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ESTUDO DA HALITOSE EM PACIENTES COM TONSILITE CRÔNICA CASEOSA, TRATADOS POR CRIPTÓLISE COM LASER DE CO_2

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Tese de Doutorado apresentada à Pós-Graduação da Faculdade de Ciências Médicas da Universidade Estadual de Campinas para a obtenção do título de Doutor em Ciências Médicas, área de concentração Ciências Biomédicas

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Se não houvesse imperfeição,
havia uma cousa a menos,
E deve haver muita cousa
Para termos muito
que ver e ouvir...

Fernando Pessoa

RESUMO

Halitose é um sintoma constrangedor com grande impacto social. Afeta milhões de pessoas, no mundo todo, que gastam muitos recursos em produtos na tentativa de obter a melhora do hálito. Uma abordagem científica da halitose justifica-se, uma vez que esta diminui a qualidade de vida e pode ser indicativa de doenças que necessitam de diagnóstico e tratamento específico. Inicialmente, foi elaborado um protocolo de avaliação da halitose baseado na literatura e na experiência pessoal, com o objetivo de minimizar custos, evitar exames desnecessários e orientar o diagnóstico. A segunda etapa do trabalho consistiu na mensuração objetiva do hálito (através da técnica de Halitometria dos Compostos Sulfurados Voláteis) em uma população com Tonsilite Crônica Caseosa (TCC), pois esta apresenta íntima relação com a queixa de halitose. O perfil halitométrico dos portadores de TCC ainda não havia sido descrito. Observou-se que a presença do cáseo é um fator preditivo de halitometria anormal nessa população. Na terceira etapa, foi estudado o impacto da criptólise por coagulação com *laser* de CO_2 em indivíduos portadores de TCC e queixa de halitose. A técnica demonstrou ser segura e bem tolerada, e os valores das halitometrias foram normalizados após o tratamento, em virtude da diminuição da formação de cáseos.

ABSTRACT

Halitosis is a very constraint symptom with a significant social impact. It is estimated that halitosis affects millions of people and these people regularly spend resources in products in order to improve their halitus. The study of halitosis in a scientific approach is justified once halitosis causes social restriction, decreases life quality and can be an indication of serious diseases that need diagnosis and specific treatment. Initially, a halitosis proposal for assessment protocol was elaborated based on the literature and on personal experience, with the objective of minimize costs, avoid unnecessary procedures and orientate diagnosis. The second part was the mensuration of halitosis (through the Volatile Sulphur Compounds Halitometry) in a population with Chronic Caseous Tonsillitis (CCT), since this disease is strongly related to the halitosis complaint. The halitometry profile in patients with CCT had not yet been described. In this study it was observed that caseum presence is a predictive factor for abnormal halitometry. On the third part, the impact of CO_2 laser cryptolysis by coagulation in patients with CCT and halitosis complaint was studied. The technique using CO_2 laser ablation demonstrated to be safe, well tolerated, and halitometry values became normal after treatment, due to the decrease in caseum formation.

1- INTRODUÇÃO GERAL

Odor e Olfação

O odor é produzido por pequenas partículas dispersas no ar, capazes de imprimir sensações olfativas nas células receptoras do epitélio da cavidade nasal. Essas partículas recebem o nome de odorivetores (Tárzia, 1996).

O olfato é um dos sentidos mais primitivos e, entre os vertebrados em geral, é, de muitas maneiras, o mais importante de todos (Tárzia, 1996). O olfato, para a maioria dos mamíferos, é a principal fonte de informação através da qual o animal se relaciona com o mundo exterior. Segundo Walter e Sayles (1949), quanto à capacidade de percepção e discriminação do odor, os animais podem ser classificados em macrosmóticos ou macrolfativos - aqueles que têm um senso de olfato muito desenvolvido, por exemplo, os roedores - anosmóticos - aqueles sem qualquer senso de olfato, por exemplo, as baleias - e os microsmóticos ou microlfativos - aqueles com pequena capacidade de percepção e de discriminação de odores. O homem é classificado como microsmótico ou microlfativo, pois apresenta pequena capacidade de percepção e de discriminação de odores. Segundo Tárzia (1996), o tempo mínimo de atuação para que uma substância seja percebida pelo ser humano é de aproximadamente 18 segundos. Após cerca de um minuto em um ambiente com odor perceptível, o olfato adapta-se por tolerância, passando a não mais registrar a presença do odor predominante, não perdendo, porém, a capacidade de registrar a presença de novos odores que possam surgir nesse mesmo ambiente. É por essa capacidade adaptativa que o indivíduo portador de mau hálito passa a não percebê-lo com o passar do tempo. É freqüente o indivíduo não perceber seu próprio hálito, ou até mesmo seu cheiro corporal. Mac Cord e Witheridge (1949) denominam esse fenômeno de fadiga olfatória.

Tárzia (1996) afirma que partículas de dispersão muito rápidas costumam não atingir o limiar de excitação do olfato. A temperatura e a umidade do ambiente afetam a dispersão de partículas, alterando suas propriedades de imprimir sensações olfativas, e o limiar de percepção do odor também pode variar de dia para dia. Outros fatores influenciam a percepção do sistema olfativo humano, tais como rinosinusopatias infecciosas ou alérgicas. As células olfativas não são capazes de perceber mais que um odor de cada vez. O odor percebido é o predominante no ambiente naquele momento.

Segundo Tárzia (1996), esse é o princípio do mascaramento dos odores, utilizado, por exemplo, nos desinfetantes e desodorantes, significando que, num determinado ambiente, a presença de um excitante olfativo mais poderoso, de odor agradável, pode mascarar a presença de outros odorivetores desagradáveis.

Halitose

O termo halitose vem do latim *halitus* (ar expirado) acrescido do sufixo *osis* (alteração patológica) (Hine, 1957). Um dos primeiros registros do mau hálito está em uma passagem do Antigo Testamento da Bíblia, onde Jó (19:17) lamenta-se: "*O meu hálito é intolerável à minha mulher...*". O filósofo grego Plutarco, em sua obra *Escrevendo Sobre Moralidade,* menciona que Heron de Siracusa, ao ser informado pelo médico sobre seu hálito, dirigiu-se a sua mulher dizendo: "*Por que não me advertiste que o meu hálito te fere a cada vez que te beijo?"*. E sua resposta foi "*Sempre pensei que o hálito de todos os homens tivesse esse terrível odor*" (Grein et al., 1982). Ensinamentos litúrgicos judeus datando de quase dois milênios afirmam que um homem que se casa com uma mulher e, subseqüentemente, descobre que ela tem halitose pode, sumariamente, divorciar-se, sem cumprir as condições do contrato de matrimônio (*ketuba*). A teologia islâmica acentua a importância do *siwak* (palito especial para limpar a boca), incluindo o seu uso durante o jejum do *Ramadan* para prevenir a halitose (Rosemberg, 2003).

Halitose é uma condição do hálito na qual este se altera, de forma desagradável tanto para o paciente como para as pessoas com as quais ele se relaciona, podendo ou não significar uma condição patológica (Tárzia, 1996). É também conhecida como hálito fétido, fedor da boca, mau hálito (Grein et al., 1982; Bogdasarian, 1986). Hipócrates reconhecia no hálito importante dado propedêutico (Passarelli e Gurfinkel, 1981).

Um dos pioneiros na pesquisa da halitose foi Howe, que descreveu esse sintoma em 1874, e, desde então, passou a ser considerada uma entidade clínica (Krasse, 1954). Antes da década de 1930, a maioria das citações pertinentes à halitose consistia em pareceres sem estudos ou fatos comprovados, os quais eram perpetuados pela literatura.

Atribuem-se a Joe Tonzetich os créditos pelos primeiros estudos científicos, na década de 60, buscando as causas da halitose. Foi esse autor que também descreveu vários fatores clínicos relacionados com o mau hálito e que, no final da década de 70, iniciou pesquisas sobre os compostos sulfurados voláteis (CSV) (Tonzetich, 1976, 1977). Esses compostos são substâncias à base de enxofre extremamente perceptíveis e desagradáveis ao olfato humano. O sulfidreto (SH2), as mercaptanas (CH3SH) e o dimetilsulfeto (CH3SCH3) são os principais CSV causadores do mau hálito, sendo o sulfidreto o mais volátil deles.

A halitose é uma queixa comum em adultos de ambos os sexos, de ocorrência mundial e apresenta uma etiologia multifatorial, mas seu principal fator causador é a decomposição da matéria orgânica, provocada por bactérias anaeróbias proteolíticas. (Uliana et al., 2002). As partículas componentes das substâncias causadoras da halitose surgem durante o processo da decomposição da matéria orgânica (restos teciduais e alimentares) denominado proteólise. A proteólise é uma reação química de redução que libera enxofre, principalmente sob a forma de sulfidretos (SH2). Existem ainda os compostos orgânicos voláteis (COV), também capazes de produzir halitose, tais como indol, escatol, putrescina, cadaverina, aminas, amônias e o hidrocarboneto metano, porém os CSV são os mais ofensivos ao olfato humano (Uliana et al., 2002).

Halitose Fisiológica

O hálito é geralmente mais forte e desagradável ao despertar. Isso ocorre, provavelmente, devido à quase total cessação do fluxo salivar durante o sono e ao acúmulo de substratos orgânicos, tais como células epiteliais descamadas e restos de alimentos na cavidade oral. Cerca de 50% dos indivíduos de meia idade emitem, socialmente, hálito desagradável, atribuído a causas fisiológicas relacionadas ao despertar matutino (Tonzetich, 1997). O epitélio bucal descamado e os restos alimentares são, geralmente, removidos pela ação da língua e ação detergente da saliva durante a mastigação normal. O ato de beber, comer ou escovar os dentes pela manhã remove a halitose causada por esses fatores concorrentes na cavidade bucal (Tonzetich e NG, 1976; Lu, 1982; Costa, 1987).

Uma outra razão teórica para o hálito desagradável, ao acordar, é a leve hipoglicemia devido ao longo período de jejum. Como o hálito desagradável, nesse caso, é uma condição generalizada, ou seja, ocorre para todas as pessoas, em maior ou menor grau, esse tipo de halitose é considerada fisiológica. No entanto, após o desjejum e a higienização da cavidade oral, esse hálito desagradável deve desaparecer. Caso algum mau odor permaneça, deve-se considerar essa halitose merecedora de cuidados especiais quanto ao seu diagnóstico causal, orientação, tratamento e controle (Bogdasarian, 1986; Costa, 1987; Passarelli e Gurfinkel, 1981).

Causas da Halitose

A cavidade oral é responsável por cerca de 90% das causas de halitose, 8% estão relacionadas com as vias respiratórias, e apenas 2% estão relacionadas com o trato gastrointestinal, com disfunções metabólicas e outras (Delanghe et al., 1999; Nachnani, 1999; Netto e Müller, 2002; Uliana et al., 2002; Tárzia, 2003; Van Steenberghe, 2004). Portanto é importante que um protocolo racional de investigação da halitose seja utilizado para evitar erros de diagnóstico e exames desnecessários. Nesse sentido, um protocolo baseado em evidências clínicas foi objeto de estudo e será abordado no primeiro capítulo.

Causas Relacionadas à Cavidade Oral

As causas da halitose relacionadas à cavidade oral devem-se, principalmente, à doença periodontal e à presença de saburra lingual (Uliana et al., 2002).

A doença periodontal é uma infecção multifatorial complexa na qual a microbiota assim como as reações inflamatórias do hospedeiro contribuem para a destruição dos tecidos de suporte dos dentes (Lindhe, 1992; Page e Kornman, 1997). A doença periodontal, freqüentemente, promove mau odor oral, e a intensidade do odor aumenta com a severidade da doença. Maiores concentrações de CSV foram detectadas em pacientes que apresentavam bolsas periodontais com profundidade de sondagem maior que 4 mm (Yaegaki e Sanada, 1992).

A saburra lingual é uma camada esbranquiçada que se forma no dorso da língua. A maior concentração de mucina na saliva faz com que haja aderência da mesma sobre o dorso lingual, principalmente na região do terço posterior. Além da aderência da saliva, há a aderência também de células epiteliais descamadas provenientes da mucosa oral e de microrganismos anaeróbios proteolíticos que aí encontram dois tipos de substratos: as proteínas da própria saliva e as proteínas das células epiteliais descamadas. Esse conjunto de microrganismos, saliva e células epiteliais descamadas forma a saburra nessa região da língua, podendo variar de extensão, espessura e viscosidade (Massler, 1951; Tonzetich, 1977; Bogdasarian, 1986, Tárzia, 2003). A saburra também pode estar associada à xerostomia (diminuição do fluxo salivar) (Tárzia, 2003).

Outros fatores da cavidade oral que podem causar a halitose são: cáries dentais; processos endodônticos; próteses porosas ou mal adaptadas, as quais podem reter restos alimentares, dificultando a higienização e propiciando a putrefação desses restos pelas bactérias; processo de cicatrização de ferida cirúrgica que, mesmo sendo um processo temporário, provoca a halitose devido à putrefação da matéria orgânica (decomposição do coágulo e de focos de material necrosado); alterações morfológicas da língua (língua fissurada, geográfica etc.), por facilitarem a retenção de restos de alimentos e predisporem a formação da saburra lingual; estomatites por apresentarem ulcerações com tecidos necróticos; cistos dentígeros com fístula drenando para a cavidade bucal, por poderem causar halitose devido à putrefação da matéria orgânica; neoplasias, por também poderem causar halitose pela presença de ulcerações e tecidos necróticos. Além disso, neoplasias também podem provocar halitose quando o paciente se encontra sob tratamento de radioterapia e/ou quimioterapia, que têm como efeito colateral a xerostomia.

Considerando-se que a boca é uma porta de entrada de microrganismos patogênicos, é de fundamental importância a identificação da presença dos fatores que podem gerar condições de instalação da halitose.

Causas Relacionadas às Doenças Otorrinolaringológicas

A halitose também pode ter origem nas estruturas constituintes das cavidades nasosinusais, nasofaringe e orofaringe. Ela é uma queixa bastante freqüente em clínica otorrinolarigológica.

Os pacientes com problemas otorrinolaringológicos, geralmente, têm dificuldade de respirar pelo nariz e, muitas vezes, tornam-se respiradores bucais, o que provoca aumento da descamação da mucosa oral, aumenta a viscosidade da saliva, formando-se, então, a saburra lingual, responsável por odorivetores presentes no ar expirado (Tárzia, 2002).

As causas mais comuns de halitose relacionadas à otorrinolaringologia são: faringotonsilites virais ou bacterianas, abscessos retrofaríngeos, presença de criptas tonsilares profundas, de corpo estranho na cavidade nasal ou sinusal, rinosinusopatias agudas e crônicas. Essas alterações causam halitose, principalmente pela ação bacteriana que leva à putrefação dos tecidos e à produção dos compostos sulfurados voláteis (Tárzia, 2003; Van Steenberghe, 2004).

Na prática clínica, uma doença bastante relacionada com a queixa de halitose é a Tonsilite Crônica Caseosa (TCC), devido à existência de criptas tonsilares profundas que propiciam a formação e retenção de cáseo em seu interior. A relação entre halitose, TCC e presença de cáseo será abordada com mais detalhes a seguir.

Causas Relacionadas às Doenças Gastrointestinais

As doenças gastrointestinais mais relacionadas à halitose são: doença do refluxo gastroesofágico, hérnia hiatal, divertículos esofagianos e síndromes de má absorção. A presença de coágulos ou pontos de sangramento em qualquer parte do sistema digestivo, seja por tumores, doenças inflamatórias ou parasitas, pode causar halitose devido à degradação do coágulo sanguíneo.

A cirrose hepática leva ao acúmulo de amônia, e esta, quando atinge os pulmões, é expirada, provocando um hálito característico conhecido como *foetor hepaticus*.

Outras causas

Distúrbios endócrino-metabólicos tais como diabetes, trimetilaminúria (deficiência congênita da enzima trimetilaminase hepática) e disfunções renais também podem causar halitose. Esses distúrbios acabam por acumular produtos característicos do metabolismo, que serão exalados no ar expirado, provocando alterações típicas no hálito.

Mensuração do Hálito

Os testes utilizados para mensuração do hálito dividem-se em subjetivos (qualitativos) e objetivos (quantitativos). No teste subjetivo, um examinador testa o hálito expirado colocando-se a uma distância de aproximadamente 20 cm do paciente (Nachnani, 1999). O teste subjetivo de detecção da halitose, também chamado de teste organoléptico, é de utilidade limitada, pois depende da capacidade olfatória do examinador. Condições climáticas ou afecções que diminuam a sensibilidade do examinador podem mascarar o diagnóstico de halitose.

Durante as décadas de 1960 e 1970, as pesquisas concentraram-se, principalmente, na aplicação de métodos químicos e instrumentais de análises direcionadas para a identificação de compostos causadores da halitose. Naquela época, um método sensível e específico de cromatografia gasosa foi adaptado para a medição direta dos compostos sulfurados voláteis (CSV), dando início à utilização de testes objetivos para a mensuração do hálito. Através da adição de inibidores de substrato e enzimas na saliva, detectou-se que os CSV são as principais substâncias responsáveis pelo mau odor da saliva putrefeita (Tonzetich e Richter, 1964; Tonzetich, 1977).

A habilidade de detectar quantidades de traços de outros componentes dos CSV pode ser útil para correlacionar a sua presença com doenças específicas e seu impacto sobre a qualidade e intensidade do mau odor (Tonzetich, 1997). Numa tentativa de se criar uma medida mais objetiva e fidedigna da halitose, foi desenvolvido um sistema de mensuração de alguns odorivetores mais freqüentemente encontrados no hálito humano.

Um instrumento de mensuração bastante utilizado, atualmente, em pesquisas clínicas é o aparelho denominado *Halimeter®,* que realiza uma leitura digital em partes por bilhão (ppb) dos compostos sulfurados voláteis (CSV) - a halitometria - .

O *Halimeter®* contém, em seu interior, um circuito elétrico e uma bomba para aspirar amostras de ar através de um sensor eletroquímico voltimétrico, que gera sinais elétricos quando exposto aos CSV. Quando os CSV atingem o sensor, eles se ionizam, e a oxidação dos compostos pode ser proporcionalmente lida como concentração em partes por bilhão (ppb) do gás ionizado.

O desenvolvimento de tecnologia capaz de mensurar os odorivetores do hálito representou um considerável avanço no diagnóstico da halitose e na avaliação da eficácia dos tratamentos efetuados.

Tonsilite Crônica Caseosa e Halitose

A Tonsilite Crônica Caseosa (TCC) é uma doença muito comum na clínica otorrinolaringológica e está freqüentemente relacionada com a queixa de halitose, em cerca de 77% das vezes (Passos et al., 2002). As tonsilas palatinas contêm criptas que podem reter restos celulares, microrganismos, partículas estranhas, restos alimentares, formando o cáseo. A tonsila palatina, portanto, é um dos locais mais susceptíveis à atividade das bactérias anaeróbias proteolíticas no trato aéreo superior. A TCC caracteriza-se pela formação e eliminação do cáseo e pode vir acompanhada de sintomas tais como hiperemia e hipertrofia das tonsilas palatinas, sem hipertermia.

A hipertrofia das tonsilas palatinas favorece o acúmulo de bactérias saprófitas nas profundezas das criptas, proporcionando a formação de cáseos (também chamados de tonsilolitos, cálculos amigdalianos) e, conseqüentemente, produzindo o mau hálito. Esses sintomas, geralmente, desaparecem após a eliminação do cáseo. Essa afecção manifesta-se, ainda, em qualquer tipo e tamanho de tonsila, uni ou bilateralmente. Pode ocorrer em qualquer idade, inclusive em indivíduos que nunca tiveram sintomas tonsilares, trazendo desconforto e insegurança para o paciente, pois tanto a eliminação do cáseo quanto o mau hálito podem ocorrer a qualquer instante, o que pode gerar prejuízos para o paciente no seu convívio social (Passos et al., 2002).

Criptólise por Coagulação com *Laser* de CO2

Os pacientes com TCC, geralmente, têm uma piora da queixa de halitose no momento em que o cáseo é expelido. Quando tratamentos com antiinflamatórios, antibióticos, gargarejos com soluções salinas ou anti-sépticas não são bem sucedidos, indica-se a tonsilectomia. A tonsilectomia é um procedimento cirúrgico que necessita de internação hospitalar e apresenta risco de morbidade e mortalidade para alguns pacientes (Passos et al., 2002).

Recentemente, foi proposta uma terapia para tratamento da TCC, mais conservadora, que preserva as características funcionais da tonsila. Essa terapia é a criptólise por coagulação com *laser* de CO2. (CCL CO2). É uma técnica efetiva para o tratamento da TCC, bem tolerada pelo paciente, que evita os riscos de uma cirurgia convencional e permite o retorno imediato do paciente às suas atividades, não havendo necessidade de internação (Passos et al., 2002).

