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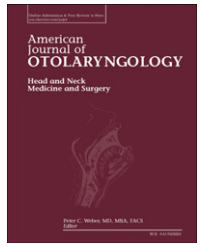

# Laser tonsil cryptolysis: In-office 500 cases review☆,☆☆,★

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ABSTRACT

**Objectives:** Tonsilloliths, proven to be tonsillar biofilms cause symptoms of halitosis, foreign body sensation and recurrent sore throats. Laser Tonsil Cryptolysis (LTC) performed in the office may represent an alternative to tonsillectomy in selected cases of persistent tonsilloliths with cryptic infections.

**Study Design:** A retrospective chart analysis using CPT codes.

**Setting:** Office and hospital.

**Methods:** A retrospective complications review consisting of bleeding, the need for an additional procedure, patient satisfaction and conversion rate to complete tonsillectomy was documented.

**Results:** Five hundred consecutive LTCs performed in the office under local anesthesia with a CO2 or diode laser were identified. Energy delivery was in continuous mode with power settings of 18W and 10W respectively. Bleeding occurred in 6 patients requiring unscheduled return office visit for evaluation. Eighty patients required a second procedure, comprising total of 1.16 procedures per patient. Eighteen (3.6%) patients underwent complete tonsillectomy. Patient satisfaction was high with an overall incidence of 0–2 days of work absence. Follow-up was 1–8 years.

**Conclusions:** With a small tonsil size, controllable gag reflex and cooperative adult patient LTC allows several advantages compared to conventional tonsillectomy. Benefits of LTC include avoidance of general anesthesia and limited ablation of cryptic pockets, resulting in reduced post-operative pain, bleeding, shorter recovery time and the convenience and cost advantage of an office procedure. With 1.16 sessions required per patient, low conversion rate to standard tonsillectomy and minimal complication rate LTC can be considered an alternative option to a patient suffering from recurrent cryptic tonsillitis with or without tonsilloliths.



## 1. Introduction

Tonsilloliths may contain calcium deposits, and some have suggested that they result from infection. Samant and Gupta [1] concluded in 1975 that they represent incomplete evacuation of pus with the dead bacteria and the inflammatory cells providing the nidus for their formation. Most of the ensuing reports regarding tonsilloliths have focused on the tonsillolith size (up to 44 gram reported) and symptoms derived from it [2]. Evidence of tonsilloliths being responsible for chronic silent infection came with Stoodley et al [3], confirming that tonsilloliths are similar in architecture and physiologically behaving as dental biofilms. This fact coincides with preferential formation of biofilms forming in grooves, depressions

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and cryptic pockets rather than on the tonsil surface. Biofilms are mixture of dormant bacteria within a matrix in a low energetic form capable of reversing their hibernation under environmental changes. Typically tonsillar biofilms are formed by anaerobic gram negative bacteria. Oxygen poor environments can be detected at the center of the tonsilloliths, with depletion of sugar at the surface. This state is reversible with the addition of fluoride in experimental models. Thus Stoodley and collaborators postulated that tonsilloliths exhibit typical behavior quite similar to dental biofilms [3].

