

Halitosis management by the general dental practitioner—results of an international consensus workshop*

R Seemann^{1,16}, M D Conceicao^{2,3}, A Filippi⁴, J Greenman⁵, P Lenton⁶,
S Nachnani⁷, M Quirynen⁸, S Roldan^{9,10}, H Schulze¹¹, N Sterer¹²,
A Tangerman¹³, E G Winkel¹³, K Yaegaki¹⁴ and M Rosenberg¹⁵

¹ Department of Preventive, Restorative and Pediatric Dentistry, School of Dental Medicine, University of Bern, Switzerland, Freiburgstrasse 7, CH-3010 Bern, Switzerland

² Universidade Sao Francisco, Itatiba, Sao Paulo, Brazil.

³ Halitus Clinic, Sao Paulo, Brazil

⁴ Department of Oral Surgery, Oral Radiology and Oral Medicine, School of Dental Medicine, University of Basel, Hebelstrasse 3, CH-4056 Basel, Switzerland

⁵ Faculty of Health and Life Sciences, Centre for Research in Biosciences, University of the West of England, Bristol BS16 1QY, UK

⁶ Oral Health Clinical Research Center, University of Minnesota School of Dentistry, Minneapolis, MN 55455, USA

⁷ University Health Resources Group, 5714, Canterbury Drive, Culver City, CA 90230, USA

⁸ Department of Periodontology, Catholic University of Leuven, Kapucijnenvoer 33, B-3000 Leuven, Belgium

⁹ ETEP (Etiology and Therapy of Periodontal Diseases) Research Group, University Complutense, Madrid, Spain

¹⁰ Plaza Ramón y Cajal s/n (Ciudad Universitaria), E-28040 Madrid, Spain

¹¹ Department of Periodontology, Operative and Preventive Dentistry, Center of Dento-Maxillo-Facial Medicine, Faculty of Medicine, University of Bonn, Welschnonnenstraße 17, D-53111 Bonn, Germany

¹² Department of Prosthodontics, Goldschleger School of Dental Medicine, Sackler Faculty of Medicine, Tel-Aviv University, Ramat-Aviv 69978, Israel

¹³ Department of Periodontology, Center for Dentistry and Oral Hygiene, University of Groningen, University Medical Center Groningen, Groningen, Antonius Deusinglaan 1, 9713AV Groningen, The Netherlands

¹⁴ Department of Oral Health, Nippon Dental University, Tokyo, Japan

¹⁵ Goldschleger School of Dental Medicine, and Department of Human Microbiology, Sackler Faculty of Medicine, Tel-Aviv University, Ramat-Aviv 69978, Israel

E-mail: rainer.seemann@zmk.unibe.ch, drmauricio@clinchalitus.com.br, andreas.filippi@unibas.ch, John.greenman@uwe.ac.uk, lento001@umn.edu, Sushnach@yahoo.com, marc.quirynen@med.kuleuven.be, srd1971@me.com, Hendrik.Schulze@ukb.uni-bonn.de, drsterer@gmail.com, atangerman@hotmail.com, edwinwinkel@mac.com, yaegaki-k@tky.ndu.ac.jp and melros@post.tau.ac.il

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Abstract

Clinical investigations on patients suffering from halitosis clearly reveal that in the vast majority of cases the source for an offensive breath odor can be found within the oral cavity (90%). Based on these studies, the main sources for intra-oral halitosis were tongue coating, gingivitis/periodontitis or a combination of the two. Thus, it is perfectly logical that general dental practitioners (GDPs) should be able to manage intra-oral halitosis under the conditions

¹⁶ Author to whom any correspondence should be addressed.

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found in a normal dental practice. However, GDPs who are interested in diagnosing and treating halitosis are challenged to incorporate scientifically based strategies for use in their clinics. Therefore, the present paper summarizes the results of a consensus workshop of international authorities held with the aim to reach a consensus on general guidelines on how to assess and diagnose patients' breath odor concerns and general guidelines on regimens for the treatment of halitosis.

Keywords: halitosis, oral malodor, consensus report

Introduction

Halitosis is defined as having offensive breath odor. Experimental evidence strongly suggests that approximately 80%–90% of offensive breath odors can be attributed to volatile sulphur compounds (VSCs) resulting from the degradation of organic substances by anaerobic bacteria in the oral cavity [1]. These anaerobic bacteria are the same bacteria associated with gingivitis/periodontitis and are commonly found in the coating located on the dorso-posterior surface of the tongue [2, 3].

