CE Course:
What's that Smell?
Addressing Halitosis: Strategies for dental professionals to identify and treat halitosis.

By: Danette Ocegueda, RDH, MS

Course Objectives:

Upon completion of this course, participants will be able to:

- Differentiate between the classifications of halitosis
- Recognize the sources of halitosis
- Identify and recommend solutions for the prevention and treatment of halitosis

It all starts with the first words out of your patient's mouth. The odor hits you square in the face. There it is – the elephant in the room that neither you nor your patient wants to address. Both you and your patient would prefer not to highlight the presence of halitosis. The patient may find the subject embarrassing and you, the clinician, may feel unprepared to manage a patient with halitosis. The information in this article will empower you, the dental professional, to address the elephant in the room, correctly identifying the etiology of your patient's breath issue and providing your patients with lasting solutions.

Halitosis (fetor oris) also known as "bad breath" or "oral malodor" is characterized by unpleasant odors arising from the oral cavity.[1] Halitosis is typically chronic in nature, although it can be intermittent.[2] It can affects individuals of all ages; depending on the source cited, halitosis affects up to 50-80% of the adult population.[3,4,5] Mild halitosis, present upon awakening, frequently termed "morning breath", is common among healthy individuals and is often caused by reduced salivary flow during sleep. While this transient form of halitosis resolves after brushing, rinsing and/or eating breakfast, chronic pathological halitosis does not. Therefore, a proper diagnosis and treatment is needed.[4,5]

Halitosis has been around since the beginning of humankind. Hints of halitosis appear in ancient literary works by Ovid and Shakespeare. Efforts to combat this common dental concern date back to historical times. Ancient historical writings point to mouthwashes of oil and water, resins from trees formed into gums, and toothbrushes made from twigs as early halitosis remedies. The early Egyptians seemed to be the first to make breath mints creating blends of boiled herbs and spices, such as frankincense, myrrh, and cinnamon mixed with honey to make sweets that were chewed or sucked.[6] While halitosis can be tracked throughout history, halitosis did not become an actual medical diagnosis until the early twentieth century. The term halitosis gained popularity in the 1920's through clever marketing campaigns by a well-known mouth rinse company.[6]

Halitosis can be an annoying social problem, leading to stress, anxiety, and avoidance of social settings.[5] It is normal for an individual to worry about fresh breath from time to time. Think about a situation where you were offered a breath mint or gum. This simple gesture can make one question the integrity of their breath. However, true halitosis can put strain on marital, business, and social relationships.[6] Let's face it; halitosis may have been the cause for more than one romantic breakup.

Studies have indicated that 85-90 % of halitosis originates from the oral cavity with 10-15% originating from other systemic or physiological sources.[3-5] A recent classification system for halitosis was proposed in the British Medical Journal in 2014 by Aydın and Harvey-Woodworth.[2] This classification system takes into account that halitosis is multifactorial and can fluctuate throughout the day. This system allows for multiple diagnoses within the same patient, thus simplifying the process. It describes five distinct types of halitosis (Table 1).[2]

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Table 1: Adapted from Aydin M. and Harvey-Woodworth C. (2014)[2]

Classifications of Halitosis	
1	Oral Halitosis
2	Airway Halitosis
3	Gastroesophageal (GI)
4	Blood borne
5	Subjective

Type 1 - Oral Halitosis: Oral halitosis makes up a vast majority of the halitosis cases. In most instances, bacterial activity originating from tongue coating or periodontal pockets is the primary cause for oral halitosis.[3-5] Tongue coating consists of desquamated epithelial cells, leukocytes, blood metabolites and different nutrients including aerobic and anaerobic bacteria. The irregular and deep fissures on the posterior one-third of the tongue provide favorable conditions for accumulation of complex bacterial (biofilm) activity. Volatile Sulfur Compounds (VSCs), polyamines, short-chain fatty acids and indoles are the by-products of bacterial interactions with specific substrates found in the oral cavity.[5] Research has shown that the volume of tongue coating increases with periodontal disease involvement. Both older and current research studies have shown that periodontal pockets over 4mm's are associated with halitosis. Individuals with periodontal pockets have a greater volume of tongue coating when compared to healthy individuals, and that VSCs may aide in production of periodontal infections .[7-10.] In addition to periodontal diseases and tongue coating; other oral conditions such as active carious lesions, dry mouth, food impactions, ill-fitting dental appliances and diseases of the alveolar bone can lead to oral halitosis. This short-term form of oral halitosis usually subsides once the condition is treated.[9]

