REVIEW

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Management of smell and taste problems

ABSTRACT

Lost or impaired smell or taste should be taken seriously, as it puts a person at higher risk for toxic exposures, such as gas leaks, smoke, and rotting food, and it also takes away the enjoyment of some of life's pleasures, such as the fragrance of flowers or the taste of good food or fine wine. In many patients, the loss follows a viral upper respiratory tract infection, and the only real treatment is to reassure patients that the problem may resolve if the damaged sensory cells regenerate. In other patients, the loss has more subtle causes and deserves a careful investigation and appropriate treatment. This article reviews the proper steps to take when investigating and treating chemosensory difficulties.

KEY POINTS

Aside from increasing the risk of toxic exposures, the loss of smell and taste often leads to depression, anorexia, and weight loss.

A thorough workup includes smell and taste testing, imaging studies, and blood testing.

Gastric reflux is a common cause of taste dysfunction.

THE LOSS OF SMELL or taste too often does not get the medical attention it deserves. This is unfortunate because of the serious implications for the patient's well-being.

In many patients, smell or taste problems follow a viral upper respiratory tract infection, which can damage sensory cells. These patients need to be told that the damaged cells may regenerate with time, resulting in the return of smell and taste sensation. In other patients, the loss has more subtle causes and requires a more in-depth workup. This article presents an approach to all patients with impaired smell or taste.

THE RISKS

Loss or impairment of smell or taste puts people at greater risk of toxic exposures. With the loss of smell, they may be unable to detect leaking gas, smoke, or the odor of rotting food. Interestingly, 80% of the patients seen in our smell and taste clinic have not been told by their physician to get a gas detector in the home.

With the loss of smell and taste, many pleasurable life experiences disappear, such as the fragrance of perfume or flowers or the taste of good food or fine wine, and this puts the individual at higher risk for depression, anorexia, and weight loss.

According to one estimate,[1,2] more than 2 million adult Americans have some type of chemosensory disorder.

CAUSES OF SMELL DYSFUNCTION

Organs of smell sensation

The sense of smell involves the passage of odor-stimulant molecules through the nasal

canal, where they interact with olfactory cells in the nasal epithelium. Messages are then sent via the olfactory (first cranial) nerves through the cribriform plate of the ethmoid bone to the olfactory bulb in the brain, located just above the nose. Thereafter, information is transmitted to different portions of the brain. Olfactory cells are thought to regenerate every 30 or 60 days.[3]

Types of smell impairment

Normosmia is the name given to normal smell. Smell dysfunction can have various presentations:

- Hyposmia, diminished sense of smell
- Parosmia, aberrant odor perception, either without an odor stimulus (phantosmia) or with an odor stimulus (distortion)
- Anosmia, total loss of smell.

People who have lost their sense of smell sometimes retain their ability to detect pungent odors such as ammonia; however, this is due to stimulation of the trigeminal (fifth cranial) nerve endings, which cover the oral cavity as well as the nose.

Loss of smell can be the result of either mechanical obstruction of or neurologic damage to the nasal cavity, the neuroepithelium in the nasal canal, or the central olfactory elements. In some patients, odorants are blocked from reaching olfactory receptors, while in others peripheral olfactory receptors, nerve conduction pathways, or central olfactory areas are damaged.

25% of patients with smell loss had a recent viral respiratory infection

Rhinitis

At our clinic, mechanical obstruction is most commonly due to rhinosinusitis (25% of cases). Allergic and nonallergic rhinitis are significant causes of obstruction.

Viral infection

From 14% to 25% of patients who report partial or total impairment of smell have had a recent viral upper respiratory tract infection. Viral infection is thought to damage peripheral olfactory receptors and neural pathways to the brain.

Head trauma

At our clinic, head trauma has been the cause of olfactory impairment in 11% of cases; at the University of Pennsylvania, it has been reported as the cause in 17.6% of cases.[4] It has been stated that 5% to 30% of patients with head injury have some olfactory loss.[5] This may be due to blockage of the nasal canal, but the most common cause is injury to the delicate olfactory nerves as they travel from the nasal canal through the cribriform plate to the olfactory bulb. Even mild jarring injuries can cause disruption of the neural pathways. Damage to the bulb itself and other central areas can also occur.