Despite inadequate understanding regarding the cause of tonsilloliths, the signs and symptoms of foreign body sensation, metallic taste, throat closing or tightening, coughing, choking and halitosis are well documented. Rio et al [4] performed halitometry in patients suffering from recurrent tonsilloliths, finding a tenfold increase in the risk of halitosis when tonsilloliths were present. Conversely, all patients without tonsilloliths had normal halitometry. Tonsilloliths form within the tonsillar crypts. The external face of the tonsil is covered by stratified squamous epithelium, which invaginates toward the inside of the tonsillar parenchyma, forming the crypts. Each adult palatine tonsil has an average of 10–20 crypts [5], which resemble fissure apertures on the tonsil surface and become an anaerobic environment for certain bacteria to accumulate to form biofilms. As the biofilm matures and enlarges the crypt dilates to accommodate the tonsillolith causing inflammation at crypts. According to Dal Rio et al [6] CO2 laser ablation of the tonsil crypts opens the crypt ostium, thus avoiding bacterial retention and allows easy clearing the cryptic pocket. The stretching and tension of scar tissue around the crypt with the resultant superficial coagulation and contraction are similar to that observed in laser skin resurfacing. The tissue vaporization leading to consequent reduction of tonsillar parenchyma results in crypt's opening directed outward thus forcing the crypt to remain widely open. Halitometry was performed before the treatment and following LTC. A histological exam following LTC showed that procedure was safe and halitometry showed reduction of volatile sulphur compounds by 30% with disappearance of halitosis [6]. Finkelstein et al [7] presented a series of 53 patients with the tonsils as a source of halitosis to assess the efficacy of CO2 laser for its treatment. Finkelstein's tonsil smelling evaluation consisted of massaging the tonsils with a gloved index finger and smelling the squeezed discharge. The authors performed Laser Cryptolysis as an office procedure under topical anesthesia and concluded that LTC appeared as an effective, safe, and well-tolerated procedure. Although simple smelling of the gloved finger may not represent an objective measurement of the reduction of halitosis.

Passos et al [8] introduced LTC as treatment for chronic tonsillitis. The CO2 laser was used with biopsies of the tonsil and histological evaluation focusing on germinal centers, lymphoid tissue, sub-epithelial fibrosis, and parenchyma fibrosis documented. The biopsies showed that the laser, used at a specific energy density, could relieve the symptoms without increase of the fibrotic content, nor decrease of the lymphoid structure. The laser action caused only epithelial coagulation, thus only weakening the tension forces in the crypt borders resulting in their marsupialization and exteriorization. The large or deeper crypts required additional vaporization creating a large furrow.

The current study is a compilation of the above mentioned indications for LTC, i.e. halitosis, tonsilloliths formation and chronic cryptic tonsillitis. The study focuses on safety, effectiveness and complications of LTC by reviewing a large series of office procedures performed. Additionally, an alternative method of examining the tonsils and tonsilloliths is suggested in indentifying imbedded tonsilloliths. Patient satisfaction and grading of halitosis were performed on some patients with the Halitosis Associated Life-quality Test (HALT) questionnaire, which was recently introduced by Kizhner et al [9].

## 2. Methods

Following IRB approval using CPT codes five hundred consecutive cases of LTC going from 2003 to 2011 were analyzed. End results included: number of total procedures, complications and number of patients that needed completion tonsillectomy under general anesthesia.

The indications for office LTC are a cooperative patient, tonsil size <+2, controllable gag reflex and the ability to adequately visualize and explore the oropharynx. The exclusion criteria are large tonsils with tonsillar tissue extending beyond the posterior pillar, hyperactive uncontrolled gag reflex and an uncooperative patient. Patients with significant tonsil hypertrophy were not considered candidates.

Patients were excluded if the tonsils expanded medial to the posterior pillar, obstructing the view of the palatopharyngeal fold. Assessment of the gag reflex, during the initial examination consisted of palpation of the anterior pillars after spraying with Benzocaine aerosol 20% spray. Patients gagging after topical spray were excluded. Prior to the procedure, only local anesthesia is used avoiding intravenous agents. Lidocaine 2% with1:100,000 epinephrine is injected with a 27 gauge needle. Approximately 1 cc. injected in each tonsil site… Local anesthesia was infiltrated along the anterior pillar and into the posterior pillar. When tonsilloliths are suspected a two hand technique using two wooden tongue blades is used. One hand gently depresses the tongue, while the other tongue depressor will press the upper border of the anterior pillar (palato-glossal fold) vertically and laterally pushing the tonsil medially and gently squeezing its contents. The tonsilloliths are hidden from view, particularly at the upper pole behind the anterior pillar. The caseous tonsilloliths material is examined with an offensive smell confirming the source of halitosis.