Type 2 - Airway Halitosis: Airway halitosis originates from the respiratory tract, the nose and/or the alveoli of the lungs. Acute or chronic system conditions can contribute to airway halitosis such as rhinosinusitis, tonsillitis, pharyngitis, laryngitis, bronchitis and pneumonia.[2] Rhinorrhea (runny nose), postnasal drip, and chronic rhinosinusitis are other sources of airway halitosis arising from the sinuses, where mucus drips or drains onto the dorsum of the tongue providing a perfect breeding ground for bacteria proliferation. Patients with chronic rhinosinusitis report halitosis as a major symptom up to 70% of the time.[2] Tonsiloliths, also known as tonsil stones, are another source of airway halitosis. Food particles and bacteria can become embedded in the crypts and crevices on the tonsils forming semi-calcified masses. A foul odor is emitted from the oral cavity, when the patient exhales breath passing over these masses. Studies have found that patients with the presence of these benign unpleasant masses are ten times more likely to have elevated breath VSC levels.[1,2,11] Approximately 10% of the general adult population have asymptomatic formation of tonsiloliths with some patients being more prone to them, due to the anatomical features of their tonsils.[2] A study by Ferguson et al. found that 77% of patients with tonsiloliths have intermittent airway halitosis.[11] Other acute and chronic diseases originating from the lungs such as bronchitis and pneumonia contribute to airway halitosis. When the patient exhales, odors are discharged in exhaled air.[2]

Type 3 - Gastroesophageal Halitosis: Gastroesophageal (GI) halitosis is defined as the leakage of odoriferous volatiles from the stomach via the esophagus into the mouth and nose. Gastric reflux and Gastroesophageal Reflux Disease (GERD) have been named as culprits of halitosis stemming for the GI tract. Halitosis from these conditions can occur when there is a reflux of gastric juices, bacteria, and undigested food particles into the pharynx.[2] Study reports on the correlation of *H.pylori* and halitosis are contradictory; some studies show a positive correlation while others report no statistically significant correlations.[2,12] Additional conditions arising from the GI system such as stomach cancer and ulcerative colitis can be considered part of Type 3 GI halitosis; however, a better diagnosis would be the classification of Type 4- Blood Borne Halitosis.[2]

Type 4- Blood Borne Halitosis: Volatile chemicals in systemic circulation can transfer to exhaled breath during the alveolar gas exchange process causing halitosis know as Blood Borne Halitosis.[2] There are four etiologic mechanisms for a diagnosis of blood borne halitosis: Systemic Diseases including those mentioned above under GI halitosis, metabolic disorders, medications, and food.[2] Exhaled breath volatiles are described in many systemic diseases. Patients with some lung diseases, liver diseases, kidney diseases or failure, blood disorders, sleep apnea, and some carcinomas (stomach, breast, and lung) can

experience halitosis that has a blood borne origin. Patients with metabolic diseases such as Trimethylaninuria (TMAU) and Diabetes fall into the Blood Borne halitosis diagnosis category as well. Trimethylaninuria, also known as fish odor syndrome, is a disorder where the body is unable to break down trimethylamine, a compound derivative from the diet that has a strong fish-like odor. This odor is released in the breath and bodily fluids.[2,5,12,13,14] A sweet or fruity smell of the breath can be a sign of diabetic ketoacidosis or the presence of dangerously high ketone levels in the body. This condition can indicate uncontrolled diabetes.[2,15]

