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RESEARCH ARTICLE

THE TONGUE SPEAKS A LOT OF HEALTH.

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ABSTRACT

Multifunctional organ of the human body without a bone yet strong is the tongue. It mainly consists of the functional portion of muscle mass, mucosa, fat and the specialized tissue of taste i.e. the papillae. Diseases may either result from internal/ systemic causes of extrinsic causes like trauma, infection, etc. A new method for classification has been proposed in this review for diseases of tongue. This review mainly focuses on encompassing almost each aspect that the body reflects via its mirror in mouth, the tongue.

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INTRODUCTION

A muscular organ situated in the oral cavity, located in the floor of mouth at the entrance of the gastrointestinal tract is the tongue. It voluntarily as well as involuntarily helps for the survival of a human. It functions for suckling in infant, co-ordinates with development of jaws with age & in adults with mastication and deglutition, perception of taste, speech and phonation, respiration. Tongue can be divided in three surfaces, the ventral surface, dorsal surface and the lateral surfaces. It is broadly divided as the anterior portion referred to as anterior two-third of the tongue and the posterior one third. When viewed through the lips or when extended, the oral portion of the tongue is prominent and is commonly referred to as the anterior two-thirds, with the posterior third less well visualized. When the tongue is removed in toto and is not extended, the oral portion may appear no larger than the posterior pharyngeal portion (Burket, 1994). The human tongue has a complex muscle architecture; it is anisotropic in the anterior–posterior direction, and its two sides are mirror images (Stone, 1990).

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The organ is anchored to the hyoid bone, styloid process and the genial tubercles of the mandible at the points of insertion of three extrinsic muscles hyoglossus, styloglossus and geniohyoglossus. The bulk of tongue is composed of four groups of intrinsic muscles that are attached to a well developed median fibrous raphae and a similar dorsal submucous fibrous raphae (Burket, 1994). The mucosa of anterior dorsal surface of tongue is characterized by two types of papillae with defined functions (filliform and fungiform) and a number of other elevations without any clear function (Halpern, 1976; Miller, 1991). A current estimate of the total number of Fungiform taste buds on the anterior two third of tongue is 2500, with variation as great as 18-fold between individuals (Miller, 1991). In general, individuals with a higher Fungiform taste bud densities report some tastes as more intense than those with fewer taste buds (Miller, 1998). Anything apart from normal may be considered as a defect or disease related to the organ involved. In this review we have tried to propose a new method of classifying diseases of tongue and give a review of tongue in different conditions.

Classification for diseases of tongue

Developmental disorders of tongue

Variations in morphology

- Ankyloglossia
- Aglossia/ Hypoglossia
- Macroglossia
- Cleft/lobed/bifurcated & tetrafurcated tongue
- Fissured tongue

Variations in function

- Speech defects
- Glossopalatine ankylosis

Variations in movement

- Trefoil tongue
- Gorlin sign
- Tongue in tuberous sclerosis
- Tongue thrusting
- Miscelleneous
- Thyroglossal duct cysts
- Lingual thyroid

Nutritional & Metabolic Disorders.

- Geographic tongue
- Depapillation and atrophic lesions
- Amyloidosis
- Diabetes
- Malabsorption syndrome
- Drug conditioned deficiency
- Hematologic abnormalities

Discolorations and Pigmentation of tongue.

Endogenous

- Jaundice
- Addisons disease
- Physiologic pigmentation
- Neurofibromatosis

Exogenous

- Metabolic products
- Food debris
- Black hairy tongue
- Dyes
- Mouth rinses [chlorhexidine]
- Chemotherapeutic agents [doxorubicin hydrochloride]

Inflammatory conditions of tongue.

- Glossitis
- Traumatic injuries
- Ulcers
- Superficial vascular changes

Infections with direct and indirect relation

Bacterial

- Scarlet fever
- Tuberculosis
- Blastomycosis
- Syphilis
- Ludwig's angina, etc

Fungal

Candida, etc

Viral

- Herpes simplex
- Herpes zoster
- HIV, etc

Parasitic

Neuromuscular disorders of tongue.

Dysphagia

- Dystonia
- Dyskinesia
- Tremors
- Myotonic dystrophy
- Obstructive sleep apnea
- Glossoptosis

Premalignant Lesions and conditions of tongue.

