European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 5, 2020

Taste Alterations-A Review

Dr.N.Anitha, Dr. S.Kowsalya, Dr.N.Aravindha Babu, Dr.K.M.K.Masthan

Department of oral pathology and Microbiology

Sree Balaji Dental College and Hospital, Chennai

Bharath Institute of Higher Education

ABSTRACT

Taste sensation is a very important factor for maintenance of the health of an individual. It is very essential sensation that serves to assess the nutritious content of food, and also supportsthe oral intake, and preventsfrom the ingestion of potentially toxic substances. Patients become distressed because of the taste disorders. This will causethe serious threat to the health of an older and more vulnerable patientsthey can have high chances to become malnourished through the loss of taste sensation or changes in taste perception.The dentist is the first person who hear complaints about alteration in taste from the patients.Taste changes which may lead the patients to seek inappropriate dental treatments. The proper diagnosis of the etiology is the most important step in the treatment of taste disorders. Thus, it is much needed that dental clinicians to be familiar with the various causes and proper management of taste changes.

KEY WORDS: *Taste perception, Alteration of taste, Gustatory disorders,Dysgeusia*

INTRODUCTION

Taste perception is the most important factor for the maintenance of sustaining human life. In human being's life enjoyment of food is consider as one of the greatest sources of pleasure. Sensitive towards the taste is a most essential need for the food to be palatable. Taste perception plays a crucial role for motivating the food intake and to obtain energy and nutrients which is very much needed for the maintenance of the body's functions.Loss of taste sensation may affect the quality of life.

PATHWAY OF TASTE

The sensation of taste is mediated by 3 cranial nerves: The facial (VII), glossopharyngeal (IX) and vagus (X).[1] The trigeminal nerve (V) provides general sensory innervation to a region that overlaps the areas served by these other cranial nerves[1]

Cranial nerve	**Location exit from skull**	**Branches**	**Innervated area related to taste function**
Mandibular (V3) a branch of the trigeminal nerve	Foramen ovale	Lingual nerve	General sensation on the anterior two thirds of tongue
Facial nerve(VII)	Internal auditory meatus	Chorda tympani nerve The Greater superficial petrosal nerve	Sensation of taste on the anterior two thirds of tongue Sensation of taste on the palate
Glossopharyngeal nerve(IX)	Jugular foramen	Lingual branch	Sensation of taste on the posterior third of tongue

			General sensation on the posterior third of tounge,oropharynx and pharyngeal mucosa
Vagus nerve(X)	Jugular foramen	Palatopharyngeal branch	Sensation of taste on the base of tongue and epiglottis General sensation on soft palate and upper larynx

The tongue is covered by numerous papillae of four varieties namely:[2,3]

Filiform papillae

Filiform papillae aremost numerous and appear as a short, rough structures which is covered by thick keratinized epithelium. Taste buds are not present in filiform papillae. The filiform and the fungiform papillae are spread mainly at the tip and along the lateral borders of the tongue.

Fungiformpapillae

Fungiform papillae are dispersed across the tongue surfaces. They are box-like, with a connective tissue core and present with a thin covering of epithelium. Most of the fungiform papillae contains single taste bud on the tip.

Circumvallate papillae

The circumvallate papillae are larger and located anterior and parallel to the sulcus terminalis, appears as a dome-shaped, which is surrounded by trough, called a crypt. The crypt is lined by gustatory epithelium, which contains several taste buds.There are 12-15 circumvallate papillae in humans.

Foliate papillae

Foliate papillae are present on the lateral sides of the tongue,which is appear like the slits, and supplied by the glossopharyngeal nerve.

Taste buds

Taste sensation is mediated by taste buds. They consist of taste cells and nerve fibers within the specialized epithelial structures. The taste molecules are detected by the chemosensitive receptors present within the taste buds. Taste buds have the capacity to regenerate and have a half-life of 10 to 15 days.[2]

The taste buds contain three types of taste receptors:[2,4]

Type I: Receptors which detects the salt taste.

Type II: Receptors found in the fungiform and circumvallate papillae and detect sweet, bitter, and umami tastes.

Type III: Receptors can be found in the circumvallate and foliate papillae and detect the sour taste.

Types of tastes[4,5]

Five types of taste are presented mainly they are,

- **Salty and Sour tastes:** salt and the sour tastes are perceived in the lateral borders of the tongue.
- **Sweet:**The sweet taste which is perceived at the tip of the tongue.
- **Bitter:**Bitterness perceived at the posterior part of tongue.
- **Umami tastes:** The umami is a new term for a taste to be described as savory, which is created by the combination of glutamate along with 5-ribonucleotides. The umami taste which is abundant in the foods including fish, crab, scallop, chicken, cheese, and black mushrooms.