A wide variety of prescription, over-the-counter, and recreational drugs can contribute to the presence of blood borne halitosis. Many prescription and over-the-counter medications such antibiotics, anti-allergic, anti-depressants, anti-hypertensives, as well as sedatives and hypnotics all have xerostomia as a side effect, which adds to halitosis issues.[1,2,4] Alcohol, marijuana, amphetamines, tobacco and solvent misuse can also be offenders for blood borne halitosis. Smelly foods such as garlic, onions, fish, spices and cured meats can cause transient blood borne halitosis. These odors discharge from the breath with exhalation.[1,2,4,13] Halitosis arising from fasting, crash dieting, and high protein diets fall under the blood-borne category. These types of diets cause the body to breakdown and metabolize its fat stores resulting in ketones that can cause the breath to have a sickly sweet smell.[1,5]

Type 5 - Subjective Halitosis: A complaint of halitosis without confirmation through objective means, by others or instruments to measure halitosis, is subjective halitosis.[2] This type of halitosis is divided into two subcategories: Psychologic or Neurologic.[2] It is normal for most individuals to worry about halitosis occasionally. It is when that worry becomes extreme or obsessive that one should consider a diagnosis of subjective halitosis. Psychological subjective halitosis has been reported in patients with obsessive-compulsive and social anxiety disorders.[2,16] Neurologic conditions such as brain injuries and/or tumors, hypothyroidism, drug abuse, nutrient deficiencies and other neurodegenerative disorders can also contribute to subjective halitosis. This may be, in part, due to a malfunction in the taste or smell receptors in the brain causing the patient to think they have halitosis.[2]

Making the diagnosis: Until determined otherwise, any patient complaining of halitosis should be considered a halitosis patient. The first step in making an accurate diagnosis of halitosis should be a thorough collection and review of the patient's medical and dental history including an appraisal of dietary practices and all current medications taken by the patient. Careful attention should be placed on the patient's past and present psychological and social history through direct questioning and active listening to your patient's concerns regarding the presence of halitosis.

Sometimes all a clinician has available to make a diagnosis of halitosis is the patient's history and the clinical examination. Reliable subjective and objective techniques exist and can aid clinicians in making an accurate diagnosis, relying on the presence of VSCs and measurable odor. One subjective approach to detect halitosis is through the sense of smell utilizing the human nose known as an organoleptic assessment.[9,17,18] This assessment is quick and easy to perform using only the human nose at a ten centimeter fixed distance from the subject's exhaled breath. An organoleptic judge, a specially trained clinician in evaluating exhaled breath, rates the quality of the subject's breath using what is known as the Rosenberg scale (Table 2). Although this assessment of the subject's breath is easy to perform and resembles the daily conditions of the subject, it is not without significant limitations. Due to subjectivity of this assessment, even if a panel of clinicians are utilized, reliability and reproducibility seems to be an issue the subject does not always accept the results.[17] Other organoleptic methods are the spoon test and the floss test. With the spoon test, a plastic spoon is used to scrape the posterior region of the tongue. After a five-second elapse time the clinician, or even the patient, appraises the degree of odor by holding the spoon two inches from the nose. Similarly, the floss test utilizes a piece of unwaxed floss to gather biofilm from interproximal spaces of a posterior tooth; The clinician then smells the odor from a distance of one inch from the nose.[17] Certainly, these methods have limitations and the reliability of these assessment methods comes into question when making a definitive diagnosis of halitosis. By definition, all the aforementioned assessment methods are open to interpretation of the individual doing the assessment. Care should be used when making a diagnosis of halitosis relying solely on these subjective methods.

Objective methods for assessing halitosis rely on devices and tests to measure the presence of VSCs, periodontal pathogens, or byproducts of protein metabolism. Gas chromatography is a highly objective, reliable, and reproducible method to measure gases (VSCs).[18] Gas

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Table 2: Adapted from Yaegaki K and Sanada K. (1992)[10]