Foi demonstrado que a CCL CO2 não altera as funções imunológicas da tonsila, promove uma abertura mecânica das criptas tonsilares, diminuindo, portanto, a retenção e formação de cáseo (Passos et al., 2002, 2004).

No entanto, apesar de os pacientes referirem melhora subjetiva da queixa de halitose, o impacto da CCL CO2 no perfil halitométrico desses pacientes ainda não havia sido estudado.

Portanto, devido à importância do tema, foi iniciada junto à Disciplina de Otorrinolaringologia da Faculdade de Ciências Médicas da Unicamp atividade ambulatorial de avaliação de pacientes portadores de halitose, para detecção das causas e encaminhamento para tratamento específico. Pelo fato de a halitose ser uma queixa freqüente em consultórios, muitos recursos são gastos na utilização de exames subsidiários invasivos e dispendiosos e na prescrição de produtos muitas vezes ineficazes. Sendo assim, a elaboração de um protocolo de avaliação de halitose, baseado em raciocínio clínico, justifica-se. Esse protocolo é apresentado no Capítulo 1 em forma de artigo intitulado: "*Halitosis - a proposal for assessment protocol*".

Um grupo de pacientes portadores de TCC foi estudado mais atentamente devido à alta taxa de queixa de halitose nessa população. Foi, então, realizado um estudo de delineamento e caracterização do perfil halitométrico desses indivíduos e a relação da halitose com a presença de fatores associados (cáseo). Esse estudo constitui o Capítulo 2, intitulado: "*Relationship between the Presence of Tonsilloliths and Halitosis in Patients with Chronic Caseous Tonsillitis*".

Os portadores de TCC que foram selecionados para criptólise tonsilar com *laser* de CO2 foram avaliados quanto ao impacto desse tratamento na melhora objetiva da halitose. Esses aspectos foram abordados no Capítulo 3, intitulado:"*CO2 Laser Cryptolysis by Coagulation for the Treatment of Halitosis*".

2- OBJETIVOS

Os objetivos deste trabalho foram:

1- Realizar revisão bibliográfica pertinente sobre o tema halitose.

2- Propor um protocolo racional para investigação da halitose

3- Avaliar o perfil da halitometria dos Compostos Sulfurados Voláteis e correlacioná-lo com a presença de cáseo em pacientes portadores de tonsilite crônica caseosa e queixa de halitose.

4- Avaliar o impacto da criptólise por coagulação com *laser* de CO_2 no perfil da halitometria de pacientes portadores de tonsilite crônica caseosa e queixa de halitose.

3- CAPÍTULOS

A deliberação CCPG - 001/98 da Universidade Estadual de Campinas (UNICAMP) regulamenta o formato alternativo para dissertações de Mestrado e teses de Doutorado e permite que artigos científicos de autoria do candidato constem como capítulos. Portanto esta tese contém três capítulos que consistem em artigos aceitos para publicação em periódicos científicos.

Capítulo 1- *"Halitosis - a proposal for assessment protocol"*

Artigo aceito para publicação na *Revista Brasileira de Otorrinolaringologia* (Comprovante de aceitação ANEXO 1).

Capítulo 2- *"Relationship between the presence of tonsilloliths and halitosis in patients with chronic caseous tonsillitis"*

Artigo aceito para publicação no periódico *British Dental Journal* (Comprovante de aceitação ANEXO 2).

Capítulo 3- *"CO_2 laser cryptolysis by coagulation for the treatment of halitosis"*

Artigo aceito e publicado no periódico *Photomedicine and Laser Surgery* (Cópia do artigo publicado ANEXO 3).

Halitosis - A Proposal for Assessment Protocol

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Abstract

Halitosis is a very constraint symptom. The real social impact of halitosis is still a research subject. The incidence of halitosis is much higher than one can imagine. It has been estimated that halitosis affects millions of people and these people spend lots of money in order to improve their halitus.

There are so many causes of halitosis but most of them are related to the oral cavity, other are related to otolaryngology and respiratory diseases. Gastrointestinal diseases, liver/renal impairment and others metabolic syndromes are minor causes.

The study of halitosis in a scientific approach is justified once halitosis causes social restriction, decreases life quality and can be an indication of serious diseases. Moreover there has been important costs involved in outpatient clinics appointments, specialists assessment, complementary exams and commercial interests. Such costs would be minimised adopting an evidence-based on anamnesis and on a rational organogram for clinical investigation.

Key Words- Halitosis, Bad Breath. Halitometry, Causes of Halitosis.

Resumo

Halitose é um sintoma muito constrangedor. O real impacto social da haltiose ainda é objeto de pesquisa. A incidência da haltiose é muito mais alta do que se possa imaginar. Estima-se que a halitose afete milhares de pessoas, e estas pessoas gastam grandes quantias em produtos para melhorar o hálito.

Existem muitas causas da halitose. A maioria delas está relacionada com a cavidade oral e algumas estão relacionadas com doenças otorrinolaringológicas e gástricas. Doenças Gastrointestinais, alterações das funções renais e hepáticas e outras síndromes metabólicas são causas menos freqüentes.

O estudo da halitose com uma abordagem científica se justifica, uma vez que a halitose é causa de restrição social, diminui a qualidade de vida e pode ser indicativa da presença de doenças mais graves que necessitam de diagnóstico e tratamento precoces. Além disso, há custos importantes que envolvem as consultas ambulatoriais, avaliação de especialistas, exames complementares e um grande interesse comercial. Esses custos podem ser minimizados, adotando uma anamnese baseada em evidências e um organograma para uma investigação clínica racional.

Palavras-chave- Halitose, Mau Hálito, Halitometria, Causas da Halitose.

Introduction

Halitosis is a latin word which means *halitus* (breathed air) and *osis* (pathologic alteration)[1]. One of the first register concerning to halitosis is in the Bible where Job (19:17) regretted: *"My bad breath is unbearable to my wife..."* The philosopher Plutarc, in his book *Writing About Morality*, has written that Heron of Siracusa when informed about his bad breath by his doctor turned to his wife and said: *"Why have not you told me before that my bad breath hurts you every time that I kiss you?"*. And her answer was *"I've always thought that all the man had this horrible odor"*[2] .Almost two thousands years ago the jewish could cancel the wedding contract (*ketuba*) if they realised that the woman had bad breath. The islamic theology enphasises the importance of the *siwak* (a special device for cleaning the mouth), recommending its use during the *Ramadan* starving period in order to prevent halitosis[3].

Halitosis is an unpleasant alteration of the halitus for the person who has the symptom and for related people either, being a pathological condition or not [4]. It is also known as foetid halitus, stinking mouth, bad breath or oral malodor[2,5]. Halitosis is a common complaint among adults of both gender, in all over the world. It has a multifatorial etiology, but its main cause is the decomposition of the organic material by microrganisms of the oral cavity[6]. One of the pioneers in halitosis research was Howe who described this symptom in 1874 and since then, halitosis has been considered a clinical entity[4]. The majority of the citations concerning to halitosis before 1930 were not confirmed by facts or studies, however were perpetuated by literature[7]. In 1934, Fair and Wells created an instrument called osmoscope, which was used for measurements of odor density in a subjective and semiquantitative way[7]. During the 40th and 50th, Fosdick and his associates from Northeastern University, used the osmoscope to conduct numerous studies and produced valuable information about halitosis causes and conditions that could be related[7]. These authors concluded that, although halitosis can have physiologic and/or pathologic systemic causes, the main cause of halitosis is physiologic and has to do with the oral cavity[7,8]. Joe Tonzetich did the first studies in the 60th searching for halitosis causes[9]. This author also described some clinical features related to bad breath and in the end of the 70th, initiated studies about the Volatile Sulphur Compounds (VSCs)[8].

During the 60th and 70th the researches concentrated, mainly, to chemical and instrumental analysis in an attempt to identify the basic halitosis compounds. By this time, a highly sensitive and specific chromatographic gas method was adapted for direct measurements of the volatile sulphur compounds in the saliva and breath[7]. Initial studies with the saliva were developed. Adding substrate inhibitors and enzimes it has been determined that the VSCs were the main substances responsible for the malodor of putrefied saliva[9]. From 1970 the gas chromatography was the most sensitive instrument used in clinical researches. It was the gas chromatography that made possible to identify and measure directly the individual VSCs components (H_2S - hydrogen sulfide, CH_3SH - methylmercaptan and CH_3SCH_3 - dimethylsulfide) in the halitus[7].

The organoleptic assessment is a subjective measurement. It is a very good qualitative method, however not very precise concerning to quantity. It depends on the examinator olfaction accuracy what may change in case of an influenza, environment humidity etc[10]. The patient is asked to come to the office during the period he/she feels the halitus worst. It is also asked not to use mouth rinses, tooth brush at least two hours before the test. The test consists on ask for the patient to breath deeply inspiring the air by nostrils and expiring by mouth, while the examinator sniffs the odor in a distance of 20 cm, considering it unpleasant or not in a scale of 0 to 5[10]. A self-examination can be relevant as it involves the patient in the process. Licking his/her own wrist, smelling it after a while, reflects the saliva contribution to oral malodor. Because organoleptic assessment is a subjective measurement, the examinator must use an objective test such as Halimeter® (Photo 1) or BANA® test to confirm results[10]. The technology development represented a considerable advance concerning to halitosis diagnosis and assessment of the treatment used.

Devices for objective assessment of oral malodor has been developed. They can be very useful to detect the VSC quantitatively and correlate them with specific diseases, their impact over the quality and intensity of oral malodor[4]. The Halimeter® is the most common device used nowadays. It has digital display which records the quantity of VSC in parts per billion (ppb). Normal halitometry (Photo 2) is considered below 150ppb.

The Halimeter® does not record all the odorivectors presented in the breathed air, so it does not dispense a good anamnesis and clinical examination. The use of mouth rinses or tooth paste can produce a bias in the measurement by the Halimeter®[11].

The BANA® test (enzymatic method benzoyl-arginine-naphtylamida) is a very practical tool to assess bacterial proliferation in the gingival sulcus and its positivity is strongly related to periodontal diseases[12]. This test, when compared to the VSC Halimeter® test, can diagnose halitosis when the Halimeter test was negative. This data suggests that BANA® could be complementary to Halimeter®[13]. Tests to assess halitosis are summarised in Table 1.

Photo 1- Interscan Halimeter®

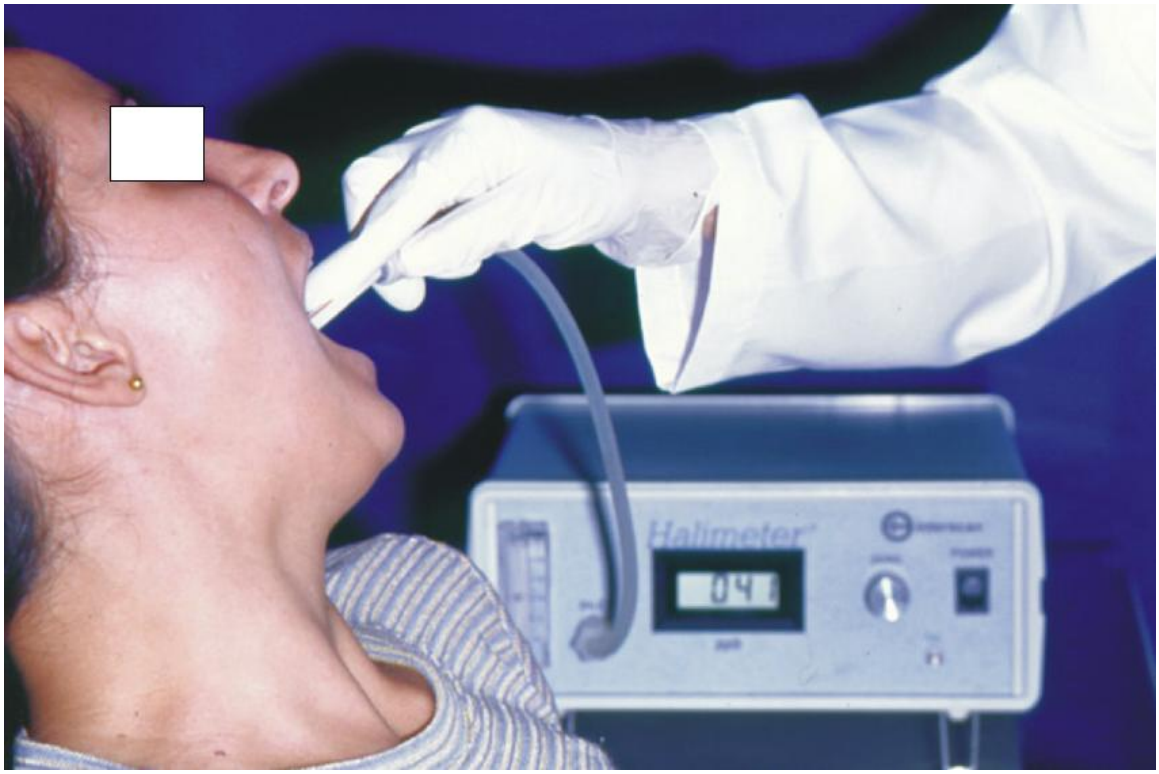

Photo 2- Halitometry Technique

Table 1- Tests for Halitosis - Most common tests used for assessment of halitosis

Test	Advantages	Problems
Organoleptic	Good in subjective assessment	Not precise in quantity; depends on the examinator olfaction accuracy
VSC Halimeter®	Good in quantifying values	Does not record all the odorivectors present in the breathed air
Bana® Test	Complementary test to halimeter	Needs a complementary assessment

Main causes of halitosis

Oral diseases related to halitosis

Oral cavity pathologies that can cause halitosis are, among others: dental caries, periodontal disease, tongue coating, exposed tooth pulps, extractions/healing wounds, interdental food impaction, dentures kept at night or not regularly cleaned, restorative crowns which are not well adapted, cysts with fistula draining into the mouth, oral cancer and ulcerations. Most of these factors causes halitosis due to tissue breakdown, putrefaction of aminoacids and decreasing of saliva flow. All these conditions result in liberation of volatile sulphur compounds (VSC)[10, 14].

The oral microbiology has been researched because bacteria play a very important role at the halitosis origin. The normal oral microbiota is compounded by cocci and bacilli, Gram positive and Gram negative[15]. The oral microbiota associated with halitosis is predominately anaerobic proteolitic Gram negative since their final metabolism products are the volatile sulphur compounds (VSC)[6].

Tongue coating is composed by concentrated saliva, bacteria, exfoliated epithelium cells, food debris and remains over the tongue dorsum[4,10]. The tongue coating is also responsible for the oral malodor and anatomical variations of the tongue as fissurated tongue, hairy tongue, ulcerated tongue can contribute to enhance the oral malodor even worse[10]. Nowadays, tongue scrapers are a very common device used by people in order to clean the tongue and avoid the coating formation and consequently decreasing the halitosis[4]. The inadequate use of the scrapers can lead to tongue ulceration what can make the halitosis worse and also can lead to a very uncomfortable sensation when eating acid or bitter food.

Otolaryngology and Respiratory Diseases Related to Halitosis

Halitosis is a very common complaint among the ENT (Ear, Nose and Throat) outpatients clinics. The main causes of halitosis related to the oronasal cavity are: acute viral or bacterial pharyngitis, chronic/purulent tonsillitis, retropharyngeal abscesses, deep crypts of the tonsils, caseous retention, chronic/purulent sinusitis, post-nasal drip,

foreign body in nasal or sinusal cavity and ozena. These pathologies cause halitosis mainly due to bacterial action which leads to putrefaction of the tissues and production of volatile sulphur compounds (VSC)[4,10]. Foetid samples of the tongue dorsum coating were compared whith nasal mucus and showed the same composition[3]. Nasal obstruction leads to a mouth breathing causing dryness of the mouth. A dry mouth provokes more epithelium cells exfoliation, xerostomia, tongue coating and therefore increases the production of volatile sulphur compounds (VSC)[10].

The deep crypts of the tonsils has to do with caseous retention. The chronic caseous tonsillitis is a pathology which symptoms are described for the patients as presence of foreign body in the throat, throat irritation, and complaint of halitosis is very high[16,17]. Recently, the modified cryptolysis technique with CO_2 laser as a conservative method for the treatment of chronic caseous tonsillitis has been proved to be a very safe and effective method, preserving the tonsilar parenchyma and decreasing caseous retention[16].

Concerning to bronchi and lungs there are some pathologies such as chronic bronchitis, bronchial carcinoma, bronchiectasias that causes tissues necrosis and ulcerations, producing malodorous gases which are expired causing halitosis[3,8]. Also, objects aspirated accidentally can lead to lung abscess formation and consequently produce halitosis bodies[10].

Digestive Diseases Related to Halitosis

Many digestive diseases are traditionally associated with halitosis. Reflux esophagitis, hiatal hernia, Zencker diverticulum, achalasia are very associated. Actually steatorrhea or other malabsorption syndromes, which cause excessive flatulence are the most important causes of halitosis concerning gastrintestinal diseases[4,10]. Specialists and internists often require gastrenterological assessment when facing a halitosis complaint. Endoscopy is one of the most widely requested tools in halitosis investigation[18].

Endoscopy is important to assess gastroesophageal reflux disease (GERD) and hiatal hernia, gastritis, duodenitis, ulcers, carcinomas and helicobacter infection[19].

In GERD, an improper function of the esophageal inferior sphincter allows acid and non-acid stomach contents to flow back into the esophagus. This alteration could result in esophageal mucosal break down. These tears can be dwelled by bacteria that leads to the production of volatile sulphur compounds. In some cases, the esophagus sphincter pathologies can cause halitosis due to putrefaction of the trapped food debris and food stasis[10,19,20].

The Helicobacter pylori infection has been associated with breath malodor, however, it is still controversial[18,19,21,22]. There are some studies that correlates H. pylori infection and altered VSC halitometries. There is some evidence that halitosis complaint in a H. pylori -positive non-ulcer dyspepsia there might be a place for H. pylori eradication[18]. Nevertheless H. pylori has a high urease activity which explains the pH increase and the lowered solubility of many malodorants[19]. This fact does not prove that H. pylori causes halitosis by itself. Indeed some authors believe that there is no convincing evidence that oral malodor can be linked to H. pylori infection[21].

The presence of clots or bleeding points at any part of the digestive system can cause halitosis due to the deterioration of blood[10]. Therefore any causes of gastrintestinal bleeding (tumors, inflammatory diseases, parasites) can cause halitosis.

Liver cirrhosis is characterised by the irreversible damage of the liver parenchyma resulting in the accumulation of ammonia. The ammonia reaches lungs to the expired air, causing characteristic halitosis[8]. Generally patients in hepatic encefalopathy have a characteristic breath scent.

The main causes of halitosis are summarised in Table 2.

Table 2- Causes of halitosis - This table summarises the distinct causes of halitosis

Localization	Frequency	Diseases
Mouth	90%	dental caries, periodontal diseases, tongue coating, exposed tooth pulps, healing wounds, interdental food impaction, dentures not cleaned properly, restorative crowns not well adapted, ulcerations, fistula, oral cancer.
Ent and respiratory system	8%	pharyngitis, tonsillitis, sinusitis, foreign body in nasal or sinusal cavity, bronchitis, bronchial carcinoma, bronchiectasias.
Digestive system	1%	gastroesophageal reflux disease, hiatal hernia, helicobacter pylori infection.
Others	1%	kidney insufficiency, halitophobia, trimethylaminuria, diabetes .

Other Causes

Renal impairment is normally a result of a chronic glomerulonephritis, which damage the glomerular function, leading to an increased urea level in the blood. The breathed air is described as ammonium-like breath and generally is accompanied by complains of dysgusia (salty taste)[10].

Diabetes can result in accumulation of ketones bodies which are breathed out producing a very characteristic halitus, moreover, diabetes causes dry mouth. Also diabetes and other insulin-resistance states are related to impaired secretion of body fluids, like lacrimae and saliva. There is a decrease in saliva production and xerostomia can occurs[23].

Trimethylaminuria or "fish odor syndrome" is a genetic metabolic disorder characterized by a failure in the oxidation route from trimethylamine (TMA) to trimethylamine N-oxide (TMA-O) in the liver . This occurs due to mutation in the FMO3 gene. High levels of TMA in urine and others body fluids confer that typical unpleasant, intermittent characteristic fishy odor of the breath[4,10].

Tumor lesions in any part of the body also produce volatile gases due to the necrosis process. These gases are expired in the breathed air causing halitosis and that is the reason why halitosis can indicate the presence of serious diseases[4,10,24].

Social Impact

The social impact of halitosis is one of the reasons for so many researches. It is very constraint for the patients, making them feel insecure to relate to other people and decreases their life quality. It is also embarrassing for relatives and friends of people who have halitosis. Also the presence of halitosis can indicates the existence of other pathologies that must be diagnosed and treated as soon as possible[24]. It has been estimated that more then 85 million people suffer with halitosis. People spend over 2 billion dollars per year buying products to mask halitosis[25]. Such costs would be minimised in adopting an anamnesis based on evidences and an rational organogram of clinical investigation. The vast majority of the patients first of all looks for help in traditional medicines, gums and non-medical advice, which are not successful strategies. The evidences show a very poor results using these strategies[3]. Many patients ask for orientation when consulting a general physician, a gastroenterologist and an ENT specialist. It is very important for these professionals to have a rational approach in halitosis investigation, because the causes are many, the patients are usually frustrated and good results depend on mainly in attacking the origin of the problem.