Taste perception

Each taste cell present in the taste buds expresses one of the five taste receptors that selectively interact with the chemical tastants such as sodium chloride (Nacl), hydrogen chloride (Hcl), sucrose, quinine, and umami substances. Taste receptors contain two G protein-coupled receptor families, T1R and T2R. Gustducin is a trimetric G-protein complex that involved in the sweet, bitter, and umami taste transduction.[5,6]As the taste receptors are usually adapted to the salivary environment, the taste of saliva is not normally recognized the major ions, whoseconcentration was fluctuates widely with the changes inflow rate of the saliva, potentially stimulate the taste receptors. Transmission of acid taste occurs by the means of blockage of the K+ channels in the membrane of taste receptors. A potential independent Na+ channel which is concerned with the transduction of salty taste, whereas, transmission of the sweet and the bitter tastes is linked with specific membrane receptors, they are associated with the second-messenger systems (cAMP and IP3).[7]Stimulation of taste receptors which produces the signals that travel through the cranial nerves VII, IX, and X to the gustatory nucleus in brain. Trigeminal nerve which is associated with the assigning sensations, such as, the temperature, texture, and the 'hotness' of food. This is probably the reason why complete loss of the taste is rarer than the loss of smell and also indicates the importance of olfactory system in the perception of taste and flavor.[7]Centrally, there aretwo pathways for the taste perception one ascends to the hypothalamus and other to thethalamus and then to the gustatory center of cortex. A disturbance along these pathways results in taste perception changes.[8]

Classification of taste disorders

Taste disorders are classified based on the two principles: type and site of the lesion.

On the basis of the type of lesion, the taste disorders are grouped as:[9,10,11]

Quantitative disorders:

- **Hypergeusia**- Increased sensitivity to taste
- **Hypogeusia** -Decreased sensitivity to taste
- **Dysgeusia** - Taste confusion
- **Ageusia** -complete loss of taste

Qualitative disorders:

- Parageusia
- Pseudogeusia
- Phantogeusia
- Agnogeusia

According to the Fikentscher 1987, taste disorders are classified based on the site of the lesion, for example, dysguesia is due to:[12]

- **Epithelial Disorders**- defect in the detection of taste due to disorders of the mucosa and taste buds
- **Neural Disorders** - defect in transmission and perception of the taste stimulus due to the neural disorders

• **Central Disorders**-central lesions, such as, brain tumor, surgeries, head trauma, Alzheimer's disease, and so on.

Depending on the results of the gustatory testing, the taste disorders can be classified as follows:

• **Total Ageusia**- complete lack of taste sensation to all types of tastes

• **Partial Ageusia**-complete lack of taste sensation to few tastes

• **Total hypogeusia**- decreased sensation to all types of tastes

• **Partial hypogeusia**-decreased sensation to few tastes

• **Hypergeusia**-increased sensitivity to taste

• **Dysgeusia**-taste confusion or presence of a strange, distorted taste sensation

Conditions and mechanisms resulting in taste changes1–[13,14,15,16–19]

Condition	Mechanism	Taste alteration
Head trauma	Damage to central or peripheral nerves	Dysgeusia Ageusia
Systemic conditions (diabetes, hypothyroidism, systemic lupus erythematosus and nasal polyps)	Alteration in taste receptor function or signal transduction Decreased salivary flow rate	Dysgeusia Elevated bitter taste
Various medications, including ACE inhibitors, calcium-antagonist, diuretics, antiarrythmics, antibiotics, antivirals, antiprotozoals, antirheumatics, antithyroid, antidiabetic, antihistamines, antidepressants, antipsychotics, local anesthetics, antineoplastic treatment, chelating agents	Interference with chemical compositionor flow of saliva Secretion of the medication in saliva Alteration in taste receptor function orsignal transduction	Hypogeusia (decreased sensitivity to taste) Dysgeusia Ageusia
Radiation or chemotherapy to treat cancer of the head and neck	Changes in salivary composition Drug secretion in oral fluids Decreased salivary flow rate Alteration in normal oral flora Decreased rate of turnover of taste buds	Dysgeusia Ageusia
Viral infections (upper respiratory tract and middle ear, herpes zoster, HIV)	Damage to central or peripheral nerves	Dysgeusia Ageusia
Oral bacterial and fungal infections	Damage to central or peripheral nerves Decreased salivary flow rate	Elevated bitter and/or metallic taste Dysgeusia
Oral conditions (lichen planus, burning mouth syndrome and dry mouth)	Damage to central or peripheral nerves Decreased salivary flow rate	Hypogeusia Dysgeusia
Local anesthetics (articaine, procaine, tetracaine, bupivacaine or lidocaine)	Direct needle trauma to nerve Hemorrhage inside the epineurium Neurotoxicity	Hypogeusia Dysgeusia Ageusia
Surgical procedures	Partial or complete nerve transaction	Dysgeusia

