By Gregory M. Schuster, DDS, MEd; Eugenia P. Roberts, DDS; and Hannah E. Tarpey, BS

# A NOVEL APPROACH TO TREATING HAIRY TONGUE

A 9300 NM $CO_2$ LASER AND LOW ENERGY ABLATION THERAPY PROVIDE EFFECTIVE PALLIATIVE CARE FOR HAIRY TONGUE.

FIGURE 1A. Initial examination, September 2021. Coated tongue wipes off with gauze. History of burning mouth symptoms started in August 2020.

FIGURE 1B. November 2021 appointment. Dark brown pigmentation with elongation of the filiform papillae that would not wipe off with gauze. Patient complained of a "burning sensation" on the lateral and tip of the tongue, dysphagia on the right side, halitosis, and a sense of "thickening" of the tongue.

Dimensions CE THE CE ANSWER SHEET APPEARS ON PAGE 29.

## EDUCATIONAL OBJECTIVES

After reading this course, the participant should be able to:

1. Explain hairy tongue and associated symptoms.
2. Describe the clinical presentation and treatment options for hyperkeratosis of the filiform lingual papillae (HFLP).
3. Discuss the use, as well as outcome, of palliative low energy ablation therapy with a $CO_2$ laser in managing HFLP.

Hairy tongue or "black hairy tongue" is a benign condition that is usually asymptomatic and self-limiting. Patients most often present to dental and medical professionals due to esthetic concerns of the elongated keratin strands of filiform papillae and dark coloration that overlays the dorsal tongue surface. Usual resolution is with conservative measures and tongue hygiene. This case report describes the treatment of a patient with a 2-year history of persistent lingual burning sensations, difficulty swallowing, and heavy tongue coating associated with refractory hyperkeratosis of the filiform lingual papillae (HFLP) on the dorsum of the tongue. These symptoms reportedly developed after a SARS-CoV-2 upper respiratory infection and recurrent antibiotic use.

While hairy tongue and HFLP share the same pathology, most cases of hairy tongue improve with oral hygiene, usually require no additional treatment, and do not return. In comparison, the patient in this case developed HFLP, which is a symptomatic version that presents with burning, does not resolve, is subject to recurrence, and requires additional treatment beyond oral hygiene. The literature has limited reporting, but if conventional treatment is ineffective, the use of diode laser photobiomodulation[1] or carbon dioxide ($CO_2$) lasers has been suggested.[2,3] To our knowledge, this presentation is the first reported use of low energy ablation (LEA) palliative therapy with a 9300 nm $CO_2$ laser. The distinction is that while diode and $CO_2$ lasers have been used before, this case is believed to be the first using this wavelength and a low energy power mode. Essentially, LEA is somewhere between ablation and photobiomodulation, and this novel approach was ultimately deemed to have successfully alleviated the symptoms associated with the patient's HFLP.

## CLINICAL CASE REPORT

A 69-year-old woman presented to the clinic at Midwestern University College of Dental Medicine-Arizona with a chief complaint of sporadic, unresolved burning sensations on the dorsum and tip of the tongue that began shortly after a COVID-19 infection in July 2020. The patient reported these tongue symptoms to an otolaryngologist in August 2020 and was diagnosed with hairy

BELMONT BUSINESS MEDIA™
Belmont Business Media designates this activity for 2 credit hours of self-study continuing education units. January 2023 and expires January 2026.

ADA CERP® | Continuing Education Recognition Program
Belmont Business Media is an ADA CERP-recognized provider.
ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.
Concerns or complaints about a CE provider may be directed to the provider or to the Commission for Continuing Education Provider Recognition at: ada.org/cerp.

PACE ACADEMY OF GENERAL DENTISTRY PROGRAM APPROVAL FOR CONTINUING EDUCATION
Belmont Business Media
Nationally Approved PACE Program Provider for FAGD/MAGD credit.
Approval does not imply acceptance by any regulatory authority or AGD endorsement.
July 1, 2021 to June 30, 2023
Provider ID 317924
AGD Subject Code: 135

FIGURE 2A. Five-month follow-up, February 2022. Patient presented with continued burning of the tongue, dysphagia on the right side, with a sensation of a "ridge" on the right lingual dorsum, and a recent history of antibiotic use.