Proposal of a Rational Protocol

The intention of this protocol is to assess the main causes of halitosis concerning their frequency and importance. A logical knowledge organisation must be kept to avoid diagnosis failures and useless/ expensive tests.

Initially a physician must have in mind that halitosis complaint is very common among general population. Nevertheless, does exist a bias concerning to differences between true halitosis and "bad taste". Some patients look for halitosis treatment due to relatives/friends warnings and others due to self awareness. It has to be considered the level

of confidence in the information given by the relatives/friends. In our experience some cases had been misconducted due to tendentious information given by an unhappy consort. Moreover, there is the physiologic halitosis[4] which is sometimes misinterpreted as a disease whereas it is normal. The halitosis most people experience when wake up is considered physiologic once it disappears after eating and/or brushing teeth. It is considered physiologic because of the decreased salivary flow and the increased putrefaction process during the night and also because of the long period of starvation while sleeping. If it persists even after eating or brushing teeth further investigation is necessary[24].

People complaining of halitosis sometimes do not have it. Ficticious halitosis, also known as halitophobia is an imaginary halitosis[10]. These patients when undergo physical examination, organoleptic /VSC halimeter tests often have normal results. It is more a psychological problem, so called Olfactory Reference Syndrome[26]. The Olfactory Reference Syndrome is a complex psychological disease related to alteration of corporeal consciousness that leads to social isolation and needs specific treatment[26]. These patients must be referred to psychological assessment. There is no point for further investigations because no organic or pharmachological treatment will be effective since this is a psychological symptom.

Because of this it is mandatory to perform a very good anamnesis/history and an objective test in all patients with halitosis complaint. In our experience VSC halitometry is used most, once it gives a numerical index.

The oral cavity is responsible for 90% of the cases of halitosis, the respiratory tract is responsible for 8% and the gastrointestinal tract and others are responsible for only 2%[4,8,10]. Since mouth is the main source of halitosis, an specialised oral/ nasal investigation is essential. Unfortunately not any dentist is capable to make a complete assessment concerning halitosis. Mild affections as gengivitis, bacterial plaques and tongue coating diseases may not be detected in a not focused dental assessment. Recently a new field of specialisation in Halitosis in Dentistry Schools has been introduced[4].

The otholaryngologist is helpful in the halitosis assessment and treatment. Once more, when the professional is not focused in the disease some important information may be lost. Chronic sinusitis and tonsilitis are most common sources of halitosis.

New approaches like computed tomography (CT) scans might be useful in detecting sinusitis not presented in a normal sinus X-ray. Chronic caseous tonsilitis (CCT) is extremely related to halitosis[16,17]. Tonsilectomy, although being a very common procedure in ENT surgical routine, still offer risks such as bleedings and complications with the anesthesia[29]. New conservative approaches as laser ablation can restore normal halitus, avoiding tonsillectomy many times[16,17].

Nowadays, because of all the problems related to modern life style, people does not drink and eat properly. The majority of people who complain of halitosis does not drink enough water or does not drink at all, replacing it for beverages or soft drinks. It causes an impairment of saliva flow due to water scarcity. They also eat too fast, not chewing adequately. In addition work routines and schedules do not facilitate oral hygiene. Lots of working people do not have an specific time to eat properly, fasting for long periods. Besides that habits such as smoking and alcoholic ingestion make things even worse. It is called specific halitosis when there is a strict relationship with a substance smoked or ingested[27]. These are examples of substances that can cause halitosis: tobacco, cigars, pipes, alcohol, marijuana. Some of these substances can cause xerostomia as a side effect, marijuana, for instance[28]. Heavy smokers, mainly cigarettes smokers, can have their tongue transformed into hairy tongue due to papilla atrophy. This may retain more food particles and epithelium cells debris, enhanced by xerostomia provoked by smoking[28]. The alcoholic drinks cause specific halitosis because they produce volatile compounds after being metabolised. Normally this kind of halitosis occurs in a couple of minutes or hours after the beverage being ingested. Alcohol also can alter the intestinal flora, producing halitosis due to fermentation[27]. Another examples of food that can cause specific halitosis are garlic and onion in an excessive intake.

When facing true halitosis a diet evaluation is essential. A nutritionist assessment is essential and there is no virtual chance of cure for these patients without alimentary re-education.

After that, if halitosis problem persists, an internist must be assessed. Endoscopy is one of the most widely examinations prescript, but its efficacy has not been proved yet[19]. It is clear that in some cases of GERD and hiatal hernia, the reflux can

contribute to halitosis[19]. There are no formal evidences correlating Helicobacter pylori infection and halitosis and its eradication in this case still on debate[19,21,22]. Gastroenterologists can contribute in halitosis assessment because some liver diseases can be involved. Liver cirrhosis affect protein metabolism. Animal proteins are decomposed in the liver and some metabolites (ammonia) can contribute to halitosis. Diabetes can contribute to ketosis and a typical rotten apple halitus can be detected. Uremic patients also has a typical smell since amonnemia in several corporal fluids is high. Those are rare but important causes of halitosis[4,10].

In few patients a respiratory evaluation must be necessary. Children sometimes aspirate small objects. It could lead to abscess formation and a bad breath is typically detected. Other lung affections as tuberculosis, blastomicosis and fugal abscesses also can contribute to halitosis[4,10].

In our personal experience, most cases of halitosis can be detected an properly treated by an experienced dentist and by an ENT specialist. In an approximately half of the patients a otolaryngologist contribution is essential. Most patients referred to a gastroenterologist underwent useless and expensive endoscopies. Thousands of unnecessary endoscopies are performed every year in patients complaining of halitosis. Although there is a significant effort trying to correlate halitosis and H. pylori infection, there is no supporting evidences yet to justify routine endoscopy as a pivotal examination in halitosis assessment. On the other hand a flexible laringoscopy performed by an expert ENT specialist is more likely to bring contribution to halitosis assessment and further treatment.

Sometimes an internist referral is important when rare causes of halitosis are searched. Cases of rare diseases diagnosed trough halitosis complaint are refereed in literature. Dietary assessment, oral hygiene education and psychological advice are essential in halitosis treatment.

In our clinic, dentists, ENT specialists, gastroenterologists, nutritionists and psychologists work together. We use VSC interscan halimeter test as routine in halitosis assessment. Each specialist perform specific tests concerning its own area only when they

judge it is essential (ie, ENT requests for laringoscopy, gastroenterolgyst request for endoscopy). There is no unnecessary examinations and virtually all patients have a diagnostic after the assessment protocol. Following this methodology for the last seven years, we have a very high percentage (91%) of patients satisfied with the treatment[30].

Finally, one must keep in mind that the patient suffering of halitosis is a person looking for help, often anxious and suspicious of any treatment, due to bad experiences using traditional approaches.

Halitosis must be treated as a serious condition and a multifatorial and a rational approaches are essential for good results.

An organogram for assessment of halitosis is suggested in Figure 1

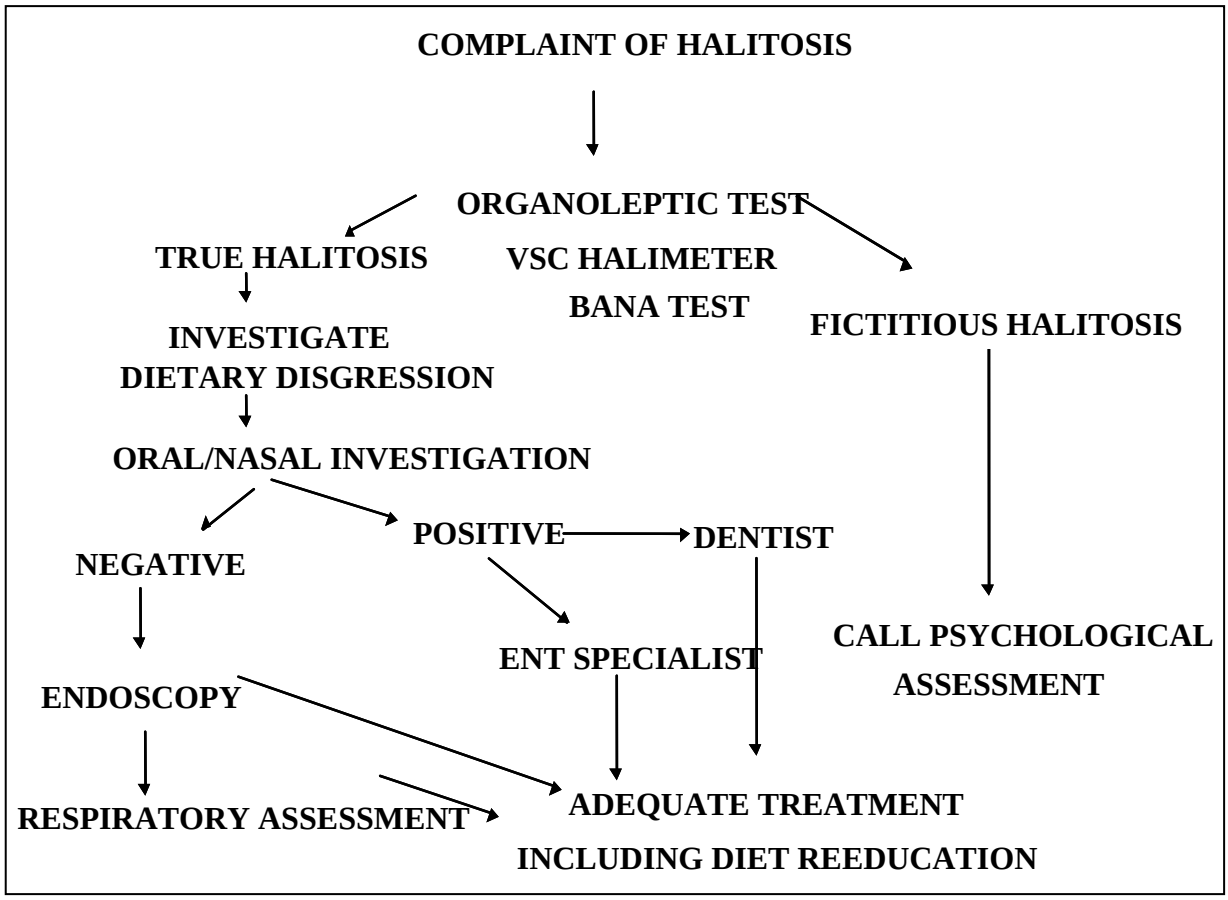

Figure 1- Organogram suggested for halitosis assessment

References

1- Hine KH. Halitosis. JADA 1957; 55 (7): 37-46.

2- Grein NJ. Estomatologia para o clínico - 7ª Aula: Halitose - diagnóstico e tratamento. Odontólogo Moderno 1982; 9(6): 40-45.

3- Rosemberg M. Halitose: perspectivas em pesquisa. Rio de Janeiro, Ed. Guanabara Koogan S.A. 2003.

4- Tárzia O. Halitose: um desafio que tem cura. 1· ed. Rio de Janeiro, Ed. de Publicações Biomédicas Ltda, 2003.

5- Bogdasarian RS. Halitosis. Otolaryngologic Clinics of North America 1986; 19:101-17.

6- Uliana RMB, Briques W, Conti R. Microbiota oral e suas repercussões no hálito. Odontologia. Ed. Artes Médicas - São Paulo- div. odontol. 4(17): 297-308, 2002.

7- Tonzetich J. Prefácio (1997). In: Rosemberg, M. Halitose: perspectivas em pesquisa. Rio de Janeiro, Ed. Guanabara Koogan, 2003.

8- Tonzetich J. Production and origin of oral malodor: a review of mechanisms and methods of analysis. J. Periodontol 1977;48:13-20.

9- Tonzetich J, Richter VJ. Evolution of odoriferous components of saliva. Arch Oral Biol 1964;9:39-48.

10- Van Steenberghe D. Breath Malodor a step-by-step approach. Quintessence Books, 1st Ed, Copenhagen, 2004.

11-Interscan corporation Manual Instruction. PO box 2496 - Chatsworth, CA 01311-2496. http:/www.gasdetection.com

12- Orrico SR, de Toledo BE, Fonseca L, Ito IY. Influence of age on the reactivity of the BANA test among brazilian children. Braz. Dent. J 1992; 2:115-22.

13- Kozlovsky A, Gordon D, Galernter I, Loesche WJ, Rosenberg M. Correlation between the BANA test and oral malodor parameters. J.Dent. Res 1994;73:1036-42.

14- Delanghe G, Ghyselen J, Bollen C, van Steenberghe D, Vandekerckhove BN, Feenstra L. An inventory of patients' response to treatment at a multidisciplinary breath odor clinic. Quintessence Int. 1999; 30:307-310.

15- Marsh P, Martin NV. Oral Microbiology. Oxford, 4. ed. p.192, 1999.

16- Passos CA, Oliveira FMZ, Nicola JH, Nicola EMD. Criptólise por Coagulação com Laser de CO_2 em Tonsilite Crônica Caseosa: método conservador e resultados. Rev. Bras. Otorrinolaringol 2002; 68:405-10.

17- Finkelstein Y, Talmi YP, Ophir D, Berger G. Laser cryptolysis for the treatment of halitosis. Otolaryngol Head and Neck Surg 2004; 131:372-7.

18- Serin E, Gumurdulu Y, Kayaselcuk F, Ozer B, Ylmaz U, Boyacioglu S. Halitosis in patients with Helicobacter pylori-positive non-ulcer dyspepsia: an indication for eradication therapy? Eur. J. Int. Med 2003; 14:45-8.

19- Hoshi K, Yamano Y, Mitsunaga A, Shimizu S, Kagawa J, Ogiuchi H. Gastrointestinal diseases and halitosis: association of gastric Helicobacter pylori infection. Int. Dent. J 2002; 52:207-11.

20- Costa IM. Patologia das halitoses. Odontólogo Moderno 1987;14: 7-16.

21- Marshall B, Howat AJ, Wright PA. Oral fluid antibody detection in the diagnosis of Helicobacter pylori infecction. J. Med. Microbiol 1999;48:1043-6.

22- Riggio MP, Leonno N. Identification by PCR of Helicobacter pylori in subgengival, plaque of adult periodontitis patients. J. Med. Microbiol 1999;48:317-22.

23- Rocha EM, Carvalho CR, Saad MJ, Velloso LA. The influence of ageing on the insulin signalling system in rat lacrimal and salivary glands. Acta Ophtalmol Scand 2003;81:639-45.

24- Costa IM. Metodologia para o estudo das halitoses. Ars Cvrandi em Odontologia 1981;7:503-8.

25- Meningaud JP, Bado F, Favre E, Bertrand JC, Guilbert F. Halitosis in 1999. Rev. Stomatol Chir Maxillofac 1999;100:240-4.

26- Lochner C, Stein DJ. Olfactory reference syndrome: diagnostic criteria and differential diagnosis. J Postgrad Med 2003;49:328-31.

27- Lu DP. Halitosis: an etiologic classification, a treatment approach and prevention. Oral Surg 1982;54: 521-6.

28- Passarelli N, Gurfinkel S. Halitose. Jornal Brasileiro de Medicina 1981;40:21-28.

29- Bluestone CD. Current indications for tonsillectomy and adenoidectomy. Ann Otol Rhinol Laryngol 1992;155:58-64.

30- Dal Rio AC, Franchi-Teixeira AR, Nicola EMD. State University of Campinas 2005; Unpublished data.

Relationship between the presence of Tonsilloliths and Halitosis in patients with Chronic Caseous Tonsillitis

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Abstract

Objective: To study the Volatile Sulphur Compounds (VSC) halitometry profile in a population with Chronic Caseous Tonsillitis (CCT) and halitosis complaint and to evaluate the relationship between the presence of a tonsillolith and abnormal halitometry in this population.

Design: Clinical prospective non-randomised.

Subjects and Methods: 49 patients with halitosis complaint and CCT, 17 male (35%), 32 female (65%) were selected among patients referred for CO_2 laser cryptolysis. Anamnesis, physical examination and VSC halitometry were done. Halitometry values less than 150 parts per billion (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 a tonsillolith at the moment of examination. A tonsillolith was present in 75% of the patients with abnormal halitometry and only 6% in patients with normal halitometry values.

Conclusions: The presence of a tonsillolith represents a tenfold increased risk to abnormal Volatile Sulphur Compounds (VSC) halitometry and can be considered as a predictable factor for abnormal halitometry in patients with CCT.

Key words: chronic caseous tonsillitis; halitosis; halitometry; tonsillolith; CO_2 laser cryptolysis.

Introduction

Halitosis is a Latin word which means *halitus* (breathed air) and *osis* (pathologic alteration), therefore, halitosis is an unpleasant alteration of the halitus[1]. It is a very unpleasant symptom, causing social restriction and decreasing the 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 (Figure 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. The halitosis complaint among patients with CCT is about 77%[9]. CCT can occur in either men or women at any age and in all kinds of tonsils[9]. When clinical treatment with topic antisepticals and oral antibiotics does not bring relief, surgical excision of the tonsils is indicated[10,11]. Recently, a less invasive therapy has been proposed. This therapy is the tonsillary cryptolysis with CO_2 laser. 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 anesthesia permitting the immediate return to the patient's activities[8,9,12].

The Interscan Halimeter ® is one of the most common devices used nowadays to perform the Volatile Sulphur Compounds (VSC) halitometry. There is an electrochemical voltammeter sensor, which generates a signal when exposed to sulphur

compounds and a digital display which records the quantity of VSC in parts per billion (ppb) present in the expired air. Hydrogen sulfide, methylmercaptans and dimethylsulfide are substances that have an offensive odor and are mainly responsible for breath malodour[5,13-15]. The Halimeter® allows an objective measurement of the halitus. Other subjective tests such as organoleptic depend on the 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 depth of the crypt.

Clinically these patients relate they have a worse halitosis symptom when they expel a tonsillolith, but it has not yet been objectively documented[16]. Also VSC halitometry profile among CCT patients has not yet been described and this important since halitosis is very common with these patients. The correlation between the VSC halitometry, which is an objective measurement and the presence of a tonsillolith has not been described. This correlation would be useful in case of absence of the device the presence of a tonsillolith predicts the source of halitosis and may help the professional, in relation to diagnosis and a successful treatment.

Objective

The aim of this study is to analyze the Volatile Sulphur Compounds (VSC) halitometry profile in a population with Chronic Caseous Tonsillitis (CCT) and halitosis complaint and to evaluate the relationship between the presence of a tonsillolith and abnormal halitometry in this population.

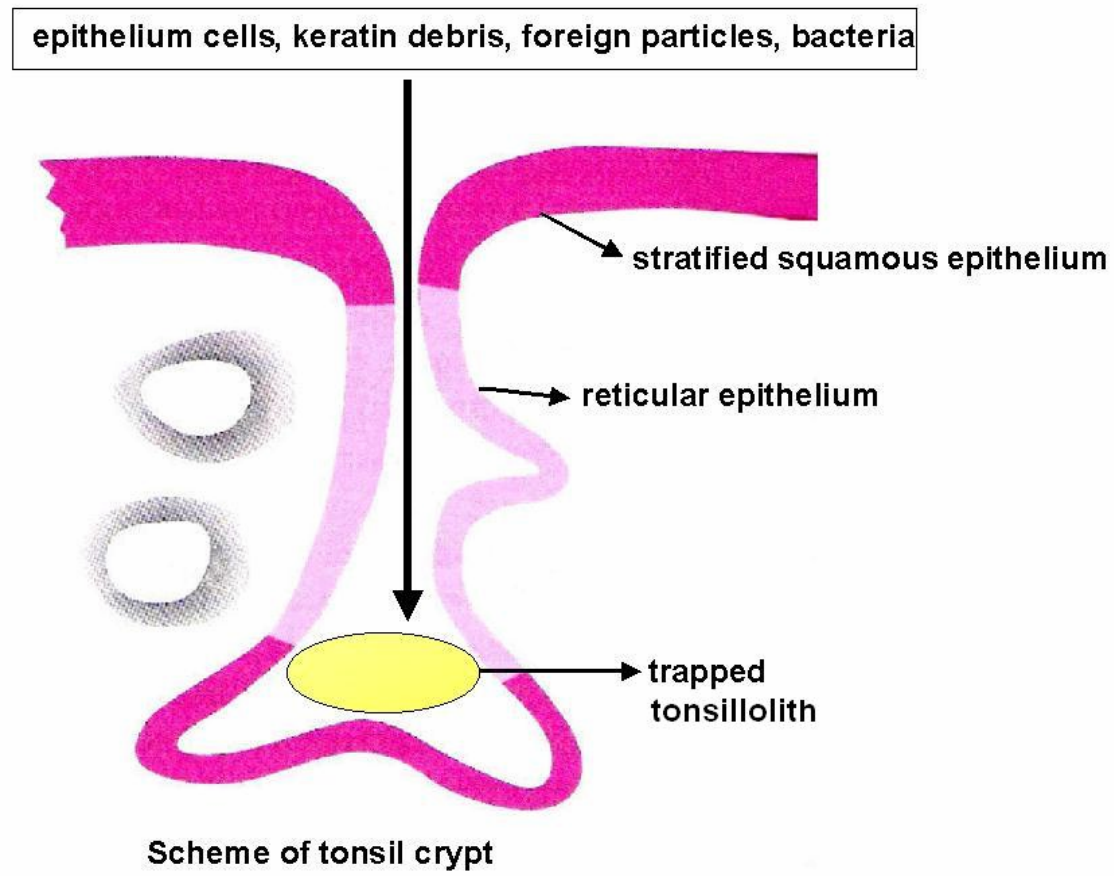

Figure 1- Scheme of Tonsil Crypt

Material and methods

Population

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

The anamnesis and physical examination of all patients were done 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 30gr of alcohol/day), drug users, pregnant women, presence of tooth and gum diseases

(carious lesions, exposed tooth pulps, extraction wounds, interdental food impactions due to prothesis not well adapted) and those taking any kind of regular medication. Patients with periodontal diseases (presenting bleeding on probing index or presenting probing depth more than 3mm) were excluded of this study in order to avoid other oral causes of halitosis. Likewise, patients presenting 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.

