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Evaluation of a halitosis clinic over a period of eleven years

KEYWORDS

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SUMMARY

About every fourth individual suffers at least temporarily from oral malodor. The most frequent cause of it is the oral cavity, in particular the tongue coating. In professional halitosis clinics, findings and diagnoses are discussed with the patients, and individual therapy concepts are designed. Currently, there are only few evaluations of such clinics, which moreover are confined to a period of a few weeks or months. The aim of the present work was to evaluate the halitosis clinic of the University Center of Dental Medicine Basel over a period of eleven years. For the purpose of a recall, 638 patients were con-

tacted, who had visited the halitosis clinic between February 2003 and February 2014. Of these, 280 patients answered a special questionnaire. The halitosis clinic was rated as helpful by 81.9% of the respondents. The majority (61.8%) only rarely or never suffered from bad breath anymore and still carried out the recommended tongue cleaning. Ninety-one patients who reported to suffer again from oral malodor, could be re-evaluated also clinically. The strictly cause-oriented therapy concept of the halitosis clinic of the University Center of Dental Medicine Basel has proved successful over eleven years.

Introduction

Unpleasantly smelling breath can impair human relations and the quality of life (DE JONGH ET AL. 2012; DE JONGH ET AL. 2014). Although in the last years media increasingly addressed the topic of “oral malodor”, it is still put under a taboo in the society (FILIPPI 2008; ZÜRCHER ET AL. 2014). Oral malodor is widespread. Studies from Japan, the USA, and Switzerland show that 20–43% of the population at least temporarily are afflicted by bad breath (MIYAZAKI ET AL. 1995; LOESCHE ET AL. 1996; BORNSTEIN ET AL. 2009A; BORNSTEIN ET AL. 2009B).

Unpleasantly smelling exhaled air is referred to as halitosis, irrespective of an oral or extraoral origin (YAEGAKI & COIL 2000; FILIPPI 2008; ZÜRCHER & FILIPPI 2012). True halitosis (physiologic or pathologic) is distinguished from psychogenic halitosis (pseudohalitosis or halitophobia) (YAEGAKI & COIL 2000). Patients affected by psychogenic halitosis sense an objectively unverifiable smell or taste. By definition, patients with pseudohalitosis can be convinced of the contrary by a clarification and a discussion of the examination results. Patients with a halitophobia can neither be dissuaded by professional diagnostics nor by a metric prove of

their conviction that oral malodor is present (NAGEL ET AL. 2006). In professional halitosis clinics, 12–27% of the patients are affected by psychogenic halitosis (SEEMANN ET AL. 2005; FILIPPI & MÜLLER 2006; ZÜRCHER & FILIPPI 2012; SCHUMACHER ET AL. 2015).

The cause of true halitosis in 80–90% of the cases is located in the oral cavity (SEEMANN ET AL. 2005; QUIRYNEN ET AL. 2009). Owing to its surface-enlarging papillary structure, the top of the tongue provides niches to anaerobic bacteria, which offer protection against oxygen (FILIPPI 2008; ZÜRCHER & FILIPPI 2014). In these niches bacteria metabolize organic material such as salivary components, food residues, plaque, or epithelial cells, thus producing among other things volatile sulphur compounds (VSC) (MCNAMARA ET AL. 1972; DELANGHE ET AL. 1997A). Due to the large relative surface of the tongue, the lingual coating is a frequent cause of halitosis (DELANGHE ET AL. 1997A; DELANGHE ET AL. 1997B; FILIPPI 2011A; DE BAAT ET AL. 2014). Other oral causes are marginal periodontitis, multiple carious lesions, insufficient oral and denture hygiene, local infections, or oral mucosal diseases (DELANGHE ET AL. 1999; LANG & FILIPPI 2004A). Co-factors facilitating oral malodor are reduced quantities of saliva, stress, smoking, high coffee consumption, or selective nutrition (LANG & FILIPPI 2004A; FILIPPI 2010).