A recent large-scale study ($n = 2000$) of persons with a complaint of halitosis found that, when halitosis could be objectively detected, the source was primarily found within the oral cavity (90%). Tongue coating was determined to be responsible for 51%, gingivitis/periodontitis for 13%, and a combination of the two for 22% of the detected breath odors [2]. While the majority of offensive breath odor can be attributed to an oral origin it is important that potential pathological sources are not overlooked. Indeed, extra-oral sources accounted for 4% ($n = 80$) of the subjects in this same study, including: ear–nose–throat (ENT) pathologies; systemic diseases (e.g. diabetes); metabolic or hormonal changes; hepatic or renal insufficiency; bronchial and pulmonary diseases; and/or gastroenterologic pathologies [2].

When the dental professional does not perceive malodor and the patient cannot provide evidence from a trusted confidant and continue to be convinced that they suffer from halitosis, this is referred to as pseudo-halitosis. Persons who have either been counseled for pseudo-halitosis or who have been successfully treated for genuine halitosis but who persist in believing that they have breath odor are categorized as having halitophobia. This is a psychiatric disorder referred to as one type of olfactory reference syndrome (ORS) [4, 5]. Because research is still very limited, it is unclear how ORS should best be classified. Classifying ORS as a type of delusional disorder seems problematic and it has now been added to the appendix of the recently published fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V, www.dsm5.com) in order to trigger more research [6]. Treating halitophobic patients in the dental practice is extremely challenging. Fortunately, the majority of breath odor does have an oral origin and, therefore, can be treated successfully in the general dental practice.

Given that the oral cavity is the primary source of breath odor it is perfectly logical that general dental practitioners (GDPs) should be able to manage intra-oral halitosis under

the conditions found in a normal dental practice. However, GDPs who are interested in diagnosing and treating halitosis are challenged to incorporate scientifically based strategies for use in their clinics. A flowchart showing how a halitosis patient could be diagnosed and treated in the dental practice is displayed in figure 1 [7].

The present paper summarizes the results of a consensus workshop of international authorities held with the aim to reach a consensus on

- (1) general guidelines on how to assess and diagnose patients' breath odor concerns
- (2) general guidelines on regimens for the treatment of halitosis.

The detailed scientific background for these conclusions and recommendations can be found in the additional review papers of this supplement [3, 8–10].

Nomenclature for diagnosis

In the literature, a confusing number of terms can be found to describe oral malodor, such as oral malodor, tongue malodor, bad breath, etc. The recommendation of the group is to use the term 'halitosis' and to distinguish between intra- and extra-oral halitosis. This concept allows for the inclusion of all the cases of real halitosis. Intra-oral halitosis is identical to oral malodor and describes cases where the source of halitosis lies within the mouth (either by tongue coating, pathologic intra-oral condition or both). This is in contrast with extra-oral halitosis where the source of halitosis lies outside the mouth. Extra-oral halitosis is further subdivided into blood-borne and non-blood-borne halitosis. In addition, the terms pseudo halitosis and halitophobia are used to describe patients who think or persist in believing they have halitosis, even after professional assessment and a diagnosis that they do not have halitosis. Temporary, or transient halitosis is caused by dietary factors such as garlic (table 1). This classification is a slight simplification based on the International Classification of Halitosis published by Yaegaki, Coil and Miyazaki [11, 12].

History taking

A thorough medical and dental history is essential. The primary focus of the medical history should be on medications and systemic diseases. Attention should be paid to the presence of nasal obstruction, mouth breathing, report of snoring and sleep apnoea, postnasal drip, allergy, tonsillitis, tonsilloliths,

