

Effectiveness of Cryptolysis for the Treatment of Halitosis: A Systematic Review

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Abstract: **Background:** Chronic caseous tonsillitis is characterized by caseum retention and halitosis. When other treatments failed, a tonsillectomy was suggested. Cryptolysis is a new conservative treatment that has recently been offered. It is painless and opens the crypt ostium, which prevents caseum retention. Halitometry is a new objective method for determining whether or not someone has halitosis. The number of volatile sulfur compounds breathed in air is measured in parts per billion (ppb). **Aim:** To investigate the effectiveness of cryptolysis for treating halitosis produced by chronic foetid tonsillitis and to evaluate the tonsils as a source of halitosis. **Methods:** A literature search was conducted using PubMed, Elsevier science direct, Wiley online library, Ovid Medline, Cochrane library, Lilacs, and Google scholar using the MeSH terms-cryptolysis, halitosis. Of the 91 articles scanned, 23 were full-text papers evaluated for eligibility, and four were chosen for qualitative analysis. The study was reported based on Preferred Reporting Items for Systematic Reviews and Meta-Analysis, and bias was characterized by Modified Newcastle- Ottawa quality assessment scale. The evaluation process includes four clinical studies. **Results:** After treatment, all patients improved their halitosis and responded well to cryptolysis. The presence of caseum was detected during testing, and caseum retention was significantly reduced. Finkelstein's tests were all positive before cryptolysis. There were no difficulties or harmful side effects. **Conclusion:** Chronic foetid tonsillitis remains a common source of halitosis after omitting dental or periodontal diseases, sinonasal, oral, pulmonary, or gastroenterological diseases as causes of halitosis. Cryptolysis is safe, cost-effective, easily applicable, well-tolerated and improves complaints of halitosis in patients with chronic caseous tonsillitis.

Keywords: Chronic foetid tonsillitis, Cryptolysis, Halitosis, Radiology, Treatment.

1. Introduction

Individuals, families, and societal equivalents can suffer from halitosis. Oral cavity diseases, trailed by sinonasal sicknesses, are the most widely recognized reasons for halitosis. Different causes are problems of the respiratory and gastrointestinal frameworks, liver/renal issues and metabolic conditions [2]-[5]. Halitosis is caused by anaerobic proteolytic bacteria decomposing organic matter, generating odorivectors

such as volatile sulphur compounds (VSC) exhaled during breathing [6], [7]. The VSCs mainly responsible for breath malodor include hydrogen sulphide, methyl mercaptans, and dimethylsulfide, which are highly detectable by the human sense of smell [8]-[10]. Some odorivectors are less offensive to the human sense of smell than VSC, such as cadaverine, putrescine, and scatol.

Gum margins and overhangs, periodontal pockets and leaking crowns are prime sites for anaerobic bacterial activity leading to putrefaction in the mouth [11]. Therefore, a valid measure of oral malodor (halitosis) and associated quality of life is necessary [1]. In addition, an appropriate halitosis-oriented otolaryngologic examination should be used for clinical diagnosis and therapy of halitosis [7]. A manoeuvre is known as "Finkelstein's tonsil smelling test", which involves massaging the tonsils and smelling the squeezed secretion, was created to help this examination [12]. The Halimeter creates a signal using an electrochemical voltameter sensor when exposed to VSC sulphur compounds. It has a digital display that shows the number of parts per billion of VSC in the expired air (ppb). It is typical to have fewer than 150 parts per billion (ppb) [7].

Several techniques have been suggested to manage or remove halitosis caused by caseums [13]. Tonsillectomy can provide a complete cure, but mouthwash, saline flush, and antiseptic solutions are ineffective. Despite its benefits, this technique is associated with pain after surgery, long recovery time, and complications because of the procedure and anaesthesia [14]. Unlike tonsillectomy, cryptolysis is a minimally invasive surgery with little morbidity, bleeding, and other consequences. Furthermore, the operation is quick, as is the time required to return to work and a normal diet. Patients appear to tolerate it well as well [15].

The use of radiofrequency (RF) cryptolysis is a relatively new application. RF waves are employed in RF cryptolysis to cause limited thermal damage in the targeted tissue, recovering through fibrosis. The most important advantage of this technique is that it is limited to the tissue to which it is applied.

Superficial vaporization of the tonsillar tissue by laser CO₂ cryptolysis, an office procedure performed under topical anaesthesia, was suggested for chronic fetid tonsillitis [16]-[18]. Chronic caseous tonsillitis (CCT) is a common condition seen in ENT clinics, and patients with CCT frequently complain of halitosis (about 77 per cent). This condition can be extremely debilitating for the patient. Recently, less invasive treatment for CCT has been recommended to protect the tonsils, which are important in the local immunological process. CO₂ laser cryptolysis with coagulation is the treatment (LCC). Patients handle LCC well, and it is essentially painless. The therapy takes four to six sessions, with a four-week break between laser sessions. According to recent research, patients with CCT treated with CO₂ LCC had a significant clinical improvement in halitosis [11]-[13].

