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Review

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Oral pigmentations

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ABSTRACT

Gingival pigmentation refers to discoloration in the gingival tissues caused by the accumulation of endogenous or exogenous pigments. Endogenous pigmentations are related to the accumulation of pigments such as melanin, hemoglobin, hemosiderin, and carotene in the oral and gingival tissues. This group includes pigmentations resulting from physiological melanin accumulation as well as those associated with systemic diseases such as Addison's disease, Peutz-Jeghers syndrome, and neurofibromatosis. Exogenous pigmentations may be caused by factors such as amalgam tattoos, heavy metal exposure, and drug-induced discolorations. In the present review vascular lesions such as varicose veins and hemangiomas, as well as melanin-based lesions such as nevi and melanoma, are also included in the current review. Additionally, the process of pregnancy and other hormonal changes on pigmentation has been addressed. Correctly and clearly identifying the underlying cause of gingival pigmentation, which is a clinical condition, is of great importance for diagnosis, prognosis, and treatment planning. In the present study, gingival and oral mucosal pigmentations were comprehensively classified and evaluated based on their etiologies, clinical appearances, and histological features. It is aimed to contribute to the clinical diagnosis and differential diagnosis processes of various oral and particularly gingival pigmentations encountered by clinicians.

Keywords: Oral pigmentations, gingiva, melanin, pigmentation, hyperpigmentation

INTRODUCTION

The oral cavity is completely covered with mucosa, and the epithelium of the tongue is of endodermal origin, while that of the lips, cheeks, gingiva, vestibulum oris, palate, and floor of the mouth is of ectodermal origin.[1] The epithelium of movable parts such as the cheeks, inner part of the lips, ventral surface of the tongue, floor of the mouth, and soft palate is non-keratinized, while the epithelium of the dorsal surface of the tongue, hard palate, and gingiva is keratinized.[2]

Pigmentation of the oral mucosa can be described as a condition resulting from the accumulation of one or more pigments in the mucosa and the resulting change in color tone.[3] Melanocytes, which produce melanin pigment, are located in the basal layer of the mucosa. The color of mucosal pigmentation varies from brown to blue or black, depending on the depth of the pigment in the mucosa.[4]

Oral pigmentation can be physiological or pathological, endogenous or exogenous in origin. Endogenous pigmentation is seen in physiological causes or diseases (such as Addison's disease) and syndromes [such as Peutz-Jeghers syndrome (PJS)].[4] Hemoglobin, hemosiderin, and bilirubin are other pigments that cause endogenous pigmentation. Exogenous pigmentation can be caused by foreign substances containing tattoo pigment, amalgam filling material, pencil lead, and colored foods (such as liqueur, red wine, coffee, and tea).[4]

Pigmentation may occur after trauma and chronic inflammation. Smoking and the use of certain systemic medications can also cause oral pigmentation.[4]

Endogenous Pigmentation

Oral pigmentation can be exogenous or endogenous. Endogenous pigmentation is related to the accumulation of pigments such as melanin, hemoglobin, hemosiderin, and carotene in oral and gingival tissues.[5] The physiological discoloration in gingival tissue, which is part of the oral mucous membrane, is primarily due to the activity of non-keratinocytic melanocyte cells that produce melanin, an endogenous pigment. Pigmented lesions caused by increased melanin accumulation can be brown, blue, gray, or black, depending on the amount of melanin in the tissues and its location.[6]

Physiological pigmentation: Physiological pigmentation develops within the first decade of life, but it may only attract the patient's attention later on.[7] It is most commonly seen in people living in Africa, Asia, and the Mediterranean basin. The color can range from light brown to black. The color tone may increase with age, smoking, hormonal effects, or the effects of certain medications. In the oral mucosa, it most commonly appears as a bilateral, well-defined, dark brown, band-like stripe on the gums, leaving the marginal gingiva empty. It may also be localized on the cheek mucosa, palatal

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mucosa, lips, and tongue.[8] Pigmentation in areas other than the gums typically has irregular borders.[7] The diagnosis of physiological pigmentation is clinical, and no treatment is required.[9]

Pigmentation Associated with Systemic Diseases and Conditions

Addison's disease: Addison's disease is the result of insufficient aldosterone and cortisol production due to damage to the adrenal cortex.[10,11] Various conditions such as tuberculosis and neoplasms can cause Addison's disease, but the most common cause is autoimmune adrenalitis.[12] Addison's disease can affect all individuals regardless of gender and age. In response to insufficient corticosteroid levels, the pituitary gland synthesizes excessive adrenocorticotropic hormone (ACTH). An increase in ACTH leads to an increase in α-melanocyte-stimulating hormone, and these two hormones promote melanogenesis and mucocutaneous pigmentation.[10,13] Oral pigmentation appears earlier than skin bronzing.[10,14] Oral pigmentation associated with Addison's disease often manifests as blue-black linear or patchy discolorations on the buccal and palatal mucosa, particularly on the lips, tongue, and gums.[15] Due to the increased need for corticosteroids in stressful situations, it may be necessary to temporarily increase the dosage of medication prior to long-term medical or dental treatment.[13,14,16]

Peutz-Jeghers syndrome (PJS): It is a genetic disorder characterized by gastrointestinal polyps with a high probability of developing into rare malignancies.[15,17,18] Although it is more likely to occur at an early age, it can occur at any age. Women and men are affected equally. The characteristic pigmentation of the lips and perioral skin, resembling numerous dark freckles, is one of the most readily recognizable and apparent symptoms of PJS and typically appears during childhood or adolescence.[13,14,19] Oral and perioral pigmentation persists throughout life and does not require treatment. However, if the patient chooses cosmetic intervention, laser therapy may be applied.[20]

Albright syndrome: Albright syndrome is a syndrome characterized by milky coffee spots on the skin, early puberty, hyperthyroidism, pituitary adenoma, and hormonal abnormalities such as Cushing syndrome, along with polycystic fibrous dysplasia.[21] Hyperthyroidism may develop due to lesions in the thyroid gland, which can result in acromegaly. Oral pigmentation begins in the first months after birth and manifests itself as localized macules on the lips.[15,22]

Von Recklinghausen's neurofibromatosis: Neurofibromatosis is an autosomal dominant, multisystem disease that affects approximately 1 in 3,500 people.[23] The clinical manifestations of neurofibromatosis type 1 include neurofibromas, café-au-lait spots, skin freckles, skeletal abnormalities, Lisch nodules, and optic gliomas.[24,25] Oral neurofibromas are most commonly found on the tongue and rarely on the gums, jawbone, or floor of the mouth.[26]

Bilirubin pigmentation: Bilirubin is a breakdown product of hemoglobin and is an important marker for assessing health problems such as neonatal jaundice, liver cirrhosis, and hepatitis.[27,28] The liver normally metabolizes bilirubin and excretes it from the body. In diseases such as cirrhosis, hepatitis, or pancreatic cancer, the liver cannot clear this waste product. Bilirubin tends to bind to elastin fibers, and this yellowish-orange bilirubin tends to accumulate intraorally along the soft palate and floor of the mouth near the lingual frenulum.[29]

Gender hormones and pregnancy: The effect of pregnancy on oral tissues has been proven in numerous clinical studies. During this process, due to varying hormonal changes, gum tissue becomes more sensitive to inflammation. It is known that the incidence of gingivitis in pregnant individuals is 25-100%, and the incidence of pyogenic granuloma is 10%.[30,31]