FIGURE 2B. First $CO_2$ laser treatment with low energy ablation therapy on the right side, with removal of hairy tongue filiform papillae.

FIGURE 2C. Immediate view posttreatment on the right tongue.

FIGURE 3. Second laser treatment. The area anterior to the circumvallate papillae was difficult to access due to the laser tip distance to tissue requirement, as well as the need to maintain the correct laser wand angulation.

tongue. After recovering from COVID-19, the patient experienced erratic hypo-hyper thyroid levels, chronic urinary tract infections (UTI), and genital herpes which she had not previously demonstrated. The patient's physician advised that her immune system had been affected.

She was routinely prescribed antivirals for herpes, trimethoprim/sulfamethoxazole antibiotics for recurring UTI infections, and tioconazole ointment for associated vaginal candida infections. Medical and medication history revealed hypothyroidism, arthritis, anxiety, gastric reflux, chronic headaches, hypertension, and atrial fibrillation. Medications included alprazolam, butalbital-acetaminophen-caffeine, flecainide, diltiazem, levothyroxine, apixaban, meclizine, and cholecalciferol, along with occasional over-the-counter antacids.

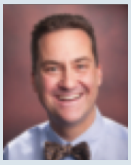
FIGURE 4A. Nine-month follow-up, June 7, 2022. The patient presented with increased elongated filiform papillae, burning pain, green-tinged coloration, and recent antibiotic use.

FIGURE 4B. Immediate view post third treatment. Patient expressed improvement of symptoms, including tongue burning.

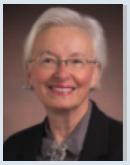
FIGURE 5. One-month follow-up after the third laser treatment. The patient reported a minimal burning sensation and significant improvements in all other tongue symptoms.

During the initial visit to the dental clinic on September 29, 2021, more than a year after oral symptoms began, an intraoral examination revealed a light yellow-brown discoloration and coating on the dorsum of the tongue (Figure 1A). Examination of the soft and hard tissues showed no other oral pathologies or abnormalities. The patient exhibited a Silness-Loe Plaque Index of 1 and good oral hygiene. Using the Numerical Rating Scale for pain (NRS) from 0 to 10, with 10 being the worst pain, the patient rated the burning sensations on the tongue as a 10 during what she described as flare-ups. The patient acknowledged tobacco smoking, but no coffee or alcohol use. The coating on the surface of the tongue could be rubbed off with gauze. Conservative tongue hygiene was advised with a toothbrush or tongue scraper.

In October 2021, the patient returned to the otolaryngologist with a chief complaint of a "knot" on the right side of the jaw, difficulty swallowing, and a sensation of food lodging in the throat. No definitive cause for the symptoms was found and no treatment was advised. She presented to the dental clinic in November 2021 (Figure 1B) for evaluation of persistent burning tongue symptoms and swallowing issues on the right side. A similar case report in the literature with mucositis and burning tongue post-COVID-19 infection resolved with 0.12% chlorhexidine mouthrinse, so this was prescribed.[4] At the 6-week follow-up appointment, she reported slight improvement in the burning sensation, with fewer flare-ups, but no resolution of the swallowing issues, papillary overgrowth, or the "thickness" now felt in the body of the tongue. Following

GREGORY M. SCHUSTER, DDS, MEd, is an associate professor and director of clinical faculty at the Dental Institute at Midwestern University College of Dental Medicine in Glendale, Arizona.



EUGENIA P. ROBERTS, DDS, is an associate clinical professor and course director for oral pathology at Midwestern University College of Dental Medicine. She can be reached at: erober@midwestern.edu.

HANNAH E. TARPEY, BS, is a fourth-year dental student at Midwestern University College of Dental Medicine-Arizona.


*The authors have no commercial conflicts of interest to disclose.*

chlorhexidine therapy, a palliative treatment option with a 9300 nm $CO_2$ laser LEA approach was offered. The patient accepted and signed consent.