- Leukoplakia
- Lichen planus

Benign Lesions of tongue

- Fibroma
- Hemangioma
- Lymphangioma
- Leiomyoma
- Rhabdomyoma
- Granular cell tumor
- Schwannoma
- Neurofibroma.
- Lymphoepithelial cysts

Malignancy of tongue

- Squamous cell carcinoma
- Melanoma
- Lymphoma

Miscellaneous

- Neck tongue syndrome
- Vascular diseases of the body of tongue
- Angioneurotic edema
- Lingual varicocities
- Burns

Developmental disturbances of tongue:

Variations in morphology: In Aglossia/ macroglossia (Figure 1) what is commonly observed is a rudimentary, small tongue. As a consequence of the lack of muscular stimulus between the alveolar arches, these do not develop transversely and the mandible does not grow in an anterior direction, producing as a result a severe dentoskeletal malocclusion (Shafer, 2012) Aglossia-Macroglossia syndrome malformation is very rare, since the first publication which was attributed by Gaillard and Nogué to Antoine De Jussieu in 1718, to present till date there have been less than 35 cases reported (Shafer 2012). The abnormal enlargement of tongue is referred to as macroglossia. It is observed to occur in conditions causing accumulation of fluid or other deposits in tissue of tongue. Congenital macroglossia is associated with Congenital Lymphangioma &/or Hemangioma as in Sturge-Weber syndrome [(1)] in Glycogen storage diseases (Stone, 1990) and other syndromes like Down's syndrome (Stone, 1990). Tongue tie is usually defined on the basis of inability to extend the tip of tongue beyond the vermillion border of lip or a line joining the lip commisures, although some authors also require evidence of speech impairement (Sedano, 1989; Young, 1979). Fissured, Cleft, Lobed, bifurcated and tetrafurcated tongues maybe associated with Coffin-Lowry syndrome, Meckle's syndrome, Fraser's syndrome (Burket, 1994).

Variations in function: Speech defects considered here are caused due to abnormal morphology of the tongue and not those caused due to involvement of the nervous system. Speech defects in pronunciation of the letters *t, d, n* and *l* sounds and words such as *ta, te, time, water, cat*. In some instances, speech defects of this type can be handled satisfactorily by a speech therapist without the need to cut frenum (Hanson, 1988).

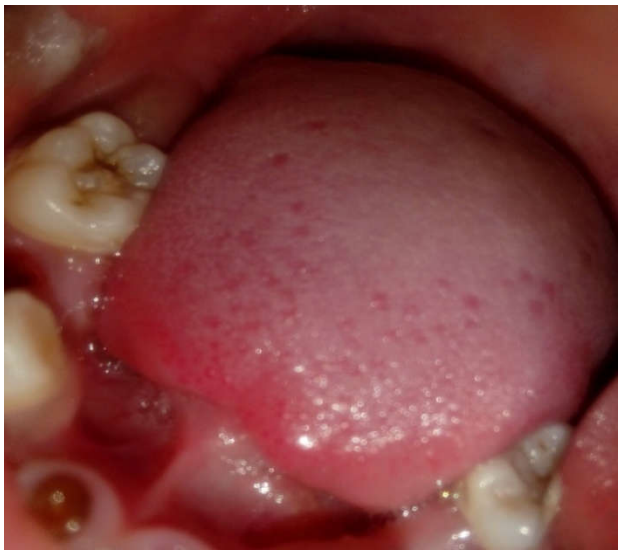

Figure 1. Ankyloglossia/ Tongue-tie

Figure 2. Geographic tongue

Attachment of the tip of the tongue to the hard palate is called as glossopalatine ankylosis or ankyloglossum superius syndrome (Gima, 1987).

Variations in movement: The ability to curl or deform the margins of the tongue is apparently under partial genetic control.[11] Few individuals can voluntarily deform the tip of the tongue into a clover leaf pattern (trefoil tongue), although no clear inheritance pattern has been identified this (Burket, 1994).