During pregnancy, estrogen and progesterone hormones also cause an increase in saliva levels. Estrogen has been reported to increase plaque on tooth surfaces, be effective against certain microorganisms, affect salivary peroxidases, influence collagen metabolism, and reduce gingival keratinization, thereby decreasing the epithelial barrier function.[32] Progesterone, on the other hand, has been found to increase the levels of prostaglandins (PGE1-PGE2) with proinflammatory effects in gingival pocket fluid, negatively affect the metabolism of periodontal ligament fibroblasts, thereby reducing glycosaminoglycan synthesis, increase vascular permeability, thereby increasing the likelihood of bleeding, and consequently cause a hyperemic appearance.[33]

Melanocytic nevi result from the proliferation of melanocytes that gather in specific areas and produce higher melanin density in that region. Although the molecular pathways are not well understood, it is believed that the new hormonal environment stimulates melanocytes to produce more melanin and potentially causes excessive pigmentation in the skin. Melasma, also known as the "pregnancy mask" or chloasma, refers to irregular hyperpigmented patches on the face.[34] Melasma tends to develop in the second half of pregnancy and is reported to affect 50-70% of pregnant women, disproportionately affecting those with darker skin tones.[35] Melasma can be classified as malar, limited to the cheeks, forehead, upper lip, nose, and chin; or mandibular, affecting the area above the mandibular ramus. The most commonly affected areas include the upper lip, forehead, chin, and eyebrows, followed by the nose and cheeks.[36]

Carotenemia: Carotenemia is a clinical condition characterized by yellow discoloration of the skin (xanthoderma) and elevated beta-carotene levels in the blood. In many patients, it results from prolonged and excessive consumption of carotene-rich foods such as carrots, squash, and sweet potatoes. It is a common finding in children. It is harmless, but jaundice in a single area may lead to misdiagnosis. Carotene may cause a golden yellow discoloration of the oral mucosa and skin. Treatment involves eliminating the causative foods.[37]

Kaposi's sarcoma: Kaposi sarcoma is a malignant neoplasm originating in the blood vessels. It used to be quite rare but has become more common recently due to the increase in diseases that cause immune deficiency, such as acquired ımmune deficiency syndrome (AIDS). Kaposi sarcoma is more likely to affect keratinized mucous membranes such as the palatal mucosa and gingiva within the oral cavity. The buccal mucosa and tongue are even less commonly affected areas.[38,39] Treatment options for Kaposi sarcoma include surgical excision, localized radiation therapy, intralesional vinblastine, cryotherapy, and single- or multi-agent chemotherapy.[40]

HIV-oral melanosis: AIDS is defined as a pathological condition originating from infection with the human immunodeficiency virus (HIV).[41] The virus attacks the immune system and often inhibits the activity of lymphocytes and macrophages. As a result, it causes progressive and ultimately irreversible immunosuppression, allowing for the development of fatal opportunistic infections, cancers, and rare autoimmune diseases. Oral lesions, which are commonly observed in HIV-infected individuals and are the first clinical indicators of the disease, are of diagnostic importance. Patients may experience salivary gland enlargement, sialadenitis, herpes labialis, buccal petechiae, and an increase in the incidence of caries.[42,43] Oral melanoma is a rare malignancy arising from the malignant transformation of melanocytes in the oral cavity.[44] Oral melanoma typically affects the maxillary gingiva, then the palate, and less commonly the mandibular gingiva.[45] The initial signs and symptoms are typically soft and pigmented upon palpation, initially asymptomatic, with irregular borders and a color spectrum ranging from dark brown to bluish black.[46]

Gingival Diseases

Inflammatory effects: Various periodontal diseases cause an increase in capillary permeability, which results in discoloration of the gingiva ranging from pink to red. Once the disease is under control, the gingiva returns to its original color.[47]

Necrotizing gingivitis: Necrotizing gingivitis is a rapidly progressing gum disease that usually starts at the tip of the interdental papillae and progresses toward the marginal gingiva, characterized by necrotic breakdown of gingival tissues and pseudomembranes.[48] It is more common in individuals with stress and weakened immune systems. It occurs equally in both women and men and in individuals between the ages of 18 and 26. It is more common in malnourished children, individuals with mental retardation (Down syndrome), and HIV-infected individuals.[49] A punctate appearance on the papillae is a pathognomonic finding. Other clinical findings include the presence of pseudomembranes covering the necrotic gingiva, which are yellow-gray in color, and foul breath. In advanced cases, systemic symptoms such as fever, fatigue, and lymphadenopathy may accompany the condition.[50,51]

Stomatitis lesions: The etiology of oral stomatitis lesions is not fully understood. It is thought that the cause of these lesions is multifactorial, involving a cell-mediated immunological reaction and genetic predisposition. Histopathological changes are observed before ulceration occurs. Lymphocytes (mononuclear cells) infiltrate the oral epithelium, edema develops, and keratinocytes (oral epithelial cells) undergo vacuolization and vasculitis. This process leads to localized swelling and subsequent ulceration of the epithelium.[52]

It affects approximately 5-25% of the general population. They are more common in childhood or adolescence.[53] The main oral symptoms of stomatitis are difficulty and pain in oral functions such as swallowing, speaking, and chewing.[54,55] Stomatitis is characterized by painful ulcers with a round or ovoid base covered with gray-white pseudomembranes and surrounded by an erythematous ring.[56] The edges of the ulcers are slightly raised. In ulcers, superficial vascular inflammation and erythrocyte extravasation in the outer layers of the lamina propria are observed, along with erythema around the lesion.[57] The most common sites of occurrence are the lip mucosa, oral floor, tongue, and buccal mucosa, and, less commonly, the soft palate.[58]

Tissue necrosis: Mucosal necrosis in the oral cavity may be a treatment-related effect. It is more commonly caused by trauma resulting from gavage procedures and/or the presence of foreign bodies (hair strands, food material). Necrosis and ulceration in the traumatized area may lead to suppurative or chronic active inflammation and granulation tissue formation. If necrosis extends to the surface and does not appear to be part of an ulcer, or if there is no loss of epithelial cells, the lesion is considered necrosis rather than erosion or ulceration. Infection caused by Actinomyces species can lead to deep infection and necrosis. Gingival inflammation and necrosis can also occur around the incisor teeth.[59]

Desquamative lesions: Desquamation refers to the peeling and shedding of the outermost layer of the skin. The factors contributing to the origin of oral lesions are quite diverse. These include dermatoses, endocrine causes, aging, metabolic disorders, irritant factors, unknown factors, and chronic infections.[60] Since many of the patients are postmenopausal women, hormonal imbalances (estrogen and testosterone deficiency, hypothyroidism) are also thought to play a role in the origin of desquamative lesions. Lesions typically present as erythema on the attached gingiva of the anterior teeth, accompanied by local or generalized desquamation/erosion. Treatment involves the use of local or systemic corticosteroids after eliminating local causes.[46]

Melanin-Containing Pigmentations

Nevus: Nevuses are congenital or acquired, benign, colored neoplasms of the skin or mucosa characterized by the presence of melanin-producing neuroectodermal cells.[61,62] They are more commonly seen on the skin than in the oral cavity. Based on their histopathological characteristics, they are classified as intramucosal, junctional, compound, and blue nevi. The most common type is intramucosal, while the least common is junctional. Their color may range from gray, brownish, or blue. Nevi are asymptomatic and are frequently found on the palate and lips.[63]

