented lines and limited to half of the cervical third of the tooth surface; and score 3 corresponds to the presence of pigmented stains extending beyond half of the cervical third.³ Figure 2 illustrates the use of this classification on a paediatric patient with black stain.

Another classification system suggested in the literature is as follows: score 1 corresponding to no line present; score 2 corresponding to an incomplete coalescence of pigmented spots; and score 3 corresponding to a continuous line formed by pigmented spots.¹¹ Although it is useful to have a classification system, its practical clinical benefit is questionable.

Differential diagnosis

Dental discolouration is a relatively common finding and its aetiology can be varied. When diagnosing black staining, a dentist

must consider the other possibilities of tooth discolouration. These can be subcategorised into extrinsic origin and intrinsic origin.

External tooth discolouration arises when chromogens (a term which refers to a colourless chemical compound that can be converted by chemical reaction into a compound which can be described as coloured) are deposited on the external surface of the tooth or its pellicle.¹² Black staining, as well as stains caused by the consumption of tea, coffee, smoking, poor oral hygiene and pharmaceuticals (such as a chlorhexidine mouth rinses and iron supplements) are all examples of a form of extrinsic staining.¹² In particular, the causes of similar discolourations include staining from tea or coffee (usually of a brown/black colour),¹² suboptimal oral hygiene (a yellow, brown or green colour)¹² and polyvalent metal salts and cationic antiseptics such chlorhexidine (often black or brown in colour).¹²

Intrinsic discolouration arises following a change to the internal structural composition or thickness of the enamel or dentine. Examples include amelogenesis imperfecta, dentinogenesis imperfecta and tetracycline staining.¹³ Internal staining is unlikely to be mistaken for black stain.

Box 1 Clinical features of black stain

- Black staining
- Dark pigmentation
- Incomplete 'dotted' line
- Buccal and lingual surfaces
- Parallel to gingival margin
- Cervical third of the tooth crown
- Highest prevalence site: lingual surfaces of mandibular anterior teeth
- Affects both primary and secondary dentition

Box 2 Black stain classification³

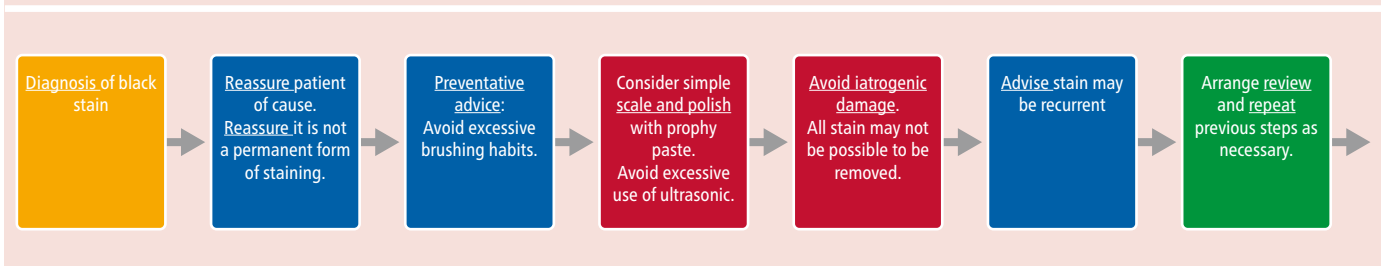
- Score 1: pigmented dots or thin line with incomplete coalescence parallel to the gingival margin
- Score 2: continuous pigmented lines and limited to half of the cervical third of the tooth surface
- Score 3: pigmented stains extending beyond half of the cervical third

It is important to differentiate between caries and black staining. Black staining is a deposit on the intact surface of the tooth and can therefore be removed through instrumentation or polishing. Caries, however, is an irreversible decalcification of the enamel or dentine. The characteristic dotted line, localised in a linear fashion to the gingival margin, aids in the differentiation between caries and black staining.¹⁰