Nasal polyps, tumors

Nasal polyps and tumors in the nasal canal can impede the progress of odorants. Polyps are common. The incidence of polyps as a cause of smell impairment varies in reports from 41% to 69%.[6]

Endocrine conditions

Endocrine disturbances such as diabetes mellitus,[7] hypothyroidism, and hypogonadism (eg, Turner syndrome, Kallmann syndrome)[8] are occasionally associated with olfactory impairment. Kallmann syndrome is characterized by hypogonadotropic hypogonadism with agenesis of the olfactory bulbs. Adrenal insufficiency[9] and pseudohypoparathyroidism[10] may also present with olfactory dysfunction.

Aging

A loss of olfactory sensitivity occurs with age. Degenerative changes occur in receptors in the nasal canal and even the olfactory bulb. The neurotransmitter pathways can also be affected. According to some estimates, almost everyone has some type of smell impairment by age 60 or 70, and half of those in their 80s are anosmic.[11]

Environmental toxins

Environmental toxins can cause severe disturbance in the olfactory system. They can enter through the blood stream or inspired air. Injury can involve the neuroepithelium or the olfactory nerves or both, and it can be reversible or irreversible. For example, exposure to arsenic, benzene, carbon disulfide,[12] cadmium, sulfur dioxide, chlorine, chromium fumes, and cigarette smoke[13] can produce

TABLE 1

Drugs that can cause impaired smell or taste

Antidepressants and anticonvulsants
Amitriptyline, carbamazepine, clomipramine, clozapine, desipramine, doxepin, fluoxetine, imipramine, lithium, phenytoin, trifluoperazine

Antihistamines and cold medications
Chlorpheniramine, loratadine, pseudoephedrine, terfenadine

Antihypertensives and cardiac medications
Acetazolamide, adenosine, amiloride, benazepril and hydrochlorothiazide, betaxolol, captopril, clonidine, diltiazem, enalapril, ethacrynic acid, nifedipine, propranolol, spironolactone

Anti-inflammatories
Auranofin, colchicine, dexamethasone, diclofenac, dimethyl sulfoxide, gold, hydrocortisone, d-penicillamine, penicillamine

Antimicrobials
Ampicillin, ciprofloxacin, clarithromycin, ofloxacin, streptomycin, tetracyclines

Antineoplastics
Cisplatin, doxorubicin, methotrexate, vincristine

Bronchodilators and other asthma medications
Albuterol, cromolyn sodium, flunisolide, metaproterenol, terbutaline

Lipid-lowering drugs
Cholestyramine, clofibrate, fluvastatin, gemfibrozil, lovastatin, pravastatin

Muscle relaxants and drugs for parkinsonism
Baclofen, dantrolene, levodopa

Radiation therapy
Radiation of the head

Vasodilators
Dipyridamole, nitroglycerin patch

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Suggest a home gas detector for patients with impaired smell

smell abnormalities. Pesticides are also important offenders.

Drugs

Drugs in many major therapeutic categories have been known to cause smell impairment (TABLE 1).

Neurologic diseases

Parkinsonism is frequently associated with olfactory dysfunction (dopaminergic medication has no effect on olfaction). Alzheimer disease can present initially with the problem of anosmia, possibly due to deposits of neuritic plaques in olfactory nerve pathways.[14] Huntington chorea and the demyelination of multiple sclerosis can also be associated with impairment of smell.

Temporal lobe epilepsy can have complications such as the inability to identify odors.

Psychiatric conditions

Psychiatric conditions such as depression and schizophrenia may also be associated with impairment of smell.

Congenital defects

Some patients complain of the inability to smell since birth. In most cases, this is congenital anosmia,[15] a condition in which the primary receptor neurons either are absent or are hypoplastic and lack cilia. However, sometimes the loss may have followed a forgotten head injury or viral infection. Magnetic resonance imaging (MRI) of the brain can confirm the absence of the olfactory bulb.