Intramucosal nevus: This is a type of nevus localized in the connective tissue. Intramucosal nevi are the most common type of nevus in the oral cavity, with a prevalence of 55%. Clinically, lesions are generally well-defined, round or oval, flat or slightly raised spots or plaques. The ideal treatment for intramucosal nevi is excisional biopsy with a 2 mm safety margin and histopathological examination to rule out the possibility of malignant transformation.[64]

Blue nevus: Blue nevus (MN) is a melanocytic lesion characterized by the proliferation of dermal dendritic melanocytes.[65] Nevi are rarely observed intraorally, with an incidence of approximately 0.1%.[66] Nearly 25% of nevi that appear in the mouth are blue nevi.[62,67] Blue nevus lesions are most commonly found on the palatal mucosa. Blue nevi are 20% more common in women than in men and are most frequently observed in the third and fourth decades of life.[68] Clinically, classic blue nevi are typically asymptomatic. Most lesions are solitary, with borders that are sometimes indistinct but often distinct and smooth in appearance.[69]

Junctional nevus: A junctional nevus is a benign proliferation of nevus cells. They are localized, symmetrical, uniform, and

typically less than 5 mm in diameter. Acquired nevi appear during childhood and reach their peak number during adolescence. Their number then decreases.[70] These lesions are characterized by the presence of melanocyte nests. In junctional nevi, the nests are seen in the dermoepidermal junction region along with single cells.[71]

Compound nevus: Oral compound nevi are one of the least common forms of oral mucosal nevi, accounting for only 5.9% to 16.5% of cases.[72] Compound nevi primarily affect the palate. Most compound nevi are raised lesions. However, one-third appear as macules, making it difficult to distinguish them from flat-colored lesions, including melanoma in situ.[72]

Melanoma: Melanoma occurs in the 4th to 7th decades of life.[73] Mucosal melanomas account for 1.3% to 6.8% of all melanomas.[73] Although the origin of oral melanoma is unknown, chronic inflammatory stimuli such as tobacco use and mechanical irritation have been proposed as potential risk factors.[74] Most oral melanomas arise from apparently normal mucosa, but nearly 30-37% begin with oral pigmentation that persists for several months or even years.[75,76] Clinically, oral melanoma is typically characterized by color variation, including black, brown, gray, purple, and red tones or depigmentation, and presents as well-defined brown or black macules/patches or nodules. The hard palate or alveolar gingiva are the most commonly affected areas.[74,75] The prognosis for individuals with oral melanoma is significantly worse than for those with cutaneous lesions, with a 5-year overall survival rate of 15%. The best way to improve prognosis is through early diagnosis of the disease.[77]

Oral melanotic macule: It is one of the most commonly observed colored lesions in the oral cavity. It is a benign lesion caused by increased melanin production, sometimes accompanied by an increase in the number of melanocytes.[3] Although lesions can occur at any age, the average age of onset is 42. Studies have indicated that the incidence rate is higher in women than in men.[78] Lip lesions tend to be diagnosed earlier than oral lesions, likely due to the fact that the vermilion border of the lips is more easily visualized by the patient compared to oral regions.[64] Clinically, a melanotic macule appears as a solitary, well-defined, uniformly colored, flat lesion ranging in color from skin tone to dark brown. Multiple lesions have also been reported.[79] The size of the lesions varies from 0.1 to 2.0 cm, with most being smaller than 1 cm.[3] The vermilion border of the lip is the most commonly affected area in all series studied and is most frequently seen on the lower lip.[80] Within the oral cavity, it is most commonly found on the gingiva, palate, and buccal mucosa. Lambertini et al.[81] recommended serial photography for melanotic macules <0.5 cm and biopsy for lesions >0.5 cm. If labial lesions exhibit irregular borders, irregular pigmentation, color differences, ulceration, or other suspicious characteristics, a biopsy is recommended regardless of size to rule out melanoma. Once a melanotic macule diagnosis is confirmed by biopsy, no further treatment is necessary.[82]

Melanoplakia: Oral pigmentation is associated with various external and internal causes, including medications, heavy metals, genetic factors, hormonal disorders (Addison's disease), syndromes (Albright syndrome, Peutz-Jegher syndrome), and post-inflammatory reactions, among various external and internal causes.[83] Physiological pigmentation is often symmetrical and appears on the gums, cheek mucosa, hard palate, lips, and tongue.[84]

Smoker's melanosis: Smoker's melanosis is an increase in melanin pigmentation seen in heavy smokers.[85] Smoker's melanosis is more common in women, and it is thought that estrogen may be a contributing factor. This pigmentation is thought to result from increased melanin production in response to exposure to heat or tobacco smoke.[86] The increased melanin is believed to have a protective effect against the harmful components of tobacco smoke.[87,88] The most common site of smoker's melanosis is the labial gingiva, but any oral region may be affected. Smokers' melanosis in pipe smokers is usually found on the buccal mucosa or lip commissure, along the red border.[86] Affected patients exhibit widespread dark brown pigmentation. Clinical history and tobacco staining on the teeth are helpful in diagnosis. Pigmentation regresses within 3 years after smoking cessation.[89]

Ephelid (freckle): Freckles are benign pigmented spots commonly seen in Caucasians and Asians.[71] Ephelides are usually small pigmented spots (typically 1-2 mm, but can also be larger), vary in color from red to light brown, and are seen in individuals with fair skin and/or red hair. They first appear at 2-3 years of age, increase during puberty, and often partially disappear with age.[71]

Lentigo: These are pigmentations that appear more frequently on the outer surfaces of the hands as a result of aging. They are more common in the 4th and 5th decades of life. Lesions are yellow, light brown, and oval or round in shape, ranging from 2 to 4 mm in size.[90] Solar lentigines are flat or slightly raised spots with clearly defined edges that develop on sun-exposed skin areas such as the face, backs of the hands, and forearms. Their color may vary from light brown to dark brown or black, depending on the individual's skin tone. In PJS, polyps develop throughout the gastrointestinal tract, and widespread lentigines appear on the mouth, lips, genital organs, palms, and soles of the feet.[91]

Pigmentation Due to Hemosiderin Deposition

This variation is a color change caused by trauma-related bleeding, which leads to hemosiderin accumulation and results in a bluish-black pigment change. The color varies from red to blue and purple, depending on the age of the lesion and the degree of degradation of the extravasated blood. The etiology may include thrombotic purpura, coagulation disorders associated with hemophilia, and hemochromatosis (iron repositioning and deposition).[92]

Vascular Pigmented Lesions

Vascular anomalies can affect the head and neck region but can also be seen in any intraoral location.[93] Most oral mucosal lesions are small and superficial, but they can also be large, voluminous tumors involving deep submucosal structures. Deep-seated lesions may appear normal in color, while superficial lesions may appear erythematous, blue, or purplish in color due to the mixture of arterial, capillary, and venous vascular channels.[93,94] Oral vascular lesions generally exhibit a compressible structure. Qualitatively, applying slight pressure causes color loss or tissue discoloration, indicating that the reddish color originates from blood within a lesion vessel.[93]

Varicose veins/varicocele: Varicocele represents a dilated and tortuous vein, presumed to result from age-related

deterioration of elastic support for the vein wall. It often presents as a solitary, reddish- to bluish-purple nodule. Although they can form on any oral mucosal surface, the lips, cheek mucosa, and ventral part of the tongue are more commonly affected areas.[95] The most common intraoral location is the ventral surface of the tongue, where varicose veins are found as numerous bluish-purple, irregular, soft elevations that whiten under pressure.[8] Varicose veins are essentially dilated veins, and blanching occurs when pressure is applied to these lesions. If a varicose vein contains a thrombus, it appears as a nodule that does not blanch with pressure. Treatment is not required if there is no aesthetic concern.[8]

