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Findings, Diagnoses and Results of a Halitosis Clinic over a Seven Year Period

Key words: halitosis, psychogenic halitosis, bad breath

Summary Halitosis or bad breath is a taboo subject that is a widespread problem in the general population. Causes of bad breath can be multifactorial and long time sufferers can be marred from deep psychological stress. Because nine out of ten cases have an oral cause, the initial inquiry should be with a dentist.

In a retrospective study from February 2003 to February 2010, the halitosis clinic at the University of Basel analyzed data from 465 patient medical histories. Study objectives evaluated the causes of halitosis, gender distribution and treatment success. All patients reported to have suffered from bad breath. However, 82.7% were actually diagnosed as having halitosis. Within this group, 96.2% showed an oral etiology and 3.8% showed an extra-oral cause. Women suffered significantly more from a psychogenic halitosis.

Success rates of 92.6% subjectively and 94.5% objectively reflect the treatment success of the diagnostic and therapeutic concepts presented at the University of Basel halitosis clinic over a seven year period.

Introduction

Bad breath is common. Despite increased interest in the subject, only a few epidemiological studies based on questionnaires with limited relevance exist. Actual rates of halitosis do not correspond to self-assessment claims of bad breath (Miyazaki et al. 1995, Loesche et al. 1996). A study from Japan showed 6–23% of the population suffered from bad breath of varying degrees (Miyazaki et al. 1995). These percentage rates are consistent with a survey among German dentists (Seemann 1999), as well as that of a population in the Swiss capital of Bern (Bornstein et al. 2009).

Halitosis (Latin halitus: breath, vapour) describes an unpleasant smelling breath regardless of oral or extra-oral cause. Contrary to popular belief, halitosis generally occurs approximately 85–90% in the oral cavity caused by bacterial decomposition of organic material (Tonzetich & Richter 1964, Tonzetich 1978, Delanghe et al. 1996, Delanghe et al. 1997, Rosenberg & Leib 1997, Amir et al. 1999, Delanghe et al. 1999a, Meyer 2006). Through the formation of bacterial by-products coating the tongue, volatile sulphur compounds (VSC) are a large reason for an unpleasant odour (Tonzetich & Richter 1964, Tonzetich 1971, Tonzetich 1977, Schmidt et al. 1978, Persson et al. 1990, Preti et al. 1992, Rosenberg & McCulloch 1992, Yaegaki & Sanada 1992, van Steenberghe et al. 2001, Filippi & Meyer 2004).

Other contributing oral conditions include periodontitis, gingivitis, in rare cases thrush, dental caries, unclean dentures, insufficient dental restorations or poor oral hygiene (Tonzetich 1978, Yaegaki & Sanada 1992, Delanghe et al. 1999b, Söder et

al. 2000, Lang & Filippi 2004). Extra-oral causes are predominantly found in the ear, nose and throat region (Delanghe et al. 1997, Delanghe et al. 1999a, Delanghe et al. 1999b) or in rare cases in the gastrointestinal tract (Lambrecht 2006).

Patients who suffer from a psychogenic halitosis are convinced of having an unbearable bad breath (Nagel et al. 2006) even though objectively no halitosis can be diagnosed. Studies from halitosis clinics in Berlin, Basel and Leuven have shown 12% to 27% of patients present with a psychogenic halitosis (Seemann et al. 2004, Filippi & Müller 2006, Quirynen et al. 2009).

The purpose of this retrospective study was to assess and evaluate the results of the halitosis clinic at the University of Basel from 2003 to 2010 and to investigate treatment reliability.

Materials and Methods

In the seven years (from February 2003 to February 2010), 465 patients were examined and treated in the halitosis clinic at the University of Basel. All patients reported to suffer from bad breath. Treatment strategies were categorized according to health history, clinical findings, diagnosis and cause related therapies (see below). Within the seven year period, five different dentists performed the examinations.

At the time the appointment was made, patients were instructed not to eat, smoke, drink coffee or perform any oral hygiene at least 4 hours before the examination, as well as to refrain from any activity that could mask their bad breath (perfumed cosmetic products, chewing gum, candy or mouthwash) on the day prior to their appointment. Onion and garlic should be avoided two days before and any treatment with antibiotic must have been completed at least four weeks or more before visiting the halitosis clinic.

