IN BRIEF

- Halitosis is a very common complaint in patients with chronic caseous tonsillitis.
- The VSC halitometry profile has not yet been described in these patients.
- When a tonsillolith is present, there is a tenfold increased risk for abnormal halitometry.
- Even if VSC halitometry is not available, in the presence of a tonsillolith the probability of true halitosis is very high.

Relationship between the presence of tonsilloliths and halitosis in patients with chronic caseous tonsillitis

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Objective To study the volatile sulphur compounds (VSC) halitometry profile in a population with chronic caseous tonsillitis (CCT) and halitosis and to evaluate the relationship between the presence of a tonsillolith and abnormal halitometry in this population.

Design Clinical prospective non-randomised study.

Subjects and methods Forty-nine patients with halitosis and CCT, 17 male (35%) and 32 female (65%), were selected among patients referred for CO_2 laser cryptolysis. Anamnesis, physical examination and VSC halitometry were carried out. Halitometry values less than 150 ppb of VSC were considered normal.

Results Patients were divided in two groups: Group A – normal halitometry (41 patients – 83.7%) and Group B – abnormal halitometry (8 patients – 16.3%). Halitometry results in Group B were 5.2 times (429%) higher than in Group A and the majority of the patients with abnormal halitometry presented with a tonsillolith at the moment of examination. A tonsillolith was present in 75% of the patients with abnormal halitometry and only 6% of patients with normal halitometry values.

Conclusions The presence of a tonsillolith represents a tenfold increased risk of abnormal VSC halitometry and can be considered as a predictable factor for abnormal halitometry in patients with CCT.

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INTRODUCTION

Halitosis is a Latin word deriving from *halitus* (breathed air) and *osis* (pathologic alteration), therefore, halitosis is an unpleasant alteration of the halitus.[1] It is a very unpleasant symptom, frequently causing social restriction and decreasing quality of life.

There are many causes of halitosis but most of them are related to the oral cavity (90%), while others are related to otolaryngology and respiratory diseases (8%). Gastrointestinal diseases, liver/renal impairment and other metabolic syndromes are minor causes (2%).[2] The presence of halitosis may indicate the existence of some medical diseases which require diagnosis and treatment.[2-6]

Chronic caseous tonsillitis (CCT) is frequently correlated to halitosis and is also a common disease. Palatine tonsils contain crypts (Fig. 1) that may retain exfoliated epithelium cells, keratin debris and foreign particles, forming a tonsillolith.[7] Therefore, palatine tonsils are the most suitable sites for the activity of anaerobic bacteria in the upper airway system.[8]

CCT symptoms are generally retention of a tonsillolith, throat irritation, sensation of foreign bodies and halitosis, which can all be very disabling for the patient. Halitosis is present in about 77% of patients with CCT.[9] CCT can occur in either men or women at any age and in all kinds of tonsils.[9] When clinical treatment with topical antiseptics and oral antibiotics does not bring relief, surgical excision of the tonsils is indicated.[10,11] Recently, a less invasive therapy, tonsillary cryptolysis using a CO_2 laser, has been proposed. The utilisation of CO_2 laser ablation can reduce crypt depth and decrease the retention of a tonsillolith, preserving the immunological function of the tonsils. This treatment is virtually painless, well tolerated and can be performed in an office setting under topical anaesthesia, permitting the patient to immediately return to their activities.[8,9,12]

The Interscan Halimeter® is one of the most common devices used to perform volatile sulphur compound (VSC) halitometry. It contains an electrochemical voltammetric sensor, which

Table 1 Distribution of sex and age in Groups A and B

Individuals	Male	Female	Test	Significance	Mean age	Standard deviation (SD)	Test	Significance
Group A (n = 41; 83.67%)	15	26	Fischer	NS	27.02	9.82	Mann-Whitney	NS
Group B (n = 8; 16.32%)	2	6	Fischer	NS	22.88	5.82	Mann-Whitney	NS
Total (n = 49; 100%)	17	32	-	-	-	-	-	-

generates a signal when exposed to sulphur compounds, and a digital display which records the quantity of VSC present in expired air in parts per billion (ppb). Hydrogen sulfide, methylmercaptans and dimethylsulfide are substances that have an offensive odour and are mainly responsible for breath malodour.[5,13-15] The halimeter allows an objective measurement of halitosis. Other subjective methods such as organoleptic tests depend on olfaction examination accuracy, which may change due to influenza, environment humidity, etc. An objective measurement of VSC is important for the diagnosis, treatment and follow-up of halitosis.[16]

The main causes of halitosis among CCT patients are related to decomposition of organic material such as food debris and putrefaction of amino acids by anaerobic proteolytic bacteria that increase the production of VSC in the tonsillary crypts. Clinically, these patients often describe worse halitosis symptoms when they expel a tonsillolith, but this has not yet been objectively documented.[16] Also, the VSC halitometry profile among CCT patients has not yet been described and this is important, since halitosis is very common in these patients. The correlation between VSC halitometry, which is an objective measurement, and the presence of a tonsillolith has not been described. This correlation could be useful in predicting the source of halitosis and may help health professionals in relation to diagnosis and successful treatment.