Hemangioma: Hemangioma is a benign proliferation of endothelial cells lining the inner part of a blood vessel.[61] Hemangioma is a developmental anomaly characterized by its onset in infancy. The lesion regresses as the patient ages. The mouth and tongue are the most commonly affected areas.[96] The lesion may be flat or slightly raised and may vary in color from red to bluish-purple depending on the type of affected vessels (capillaries, veins, or arteries) and the location of the lesion in the tissues.[97,98] Treatment is required for head and neck hemangiomas when they bleed or exert pressure on vital organs. Hemangiomas of the larynx and tongue root, in particular, can cause breathing difficulties. Another reason for treatment may be the patient's aesthetic concerns. While medical and conservative methods are more important in the choice of treatment in children, surgical excision is often preferred in adults.[99]

Angiosarcoma: Angiosarcomas are malignant, poorly prognostic, and very rare sarcomas originating from vascular endothelial cells.[100] Angiosarcomas are often found in the skin or bone areas.[101] Men and women are affected equally. Angiosarcoma of the oral cavity is very rare; only a few case reports and case series are described in the literature.[102] In general, angiosarcoma is a highly aggressive tumor. Angiosarcoma of the oral cavity can be found in various tissues such as oral soft tissue, minor salivary glands, and bones.[102]

Telangiectasia: Telangiectasia is a rare autosomal recessive neurodegenerative disease that typically begins in early childhood and is characterized by persistent ataxia, telangiectasia of the sclera and skin, cutaneous findings (hypertrichosis, vitiligo, seborrheic dermatitis, acanthosis nigricans), and immunodeficiency.[103] Telangiectasias are irregularly shaped capillary areas in the oral cavity and nasal cavities that turn white when pressure is applied and immediately turn red again when pressure is released. Telangiectasias are generally located superficially in the mucosa and are prone to rupture with minimal trauma.[104]

EXOGENOUS PIGMENTATION

The best examples of pigmented substances directly deposited on the mucosa include amalgam pigmentation, graphite ink, and colored substances (chewing colored plants, liquids containing dye, etc.). Coloring agents, heavy metals (bismuth, mercury), amalgam tattoos, and drug-related factors can cause discoloration.[105]

Drug-Induced Discoloration

Drugs can cause discoloration of the skin and mucosa through various mechanisms.[106] In some cases, drug metabolites may accumulate in local areas. Although the mucosa may appear discolored clinically, such coloration cannot be interpreted as true pigmentation.[107] Drugs from the tetracycline group are representatives of this phenomenon.[71] However, there are several other drugs, including antimalarial drugs and drugs from different classes, that can cause discoloration. Some drugs, including chloroquine and chlorpromazine, have been found to physically bind to melanin.[108] Drug-induced discoloration may be irregular, localized to a single mucosal area, or multifocal, affecting multiple areas. Additionally, pigmentation may be macular in style and colored.[107] If discoloration is associated with the use of a specific drug known to cause pigmentation over a certain time period, then further intervention is generally not required. The discolored areas may resolve over time.[109]

Heavy Metal Pigmentations

Discoloration of the oral mucosa may occur due to elevated levels of heavy metals such as lead, bismuth, mercury, silver, arsenic, and gold in the blood (Table).[110] It may also occur in cases where diseases are treated with heavy metals. In the past, discoloration has been observed in cases where syphilis was treated with arsenic. Children can experience this condition due to lead-tainted water or medications that contain silver or mercury. Clinically, blue-black pigmentation along the gum line is quite typical.[110] Early diagnosis of pigmentation caused by heavy metals is important because it prevents the development of severe systemic toxic effects caused by metals.[8,111]

Table. Drugs and chemicals causing pigmentation in the oral cavity

Medicine/ chemical agent	Color	Localization
Arsenic	Brown	Tongue
Bismuth	Blue-grey/brown/black	Gingiva/tongue/buccal mucosa
Bromine	Brown	Tongue
Busulfan	Brown	Buccal mucosa
Chlorhexidine	White	Tongue
Chloroquine	Blue-brown	Hard palate/gingiva/lip
Doxorubicin	Dark-brown	Buccal mucosa/tongue
Gold	Purple	Gingiva
Heroin inhalation	Dark brown maculae	Tongue
Iron	Dark-brown	-
Lead	Blue-grey	Gums/tongue
Manganese	Dark-brown	-
Mercury	Blue-grey/blue-black	Gingival/buccal mucosa
Methyldopa	Dark	Tongue
Oral contraceptives	Dark	Mucosa
Phenylalanine	Brown	Tongue
Phenothiazine	Blue-brown	Mucosa
Quinidine	Blue-black	Palatinal mucosa
Kinin	Blue-black	-
Thallium	Blue-brown	Gingival
Tobacco	Misty gray/brown	-
Vanadium	Green	Tongue
Zidovudine	Dark	Soft palate/lip/tongue
Silver	Brown	Gums

Amalgam Tattooing

This condition is one of the most common causes of oral pigmentation. It occurs after improper dental amalgam treatments. These are localized, flat, blue-gray, painless lesions, several millimeters in diameter, most commonly occurring on the alveolar mucosa and attached gingiva, and may be single or multifocal.[110] Amalgam staining may occur during the placement or removal of a restoration when amalgam particles enter an abrasion, extraction site, or gingival pocket. Most amalgam tattoos are 6 mm or smaller in size.[112] Multiple lesions may be present. Evidence of radio-opaque metallic deposits may aid in the diagnosis of amalgam staining, but radiographic images are often absent often.[14,113] There is no indication for treatment of amalgam or foreign body staining. Extensive lesions in the aesthetic area can be effectively treated with surgical excision and gingival grafting.[114]

Colorant Agents

Black hairy tongue is caused by the proliferation of chromogenic bacteria in the filiform papillae of the tongue. Poor oral hygiene, excessive smoking, antibiotics, and overuse of antiseptic mouthwashes are often implicated.[115] Yellow-brown-black discoloration appears in the papilla region of the tongue.[116] Staining caused by certain fruits and foods colored with various additives is the most common type of non-permanent mucosal discoloration. In individuals with poor oral hygiene, heavy smokers, and some users of broad-spectrum antibiotics, pigmentation may occur in the filiform papillae of the tongue due to hyperkeratosis. Exogenous pigmentation may also occur due to the spread of old materials used in endodontic fillings into bones and tissues. This condition manifests as discoloration of the mucosa at the root tip of the affected tooth.[117]

DEPIGMENTED CONDITIONS

In diseases such as albinism and vitiligo, the skin appears white instead of its normal color due to a lack of pigment.[118]

Albinism

Albinism is a genetically transmitted group of autosomal recessive conditions characterized by a hereditary decrease or absence of melanin pigment production, which gives the skin, iris of the eyes, and hair their natural color.[119] Some degree of pigment deficiency is present in all types of albinism, but the amount of pigment varies from type to type. An individual with albinism may exhibit any of the following symptoms:[118]

- Lack of color in the hair, skin, or iris of the eye;
- Skin and hair that are lighter in color than normal;
- Patchy, uneven skin color;
- Strabismus (crossed eyes);
- Light sensitivity (photophobia);
- Rapid eye movements (nystagmus);
- Vision problems or functional blindness;
- Severe gingivitis;
- Oral mucosal ulceration; and
- Periodontal diseases.