Each patient was given a special designed questionnaire (Filippi 2006a) with 35 specific questions for the halitosis consultation to facilitate an introductory conversation with the examiner. Over the years, the questionnaire has been adapted and optimized to improve quality. The general and detailed halitosis history gave information about type, frequency, time of day, extent of halitosis, therapies previously carried out through physicians, dentists or self-treatment, resulting psychological stress as well as typical halitosis co-factors such as dietary and smoking habits. 14 patients from 465 were excluded in the analysis because of incomplete questionnaires. The recorded clinical findings focused on common halitosis sites. These include an examination of the oral and pharyngeal soft tissue (particularly a coated tongue, Waldeyer's ring, salivary ducts, the presence of mucosal moisture) as well as dental fillings and restorations. A periodontal screening and assessment of oral hygiene was also evaluated. If signs of periodontal disease or pericoronitis were present, an orthopantomogram (OPG) was taken for further periodontal therapy or extraction.

An organoleptic evaluation was carried out during the initial consultation with the distance of operator to patient (1 m = grade 3) and the intraoral examination evaluated (30 cm = grade 2 and 10 cm = grade 1) (Seemann 2001). The subsequent instrumental measurement of exhaled air was performed using a sulfide monitor (Halimeter®, manufactured by Interscan Corporation, Chatsworth, CA, USA) (Rosenberg et al. 1991a, b, Brunner et al. 2010). With the help of an internal pump, air is drawn through a hose and fed to an electrochemical gas sensor. Within a few seconds, a display shows the concentration of volatile sulphur compounds (VSC) in ppb (parts per billion). For the present analysis only oral readings were taken. The nasal values were used for a differential diagnosis. All patients were assessed using a modified form of the halitosis classification by Miyazaki et al. (1999) (Tab. I).

If halitosis was diagnosed from an oral cause, a corresponding therapy was initiated. If a heavy coated tongue was detected, supplemental tongue cleaning instruction was to be included in the daily oral hygiene regime which included cleaning 2–3 times a day with a special tongue cleaner. If a heavy coated tongue persisted and/or strong gag reflex were present, then tongue cleaning and an additional disinfecting mouthwash was added during a one week period. If gingival or periodontal infections were present, then professional treatment was performed followed by restorative, prosthetic or surgical therapy, if necessary. Patients receiving treatments after 2006 were given a guidebook on the taboo subject of halitosis (Filippi 2006b) with new information for further reading. After the initial consultation, a one or two week follow-up appointment was scheduled which compared new organoleptic and instrumental measurements of exhaled air to baseline data. Further maintenance instruction was given as needed. The objective therapy success was based on the findings at this evaluation. The subjective therapy success was based on the patient's opinion if the condition had improved, showed no improvement or was cured. Two to four months later, if needed, a second follow-up appointment was scheduled which also was included in the therapeutic evaluation success. If the patient preferred not to have a follow-up appointment after the initial consultation, a telephone call was made to assess the subjective outcome. Furthermore, if requested, the patient was allotted to a cause related recall system. Some patients with persistent bad breath rescheduled themselves if they resided far away and had long travel distances to the clinic. In cases, where no oral cause of halitosis could objectively be diagnosed, the patient was referred to an appropriate ENT specialist or internist. Tonsillitis was always found in combination with clinical findings accompanied by typical color and morphological changes on the tonsillar surface (Lambrecht 2006). If halitosis was not possible to diagnose upon the initial visit, a second appointment was scheduled at a different time of day to avoid recording any circadian rhythms. Patients with psychogenic halitosis (pseudo-halitosis or halitophobia) were informed of the diagnoses at the follow-up appointment. In dealing with such patients utmost discretion must be practiced so as no to diminish the trust relationship between dentist and patient (Nagel et al. 2006). In the course of the follow-up appointment, these patients were recommended to seek psychological counseling.

Tab. I Classification of halitosis, modified by Miyazaki et al. (1999)

I	True halitosis with oral causes	Clinically diagnosed intraoral causes and verified with the Halimeter® and organoleptically
IIa	True halitosis with extraoral causes	Causes in the ear, nose and throat region (ENT)
IIb	True halitosis with extraoral causes	Causes from the stomach (gastroenterology)
III	Psychogenic halitosis	No differentiation between pseudohalitosis and halitophobia

For each of the 451 patients a statistical analysis was performed which included questionnaire responses, dental examination findings, organoleptic measurements, Halimeter® values, type of therapy and recall findings. Patients with extraoral halitosis were referred to an external specialist and therefore not included in the statistical analysis. Treatment success differed between the objective and the subjective outcomes (patient viewpoint). The objective therapy could only be measured in patients who returned for a follow-up examination.