		Ageusia

Clinical Evaluation and Diagnosis

There are four basic components in the clinical evaluation of a patient with gustatory disorder:

Detailed history: The proper history plays a major role in etiological diagnosis. Often associated events with the onset of gustatory complaint gives the most needed clue about the cause of the disorder. A detailed history of changes in the medication and dental procedures such asextraction of teeth, surgeries, types of toothpaste, and oral rinses usedshould also be taken into consideration.[12,20]

Physical examination: plays an important role in theetiological diagnosis. Abnormalities seen in the oral andnasal cavities may provide key etiological information and focus attention on the local factor in nose or the oral cavity, to explain the development of gustatory disorder. Incases of phantom taste complaints, essential to rule out the oral health problems that may contribute to these. A thorough oral examination should be performed, including assessment of the possible abnormalities in the microbial flora of the oral cavity.[12,21,22]

Psychophysical examination:A psychophysical evaluation is essential to corroborate the patient's complaints, determine the efficacy of treatment, and measure the degree of permanent impairment. The practitioner should also be sensitive to the patient's psychological state. Depression may be the result of a taste problem or contribute to a taste complaint. In either case, referral for psychological counseling should be considered, although not as a first step.[12,22]

Medical imaging: The role of imaging is in many ways an extension of thephysical examination and in the case of inflammatory processes in the oral cavity, nose, and paranasal sinuses may provide anatomical and etiological diagnostic information. Examinations using imaging techniques to rule out or prove the presence of damage to central nervous structures and in particular to the brain stem, thalamus, and pons may be necessary.[8,22]

Management of taste Disorders

Taste changes which causes stressfor the patients, particularly if a diagnosis is not established and treatments are not effective. Practitioners must counsel patients with coping strategies and behavioral modification techniques. Moreover, patients need to be advised on nutrition and appetite issues to prevent nutritional deficiencies. Special attention has to be paid to possible underlying illnesses and medicines taken by the patient.[7,9] Specific conditions related to taste dysfunction, such as, hyposalivation, poor oral hygiene, use of tobacco products and/or alcohol, have relatively simple solutions. Discontinuing the etiological habit, chewing sugarless gum or candy for taste and salivary stimulation, or prescribing sialogogue can be used for individuals with residual salivary gland function. Chewing gum or candy may also cover the unpleasant taste and provide symptomatic relief. In patients with gastric reflux, acid pump inhibitors, such as, omeprazole,pantaprazole, and lansoprazole are effective. In cases of exposure to toxins or drugs, elimination of the offending agent often improves the problem. If trauma is the cause, no specific therapy is available, but the condition may improve in time with regeneration of the nerve cells.[23] Taste loss and xerostomia in patients being treated with radiotherapy can be prevented by protecting healthy oral tissues from the effects of irradiation. One method is by minimizing the radiation fi eld by shielding or avoiding irradiation of the tongue and salivary glands. Avoiding extraneous irradiation is often possible by recent advances in radiation treatment techniques, such as 3-D conformal radiation therapy and intensity-modulated radiotherapy (IMRT).[11,24] Necrotic oral lesions such as Acute Necrotizing Ulcerative Gingivitis, Acute Necrotizing Ulcerative Periodontitis, chronic ulcers, and malignant ulcers may present with smell and taste changes, which may be secondary to gramnegative bacterial overgrowth. In such cases, use of topical antiseptics such as chlorhexidine gluconate or systemic antimicrobials such as metronidazolemay be considered, along with specific treatment for the lesions.[24] The relationship between zinc and taste perception has been well-established. Zinc deficiency in humans and animals impairs sensitivity to taste and odors, altering perception.

Clinical evidence suggests that exogenous zinc sulfate administration successfully improves taste and odor disorders.[25]

Conclusion

Taste changes affect the quality of life of the patients. The availability of testing for the integrity remains limited. Patients are often subjected to the unnecessary and sometimes irreversible and damaging treatment of teeth and other oral mucosal tissues. Thus, proper oral examination and identification of the etiological factors helps for the management of oral disorders.