VSC Halitometry

At the time of the dental assessment, all the 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 Halimeter® Interscan 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 also followed the Halimeter® Interscan instruction manual. Halitometry was done by the same person always on Monday afternoon, at the Multidisciplinary Group of Laser Medicine.

The Halimeter®device was adjusted to zero before every measurement. The technique consisted of having the patient keeping 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 holding one's breath for the few seconds of testing. The straw was removed from as soon as peak was reached. The display allowed the reading to return to -/+ 10 ppb before the next measurement was taken. This procedure was repeated three times and the results were recorded (Figure 2).

An electronic data sheet was created using the Microsoft Windows Excel® software with 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.

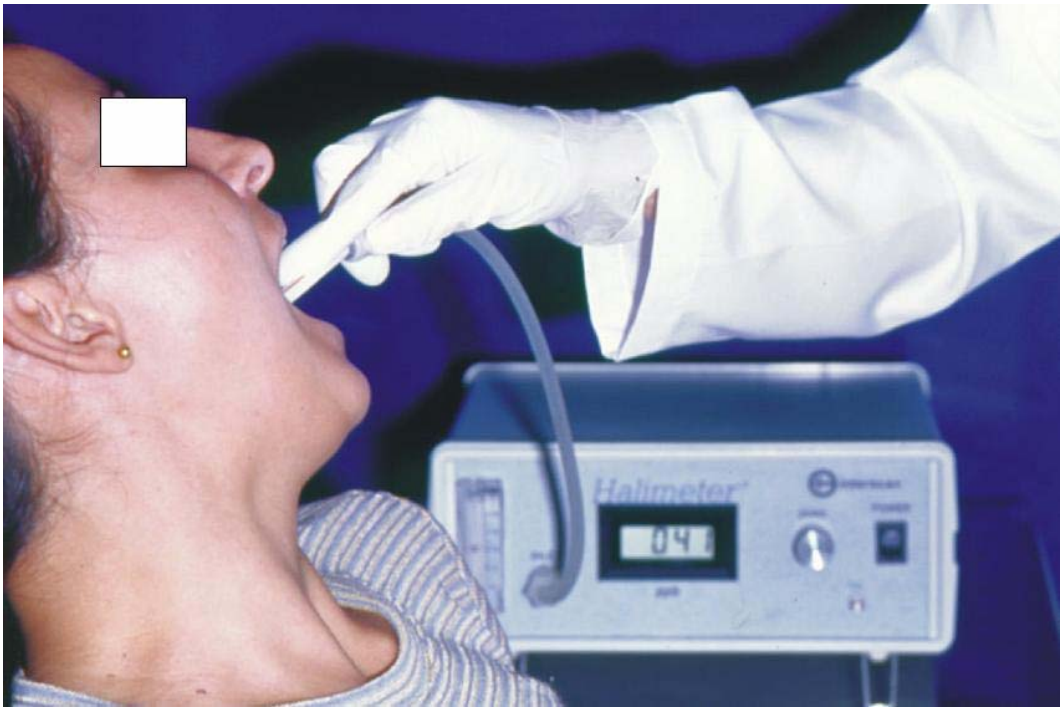

Figure 2- Halitometry test

Statistical Analysis

The value of the average of the three measurements was used for the halitometry statistical analysis. According to the Halimeter® Interscan instrunction manual, results less than 150 ppb of Volatile Sulphur Compounds (VSC) were considered normal.16, 17

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

The correlation between the presence of a tonsillolith and abnormal halitometry and whether the presence of a tonsillolith was a predictor 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 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.

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 summarizes the distribution of sex and age of both groups.

Table 1- Distribution of Sex and Age

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

Table 2and Figure 3 summarizes halitometry values in groups.

Table 2- Distribution According to Halitometry Values, per Group

Total	Mean Halitometry*	Maximum Value*	Minimum Value*	difference in %
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

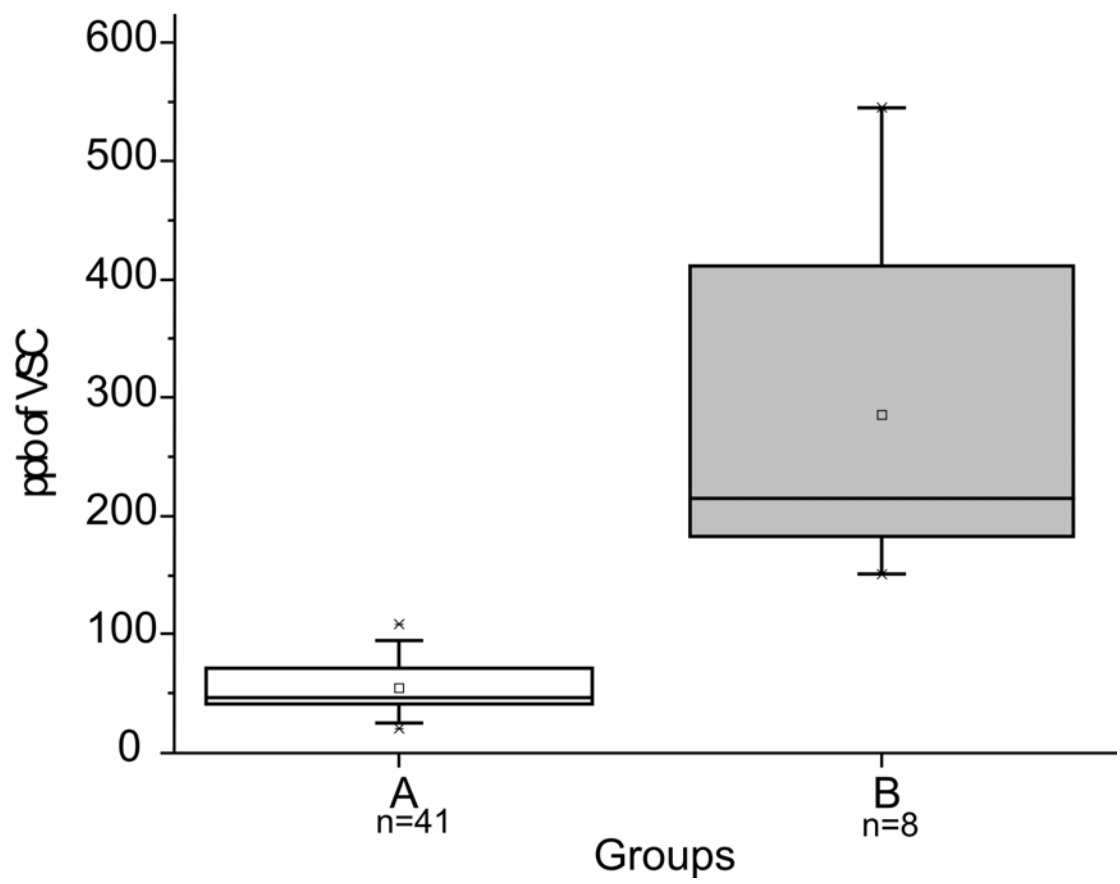

Figure 3- Distribuition of Halitometry per Group

Table 3 summarizes the presence of a tonsillolith.

Table 3- Frequency of a Tonsillolith in Different Groups

Presence of Tonsillolith	Group A- Normal Halitometry (%)	Group B- Abnormal Halitometry (%)	Group A- Normal Halitometry (ppb)	Group B- Abnormal Halitometry (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 in ppb			10.7	103*
Total	**100**	**100**	**41**	**8**

Kappa= 0.3889; *= t-student test, statistically significant

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. t-Student test demonstrated that values of halitometry 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 halitometry was tested by the Fleiss quadratic test.

Table 4- Fleiss Quadratic Test

		Confidence Interval 95%	
	p	**Inferior value**	**Superior value**
Sensitivity	75.00	35.58	95.55
Specificity	77.50	61.14	88.60
Pos. predicitve value	40.00	17.46	67.11
Neg. predictive value	93.94	78.38	98.94
Accuracy	77.08	62.33	87.49

T

The study of dycotomic logistic regression correlated the presence of a tonsillolith as a risk factor for the abnormal halitometry. The presence of a tonsillolith at the moment of the physical examination represents a relative increased risk for abnormal halitometry of 10.3 times.

Table 5- 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%

Discussion

In this study, 49 patients of both genders with CCT and halitosis complaint were selected. These patients were assessed by specialists and selected for tonsillary cryptolysis with CO_2 laser. Since halitosis may have a multifatorial origin, all oral and systemic diseases were excluded. Except for the 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 present 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 8 individuals (16.3%) presented abnormal halitometry. VSC halitometry is a method to detect 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 VSC Halimeter®[16,20]. Halitosis can occur in a determined period of the day and may have a cyclic behavior. 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 8 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 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 even 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 means 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 obtained normal halitometry values.

In this population of patients with CCT and halitosis complaint 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 to have an abnormal halitometry. Therefore, the halitosis complaint in patients with CCT and the presence of a tonsillolith must not be underestimated, even if a 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 complaint 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 tonsillolith at the time of examination. The presence of a tonsillolith represents a tenfold risk factor for halitosis and is correlated to abnormal VSC-halitometry in patients with CCT.

References

1- Hine KH. Halitosis. JADA 1957; 55: 37-46.

2- Lu DP. Halitosis: an etiologic classification, a treatment approach and prevention. Oral Surg 1982; 54: 521-26.

3- Passarelli N, Gurfinkel S. Halitose. Jornal Brasileiro de Medicina 1981; 40: 21-28.

4- Bogdasarian RS. Halitosis. Otolaryngologic Clinics of North America 1986; 19: 101-17.

5- Costa IM. Patologia das halitoses. Odontólogo Moderno 1987; 14: 7-16.

6- Meningaud JP, Bado F, Favre E, Bertrand JC, Guilbert F. Halitosis in 1999. Rev Stomatol Chir Maxillofac 1999; 100: 240-44.

7- Abbey K, Kawabata I. Computerized three-dimensional reconstruction of the crypt system of the palatine tonsil. Acta Otolaryngol 1988; 454: 39-42.

8- Finkelstein Y, Talmi YP, Ophir D, Berger G. Laser cryptolysis for the treatment of halitosis. Otolaryngol Head and Neck Surg 2004; 131: 372-77.

9- *Passos CA, Oliveira FMZ, Nicola JH, Nicola, EMD. Criptólise por Coagulação com Laser de CO_2 em Tonsilite Crônica Caseosa: método conservador e resultados. Braz Journal Otorhinolaryngol 2002; 68: 405-10.

10- Bluestone CD. Current indications for tonsillectomy and adenoidectomy. Ann Otol Rhinol Laryngol 1992; 155: 58-64.

11- Ginström, R, Silvola J, Saarnivaara L. Local bupivacaine-epinephrine infiltration combined with general anethesia for adult tonsillectomy. Acta Oto-Laryngologica 2005; 125: 972-975.

12- Krespi YP, Ling EH. Tonsils cryptolysis using CO_2 swiftlase. Op Tech Otolaryngol Head and Neck Surg 1994; 5: 294-7.

13- Tonzetich J, Richter VJ. Evolution of odoriferous components of saliva. Arch Oral Biol 1964; 9: 39-48.

14- Tonzetich J. Production and origin of oral malodor: a review of mechanisms and methods of analysis. J. Periodontol 1977; 48: 13-20.

15- Tárzia O. Halitose: um desafio que tem cura. 1. ed. Rio de Janeiro: Ed. de Publicações Biomédicas Ltda; 2003. p.75-83

16- Van Steenberghe D. Breath Malodor a step-by-step approach. 1st ed. Copenhagen: Quintessence Books; 2004. p. 18-68.

17- Interscan Corporation Manual Instruction. PO box 2496 - Chatsworth, CA 01311-2496. http:/www.gasdetection.com

18- Campos CAH, Costa HOO. Tratado de Otorrinolaringologia. 1 ed. São Paulo: Ed. Roca; 248-52.

19- *Rosemberg M. Bad breath: Research perspectives. 2nd ed. Tel Aviv, Israel: Ramot Publishing; 1997.

20- Uliana RMB, Briques W, Conti R. Microbiota oral e suas repercussões no hálito. São Paulo: Odontologia Ed. Artes Médicas div. odontol; 2002. p. 297-308.

21- Ansai T, Takehara T. Tonsillolith as a halitosis-inducing factor. Br Dent J. 2005; 198: 263-4.

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CO2 Laser Cryptolysis By Coagulation For The Treatment Of Halitosis

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Abstract

Objective: The aim is to evaluate impact of CO_2 Laser Cryptolysis by Coagulation (LCC) treatment in the Volatile Sulphur Compounds (VSC) halitometry in patients with Chronic Caseous Tonsillitis (CCT), since halitosis is an important complaint of all patients. **Background Data**: Caseum retention and halitosis characterize CCT. Failure of clinical treatment indicated tonsillectomy. Recently, a conservative new treatment was introduced: CO_2 LCC. It is painless, opens the crypt ostium, avoiding caseum retention. Halitometry is an objective new method for halitosis diagnosis. It measures VSC in *parts per billion* (ppb) in the breathed air.

Methods: Thirty-eight patients with CCT and halitosis complaint were selected, underwent physical examination and halitometry measurements followed by 4 sessions of LCC. The laser technique consisted of 6W applications, in scanned and unfocused mode, around crypts, following the shape of their openings (fluence 54.5 joules/cm^2) and afterwards, over the entire tonsillar surface (fluence 18 joules/cm^2). Halitometries were done before each LCC session. **Results**: LCC was well tolerated by all patients. All related halitosis improvement after LCC treatment. Eight patients (21%) had abnormal halitometry (>150 ppb) before treatment and after LCC sessions halitometry values became normal. These patients had caseum at examination. VSC measurement was reduced by 30.1% and caseum retention was significantly decreased in this group. **Conclusions**: Abnormal halitometry in this population is related with caseum presence. LCC is safe, well tolerated and improves halitosis complaint in patients with CCT. Improvement was related to a decrease in caseum retention. Patients with abnormal halitometry had VSC-halitometry improvement about 30%.

Key words: caseum; coagulation with CO_2 laser; halitosis; tonsil.

Introduction

Halitosis is a Latin word which means *halitus* (breathed air) and *osis* (pathologic alteration).[1,2]

There are so many causes of halitosis but most of them are related to the oral cavity (90%), other are related to otolaryngology and respiratory diseases (8%). Gastrointestinal diseases, liver/renal impairment and others metabolic syndromes are minor causes (2%).[3-5]

The main causes of halitosis are related to the decomposition of organic material by anaerobic proteolytic bacteria, consequently increasing the production of odorivectors such as Volatile Sulphur Compounds (VSC) exhaled during breathing.

Hydrogen sulfide, methylmercaptans and dimethylsulfide are substances of great perception by the human sense of smell and are the VSC most responsible for breath malodor.[6-8] Nevertheless, there are odorivectors other than VSC such as cadaverine, putrescine and scatol that are much less offensive to the human sense of smell than VSC.[8,9]

Recently, methods and instruments have been developed to identify and quantify substances present in the breathed air.[8, 10] The Halimeter® is a device with an electrochemical voltammeter sensor which generates a signal when exposed to VSC sulphur compounds. It has a digital display which records the quantity of VSC in parts per billion (ppb) present in the expired air. Results below 150 ppb are considered normal.[11] Halimeter® is one of the most common devices used nowadays, either in clinical studies or specialized clinics, that allows a correct diagnosis, follow up and reassessment of halitosis.[8,10]

Palatine tonsils contain crypts (Fig. 1), that are twisted tubular invaginations extending from the tonsillar surface penetrating deeply through the parenchyma.[12,13] These crypts, depending on the depth, may retain exfoliated epithelium cells, keratin debris and foreign particles causing the accumulation of secretion and caseum formation. Therefore, palatine tonsils are the most suitable sites for the activity of anaerobic bacteria in the upper airway system.[13,14]

Chronic Caseous Tonsillitis (CCT) is a common disease at Ear Nose and Throat (ENT) clinics and halitosis complaint among patients with CCT are prevalent (about 77%).[15] This complaint can be very disabling for the patient. Caseum formation and its retention inside the tonsil crypts characterise CCT. Caseum retention also may cause inflammation leading to hyperemia and hypertrophy of the tonsils (Fig. 2). Other CCT related symptoms are throat irritation and sensation of foreign bodies. CCT affects both men and women at any age, in all kinds of tonsils without any relation to their size and can occur on one or both sides.[12, 15] Clinically tonsil caseum is strongly related to halitosis complaint.[13, 15] However an objective measure of halitosis (VSC halitometry) in patients with CCT has not been described previously in the literature.

The initial approach for CCT includes the use of topic antisepticals, anti-inflamatories and oral antibiotics. When the clinical treatment does not bring relief, surgical excision of the tonsils is indicated.[13, 15 16]

Recently, a less invasive therapy has been proposed for the CCT treatment in order to preserve the tonsils due to their importance in the local immunological process.[15,17] This therapy is the CO_2 Laser Cryptolysis by Coagulation (LCC). LCC is tolerated quite well by the patients and virtually painless. The treatment takes four to six sessions on the average, with an interval of 4 weeks between the laser sessions. The coagulation is obtained with moderate CO_2 laser power density, reaching temperatures in the tonsillary tissue between 50 to 100^0 C. Consequently there is dehydration, whitening and contraction of the tissue due to the proteins and collagen denaturation.[15, 18] With this technique, more conservative than the conventional ones with CO_2 laser, the laser-tissue interaction occurs only superficially in the epithelial layer, widening the tonsillar ostium, reducing crypt depth and decreasing caseum retention.[15,19]

Recent studies have shown that patients with CCT treated by CO_2 LCC reported a considerable clinical improvement of halitosis.[15, 19] However, a systematic and objective study using the VSC halitometry in these patients has not yet been described. The study of halitosis in these patients is justified since it is a very common symptom among these patients and CO_2 LCC is a relatively new technique. CO_2 LCC produces crypt ostium widening, causes superficial tonsillar coagulation and its effects related to halitus are not known yet.