Organoleptic Scoring or Rosenburg Scale		
0	No odor	Odor not detected
1	Barely noticeable	Odor is detectable but could be questionable
2	Slightly but clearly noticeable	Odor is detected
3	Moderate	Odor is definitively detected
4	Strong	Strong odor is detected but tolerable
5	Extremely strong foul odor	Extreme detectable odor that is not tolerated well by examiner

chromatography and sulfide monitors are employed to measure a variety of gases. The body of knowledge suggests that VSCs and periodontal pathogens are responsible for a majority of Type 1-Oral halitosis.[1-4] VSCs are gases that are produced from gram-negative microorganisms and by-products of metabolized bacteria. Hydrogen sulfide and methyl mercaptan are the two VSCs primarily responsible for oral halitosis and, although dimethyl sulfide can contribute to oral halitosis, it is primarily responsible for blood borne halitosis. Gas chromatography units are able to differentiate and quantify the different VSCs gases. The disadvantage to gas chromatography is the unit is very large, expensive, ranging from $13,000 to $84,000 and requires a highly trained staff to perform the assessments.[17] Smaller chairside units have been developed to process and determine the presence of VSCs. One such unit takes eight minutes to differentiate VSCs in the oral cavity, which may not be feasible for a busy dental practice to make a halitosis diagnosis.[18] Portable chairside sulfide monitors are able to measure the presence of VSCs as well, but are unable to differentiate between the different VSCs. These units are unable to detect other volatile components in the breath that may also contribute to halitosis.[18] Sulfide monitors provide reproducible, reliable, and objective results. The units are small, portable, and relatively inexpensive. The procedure itself is easy to conduct and results are immediate, so these units may be more acceptable for a small dental practice.[18]

Saliva tests are another objective tool to diagnose halitosis. These tests provide an inexpensive means to assist the dental professional in diagnosing halitosis. These saliva tests can test for periodontal pathogens or the breakdown of proteins. The BANA test detects periodontal pathogens specifically *t.denticola*, *P. gingivalis, and t. forsythensis*. While we know that the presence of gram-negative microorganisms are linked to periodontitis and can be a source of halitosis, one major disadvantage is that not all individuals with the existence of these pathogens in their oral cavity will exhibit oral halitosis.[18] The converse is also true, not all patients with halitosis will have periodontal pathogens present. As mentioned previously, the gases or VSCs responsible for halitosis are a result of byproducts of bacterial biodegradation of substrates, mainly proteins. The Amine test and Beta-galactosidase test assess for protein breakdown or the presence of byproducts of the breakdown process, amines or glycoproteins depending on the test. These byproducts can be quantified and connected to odor measurements.[18] Another saliva test is the saliva incubation test, which tests for halitosis indirectly. With this assessment, a saliva sample is collected from the patient, and then incubated for three to six hours; the clinician evaluates the odor utilizing organoleptic values.[18] These objective methods are instruments that a clinician may employ to assist in making a differential diagnosis for halitosis. Once halitosis has been diagnosed and the type has been determined, treatment measures may be deployed to aid the patient in controlling this embarrassing condition.

A treatment needs (TN) classification system for treating patients with halitosis has been established (Table 3).[19,20] Once a diagnosis is made and underlying cause has been defined, a clinician can then recommend the best course of action based on the patient's treatment needs using the treatment needs table (Table 4) as a guide.[19,20] All patients with suspected halitosis would benefit from TN-1, an explanation of halitosis and its potential causes, and comprehensive oral hygiene instructions that includes direction on how to clean the tongue. Once a clinician has determined the patient has a diagnosis of Type 1- Oral Halitosis, a complete halitosis treatment regimen can be recommended and initiated.

Clinicians can effectively help their patients treat oral halitosis by incorporating a breath care system into their clinical practice. Patients frequently self-treat halitosis with

three methods: brushing their teeth, gum or mints, and mouthwash. While these modalities may provide short-term results, they are not definitive treatments and may delay a proper diagnosis.[21] The oral healthcare provider should ensure that all necessary dental treatment, including a thorough oral prophylaxis or periodontal therapy has been completed to rule out untreated dental diseases as a causative agent for the existence of oral halitosis. There are two methods known for long-term oral halitosis relief: chemical products and mechanical devices.