Since 2010 fifty patients also completed the HALT questioner before and after LTC. Additionally, mapping of the location of the tonsilloliths was performed.

As the general technique for LTC is covered elsewhere [10] some key points are worth mentioning. Ablation of the upper corner of the anterior pillar to expose the superior pole of the tonsil enables complete identification of new crypts filled with tonsilloliths (Fig. 1).

Then the tonsil lymphoid tissue is ablated with CO2 laser with a rapidly rotating 2 mm scanning device to evaporate the tonsil surface layer by layer (Fig. 2), similar to peeling the

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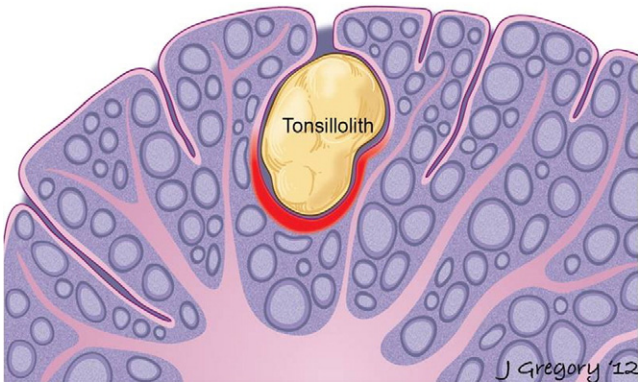


**Fig. 1 – Tonsil cryptic infection with tonsillolith (biofilm).**

layers of an onion. The laser action with scanner causes char-free epithelial coagulation. Contraction of mucosa at the ablation site weakens the crypt borders resulting in their marsupialization. The mucosal tension and forces end up pulling the edges apart resulting in thus opening the crypts. The tissue characteristics of the tissue after ablation resemble those after laser skin resurfacing. Eventually exteriorization of the cryptic pocket with complete evacuation occurs as the laser energy reaches close to the bottom of the crypt (Fig. 3). The large or deeper crypts require additional vaporization creating a large furrow. The procedure is continued until the bottom of the crypts are identified and coagulated to avoid reformation of biofilm. Post procedure patient instructions include analgesic medications, topical anesthetics in the form of a gargling solution and antibiotics.

## 3. Results

Five hundred patients who underwent LTC in the office during the past 8 years were identified. The age range was 11–73 years, with a female predominance of 62%. All patients had follow up appointment scheduled within 4–9 days following the procedure. The length of the procedure was less than 30 minutes. The lasers in use were CO2 laser (Lumenis, Santa Clara, CA) with scanner set at 2 mm and Kamami pharyngeal hand piece at 18 W under continuous mode for the vast majority of the cases. Diode laser, 980 nm (ARC lasers, Nuremberg Germany) with 300 micron fiber and curved tip surgical hand piece with a power setting of 10 W in continuous mode was used where ablation of only of single crypt was needed.

Post operative bleeding necessitating bleeding control under local anesthesia in the office occurred in 1 patient. Additionally five patients reported minor bleeding which resolved spontaneously with intake of ice cold water. No hospital admissions or emergency department visits were recorded in this series. Eighty patients required a repeat procedure due to persistence symptoms and tonsilloliths, comprising 1.16 procedures per patient. A total of 18 patients (3.6%) patients required complete conventional tonsillectomy under general anesthesia. Patient satisfaction was high overall with limited disability and 0–2 work days lost. Patient follow-up was 1–8 years.

Over the last three years in 50 patients we had documented and recorded: stone visualization and HALT scores before and after the LTC procedure. In almost 40% of these patients the tonsilloliths were not visible and were hidden behind the anterior pillars, only careful pillar retraction could reveal them, usually in the upper tonsil pole. Improvement on the self reported HALT questionnaire was 46% ($P < 0.05$). There appeared to be no connection between tonsil size and tonsil stone production with patients with small to medium size tonsils producing large tonsilloliths once the tonsils were pushed medially following lateralization of the anterior pillar. This can be easily performed using topical anesthetic even with patient with strong gag reflex.