For the present retrospective study, 11 out of 35 questions from the halitosis questionnaire were selected (Tab. II). This study examined the number of referrals, findings and diagnoses of halitosis, causes suspected by the patient, previous examinations and treatments and the degree the patient suffered. For the descriptive analysis, descriptive statistics tables were created. The p-values were calculated according to Fisher's Exact Test whereas $p<0.05$ was set as the significance level. Statistical calculations were performed with the "Statistical package R" (The R Foundation for Statistical Computing Version 2.9.2).

Results

The patient gender distribution was nearly even with 51.8% male (n=241) and 48.2% female (n=224). After excluding 14 patients with incomplete questionnaires, there were 51.7% male (n=233) and 48.3% female (n=218).

At the time of initial consultation, the average age of patients was 43.7 years (6–83).

Referrals

Of the 451 patients included in this study, 83.1% (n=375) came to the halitosis clinic on their own accord. From the 16.9% remaining patients (n=76) referred by physicians, 25% (n=19) of them came from dental colleagues. Further referrals came from general practitioners (23.7%, n=18), internists (19.7%, n=15), gastroenterologists (19.7%, n=15) and otorhinolaryngologist (10.5%, n=8). One patient (1.3%) was referred by a pulmonologist. Over the years, the external referral bases have significantly increased ($p<0.001$) (Fig.1).

In 75% of referred patients (n=57) halitosis had an oral cause and in 15.8% (n=12) a psychological cause. In the remaining 9.2% (n=7) no oral cause could be established.

Findings and diagnoses

All patients believed they had bad breath. In 82.7% of the patients (n=373) a true halitosis was diagnosed. Of those, 96.2% (n=359) had an oral cause. The remaining 2.9% (n=11) had an origin in the ear, nose and throat region and 0.8% (n=3) came from an internal organ. The number of patients with a

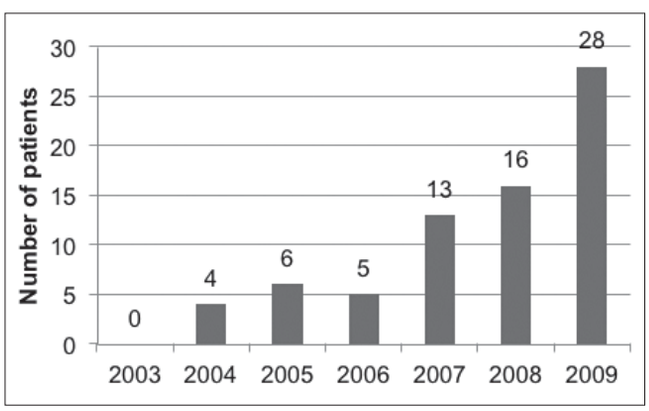

Fig. 1 Number of patients from external referrals per year (from February 2003 to the end of 2009)

Tab. II Evaluation of 11 questions of the Basel University halitosis questionnaire

How do you know that you have bad breath?	Body language from other people Someone told me I just know
When did you first notice that you have bad breath?	__ years ago, __ months ago, __ weeks ago
Do you smoke?	yes or no if yes, how many cigarettes a day?
Does your bad breath have an influence on your private life or your social life? If yes, which one?	please answer in your own words
Do you think that you have bad breath at present?	yes or no
What do you think is responsible for your bad breath?	please answer in your own words
What measures have you undertaken to fight against bad breath?	Nothing at all mouthwash, chewing gum, breath mints avoided certain foods, which foods: anything else:
Have you visited any other doctors about your bad breath? (Dentist, physician, ENT specialist…?)	yes or no if yes, when? __ what type of doctor? dentist, family doctor, ENT specialist, internist, other physician?
What treatments were carried out by these doctors?	Examination of the mouth, the throat, the sinuses, the stomach, the blood, x-rays, gastroscopy/endoscopy, dental treatment, other:
Were any medications or treatments prescribed or recommended?	yes or no if yes, which one? antibiotics, medication against stomach acid, mouthwash, throat lozengers, other:
Are you on a special diet?	yes or no if yes, which one?