In albinism, photophobia, severe gingivitis, oral mucosal ulcerations, and periodontal disease are prominent.[102] Patients with albinism should be informed that they should visit the dentist regularly to maintain oral hygiene, as they are prone to recurrent gingivitis.[121]

Vitiligo

This is a non-contagious acquired pigmentation disorder characterized by distinct white patches of varying shapes and sizes that increase in number and size over time.[122] Vitiligo has a global prevalence of 1%.[123] Although the origin of vitiligo is unknown, its pathogenesis has been attempted to be explained by various hypotheses, including the genetic hypothesis, autoimmune hypothesis, neural hypothesis, autocytotoxic hypothesis, new microenvironment-related hypothesis, and convergence theory.[122,124] Nagarajan et al.[122] According to their study, oral mucosal depigmentation is present in the lips (42%), palate (8%), cheek mucosa (5%), lip mucosa (5%), and gums (2%). Oral depigmentation may be the first sign of vitiligo, which can appear in inconspicuous areas. In such cases, dentists can diagnose vitiligo early.[125]

CONCLUSION

Oral pigmentations are common conditions characterized by discoloration of the oral mucosa and may arise from physiological, systemic, genetic, or environmental factors. In addition to endogenous sources (such as melanin and hemosiderin) and exogenous sources (such as amalgam, drugs, and heavy metals), depigmented conditions and vascular lesions also play a role in intraoral discolorations.Correct diagnosis is crucial for determining the need for treatment and for the early detection of systemic diseases. It is important for clinicians to distinguish the causes of pigmentation and to manage cases appropriately.

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Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

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REFERENCES

1. Roth DM, Bayona F, Baddam P, Graf D. Craniofacial Development: Neural Crest in Molecular Embryology. *Head Neck Pathol*. 2021;15(1):1-15. doi: 10.1007/s12105-021-01301-z.
2. Özbayrak S, Ağız Hastalıkları Atlası; Tanı Kriterleri, Ayırıcı Tanı ve Tedavi Yaklaşımları. Quintessence Yayıncılık. İstanbul, P:1, 2003.