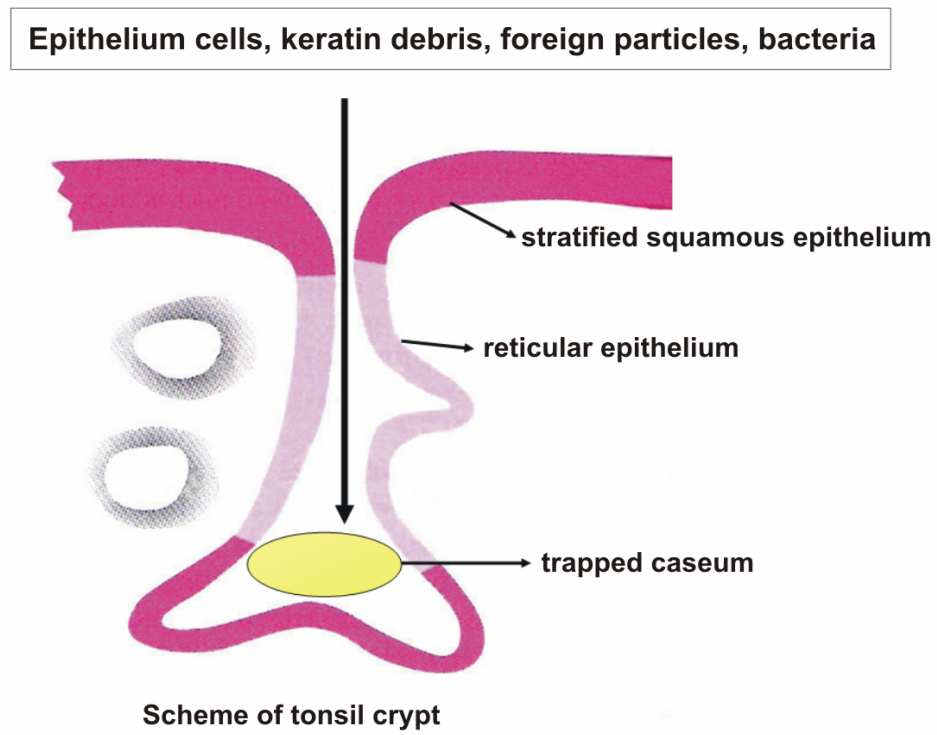


Figure 1- Scheme of palatine tonsil crypt

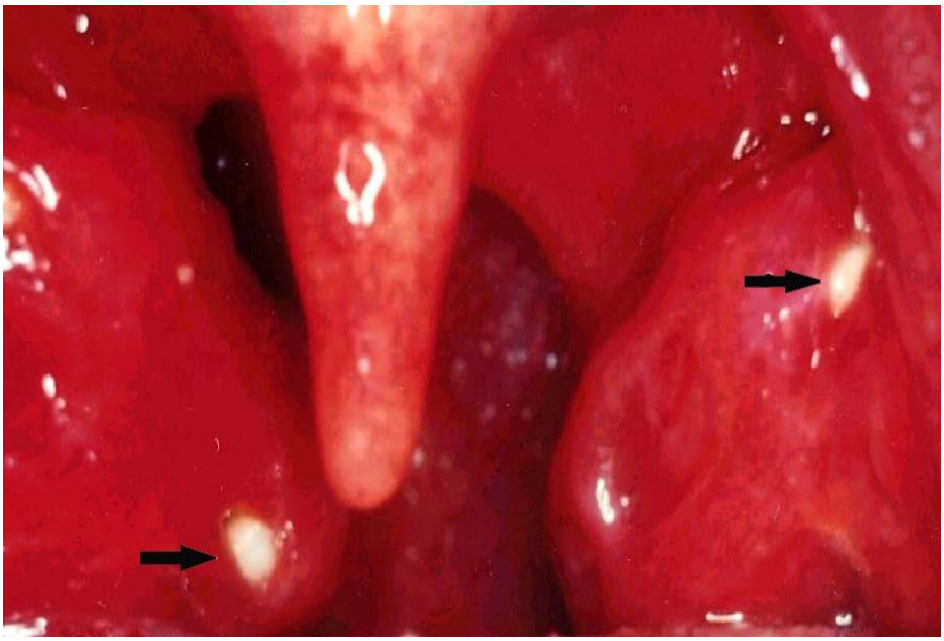


Figure 2- Tonsil with caseum (arrows) causing hyperemia and hypertophy in the palatine tonsils.

Objectives

The aim of this study is to evaluate the impact of CO_2 Laser Cryptolysis by Coagulation on the VSC halitometry profile of patients with Chronic Caseous Tonsillitis and complaints of halitosis.

Material and Methods

Study Design: Thirty-eight adult patients of both genders, with CCT diagnosis and halitosis complaint, were selected at the Medicine Laser Unit of the University Hospital Center. These patients were evaluated by a multiprofessional team that included a senior otolaryngologist, a specialist in internal medicine and a senior dentist.

Selection Criteria: All patients were assessed at the ENT outpatient clinic at the State University of Campinas - UNICAMP. They underwent anamnesis, complete clinical and oral examination, and answered questions related to food habits, oral hygiene, medical history and use of medications (ANEXO 4). After failure with conventional clinical treatment for CCT, they were selected for CO_2 LCC.

The exclusion criteria were patients with prothesis or restorations not well adapted, presence of periodontal diseases, tooth decay, exposed tooth pulps, presence of infection of the soft tissue of the oral cavity, presence of systemic diseases (such as gastrointestinal, pulmonary, hepatic, endocrine, auto-immune, or other metabolic disorders) and pregnancy. Smokers, heavy alcoholic drinkers (more than 30g of alcohol/day), drug users, those taking any kind of regular medication and those with xerostomia were also excluded. Except for the CCT, all patients had a normal medical history. These criteria were established to exclude other causes of halitosis.

The patients underwent four CO_2 LCC sessions with an interval of four weeks between the sessions. Every return, all patients were reassessed concerning to the symptoms improvement.

The VSC halitometry test was performed immediately before each laser session. The halitometry values were recorded for statistical analysis.

Halitometry Technique:

Preparation: All patients received instructions before the halitometry to abstain from oral mouthwash or toothpaste, from chewing gum and from spicy or seasoned food at least three hours before halitometry, and to not fast for a period of more than four hours.

All patients agreed to participate in the study in accordance with the University Ethical Research Committee and signed an informed consent agreement (ANEXO 5).

Technique: Halitometry was always performed in the same time period, at the beginning of the afternoon, on Monday, at the Multidisciplinary Group of Laser Medicine at State University of Campinas Hospital. The VSC halitometry technique (Fig.3) followed the instruction manual for the Halimeter® (Halimeter RH-17 Series - Interscan Corporation - Chatsworth, CA).

Device: The Halimeter®device measures VSC in ppb, and before each measurement it is set to 0 ppb according to manufacturer's instructions. The technique consisted of having the patient keeping his/her mouth closed for three minutes prior to testing, trimming the Halimeter® 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 holding one's breath for the few seconds of testing, until a peak value is obtained which will occur in 8-10 seconds on average. The display 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.

Figure 3- Halitometry technique

Laser Cryptolisys Technique:

The CO_2 laser used in this study was SHARPLAN 40C with nominal power of 40W, (CO_2 Surgical Lasers System - SHARPLAN Lasers, Inc. - Israel) attached to an articulated arm, hand piece and a scanner accessory (*Swiftlase*). A smoke aspirator with biological filter, frontal light beam to illuminate the orophaynx and protection glasses for the patient and medical team were also used. The coagulation technique with CO_2 laser, as described by PASSOS *et al*., 2002,[15] consisted of applications of 6W of CW laser power, in scanned and unfocused mode, over a mean area of 2.2 mm^2, initially only around the crypts and following the shape of their openings (Fig.4). The laser fluence applied around the crypt was about 54.5 joules/cm^2. At a subsequent time, the laser beam was swept over the entire tonsillar surface with a fluence about 18 joules/cm^2 (Fig.5). It is important that the hand piece not touch the tonsils and be lined up with the labial commissura.

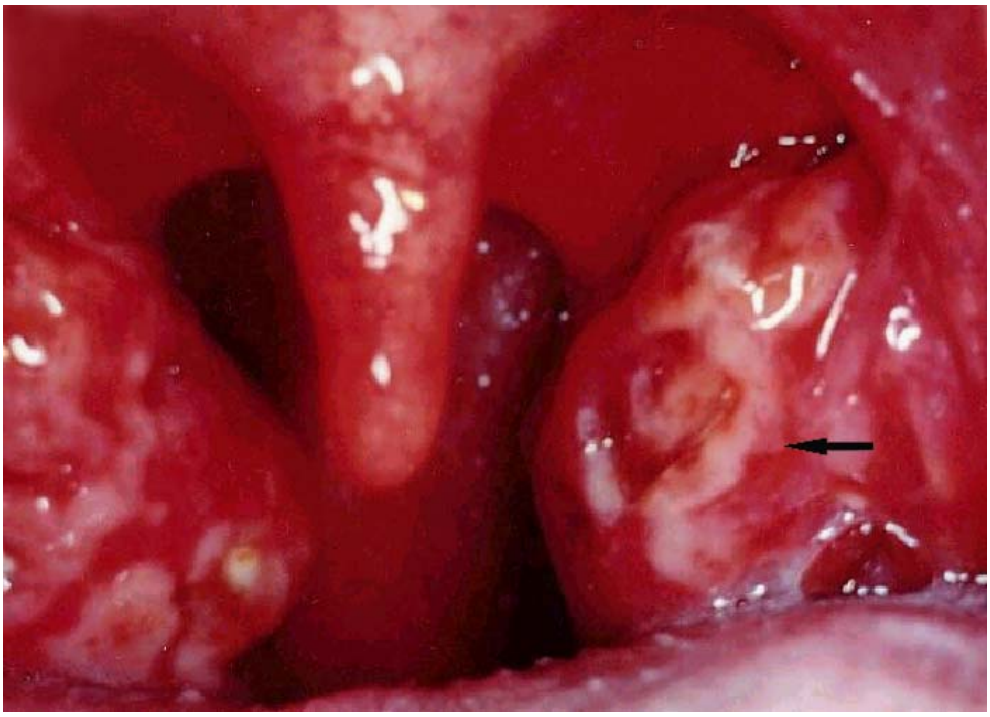


Figure 4- Laser around the crypt (arrow) with a fluence about 54.5 joules/cm^2.

Figure 5- Laser all over the tonsil with a fluence about 18 joules/cm^2.

This procedure was repeated every 4 weeks, 4 sessions in total for each patient.

To calculate the laser fluence applied around the crypt, the sweeping speed was estimated to be 5 mm/sec, the laser beam diameter 2.2 mm and a laser power of 6W, resulting in a energy density, or fluence, of 54.5 joules/cm^2. The laser was swept over the tonsilar surface at an estimated speed of 15 mm/sec, resulting in a fluence of about 18 joules/cm^2.

The patients were advised not to eat spices, seasonings, acidic food and to avoid hard or crisp food during the two first days after the procedure. The technique proposed in this study showed to be a safe and efficient method, able to be performed in the ambulatory under topic anesthesia; therefore, permitting to the patients immediate return to their activities.

Data treatment: An electronic data sheet was created using the Microsoft Windows Excel® software with name, registration number, age, gender, the three halitometry values (in ppb of VSC) and the mean of the three measurements (in ppb of VSC).

Statistic Analysis: The mean of the three halitometry values of each patient obtained before each laser session was used for the statistical analysis. Non-parametric tests were used because the population was considered to have a distribution different from normal.

The different halitometry measures were compared within the same group and between the two groups. The Friedman test was used for the intra-group comparison, analysing the halitometry profile in a population throughout the treatment.

Comparisons between the groups were made using the Mann-Whitney test. The Percentual Variation (PV) between the second, third and fourth laser sessions in relation to the initial halitometry was calculated in both groups.

PV formula was as follows:

$$\mathbf{PV = 100x(halitometry_i - halitometry_1)/(halitometry_1),}$$

where:

i= 2, 3 or 4 indicates the halitometry value of the second, third and fourth laser sessions and

halitometry$_1$= initial halitometry value.

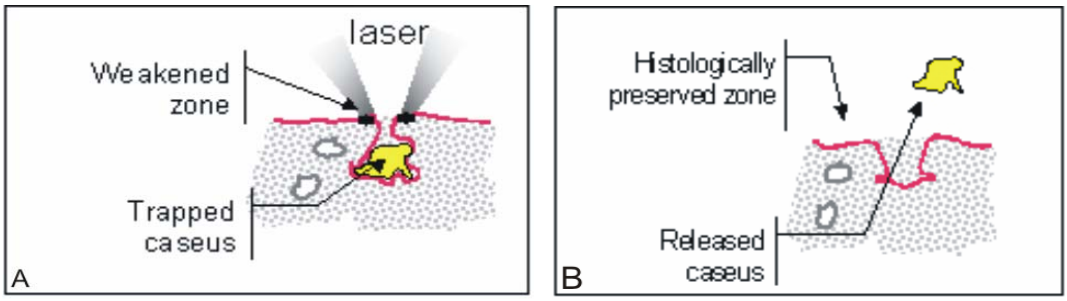
Rejection level (p) was fixed at a value of ≤ 0.05.

Results

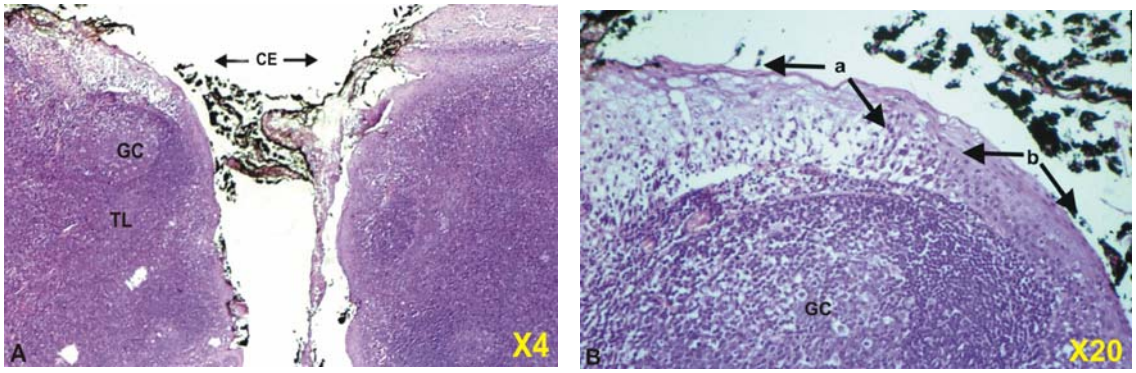
The studied population was composed of 38 patients (13 male, 25 female), with a mean age of 26 years old (SD = 9.59).

The action of CO_2 laser cryptolysis by coagulation was superficial, causing only epithelial coagulation, with no significant tissue slough after each laser application. This enabled a weakening of the tension forces in the crypt borders, causing them to open. This effect resulted in the reduction and even disappearance of caseum retention.

Figure 6 illustrates the laser action in the crypts. Figure 7 shows widening of the crypt ostium induced by laser action, preserving the immunological function of tonsil. Figure 8 demonstrates that the laser was effective in widening the tonsil crypts entrance.



Figures 6A and 6B- Schematic representation of CO_2 LCC procedure. **A)** Low-energy density is applied around the crypt, causing an immediate weakening zone hit by the laser beam. **B)** CO_2 laser caused the widening of the opening ostium and shallowing of the crypt, resulting in elimination of debris and of other residues, facilitating and preventing caseum retention.



Figures 7A and 7B- Histological section of one of the crypt showing the laser action. CE crypt entrance, GC - germinal center, TL - lymphoid tissue. H&E, original magnification, X4. B) Detail of areas of damaged epithelium (a) and normal epithelium (b) pointed by arrows. H&E, original magnification, X 20 (from Passos *et al*.,[19] with permission).

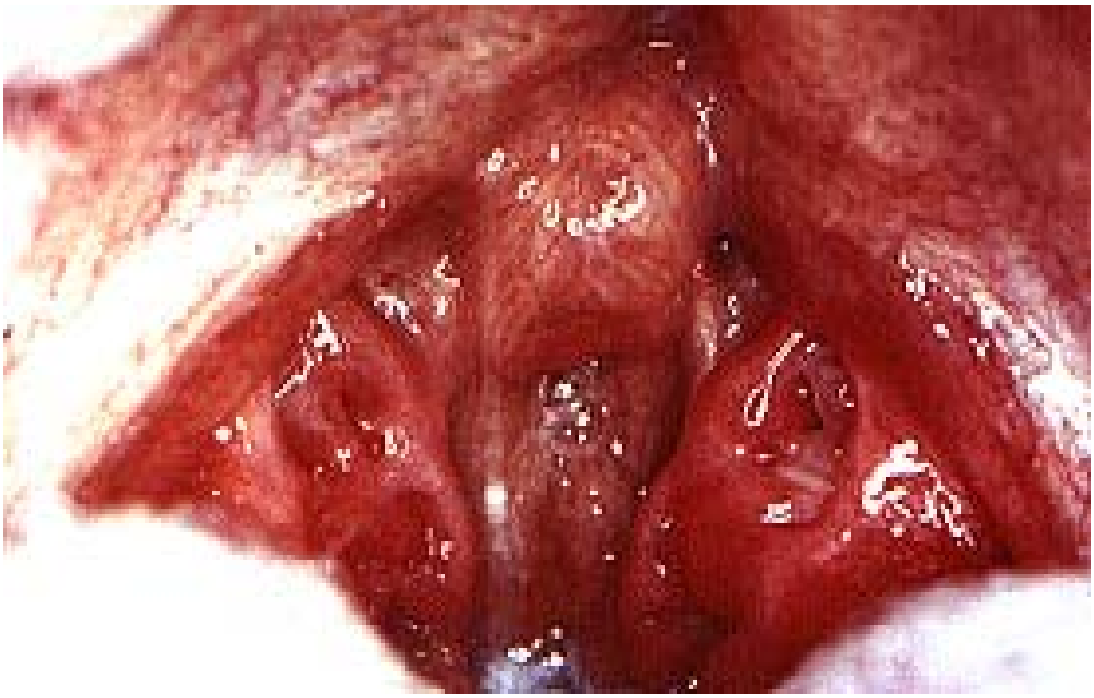


Figure 8- Aspect of the tonsil with the opened crypts after CO_2 LCC treatment (from Passos *et al*.,[15] with permission).

Two groups were created:

Group A: patients with normal halitometry values, including those who had halitometry values below 150 ppb.

Group B: patients with abnormal halitometry, including those who had halitometry values above 150 ppb.

Table 1 represents the distribution of the two studied groups in relation to sex and age.

Table 1- Distribution of the population in the groups concerning to sex and age

Patients	**Male**	**Female**	**Mean age (years)**	**Standard Deviation SD**
Group A- normal halitometry (n=30)	11 (37%)	19 (63%)	26.6	10
Grupo B- abnormal halitometry (n=8)	2 (25%)	6 (75%)	21.2	5.8
Total =38	**13 (34%)**	**25 (66%)**		

Halitometry mean values recorded throughout CO_2 LCC treatment are represented in Table 2.

Table 2- Halitometry means in Group A and Group B in the CO_2 LCC sessions

Halitometry (in ppb)	**1st**	**2nd**	**3rd**	**4th**
mean group A	55.2	52.9	60.2	58.3
SD group A	25.7	24.8	25.7	23.3
mean group B	249	273	229	121
SD group B	182	113.8	145	75

Table 3 shows that caseum was present in all patients in group B (abnormal halitometry) and in only 10% of patients in group A (normal halitometry) before treatment.

Table 3- Caseum presence in both groups before CO_2 Laser Treatment

Caseum presence at first examination	Group A	Group B	Total
Yes	3 (10%)	8 (100%)	11
No	27 (90%)	0	27
Total	**30**	**8**	**38**

Table 4 demonstrates that, at the end of treatment, caseum disappeared in all patients of group B. This improvement reflects significant amelioration of VSC halitometry in this group, as one can see in Table 5.

Table 4- Caseum presence in both groups after CO_2 Laser Treatment

Caseum presence at last examination	Group A	Group B	Total
Yes	1 (3.3%)	0	1
No	29 (96.7%)	8 (100%)	37
Total	**30**	**8**	**38**

Table 5- Friedman Test

n	chi-square	p	statistical significant
Group A =30	2.959	0.398	no
Group B = 8	10.367	0.016	yes*

*The test demonstrated that the measures of the last halitometry were, on average, less than the first and second ones.

Comparative Statistics

A) Intra - Group Comparison

Group A (normal halitometry), the Friedman test (Table 6) demonstrated that there was no statistical difference (p = 0.398) among the different halitometry measures taken before each laser session.

In Group B (abnormal halitometry), the Friedman test (Table 6) demonstrated that there was statistical difference (p = 0.016) among the halitometry measures taken at each laser session.

B) Inter - Group Comparison

The Percentual Variation of the second, third and fourth halitometry values in relation to the first were calculated. The Percentual Variation of Groups A and B were compared using the Mann-Whitney test. The difference between the PV of Group A and Group B in the fourth halitometry was statistically significant (Table 6).

Table 6- Comparison of Percentual Variation of Groups A and B (Mann-Whitney)

	PV-1A x PV-1B	**PV-2A x PV-2B**	**PV-3A x PV3B**
p	0.914	0.210	0.11

PV-1- percentual variation between the second and the first halitometry value;

PV-2- percentual variation between the third and the first halitometry value;

PV-3- percentual variation between the fourth and the first halitometry value.

The mean of the percentual variation of the halitometry values in relation to the initial halitometry was also calculated for Groups A and B. The results demonstrated that there was a decrease of 30.1% in the fourth halitometry value when compared to the first in Group B (Table 7).

Table 7- Groups A and B halitometry Percentual Variation mean

	PV-1 mean in %	PV-2 mean in %	PV-3 mean in %
Group A (n=30)	11.3	31.3	25.4
Group B (n=8)	170.6	130.1	-30.1*

VP-1- percentual variation between the second and the first halitometry value;

VP-2- percentual variation between the third and the first halitometry value;

VP-3- percentual variation between the fourth and the first halitometry value.

Discussion

Chronic Caseous Tonsillitis (CCT) is a disease that affects both genders, without predominance.[12, 15] CCT can affect individuals at any age; however, teenagers and young adults with CCT seem to be more affected by halitosis. Our studied population was composed predominantly of young adults (average age 26.3).

In this study, 38 patients with CCT were selected from a university hospital, with a wide age range and complaint of halitosis. These patients were assessed by specialists and were indicated for CO_2 laser cryptolysis by coagulation due to failure of traditional clinical treatment and trying to avoid surgical tonsillectomy in order to preserve the immunological function of the palatine tonsils.