## 4. Discussion

Since the advent of LTC part of the search focused revealing the presence and depth of tonsillar crypts with tonsilloliths.

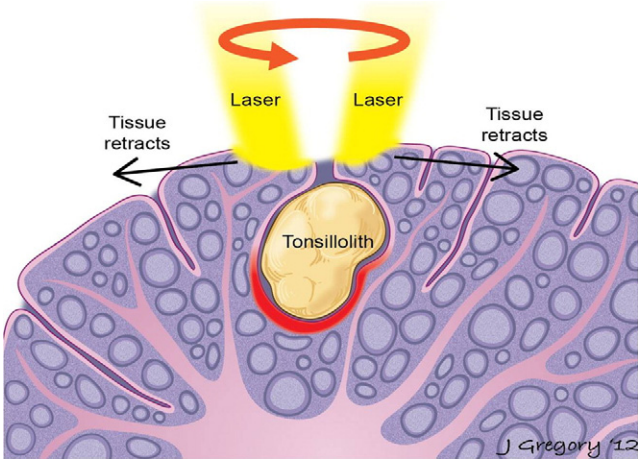


**Fig. 2 – Laser Tonsil Cryptolysis (LTC). Note the tissue retraction at the crypt surface caused by CO2 laser ablation with scanner.**

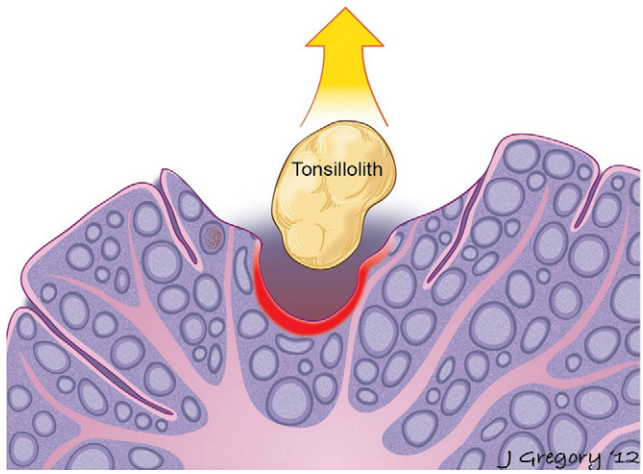


**Fig. 3 – Marsupialization of tonsil crypt and evacuation of the tonsillolith are the end result of LTC.**

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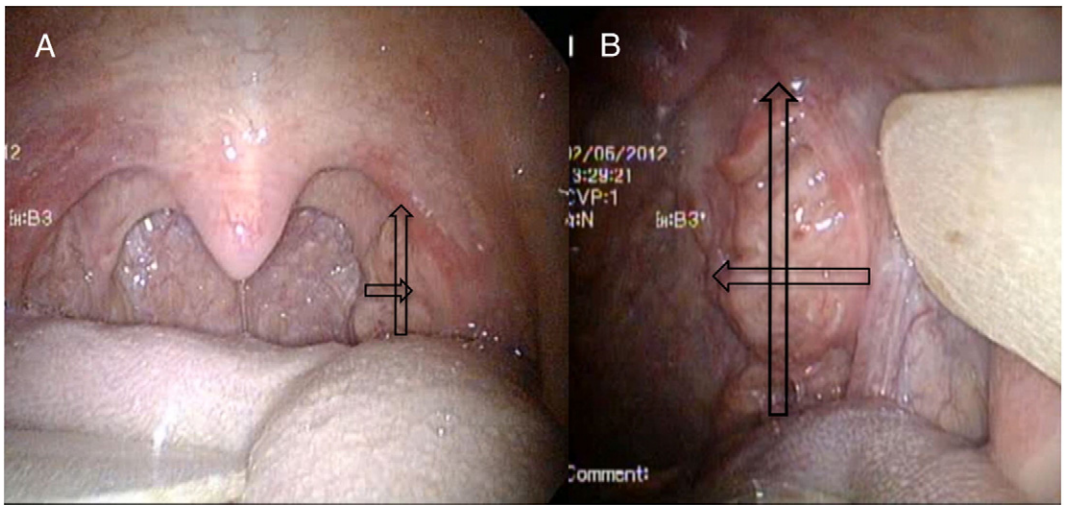