In about 4% of the cases, extraoral causes are responsible for true halitosis. Mostly, these are diseases in the ear, nose and throat (ENT) area, more rarely in the gastrointestinal tract (for example chronic tonsillitis, chronic sinusitis, hypoglycemia, reflux etc.) (DELANGHE ET AL. 1997B; LANG & FILIPPI 2004A; QUIRYNEN ET AL. 2009; LAMBRECHT 2011).

Since 2003 the University Center of Dental Medicine Basel offers a halitosis clinic. The concept comprises a general and special halitosis anamnesis, a halitosis examination including organoleptic and instrumental measurements of the breathing air, and as appropriate salivary diagnostics. The findings and results are discussed in detail with the patient, and an individual therapy concept is designed. Basically, microorganisms and the nutrient supply for the bacteria are supposed to be reduced and volatile sulphur compounds are to be converted into nonvolatile ones. In support, oral cosmetics such as for example mouth rinses or sprays can be applied (QUIRYNEN ET AL. 2002; YAEGAKI ET AL. 2002; LANG & FILIPPI 2004B; FILIPPI 2008; FILIPPI 2010; FILIPPI 2011B; DADAMIO ET AL. 2013A; DADAMIO ET AL. 2013B; ILERI KECELI ET AL. 2013; ZÜRCHER & FILIPPI 2014; ZÜRCHER ET AL. 2014). Commonly, a professional halitosis therapy needs two treatment sessions (DELANGHE ET AL. 1999; ZÜRCHER & FILIPPI 2012; SCHUMACHER ET AL. 2015).

Currently, there are some scientific data on the therapeutic success of halitosis clinics. However, these are limited to a short post-therapeutic period of a few weeks or months (DELANGHE ET AL. 1999; SEEMANN ET AL. 2001A; TANAKA ET AL. 2003; SEEMANN ET AL. 2005; FILIPPI & MÜLLER 2006; ZÜRCHER & FILIPPI 2012; DADAMIO ET AL. 2013A; ILERI KECELI ET AL. 2013; AUNG ET AL. 2015; SCHUMACHER ET AL. 2015).

The aim of the present study was to find out, to what extent the therapy concept of the halitosis clinic of the University Center of Dental Medicine Basel proved successful over a period of eleven years. For this purpose, special questionnaires as well as clinical findings from a recall were analyzed. With the aid of the questionnaires, primarily the subjective information of the respondents was evaluated. In part, the clinically objective improvement of the oral malodor could be assessed as well. Patients were informed in writing beforehand about the goal of the present investigation and the use of their anonymized information.

Materials and Methods

From February 2003 to February 2014, 697 patients had visited the halitosis clinic of the University Center of Dental Medicine Basel (first consultation). Within these eleven years, they were examined and treated by altogether five different dentists (FILIPPI & MÜLLER 2006; ZÜRCHER & FILIPPI 2012; SCHUMACHER ET AL. 2015). In the context of the present work, 638 patients were informed in writing about the possibility of a free halitosis recall. At the same time, they were asked to answer a special questionnaire concerning oral malodor (Tab. I). Fifty-nine patients had meanwhile moved and could not be contacted any longer. The questionnaire was sent by mail together with a return envelope or by e-mail, but could also be completed online. Patients who arranged a recall appointment were asked to bring along the completed questionnaire. The recall session was carried out by the two first authors of the present investigation. It corresponded to the common procedure of a halitosis clinic at the University Center of Dental Medicine Basel (LANG & FILIPPI 2004B; FILIPPI & MÜLLER 2006; FILIPPI 2008; FILIPPI 2011C; ZÜRCHER & FILIPPI 2012; SCHUMACHER ET AL. 2015). During the introductory conversation, the halitosis history was taken again. Thereafter, the clinical examination was performed. It comprised the assessment of the oral soft tissues and the oral hygiene, the control of existing restorations as well as a periodontal screening. The tongue coating was recorded using Winkel's tongue coating index (WTCl). The tidal air was evaluated organoleptically (via the olfactory sense) and instrumentally using a sulphide monitor (Halime-