The first LEA treatment (Figure 2A through Figure 2C) addressed the right side tongue on February 22, 2022, where symptoms were most problematic. The patient agreed to have only topical anesthetic applied. The lesion was treated using a continuous motion of the laser; first in an anterior-posterior direction, and then in a medial-lateral direction just anterior to the circumvallate papillae, allowing for overlap in each direction. Four passes of the area were performed, along with a wet gauze cleaning in between each individual pass to remove the strands of exfoliated keratin. Treatment time averaged 3 minutes per pass, for a total treatment time of approximately 12 minutes. No charring or bleeding of the papillae was noted, although an epithelial level of desiccation appeared after the third and fourth passes, which rehydrated within 30 seconds following use of the wet gauze. During treatment, the patient reported a "stinging" sensation, but no pain or heat sensation. At the end of treatment, she expressed immediate improvement in right side swallowing, and her tongue burning sensation was reported as NRS 2 on the dorsum and 0 at the tip.

On March 10, 2022, the patient presented for the second LEA treatment on the left side of the tongue, at which time she reported significant improvements, with an NRS 0 rating for pain or burning on the tongue, no swallowing discomfort on the right side, and only a persistent "irritation" of the far-dorsal tongue anterior to the circumvallate papillae. The same LEA protocol was followed. During treatment, the posterior area of the tongue became increasingly difficult to access due to the required laser tip distance and angulation (Figure 3).

She reported for the 4-week follow-up appointment, stating that 5 days after the second laser treatment she had another UTI, with antibiotic therapy again. At the end of the course of trimethoprim/sulfamethoxazole, the patient experienced burning sensations on the anterior tip and anterior lateral borders of the tongue, with a pain level of NRS 6. An antifungal oral rinse and oral probiotics were advised. It was agreed to monitor the tongue and that retreatment with LEA would be an option if the hairy tongue returned or if burning persisted. An 8-week post-operative evaluation confirmed the patient was able to maintain tongue hygiene, and the burning sensation continued on only a small area at the tip of the tongue, which was reported as NRS 2.

The patient continued receiving dental care at the clinic, with no tongue issues until 2 months later (in June 2022), when she presented with increased filiform papillae and heavy green-brown coating on the dorsal tongue after completing yet another course of antibiotics (Figure 4A). In addition, she reported increased stress and higher daily tobacco use. The patient consented to a third palliative LEA treatment, this time for the entire tongue surface. The same LEA protocol was followed. She again expressed immediate relief of symptoms (Figure 4B). At the 1-month follow-up (Figure 5), the patient continued to maintain good tongue hygiene, reporting only an NRS 2 burning sensation and high satisfaction rating—even while enduring another bout of UTI and antibiotic therapy.

## LASER PROTOCOL

A 9300 nm $CO_2$ laser was set on low power mode for all three LEA sessions, with settings of an 0.012 $cm^2$ spot size, 20% cutting speed, and no mist, corresponding to an irradiance of 33.3 $W/cm^2$. The average irradiated area was 12 $cm^2$. Treatment time was 12 minutes for the first session, and 6 minutes each for the remaining two sessions, for a total radiant energy of 86 joules (Table 1). All treatment sessions were performed using 20% benzocaine topical anesthetic and high-volume evacuation.

## DISCUSSION

The patient presenting in this case exhibited painful oral symptoms with HFLP. Contributing factors could be due to post-COVID-19 immunosuppression, chronic use of antibiotics, xerostomia, and smoking. Systemic antibiotics, such as cephalosporin, penicillin, and metronidazole,[5] and medications, such as antidepressants, antineoplastic,s and antipsychotics,[5,6] are known risk factors for hairy tongue. Should HFLP be persistent or recur, as it did in this case report, some researchers