Figure 3. Depapillated areas on dorsum of tongue in lactating mother with nutritional deficiency

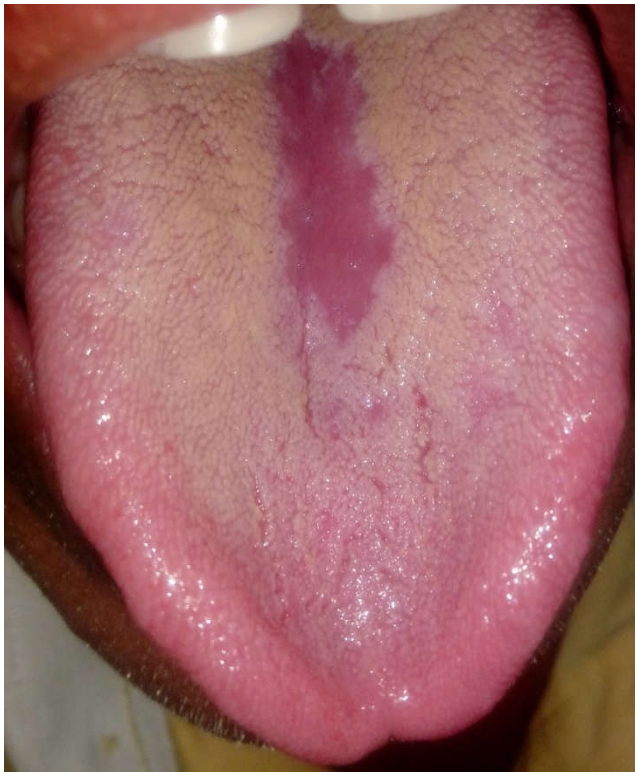

Figure 4. Median rhomboid glossitis.

The unusual extensibility of tongue, both to touch the tipoff the nose is referred to as Gorlin's sign seen in patients with Ehler-Danlos syndrome (Brighton, 1970). Tongue in tuberous sclerosis has been described as "long and narrow" but does not show extensibility (Burket, 1994).

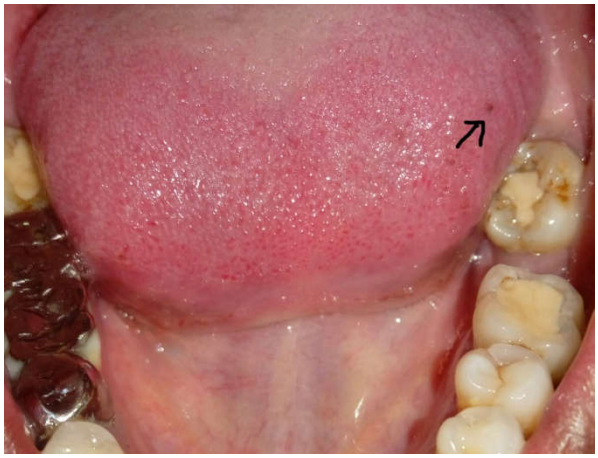

Figure 5. Physiologic pigmentation (mole)

Figure 6. Aphthous ulcer on ventral surface in a 30 year old male

Figure 7. Ulcer on ventral surface extending upto floor of mouth in a 70 year old patient

Figure 8. Suspected malignancy on lateral surface of tongue in a patient with history of tobacco abuse.

Tongue thrusting is the positioning of the tongue between the anterior teeth during swallowing, speaking or at rest (Gellin, 1978).

Miscellaneous: Thyroglossal cysts can be defined as an irregular neck mass or a lump which develops from cells and tissues left over after the formation of the thyroid gland during developmental stages University RMC, 2015. Thyroglossal cysts are the most common cause of midline neck masses and are generally located caudal to (below) the hyoid bone. These neck masses can occur anywhere along the path of the thyroglossal duct, from the base of the tongue to the suprasternal notch (Deaver, 2009).