Tonsil stones, most common in the crypts of the palatine tonsils, can induce halitosis. Coblation cryptolysis is a different way to cure tonsil caseum. Coblation technology involves transmitting a radiofrequency bipolar electrical current through a medium of normal saline, resulting in a sodium ion plasma field [19]. The present study aimed to investigate the source of halitosis and assess the efficacy of cryptolysis in the treatment of halitosis. To assess the efficacy of cryptolysis for treating oral bad breath caused by chronic fetid tonsillitis.

2. Materials and Methods

A. Study Design

A systematic review of the Randomized Control Trials (RCT) was done on the effectiveness of cryptolysis in the treatment of halitosis.

B. Search Strategy

The following databases were used to find published articles on clinical studies based on the effectiveness of cryptolysis for the treatment of halitosis: Pubmed, Ovid Medline, Elsevier science direct, Wiley online library, Cochrane Library, Lilacs and Google scholar. Each database was searched to obtain the articles using specific MeSH representations. The MeSH term used was "cryptolysis" AND "halitosis."

3. Eligibility Criteria

A. Inclusion Criteria

1. Studies published in English.
2. Studies in which cryptolysis is used as one of the interventions for halitosis.
3. Full-text articles available in search engines mentioned in the search strategy were included.
4. Publications over the years.

B. Exclusion Criteria

1. Articles published in other languages
2. Only abstracts available
3. Unrelated articles
4. In-vitro studies
5. Articles focusing on other treatment options
6. Articles without full text

7. Articles on other properties of cryptolysis.

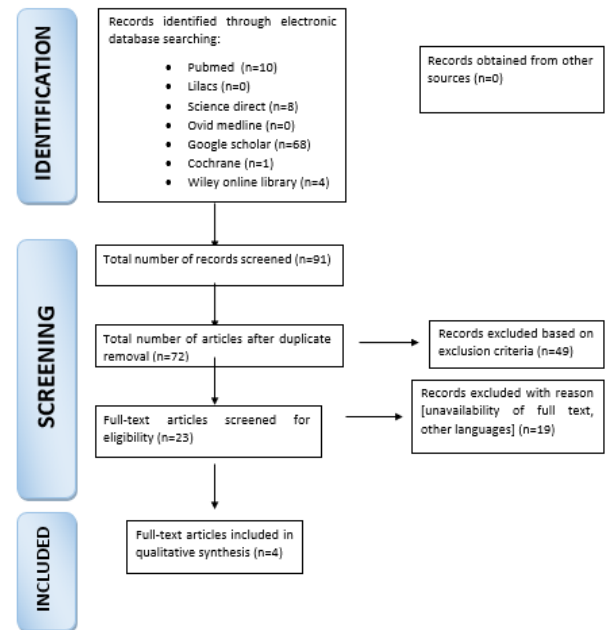


Fig. 1. Flow diagram showing the number of studies identified, screened, assessed for eligibility, excluded and included in the systematic review

After the appropriate MeSH terms search, 91 articles were found online. After duplicates removal, 72 articles were screened, and 23 full-text articles were selected. Inclusion and exclusion criteria were applied. In addition, four related articles were selected for further assessment.

4. Results

Table 1 shows the characteristics of the intervention in the included studies. In all the above studies, the efficacy of cryptolysis for the treatment of halitosis was reviewed.

Table 2 shows the outcome and result of the efficacy of cryptolysis for the treatment of halitosis in the studies mentioned above. The outcome and results were positive in the above studies showing cryptolysis effective in the treatment of halitosis.

Table 3 shows the bias analysis of all the included studies. It is categorized as high-risk bias “-”, low-risk bias “+” and unclear “?”. Categorization was done according to the Cochrane risk of bias tools for randomized controlled trials.

5. Discussion

The findings of this study reveal that cryptolysis is an effective treatment for halitosis. Many people seeking professional help have halitosis, which is a social issue. Unfortunately, most medical and dental professionals are unaware of how to treat halitosis. Therefore, clinicians should diagnose, analyze, and treat persons who suffer from this socially harmful illness. Men and women are both susceptible to halitosis. However, our population's descriptive statistics revealed that young women with halitosis were the majority [19].