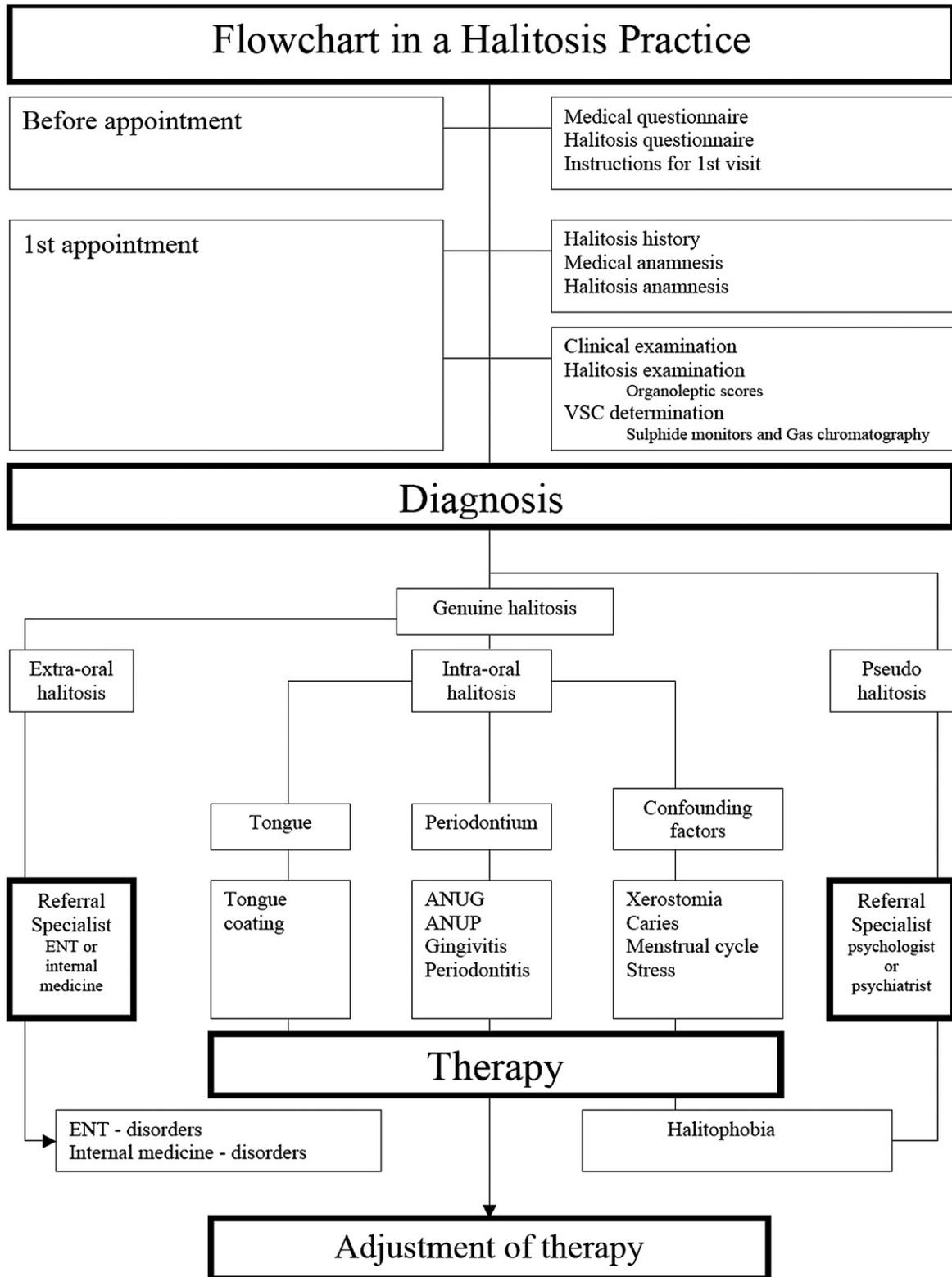


Figure 1. Flowchart for the treatment of halitosis in a dental practice (adjusted from [7]), ENT = ear, nose and throat.

dysphagia, previous ENT encounters, types of food typically eaten (to research odorous food intake) as well as vitamin A, B, C, D and zinc-containing food intake.

The oral history includes questions assessing the frequency of dental visits, dental products being used, the presence and maintenance of a dental prosthesis and

the frequency and the instruments used for tooth brushing, interdental cleaning and tongue brushing/scraping. In addition a specific halitosis-related questionnaire should be used. This questionnaire includes questions about the breath malodor, the time of occurrence during the day, when the problem first presented itself, whether others have reported the problem

Table 1. Recommended terms for the diagnosis of halitosis under conditions found in the general dental practice (based on [12]).