Nutritional & Metabolic Disorders: The tongue is normally covered with tiny, pinkish-white bumps (papillae), which are actually short, fine, hairlike projections. With geographic tongue, patches on the surface of the tongue are missing papillae and appear as smooth, red "islands," often with slightly raised borders. These patches (lesions) give the tongue a map like, or geographic, appearance. Figure 2. The lesions often heal in one area and then move (migrate) to a different part of your tongue. Geographic tongue is also known as benign migratory glossitis (Mayo Clinic, 2018). Bald tongue is defined as complete atrophy of lingual papillae seen in pernicious, Hunter's glossitis or iron deficiency anemia, pellagra bald tongue of Sandwith (McGraw Hill, 2002). The term atrophic glossitis is commonly used to describe the appearance of tongue that results from various nutritional deficiencies and hematological abnormalities Figure 3. Refer Table 1. Depapillation may also be associated with malapsorption syndrome, drug conditioned deficiency (isoniazid) (Burket, 1994). Diabetes and chronic candidiasis are associated with conditions variously referred to as Median rhomboid glossitis, Figure 4. central papillary atrophy or atrophic glossitis (Burket, 1994). Amyloidosis of the oral cavity is uncommon. The tongue is the most frequent site, followed by the floor of the mouth, buccal mucosa, soft palate, gingiva, hard palate and lower lip region (Dimitrios Andreadis, 2011). The most common symptoms are fatigue, unexplained weight loss, swelling of the ankles and legs due to fluid accumulation (oedema), shortness of breath, loss of appetite, an enlarged tongue (macroglossia), unexplained bruising around the eyes, numbness or tingling in the hands and feet (peripheral neuropathy) (Robbins *et al*., 2010).

Table 1. Characteristic appearances seen of the tongue

Moeller- Hunter Glossitis/ Beefy red tongue	Pernicious Anemia
Bald tongue of Sandwith	Pellagra
Atrophic glossitis	Diabetes, candidiasis
Benign migratory glossitis/ geographic tongue/ wandering rash	Immunologic reaction
Interstitial glossitis	Syphilis
Strawberry tongue	Scarlet fever
Baked tongue	Typhoid fever
Parrot tongue	Tongue of chronic low grade fevers
Wooden tongue of cattle	Actinomycosis
Earthy/ encrusted/ hairy tongue	In dehydrated, debilitated, terminally ill patients

Table 2. Pigmentation/ discoloration of tongue

Color of tongue	Condition associated
Brown	Physiologic pigmentation, Mole/ melanin deposition.
Yellow	Poor oral hygiene Food debris Dyes from candy, beverages etc Jaundice
Black	Hairy tongue due to hypertrophy of the papillae. Discoloration due to growth of bacteria producing pigment. Staining from food.
Blue	Food debris due to edible coloring agents. Sign of cyanosis. Sign of primary adrenal insufficiency. Airway obstruction Asthmatic attacks Chronic obstructive pulmonary disease (COPD) Congenital heart disease Pneumonia Poisoning Suffocation Bacteria producing pigment.
White	Coating on tongue. Candida infection Leukoplakia Lichen planus
Purple	vitamin B2 (riboflavin) deficiency Central cyanosis High levels of cholesterol Food coloring agents.
Red	Glossitis/ inflammation. Vitamin deficiencies Anemia Depapillation Scarlet fever (strawberry tongue) Toxic shock syndrome Kawasaki syndrome

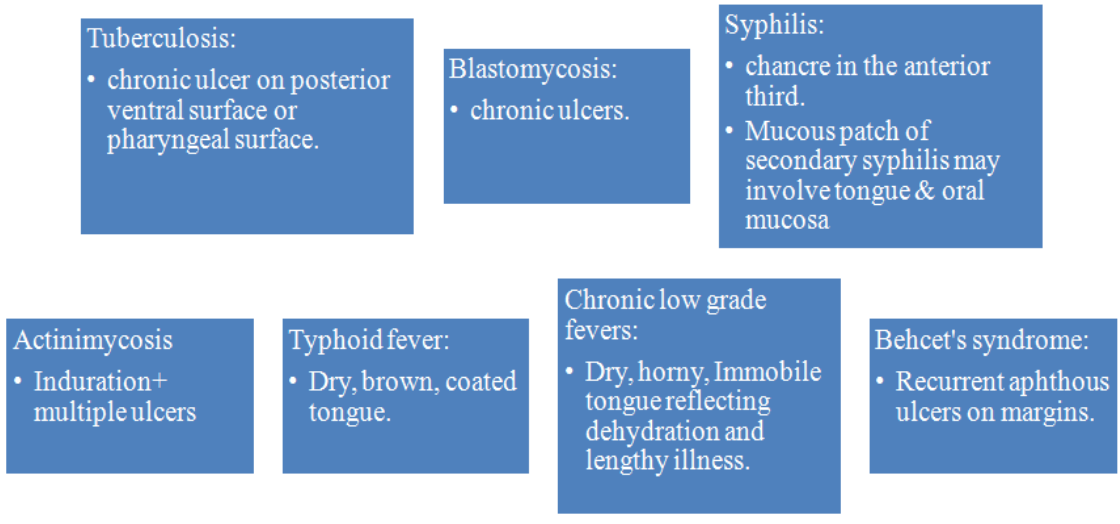

Table 3. Bacterial Infections associated with tongue and their characteristic features enlisted in a single frame (Burket, 1994).