REFERENCES

1. Netter FH. Atlas of human anatomy, professional edition. 4 ed. Philadelphia: WB Saunders; 2006.
2. Nelson GM. Biology of taste buds and the clinical problem of taste loss. Anat Rec 1998;253:70-8.
3. Klasser GD, Utsman R, Epstein JB. Taste change associated with a dental procedure: Case report and review of the literature. J Can Dent Assoc 2008;74:455-61.
4. Chaudhari N, Roper SD. The cell biology of taste. J Cell Biol 2010;190:285-96.
5. Sasano T, Satoh-Kuriwada S, Kaneta N, Shoji N, Kawai M, Uneyama H. Incidence of taste disorder and umami taste disorder among the Japanese elderly and youth. J Nutr Food Sci 2012;S10:002.
6. Matsuo R. Role of saliva in the maintenance of taste sensitivity. Crit Rev Oral Biol Med 2000;11:216-29.
7. Hummel T, Landis BN, Hüttenbrink KB. Smell and taste disorders. GMS Curr Top Otorhinolaryngol Head Neck Surg 2011;10:Doc04.
8. Onoda K, IkedaM. Elucidation of taste disorders caused by central lesions. JMAJ 2003;46:296-301.
9. Su N, Ching V, Grushka M. Taste disorders: A review. J Can Dent Assoc 2013;79:d86
10. Kumbargere SN, Naresh YS, Srinivas K, Renjith George P, Shrestha A, Levenson D, et al. Interventions for the management of taste disturbances. Cochrane Summaries 2013;CD010470.
11. Hong JH, Omur-Ozbek P, Stanek BT, Dietrich AM, Duncan SE, Lee YW, et al. Taste and odor abnormalities in cancer patients. J Support Oncol 2009;7:58-65.
12. Cowart BJ. Taste dysfunction: A practical guide for oral medicine. Oral Dis 2011;17:2-6.
13. Valmaseda-Castellón E, Berini-Aytés L, Gay-Escoda C. Lingual nerve damage after third lower molar surgical extraction. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2000; 90(5):567–73.
14. Pogrel MA, Schmidt BL, Sambajon V, Jordan RC. Lingual nerve damage due to inferior alveolar nerve blocks: a possible explanation. J Am Dent Assoc 2003; 134(2):195–9.
15. Pogrel MA, Thamby S. Permanent nerve involvement resulting from inferior alveolar nerve blocks. J Am Dent Assoc 2000; 131(7):901–7.
16. Fielding AF, Rachiele DP, Frazier G. Lingual nerve paresthesia following third molar surgery: a retrospective clinical study. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 1997; 84(4):345–8.
17. Paxton MC, Hadley JN, Hadley MN, Edwards RC, Harrison SJ. Chorda tympani nerve injury following inferior alveolar injection: a review of two cases. J Am Dent Assoc 1994; 125(7):1003–6.
18. Shafer DM, Frank ME, Gent JF, Fischer ME. Gustatory function after third molar extraction. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 1999; 87(4):419–28.
19. Brann CR, Brickley MR, Shepherd JP. Factors influencing nerve damage during lower third molar surgery. Br Dent J 1999; 186(10):514–6.
20. Naik BS, SheĴ y N, Maben EV. Drug-induced taste disorders. Eur J Intern Med 2010;21:240-3.
21. Sakashita S, Takayama K, Nishioka K, Katoh T. Taste disorders in healthy "carriers" and "non-carriers" of candida albicans and in patients with candidosis of the tongue. J Dermatol 2004;31:890-7.
22. Snow JB Jr, Doty RL, Bartoshuk LM. Clinical evaluation of olfactory and gustatory disorders. In: Getchell TV, Bartoshuk LM, Doty RL, Snow JB, editors. Smell and Taste in Health and Disease. New York: Raven Press; 1991.
23. Mann NM. Management of smell and taste problems. Cleve Clin J Med 2002;69:329-36

24. Epstein JB, Barasch A. Taste disorders in cancer patients: Pathogenesis, and approach to assessment and management. Oral Oncol 2010;46:77-81.
25. Yagi T, Asakawa A, Ueda H, Ikeda S, Miyawaki S, Inui A. The role of zinc in the treatment of taste disorders. Recent Pat Food Nutr Agric 2013;5:44-51.