psychological cause was 17.3% (n=78) (Fig. 2), with a significant higher proportion of women (70.5%, n=55) than men (29.5%, n=23) ($p<0.05$). In 84.7% (n=382) of patients, a coated tongue was diagnosed followed by 19.3% (n=87) with periodontitis and 15.3% (n=69) with gingivitis. Smokers made up 17.3% (n=78), with only one exhibiting a pronounced smoker's breath. Another group 5.8% (n=26) at the time of this study was dieting (vegetarian, low fat, low salt or lactose-free).

Suspected cause

Of a total of 587 responses to the question "What do you think is the cause for your bad breath?", "do not know" was the most frequent answer (31.3%, n=184), followed by "the oral cavity" (23.5%, n=138). A further 11.4% (n=67) specifically mentioned the surface of the tongue and 5.6% (n=33) answered the teeth as being responsible. Furthermore, 17% (n=100) related bad breath to the gastrointestinal tract and 14.1% (n=83) as the ear, nose and throat region. Other causes such as diet, stress, diabetes, medications, hormones, mental state or age were rarely mentioned (Fig. 3).

Previous investigations and treatments

The majority of patients (94.5%, n=426) had previously sought a remedy to treat bad breath themselves either by covering it with gum and candy (89.2%, n=380) or using a mouthwash (62.9%, n=268). Another group of patients (28.9%, n=123) avoided certain foods (garlic, onions, dairy products) or maintained good oral hygiene (5.4%, n=23), 11% (n=47) tried a tongue cleaner. One patient (0.2%) even stopped smoking. Because of their bad breath, 63% of patients (n=284) had previously visited one or several doctors. Here there were no differences between men and women ($p=0.777$) or patients with a true or psychogenic halitosis ($p=0.901$). Of the 27.1% (n=77) whose initial consultation was with a gastroenterologist, 12% (n=34) were prescribed medication for stomach acid. Of the 13.7% (n=39) whose initial consultation was with an ENT specialist, 3.5% (n=10) underwent a tonsillectomy.

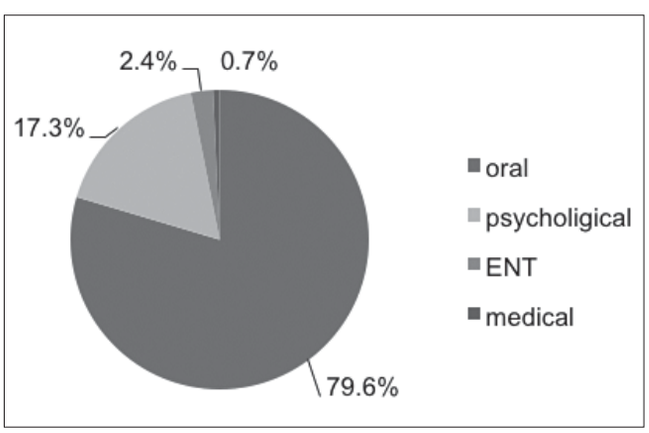

Fig. 2 Distribution of halitosis causes

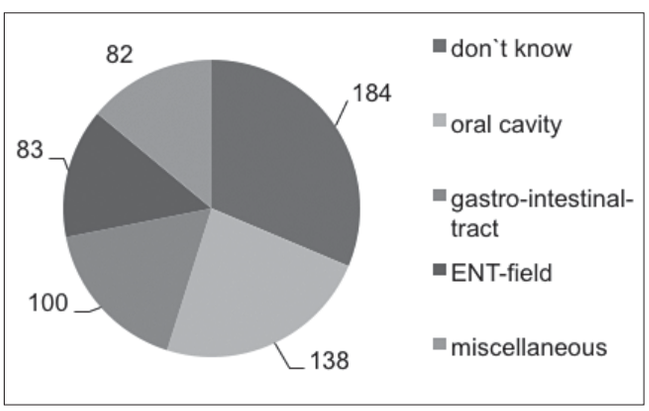

Fig. 3 Distribution of the suspected causes (multiple answers possible)

