Gingival melanosis: a review of diagnosis and treatment criteria

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Abstract

Hyperpigmentation of the gingiva is an aesthetic problem for patients with gingival exposure when smiling. The main gingival pigmentation occurs primarily physiologically as a response to trauma, chemicals and ultraviolet radiation. The aim of this study is to review the literature on the criteria for diagnosing and treating gingival pigmentation (melanosis). The author studied articles from the PubMed, EMBASE and SciELO databases from 2005 (January) to present (December 2018). The clinical criteria for diagnosis are based on the severity and extent of the pigmentation on the marginal and attached gingiva. In this way, gingival melanosis is more common at the attached gingiva level, with shades ranging from light chestnut to dark brown. In conclusion, all gingival depigmentation techniques are effective, the differences being cost, healing speed, comfort and degree of postoperative pain.

Keywords: oral pigmentation, melanin, hyperpigmentation, gingiva, MeSH NLM).

Introduction

“Gingiva” is an umbrella term that refers to the tissues that support the tooth [(1)]. It includes the protective gingiva (gum) and the attached gingiva (periodontal ligament, root cement, and the actual alveolar bone). Its main function is to attach the tooth to the bone tissue of the jaws, apart from maintaining the integrity of the surface of the occlusal mucosa [(2)].

One of the macroanatomical features of the gingiva is that healthy gum is usually coral-pink, color which varies depending on the degree of keratinization, the thickness of the gingiva, the degree of vascularization and the presence of melanocytic cells. The color may vary between light chestnut and dark brown.

The gingiva may be pigmented (making it darker) either physiologically or pathologically. The most common pigmentations affecting the protective gingiva are lesions of melanocytic origin, or melanocytic pigmentation (gingival melanosis), occurring due to an excessive deposition of melanin in the basal and suprabasal layers of the epithelium [(3)].

Clinical pigmentation caused by excess melanin is normal, but it is usually a cosmetic problem for some people, mainly those with short lips and high smile lines. On some occasions, gum color conditions impact the end result of an oral rehabilitation treatment, and it is here that the principles of mucogingival surgery can be applied to remove those melanocytic pigmentations and obtain better aesthetic outcomes. However, the clinician must carefully examine the features for the diagnosis and treatment of gingival melanosis. Thus, this review aims to analyze the main diagnostic and treatment considerations necessary to treat melanocytic pigmentations in the mouth; emphasis has been placed on the current and updated concepts obtained from the multiple sources of information consulted.

Method

The author searched for papers from the PubMed, EMBASE and SciELO databases from 2005 (January) to present (December 2018). The research was supplemented with a manual search of the lists of references of each paper selected. Additionally, we obtained papers published in the 1990s and 2000s, and we studied the most relevant ones along those twenty years. The following search words (key words) were selected: ((“Pigmentation disorders” [MeSH] or (“Disorders” and “pigmentation” [all fields]) or (“Melanin precursor” [MeSH] or (“Precursor” and “melanin” [all fields]) or (“surgery” [all fields]) or (“surgical procedures” [MeSH]) or (“oral mucosa”[MeSH]) or (“mucosa” and “oral” [all fields]) or (“Oral pigmentation ” [all fields]) or (“hyperpigmentation” [all fields]) or (“gum” [MeSH]) or (“gingival disease” [MeSH]) or (“disease” and “gingiva” [all fields]) or (“procedures” [all fields]) or (“surgical operating procedures” [all fields]) o (“melanosis” [all fields]) or (“gingival melanosis” [all fields])). A second search was conducted using health science descriptors (MeSH NLM): ((pigmentation disorders) or (pigmentation) or (skin pigmentation) or (melanosis)). These papers were selected to keep only those which best described the elements of this review. From an initial search of 150 papers, we analyzed 45 papers related to diagnostic and therapy criteria for gingival melanosis.

Development

Gingival melanosis

An alteration characterized by a change in the color of the gingiva, which becomes darker as a result of melanin accumulation. It is probably caused by a genetic condition, and Dummet [4]

suggests that the degree of pigmentation is relative, and that it depends on chemical, mechanical, and physical stimuli.

Gingival melanosis is more prevalent among dark-skinned people, the French, Filipinos, Arabs and Chinese people [5]. However, it has been found that it can appear in every social group [6]. It is more common in the anterior area of the mandible; in dark-skinned people it is even found in the palatal mucosa and the tongue [6]. In 27.5% of the cases it is present in the attached gingiva, the papilla gingiva, the gingival margin, and the alveolar mucosa [7]. According to another study, its prevalence is 60.24% [6]. Huaman [8] studied 130 patients and found a 30% prevalence of light chestnut melanosis, 40.8% of medium chestnut melanosis, and 28.4% of dark chestnut melanosis; 94.5% of the cases showed melanosis in the attached gingiva, and 5.4% in the marginal gingiva.