**Fig. 4 – Retraction of left anterior pillar and exposure of upper tonsillar pole. Arrows show the enhanced tonsil tissue exposure between A & B.**

As crypts become loaded with tonsilloliths they dilate, resulting in clinical of inflammation and a foreign body sensation. Occasionally, part of the tonsilloliths will break off and present in the anterior oral cavity causing oral malodor and social embarrassment. Since tonsilloliths are biofilms, the only permanent intervention is mechanical disruption and ablation of the base of the crypt with laser or total surgical resection. Therefore, a careful tonsillar exam is a search for tonsilloliths specifically addressed with two hand pillar retraction described here and introduced by the senior author.

Advantages of carefully examining tonsil pockets over previously described tonsil assessment include several factors. From the patient's perspective much less gagging is produced and direct visualization allowing the identification and partial extraction of tonsilloliths. While Finkelstein's palpation and tonsillar massage test is performed blindly and can initiate severe gagging. The elevation of the anterior pillar laterally and pushing the tonsil medially allow a clear visualization of the tonsil, which allows the surgeon a clearer plan for the procedure. Moreover, while a tonsillar massage will push the tonsilloliths deeper into the crypts, this method will do quite the opposite, by exteriorizing the crypts and revealing hidden biofilm loaded crypts resulting with better identification of areas needed to be treated. This method also discloses the tonsils that on a regular one hand oropharyngeal exam with tongue depression most tonsilloliths will be missed (Fig. 4A & B). By comparison of the same tonsil in Fig. 4 (as the depth of the picture is different we compared the tonsil to itself) and comparing the height to width measurement with this exposure method the ratio of height to width was 60/30 (2) while without was 10/3 (3.33). Assuming the same anterior posterior ratio we gain over 250% additional tonsil tissue exposure. Our observation indicated that some of the stones are completely embedded within the crypts, with the location of caseous material varying from upper pole to mid pole and rarely at lower pole, thus obliging us to seek for the tonsilloliths aggressively. This method used for evaluation of tonsil crypts will answer that need precisely by localizing tonsilloliths and the exact location and the depth of tonsil crypts (Fig. 5A & B). This method allows mapping of the