Halitosis in CCT patients can affect men and women equally. However, the descriptive statistic of our population demonstrated that there was a predominance of young women with halitosis.

From the studied population, only eight (21%) patients with CCT had abnormal halitometry. All of these patients had caseum at examination. The other 30 patients (79%) had normal halitometry and only 10% of these patients had caseum at examination.

At first glance, these results seem paradoxal, since all patients included in this study had halitosis complaint. However, firstly, although caseum characterizes CCT, it may not be present at the exact moment of evaluation. Secondly, it is known that devices

developed to detect odorivectors may not detect halitosis in all patients, because some odorivectors are not detectable by this method. There are other odorivectors than VSC that produce halitosis (such as cadaverine, putrescine and scatol).[9,10] Those vectors are not detectable by the Halimeter®, which can detect only sulphur-related odorivectors, and as yet, there are no other devices to detect other odorivectors.

In Group A (normal halitometry), statistical tests demonstrated that there was no difference in the halitometry values throughout the laser treatment. This means that patients with normal halitometry (below 150 ppb) before treatment continued with normal values after laser treatment. It is important to notice that, in Group A, there were no side effects related to LCC, and patients experienced improvement of symptoms with regard to halitosis, sore throat, sensation of foreign bodies and caseum formation. According to Group A patients, their quality of life improved after undergoing CO_2 LCC. The presence of tonsillary caseum presence represents an increased risk to abnormal halitometry and can be considered a predictor factor for abnormal halitometry in patients with CCT (unpublished data). In group A, tonsillary caseum was present only in 10% of the patients throughout the treatment, which means that, despite complaints of halitosis, in the absence of caseum the halitometry test was normal. This would explain why most of patients of this study did not have abnormal halitometry. Caseum was not always present in Group A. Sometimes it was present in the depth of the crypt, not visible, in a very small size, or not enough to produce VSC capable of triggering the Halimeter up to 150 ppb (a value established by the Halimeter instrunction manual) but reaching values close to 150 ppb. Therefore, when there is the absence of caseum, halitometry is most likely to be normal. Sometimes, caseum is not visible upon original evaluation, but after expressing the tonsils it comes up. Sometimes the movement of swallowing presses the tonsils, and the patient ends up swallowing the caseum. So, even though caseum is not present at the time of the examination, the patient's complaint needs to be taken into account.

In Group B (abnormal halitometry) statistical tests demonstrated that there was a decrease in the halitometry values with laser treatment, culminating with the normalization of the VSC halitometry values in all patients at the end of the treatment.

These patients also experienced an improvement in their halitosis, and the caseum formation practically ceased. It is important to emphasize that all patients of this group had caseum at all halitometry tests, confirming that the presence of caseum is an increased risk for abnormal halitometry.

It is known that CO_2 LCC causes epithelium cells to exfoliate. One may argue that this debris could be substrate for bacterial proliferation, causing halitosis. Nevertheless, our study did not confirm this hypothesis, maybe because CO_2 LCC was uesd to open the crypts, thus avoiding the retention of cells debris.

When treating the tonsils with a low-energy CO_2 laser, using unfocused scanned mode, a coagulative situation is guaranteed, with no volatilization of tissue. So, the tissue volume is preserved immediately after the laser action, having only a superficial thermal effect of little penetration, but sufficient to cause contraction along the epithelial surface, with the consequent mechanical opening of the treated crypts.[19-21] Superficial coagulation and contraction is similar to that observed in resurfacing treatments.[22, 23] Mechanical opening of the crypts creates less risk of retention of debris and consequently decreases caseum formation. This explains the normalization of the VSC halitometry values in patients of Group B.

The number of patients in Group B was small, and perhaps if there had been more patients in this group, a more significant statistical difference might have been revealed.

The selected patients were few because the exclusion criteria were wide and strict. Moreover, as the laser treatment required numerous sessions there were some patients who discontinued it. Patients who abandoned the treatment before the fourth laser session were, of course, excluded. Our 3-year follow up demonstrated a decrease in tonsillitis recurrence, and there were no side effects (such as abscess formation) or other complications.

Conclusion

In a selected group of patients with Chronic Caseous Tonsillitis(CCT) and halitosis complaint, a new conservative method of CO_2 Laser Cryptolysis by Coagulation was performed in order to avoid tonsillectomy. This treatment was well tolerated, and no side effects were noted. All patients experienced an improvement of halitosis and other CCT-related symptoms. In the group of patients presenting an abnormal halitometry profile, this improvement was about 30.1%. All patients presented normal halitometry after four sessions of CO_2 Laser Cryptolysis by Coagulation.

Finally, an increase of self-esteem was noticed in both groups, with improvement in their appearance. The patients also claimed improvement in their personal relationships with partners, parents, and friends. Overall, quality of life improved for patients with CCT and halitosis complaint after undergoing CO_2 LCC treatment. The objective measures of halitometry allowed patients to monitor their own improvement in halitosis throughout the CO_2 LCC treatment, which increased their self-confidence.

References

1- Hine, K.H. (1957). Halitosis. JADA. 55, 37-46.

2- Lu, D.P. (1982). Halitosis: an etiologic classification, a treatment approach and prevention. Oral Surg. 54, 521-26.

3- Dal Rio, A.C., Franchi-Teixeira, A.R., Nicola, E.M.D. Halitosis - a proposal for assessment protocol. Rev. Bras Otorrinolaringol (in press).

4- Meningaud, J.P., Bado, F., Favre, E., Bertrand, J.C., Guilbert, F. (1999). Halitosis in 1999. Rev Stomatol Chir Maxillofac. 100, 240-244.

5- Bogdasarian, R.S. (1986). Halitosis. Otolaryngologic Clinics of North America. 19, 101-117.

6- Tonzetich, J., Richter, V.J. (1964). Evolution of odoriferous components of saliva. Arch Oral Biol. 9, 39-48.

7- Tonzetich, J. (1977). Production and origin of oral malodor: a review of mechanisms and methods of analysis. J Periodontol. 48, 13-20.

8- Tárzia, O. (2003). Halitose: um desafio que tem cura. 1ª ed. Rio de Janeiro: Ed. de Publicações Biomédicas Ltda. 75-83.

9- Uliana, R.M.B., Briques, W., Conti, R. (2002). Microbiota oral e suas repercussões no hálito. São Paulo: Odontologia Ed. Artes Médicas div. odontol. 297-308.

10- Van Steenberghe, D. (2004). Breath Malodor a step-by-step approach. 1st ed. Copenhagen: Quintessence Books. 18-68.

11- Interscan Corporation Manual Instruction. PO box 2496 - Chatsworth, CA 01311-2496. http:/www.gasdetection.com

12- Campos, C.A.H., Costa, H.O.O. (2002). Tratado de Otorrinolaringologia. 1 ed. São Paulo: Ed. Roca. 248-252.

13- Finkelstein, Y., Talmi, Y.P., Ophir, D., Berger, G. (2004). Laser cryptolysis for the treatment of halitosis. Otolaryngol Head and Neck Surg. 131, 372-377.

14- Rosemberg M. (2003). Halitose: perspectivas em pesquisa. 2nd ed. Rio de Janeiro: Ed. Guanabara Koogan S.A. 1-118.

15- Passos, C.A.C., Oliveira, F.M.Z., Nicola, J.H., Nicola, E.M.D. (2002). Criptólise por Coagulação com Laser de CO_2 em Tonsilite Crônica Caseosa: método conservador e resultados. Rev Bras Otorrinolaringol. 68, 405-410.

16- Bluestone, C.D. (1992). Current indications for tonsillectomy and adenoidectomy. Ann Otol Rhinol Laryngol. 155, 58-64.

17- Krespi, Y.P., Ling, E.H. (1994). Tonsils cryptolysis using CO_2 swiftlase. Op Tech Otolaryngol Head and Neck Surg. 5, 294-297.

18- Brugmans, M.J., Kemper, J., Gijsbers, G.H., van der Meulen, F.W., van Gemert, M.J. (1991). Temperature response of biological materials to pulsed non ablative CO_2 laser irradiation. Lasers Surg Med. 11, 587-594.

19- Passos, C.A.C., Altemani, A., Nicola, J.H., Nicola, E.M.D. (2004). Hystopathological evaluation in biopsies of palatine tonsils submitted to cryptolysis by coagulation with CO_2 laser for treatment of chronic caseous tonsillitis. Photomed Laser Surg. 22, 211-219.

20- Nicola, E.M.D., Nicola, J.H. (1994). Low power CO_2 laser in the treatment of chronic pharyngitis: a five year experience. Laser Surgery: Advanced Characterization, Therapeutics and Systems. 2128, 85-87.

21- Moore, P., Ridgway, T.D., Higbee, R.G., Howard, E.W., Lucroy, M.D. (2005). Effect of wave length on low intensity laser irradiation-stimulated cell proliferation in vitro. Lasers Surg Med. 36, 8-12.

22- Hedelund, L., Haedersdal, M., Egekvist, H., Heidenhein, M., Hans, C.W., Poulsen, T. (2005). CO_2 laser-resurfacing: increased risk of side effects after uv-exposure-an experimental animal study. Lasers Surg Med. 36, 79-84.

23- Reinish L. (2002). Scatter-limited phototherapy: a model for laser treatment of skin. Lasers Surg Med. 30, 381-388.

4- DISCUSSÃO GERAL

O impacto social da halitose ainda é motivo de pesquisa. A incidência de mau hálito na população é muito maior do que se possa imaginar. Estima-se que o mau hálito crônico afeta milhares de pessoas em todo o mundo, envolvendo gastos de bilhões de dólares anuais em produtos para melhorar o hálito (Tárzia, 2002). A maioria dos pacientes procura por produtos mascaradores do hálito e aconselhamentos de leigos, o que acaba resultando em insucesso e frustração (Rosemberg, 2003).

A halitose não representa um risco de vida, porém é distúrbio constrangedor tanto para o portador quanto para as pessoas que com ele se relacionam, portanto é um fator de restrição social que pode levar à perda de qualidade de vida. A halitose também pode ser um indicativo da presença de doenças graves que requerem diagnóstico e tratamento adequados.

Conforme abordado no Capítulo 1, há vários fatores causadores da halitose, sendo que a grande maioria está relacionada com a cavidade oral, pequena parte está relacionada com o sistema respiratório, e apenas uma porcentagem mínima está relacionada com o sistema digestivo e outros distúrbios metabólicos (Delanghe et al.; 1999; Nachnani, 1999; Netto e Müller, 2002; Uliana et al., 2002; Tárzia, 2003; Van Steenberghe, 2004). Essa visão é importante, porque vai de encontro ao pensamento atualmente generalizado de que a maioria das causas da halitose se relaciona a distúrbios do sistema disgestivo.

Várias especialidades médicas e odontológicas deparam-se com o problema da halitose em sua prática diária. Os pacientes procuram por clínicos gerais, gastroenterologistas, otorrinolaringologistas e cirurgiões dentistas, indistintamente. É muito importante que esses profissionais possuam uma linha propedêutica racional na investigação da halitose, pois os fatores causadores são muitos, e os pacientes geralmente já experimentaram frustrações prévias. Pacientes com queixa de halitose são pacientes que procuram por ajuda, geralmente ansiosos e desconfiados de qualquer tratamento, devido às experiências com tratamentos anteriores mal sucedidos.

Nem sempre a propedêutica avançada solicitada, apesar de dispendiosa, contribui para a elucidação causal. Por exemplo, a solicitação de uma endoscopia digestiva no início da investigação de halitose não se justifica, quando se levam em conta as freqüências das causas etiológicas.

Inicialmente, é preciso ter em mente que, algumas vezes, a halitose em questão pode ser fisiológica. Quando patológica, o sucesso do tratamento concentra-se na correta identificação do fator causal e sua erradicação. A presença de halitose pode estar relacionada com doenças hepáticas, metabólicas e renais graves, que devem ser investigadas.

O protocolo de investigação proposto foi elaborado com o intuito de minimizar gastos com exames e medicações pouco efetivas, diminuir a frustração dos pacientes e fornecer informações aos profissionais da área da saúde.

No Capítulo 2, foi estudado o perfil halitométrico de um grupo de 49 pacientes portadores de tonsilite crônica caseosa (TCC) e queixa de halitose. Os portadores de TCC apresentam altas taxas de halitose e presença de cáseo tonsilar em algum momento da evolução da doença. Este estudo revelou que a maioria dos pacientes com halitometria alterada apresentavam cáseo tonsilar no momento do exame e que a presença do cáseo representa um aumento de 10 vezes no risco relativo para halitometria alterada.

Isso é importante, porque, durante a avaliação e tratamento de portadores de TCC com queixa de halitose, a presença de cáseo tonsilar indica alta probabilidade de halitometria alterada e sugere tratar-se de halitose verdadeira. Como a maioria dos serviços não dispõe de halímetros na prática clínica, essa informação é relevante para a correta condução do caso.

No Capítulo 3, foi estudado o impacto do tratamento por criptólise por coagulação com *laser* de CO_2 (CCL) no perfil da halitometria dos pacientes com tonsilite crônica caseosa (TCC).

Os pacientes foram divididos em dois grupos: Grupo A - halitometria normal (abaixo de 150 ppb) e Grupo B – halitometria alterada (acima de 150 ppb).

Os pacientes com halitometria inicial normal (Grupo A) mantiveram esse perfil de normalidade ao longo do tratamento com *laser*. É importante notar que não houve nenhum efeito colateral relacionado à criptólise e que esses pacientes relataram uma melhora da queixa da halitose e diminuição da formação de cáseo.

No Grupo B (halitometria anormal), os testes estatísticos demonstraram que houve um decréscimo nos valores das halitometrias ao longo do tratamento com *laser*, culminando com a normalização das halitometrias de todos os pacientes desse grupo no final do tratamento. Esses pacientes também relataram melhora da queixa de halitose, e a formação de cáseo praticamente cessou.

Sabe-se que a criptólise por coagulação com *laser* de CO_2 causa esfoliação das células epiteliais. A abertura mecânica das criptas proporcionada pela varredura do *laser* leva à diminuição da retenção de restos celulares, restos alimentares, estagnação de saliva, diminuindo a formação de cáseo. Isso explica a normalização das halitometrias dos pacientes do Grupo B.

Finalmente, foi notada uma elevação subjetiva dos níveis de auto-estima em todos os pacientes ao longo do tratamento, exteriorizada através da melhora da aparência e cuidado físico. Além disso, os pacientes relataram melhora dos seus relacionamentos com parceiros, pais e amigos.

A qualidade de vida dos pacientes com tonsilite crônica caseosa e queixa de halitose melhorou após serem submetidos à criptólise por coagulação com *laser* de CO_2, sem ocorrência de efeitos colaterais significativos.

Esse conjunto de trabalhos salientou a importância da integração entre as diversas especialidades médicas e odontológicas no diagnóstico correto da halitose e no tratamento de uma causa específica (tonsilite crônica caseosa). Além de beneficiar pacientes, essa atividade proporcionou integração multiprofissional e aprendizado mútuo entre as equipes que dela participaram. Os conhecimentos adquiridos foram confrontados com a literatura, difundidos em aulas e seminários para médicos, estudantes e residentes, e publicados em periódicos de circulação nacional e internacional. Com isso, cumpre-se o papel da Universidade em relação à comunidade na qual se insere.

5- CONCLUSÃO GERAL

1- Foi realizada revisão pertinente da literatura sobre o tema halitose em livros-texto, artigos na base de dados ***Méd Line*** e **LILACS**, abrangendo Odontologia, Otorrinolaringologia, Gastroenterologia e a Medicina Interna.

2- Foi elaborado um protocolo para avaliação e diagnóstico causal da halitose, visando a minimizar gastos, a evitar realização de exames desnecessários e a diminuir a frustração dos pacientes.

3- Foi descrito o perfil da halitometria dos Compostos Sulfurados Voláteis em pacientes portadores de tonsilite crônica caseosa. A presença de cáseo demonstrou ser fator de alto risco para halitose e um fator preditivo para halitometria alterada nesse grupo.

4- Foi estudado o impacto da criptólise por coagulação com laser de CO_2 no perfil halitométrico de pacientes portadores de tonsilite crônica caseosa. Todos os pacientes relataram melhora da queixa de halitose com ganho em qualidade de vida. Os pacientes com halitometria alterada apresentaram normalização desta ao final do tratamento.

6- REFERÊNCIAS BIBLIOGRÁFICAS

Abbey K, Kawabata I. Computerized three-dimensional reconstruction of the crypt system of the palatine tonsil. Acta Otolaryngol 1988; 454: 39-42.

Ansai T, Takehara T. Tonsillolith as a halitosis-inducing factor. Br Dent J. 2005; 198:263-4.

Bluestone CD. Current indications for tonsillectomy and adenoidectomy. Ann Otol Rhinol Laryngol 1992; 155:58-64.

Bogdasarian RS. Halitosis. Otolaryngologic Clinics of North America 1986; 19(1):101-17.

Brugmans MJ, Kemper J, Gijsbers GH, Van Der Meulen FW, Van Gemert MJ. Temperature response of biological materials to pulsed non ablative CO_2 laser irradiation. Lasers Surg Med 1991; 11: 587-94.

Campos CAH, Costa HOO. Tratado de Otorrinolaringologia. São Paulo: Ed. Roca; 2002. p. 248-52.

Costa IM. Metodologia para o estudo das halitoses. Ars Cvrandi em Odontologia 1981; 7(11):503-8.

Costa IM. Patologia das halitoses. Odontólogo Moderno 1987; 14(6):7-16.

Dal Rio AC, Franchi-Teixeira AR, Nicola EMD. Halitosis - a proposal for assessment protocol. Rev. Bras Otorrinolaringol (*in press*).

Dal Rio AC, Franchi-Teixeira AR, Nicola EMD. Universidade Estadual de Campinas 2005, dados não publicados.

Delanghe G, Ghyselen J, Bollen C, Van Steenberghe D,Vandekerckhove BN, Feenstra L. An inventory of patients' response to treatment at a multidisciplinary breath odor clinic. Quintessence Int 1999; 30(50):307-10.

Finkelstein Y, Talmi YP, Ophir D, Berger G. Laser cryptolysis for the treatment of halitosis. Otolaryngol Head and Neck Surg 2004; 131:372-7.

Ginströn, R, Silvola J, Saarnivaara L. Local bupivacaine-epinephrine infiltration combined with general anethesia for adult tonsillectomy. Acta Oto-Laryngologica 2005; 125:972-5.

Grein NJ, Neves JF, Tommasi AF, Tetu E, Piazzetta CM, Tacla M, et al. Estomatologia para o clínico: Halitose - diagnóstico e tratamento. Odontólogo Moderno 1982; 9(6):40-5.

Hedelund L, Haedersdal M, Egekvist H, Heidenhein M, Hans CW, Poulsen T. CO_2 laser-resurfacing: increased risk of side effects after uv-exposure-an experimental animal study. Lasers Surg Med 2005; 36:79-84.

Hine KH. Halitosis. J A D A 1957; 55 (7):37-46.

Hoshi K, Yamano Y, Mitsunaga A, Shimizu S, Kagawa J, Ogiuchi H. Gastrointestinal diseases and halitosis: association of gastric Helicobacter pylori infection. Int Dent J 2002; 52:207-11.

Howe JW. The breath and the diseases which give it a fetid odor. Appleton and Co 1874; 7-8.

Interscan Corporation Manual Instruction. PO box 2496 - Chatsworth, CA 01311-2496. Disponível em: http://www.gasdetection.com

Kozlovsky A, Gordon D, Galernter I, Loesche WJ, Rosenberg M. Correlation between the BANA test and oral malodor parameters. J Dent Res 1994; 73:1036-42.

Krasse B. The proportional distribution of Streptococcus salivarius and streptococci in various parts of the mouth. Odontol Rev 1954; 5:203.

Krespi YP, Ling EH. Tonsils cryptolysis using CO_2 swiftlase. Op Tech Otolaryngol Head and Neck Surg1994; 5:294-7.

Lindhe J. Tratado de Periodontologia Clínica. 2. ed. Rio de Janeiro: Ed. Guanabara Koogan; 1992.

Lochner C, Stein DJ. Olfactory reference syndrome: diagnostic criteria and differential diagnosis. J Postgrad Med 2003; 49:328-31.

Lu DP. Halitosis: an etiologic classification, a treatment approach and prevention. Oral Surg 1982; 54(5):521-6.

Marsh P, Martin NV. Oral Microbiology. 4. ed. Oxford: 1999; p.192.

Marshall B, Howat AJ, Wright PA. Oral fluid antibody detection in the diagnosis of Helicobacter pylori infecction. J Med Microbiol 1999; 48:1043-6.

Massler M. Fetor ex. ore. Oral Surg Oral Med & Oral Path 1951; 4:110-25.

Mc Cord CP, Witheridge WN. Odors: physiology and control. New York: Mc Graw-Hill Book Co; 1949.

