International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979; Impact Factor: RJIF 5.72
Received: 17-02-2019; Accepted: 21-03-2019
www.allsubjectjournal.com
Volume 6; Issue 4; April 2019; Page No. 146-148

Black stain: A case report

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Abstract
Black stain is a type of extrinsic discoloration of the tooth on the gingival margin. Black stain is hard to be wiped off by daily cleaning via toothbrushing, and tends to recurred after professional hygiene. The most effective therapies seem to be lactoferrin, diode laser, laser nd:YAG and phototherapy. A 50 years old female patient with good health condition came to our attention due to the recurrent presence of black stains on the surfaces of the teeth. We decided to carry out a laser therapy session, after placing the fluoride gel on the surfaces of the teeth, diode laser irradiation was performed with wavelength 970 nm, power of 1.5W and for a time of about 10 second for tooth. In addition, lactoferrin tablets were prescribed. The patient at the control after 60 days has had an important reduction of the black stains.

Keywords: black stain, oral microbiota, lactoferrin, diode laser, laser nd:YAG, phototherapy

1. Introduction
Black stain is a type of extrinsic discoloration of the tooth that it may be clinically diagnosed as pigmented, dark lines parallel to the gingival margin or as an incomplete coalescence of dark dots rarely extending beyond the cervical third of the crown [1].
It is common in pediatric subjects but can also occur in adults, regardless of gender.
Black stain is hard to be wiped off by daily cleaning via toothbrushing, and tends to recurred after professional hygiene, for this reason can cause an aesthetic problem for individuals.
It consists of ferric sulphides deposited on the surface of the teeth following the chemical reaction between the hydrogen sulfide produced by the anaerobic bacteria and the iron excess in the saliva [2]. Chromogenic bacteria are proposed as an etiological factor in the production of black pigment. Periodontal pathogens such as Porphyromonas gingivalis, Prevotella intermedia, and Prevotella nigrescens are reported to be black-pigmented anaerobes in oral cavity [3]. In addition, traditional bacteriological examinations are implicated Actinomycetes as the predominant cultivable microorganisms find in black stain, but as the results are not unanimous and only a few selected species are evaluated, the relationship between microorganisms and black stain remains uncertain [1].
In according with many studies dietary chromogens found in tea, coffee and other beverages (tannins) are possible aetiological agents and tobacco and chlorhexidine mouthrinses result in extrinsic staining by adsorption onto the tooth surface via plaque or the acquired pellicle [4]. However, metallic extrinsic discolouration may be associated with medicines that contain metal salts and with industrial exposure to iron, manganese and silver [5].
Most epidemiological studies worldwide find that children with black-stained teeth have lower caries prevalence or experiences [6]. In accoridng with the study of Henrich-Weltzien *et al*. children with BS have lower DMFT ($p = 0.013$), lower DT values ($p = 0.005$) and a tendency to lower caries prevalence ($p = 0.061$) than children with non-discoloured plaque [7]. With regard to therapy in literature there are few data, so having an effective therapy in the treatment of tooth pigmentation is still a challenge for dental hygienists and dentists because, even after professional hygiene, pigmentation tends to recurred. Infact, professional hygiene solves the aesthetic problems momentarily, but does not cure the causes of the formation of these pigments. The most effective therapies seem to be lactoferrin [8], diode laser [9], laser nd:YAG and phototherapy [10].

2. Case report
A 50 years old female patient with good health condition came to our attention due to the presence of black stains on the surfaces of the teeth (Fig.1). The patient had always performed the checks and the professional oral hygienes on a regular basis, but the black stains recurred after few months. We decided to carry out a laser therapy session, after placing the fluoride gel on the surfaces of the teeth, diode laser irradiation was performed with wavelenght 970 nm, power of 1.5W and for a time of about 10 second for tooth (Fig.2).
In addition, lactoferrin tablets were prescribed to the patient twice a day between meals for 60 days.

Fig 1: black stain on the surfaces of the teeth

Fig 2: diode laser irradiation

3. Results

The patient at the control after 60 days has had an important reduction of the black stains (Fig.3). The patient was advised to continue treatment with lactoferrin tablets for another four months, for a total of six months in addition with eletric toothbrush and a toothpaste with hydroxyapatite.

Fig 3: control after 60 days

4. Discussion

Tooth color is usually compromised by some discoloration or staining, either on an individual tooth or on all teeth, however, aesthetics and color of the teeth are reflection of systemic health. The stains can be divided into two types: intrinsic stains that are related to enamel and dentin properties and extrinsic stains that are associated to deposition of either food or beverage stains on the tooth surface (red wine, coffee, tea, Coca-Cola, red juices), poor tooth brushing techniques, smoking, dietary intake of tannin-rich foods (such as spinach, collard greens, broccoli and beet), excess use of chlorhexidine mouthwash, and/or consumption of metal salts [4]. This happens because all these substances have in their composition tannic acid, which denatures saliva proteins and leads to the formation of brown discolorations. As regard instead extrinsic tooth staining can be caused by compounds that are incorporated into the pellicle and produce a stain consequently to their basic color (chromogen), or those that lead to staining caused by chemical interaction at the tooth surface [4]. In according with Reid *et al*. brown and black pigmentation contains undissolved iron, probably iron-sulfide, which is formed by interaction of hydrogen-sulfide produced by bacteria from periodontal tissue and iron from saliva or gingival exudates [11].

Moreover is found a higher concentration of salivary lactoferrin, calcium and phophorus in the saliva of a patient with black extrinsic stains [11].

From the analysis performed in various studies many of these bacteria are non-culturable.

Li *et al*., [1]. used sequencing of the bacterial 16S rRNA gene to evaluate oral microbiota in children with and without black stain and found that Actinomyces, Cardiobacterium, Haemophilus, Corynebacterium, Tannerella and Treponema are more abundant in plaque samples of children with black stain, but patients with pigmentation have less S. mutans and lower saliva pH than patients without pigmentation [1].

The treatment of black stain is difficult, the classic removal of this pigments includes numerous methods such as whitening toothpastes, professional cleaning, polishing and micro-abrasion with abrasives and acids, but pigmentation tends to recurred. From what can be inferred by the scientific literature, the more effective treatments are lactoferrin, diode laser, laser nd:YAG and phototherapy.

In according with the study of Nakano *et al*. lactoferrin (LF) and lactoperoxidase (LPO) are antimicrobial proteins found in saliva; which can promote a shift from a highly diverse and Gram-negative-dominated to a Gram-positive-dominated community in the microbiota of supragingival plaque and tongue coating [8].

Another study of Bernardo *et al*. reports that application of phototherapy results in a reduction in area, color and bacterial colonization of black plaque in adults [10].

The literature is scarce at the moment and other studies will be necessary to deepen the topic.

5. Conclusions

What is clear from various studies is that tooth discoloration is influenced by many factors such as food or beverage stains on the tooth surface, poor tooth brushing techniques, smoking, dietary intake of tannin-rich foods, excess use of chlorhexidine mouthwash, and/or consumption of metal salts. Children with black-stained teeth have lower caries prevalence, for this reason many studies show that plaque-associated oral microbial communities could majorly contribute to the formation of pigment and caries in primary dentition and suggests potential clinical applications of monitoring oral microbiota as an indicator for disease diagnosis and prognosis.

The most effective treatments for black stain removal seem to be the use of lactoferrin and application of photothepay.

Futher studies with different methods of therapy and different population are required to deepen the topic.

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