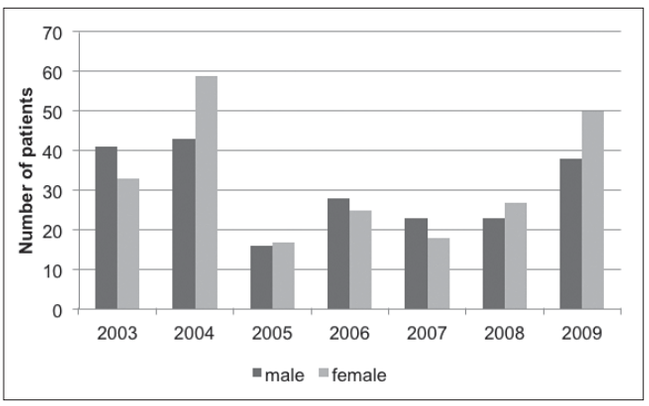

Fig. 4 Distribution of patients visiting the halitosis clinic (from February 2003 to the end of 2009)

Life of suffering and its influence on social life

Of the 451 patients, 14% (n=63) claimed to have suffered less than one year, 53.9% (n=243) between one and ten years and 32.2% (n=145) had suffered more than ten years. In 83.4% (n=376) bad breath took its toll on one's social life, manifested to varying degrees of inhibition, insecurity, isolation, withdrawal, reduced social contact, problems in relationships, less talking by an unwillingness to speak or by keeping a distance to others.

The larger proportion of patients (72.7%, n=328) were aware of bad breath from their surroundings, 35% (n=158) through interpretation of nonverbal body language, 34.6% (n=156) reported to smell it themselves and just knew that they had bad breath.

Therapy success

The average number of appointments was 2.1 (23.9% [n=108] two appointments, 32.2% [n=145] more than two appointments). Those who did not need any further treatment were 43.9% (n=198) and not placed in the recall system. The majority of patients (88.5%, n=224) with an oral etiology could objectively be relieved of their bad breath, even though from the patient's point of view (subjectively), 82% (n=255) achieved relief. However, if all of those who responded with "an improved outcome" were tallied, the objective success rate would be 94.5% (n=239) and a 92.6% (n=288) subjective success rate.

Distribution over seven years

Since the halitosis clinic began in February 2003, an equal number of men and women sought consultation (Fig. 4). Within this same time period, an increase ($p=0.072$) in psychogenic halitosis could be observed and the subjective success rates remained consistently high ($p=0.79$), the objective success rates increased ($p=0.093$), which is thought to be due to an observed learning curve.

Discussion

Approximately the same number of men and women with an average age of 43.7 years visited the halitosis clinic. This cor-

responds to the results of the German and Belgian halitosis clinical studies (Seemann et al. 2004, Quirynen et al. 2009). The assumption that women consult doctors earlier or more frequently than men (Miyazaki et al. 1995, Quirynen et al. 2009) could not be confirmed in this study.

Referrals

In the present study, 16.9% of referrals corresponds with the number of referrals to other halitosis clinics (Delanghe et al. 1999b, Seemann et al. 2004, Quirynen et al. 2009). However, referrals have increased over the past few years, pointing to an increased awareness among physicians that the most common cause of bad breath stems from the oral cavity. In addition, some dental colleagues are more comfortable in referring their patients to a specialist clinic for further treatment.

Findings and diagnoses

In the majority of patients with a true halitosis (87.2%), an oral cause was diagnosed in 96.2% of the cases. Most frequent contributing factors were a coated tongue followed by periodontitis and gingivitis (De Boever & Loesche 1996, Rosenberg & Leib 1997, Yaegaki 1997, Delanghe et al. 1999b). Comparatively, an extra-oral cause is rare, underlining the need for a dentist to first be consulted about bad breath. Of the 451 patients in this study, all sought advice from a dentist, which is not a true representation of the distribution within the general population. This study presented with a high proportion (17.3%) of psychogenic halitosis patients, which slightly increased over the seven year period. These results support those of another halitosis clinic (Quirynen et al. 2009), which observed an even greater increase. Strikingly the proportion of women was more than double, which has also been observed in other studies (Seemann et al. 2004, Seemann et al. 2006, Quirynen et al. 2009). Psychogenic halitosis includes patients with pseudo-halitosis and those with a halitophobia (Rosenberg & Leib 1997). Both of these groups claimed to have bad breath themselves which could not be perceived by others (Nagel et al. 2006). Patients with pseudo-halitosis left their treatment sessions convinced that their halitosis could not be detected even with objective diagnostic tools (organoleptic and instruments). In contrast, halitophobia patients who have received intensive explanation and counseling about their findings are not convinced that their bad breath does not exist and that no somatic therapy is necessary (Rosenberg & Leib 1997). Dealing with such patients is beyond the scope of the halitosis therapist, they belong in the hands of a psychotherapist. Even if referrals of such patients are not always successful (Delanghe et al. 1997, Delanghe et al. 1999a, Nagel et al. 2006), every halitosis clinic needs to establish appropriate multidisciplinary referral contacts to make the treatment process most comfortable for the patient.