OBJECTIVE

The aim of this study is to analyse the volatile sulphur compound (VSC) halitometry profile in a population with chronic caseous tonsillitis (CCT) and halitosis and to evaluate the relationship between the presence of a tonsillolith and abnormal halitometry in this population.

SUBJECTS AND METHODS

Population

Forty-nine patients of both sexes, ranging in age from 14 to 57 years (mean 26.35, SD 9.37) with CCT and halitosis were selected for this study.

The anamnesis and physical examination of all patients were carried out by an otolaryngologist and by a dentist at the State University of Campinas, Brazil. Patients answered questions related to food habits, oral hygiene, medical history and use of medications. The exclusion criteria were smokers (someone who smokes any tobacco product, either daily or occasionally), heavy alcoholic drinkers (more than 30 g alcohol/day), drug users, pregnant women, presence of tooth and gum diseases (carious lesions, exposed tooth pulps, extraction wounds, interdental food impactions due to maladapted prostheses) and those taking any kind of regular medication. Patients with periodontal diseases (presenting bleeding on probing index or probing depth more than 3 mm) were excluded from study in order to avoid other oral causes of halitosis. Likewise, patients presenting with a thick tongue coat were also excluded from the study.

Gastrointestinal, pulmonary and other systemic metabolic disorders were also excluded. Except for the CCT, all patients had a normal medical background. These criteria were established to exclude other causes of halitosis.

Table 2 Distribution of halitometry values in each group

Total	Mean halitometry*	Maximum value*	Minimum value*	Difference
Group A n = 41	53.9	108	20	
Group B n = 8	285.25	545	151	429.2% higher than Group A

* values in ppb of VSC

Table 3 Frequency of tonsillolith in each group

Presence of tonsillolith	Group A (%)	Group B (%)	Group A (ppb)	Group B (ppb)
Yes	6.06	75	59.3 (n = 9)	362.5 (n = 6)
No	93.94	25	48.6 (n = 32)	259.5 (n = 2)
Difference (ppb)			10.7	103*
Total	100	100	41	8

Kappa = 0.3889
*= Student t-test, statistically significant

VSC halitometry

At the time of the dental assessment, all patients were advised not to use oral mouthwash or toothpaste, chewing gum, spicy or seasoned food for at least three hours before halitometry and not to fast for a period of more than four hours. The patients were also asked not to use perfume or any cosmetic fragrance on the day of the halitometry test. All these instructions were given following the Interscan Halimeter® instruction manual.

All patients agreed to participate in the study in accord with the University Ethical Research Committee and signed an informed consent form.

Halitometry technique

The technique used also followed the Interscan Halimeter® instruction manual. Halitometry was carried out by the same person on Monday afternoons at the Multidisciplinary Group of Laser Medicine.

The halimeter device was adjusted to zero before every measurement. The technique consisted of having the patient keep his/her mouth closed for three minutes prior to testing, adjusting the device to zero, inserting a sterile straw probe two inches into a slightly opened mouth (the straw must not touch the lips, teeth or internal surface of the mouth nor could the patient blow through or inhale from the straw) and the patient holding his/her breath for the few seconds of testing. The straw was removed as soon as peak was reached. The reading was allowed to return to +/-10 ppb before the next measurement was taken. This procedure was repeated three times and the results were recorded (Fig. 2).

An electronic data sheet was created using Microsoft Windows Excel® software containing name, registration number, age, gender, the three halitometry values (in ppb of VSC), the mean of the three measurements (in ppb of VSC) and the presence or absence of tonsillolith at the time of VSC analysis.

Statistical analysis

The value of the average of the three measurements was used for the halitometry statistical analysis. According to the Interscan Halimeter® instruction manual, results less than 150 ppb of VSC were considered normal.[16,17]

The statistical analysis characterised two groups of patients according to halitometry profile: Group A – normal halitometry (<150 ppb VSC); Group B – abnormal halitometry (>150 ppb VSC).

The correlation between the presence of a tonsillolith and abnormal halitometry and whether the presence of a tonsillolith was a predicting factor for the abnormal halitometry were studied.