Autoimmune disorders

Sjögren syndrome (with accompanying symptoms of eye, nasal, and mouth dryness) is often accompanied by impaired smell due to lymphocytic infiltration into the nasal canal and the lacrimal and salivary glands. It shares certain autoimmune characteristics with rheumatoid arthritis, scleroderma, and systemic lupus erythematosus. Involvement of the central nervous system and spinal cord has been reported.[16,17]

OFFICE TESTING FOR IMPAIRED SMELL

Several simple chemosensory tests can be done in the primary care office if the patient's history or examination of the cranial nerves suggests it. In general, chocolate, coffee, or perfume may be used for initial superficial testing; however, strong, irritating aromas such as ammonia are more appropriate for measuring trigeminal nerve function rather than olfactory nerve function. Also, each nostril should be tested separately to ascertain whether the problem is unilateral or bilateral.

Simple smell tests can be done in the office

The UPSIT

The "UPSIT" (University of Pennsylvania Smell Identification test, Sensonics, Inc, Haddonfield, NJ) is a scratch-and-sniff test that uses 40 microencapsulated odorants on cards, which the patient tries to identify. The test can be administered by the physician or self-administered by the patient. Scoring is on a scale of 0 to 40, with 34 to 40 indicating normosmia, 26 to 30 moderate hyposmia, and 6 to 18 anosmia (with an allowance for chance). A score of 0 to 5 indicates a malingerer. The UPSIT offers a dependable indication of normosmia vs olfactory dysfunction.

Threshold testing

At our clinic we use the Connecticut Chemosensory Clinical Research Center (CCCRC) test, which tests both the patient's threshold to detect an odorant and the patient's ability to distinguish between various odorants.

The object is to find the weakest concentration of butanol that the patient can detect, starting with the weakest dilution. At each stage, the patient is given two bottles—a "live" bottle (containing butanol dilution) and a "blank" bottle (containing plain water)—and is asked to choose the bottle with the butanol.

The test starts with the weakest concentration and proceeds to progressively stronger concentrations until the patient can detect the smell. The test continues until the patient either gives five consecutive correct answers or consistently shows no ability to detect the butanol. A numerical score is then given. This part of the test usually takes about 20 minutes.

Next, the odor identification component tests the patient's ability to identify eight different smells. Each nostril is tested separately. The results are combined with the threshold test score to give a composite score:

- 0 to 1.75 indicates anosmia
- 2 to 3.75 severe hyposmia
- 4 to 4.75 moderate hyposmia
- 5 to 5.75 mild hyposmia
- 6 to 7 normosmia.

For patients over age 65, the score is adjusted upward by one point.

Trigeminal nerve assessment

In addition to olfactory nerve endings, the nasal epithelium contains trigeminal (fifth cranial) nerve endings. While less sensitive to stimulants than the olfactory nerves, trigeminal nerve endings are important in detecting tactile pressure, pain, and temperature sensations in the areas of the mouth, eyes, and nasal cavity. Trigeminal nerve dysfunction can cause alteration in epithelial physiology that can affect reception, transmission, or processing of information in olfactory receptors.[18] Trigeminal nerve function is assessed by the ability to detect pungent odors, such as mustard oil, capsaicin (used, eg, in hot chili powder, mace spray), and onion.

Laboratory tests for impaired smell

Laboratory testing in patients with impaired olfaction is performed to provide clues to a causative underlying condition. The workup should include a complete blood count, sedimentation rate, blood sugar concentration, and blood urea nitrogen, as well as tests of thyroid function and antinuclear antibody level.

Other tests may be ordered depending on the history and physical findings.

Imaging

Computed tomography (CT) of the nose and sinuses and MRI of the brain are often required. In our clinic, single-photon emission CT of the brain has revealed defects in some patients with anosmia associated with a head injury when CT and MRI studies were negative.[19]

TREATMENT OF IMPAIRED SMELL

Drugs

Topical corticosteroids. In patients with anosmia due to edema from rhinosinusitis or polyps, topical corticosteroids can bring striking improvement. Their lack of significant adverse effects with long-term use is impressive compared with systemic corticosteroids.

Antibiotics, decongestants, antihistamines. In patients with loss of smell due to bacterial infection, antibiotics (a penicillin or cephalosporin), decongestants, and antihistamines are useful.

Desensitization with the aid of an allergist is sometimes indicated if the smell problem is due to allergic rhinitis.

Surgery

When conservative approaches are not sufficient, endoscopic nasal and sinus surgery can produce dramatic changes.