Tab. I Halitosis questionnaire of the recall

Question	Predefined answers
Are you currently suffering from bad breath?	No/Yes If yes, how often? Once a month / Once a week / Daily / Always
How do you know that you still have bad breath?	Somebody has told me / Using the air-bag method / Non-verbal body language of other people / I simply know it
Are you currently suffering from dry mouth?	No/Yes If yes, how often? ___ times per _____
How much water do you drink per day?	0.5–1 liter / 1–2 liters / 2–3 liters / More than 3 liters
Do you drink coffee?	No/Yes, ___ cups per day
How often do you clean the tongue?	Never / Once a month / Once a week / Daily: 1x / 2x / 3x / more How do you clean the tongue? Tongue brush / Tongue scraper / Toothbrush / Tongue paste / Toothpaste / Other: _____
Do you use a mouthwash solution?	No/Yes If yes, how often? ___ times per _____ Name of the mouthwash solution: _____
Did the halitosis clinic have a positive impact for you?	No / Perhaps / Yes If yes, which one? I do not have bad breath anymore / I feel less self-conscious / My private or social life has changed / Other: _____

Tab. II Classification of halitosis (modified by ZÜRCHER & FILIPPI 2012 according to MIYAZAKI ET AL. 1999)

I	True halitosis due to oral cause	Intraoral cause can be clinically diagnosed and verified both organoleptically and instrumentally
Ila	True halitosis due to extraoral cause	Cause in the ENT area
IIb	True halitosis due to extraoral cause	Cause in the internistic area
III	Psychogenic halitosis	No distinction between pseudohalitosis and halitophobia

ter®, Interscan Co., Chatsworth, CA, USA) (ROSENBERG ET AL. 1991A; ROSENBERG ET AL. 1991B; SEEMANN ET AL. 2001A; BRUNNER ET AL. 2010; LALEMAN ET AL. 2014). The diagnosis was made with the aid of a simplified variant of the halitosis classification according to MIYAZAKI ET AL. (1999) (Tab. II).

The statistical evaluation of the data was carried out using ordinal logistic regression in order to examine the effect of different variables on the tongue cleaning behavior. The independent variables included the year of the first consultation, the patients' assessment, xerostomia, the age of the patient as well as the oral or extraoral cause of the halitosis. The frequency of tongue cleaning was classified in three groups (daily, rarely, never). Specific differences between groups were analyzed with the aid of the t-test, assuming the level of significance at $p < 0.05$. For the descriptive statistics contingency tables were used.