The following were used for the analysis:

- Fisher exact test and Mann-Whitney test to compare sex and age in each group
- Kappa coefficient test to correlate the presence of a tonsillolith and halitometry
- Determination of accuracy of the correlation between the presence of a tonsillolith and abnormal halitometry: specificity, sensibility, positive predictive value and negative predictive value
- Dycotomic logistic regression to verify if a tonsillolith was a risk factor for abnormal halitometry.

Considered level of significance was 5% ($p < 0.05$).

RESULTS

Forty-nine patients were studied, ranging in age from 14 to 57 years. The halitometry cut-off value divided patients in two groups: Group A: normal halitometry (below 150 ppb) and Group B: abnormal halitometry (above 150 ppb). Table 1 summarises the distribution of sex and age of both groups. Table 2 and Figure 3 summarise the halitometry values in both groups. Table 3 summarises the frequency of presence of tonsilloliths in both groups.

The Kappa coefficient test demonstrated that at the time of VSC analysis a tonsillolith was present in 75% of the patients with abnormal halitometry and in only 6% of the patients with normal halitometry. Student's t-test demonstrated that halitometry values were statistically higher in patients with a tonsillolith at the time of VSC analysis.

In this clinical study, VSC halitometry was considered the gold standard for the diagnosis of halitosis. The hypothesis that the presence of a tonsillolith is related to abnormal

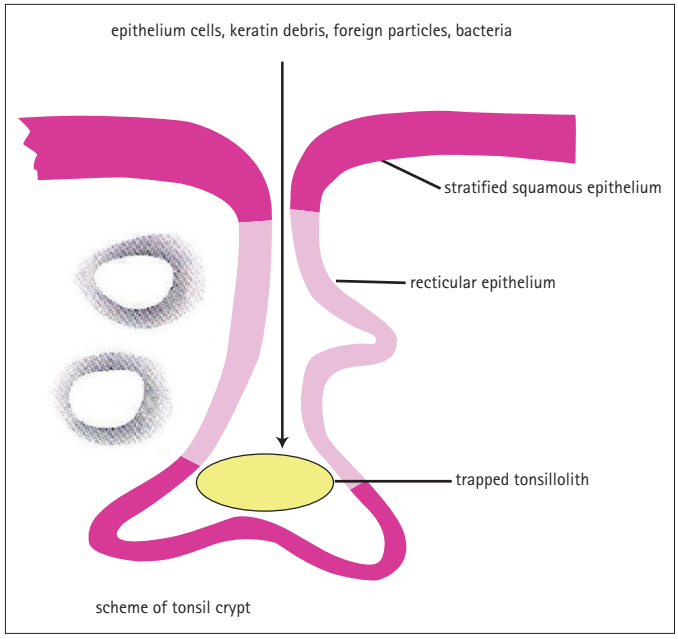

Fig. 1 Schematic of a tonsil crypt

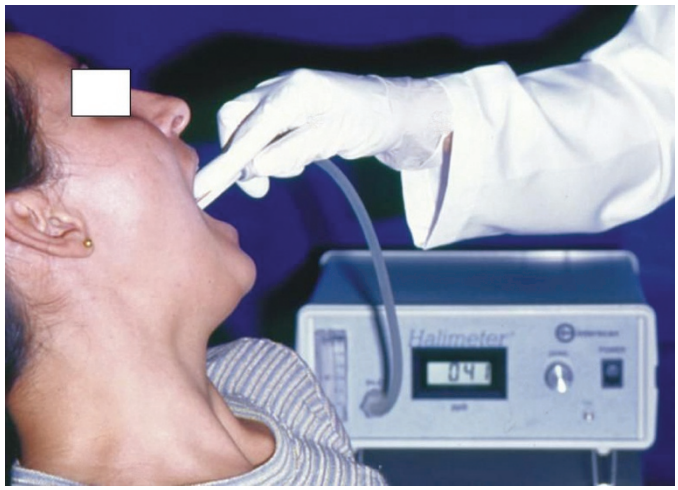

Fig. 2 Performing the halitometry test

Table 4 Results of Fleiss quadratic test

	p	95% confidence interval	
		Inferior value	Superior value
Sensitivity	75.00	35.58	95.55
Specificity	77.50	61.14	88.60
Positive predicitve value	40.00	17.46	67.11
Negative predictive value	93.94	78.38	98.94
Accuracy	77.08	62.33	87.49