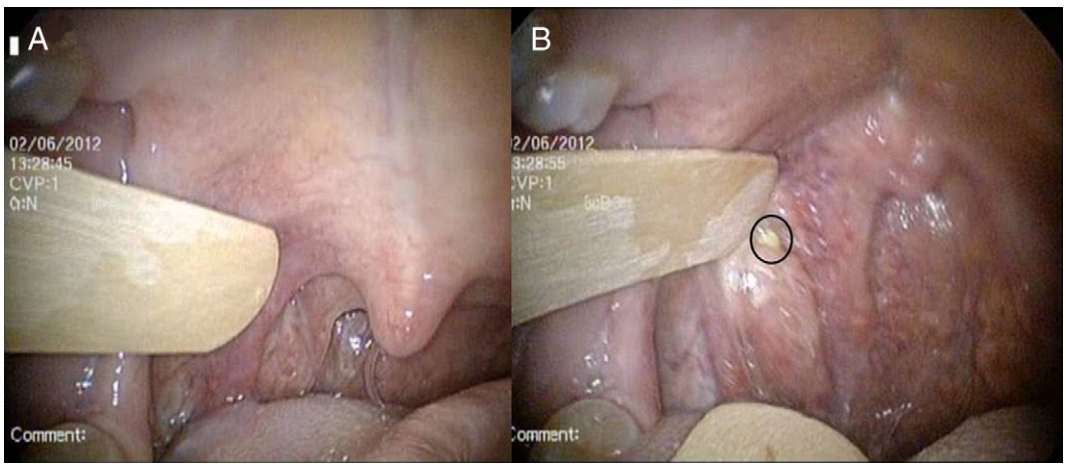


**Fig. 5 – Right tonsil with anterior pillar retraction (A) exposing previously undetected tonsilloliths (circled) (B).**

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tonsillar site for more accurate and complete crypt vaporization with the laser, thus causing less tissue damage and potentially minimal post operative pain.

### 4.1. *Laser choice*

While the choice of a CO2 laser with a scanner is perhaps more accurate and effective for a quicker ablation, a CO2 laser for the office is a higher fiscal burden. A small diode laser may be an alternative device for limited use in treating one or two cryptic areas. Sedlmaier et al [11] compared the CO2 laser versus a diode laser in a group of 183 pediatric tonsillotomies with results showing similar pain scores at both group, without post-operative complications such as bleeding or significant pain. Furthermore, laser tonsillectomy potentially offers an advantage over standard tonsillectomy when pain, intra-operative hemostasis, re-bleeding and post-operative inflammatory reaction are considered as suggested by the Jiang et al [12] study. Another confirmation for minimal complication arises from Eisfeld et al's [13] study who observed 181 partial tonsillotomies performed with CO2 laser. In his observation post operative bleeding was 0%, repeated infection was 3% with a follow-up period of six years.

Our results comprise a large series of LTC procedures performed for chronic cryptic tonsillitis with or without tonsilloliths. Although LTC is not as definite or complete as conventional tonsillectomy, it is definitely counterbalanced by a negligible complication rate, postoperative pain, loss of productive time or post operative bleeding as was pointed out by the aforementioned series. Note the ablation of anterior pillar exposing the upper pole of tonsil.

### 4.2. *Patient satisfaction*

As LTC is performed under local anesthesia it offers greater patient comfort and minimal recovery time. In cases with superficial exposure of crypts one can perform LTC even with topical anesthesia. It is well known that the tonsil lymphoid structure has minimal sensory innervations and by not injuring the pillars one may be able to avoid even injections of local anesthetics. Intra operative or post operative bleeding was negligible due to absence of large blood vessels at the surface of tonsils far away from the tonsil capsule and pharyngeal muscles. The amount of second procedures required (planned or unplanned) was 1.16 per patient comparing to 1.42 in Finkelstein's series. This number possibly reflects a natural learning curve as well as accurate identification and mapping of loaded and inflamed crypts prior to LTC. As with all tonsillotomies performed with various surgical devices post operative pain is in general much less intense than a complete tonsillectomy, as pointed out in previous studies. The estimated work loss was usually zero but no more than two days, a factor leading to major patient satisfaction since the vast majority of LTC patients were working adults. The HALT questionnaire allowed us to score patient satisfaction in reduction of halitosis, albeit recorded only in some of the patients (50), our results showed clearly a significant reduction of 46% in HALT scores completed prior and following LTC.

## 5. Conclusions

Laser Tonsil Cryptolysis (LTC) performed for cryptic tonsillitis with tonsilloliths in selected patients with small tonsils, a controllable gag reflex, and cooperative permits numerous advantages over conventional tonsillectomy. Most important are a brief recovery time and avoidance of general anesthesia with LTC. The proper examination of tonsils explained in detail above is essential in selecting the patients. With 1.16 sessions required per patient, a low conversion rate to conventional tonsillectomy and no incidence of serious post operative complications, LTC should be considered as an alternative option for the properly selected and appropriate adult patient.

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