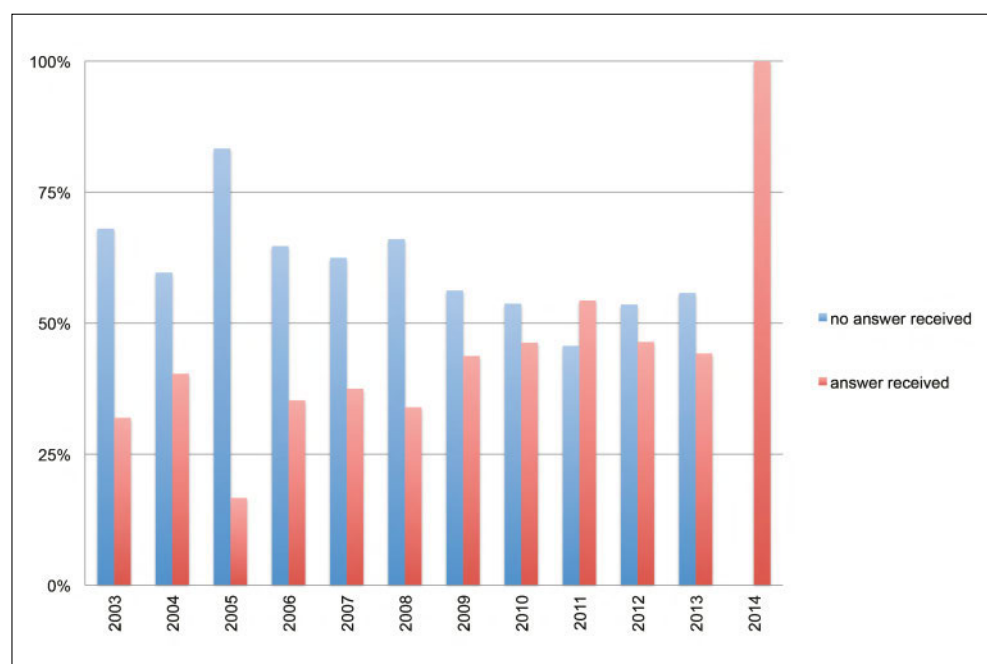
Results

Between February 2003 and February 2014, 697 individuals had visited the halitosis clinic of the University Center of Dental Medicine Basel. Genders were distributed about equally ($n=320/377$). At the first appointment, patients on average were 43.1 years old (6–84 years, SD 15.05).

For the present study, 91.7% of the patients could be contacted and received the special halitosis questionnaire. A total of 280 individuals, 126 females and 154 males, answered. At this time, the patients on average were 51.8 years old (13–90 years, SD 15.70). A clear association between the time of the first consultation and the response rate of the questionnaires became evident ($p < 0.001$): the longer the first consultation dated back, the more rarely the questionnaire was returned (Fig. 1).

In the 280 completed questionnaires, 42.5% ($n=119/280$) of the patients indicated that they did not have bad breath any longer. One third (33.6%, $n=94$) still suffered always or daily from oral malodor, 19.3% ($n=54$) more rarely. No association could be found between the question "Are you currently suffering from bad breath?" and the time of the first consultation ($p=0.6936$). Most frequently these patients were made aware of oral malodor by their environment (Tab. III). Individuals who still or again suffered from subjectively perceived halitosis ($n=161/280$), answered the questions concerning xerostomia, intake of fluids, and coffee consumption as follows: one third was afflicted with dry mouth, and the majority drank one to two liters of water per day. An association between xerostomia and the intake of a certain amount of water could not be found ($p=0.2364$). The majority of the patients daily consumed between one and seven cups of coffee, on average 2.8 cups (Tab. IV).

The greater part of the respondents (87.9%, $n=246/280$) carried out tongue cleaning, 184 of these daily. Most frequently, a tongue cleaner (tongue brush or tongue scraper), clearly less often the tooth brush was used (Tab. III). There was no statistical difference between the utilization of these auxiliaries in terms of the subjectively perceived oral malodor (tongue cleaner $p=0.1477$, tooth brush $p=0.6258$). The time of the first consultation did not affect the frequency of tongue cleaning ($p > 0.05$), and neither did the regularity of tongue cleaning significantly depend on whether the patients conceived the clinic as helpful or less helpful ($p=0.5010$). Likewise, no differences in this respect were evident in individuals with bad breath due to an oral cause ($p=0.7886$). About two thirds of the patients who subjec-

**Fig. 1** Response rate of the halitosis questionnaire dependent on the year of the first consultation

Tab. III Results from the halitosis questionnaire (multiple answers possible), part 1

Question	Answer	Number of answers (n=280)
Awareness of own oral malodor	“Somebody has told me”	97
	Airbag method	10
	Nonverbal communication	43
	“I simply know it”	55
	No specification	2
Way of tongue cleaning/utilization of mouthwash solution	Tongue cleaner	239
	Toothbrush	55
	Tongue paste	43
	Toothpaste	33
	Mouthwash solution	175
Subjective benefit of the clinic	No bad breath	74
	Rarely bad breath	24
	Improved social life	92
	Better informed	32
	Not specified	51

tively suffered from halitosis used a mouthwash solution, more than one third even daily (Tab. IV). They utilized a mouthwash solution more frequently than individuals who subjectively did not suffer from oral malodor ($p=0.0302$).

For the larger part of the patients (81.9%, $n=229$), the clinic had a positive effect. Most often an advantageous alteration of the social life was cited as reason (Tab. III).