Diagnosis	Description
Temporary halitosis	Malodor is caused by dietary factors such as garlic
Intra-oral halitosis	Obvious malodor, with intensity beyond socially acceptable level and/or affecting personal relationships Origin is the dorso-posterior region of the tongue and/or a pathologic condition or malfunction of oral tissues (e.g. periodontal disease) The condition is influenced by co-factors influencing saliva quality and quantity (e.g. medication, smoking, Sjögren disease etc).
Extra-oral halitosis	Malodor originates from pathologic conditions outside the mouth such as nasal, paranasal, laryngeal regions, the pulmonary or upper digestive tract (non-blood-borne extra-oral halitosis). In case of a blood-borne extra-oral halitosis the malodor is emitted via the lungs and originates from disorders anywhere in the body (e.g. hepatic cirrhosis)
Pseudo-halitosis	Obvious malodor is not perceived by others but the patient stubbornly complains of its existence. Condition is improved by counselling and simple oral hygiene measures.
Halitophobia	After treatment for halitosis and pseudo-halitosis, the patient persists in believing to suffer from halitosis. No physical or social evidence exists for the presence of halitosis.

and how it was reported i.e. in a straight or indirect way (to exclude pseudo-halitosis). The patient is also asked if he is psychologically or emotionally stressed, if previous attempts to address the problem have been undertaken (by himself, doctors or dentists), and if typical cofactors of halitosis are likely to play a part, such as diet, smoking, snoring, stress, behavioral alterations due to halitosis or dry mouth symptoms.

A standardized halitosis-related questionnaire can be found at Computerized 'Anamnesis' International (CAI, www.healthquestionnaires.eu). Another recommendable open access example can be found at University of Basle, Switzerland (www.andreas-filippi.ch/pdfs/halitosis%20questionnaire%20english.pdf).

Examination

Two primary methods recommended for the clinical detection of halitosis in the dental practice include

- (1) an organoleptic measurement, that is a subjective sensory test scored on the basis of the examiner's perception of a patient's breath odor,
- (2) an instrumental test that is an objective way to measure the VSC known to be the principal components of breath odor [13, 14].

Organoleptic (subjective) measurement

The organoleptic measurement is mandatory, even if an instrumental detection is performed. The international literature reveals that a panel of judges does not necessarily improve the accuracy of the organoleptic assessment (see review papers in this supplement [8, 9]). Therefore, one judge is sufficient. However, it is highly recommended to have a second judge available in the dental practice in order to provide a second opinion (especially when dealing with pseudo halitosis patients) or in order to perform measurements when the first judge is not available or shows fatigue and is unable to perform the organoleptic judging for a short period of time.

It is important that the persons who serve as odor judges have a good sense of smell. This can easily be verified by

using a simple smell identification test (Sensonics Inc., Haddon Heights, NJ, USA). It is also recommended to perform a regular self-calibration by using own morning breath samples or if available instrumental measurements in parallel [8].

The most simple organoleptic scale, which can be recommended to dentists with no or limited experience, is a yes/no decision performed at different distances from the patient's mouth [15] (table 2(A)). For more experienced dentists, the widely used 6-point scale describing the severity of the perceived odor at a defined distance, can be recommended [12, 16, 17] (table 2(B and C)).

An organoleptic test at the first appointment should always be performed on oral and nasal air. By comparing the mouth and the nose exhaled air intra-oral halitosis can be distinguished from nasal and blood-borne extra-oral halitosis [16].

Instrumental (objective) measurement

An instrumental detection method for VSCs is not mandatory but can be recommended as a second opinion, as aid for the calibration of odor judges, and for building trust with the patient, especially for patients with pseudo halitosis and halitophobia. Based on the currently available data in the literature [9] two devices for the detection of VSCs can be recommended for the use in the dental practice: the Halimeter and the OralChroma. Both show acceptable correlations with calibrated odor judges and appear to be easy to use under the conditions found in a regular dental practice [9, 18]. However, it should be noted that the Halimeter is unsuitable for measuring patients with extra-oral blood-borne halitosis from dimethyl sulfide origin [19] (table 3).

For other potentially useful instruments and devices such as chairside color-tests kits [20, 21] the current lack of scientific data limits a clear recommendation.

For both the organoleptic and the instrumental detection of halitosis a sampling method (negative pressure syringe method, sample bags) is recommended. A detailed description can be found elsewhere [9]. Compared to an organoleptic assessment during which the examiner directly sniffs the exhaled air of the patient, a sampling technique has the following advantages:

Table 2. Examples for recommended organoleptic scales for the general dental practitioner.