Finkelstein et al. studied 38 patients with CCT who were of

Table 1
Characteristics of the interventions as reported in the included studies

S. No.	Author Name	Year	Sample Size	Patient Characteristics	Duration	Preparation Used	Intervention
1	Finkelstein et al., ⁷	2004	53 (30 males and 23 females)	Patients with chronic foetid tonsillitis who have halitosis	1 to 3 sessions separated by 1 to 3 months	Laser cryptolysis technique. Topical anaesthesia included 1.5% lidocaine spray to the oropharynx and oral cavity. infiltration of 1% lidocaine and 0.01% of adrenalin or nordefrin Sharplan's office ENT CO2 laser system is used.	There were no perioperative anaesthetic problems, such as early or delayed [perioperative] bleeding, infection, nasal regurgitation, or voice alteration in any of the patients. Analgesics or non-steroidal anti-inflammatory medicines were used to treat a sore throat.
2	Dal Rio et al. ⁹	2006	38 (13 males and 25 females)	Adults of both sexes have a halitosis problem and have been diagnosed with CCT.	Four sessions with an interval of 4 weeks	Halitometry technique, laser cryptolysis technique.	Patients with normal halitometry values, including those with halitometry values less than 150 ppb, are in Group A. Patients with aberrant halitometry, such as those with halitometry readings greater than 150 ppb, were assigned to Group B.
3	Ata et al. ⁶	2014	34 (8 males and 26 females)	Patients with caseum induced halitosis	December 2009 to July 2012	Tonsil odour test by Finkelstein. Organoleptic evaluation. Using a bipolar power unit, a visual analogue scale radiofrequency cryptolysis approach is used. 1.5 per cent lidocaine spray [xylocaine] to the oropharynx to minimize gag reflex. A mixture of 1% lidocaine and 1/100000 adrenaline was administered.	Three individuals had severe halitosis, 24 had average halitosis, and 7 had mild halitosis, according to organoleptic testing.
4	Erdur et al., ⁸	2021	28 (17 female and 11 male)	Patients who had halitosis due to chronic caseous tonsillitis and had coblator cryptolysis surgery	December 2018 to July 2020	Coblation cryptolysis.	Organoleptic tests revealed that 75% of patients had no halitosis after surgery, despite a preoperative VAS score of 8.0+/- 1.33.

Table 2
Outcome assessment and result

S.No.	Author Name	Year of Publication	Outcome	Result	P-Value
1	Finkelstein et al. ⁷	2004	The relationship between subjective and objective halitosis severity rating was significant (p=0.006).	Chronic foetid tonsillitis remains a common source of halitosis after omitting dental or periodontal diseases, sinonasal, oral, pulmonary, or gastroenterological diseases as causes of halitosis. Therefore, patients with halitosis should be treated based on their physical examination, including Finkelstein's tonsil smelling test. For the treatment of halitosis, laser CO2 cryptolysis is an effective, safe, and well-tolerated method.	p=0.006
2	Dal Rio et al., ⁹	2006	Group A (normal halitometry) the Friedman test demonstrated no statistical difference (p= 0.398) among the different halitometry measures taken before each laser session. However, in Group B (abnormal halitometry), the Friedman test demonstrated a statistical difference (p= 0.016) among the halitometry measures taken at each laser session.	The presence of the caseum is linked to abnormal halitometry in this population. In patients with CCT, LCC is safe, well-tolerated, and relieves halitosis complaints. A decrease in caseum retention was linked to improvement. Patients with abnormal halitometry saw a 30 per cent improvement in VSC halitometry.	Group A: p=0.398 Group B: p=0.016
3	Ata et al., ⁶	2014	Change in measurements was statistically significant [p<0.001]	For the treatment of halitosis caused by caseums in the crypts of the palatine tonsil, RF cryptolysis is a cost-effective, safe, and simple procedure.	p<0.001
4	Erdur et al., ⁸	2021	Before and after the surgery, Finkelstein measurements showed a statistically significant difference [p0.001].	It is a viable, effective, safe, minimally invasive, and cost-efficient therapy option for halitosis caused by tonsil caseums. After the operation, there were no complications.	p<0.001

varying ages and complained of halitosis [7]. These individuals were reviewed by specialists and were suggested for CO2 LCC after failing to respond to typical treatments and wishing to avoid surgical tonsillectomy to preserve the immune function

of the palatine tonsils. In CCT patients, both men and women can develop halitosis [20]. Our population's descriptive data, on the other hand, revealed a prevalence of young women with halitosis.

Table 3
Bias assessment as included in the studies

Author Name, Year	Random Sequence Generation	Allocation Concealment	Blinding of Outcome	Incomplete Outcome Data	Blinding Of Participants and Personnel	Selective Reporting
Finkelstein et al.,7	+	+	+	+	+	+
Dal Rio et al.,9	+	-	+	+	?	+
Ata et al.,6	?	+	+	+	+	+
Erdur et al.,8	?	+	+	?	+	+

Decision rule criterion *+= [high risk], no*= - [low risk]

According to Dal Rio et al., Laser cryptolysis should be administered to a consenting patient with a modest or well-controlled gag reflex to evaporate the tonsillar crypts gradually [9]. Depending on the size of the tonsils, one to three therapy sessions may be required. The amount of vaporized tissue ablated determines symptom elimination; however, the amount of vaporized tissue ablated in each session is limited, as extensive vaporization can result in the absorption of a significant amount of heat energy, resulting in deep and severe bothersome pain and discomfort [21]. If properly conducted, this therapy procedure allows the patient to continue normal daily activities. However, one session's improvement may be insufficient or fleeting. In addition, It also should be noted that postoperative pain and discomfort are minimal if the tonsillar pillars are not lased.