Ninety-one patients, 29 females and 62 males, had completely answered the special halitosis questionnaire and arranged an appointment for the clinical examination (halitosis recall) at the University Center of Dental Medicine Basel. At the first consultation (between 2003 and 2014), in $n=82/91$ of the cases an oral cause of the bad breath was diagnosed, while seven were afflicted with a psychogenic halitosis, and in two patients the cause was located in the ENT area. At the time of the recall, an oral cause was revealed in 76 of 91 patients, and in eleven individuals a psychogenic halitosis was diagnosed. Seventy-two of the 91 patients subjectively suffered from oral malodor. In the majority (47.2%, $n=43$) this self-assessment correlated with the findings recorded objectively (Tab. V).

Discussion

Due to the partly long period of up to eleven years between the first consultation and the halitosis recall, some patients had moved and could not be traced anymore. The assumption proved true that in cases of first consultations dating back a longer period of time, questionnaires were returned more rarely. Despite the partly long period of time since the first appointment, 42.5% of the respondents felt free from oral malodor, which can be considered a long-term therapy success.

Tab. IV Results from the halitosis questionnaire, part 2

Question	Answer	Subjectively perceived oral malodor (n=161)
Mouth dryness		56
Intake of fluids (liter)	0.5–1	37
	>1–2	92
	>2–3	28
	>3	4
Coffee (number of cups)	1	24
	2	33
	3	50
	4	17
	5	6
	6	5
	7	2
Tongue cleaning	Daily	108
	Occasionally	38
	Never	15
Mouthwash solution	Daily	63
	Occasionally	40
	Never	51
	Not specified	7
Tongue cleaning and mouthwash solution	Occasionally	52
	Daily	51

Tab. V Comparison of the self-assessment of oral malodor with the objective finding

		Objective finding		Sum
		Halitosis	No halitosis	
Subjective assessment	Halitosis	43	29	72
	No halitosis	7	12	19
Sum		50	41	91

Most frequently, patients with bad breath are made aware of the halitosis by third parties. Nonverbal signs were mentioned markedly more rarely than in comparable studies (ZÜRCHER & FILIPPI 2012; SCHUMACHER ET AL. 2015). The reason for this finding could be the clarification at the first consultation that the nonverbal body language does not yield reliable information about the own breath. In the more private sphere, the oral malodor was addressed to a lesser extent. The reason presumably is an inhibitory threshold hindering an open talk about this topic (ZÜRCHER & FILIPPI 2012; SCHUMACHER ET AL. 2015). Despite

increased presence in the media, oral malodor still is a taboo issue and requires further educational work and information (ZÜRCHER & FILIPPI 2012; ZÜRCHER 2014). For example, the recommended so-called airbag method, i.e. a possible selftest in which the own expiratory air is collected in an odorless plastic bag and examined using the own nose (FILIPPI 2011D), was applied by only 6.2% of the patients.

A dry mouth can facilitate the emergence of oral malodor. In order that the mucous membranes are sufficiently moistened, an adequate intake of fluids is necessary. More than one third of the patients with subjectively perceived bad breath also suffered from xerostomia. The present evaluation confirms the assumption that many individuals fall below the recommended daily amount of drinking water (FILIPPI 2011E). Only 19.9% of the respondents drank two liters of water or more per day. Regular tongue cleaning can reduce oral malodor (MIYAZAKI ET AL. 1995; SEEMANN ET AL. 2001B). The halitosis clinic of the University Center of Dental Medicine Basel recommends two to three cleaning procedures per day, preferably using a tongue brush and tongue paste. Many studies already demonstrated the advantages and effectiveness of this concept (YAEGAKI & COIL 2000; SEEMANN ET AL. 2001A; SEEMANN ET AL. 2001B; QUIRYNEN ET AL. 2002; LANG & FILIPPI 2004B; FILIPPI 2010; FILIPPI 2011F; DADAMIO ET AL. 2013A; DADAMIO ET AL. 2013B; ILERI KECELI ET AL. 2013; ZÜRCHER & FILIPPI 2014; ZÜRCHER ET AL. 2014; SEEMANN ET AL. 2014; AUNG ET AL. 2015). Most patients carried out a tongue cleaning, more than two thirds even daily. Something similar also became evident with respect to the utilization of a mouthwash solution. For cleaning, most patients used a tongue cleaner, although predominantly without tongue paste. Only few participants (<7%) of the present study implemented the entire tongue cleaning concept of the halitosis clinic of the University Center of Dental Medicine Basel. Reasons for the inconsistently performed tongue cleaning could be the additionally needed auxiliaries and the time required.