(A) Distance malodor scale (adapted from [15])	
Grade 0	No malodor detected
Grade 1	Malodor is clearly detected if the observer approached to a distance of about 10 cm to the mouth of the patient
Grade 2	Malodor is clearly detected if the observer approached to a distance of about 30 cm to the mouth of the patient
Grade 3	Malodor is clearly detected if the observer approached to a distance of about 100 cm to the mouth of the patient
(B) Fixed distance odor intensity scale (adapted from [16])	
Grade 0	No appreciable odor
Grade 1	Barely noticeable odor (detection threshold of odor)
Grade 2	Slight, but clearly noticeable malodor (recognition threshold of malodor)
Grade 3	Moderate malodor
Grade 4	Strong malodor
Grade 5	Extremely strong malodor
(C) Fixed distance odor intensity scale [15, 17]	
0: Absence of odor	Odor cannot be detected
1: Questionable odor	Odor is detectable, although the examiner could not recognize it as malodor
2: Slight malodor	Odor is deemed to exceed the threshold of malodor recognition
3: Moderate malodor	Malodor is definitely detected
4: Strong malodor	Strong malodor is detected, but can be tolerated by examiner
5: Severe malodor	Overwhelming malodor is detected and cannot be tolerated by examiner (examiner instinctively averts the nose)

Table 3. Pros and cons for clinically recommendable devices to measure volatile sulphur compounds.

Halimeter	OralChroma
+ • Simple and fast – • Can just measure intra-oral halitosis • Maintenance (regular costly sensor calibration at the manufacturer)	• Can give indication on extra-oral blood-borne halitosis • Technical sensitive • Single measurement takes 8 min • Maintenance (regular costly sensor calibration)

- higher degree of privacy for the patient
- receipt of a more concentrated sample
- cross-infection control.

Based on the opinions of the workshop participants, the initial organoleptic assessment should be performed in the morning and the patient should be instructed to refrain from the following prior to the appointment in order to get the most reliable measurement results:

- no fragrances or other masking products
- no smoking
- no antibiotic treatment at least three weeks (better six to eight weeks) before the examination
- ‘nothing in the mouth’ except water on the morning of the examination (no drinking or eating in the morning prior to the oral examination)
- no tongue cleaning for 24 h before the first breath assessment.

Treatment of halitosis

The treatment recommendations for halitosis are based on earlier publications by Miyazaki, Yaegaki and Coil [11, 12] and have been amended according to the simplifications of the international classification of halitosis suggested in this paper.

Recommended treatment needs (TN 1–5) have been defined (table 4).

Additional comments to TN1

A regularly performed mechanical tongue cleaning can be regarded as basic therapeutic and preventive measure for all types of halitosis. However, concerns have been raised based on an experiment in rodents showing that the experimental induction of tongue cancer using carcinogenic dimethylbenzanthracene (DMBA) was increased by mechanically injuring the tongue using a root canal instrument or even a regular toothbrush [22, 23]. A massive mechanical stimulation of the tongue with a power toothbrush could induce plasma membrane disruption of tongue cells and the release of c-Fos, a protein with oncogenic activity [24]. The mechanical stimulation of the tongue with a regular toothbrush can cause micro-bleeding, detectable by hemoglobin in saliva [23].

Therefore, tongue cleaning should be carried out gently with low force and should be instructed thoroughly in order to avoid unnecessary tissue trauma. Just the tongue dorsum with focus on the posterior part should be cleaned, not the lateral borders. In the absence of coating, tongue cleaning should not be advocated. Members of this consensus group are not aware of any experimental evidence currently reported in the literature that substantiates the benefits of providing a professional tongue cleaning using any kind of electrical device.

If tongue cleaning alone is not sufficient, standard antiseptics with proven efficacy such as chlorhexidine, cetylpyridinium chloride and zinc formulation should be used according to the manufacturers instructions applied as tongue

Table 4. Recommended treatment for halitosis under conditions found in the general dental practice (based on [12]), TN = treatment need.

Treatment Need	Description				
TN1	Explanation of halitosis and instructions for oral hygiene including tongue cleaning and use of additional measures such as mouth rinsing etc.				
TN2	Professional prophylaxis and treatment of oral pathologic condition (mainly periodontitis) if present				
TN3	Referral to a physician, medical specialist or interdisciplinary halitosis specialist				
TN4	Explanation of examination data, further professional instruction, education and reassurance				
TN5	Referral to a clinical psychologist, psychiatrist or other psychological specialist				
Treatment					
Diagnosis	TN1	TN2	TN3	TN4	TN5
Intra-oral halitosis	X	X			
Extra-oral halitosis	X		X		
Pseudo-halitosis	X			X	
Halitophobia	X				X

gel or mouth rinse (for details see the review article of this supplement from [10]).