Treating parosmia

Parosmia, or aberrant odor perception, presents a challenge. Viral infection, rhinitis, head trauma, and brain tumors are occasionally the cause, and attending to these problems may resolve the parosmia. When no cause is found, anticonvulsive medications (clonazepam, gabapentin) have been helpful.

Reassuring the patient

In patients with loss of smell following an upper respiratory tract viral infection, no effective therapy is available. However, since olfactory cells may regenerate with time, from months to years,[20,21] patients can be told that their condition may eventually resolve.

Although not all patients can be helped, they deeply appreciate the attention and investigation given to them, because their previous visits to other physicians may have been frustrating.

TASTE DYSFUNCTION

Taste and smell are interdependent, and difficulty with one is sometimes interpreted as a problem with the other. Loss of taste occurs when there is a disturbance in the saliva or the surroundings of the taste cells.[22] Normogeusia is the name given to normal taste. Loss or impairment of taste can occur in degrees:

- Hypogeusia, diminished taste
- Dysgeusia, distorted taste
- Aliageusia, altered taste, usually pleasant
- Phantogeusia, persistent abnormal taste in the absence of a stimulus
- Ageusia, no taste.

Ageusia is rare because of the redundant and complex anatomic pathways involved. However, hypogeusia, dysgeusia, and phantogeusia are common.

Organs of taste sensation

The taste system detects sweet, sour, bitter, and salty qualities and protects us from ingesting possibly harmful substances. Taste receptor cells are found in the taste buds, which are located in the mouth, throat, larynx, and esophagus. The cells live approximately 10 days and then regenerate.[23]

Four different cranial nerves (the fifth, seventh, ninth, and tenth) provide the sensory coverage of the tongue and mouth. The trigeminal (fifth cranial) nerve is responsible for detecting the burning sensation caused by peppers and ammonia. This nerve supplies sensation to the mouth and nose and transmits messages about chemical irritants to the brain.

Taste stimulants require salivary secretion to get to the taste buds. Soluble carrier proteins assist in transportation to the receptors.

Topical steroids can bring striking improvement in sinusitis- or polyp-related smell loss

Causes of taste dysfunction

Conditions that can lead to loss of taste include:

- Aging
- Inflammation in the mouth
- Infection that reduces blood flow to the tongue and interferes with saliva production and leads to injury of cell receptors

- Gastric reflux (a common cause)
- Systemic conditions such as diabetes mellitus, Sjögren syndrome, pernicious anemia, and Crohn disease.

Other causes of impaired taste include:

Pesticide exposure. Pesticides such as organochloride compounds and organophosphate and carbamate pesticides[24] are used widely and can reach taste receptors via air, water, or food. Workers who spray material are directly exposed, and the general public can be exposed at home or at work by eating foods or drinking water contaminated by pesticides. The molecules bind to the tongue, and their chemical effects on taste buds and nerve endings can cause hypogeusia or dysgeusia. Neurotoxic effects on the brain can result in neuropsychologic difficulties.

Drug, metal exposure. Lead poisoning can produce a metallic taste.[25] Workers exposed to zinc and copper fumes have complained of metallic tastes.[26] Drugs such as antithyroid agents, angiotensin-converting enzyme inhibitors,[27] and certain antibiotics (clarithromycin) can cause taste complaints (TABLE 1).[28]

Patients with taste loss require smell testing

Trauma. Head injury can cause taste impairment, but only 0.5% of head trauma patients complain of taste loss. Dysgeusia is a more common complaint and is usually the result of injury to peripheral nerves. Trauma to the chorda tympani branch of the facial nerve can result in either ageusia or dysgeusia.

Surgical procedures. Surgery involving the middle ear can sometimes cause stretching or sectioning of the nerve, causing taste loss. Bronchoscopy, laryngoscopy, and tonsillectomy can sometimes damage the lingual branch of the glossopharyngeal nerve, leading to dysgeusia. Operations on the brain can occasionally cause taste alteration if the central gustatory pathways are damaged.[29] General anesthesia itself can cause taste difficulties.[30]

Radiation. Radiation treatment can injure the taste buds, transmitting nerves, and salivary glands, resulting in taste dysfunction.

TASTE TESTING

Taste vs flavor

Verification of the specific taste complaint is necessary, since many patients complain of taste loss and yet testing reveals the presence of normal taste. In most of these cases, it is flavor that has been impaired.