Table 4. Neuro-muscular disorders associated with tongue (Burket, 1994).

Dysphagia	Weakness of tongue muscles
Dysarthria	Speech problems caused by neuromuscular disorder
Dystonia	Abnormally increased muscular tone
Dyskinesia	Repetative uncontrolled muscular activity
Tremors	Rhythemic oscillation of a part of the body
Obstructive sleep apnea	Intermittent ceasation of respiration associated with regular sleep
Glossoptosis	Postero-inferior positioning of the tongue.

Table 5. Benign growths of the tongue (Brian, 2012)

Granular cell tumors	Granular cell tumors are small, solitary, firm, painless tumors that can occur throughout the body. More than one half of cases occur in the oral cavity, and up to one third involve the dorsum of the tongue.
Fibroma	Traumatic fibroma is a common lesion of the oral cavity. It usually appears along the bite line as a focal, thickened area that is typically dome shaped, pink, and smooth. It is caused by the accumulation of dense, collagenous connective tissue at the site of chronic irritation.
Lymphoepithelial cysts	Lymphoepithelial cysts are yellowish nodules located on the ventral surface of the tongue, tonsillar region, or floor of the mouth. They are benign and thought to arise from the entrapment of salivary epithelium in lymphoid aggregates during embryogenesis
Papilloma	Squamous Papilloma is one of the more common oral lesions, occurring in up to 1 percent of adults. It is generally associated with human papillomavirus type 6 or 11 infection. Papillomas typically appear as a single, isolated, pedunculated lesion with finger-like projections. Treatment involves surgical excision or laser ablation.

Localized amyloidosis of tongue typically presents as macroglossia, tongue protrusion beyond the alveolar ridge, speech impairment and dysphagia (Faramarz Memari *et al*., 2011).

Discolorations and Pigmentation of tongue: Refer table 2.
Physiologic pigmentation (Figure 5) of the oral mucosa is clinically manifested as multifocal or diffuse melanin pigmentation with variable prevalence in different ethnic groups (Lenane *et al*., 2000). Physiologic pigmentation, which is common in African, Asian, and Mediterranean populations, is due to greater melanocyte activity rather than a greater number of melanocytes (Gaeta *et al*., 2002). Differential diagnosis for brownish pigmentation depends on whether the lesion is focal (melanotic macule, nevus, melanoma), diffuse (ecchymosis, melanoma, drug induced), or multifocal (physiologic pigmentation, drug induced, oral lichen planus, and so on) (Chandra *et al*., 2010). In darker skinned people, oral pigmentation increases, but there is no difference in the number of melanocytes between fair-skinned and dark-skinned individuals. The variation is related to the differences in the activity of melanocytes (Özbayrak *et al*., 2000). Melanin-containing electron-dense vesicles, so-called melanosomes, are formed within the cytoplasm and transported along the dendrites (Hicks *et al*., 2000). Black hairy tongue/ coated tongue is caused due to heavily kertinized surface layers of filiform papillae are continuously desquamated. Longer papillae give the tongue a hairy appearance (Burket, 1994).

Inflammatory conditions of tongue: Glossitis refers to inflammation of the tongue. The condition causes the tongue to swell in size, change in color, and develop a different appearance on the surface. Types: Acute, chronic, atrophic, idiopathic. Traumatic injuries may be caused due to sharp teeth, tongue-bite, sharp margins of restorations and prosthesis, ill-fitting dentures. Ulcers of the tongue (Figure 6, 7.) may result from a variety of physical and infectious agents acting on the normal mucosa that has been already damaged by atrophic changes, vesiculobullous disease or other immunologic reactions (Burket, 1994). Superficial vascular changes like lingual varicosities are evident as prominent purplish blue spots, nodules and ridges, usually on the anterior ventral surface of the tongue (Burket, 1994). Caviar spots are the angiomas of the tongue.