Table 3: Adapted from Miyazaki H. et al. (1999) and Suzuki N. et al. (2015)[19,20]

Category:	Treatment Regimen
TN-1	Explanation of halitosis and OHI
TN-2	Prophylaxis/SRP and needed dental treatment
TN-3	Referral to physician and/or specialist
TN-4	Explanation of halitosis, further education/ instructions, and reassurance
TN-5	Referral to a psychologist or psychiatrist

Prescription and over-the-counter chemical products have been widely used and clinically proven to effectively reduce halitosis.[20, 22] Prescription antibacterial agents, such as Chlorhexidine Gluconate (CHX) reduces halitosis by decreasing the bacteria load in the oral cavity. Long-term patient compliance can be an issue with CHX, due to unpleasant side effects of staining and taste alterations.[20, 22] Over-the-counter products like toothpaste and mouthwash contain chemical agents such as: Zinc, Chlorine Dioxide (ClO_2), Triclosan, Cetylpyridinium Chloride (CPC), and Essential Oils have been used. Individually, these chemical agents all inhibit the production of volatile sulfur compounds. Some over-the-counter products contain a combination of one or more chemical agents to yield stronger effects.[20, 22] Mouth rinses or sprays containing antibacterial agents such as Chlorhexidine (CHX), Cetylpyridinium Chloride (CPC), and essential oils may play an important role in reducing the levels of halitosis producing bacteria on the tongue, and Chlorine Dioxide ClO_2 and Zinc (ZN) containing mouth rinses can be effective in neutralizing odoriferous sulfur compounds.[23]

Table 4: Adapted from Miyazaki H. et al. (1999) and Suzuki N. et al. (2015)[19,20]

Type of Halitosis	Treatment Need (TN)
Type 1 Oral	TN-1, TN-2
Type 2 Airway	TN-3, TN-4
Type 3 Gastroesophageal (GI)	TN-3
Type 4 Blood borne	TN-3
Type 5 Subjective	TN-1,TN-4, TN-5

Mechanical solutions are another option to reduce coating on the tongue, which can harbor odor-causing microorganisms (Image 1). Mechanical removal of biofilm present on the dorsum of the tongue can be accomplished by using a toothbrush or tongue cleaner/scraper. Most patients do not clean the tongue and those who do, typically use a manual toothbrush. Utilizing this method is like cleaning a shag carpet with a broom. Some particles are removed but some are shifted to other areas of the tongue without actually removing the biofilm. A more effective method to remove biofilm from the dorsum of the tongue is the use of a manual tongue cleaner or scraper. Clinical studies have shown that the addition of a manual tongue cleaner resulted in greater reduction of VSCs.[24] Findings from a study performed by Pedrazzi et al. demonstrated a 75% reduction in VSCs with a tongue scraper, while the toothbrush only achieved a 45% reduction in VSCs.[25] According to a 2013 meta-analysis performed by Kuo et al. comparing toothbrushing versus toothbrushing plus tongue cleaning on halitosis and tongue coating demonstrated reductions in volatile sulfur compounds (VSCs) and tongue coating in the toothbrushing plus tongue cleaning group.[24] Additionally, a 2015 study by Aung et al. found that use of tongue cleaning device combined with toothbrushing significantly reduced the indicators of halitosis and tongue coating when compared to toothbrushing alone, resulting in lower levels of VSCs and tongue coating.[22]

There are various types of tongue cleaners, both manual (Image 1) and mechanical (Image 2) of different shapes and sizes. Either manual or mechanical in design, incorporating this simple tool into a patient's daily biofilm management routine will dramatically improve halitosis. Clinicians

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Image 1: Manuel Tongue Cleaners
Images sources: www.aliexpress.com, www.philipsoralhealthcare.com, www.genkent.com/products/genkent-tongue-cleaner-stainless-steel, www.orabrush.com, www.tonguesweeperpro.com, www.verifresh.com, www.wooshy.com

should also consider the addition of a power toothbrush for enhanced oral health outcomes. According to Aung et al., the most effective method for reducing odor-causing VSCs and tongue coating in subjects with oral halitosis is the combination of toothbrushing, mouth washing, and tongue cleaning.[22]