The larger part of the respondents (81.9%) considered the first consultation helpful. Patients felt better informed, saw a positive development in social life, and knew how to get rid of their bad breath. The therapy concept also has a positive impact on the regularity of tongue cleaning (87.9%). Since the obtained data are subjective, no objective success rate can be derived. Based on the feedback, the clinic nevertheless can be regarded as very helpful.

The clinical response rate only amounted to 14.2% and thus was very low. Reasons for this could be long access routes or lack of time (SCHUMACHER ET AL. 2015). Patients who according to the answers in the questionnaire no longer suffered from oral malodor possibly did not see the necessity of a recall. From the 91 individuals who could be clinically re-evaluated, 76 revealed halitosis due to an oral cause. The oral cavity hence continued to be the main cause (DELANGHE ET AL. 1997A; DELANGHE ET AL.

1997B; SEEMANN ET AL. 2005; QUIRYNEN ET AL. 2009; DE BAAT ET AL. 2014). In about two thirds of the patients the subjective assessment agreed with the objective findings. Studies similar to the present one failed to demonstrate more than only weak correlations between self-perception and organoleptic or instrumental measurements (TANAKA ET AL. 2003; BORNSTEIN ET AL. 2009A; BORNSTEIN ET AL. 2009B). Possibly, the participants of this investigation, owing to the clarification at the first consultation, were less self-conscious to talk about the topic of oral malodor with their environment. By means of reliable information from a counterpart, the self-assessment can be regularly verified.

Based on the returned questionnaires (n=280), the subjective therapy success over the eleven years amounted to 81.9%. The majority of the respondents (61.8%) felt free from oral malodor or suffered only rarely from it. Among the patients who underwent a clinical re-evaluation (n=91), 74 reported on a subjective therapy success, and 49 had rarely or no halitosis at all any longer. It can be assumed that individuals who were dissatisfied with the treatment more likely took advantage of the recall appointment.

The subjective therapy success rate of 81.9% found in the present evaluation is comparable to that observed by FILIPPI & MÜLLER 2006, ZÜRCHER & FILIPPI 2012, and SCHUMACHER ET AL. 2015. This shows that the therapy concept over the eleven years proved successful. The weakness of the present study was that it mainly relied on the self-assessment of the patients. Clinically, only a small patient sample could be re-evaluated. Correspondingly, further evaluations would be necessary for objective assessments.

Résumé

Environ une personne sur quatre souffre de mauvaise haleine (halitose). La cause la plus courante est la cavité buccale, en particulier une langue chargée. Lors d'une consultation relative à l'halitose, les résultats et les diagnostics sont discutés avec le patient et un plan de traitement individuel est établi. Actuellement, il existe quelques études scientifiques de ces consultations. Cependant, celles-ci sont limitées à des semaines ou des mois. Le but de la recherche présente est d'évaluer la consultation de l'halitose du Centre universitaire de médecine dentaire de Bâle pour une période prolongée de onze ans. Dans le cadre d'un contrôle subséquent, les données entre février 2003 et février 2014 ont été réévaluées. 280 patients ont répondu à un questionnaire. 81,9% des patients ont estimé la consultation utile. La plupart (61,8%) n'avaient plus, ou seulement sporadiquement, mauvaise haleine et continuaient le nettoyage de la langue comme recommandé. 91 d'entre eux ont de plus pris rendez-vous.

Le concept thérapeutique conseillé par le Centre universitaire de médecine dentaire de Bâle a fait ses preuves pendant plus de onze ans.

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