Diagnostic considerations

Clinically, gingival melanosis appears as dark stains in shades of black, brown, and dark brown, caused by excess melanin deposited on the keratinocytes and/or melanocytes in the basal layer of the epithelium [9].

The degree of pigmentation of the gingiva is usually similar to that of the skin [6], and it depends on melanocyte activity, the number of melanosomes, their degree of dispersion, and the range of degradation of the pigment [10].

Physiological pigmentation is usually symmetrical, persistent, and it does not alter the normal architecture of the gingiva. It is more frequent in women than in men [11]. Dummet [12] proposes a classification of the color of the melanosis: light chestnut, medium chestnut, and deep chestnut.

Gupta [13] organized the melanocytic stains according to a pigmentation pattern, in order to simplify the diagnosis (Table 1).

Table 1. Melanocytic pigmentation index according to Gupta

0: No clinical pigmentation
1: mild clinical pigmentation (light brown)
2: moderate clinical pigmentation (medium brown)
3: heavy clinical pigmentation (deep brown, blue-black tissue).

Gingival melanosis can appear in the shape of triangles or lines, or diffuse, and of different color, ranging from black, to dark and light brown. In 2017, the American Academy of Periodontology and the European Federation of Periodontology amended the 1999 classification of periodontal diseases, and proposed a new classification of periodontal and peri-implant diseases [14], according to which gingiva color alterations are diagnosed as "gingival pigmentations".

Table 2. Diagnosis of alterations in gingiva color based on the workshop held in 2017.

Gingival pigmentations
I. Melanoplakia
II. Smoker's melanosis
III. Drug-induced pigmentations
IV. Amalgam tattoo

Gingival pigmentations can be mistaken for premalignant or malignant lesions such as dysplastic nevi or melanoma [15]. However, the clinical examination must be thorough, and the patient's clinical history must be reviewed, as in some cultures, the custom of pigmenting

their gingivas with herbs and dyes begins in early childhood [16], and this does not correspond to a pathological state of the gingiva, for it is an exogenous form of pigmentation.

There are also systemic conditions that cause pigmentations in the oral cavity, such as the Albright syndrome, Peutz-Jeghers syndrome, neurofibromatosis, and Adisson's disease [17].

Other conditions similar to physiological melanosis are: smoker's melanosis and amalgam tattoos.

- **Smoker's melanosis**

Patients who are smokers produce more melanin to protect the epithelium from the thermal substances in cigarettes [18]; these patients usually have melanosis in the anterior area, which presents itself as single stains in the interdental papilla. Araki [19] states that smoker's melanosis depends on the number of cigarettes the individual smokes, and that it depends directly on the dosage. Axell [20] adds that there is more pigmentation in the first year as a smoker, and that it usually diminishes when the person stops smoking. Axell [20] also states that 21.5% of smokers have gingival melanosis.

According to Marakoğlu [21], smoking 5-9 cigarettes a day is enough for a melanocytic stain to appear. Hanioka [22] even found gingival melanosis in smokers' children, meaning that passive smokers have a predisposition to develop this kind of pigmentations. Sridharan [23] also found solitary pigmentations in the interdental papilla in children exposed to environmental tobacco smoke, and concluded that there is a correlation between the exposure to environmental tobacco smoke and gingival pigmentation. Hanioka [22] found a link between the exposure to environmental tobacco smoke and gingival pigmentation in children with a 5.6 odds ratio, as well as a prevalence of gingival melanosis in 71% of the children assessed; such a high prevalence is associated with the fact that they are passive smokers.

- **Amalgam tattoo**

Focal argyrosis or tattoos are lesions caused by the traumatic implantation of metal particles on soft tissue [23]. It is the most common exogenous cause of pigmentation, with a 0.4-0.8% frequency in clinical case type studies [24]. The reaction of the macrophages to the amalgam makes copper and zinc disappear quickly, while mercury and tin disappear slowly, but this is not the case with silver, which usually persists in the tissue [25-27].

Amalgam tattoos can happen when a restoration is removed, during endodontic treatment, or when penetrating the alveoli during tooth extraction [28].

Panoramic or periapical radiography is useful to observe the radiopacity of metals, but they are only visible in 25% of the cases as the particles tend to be very small [29-30].