Treatment options and treatment planning

The holistic treatment of black staining initially includes explaining the cause of the staining to both patient and guardian. Patients are often reassured, knowing the staining 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. A combination of a simple scale and polishing with pumice paste is often sufficient to remove the stain. Black staining deposited on the pitted grooved areas can often prove extremely difficult to remove. If stains are difficult to remove, a tissue can be used to 'blot' out the excess water from the pumice paste and the tooth dried to concentrate and take further advantage of its abrasive particles.¹⁰

Fig. 3 Flowchart to aid in treatment planning of black stain



Overuse of the ultrasonic scaler should be avoided as this may lead to undesired loss of enamel. Patients can be further reassured that its position close to the gingival margin means it is often concealed by the lip when at rest. Black staining can unfortunately commonly reoccur despite complete removal and patients should be advised this is a normal occurrence. The authors suggest a treatment flowchart (Fig. 3) that can aid in treatment planning. The flowchart cannot be fully evidence-based, given the small volume of research in this area and so it is based on the authors' experience.

Case report

The author (UJ) examined an interesting case of black staining, present in monozygotic (identical) twins, which was seen in primary care during his foundation training.

Two-year-old monozygotic twins of Malaysian ethnicity attended for their first dental examination. Their parents' main concern was the presence of 'a black discolouration' noticed on the dentition of just one of the twins (Fig. 4).

The black staining was noted by the parents to have been present since the teeth first erupted in the child with the staining, with no sign of its severity decreasing. The other child was reported to have never experienced staining of this nature.

Medical history for both children was unremarkable, with no history of previous childhood illness or medications. Dental history revealed a good oral hygiene regime with supervised brushing using a full-strength fluoride toothpaste twice a day.

An examination of the children's diet revealed a healthy balanced diet, with a considerable amount of fruits and vegetables. In particular, consisting of broccoli, sweetcorn, spinach, lettuce, tomato, blueberries, kiwi, apples, orange and grapes. Both twins had no significant differences in their diet.

Intra-oral examination revealed the presence of black staining in twin one, affecting

all of the primary teeth present (seen in Figures 1 and 2). Over 50% of the teeth affected scored 3; pigmented stains extending beyond half of the cervical third.

Discussion

The treatment plan consisted of reassuring the parents of the nature of the black staining and its likely short-term duration. Potential contributing factors were discussed, although importance of maintaining a balanced diet was emphasised. An acclimatisation period was agreed to ensure appropriate familiarisation of the dental environment before reassessing the severity of the staining and considering an attempt for its removal using prophy paste or ultrasonic scaling. The black staining was effectively removed.

A review, 12 months after initial presentation, revealed no changes in the presentation of the staining. An appointment to repeat a clinical examination was delayed due to the COVID-19 pandemic.

Black staining may reoccur soon after removal if the patient fails to follow oral hygiene instruction and diet advice. We would advise ideally reviewing the patient three months after initial treatment in order to ensure staining has

not returned and contributing factors have been controlled. Once it has been confirmed that the patient is able to effectively manage their black staining with diet and oral hygiene, a normal dental recall period based on dental examination can resume.

It is interesting to examine the presence of a black staining in just one of the monozygotic twins. The twins have almost identical genetic makeup and are influenced by similar environmental factors which may contribute to the presence of black staining, such as their diet and brushing regime. Both children's diet is rich in fruit and vegetables. In particular, those rich in iron, a potential contributing factor to black staining. It is worth noting that our history revealed similar dietary habits in both children, which perhaps would not explain the presence of staining in just one child and not the other, if diet was a significant contributing factor.

Conclusion

Black stain is a form of extrinsic stain and is a commonly occurring dental problem. Correct diagnosis of black stain is essential to ensure the appropriate advice is given and subsequent treatment for this extrinsic staining. It can



Fig. 4 Black stain seen on teeth of only one of two monozygotic twins (left)

often prove an aesthetic concern for the patient and simple procedures by the dentist can significantly improve a patient's self-esteem. Care must be taken by the clinician to avoid iatrogenic damage when attempting stain removal.

Ethics declaration

The authors declare no conflicts of interest.

Author contributions

Uzair Janjua contributed to project design and manuscript drafting. Gurpreet Bahia and Siobhan Barry contributed to manuscript drafting and refinement.

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