Meningaud JP, Bado F, Favre E, Bertrand JC, Guilbert F. Halitosis in 1999. Rev Stomatol Chir Maxillofac 1999; 100(5):240-4.

Moore P, Ridgway TD, Higbee, RG, Howard EW, Lucroy, MD. Effect of wave length on low intensity laser irradiation-stimulated cell proliferation in vitro. Lasers Surg Med 2005; 36:8-12.

Nachnani S. Oral Malodor: A Brief Review. CDHA Journal 1999; 14(2):13-5.

Netto CC, Müller KP. Distúrbios Gastrointestinais e os Odores Bucais. In: Cardoso RJA, Gonçalves EAN. Odontopediatria: prevenção. São Paulo: Ed. Artes Médicas Divisão Odontológica; 2002. p. 309-12.v. 4.

Nicola EMD, Nicola JH. Low power CO_2 laser in the treatment of chronic pharyngitis: a five year experience. Laser Surgery: Advanced Characterization, Therapeutics and Systems. 1994; 2128:85-7.

Orrico SR, Toledo BE, Fonseca L, Ito IY. Influence of age on the reactivity of the BANA test among brazilian children. Braz Dent J 1992; 2:115-22.

Page RC, Kornman KS. The Pathogenesis of human periodontitis: an introduction. Periodontology 2000 1997; 14:9-11.

Passarelli N, Gurfinkel S. Halitose. Jornal Brasileiro de Medicina 1981; 40(1):21-8.

Passos CAC, Altemani A, Nicola JH, Nicola EMD. Hystopathological evaluation in biopsies of palatine tonsils submitted to cryptolysis by coagulation with CO_2 laser for treatment of chronic caseous tonsillitis. Photomed Laser Surg 2004; 22:211-9.

Passos CAC, Oliveira FMZ, Nicola JH, Nicola EMD. Criptólise por Coagulação com Laser de CO_2 em Tonsilite Crônica Caseosa: método conservador e resultados. Rev Bras Otorrinolaringol 2002; 68(2):405-10.

Reinish L. Scatter-limited phototherapy: a model for laser treatment of skin. Lasers Surg Med 2002; 30:381-8.

Riggio MP, Leonno N. Identification by PCR of Helicobacter pylori in subgengival, plaque of adult periodontitis patients. J Med Microbiol 1999; 48:317-22.

Rocha EM, Carvalho CR, Saad MJ, Velloso LA. The influence of ageing on the insulin signalling system in rat lacrimal and salivary glands. Acta Ophtalmol Scand 2003; 81:639-45.

Rosemberg M. Halitose: perspectivas em pesquisa. Rio de Janeiro: Ed. Guanabara Koogan S.A.; 2003.

Serin E, Gumurdulu Y, Kayaselcuk F, Ozer B, Ylmaz U, Boyacioglu S. Halitosis in patients with Helicobacter pylori-positive non-ulcer dyspepsia: an indication for eradication therapy? Eur J Int Med 2003; 14:45-8.

Tárzia O. Halitose. 2. ed. Rio de Janeiro: Editora de Publicações Científicas Ltda.; 1996.

Tárzia O. Tratamento Odontológico da Halitose. In: Cardoso RJA, Gonçalves EAN. Odontopediatria: prevenção. São Paulo: Ed. Artes Médicas Divisão Odontológica; 2002. p. 317-29. v. 4.

Tárzia O. Halitose: um desafio que tem cura. Rio de Janeiro: Ed. de Publicações Biomédicas Ltda.; 2003.

Tonzetich J, Richter VJ. Evolution of odoriferous components of saliva. Arch Oral Biol 1964; 9:39-48.

Tonzetich J, NG SK. Reduction of mal odor by oral cleansing procedures. Oral Surg 1976; 42:172-81.

Tonzetich J. Production and origin of oral malodor: a review of mechanisms and methods of analysis. J Periodontol 1977; 48(1):13-20.

Tonzetich J. Prefácio (1997). In: Rosemberg M. Halitose: perspectivas em pesquisa. Rio de Janeiro: Ed. Guanabara Koogan; 2003.

Uliana RMB, Briques W, Conti R. Microbiota oral e suas repercussões no hálito. In: Cardoso RJA, Gonçalves EAN. Odontopediatria: prevenção. São Paulo: Ed. Artes Médicas Divisão Odontológica; 2002. p. 297-308. v.4.

Van Steenberghe D. Breath Malodor a step-by-step approach. Copenhagen: Quintessence Books; 2004.

Walter HE, Sayles LP. Biology of vertebrates. New York: Macmillan Co;1949. p. 774.

Yaegaki K, Sanada K. Volatile sulphur compounds in mouth air from clinically healthy subjects and patients with periodontal disease. J Periodont Res 1992; 27:233-8.

7- ANEXOS

1- Documento de confirmação de aceitação do artigo *Halitosis - a proposal for assessment protocol* para publicação na Revista Brasileira de Otorrinolaringologia.

2- Documento de confirmação de aceitação do artigo *Relationship between the presence of Tonsilloliths and Halitosis in patients with Chronic Caseous Tonsillitis* para publicação no periódico *British Dental Journal*.

3- Artigo *CO_2 Laser Cryptolysis by Coagulation for the Treatment of Halitosis* publicado pelo periódico *Photomedicine and Laser Surgery* volume 24, número 5, páginas 630-6, 2006.

4- Protocolo para avaliação de pacientes.

5- Parecer do Comitê de Ética.

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Mensagem
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São Paulo, 8 de Setembro de 2005

Ilmo(a) Sr.(a)
Prof (a), Dr(a) Ana Cristina Coelho Dal Rio

Referente ao código de fluxo: 595
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Temos o prazer de informar que o manuscrito Halitose - proposta de um protocolo de avaliação foi aprovado pelo Conselho ial do Revista Brasileira de Otorrinolaringologia e será publicado em breve.
Lembramos que algumas modificações poderão ser solicitadas até a publicação do artigo. Obrigado por submeter seu trabalho na Revista Brasileira de Otorrinolaringologia e esperamos continuar merecendo sua preferência para eventual publicação de suas pesquisas.

Atenciosamente,

Dr. Henrique O. Costa
Diretor de Publicações

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Mensagem

24th Apr 2007

Dear Dr dal Rio,

Manuscript Title: MSS-2007-048R
Title: RELATIONSHIP BETWEEN HALITOSIS AND TONSILLOLITH: OBJECTIVE APPROACH

Thank you for sending me the revised version of your paper and for making the changes recommended by the referees. I am now very happy to officially accept this paper for publication.

All future correspondence relating to your manuscript should be addressed to Miss Kate Maynard, the Assistant Editor (k.maynard@nature.com). Please remember to quote the manuscript number at the top of this letter.

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As you will no doubt have noticed the design of the British Dental Journal includes an 'in-brief' box for most of our papers. I would be grateful if you could follow the suggested guidelines in the enclosed sheet. If you have not already done so, I would ask you to send back three to five bullet points we can use. Please note that these are not intended to be a summary of the content of the paper but more a summary of the benefit to the average reader of the findings of the paper.

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Yours sincerely,
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Anexos

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Photomedicine and Laser Surgery
Volume 24, Number 5, 2006

Pp. 630–636

CO_2 Laser Cryptolysis by Coagulation for the Treatment of Halitosis

ANA C. DAL RIO, M.Sc., CÂNDIDA A.C. PASSOS, Ph.D.,
JORGE H. NICOLA, Ph.D., and ESTER M.D. NICOLA, M.D., Ph.D.

ABSTRACT

Objective: **The aim of this study was to evaluate the impact of CO_2 laser cryptolysis by coagulation (LCC) treatment in the volatile sulphur compounds (VSC) halitometry in patients with chronic caseous tonsillitis (CCT).** ***Background Data:*** **Caseum retention and halitosis characterize CCT. Failure of clinical treatment indicated tonsillectomy. Recently, a conservative new treatment, CO_2 LCC, has been introduced. It is painless and opens the crypt ostium, thus avoiding caseum retention. Halitometry is an objective new method for halitosis diagnosis. It measures VSC in parts per billion (ppb) in breathed air.** ***Methods:*** **Thirty-eight patients with CCT and complaints of halitosis were selected, underwent physical examination and halitometry measurements, and then received four sessions of LCC. The laser technique consisted of 6-W applications, in scanned and unfocused mode, around crypts, following the shape of their openings (fluence 54.5 joules/cm^2) and, afterwards, over the entire tonsillar surface (fluence 18 joules/cm^2). Halitometries were done before each LCC session.** ***Results:*** **LCC was well tolerated by all patients, and all patients showed improvement in halitosis after LCC treatment. Eight patients (21%) had abnormal halitometry (>150 ppb) before treatment, but after LCC sessions their halitometry values became normal. These patients had caseum at examination. VSC measurement was reduced by 30.1%, and caseum retention was significantly decreased in this group.** ***Conclusion:*** **Abnormal halitometry in this population is related to the presence of caseum. LCC is safe, well tolerated, and improves complaints of halitosis in patients with CCT. Improvement was related to a decrease in caseum retention. Patients with abnormal halitometry had VSC halitometry improvement of approximately 30%.**

INTRODUCTION

THERE ARE MANY CAUSES of halitosis, but most of them are related to the oral cavity (90%); others are related to otolaryngology and respiratory diseases (8%). Gastrointestinal diseases, liver/renal impairment, and other metabolic syndromes are minor causes (2%).[1–5]

Halitosis is primarily related to the decomposition of organic material by anaerobic proteolytic bacteria, consequently increasing the production of odorivectors such as volatile sulphur compounds (VSC) exhaled during breathing.

Hydrogen sulfide, methylmercaptans, and dimethylsulfide are the VSC most responsible for breath malodor and they are easily perceived by human sense of smell.[6–8] There are other odorivectors (such as cadaverine, putrescine, and scatol) that are much less offensive to the human sense of smell than VSC.[8,9]

Recently, methods and instruments have been developed to identify and quantify substances present in the breathed air.[8,10] The Halimeter® is a device with an electrochemical voltammeter sensor that generates a signal when exposed to VSC sulphur compounds. It has a digital display that records the quantity of VSC in parts per billion (ppb) present in the expired air. Results below 150 ppb are considered normal.[11] The Halimeter® is one of the most common devices used that allows a correct diagnosis, follow-up, and reassessment of halitosis.[8,10]

Palatine tonsils contain crypts (Fig. 1), which are twisted tubular invaginations extending from the tonsillar surface and

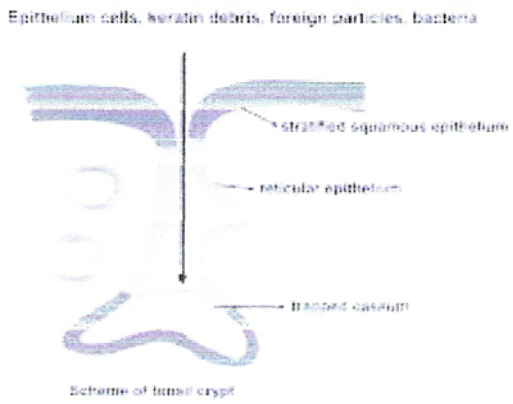

FIG. 1. Scheme of palatine tonsil crypt.

penetrating deeply through the parenchyma.[12,13] These crypts, depending on the depth, may retain exfoliated epithelium cells, keratin debris, and foreign particles, causing the accumulation of secretion and caseum formation. Therefore, palatine tonsils are the most suitable sites for the activity of anaerobic bacteria in the upper airway system.[13,14]

Chronic caseous tonsillitis (CCT) is a common disease at ear, nose, and throat (ENT) clinics, and complaints of halitosis among patients with CCT are prevalent (about 77%).[15] This complaint can be very disabling for the patient. Caseum formation and its retention inside the tonsil crypts characterize CCT. Caseum retention also may cause inflammation, leading to hyperemia and hypertophy of the tonsils (Fig. 2). Other CCT-related symptoms are throat irritation and sensation of foreign bodies. CCT affects both men and women at any age, in all kinds of tonsils, without any relation to their size, and can occur on one or both sides.[12,15] Clinically, tonsil caseum is strongly related to halitosis complaint.[13,15] However, an objective measure of halitosis (VSC halitometry) in patients with CCT has not been described previously in the literature.

The initial approach for CCT includes the use of topical antiseptics, anti-inflamatories, and oral antibiotics. When this clinical treatment does not bring relief, surgical excision of the tonsils is indicated.[13,1516]

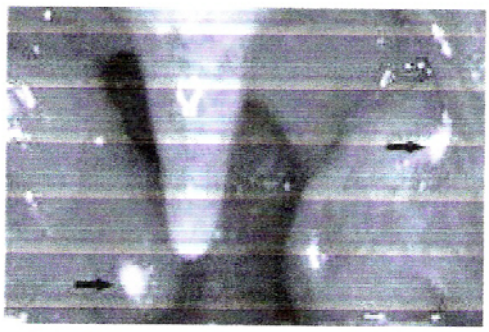

FIG. 2. Tonsil with caseum (arrows) causing hyperemia and hypertophy in the palatine tonsils.

Recently, a less invasive therapy has been proposed for CCT treatment in order to preserve the tonsils due to their importance in local immunological process.[15,17] This therapy is CO_2 laser cryptolysis by coagulation (LCC). LCC is tolerated quite well by patients and is virtually painless. The treatment takes four to six sessions on average, with an interval of 4 weeks between laser sessions. The coagulation is obtained with moderate CO_2 laser power density, reaching temperatures in the tonsillary tissue of 50–100°C. Consequently, there is dehydration, whitening, and contraction of the tissue due to protein and collagen denaturation.[15,18] With this technique, which is more conservative than conventional ones using the CO_2 laser, the laser/tissue interaction occurs only superficially in the epithelial layer, widening the tonsillar ostium, reducing crypt depth and decreasing caseum retention.[15,19]

Recent studies have shown that patients with CCT treated by CO_2 LCC reported a considerable clinical improvement of halitosis.[15,19] However, a systematic and objective study using the VSC halitometry in these patients has not yet been described. The study of halitosis in these patients is justified since it is a very common symptom among these patients, and CO_2 LCC is a relatively new technique.

The aim of this study is to evaluate the impact of CO_2 LCC on the VSC halitometry profile of patients with CCT and complaints of halitosis.

METHODS

Study design

Thirty-eight adult patients of both genders, with CCT diagnosis and halitosis complaint, were selected at the Medicine Laser Unit of the University Hospital Center. These patients were evaluated by a multiprofessional team that included a senior otolaryngologist, a specialist in internal medicine, and a senior dentist.

Selection criteria

All patients were assessed at the ENT outpatient clinic at the State University of Campinas (UNICAMP). They underwent anamnesis and complete clinical/oral examinations, and answered questions related to food habits, oral hygiene, medical history, and use of medications. After failure with conventional clinical treatment for CCT, they were selected for CO_2 LCC.

The exclusion criteria were patients with prothesis or restorations not well adapted, presence of periodontal diseases, tooth decay, exposed tooth pulps, presence of infection of the soft tissue of the oral cavity, presence of systemic diseases (such as gastrointestinal, pulmonary, hepatic, endocrine, autoimmune, or other metabolic disorders), and pregnancy. Smokers, heavy alcoholic drinkers (more than 30 g of alcohol/day), drug users, those taking any kind of regular medication, and those with xerostomia were also excluded. Except for the CCT, all patients had a normal medical history. These criteria were established to exclude other causes of halitosis.

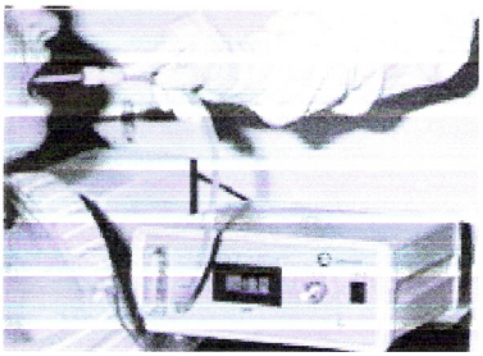

FIG. 3. Halitometry technique.

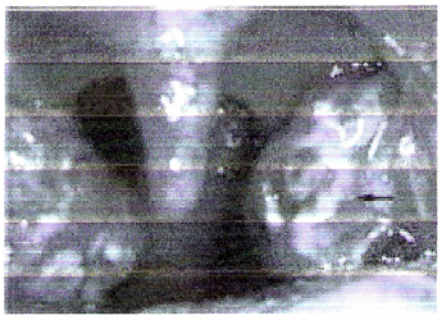

FIG. 4. Laser around the crypt (arrow). The laser fluence applied around the crypt was approximately 54.5 joules/cm².

The patients underwent four CO_2 LCC sessions with an interval of 4 weeks between the sessions. At each session, all patients were reassessed concerning symptom improvement.

The VSC halitometry test was performed immediately before each laser session. The halitometry values were recorded for statistical analysis.

Halitometry technique

Preparation. All patients received instructions before the halitometry to abstain from oral mouthwash or toothpaste, from chewing gum, and from spicy or seasoned food at least three h before halitometry, and to not fast for a period of more than four h.

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

Technique. Halitometry was always performed in the same time period, at the beginning of the afternoon, on Monday, at the Multidisciplinary Group of Laser Medicine at State University of Campinas Hospital. The VSC halitometry technique (Fig. 3) followed the instruction manual for the Halimeter® (Halimeter RH-17 Series, Interscan Corp., Chatsworth, CA).

Device. The Halimeter® device was trimmed before every measurement. The technique consisted of having the patient keeping his/her mouth closed for 3 min prior to testing, trimming the Halimeter® to zero, inserting a sterile straw probe 2 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 holding one's breath for the few seconds of testing, until a peak value is obtained which will occur in 8–10 sec on average. The display 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.

Laser cryptolisys technique

The CO_2 laser used in this study was Sharplan 40C with nominal power of 40 W (CO_2 Surgical Lasers System, Sharplan Lasers, Inc., Israel) attached to an articulated arm, handpiece, and a scanner accessory (*Swiftlase*). A smoke aspirator with biological filter, frontal light beam to illuminate the orophaynx, and protection glasses for the patient and medical team were also used. The coagulation technique with CO_2 laser,[15] consisted of applications of 6 W of continuous wave (CW) laser power, in scanned and unfocused mode, over a mean area of 2.2 mm², initially only around the crypts and following the shape of their openings (Fig. 4). The laser fluence applied around the crypt was about 54.5 joules/cm². At a subsequent time, the laser beam was swept over the entire tonsillar surface with a fluence of about 18 joules/cm² (Fig. 5). It is important that the handpiece not touch the tonsils and be lined up with the labial commissura. This procedure was repeated every 4 weeks, 4 sessions in total for each patient.

To calculate the laser fluence applied around the crypt, the sweeping speed was estimated to be 5 mm/sec, the laser beam diameter 2.2 mm, and a laser power of 6 W, resulting in a energy density, or fluence, of 54.5 joules/cm². The laser was swept over the tonsilar surface at an estimated speed of 15 mm/sec, resulting in a fluence of about 18 joules/cm².

The patients were advised not to eat spices, seasonings, or acidic food, and to avoid hard or crisp food during the 2 first days after the procedure.

FIG. 5. Laser over the tonsil with a fluence of approximately 18 joules/cm².

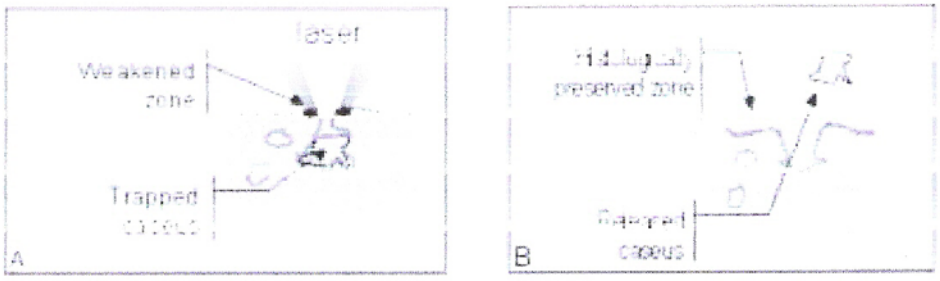

FIG. 6. Schematic representation of CO_2 laser cryptolysis by coagulation (LCC) procedure. (**A**) Low-energy density is applied around the crypt, causing an immediate weakening zone hit by the laser beam. (**B**) CO_2 laser caused the widening of the opening ostium and shallowing of the crypt, resulting in elimination of debris and of other residues, thus facilitating and preventing caseum retention.

Data treatment

An electronic data sheet was created using Microsoft Windows Excel® software with name, registration number, age, gender, the three halitometry values (in ppb of VSC), and the mean of the three measurements (in ppb of VSC).

Statistical analysis

The mean of the three halitometry values of each patient obtained before each laser session was used for the statistical analysis. Non-parametric tests were used because the population was considered to have a distribution different from normal.

The different halitometry measures were compared within the same group and between the two groups. The Friedman test was used for the intra-group comparison to analyze the halitometry profile in a population throughout treatment.