## REFERENCES


1. Samiei N, Ghane HK, Fekrazad R. Diode laser surgery as a conservative management of hairy tongue lesion resistance to treatment. *Case Rep Dent*. 2021;2021:5656884.
2. Jung DW, Cho E, Ahn HJ. $CO_2$ laser application for treatment of the hairy tongue. *J Oral Med Pain*. 2013;38:97–101.
3. Schlager E, St Claire C, Ashack K, Khachemoune A. Black hairy tongue: predisposing factors, diagnosis, and treatment. *Am J Clin Dermatol*. 2017;18:563–569.
4. Tomo S, Miyahara GI, Simonato LE. Oral mucositis in a SARS-CoV-2-infected patient: Secondary or truly associated condition? *Oral Dis*. 2022;28(Suppl 1):963–967.
5. Ren J, Zheng Y, Du H, et al. Antibiotic-induced black hairy tongue: two case reports and a review of the literature. *J Int Med Res*. 2020;48:300060520961279.
6. Thompson DF, Kessler TL. Drug-induced black hairy tongue. *Pharmacotherapy*. 2010;30:585–593.
7. Fidan V, Koyuncu H, Akin O. Oral lesions in COVID-19 positive patients. *Am J Otolaryngol*. 2021;42:102905.
8. Patil R, Nayak S, Munshi M, Bobhate S. Scrape cytology in rare case of hairy tongue. *J Cytol*. 2009;26:91–93.
9. Handler MZ, Butler DF, Eisen D, Burgess J, Lynch DP, Stafford GL. Hairy Tongue. Available at: https://emedicine.medscape.com/article/1075886-overview. Accessed November 9, 2022.
10. Roberts EP, Schuster G, Haub S. Case report: Spongiotic gingivitis in an adult male treated with novel 9300nm $CO_2$ laser low energy ablation. *J Am Dent Assoc*. 2021;153:67–73.
11. Schuster G, Roberts EP. The clinical impact of 9300nm $CO_2$ laser low energy ablation therapy on oral lichen planus: A case report. *J Laser Dent*. 2022;26:111–122.
12. Fantarella D, Kotlow L. The 9.3-µm $CO_2$ dental laser: Technical development and early clinical experiences. *J Laser Dent*. 2014;22:10–27.
13. Lopez-Jornet P, Camacho-Alonso F. Comparison of pain and swelling after removal of oral leukoplakia with $CO_2$ laser and cold knife: a randomized clinical trial. *Med Oral Patol Oral Cir Bucal*. 2013;18:e38–e44.

TABLE 1. Low Energy Ablation Laser Parameters

| | |
|---|---|
| Model | Solea Model 2.0 |
| Year Produced | 2014 |
| Number and Type of Emitters (laser or LED) | 1 $CO_2$ laser |
| Wavelength and Bandwidth | 9300 nm |
| Pulse Mode (CW or Hz, duty cycle) | 160 Hz |
| Pulse Duration | 1 microsecond to 130 microseconds |
| Cutting Speed | 20% |
| Airflow | None |
| Mist or Water | None |
| High-Volume Evacuation | Yes |
| | |
| Beam Spot Size at Target ($cm^2$) | 0.012 $cm^2$ |
| Irradiance at Target ($W/cm^2$) | 33.3 $W/cm^2$ |
| Exposure Duration (average/session) | 480 seconds |
| Radiant Exposure ($joule/cm^2$) | 3.58 $J/cm^2$ |
| Radiant Energy (J) | 43 J |
| Location Irradiated | Dorsum tongue |
| Area Irradiated ($cm^2$) | 12 $cm^2$ |
| Application Technique | Contact |
| Number and Frequency of Treatment Sessions | Three sessions over 4 months |
| Total Radiant Energy Over Entire Treatment Course (J) | 86 J |

have suggested chlorhexidine,[4] hydrogen peroxide antiseptics,[7] antifungals, antivirals, or even keratolytic agents[2]—such as oral retinoids, urea solution, topical triamcinolone acetonide, or salicylic acid—for treatment.[1,3,6,8] These therapies may have unwanted side effects, including local tissue irritation and possible systemic absorption. More invasive options to remove the hyperkeratotic papillae include surgical scalpel,[8] scissor, and electrodessication.[9] Less invasive procedures include diode photobiomodulation[1] and excision with $CO_2$ lasers, the latter requiring local anesthesia and extended wound healing.[2,3]