3. Müller S. Melanin-associated pigmented lesions of the oral mucosa: presentation, differential diagnosis, and treatment. *Dermatol Ther.* 2010;23(3):220-229. doi:10.1111/j.1529-8019.2010.01319.x
4. De Giorgi V, Sestini S, Bruscino N, et al. Prevalence and distribution of solitary oral pigmented lesions: a prospective study. *J Eur Acad Dermatol Venereol*. 2009;23(11):1320-1323. doi:10.1111/j.1468-3083.2009.03186.x
5. Kauzman A, Pavone M, Blanas N, Bradley G. Pigmented lesions of the oral cavity: review, differential diagnosis, and case presentations. *J Can Dent Assoc*. 2004;70(10):682-683.
6. Eisen D. Disorders of pigmentation in the oral cavity. *Clin Dermatol.* 2000;18(5):579-587. doi:10.1016/s0738-081x(00)00148-6
7. Mallikarjuna K, Gupta S, Shukla S, Chaurasia S. Unusual extensive physiologic melanin pigmentation of the oral cavity: a clinical presentation. *J Indian Soc Pedod Prev Dent*. 2013;31(2):121-125. doi:10.4103/0970-4388.115718
8. Müller S. Melanin-associated pigmented lesions of the oral mucosa: presentation, differential diagnosis, and treatment. *Dermatol Ther.* 2010;23(3):220-229. doi:10.1111/j.1529-8019.2010.01319.x
9. Mallikarjuna K, Gupta S, Shukla S, Chaurasia S. Unusual extensive physiologic melanin pigmentation of the oral cavity: a clinical presentation. *J Indian Soc Pedod Prev Dent*. 2013;31(2):121-125. doi:10.4103/0970-4388.115718
10. Nieman LK, Chanco Turner ML. Addison's disease. *Clin Dermatol.* 2006;24(4):276-280. doi:10.1016/j.clindermatol.2006.04.006
11. Espiard S, McQueen J, Sherlock M, et al. Improved urinary cortisol metabolome in addison disease: a prospective trial of dual-release hydrocortisone. *J Clin Endocrinol Metab.* 2021;106(3):814-825. doi:10.1210/clinem/dgaa862
12. Sarkar SB, Sarkar S, Ghosh S, Bandyopadhyay S. Addison's disease. *Contemp Clin Dent.* 2012;3(4):484-486. doi:10.4103/0976-237X.107450
13. Alawi F. Pigmented lesions of the oral cavity: an update. *Dent Clin North Am*. 2013;57(4):699-710. doi:10.1016/j.cden.2013.07.006
14. Neville B, Damm D, Allen C, Chi A. Oral and maxillofacial pathology. 4th ed. St. Louis: Elsevier; 2016.
15. Lenane P, Powell FC. Oral pigmentation. *J Eur Acad Dermatol Venereol.* 2000;14(6):448-465. doi:10.1046/j.1468-3083.2000.00143.x
16. Parker CC, Kynaston H, Cook AD, et al. Duration of androgen deprivation therapy with postoperative radiotherapy for prostate cancer: a comparison of long-course versus short-course androgen deprivation therapy in the RADICALS-HD randomised trial. *The Lancet*. 2024;403(10442):2416-2425. doi:10.1016/S0140-6736(24)00549-X
17. Pereira CM, Coletta RD, Jorge J, Lopes MA. Peutz-Jeghers syndrome in a 14-year-old boy: case report and review of the literature. *Int J Paediatr Dent*. 2005;15(3):224-228. doi:10.1111/j.1365-263X.2005.00627.x
18. Tacheci I, Kopacova M, Bures J. Peutz-Jeghers syndrome. *Curr Opin Gastroenterol.* 2021;37(3):245-254. doi:10.1097/MOG.0000000000000718.
19. Eisen D. Disorders of pigmentation in the oral cavity. *Clin Dermatol.* 2000;18(5):579-587. doi:10.1016/s0738-081x(00)00148-6
20. Mozaffari HR, Rezaei F, Sharifi R, Mirbahari SG. Seven-Year Follow-Up of Peutz-Jeghers Syndrome. *Case Rep Dent*. 2016;2016:6052181. doi:10.1155/2016/6052181
21. Günhan Ö. Oral ve Maksillofasiyal Patoloji. istanbul: Quintessence Yayıncılık Tanıtım Paz. ve DıĢ tic. Ltd. ğti; 2015.
22. Palmisano B, Berry C, Boyce A, et al. Fibrous dysplasia/McCune-Albright syndrome: state-of-the-art advances, pathogenesis, and basic/translational research. *Orphanet J Rare Dis*. 2025;20(1):414. doi:10.1186/s13023-025-03909-8
23. Boyd KP, Korf BR, Theos A. Neurofibromatosis type 1. *J Am Acad Dermatol*. 2009;61(1):1-16. doi:10.1016/j.jaad.2008.12.051
24. Theos A, Korf BR; American College of Physicians; American Physiological Society. Pathophysiology of neurofibromatosis type 1. *Ann Intern Med*. 2006;144(11):842-849. doi:10.7326/0003-4819-144-11-200606060-00010
25. Yoshida Y. Neurofibromatosis 1 (von recklinghausen disease). *Keio J Med*. 2025;74(1):37-41. doi:10.2302/kjm.2023-0013-IR.
26. Gosavi SR, Jain RS, Datarkar A. Prevalence of oral neurofibroma in Central Indian population: a retrospective study of 20 years. *J Oral Maxillofac Pathol*. 2021;25(1):25-30. doi:10.4103/jomfp.JOMFP_237_20
27. Minakawa M, Wares MA, Nakano K, et al. Measuring and imaging of transcutaneous bilirubin, hemoglobin, and melanin based on diffuse reflectance spectroscopy. *J Biomed Opt*. 2023;28(10):107001. doi:10.1117/1.JBO.28.10.107001
28. Zimmer J, Hansen BM, Peswa L, et al. Noninvasive assessment of bilirubin levels in newborn infants with dark skin pigmentation. *Acta Paediatr.* 2026. doi:10.1111/apa.70454
29. Daley TD, Armstrong JE. Oral manifestations of gastrointestinal diseases. *Can J Gastroenterol.* 2007;21(4):241-244. doi:10.1155/2007/952673
30. Güncü GN, Tözüm TF, Cağlayan F. Effects of endogenous sex hormones on the periodontium--review of literature. *Aust Dent J.* 2005;50(3):138-145. doi:10.1111/j.1834-7819.2005.tb00352.x
31. Kurtzman GM, Horowitz RA, Johnston R, Lanphier L. Oral Biofilm and Gender-Specific Health Considerations. *Cureus*. 2025;17(8):e91289. doi:10.7759/cureus.91289
32. Lindhe, J, Karring, T., Lang N.P. Clinical Periodontology and Implant Dentistry, Chapter 6, forth edition, blackwell publishing company. 2003
33. Mascarenhas P, Gapski R, Al-Shammari K, Wang HL. Influence of sex hormones on the periodontium. *J Clin Periodontol.* 2003;30(8):671-681. doi:10.1034/j.1600-051x.2003.00055.x
34. Winton GB, Lewis CW. Dermatoses of pregnancy. *J Am Acad Dermatol.* 1982;6(6):977-998. doi:10.1016/s0190-9622(82)70083-0
35. Kamalabadi YM, Campbell MK, Zitoun NM, Jessani A. Unfavourable beliefs about oral health and safety of dental care during pregnancy: a systematic review. *BMC Oral Health*. 2023;23(1):762. doi: 10.1186/s12903-023-03439-4
36. Lee HJ, Ha SJ, Lee SJ, Kim JW. Melanocytic nevus with pregnancy-related changes in size accompanied by apoptosis of nevus cells: a case report. *J Am Acad Dermatol.* 2000;42(5Pt2):936-938. doi:10.1016/s0190-9622(00)90277-9
37. Övetti, NHC, Mungan HNÖ, Yılmaz BŞ, Bulut FD. Hiperkarotenemi. *Cukurova Med J.* 2018;43(2):500-501. doi:10.17826/cumj.342841
38. Lomelí-Martínez SM, González-Hernández LA, Ruiz-Anaya AJ, et al. Oral manifestations associated with HIV/AIDS patients. *Medicina (Kaunas).* 2022;58(9):1214. doi:10.3390/medicina58091214
39. Varadarajan S, Balaji TM, Kumar S N, et al. Reviewing the oral pigmented lesions of human immunodeficiency virus with emphasis on the effect of highly active antiretroviral therapy. *Dis Mon*. 2021;67(9):101167. doi:10.1016/j.disamonth.2021.101167
40. Venkateswaran N, Ramos JC, Cohen AK, et al. Spotlight on ocular Kaposi's sarcoma: an update on the presentation, diagnosis, and management options. *Expert Rev Ophthalmol*. 2021;16(6):477-489. doi:10.1080/17469899.2021.1962294
41. Oleske J, Minnefor A, Cooper R Jr, et al. Immune deficiency syndrome in children. *JAMA*. 1983;249(17):2345-2349.
42. Valdez IH, Pizzo PA, Atkinson JC. Oral health of pediatric AIDS patients: a hospital-based study. *ASDC J Dent Child*. 1994;61(2):114-118.
43. Wolk R, Massi D, Trochesset D. Pigmented lesions of the oral mucosa: clinical presentation, histology, and recommendations for management. *am J Clin Dermatol*. 2025;26(5):761-775. doi:10.1007/s40257-025-00950-y
44. Abati S, Sandri GF, Finotello L, Polizzi E. Differential diagnosis of pigmented lesions in the oral mucosa: a clinical based overview and narrative review. *cancers (Basel).* 2024;16(13):2487. doi:10.3390/cancers16132487
45. Williams MD. Update from the 4th edition of the World Health Organization Classification of Head and Neck Tumours: Mucosal Melanomas. *Head Neck Pathol*. 2017;11(1):110-117. doi:10.1007/s12105-017-0789-y
46. Mustafa MB, Porter SR, Smoller BR, Sitaru C. Oral mucosal manifestations of autoimmune skin diseases. *Autoimmun Rev.* 2015;14(10):930-951. doi:10.1016/j.autrev.2015.06.005
47. Coventry J, Griffiths G, Scully C, Tonetti M. ABC of oral health: periodontal disease. *BMJ*. 2000;321(7252):36-39. doi:10.1136/bmj.321.7252.36
48. Folayan MO. The epidemiology, etiology, and pathophysiology of acute necrotizing ulcerative gingivitis associated with malnutrition. *J Contemp Dent Pract*. 2004;5(3):28-41.
49. Marucha PT. Acute gingival infections. In: Carranza FA, Newman MG, Takei HH, Klokkevold PR, editors. Clinical periodontology. 10th ed. Philadelphia; WB Saunders comp: 2006. p. 391–397.
50. Atout RN, Todescan S. Managing patients with necrotizing ulcerative gingivitis. *J Can Dent Assoc*. 2013;79:d46.
51. Gasner NS, Brizuela M, Schure RS. Necrotizing Periodontal Diseases. In: StatPearls. Treasure Island (FL): StatPearls Publishing. 2025.
52. Scully C, Porter S. Oral mucosal disease: recurrent aphthous stomatitis. *Br J Oral Maxillofac Surg.* 2008;46(3):198-206. doi:10.1016/j.bjoms.2007.07.201