Infections with direct and indirect relation: Infections (Table 3) with direct association lead to sign and symptoms due to presence of the causative organism on the tongue, but some conditions like HIV may show indirect association, i. e the symptoms may suggest presence of infection but is not a characteristic always to rule out diagnosis. The infections should be categorized as bacterial, fungal, viral and parasitic. Bacterial may be caused due to prior infection, odontogenic cause, piercing, trauma, etc. Ludwig's angina shows an indurated swelling of the whole floor of mouth and the base of the tongue, which pushes the tongue upwards and prevents the patient from closing mouth. It is not an infection of tongue, rather a squeal to periapical infection spreading to spaces (Burket, 1994). In infections with toxin producing Strep pyogennes (scarlet fever) the classic sign of strawberry tongue is described because of prominent red fungiform papillae against a whitish pink coating (Burket, 1994). Oral thrush also known as candidiasis, oral thrush is a yeast infection that develops inside the mouth. The condition results in white patches that are often cottage cheese-like in consistency on the surfaces of the mouth and tongue. Oral thrush is most commonly seen in infants and the elderly, especially denture wearers, or in people with weakened immune systems. People with diabetes and people taking inhaled steroids for asthma or lung disease can also get thrush. Oral thrush is more likely to occur after the use of antibiotics (https://www.webmd.com/oral-health/guide/ tongue-problem-basics-sore-or-discolored-tongue- and-tongue-bumps#1). Herpes zoster may affect the lingual branch of the mandibular division of fifth cranial nerve and produce a series of ulcerations along the anterior third of the tongue on one side. Localization and encystment of cestode and nematode parasites in tongue muscles have been described in a number of occasions (Burket, 1994). HIV may show associated infections due to hampered immune mechanism, opportunistic candidal infections are observed.

Neuro-muscular disorders associated with tongue: Refer Table 4.

Rabbit syndrome: Fine trmors and fasciculations of tongue are described as "vermicular movements", rapid darting of the tongue as "fly catcher's tongue" or "bon-bon sign" and when

associated with involuntary mouthing, chewing and smacking movements of the lipswith constant tremor (Burket, 1994).

Premalignant lesions and conditions of tongue: Leukoplakia is a whitish patch or plaque that cannot be characterized, clinically or pathologically, as any other disease and which is not associated with any other physical or chemical causative agent except the use of tobacco. If it occurs on tongue, it is called as 'chronic superficial glossitis' confined to ant. 2/3 rd of tongue, dorsum and lateral border. The affected area shows milky-white patches with fissure and cracks (Burket, 1994). Lacelike , erosive and bullous variety of this disorder may affect the tongue in addition to the cheeks, lips, and gingiva referredto as Lichen planus. Chronic Lichrn planus often leads to considerable atrophy and scarring of the tongue dorsum (Burket, 1994). Benign lesions or growths of the tongue (Table 5) are generally due to the musculature of the tongue. All tumors related to skeletal muscles need to be considered. The tumor characteristics generally remain the same. Even cysts of the tongue contribute to benign lesions like Mucocele, lymphoepithelial cysts.

Malignancy of the tongue: Squamous cell carcinoma (SCC) of the tongue is the most frequent intra oral head and neck cancer. European statistics indicate an incidence of around 10–20 per 100 000 of the population (Crede, 2012). In young patients the main causal factor of oropharyngeal SCC appears to be HPV infection, associated mostly with cancer of the tonsils (Hobbs, 2006). In adults malignancy is mostly associated with tobacco and or alcohol abuse. Lateral border of the tongue is usually involved.[1] Surgical excision with or without radiotherapy if often line of treatment. Figure 8.

Miscellaneous conditions: Include Angioneurotic edema of the tongue and burns. Burns may be caused by thermal or chemical agents. Example of severe burns is one caused by electric contact or due to ingestion of lye (Burket, 1994).

Conclusion

Paying attention toward tongue during examination of a patient plays a crucial part in diagnosis. As a lot of systemic as well as local conditions may be associated with anything that doesn't appear normal. The muscle of the mouth, the tongue may reveal many aspects about the health of a person.

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