The 9300 nm $CO_2$ laser with LEA and epithelial stimulation successfully removed the hyperkeratotic papillae and alleviated the patient's symptoms immediately after treatment. Other effective approaches by Jung et al[2] using a $CO_2$ laser and Samiei et al[1] with diode laser treatment for hairy tongue incorporated unilateral local anesthesia. Laser LEA treatments for this and other oral lesions, such as erosive lichen planus and spongiotic gingivitis, have been successfully managed with only a thin application of 20% topical benzocaine.[10,11]

Since $CO_2$ wavelengths are highly absorbed in water and the superficial epithelial layer,[12] the desiccated appearance or "white spots" that were noted during LEA treatment appear to be ablated epithelial cells or keratin proteins. The thermal effects from LEA treatment may also contribute to bacterial and fungal disinfection, as shown in other laser studies.[1] Compared to surgical scalpel techniques, $CO_2$ lasers also minimize post-operative pain and swelling.[13]

## CONCLUSION

This case report described a novel palliative treatment for a painful, persistent, and refractory HFLP with the use of a 9300 nm $CO_2$ laser with LEA. The patient reported immediate and long-term improvement of oral symptoms with this laser application. Another consideration when weighing this treatment approach is that along with removing hyperkeratotic papillae, LEA therapy may have antibacterial and antifungal properties that help promote successful resolution of HFLP. D

**Acknowledgment:** This case report was approved by the Midwestern University Office of Research and Sponsored Programs Institutional Review Board AZCS-183.

## CE QUESTIONS

THE ANSWER SHEET AND FURTHER INSTRUCTIONS ARE LOCATED ON THE TEAR-OUT CARD THAT APPEARS ON PAGE 29, OR TAKE THE TEST ONLINE AT DIMENSIONSOFDENTALHYGIENE.COM.

1. Fill in the blank: Hairy tongue or "black hairy tongue" is a benign condition that is usually _____ and self-limiting.
   A. Symptomatic
   B. Asymptomatic
   C. Transmissive
   D. Debilitating

2. Resolution of hairy tongue is typically accomplished by what means?
   A. Electrodessication
   B. Conservative measures
   C. Tongue hygiene
   D. B and C

3. This case report describes treatment of a patient presenting with which symptom(s)?
   A. Lingual burning sensations
   B. Difficulty swallowing
   C. Heavy tongue coating associated with refractory hyperkeratosis of the filiform lingual papillae (HFLP)
   D. All of the above

4. If conventional treatment of HFLP is ineffective, the use of diode laser photobiomodulation and carbon dioxide ($CO_2$) lasers has been suggested.
   True
   False

5. Following chlorhexidine therapy, the patient in this case report pursued which alternative treatment?
   A. Palliative low energy ablation (LEA) therapy with a 9300 nm $CO_2$ laser
   B. Diode photobiomodulation
   C. Hydrogen peroxide antiseptics
   D. Keratolytic agents

6. At the first LEA session, an epithelial level of desiccation appeared after the third and fourth laser passes, which rehydrated within what time frame after being wiped with wet gauze?
   A. 20 seconds
   B. 25 seconds
   C. 30 seconds
   D. 35 seconds

7. The patient presented for the second LEA tongue treatment, at which time she reported significant improvement in her original symptoms.
   True
   False

8. Using the same LEA protocol, a third palliative session treated which area of the tongue, providing immediate relief of symptoms?
   A. Right side
   B. Left side
   C. Entire tongue surface
   D. Lingual frenulum

9. A 9300 nm $CO_2$ laser was set on high power mode for all three LEA sessions.
   True
   False

10. A consideration for this treatment approach is that along with removing hyperkeratotic papillae, LEA therapy may offer which properties that help promote successful resolution of HFLP?
   A. Fluoride release and recharge
   B. Antibacterial and antifungal
   C. Neuroprotective and systemic
   D. Antioxidant and anti-plaque