Discussion

Many treatments have been proposed to remove melanocytic pigmentations, such as chemical agents (phenol 90% plus alcohol 95%), free grafts, abrasion with rotating or manual tools, cryosurgery with liquid nitrogen, gingivectomies, electrosurgery, and laser [15]. Many techniques have become obsolete given their many drawbacks, and others are used less and less. Chemical agents cause major thermal damage [31], free grafts are usually not aesthetic [32], rotating tools do not allow the clinician to control the depth of the de-epithelization, gingivectomy is usually linked to bone loss, and the depigmentation it creates is not permanent [33].

The term “melanocytic depigmentation” refers to a group of periodontal plastic surgery techniques used to reduce and remove pigmented gingiva [6]. One of the first techniques proposed is surgical depigmentation with scalpels, which removes the epithelial tissue leaving the connective tissue to heal by second intention.

The technique known as “mucoabrasion” was proposed by Pérez Fernández in 1977 [34], and consists in making an abrasion with a diamond bur until the melanocytic pigmentation has been removed or is no longer visible. It is a simple, quick technique, with low morbidity for the patient. It is advised to drill past the first bleeding to make sure that the basal layer of the epithelium has been reached [35]. This technique requires copious irrigation, and it has the disadvantage that it is not possible to control the depth of the de-epithelization [36].

Another technique consists in applying laser (an acronym for “Light Amplification by Stimulated Emission of Radiation”), which allows for a high concentration of energy in the area, and it allows for the removal of soft tissue by ablation, but it is not indicated on hard tissue due to its thermal effects [37]. Laser treatment is a very powerful tool to remove melanocytic stains, it only requires a topical anesthetic, it leaves no scars, it is a fast and simple technique with good results. It usually takes several sessions, and it requires great skill on the part of the operator [6].

Laser treatment causes less bleeding and it reduces postoperative pain [6]. It has the disadvantage that it causes thermal damage to the bone, for it can penetrate between 2 and 4 millimeters from the surface [38]. Er:YAG's laser has been proven to cause less thermal damage; its use must be based on maintaining homeostasis and reducing postoperative pain [6]. There is not enough evidence to indicate that using laser is better than using a scalpel for depigmentation procedures. The Nd:YAG laser has also had good results, showing a high affinity for melanine or dark pigments [39]. This laser does not require an anesthetic either, but it is recommended to assess each patient’s pain threshold to decide whether to use an anesthetic or not [3].

Furthermore, cryosurgery uses liquid nitrogen (-196°C) which is applied with soaked cotton wads, or directly on the tissue and left for 20-30 seconds to freeze the epithelium. The

epithelium then thaws spontaneously in one minute, necrotizes, and the area re-epithelializes in 3-4 weeks [40].

Most human tissues freeze at -2°C and there is cellular death below -20°C. Cryosurgery uses cryogens to cause cellular death in the epithelium [41]. Tetrafluoroethane (TFE) and liquid nitrogen are the most widely used cryogens. Shirazi et al. [42] evaluated the use of cryosurgery in 15 patients; they found good depigmentation results with a slight degree of recurrence, which was not significant at the end of a 24-month period post surgery. Signh et al. [41] compared cryosurgery with TFE versus laser diodes to remove melanocytic pigments, and they found a similar level of satisfaction among the 20 patients under study; after 18 months of control, the TFE showed less postoperative pain ($p<0.001$) and there was repigmentation in one case in each group.

In one case, Ahmed et al. [43] found good results without recurrence 30 months after the treatment with cryosurgery. They added that this technique leads to full regeneration and a sterile inflammatory reaction. Together with laser, it has been recognized for its high aesthetic effectiveness, as well as for the high level of patient satisfaction [41].

A combined technique has also been proposed, which is the combination of the de-epithelization of the basal layer of the attached gingiva with a Nº15 scalpel and the abrasion of the stains in the interdental papilla with fine-grain diamond burs [44].

Grados et al. [44] state the advantages of this technique: it is a relatively simple operative technique, it is performed in a relatively short operative time, it causes little bleeding, it provides comfort to the patients during and after the intervention, it does not require costly instruments or devices, and its results are satisfactory. In a clinical case series, Castro and Grados [45] found good aesthetic results two years after the application of this technique; they add that the repigmentation index is low at the end of the period assessed.

Conclusions

Gingival melanosis is not a pathological problem for most patients; it is a cosmetic problem for people with high smile lines and gingiva exposure. It appears in the form of pigmented lesions which range from light chestnut to dark brown, they are more prevalent in dark-skinned people, but they can be present in every social group. The main gingival depigmentation techniques include gingivectomy, mucoabrasion, laser, and cryosurgery. All of these techniques are effective to remove melanocytic stains, and the differences between them include the degree of postoperative pain, discomfort, cost, and postoperative complications.

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