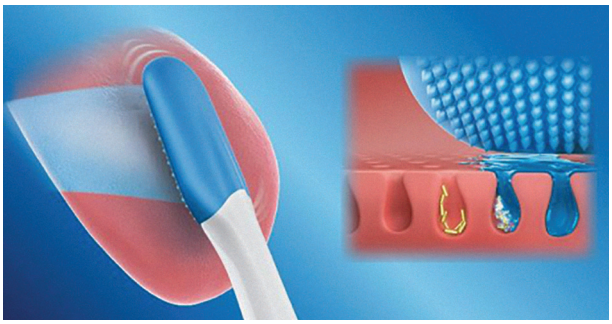

Image 2: Mechanical Tongue Cleaner and Oral Rinse containing Cetylpyridinium Chloride (CPC) and Zytex (zinc and essential oils). *Image Courtesy of Philips Oral Healthcare*

Offer your patients a complete oral hygiene regimen utilizing both chemical and mechanical methods to reduce odor-causing bacteria present in the oral cavity and reduce VSCs. *For the ultimate in mouth cleaning experience and fresh breath, recommend a 3-step full mouth cleaning process:*

1. **Brush/Floss –** To eliminate odor-causing plaque and debris from the teeth and gums
2. **Scrape –** To remove odor-causing bacteria from the surface of the tongue
3. **Rinse/Spray –** To sweep away any leftover bacteria and neutralize odoriferous sulfur compounds

In conclusion, halitosis is a serious dental concern. We, as oral health providers, owe it to our patients to address the elephant in the room. Start the conversation – make an accurate diagnosis, refer if necessary and offer lasting breath care solutions.

About the Author

Danette Ocegueda, RDH, MS is the Manager of Professional Education for Philips Oral Healthcare-Western Region. She received her Bachelor of Science degree in Dental Hygiene from Old Dominion University, her Master of Science in Dental Hygiene Education for the University of Missouri-Kansas City. Danette is a national speaker with over twenty-eight years of experience in clinical practice, academia, research, and Forensic Dentistry. She is a member of the California Dental Hygienists' Association, the California Dental Hygiene Educators' Association, the American Dental Hygienists' Association and the American Dental Education Association. A past recipient of the ADHA/Sigma Phi Alpha Graduate Journalism Award and the Dentsply Sirona Graduate Student Clinician's Research Award, she is also a contributor to Darby and Walsh's Dental Hygiene: Theory and Practice 5th edition textbook. To obtain more information on Philips Sonicare BreathRx Breath Care solutions and other innovative Philips Products contact Philips Customer Care at 1(800) 422-9448

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Home Study Correspondence Course

"What's that Smell? Addressing Halitosis: Strategies for dental professionals to identify and treat halitosis."

Circle the correct answer for questions 1-10

1. "Morning breath" which is present upon awakening is:
   a. Classified as mild halitosis
   b. Often caused by reduced salivary flow during sleep
   c. Usually resolves after brushing, rinsing or eating breakfast
   d. All of the above

2. The primary bacterial source responsible for most of the cases of oral halitosis is:
   a. Lungs and tongue coating
   b. Tonsils and lungs
   c. Tongue coating and periodontal pockets
   d. Periodontal pockets and food

3. Airway halitosis originates from the respiratory tract, nose and lungs.
   a. True
   b. False

4. Patients with chronic sinusitis which allows mucus to drain onto the dorsum of the tongue experience halitosis 70% of the time.
   a. True
   b. False

5. Tonsiloliths (tonsil stones) are another source of airway halitosis.
   a. True
   b. False

6. Which of the following can be sources for upper GI (Gastroesophogeal) halitosis?
   a. Tonsilitis
   b. Gastric Reflux Disease
   c. Periodontal Disease
   d. Pneumonia

7. Factors which contribute to Blood Borne halitosis include:
   a. Uncontrolled diabetes and odiferous foods
   b. Misuse of alcohol, marijuana and tobacco
   c. Crash and high protein diets
   d. All of the above

8. Subjective halitosis cannot be measured by objective means and is caused by:
   a. Psychological and neurological sources
   b. Allergy medications
   c. Uncontrolled diabetes
   d. Poor oral hygiene

9. Organoleptic methods for assessing halitosis include which of the following?
   a. The Rosenberg scale breath test
   b. The spoon and floss test
   c. Subjective narratives from family and or friends
   d. Both a and b

10. Long term chronic halitosis treatment includes:
    a. Use of the Treatment Needs classification system
    b. Chemical products
    c. Mechanical devices
    d. All of the above

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