Table 5 Results of dycotomic logistic regression

Parameters	Estimative	Chi-square	p-value	Odds ratio
Intercept	-2.74	14.11	0.0002	
Presence of tonsillolith	2.33	6.73	0.0095	10.33

confidence interval 95%

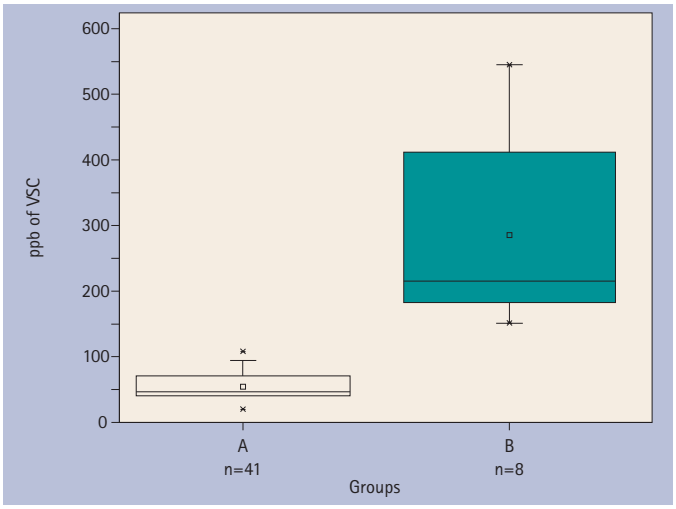

Fig. 3 Distribution if halitometry in each group

halitometry was tested using the Fleiss quadratic test (Table 4).

The study of dycotomic logistic regression (Table 5) showed the presence of a tonsillolith was a risk factor for abnormal halitometry. The presence of a tonsillolith at the moment of the physical examination represented a relative increased risk for abnormal halitometry of 10.3 times.

DISCUSSION

In this study, 49 patients of both genders with CCT and halitosis were selected. These patients were assessed by specialists and selected for tonsillary cryptolysis with CO_2 laser. Since halitosis may have a multifactorial origin, all oral and systemic diseases were excluded. Except for CCT, all patients had a normal medical and dental background. These strict criteria were established to exclude other possible causes of halitosis.

Halitosis is one of the most common symptoms in patients with CCT. In this selected study population, the abnormal VSC halitometry did not show any correlation with sex or age. These data agree with literature and clinical observation.[9,18,19]

All patients had bad breath complaints. Nevertheless only eight individuals (16.3%) presented abnormal halitometry. VSC halitometry is a method that detects some important odorivectors (sulphur-related) involved in halitosis, but there are other vectors also offensive to the human olfaction (cadaverine, putrescine, scatol) that are not detectable by the Interscan Halimeter®.[16,20] Halitosis can occur at certain periods of the day and may occur cyclically. Since VSC analysis was performed at same time on pre-determined days of the week, it is possible that some patients were not exhaling VSC at the time of analysis. These facts could explain why only eight patients presented abnormal VSC halitometry.

Halitometry results in Group B (abnormal halitometry = 285.2 ppb) was much higher than in Group A (normal halitometry = 53.9 ppb) and the presence of a tonsillolith in Group B was much more frequent than in Group A (75% *versus* 6%). The patients with abnormal halitometry who did not present with a tonsillolith at the time of VSC analysis (n = 2) were reassessed and the presence of abundant exsudative non-purulent secretion was detected by pressing the tonsils. This could explain the alteration of the VSC measurement in the absence of visible tonsillolith.

In Group A, 94% of the patients did not have a tonsillolith at the time of VSC analysis. In Group B the patients who had a tonsillolith presented higher values of VSC than those who did not. This shows that in the presence of a tonsillolith, VSC analysis is very likely to be abnormal. On the other hand, when a tonsillolith is absent, VSC halitometry tends to be normal. Our analysis demonstrated that 94% of the patients who did not have a tonsillolith showed normal halitometry values.

In this population of patients with CCT and halitosis, the presence of a tonsillolith (easily detected in a physical examination) has a good correlation with abnormal VSC halitometry (sensivity of 75%, specificity of 77%). The dycotomic logistic regression analysis demonstrated that the presence of a tonsillolith at the time of VSC analysis represents a tenfold increased risk of an abnormal halitometry. Therefore, halitosis in patients with CCT and a tonsillolith must not be underestimated, even if VSC halitometry is not available.[21]

CONCLUSION

Halitosis is a very common complaint amongst patients with chronic caseous tonsillitis (CCT). Sixteen percent of the patients with CCT and halitosis had abnormal VSC-halitometry values (Group B) and these values were five times higher than those in Group A. The majority (75%) of the patients with abnormal halitometry had a tonsillolith at the time of examination. The presence of a tonsillolith therefore represents a tenfold risk factor for halitosis and is correlated to abnormal VSC halitometry in patients with CCT.

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