Flavor is a complete sensory experience arising from ingested stimulant molecules and involves taste, smell, texture, and temperature. It is thought that perhaps 75% of flavor sensation is produced by odorants. Thus, patients with taste loss complaints require smell testing.

Whole-mouth taste test

A whole-mouth taste test is used to assess the patient's ability to detect, identify, and evaluate the intensity of different concentrations of sweet, sour, salty, and bitter taste solutions. Flavor can be enhanced by monosodium glutamate, a phenomenon referred to as umami. Some experts believe umami is a taste distinct from the four traditional tastes.

Spatial taste test

A spatial test is used to assess different areas of the mouth since localized areas of impairment can be undetected. A cotton swab dipped in a special taste solution is placed in different areas of the mouth. The throat is evaluated by having a patient swallow part of each taste solution. The individual is requested to assess taste quality and intensity.

Flavor discrimination test

A flavor discrimination test is often used to evaluate the combination of both taste and smell sensation. Four different solutions are used, each with a different degree of sweetness. The patient is requested to taste the solutions in random order.

Electrogustometry

In electrogustometry, weak electrical currents are delivered to the various taste bud fields in the mouth cavity.

Somatosensory testing

Somatosensory tests measure contact detection and spatial acuity thresholds. A patient's contact (pressure) detection threshold is tested with Semmes-Weinstein monofilaments, which exert a force proportional to their gauge when applied to a peripheral nerve field. Different areas of the mouth are tested.

TABLE 2

Smell and taste centers in the United States

California
Nasal Dysfunction Clinic
University of California, San Diego, Medical Center
200 W. Arbor Drive
San Diego, CA 92103-8654

Colorado
Rocky Mountain Taste and Smell Center
University of Colorado Health Science Center
4200 E. Ninth Avenue
Denver, CO 80262

Connecticut
Connecticut Chemosensory Clinical Research Center
University of Connecticut Health Center
263 Farmington Avenue
Farmington, CT 06030

Maryland
National Institute of Dental Research
National Institutes of Health
NIH Bldg. 10, Room 1N-114
Bethesda, MD 20892

New York
Clinical Olfactory Research Center
State University of New York Health Science Center at Syracuse College of Medicine
766 Irving Avenue
Syracuse, NY 13210

Ohio
University of Cincinnati Taste and Smell Center
University of Cincinnati College of Medicine
231 Bethesda Avenue
Cincinnati, OH 45267-0528

Pennsylvania
Chemosensory Clinical Research Center
Monell Chemical Senses Center
3500 Market Street
Philadelphia, PA 19104-3308

University of Pennsylvania Smell and Taste Center
Hospital of University of Pennsylvania
3400 Spruce Street
Philadelphia, PA 19104-4283

Virginia
MCV Smell and Taste Clinic
Medical College of Virginia
Richmond, VA 23298-0551

Oral and nasal somatosensory chemoreception can affect taste and olfaction. Intense stimulation can cause a decrease in taste responsiveness.[31]

TREATMENT OF IMPAIRED TASTE

Mouth infections that produce hypogeusia or dysgeusia may necessitate dental therapy and antibiotics. Not infrequently, antifungal therapy is required. Clotrimazole troches are used frequently for this purpose.

In patients with gastric reflux, acid pump inhibitors such as omeprazole 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 the regeneration of nerve cells. In cases of radiation or surgical damage, no therapy can be prescribed. Only time will tell if the condition will improve.

In cases of dysgeusia and burning mouth disorder (a condition most prevalent in postmenopausal women), tricyclic antidepressants (which have analgesic properties) and clonazepam can be helpful. Clonazepam causes brain stem serotonergic descending inhibition, and therefore is a valuable aid in these problems.

In taste impairment due to mouth infection, an antifungal often is required

REFERRAL TO A SMELL AND TASTE CENTER

A number of centers in this country specialize in the diagnosis and management of chemosensory problems (TABLE 2). The University of Connecticut Health Center, which has been treating smell and taste loss for more than 19 years, uses a team approach that starts with smell and taste testing and includes an internist, otorhinolaryngologist, neurologist, and dentist.

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Flavor involves taste, smell, texture, temperature