Comparisons between the groups were made using the Mann-Whitney test. Percentual variation (PV) between the second, third, and fourth laser sessions, in relation to initial halitometry, was calculated in both groups.

The PV formula was as follows:

$$PV = 100 \times (\text{halitometry}_i - \text{halitometry}_1)/(\text{halitometry}_1)$$

where i = 2, 3, or 4, indicating the halitometry value of the second, third, and fourth laser sessions, and halitometry_1 = initial halitometry value. Rejection level (p) was fixed at a value of ≤ 0.05.

RESULTS

The studied population was composed of 38 patients (13 male, 25 female), with a mean age of 26 years old (SD = 9.59).

The action of CO_2 LCC was superficial, causing only epithelial coagulation, with no significant tissue slough after each laser application. This enabled a weakening of the tension forces in the crypt borders, causing them to open. This effect resulted in the reduction and even disappearance of caseum retention.

Figure 6 illustrates the laser action in the crypts.

Two groups were created:

- Group A: Patients with normal halitometry values, including those who had halitometry values below 150 ppb
- Group B: Patients with abnormal halitometry, including those who had halitometry values above 150 ppb

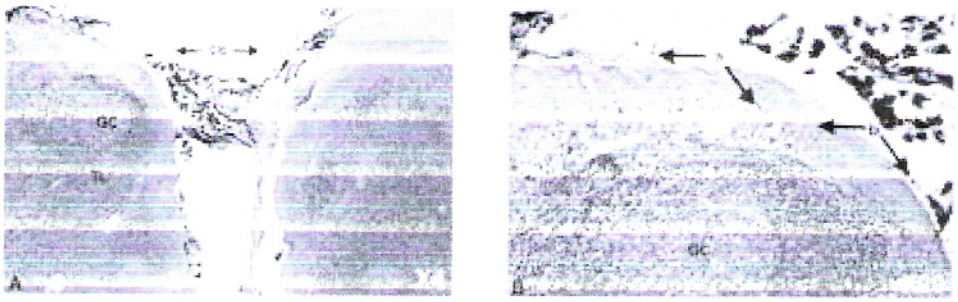

FIG. 7. (**A**) Histological section of one of the crypts showing the laser action. CE, crypt entrance; GC, germinal center; LT, lymphoid tissue. Original magnification, ×4; H&E stain. (**B**) Detail of areas of damaged epithelium (a) and normal epithelium (b) pointed by arrows. Original magnification, ×20; H&E stain. (From Passos et al.,[19] with permission.)

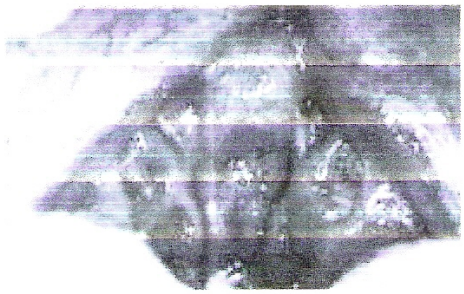

FIG. 8. Aspect of the tonsil with the crypts opened after CO_2 laser cryptolysis by coagulation (LCC) treatment. (From Passos et al.,[15] with permission.)

Table 1 represents the distribution of the two studied groups in relation to sex and age.

Halitometry mean values recorded throughout CO_2 LCC treatment are represented in Table 2.

Comparative statistics

Intra-group comparison. Group A (normal halitometry), the Friedman test (Table 6) demonstrated that there was no statistical difference ($p = 0.398$) among the different halitometry measures taken before each laser session. In Group B (abnormal halitometry), the Friedman test (Table 6) demonstrated that there *was* statistical difference ($p = 0.016$) among the halitometry measures taken at each laser session.

Intergroup comparison. The PV of the second, third, and fourth halitometry values in relation to the first were calculated. The PV of Groups A and B were compared using the Mann-Whitney test. The difference between the PV of Group A and Group B in the fourth halitometry was statistically significant (Table 6).

The mean of the PV of halitometry values in relation to initial halitometry was also calculated for Groups A and B. The results demonstrated that there was a decrease of 30.1% in the fourth halitometry value when compared to the first in Group B (Table 7).

TABLE 1. DISTRIBUTION OF THE POPULATION IN GROUPS ACCORDING TO SEX AND AGE

Patients	*Male*	*Female*	*Mean age (years)*	*SD*
Group A, normal halitometry ($n = 30$)	11 (37%)	19 (63%)	26.6	10
Group B, abnormal halitometry ($n = 8$)	2 (25%)	6 (75%)	21.2	5.8
Total ($n = 38$)	13 (34%)	25 (66%)	—	—

TABLE 2. HALITOMETRY MEANS IN GROUPS A AND B IN THE CO_2 LCC SESSIONS

Halitometry (in ppb)	*1st*	*2nd*	*3rd*	*4th*
Group A				
Mean	55.2	52.9	60.2	58.1
SD	25.7	24.8	25.7	23.1
Group B				
Mean	249	273	229	121
SD	182	113.8	145	75

LCC, laser cryptolysis by coagulation; SD, standard deviation.

TABLE 3. CASEUM PRESENCE IN BOTH GROUPS BEFORE CO_2 LASER TREATMENT

Caseum presence at first examination	*Group A*	*Group B*	*Tot*
Yes	3 (10%)	8 (100%)	11
No	27 (90%)	0	27
Total	30	8	38

TABLE 4. CASEUM PRESENCE IN BOTH GROUPS AFTER CO_2 LASER TREATMENT

Caseum presence at last examination	*Group A*	*Group B*	*Tot*
Yes	1 (3.3%)	0	1
No	29 (96.7%)	8 (100%)	37
Total	30	8	38

TABLE 5. FRIEDMAN TEST

n	*Chi-square*	*p*	*Statistical significanc*
Group A = 30	2.959	0.398	No
Group B = 8	10.367	0.016	Yes[a]

[a]The test demonstrated that the measures of the last halitometry were, on average, less than the first and second ones.

TABLE 6. COMPARISON OF PERCENTUAL VARIATION OF GROUPS A AND B (MANN-WHITNEY)

	$PV\text{-}1_A \times PV\text{-}1_B$	$PV\text{-}2_A \times PV\text{-}2_B$	$PV\text{-}3_A \times PV3$
p	0.914	0.210	0.11

PV-1, percentual variation between the second and the first halitometry value; PV-2, percentual variation between the third and the first halitometry value; PV-3, percentual variation between the fourth and the first halitometry value.

TABLE 7. HALITOMETRY PERCENTUAL VARIATION MEAN OF GROUPS A AND B

	PV-1 mean, %	*PV-2 mean, %*	*PV-3 mean, %*
Group A ($n = 30$)	11.3	31.3	25.4
Group B ($n = 8$)	170.6	130.1	−30.1

VP-1, percentual variation between the second and the first halitometry value; VP-2, percentual variation between the third and the first halitometry value; VP-3, percentual variation between the fourth and the first halitometry value.

DISCUSSION

CCT is a disease that affects both genders, without predominance.[12,15] CCT can affect individuals at any age; however, teenagers and young adults with CCT seem to be more affected by halitosis. Our studied population was composed predominantly of young adults (average age, 26.3).

In this study, 38 patients with CCT were selected from a university hospital, with a wide age range and complaint of halitosis. These patients were assessed by specialists and were indicated for CO_2 LCC due to failure of traditional clinical treatment and trying to avoid surgical tonsillectomy in order to preserve the immunological function of the palatine tonsils.

Halitosis in CCT patients can affect men and women equally. However, the descriptive statistic of our population demonstrated that there was a predominance of young women with halitosis. From the studied population, only eight (21%) patients with CCT had abnormal halitometry. All of these patients had caseum at examination. The other 30 patients (79%) had normal halitometry, and only 10% of these patients had caseum at examination.

At first glance, these results seem paradoxal, since all patients included in this study had halitosis complaints. However, firstly, although caseum characterizes CCT, it may not be present at the exact moment of evaluation. Secondly, it is known that devices developed to detect odorivectors may not detect halitosis in all patients, because some odorivectors are not detectable by this method. There are odorivectors other than VSC that produce halitosis (such as cadaverine, putrescine, and scatol).[9,10] Those vectors are not detectable by the Halimeter®, which can detect only sulphur-related odorivectors, and as yet, there are no other devices to detect other odorivectors.

In Group A (normal halitometry), statistical tests demonstrated that there was no difference in the halitometry values throughout the laser treatment. This means that patients with normal halitometry (below 150 ppb) before treatment continued with normal values after laser treatment. It is important to note that, in Group A, there were no side effects related to LCC, and patients experienced improvement of symptoms with regard to halitosis, sore throat, sensation of foreign bodies, and caseum formation. According to Group A patients, their quality of life improved after undergoing CO_2 LCC. The presence of tonsillary caseum represents an increased risk to abnormal halitometry and can be considered a predictor factor for abnormal halitometry in patients with CCT (unpublished data). In Group A, tonsillary caseum was present in only 10% of the patients throughout the treatment, which means that, despite complaints of halitosis, in the absence of caseum the halitometry test was normal. This would explain why most of patients of this study did not have abnormal halitometry. Caseum was not always present in Group A. Sometimes it was present in the depth of the crypt, not visible, in a very small size, or not enough to produce VSC capable of triggering the Halimeter up to 150 ppb (a value established by the Halimeter instruction manual) but reaching values close to 150 ppb. Therefore, when there is the absence of caseum, halitometry is most likely to be normal. Sometimes, caseum is not visible upon original evaluation, but after expressing the tonsils it comes up. Sometimes the movement of swallowing presses the tonsils, and the patient ends up swallowing the caseum. So, even though caseum is not present at the time of the examination, the patient's complaint needs to be taken into account.

In Group B (abnormal halitometry), statistical tests demonstrated that there was a decrease in halitometry values with laser treatment, culminating with the normalization of VSC halitometry values in all patients at the end of treatment. These patients also experienced an improvement in their halitosis, and caseum formation practically ceased. It is important to emphasize that all patients of this group had caseum at all halitometry tests, confirming that the presence of caseum is an increased risk for abnormal halitometry.

It is known that CO_2 LCC causes epithelium cells to exfoliate. One may argue that this debris could be substrate for bacterial proliferation, causing halitosis. Nevertheless, our study did not confirm this hypothesis, maybe because CO_2 LCC was used to open the crypts, thus avoiding the retention of cells debris.

When treating the tonsils with a low-energy CO_2 laser, using unfocused scanned mode, a coagulative situation is guaranteed, with no volatilization of tissue. So, the tissue volume is preserved immediately after the laser action, having only a superficial thermal effect of little penetration, but sufficient to cause contraction along the epithelial surface, with consequent mechanical opening of the treated crypts.[19–21] Superficial coagulation and contraction is similar to that observed in resurfacing treatments.[22,23] Mechanical opening of the crypts creates less risk of retention of debris and consequently decreases caseum formation. This explains the normalization of the VSC halitometry values in patients of Group B.

The number of patients in Group B was small, and perhaps if there had been more patients in this group, a more significant statistical difference might have been revealed.

The selected patients were few because the exclusion criteria were wide and strict. Moreover, as laser treatment required numerous sessions, there were some patients who discontinued it. Patients who abandoned the treatment before the fourth laser session were, of course, excluded. Our 3-year follow-up demonstrated a decrease in tonsillitis recurrence, and there were no side effects (such as abscess formation) or other complications.

CONCLUSION

In a selected group of patients with CCT and halitosis complaint, a new conservative method of CO_2 LCC was performed in order to avoid tonsillectomy. This treatment was well tolerated, and no side effects were noted. All patients experienced an improvement of halitosis and other CCT-related symptoms. In the group of patients presenting an abnormal halitometry profile, this improvement was approximately 30.1%. All patients presented normal halitometry after four sessions of CO_2 LCC.

Finally, an increase of self-esteem was noticed in both groups, with improvement in their appearance. Patients also claimed improvement in their personal relationships with partners, parents, and friends. Overall, quality of life improved for patients with CCT and halitosis complaint after undergoing CO_2 LCC treatment. The objective measures of halitometry allowed patients to monitor their own improvement in halitosis throughout the CO_2 LCC treatment, which increased their self-confidence.

REFERENCES

1. Hine, K.H. (1957). Halitosis. JADA 55, 37–46.
2. Lu, D.P. (1982). Halitosis: an etiologic classification, a treatment approach and prevention. Oral Surg. 54, 521–526.
3. Dal Rio, A.C., Franchi-Teixeira, A.R., and Nicola, E.M.D. (2006). Halitosis—a proposal for assessment protocol. Rev. Bras. Otorrinolaringol. (in press).
4. Meningaud, J.P., Bado, F., Favre, E., et al. (1999). Halitosis in 1999. Rev. Stomatol. Chir. Maxillofac. 100, 240–244.
5. Bogdasarian, R.S. (1986). Halitosis. Otolaryngol. Clin. North Am. 19, 101–117.
6. Tonzetich, J., and Richter, V.J. (1964). Evolution of odoriferous components of saliva. Arch. Oral Biol. 9, 39–48.
7. Tonzetich, J. (1977). Production and origin of oral malodor: a review of mechanisms and methods of analysis. J. Periodontol. 48, 13–20.
8. Tárzia, O. (2003). *Halitose: Um Desafio Que Tem Cura,* 1st ed. [in Spanish]. Rio de Janeiro: Ed. de Publicações Biomédicas Ltda.
9. Uliana, R.M.B., Briques, W., Conti, R. (2002). *Microbiota Oral e Suas Repercussões No Hálito* [in Spanish]. São Paulo: Odontologia Ed. Artes Médicas Div. Odontol.
10. Van Steenberghe, D. (2004). *Breath Malodor—A Step-by-Step Approach,* 1st ed. Copenhagen: Quintessence Books.
11. *Interscan Corporation Manual of Instruction.* (2006). Available at www.gasdetection.com.
12. Campos, C.A.H., and Costa, H.O.O. (2002). *Tratado de Otorrinolaringologia,,* 1st ed. [in Spanish]. São Paulo: Ed. Roca.
13. Finkelstein, Y., Talmi, Y.P., Ophir, D., et al. (2004). Laser cryptolysis for the treatment of halitosis. Otolaryngol. Head Neck Surg 131, 372–377.
14. Rosemberg M. (2003). *Halitose: Perspectivas em Pesquisa,* 2nd ed. [in Spanish]. Rio de Janeiro: Ed. Guanabara Koogan S.A.
15. Passos, C.A.C., Oliveira, F.M.Z., Nicola, J.H., et al. (2002). Criptólise por Coagulação com Laser de CO_2 em Tonsilite Crônica Caseosa: método conservador e resultados [in Spanish]. Rev. Bras Otorrinolaringol. 68, 405–410.
16. Bluestone, C.D. (1992). Current indications for tonsillectomy and adenoidectomy. Ann. Otol. Rhinol. Laryngol. 155, 58–64.
17. Krespi, Y.P., and Ling, E.H. (1994). Tonsils cryptolysis using CO_2 Swiftlase. Oper. Techniq. Otolaryngol. Head Neck Surg. 5, 294–297.
18. Brugmans, M.J., Kemper, J., Gijsbers, G.H., et al. (1991). Temperature response of biological materials to pulsed nonablative CO_2 laser irradiation. Lasers Surg. Med. 11, 587–594.
19. Passos, C.A.C., Altemani, A., Nicola, J.H., et al. (2004) Hystopathological evaluation in biopsies of palatine tonsils submitted to cryptolysis by coagulation with CO_2 laser for treatment of chronic caseous tonsillitis. Photomed. Laser Surg. 22, 211–219
20. Nicola, E.M.D., and Nicola, J.H. (1994). Low-power CO_2 laser in the treatment of chronic pharyngitis: a five-year experience. Laser Surg. 2128, 85–87.
21. Moore, P., Ridgway, T.D., Higbee, R.G., et al. (2005). Effect of wave length on low intensity laser irradiation-stimulated cell proliferation *in vitro*. Lasers Surg. Med. 36, 8–12.
22. Hedelund, L., Haedersdal, M., Egekvist, H., et al. (2005). CO_2 laser-resurfacing: increased risk of side effects after UV exposure—an experimental animal study. Lasers Surg. Med. 36, 79–84.
23. Reinish, L. (2002). Scatter-limited phototherapy: a model for laser treatment of skin. Lasers Surg. Med. 30, 381–388.

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PROTOCOLO PARA AVALIAÇÃO DOS PACIENTES

EXAME DE HALITOMETRIA

Nome:
Sexo:
Idade:
Data:

Exame realizado com aparelho ***Halimeter RH 17 Interscan®-USA,*** calibrado previamente segundo normas da **Interscan International.**

Data	Primeira medida	Segunda medida	Terceira medida	Média

Resultados expressos em partes por bilhão de Compostos Voláteis Sulfúricos (CVS), segundo normas da INTERSCAN, 1999 (dp=10pb).
Resultado normal para o dia: até 150 ppb.

ANAMNESE

NOME:

SEXO: IDADE: DATA DE NASCIMENTO:

CARGO OU FUNÇÃO:

QUEIXA DE HALITOSE: SIM NÃO

QUEM DETECTOU:

HÁ QUANTO TEMPO:

1. NUTRIÇÃO

ALIMENTAÇÃO:

DIETA PREFERENCIAL:

LANCHES:

ALIMENTOS ALÍLICOS (alho, cebola):

SALADAS CRUAS:

CAFEZINHO:

CONSUMO DE ÁGUA (COPOS POR DIA):

DIÁRIO ALIMENTAR

CAFÉ:

ALMOÇO:

LANCHE:

JANTAR:

2. QUESTIONÁRIO ODONTOLÓGICO:

FREQÜÊNCIA DE ESCOVAÇÃO:

USO DO FIO DENTAL:

PERIODICIDADE DAS CONSULTAS ODONTOLÓGICAS:

FAZ ALGUM TIPO DE PROFILAXIA ESPECÍFICA:
ESCOVAÇÃO DA LÍNGUA:

HISTÓRICO DE CÁRIES:

HISTÓRICO DE DOENÇAS PERIODONTAIS:

ANTECEDENTES CIRÚRGICOS:

USO DE APARELHO ORTODÔNTICO:

USO DE PRÓTESE:

3. QUESTIONÁRIO OTORRINOLARINGOLÓGICO:

HISTÓRICO DE SINUSITES, RINITES, FARINGITES:

FORMAÇÃO DE CÁLCULOS AMIGDALIANOS:

CEFALÉIA:

OTITES DE REPETIÇÃO:

DESCARGA RETROFARÍNGEA

4. QUESTIONÁRIO GASTROENTEROLÓGICO

AZIA:

GASTRITE:

DIABETES:

MÁ DIGESTÃO:

ANTECEDENTES DE NEFROPATIA

HEPATOPATIA:

HÁBITO INTESTINAL:
OBSTIPAÇÃO:

5. HÁBITOS

CIGARRO:

ÁLCOOL:

USA ENXAGÜANTES: QUAIS: HÁ QUANTTC
TEMPO ?

FAZ USO DE MEDICAÇÕES: QUAIS:

6. TRATAMENTOS UTILIZADOS

QUAIS TRATAMENTOS JÁ TENTOU: RESULTADO:

7. IMPRESSÃO DIAGNÓSTICA E COMENTÁRIOS:

8. EVOLUÇÃO:

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CEP, 19/08/03
(Grupo III)

PARECER PROJETO: N° 126/2003

I-IDENTIFICAÇÃO:

PROJETO: **"ESTUDO DA HALITOSE EM PACIENTES COM TONSILITE CRÔNICA CASEOSA, TRATADOS POR CRIPTÓLISE COM LASER DE CO2"**
PESQUISADOR RESPONSÁVEL: Ana Cristina Coelho Dal Rio Teixeira.
INSTITUIÇÃO: Departamento de Otorrinolaringologia UNICAMP
APRESENTAÇÃO AO CEP: 09/04/2003
APRESENTAR RELATÓRIO EM: 19/02/04 e 19/08/04

II - OBJETIVOS

Estudar a incidência da queixa de halitose em pacientes com tonsilite crônica caseosa; diagnosticar a halitose nos pacientes com tonsilite crônica caseosa através da halitometria de compostos sulfurados voláteis; avaliar a melhora da queixa da halitose após tratamento da tonsilite crônica caseosa por criptólise por coagulação com laser de CO2.

III - SUMÁRIO

Nesse protocolo está previsto que os voluntários, sujeitos da pesquisa, que atendam aos critérios de inclusão serão tratados de acordo com o proposto para tonsilite crônica - criptólise por coagulação com laser de CO2 - antes do início do tratamento e após seu término, os pacientes passarão por avaliação da halitose através de equipamento específico (halimeter) esse procedimento consiste na colocação de uma cânula de plástico descartável na cavidade oral para avaliar o ar expirado. Os critérios de inclusão/exclusão estão estabelecidos e existe um termo de consentimento.

IV - COMENTÁRIOS DOS RELATORES

Após nova avaliação e respondidas as pendências ressaltadas pelos assessores, recomendamos sua aprovação por estar de acordo com as normas da Resolução 196/96 e complementares.