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References

- [1] Tonzetich J 1977 Production and origin of oral malodor: a review of mechanisms and methods for analysis *J. Periodontol.* **48** 13–20
- [2] Quirynen M, Dadamio J, Van den Velde S, De Smit M, Dekeyser C, Van Tornout M and Vanderkerckhove B 2009 Characteristics of 2000 patients who visited a halitosis clinic *J. Clin. Periodontol.* **36** 970–5
- [3] Sterer N and Rosenberg M 2011 *Breath odors. Origin, Diagnosis, and Management* (Berlin: Springer) pp 5–57
- [4] Phillips K A and Menard W 2011 Olfactory reference syndrome: demographic and clinical features of imagined body odor *Gen. Hosp. Psychiatry* **33** 398–406
- [5] Pryse-Phillips W 1971 An olfactory reference syndrome *Acta Psychiatr. Scand.* **47** 484–509
- [6] Feusner J D, Phillips K A and Stein D J 2010 Olfactory reference syndrome: issues for DSM-V *Depression Anxiety* **27** 592–99
- [7] Winkel E G 2008 Halitosis control (chapter 60) *Clinical Periodontology and Implant Dentistry* 5th edn, ed J Lindhe, T Karring and N P Lang (Oxford: Blackwell) pp 1325–40
- [8] Greenman J, Lenton P, Seemann R and Nachnani S 2014 Organoleptic assessment of halitosis for the general dental practitioner *J. Breath Res.* **8** 017102
- [9] Laleman I, Dadamio J, De Geest S, Dekeyser C and Quirynen M 2014 Instrumental assessment of halitosis for the general dental practitioner *J. Breath Res.* **8** 017103
- [10] Sterer N and Rosenberg M 2011 *Breath odors. Origin, Diagnosis, and Management* (Berlin: Springer) pp 95–105
- [11] Coil J M, Yaegaki K, Matsuo T and Miyazaki H 2002 Treatment needs (TN) and practical remedies for halitosis *Int. Dental J.* **52** 187–91 (PMID: 12090450)
- [12] Yaegaki K and Coil J M 2000 Examination, classification, and treatment of halitosis; clinical perspective *J. Can. Dental Assoc.* **66** 257–61 (PMID: 10833869)
- [13] Tonzetich J 1971 Direct gas chromatographic analysis of sulphur compounds in mouth air in man *Arch. Oral Biol.* **16** 587–97
- [14] Van den Velde S, van Steenberghe D, Van Hee P and Quirynen M 2009 Detection of odorous compounds in breath *J. Dental Res.* **88** 285–9
- [15] Bornstein M M, Kislig K, Hoti B B, Seemann R and Lussi A 2009 Prevalence of halitosis in the population of the city of Bern, Switzerland: a study comparing self-reported and clinical data *Eur. J. Oral Sci.* **117** 261–7
- [16] Rosenberg M 1996 Clinical assessment of bad breath: current concepts *J. Am. Dental Assoc.* **127** 475–82
- [17] Murata T, Yamaga T, Iida T, Miyazaki H and Yaegaki K 2002 Classification and examination of halitosis *Int. Dental J.* **52** 181–6 (PMID: 12090449)
- [18] Lenton P, Majerus G, Levitt M and Hodges J S 2004 Comparison of new breath-testing device to established assessment methods *J. Dental Res.* **83** (special issue A) abstract number 3330
- [19] Tangerman A and Winkel E G 2007 Intra- and extra-oral halitosis: finding of a new form of extra-oral blood-borne halitosis caused by dimethyl sulphide *J. Clin. Periodontol.* **34** 748–55
- [20] Dadamio J, Van Tornout M, Vancauwenberghe F, Federico R, Dekeyser C and Quirynen M 2012 Clinical utility of a novel colorimetric chair side test for oral malodor *J. Clin. Periodontol.* **39** 645–50
- [21] Sterer N, Greenstein R B and Rosenberg M 2002 Beta-galactosidase activity in saliva is associated with oral malodor *J. Dental Res.* **81** 182–5
- [22] Fujita K, Kaku T, Sasaki M and Onoe T 1973 Experimental production of lingual carcinomas in hamsters by local application of 9, 10-dimethyl-1,2-benzanthracene *J. Dental Res.* **52** 327–32
- [23] Yaegaki K, Coil J M, Kamemizu T and Miyazaki H 2002 Tongue brushing and mouth rinsing as basic treatment measures for halitosis *Int. Dental J.* **52** 192–6 (PMID: 12090451)
- [24] Amano K, Miyake K, Borke J L and McNeil P L 2007 Breaking biological barriers with a toothbrush *J. Dental Res.* **86** 769–74