53. Sakarya U, Gündoğan O, İmre A, Arslan B, Pınar E. Rekürren aftöz stomatitli 112 hastanın demografik ve labaratuvar verileri: retrospektif inceleme. *KBB-Forum* 2014;13(1).
54. Hamishehkar H, Nokhodchi A, Ghanbarzadeh S, Kouhsoltani M. Triamcinolone acetonide oromucoadhesive paste for treatment of aphthous stomatitis. *Adv Pharm Bull.* 2015;5(2):277-282. doi:10.15171/apb.2015.038
55. Mancini A, Inchingolo AM, Marinelli G, et al. Topical and systemic therapeutic approaches in the treatment of oral herpes simplex virus infection: a systematic review. *Int J Mol Sci.* 2025;26(17):8490. doi:10.3390/ijms26178490
56. Scully C. Clinical practice. Aphthous ulceration. *N Engl J Med.* 2006; 355(2):165-172. doi:10.1056/NEJMcp054630
57. Çağlayan F, Yılmaz A. B. Rekurrent aftoz stomatitis. *Atatürk Üni Diş Hekimliği Fak Derg.* 2009;47-54.
58. Slebioda Z, Szponar E, Kowalska A. Recurrent aphthous stomatitis: genetic aspects of etiology. *Postepy Dermatol Alergol.* 2013;30(2):96-102. doi:10.5114/pdia.2013.34158
59. Faustino ISP, Georgaki M, Santos-Silva AR, Vargas PA, Lopes MA. Head and neck radiotherapy leading to extensive late oral soft-tissue necrosis. *Oral Oncol.* 2022;125:105710. doi: 10.1016/j.oraloncology.2021.105710.
60. Kinane DF, Stathopoulou PG, Papapanou PN. Periodontal diseases. *Nat Rev Dis Primers.* 2017;3:17038. doi:10.1038/nrdp.2017.38
61. Popa C, Stelea C, Popa R, Popescu E. Leziuni pigmentare endogene orale ī periorale [oral and perioral endogenous pigmented lesions]. *Rev Med Chir Soc Med Nat Iasi.* 2008;112(4):1054-1060.
62. Moscarella E, Ronchi A, Brancaccio G, et al. Spectrum of blue nevus-like lesions, including blue nevus, pigmented epithelioid melanocytoma, and animal-type melanoma. *Clin Dermatol.* 2025;43(3):323-333. doi:10.1016/j.clindermatol.2024.09.003
63. Çiçek Y, Ertaş U. The normal and pathological pigmentation of oral mucous membrane: a review. *J Contemp Dent Pract.* 2003;4(3):76-86.
64. Buchner A, Merrell PW, Carpenter WM. Relative frequency of solitary melanocytic lesions of the oral mucosa. *J Oral Pathol Med.* 2004;33(9):550-557. doi:10.1111/j.1600-0714.2004.00238.x
65. Heper AO, Aydıner F, Erol E, Ensari A, Dökmeci F. Blue (mavi) nevüs'ün nadir bir lokalizasyonu ve uterin serviksin pigmente lezyonları: olgu sunumu. *KÜ Tıp Fak Derg.* 2008;9:29-31.
66. Mortazavi H, Safi Y, Baharvand M, Rahmani S, Jafari S. Peripheral exophytic oral lesions: a clinical decision tree. *Int J Dent.* 2017; 2017:9193831. doi: 10.1155/2017/9193831
67. Lovas GL, Wysocki GP, Daley TD. The oral blue nevus: histogenetic implications of its ultrastructural features. *Oral Surg Oral Med Oral Pathol.* 1983;55(2):145-150. doi:10.1016/0030-4220(83)90170-6
68. González-Cámpora R, Galera-Davidson H, Vázquez-Ramírez FJ, Díaz-Cano S. Blue nevus: classical types and new related entities. A differential diagnostic review. *Pathol Res Pract.* 1994;190(6):627-635. doi:10.1016/S0344-0338(11)80402-4
69. Mooi WJ, Krausz T: Biopsy Pathology of melanocytic disorders. Biopsy Pathology Series, Chapman & Hall Medical. London. 1992:106-135.
70. Schäfer T, Merkl J, Klemm E, Wichmann HE, Ring J; KORA Study Group. The epidemiology of nevi and signs of skin aging in the adult general population: results of the KORA-survey 2000. *J Invest Dermatol.* 2006;126(7):1490-1496. doi:10.1038/sj.jid.5700269
71. Praetorius C, Sturm RA, Steingrimsson E. Sun-induced freckling: ephelides and solar lentigines. *Pigment Cell Melanoma Res.* 2014;27(3): 339-350. doi:10.1111/pcmr.12232
72. Cardoso LB, Consalaro A, da Silva Santos PS, da Silva Sampieri MB, Tinoco-Araújo JE. Oral compound nevus. *Dermatol Online J.* 2014; 20(2):doj_21542.
73. McLean N, Tighiouart M, Muller S. Primary mucosal melanoma of the head and neck. Comparison of clinical presentation and histopathologic features of oral and sinonasal melanoma. *Oral Oncol.* 2008;44(11):1039-1046. doi:10.1016/j.oraloncology.2008.01.014
74. Patrick RJ, Fenske NA, Messina JL. Primary mucosal melanoma. *J Am Acad Dermatol.* 2007;56(5):828-834. doi:10.1016/j.jaad.2006.06.017
75. Hicks MJ, Flaitz CM. Oral mucosal melanoma: epidemiology and pathobiology. *Oral Oncol.* 2000;36(2):152-169. doi:10.1016/s1368-8375(99)00085-8
76. Mogensen M, von Knorring T, Hölmich LR, et al. Modermærkekræft [melanoma]. *Ugeskr Laeger.* 2025;187(14):V10240698. doi:10.61409/V10240698
77. Hicks MJ, Flaitz CM. Oral mucosal melanoma: epidemiology and pathobiology. *Oral Oncol.* 2000;36(2):152-169. doi:10.1016/s1368-8375(99)00085-8
78. Tavares TS, Meirelles DP, de Aguiar MCF, Caldeira PC. Pigmented lesions of the oral mucosa: a cross-sectional study of 458 histopathological specimens. *Oral Dis.* 2018;24(8):1484-1491. doi:10.1111/odi.12924
79. Gupta G, Williams RE, Mackie RM. The labial melanotic macule: a review of 79 cases. *Br J Dermatol.* 1997;136(5):772-775.
80. Tavares TS, Meirelles DP, de Aguiar MCF, Caldeira PC. Pigmented lesions of the oral mucosa: a cross-sectional study of 458 histopathological specimens. *Oral Dis.* 2018;24(8):1484-1491. doi:10.1111/odi.12924
81. Lambertini M, Patrizi A, Ravaioli GM, Dika E. Oral pigmentation in physiologic conditions, post-inflammatory affections and systemic diseases. *G Ital Dermatol Venereol.* 2018;153(5):666-671. doi:10.23736/S0392-0488.17.05619-X
82. Kauzman A, Pavone M, Blanas N, Bradley G. Pigmented lesions of the oral cavity: review, differential diagnosis, and case presentations. *J Can Dent Assoc.* 2004;70(10):682-683.
83. Hassona Y, Sawair F, Al-Karadsheh O, Scully C. Prevalence and clinical features of pigmented oral lesions. *Int J Dermatol.* 2016;55(9):1005-1013. doi:10.1111/ijd.13133
84. Holmstrup P, Plemons J, Meyle J. Non-plaque-induced gingival diseases. *J Periodontol.* 2018;89 Suppl 1:S28-S45. doi:10.1002/JPER.17-0163
85. Hedin CA, Axéll T. Oral melanin pigmentation in 467 Thai and Malaysian people with special emphasis on smoker's melanosis. *J Oral Pathol Med.* 1991;20(1):8-12. doi:10.1111/j.1600-0714.1991.tb00879.x
86. Müller S. Melanin-associated pigmented lesions of the oral mucosa: presentation, differential diagnosis, and treatment. *Dermatol Ther.* 2010;23(3):220-229. doi:10.1111/j.1529-8019.2010.01319.x
87. Meleti M, Vescovi P, Mooi WJ, van der Waal I. Pigmented lesions of the oral mucosa and perioral tissues: a flow-chart for the diagnosis and some recommendations for the management. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2008;105(5):606-616. doi:10.1016/j.tripleo.2007.07.047
88. Livingstone D, Baliah J, Flora J, Sivabalan P. Half and half smoker's melanosis. *Br Dent J.* 2025;239(6):367-368. doi:10.1038/s41415-025-9213-2
89. Neville BW, Damm DD, Allen CM, Bouquot JE, editörler. Oral ve maksillofasiyal patoloji. 2. baskı Toronto (ON): W.B. Saunders Company; 2002.
90. Cawley EP, Curtis AC. Lentigo senilis. *AMA Arch Derm Syphilol.* 1950; 62(5):635-641. doi:10.1001/archderm.1950.01530180024005
91. Lodish MB, Stratakis CA. The differential diagnosis of familial lentiginosis syndromes. *Fam Cancer.* 2011;10(3):481-490. doi:10.1007/s10689-011-9446-x
92. Naidu RM, Joshua E, Saraswathi T, Ranganathan K. Pigmentation of palatal mucosa due to trauma: a case report. *J Oral Maxillofac Pathol.* 2002;1:34-6.
93. McNamara KK, Kalmar JR. Erythematous and Vascular Oral Mucosal Lesions: A Clinicopathologic Review of Red Entities. *Head Neck Pathol.* 2019;13(1):4-15. doi:10.1007/s12105-019-01002-8
94. Amirchaghmaghi M, Pakfetrat A, Kiafar B, Zamani T. Dermoscopy of pigmented oral lesions; a research study. *Photodiagnosis Photodyn Ther.* 2025;52:104524. doi:10.1016/j.pdpdt.2025.104524
95. Lazos JP, Piemonte ED, Panico RL. Oral varix: a review. *Gerodontology.* 2015;32(2):82-89. doi:10.1111/ger.12074
96. Kauzman A, Pavone M, Blanas N, Bradley G. Pigmented lesions of the oral cavity: review, differential diagnosis, and case presentations. *J Can Dent Assoc.* 2004;70(10):682-683.
97. Gaeta GM, Satriano RA, Baroni A. Oral pigmented lesions. *Clin Dermatol.* 2002;20(3):286-288. doi:10.1016/s0738-081x(02)00225-0
98. Holm A, Mulliken JB, Bischoff J. Infantile hemangioma: the common and enigmatic vascular tumor. *J Clin Invest.* 2024;134(8):e172836. doi: 10.1172/JCI172836
99. Doğan M, Ozgürsoy OB, Muz SE, Gerçeker M, Dursun G. Erişkinlerde larengeal hemanjiyoma yaklaşım: olgu sunumu [Management of laryngeal hemangioma in adults: a case report]. *Kulak Burun Bogaz Ihtis Derg.* 2010;20(6):314-317.
100. Gaballah AH, Jensen CT, Palmquist S, et al. Angiosarcoma: clinical and imaging features from head to toe. *Br J Radiol.* 2017;90(1075):20170039. doi:10.1259/bjr.20170039
101. Connor SE, Flis C, Langdon JD. Vascular masses of the head and neck. *Clin Radiol.* 2005;60(8):856-868. doi:10.1016/j.crad.2005.04.002
102. Fanburg-Smith JC, Furlong MA, Childers EL. Oral and salivary gland angiosarcoma: a clinicopathologic study of 29 cases. *Mod Pathol.* 2003; 16(3):263-271. doi:10.1097/01.MP.0000056986.08999.FD.
103. Gatti RA. Ataxia-telangiectasia. *Dermatol Clin.* 1995;13(1):1-6.
104. Marx RE, Stern D. Oral and maxillofacial pathology: a rationale for diagnosis and treatment. *Quintessence.* 2012.