Suspected cause

The second most common cause of halitosis is the gastrointestinal tract (17%) followed by the ear, nose and throat region (14.1%). The oral cavity was only slightly ahead with 23.5% as the most common cause. These results support the widespread belief by patients that halitosis is caused by a pathological change in the gastrointestinal tract (Seemann 2000). When patients were asked where their bad breath originated, the most common response (31.3%) was "do not know" which underscores the necessity to educate the general population. With more public awareness, patients avoid unnecessary visits to medical specialists.

Previous examinations and treatments

Almost every patient (94.5%) tried self-remedies to combat bad breath. These included chewing gum, sweets or mouthwashes which had a masking effect but no influence on the cause of bad breath (Quirynen et al. 2002). More than half of the patients (63%) had previously consulted other medical professionals before visiting the halitosis clinic. In a German study, this number was higher at 83.5% (Seemann et. al. 2004). In 40.8% of patients, a medical examination was performed with shocking results: 12% of the patients were prescribed a medication to block stomach acid and another 3.5% had a tonsillectomy without ever having a professional examination of their breath.

Life of suffering and its influence on social life

Some halitosis patients (32.2%) have suffered for over ten years, which suggests that many are unaware of whom to contact for help. 83.4% said that the suffering from bad breath had an impact on their social life. This is in contrast to the previous assumption that one half of affected persons felt an influence on their social life (Bosy 1997). It is however gratifying that a high percentage of patients (72.7%) have been made aware of bad breath from their surroundings, showing that the inhibition level of this taboo topic has decreased.

Therapy success

The University of Basel halitosis clinic has consistently shown a high treatment success over the years. Other halitosis clinics have shown success rates (complete disappearance or improvement of bad breath) to be between 68% and 79% (Delanghe et al. 1999b, Quirynen 2009). The diagnostic and therapeutic approach over the past seven years has shown that bad breath can often be eliminated through simple measures. A long term success rate was not examined in this study because many of the participating patients had very long travel distances and could not be maintained in a recall system.

Distribution over seven years

The consistent number of patients seeking professional advice from a halitosis clinic, despite today's media coverage of this taboo subject, has proven it to be a welcoming contact center for those affected.

Résumé

L'halitose, problème souvent tabou, est très répandue dans la population. Les causes d'une mauvaise haleine peuvent être très diverses. Les personnes concernées peuvent avoir subi un long calvaire avec pour conséquences des perturbations psychiques parfois considérables. Comme dans neuf sur dix cas une cause buccale est diagnostiquée, le dentiste devrait être la première personne contactée.

Les données de 451 patients qui se sont présentés à la consultation de la mauvaise haleine (halitose) de l'Université de Bâle, entre février 2003 et février 2010, ont été évaluées de façon rétrospective sur la base de leurs dossiers médicaux. Le but de cette étude était l'évaluation des causes de l'halitose et la répartition selon le sex-ratio des patients, ainsi que de démontrer la réussite du traitement.

Tous les patients avaient déclaré souffrir de leur mauvaise haleine. 82,7% d'entre eux présentaient une vraie halitose, dont 96,2% avaient une étiologie buccale. Les causes exo-buccales restaient rares avec 3,8%. L'halitose d'origine psychique est nettement plus répandue parmi les femmes.

Avec un taux de succès de 92,6% (subjectivement), respectivement de 94,5% (objectivement), le concept de diagnostic et thérapie de la consultation de l'halitose de l'Université de Bâle s'est avéré être un succès.

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