Ata et al., found that 12 months after a single cryptolysis session, 26 patients (76.47%) had negative Finkelstein test results, whereas the remaining eight had positive test findings [6]. Furthermore, before RF cryptolysis, organoleptic measurements revealed that three of the patients (8.82%) had severe halitosis, 24 (70.58%) had average halitosis, and seven (20.58%) had light halitosis. However, 12 months after a single RF cryptolysis session, 26 (76.47%) had fully recovered, six (17.64%) had partially recovered, and two (5.88%) had not recovered at all [22].

According to Erdur et al., coblation cryptolysis is an efficient treatment for halitosis caused by tonsil caseums [8]. After a single session of coblation cryptolysis, the patient group suffering from halitosis induced by tonsil caseum had a high recovery rate. After the operation, 23 patients (82.1%) had no caseum at the six-month follow-up. The Finkelstein test and the organoleptic test showed a statistically significant difference before and after surgery. Organoleptic examinations found that 21 individuals (75%) had no halitosis after surgery ($p = 0.001$). It decreased preoperatively ($p=0.001$) but increased postoperatively ($p=0.001$) [8].

Caseums occur when epithelium, dietary wastes, and secretory proteins accumulate in the crypts of the tonsils. Because the processing of caseums by proteolytic anaerobic bacteria results in the generation of VSCs, which causes bad breath, the presence of these caseums is strongly linked to halitosis. Caseums can also induce a tickling sensation and a feeling of chronic irritation or a foreign body in the throat [23]. Although the tonsils have been mentioned as a possible target for halitosis, doctors and researchers generally neglect their function in developing bad breath. They are significant not only in the emergence of local infections and upper airway obstruction but also in secondary disorders, as they provide a path for bacteria and viruses to enter the body [24].

Tonsil stones, most common in the crypts of the palatine tonsils, can induce halitosis. Although tonsillectomy is an effective method in treating tonsil stones, it often requires general anaesthesia and for its vital risks such as postoperative and intraoperative bleeding, and disadvantages such as long postoperative recovery period, severe pain and long return time to normal life [17]. These negative factors have forced ENT surgeons to find alternative treatment modalities. In addition, the presence of the tonsillary caseum increases the probability of aberrant halitometry and can be used as a predictive factor in patients with abnormal halitometry. As a result, halitometry is most likely normal [18].

Once the source of halitosis in the tonsils is established, the therapeutic management may begin with metronidazole for ten days [1]. In many cases, the outcome of antibiotic treatment is initially satisfactory, and the odour disappears but reappears shortly following the cessation of treatment. In case conservative treatment fails, cryptolysis may be suggested. The number of needed treatment sessions depends mainly on tonsillar dimensions and varies from one to three. It could also be a more effective treatment for caseum-induced halitosis and caseum production. This procedure is associated with a lower risk of bleeding than a tonsillectomy, and patients can return to a normal diet in a shorter period [4]. However, it entails using more expensive equipment and is also associated with a risk of retinal damage to the operating team and the patient. Protective glasses should be used.

In Radiofrequency cryptolysis, RF waves cause limited thermal damage in the target area, which recovers through fibrosis [16]. Laser cryptolysis is a halitosis therapy option with a lower risk of bleeding. Another approach for treating tonsil caseum is coblation cryptolysis. Coblation technology involves transmitting a radiofrequency bipolar electric current through a medium of normal saline, forming a sodium ion plasma field [7]. The follow up demonstrated a decrease in recurrence, and there were no side effects like abscess formation or other complications. Unfortunately, the selected patients were few because the exclusion criteria were wide and strict. Moreover, treatment required numerous sessions, and some patients discontinued it. However, the three-year follow-up demonstrated decreased tonsillitis recurrence, and there were no side effects such as abscess formation or other complications.

6. Conclusion

Patients with halitosis of unclear origin are almost certainly suffering from chronic fetid tonsillitis. Therefore, Finkelstein's tonsil smelling test is critical for diagnosis and therapeutic

monitoring, as it pinpoints the source of halitosis in the tonsils. Unlike tonsillectomy, cryptolysis is a minimally invasive technique with little morbidity, haemorrhage, and other consequences. However, compared to tonsillectomy, this method has significant drawbacks, such as not all patients will be completely free of the disease. Nonetheless, this approach to treating halitosis appears successful, simple, safe and well-tolerated.

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