105. Sreeja C, Ramakrishnan K, Vijayalakshmi D, Devi M, Aesha I, Vijayabanu B. Oral pigmentation: a review. *J Pharm Bioallied Sci.* 2015; 7(Suppl 2):S403-S408. doi:10.4103/0975-7406.163471

106. Dereure O. Drug-induced skin pigmentation. Epidemiology, diagnosis and treatment. *Am J Clin Dermatol.* 2001;2(4):253-262. doi:10.2165/00128071-200102040-00006

107. Alawi F. Pigmented lesions of the oral cavity: an update. *Dent Clin North Am.* 2013;57(4):699-710. doi:10.1016/j.cden.2013.07.006

108. Mårs U, Larsson BS. Pheomelanin as a binding site for drugs and chemicals. *Pigment Cell Res.* 1999;12(4):266-274. doi:10.1111/j.1600-0749.1999.tb00760.x

109. Dereure O. Drug-induced skin pigmentation. Epidemiology, diagnosis and treatment. *Am J Clin Dermatol.* 2001;2(4):253-262. doi:10.2165/00128071-200102040-00006

110. Gökdemir G. Oral Mukozanın Benign Pigmente Lezyonları. Archives of the Turkish Dermatology. *Venerology/Turkderm*. 2012;46(2):66-71.

111. Camayo TV, Lee VR, Zhou XA. Drug-induced pigmentation. In: StatPearls. Treasure Island (FL). *StatPearls* 2025.

112. Buchner A, Hansen LS. Amalgam pigmentation (amalgam tattoo) of the oral mucosa. A clinicopathologic study of 268 cases. *Oral Surg Oral Med Oral Pathol.* 1980;49(2):139-147. doi:10.1016/0030-4220(80)90306-0

113. Sasaki R, Taneda S, Okamoto T. Gingival amalgam tattoo. *CMAJ.* 2023; 195(32):E1083-E1084. doi:10.1503/cmaj.230584.

114. Thumbigere-Math V, Johnson DK. Treatment of amalgam tattoo with a subepithelial connective tissue graft and acellular dermal matrix. *J Int Acad Periodontol*. 2014;16(2):50-54.

115. Allen CM, Camisa C: Oral disease. Dermatology. Ed. Bolognia JL, Jorizzo JL,Rapini RP. 2. Baskı, Londra, Elsevier, 2008;1038.

116. Gaeta GM, Satriano RA, Baroni A. Oral pigmented lesions. *Clin Dermatol*. 2002;20(3):286-288. doi:10.1016/s0738-081x(02)00225-0

117. Abati S, Sandri GF, Finotello L, Polizzi E. Differential diagnosis of pigmented lesions in the oral mucosa: a clinical based overview and narrative review. *Cancers (Basel).* 2024;16(13):2487. doi:10.3390/cancers16132487

118. Bailleul-Forestier I, Monod-Broca J, Benkerrou M, Mora F, Picard B. Generalized periodontitis associated with Chédiak-Higashi syndrome. *J Periodontol.* 2008;79(7):1263-1270. doi:10.1902/jop.2008.070440

119. Grønskov K, Ek J, Brondum-Nielsen K. Oculocutaneous albinism. *Orphanet J Rare Dis.* 2007;2:43. doi:10.1186/1750-1172-2-43

120. Bailleul-Forestier I, Monod-Broca J, Benkerrou M, Mora F, Picard B. Generalized periodontitis associated with Chédiak-Higashi syndrome. *J Periodontol*. 2008;79(7):1263-1270. doi:10.1902/jop.2008.070440

121. Murthy V, V Y, Thomas S, Nair P. Prosthodontic management of an albinism patient-dental implications and management. *BMJ Case Rep.* 2013;2013:bcr2012008004. doi:10.1136/bcr-2012-008004

122. Moretti S. Giannotti B, editör. Vitiligo.

123. Lawoyin D, Brown R, Reid E, Sam F, Obayomi T. Concurrent presentation of cutaneous and oral soft tissue vitiligo: a case report and literature review. *Int J of Dent Sci.* 2007; 5:56-60.

124. Haulrig MB, Idorn L, Skov L. Vitiligo [Vitiligo]. *Ugeskr Laeger.* 2025; 187(14):V10240662. doi:10.61409/V10240662

125. Nagarajan A, Masthan MK, Sankar LS, Narayanasamy AB, Elumalai R. Oral manifestations of vitiligo. *Indian J Dermatol.* 2015;60(1):103. doi: 10.4103/0019-5154.147844