CASE REPORT

Laser palliation of oral manifestations of human immunodeficiency virus infection

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ABSTRACT

Background. The author describes the use of lasers to palliate the oral manifestations of the human immunodeficiency virus, or HIV, infection. He discusses the advantages to both patients and dentists, but he does not address the use of lasers as a modality to treat or cure HIV infection.

Case Description. Many oral manifestations of HIV infection can be used as markers for degree of immunosuppression. These manifestations may be treated with antibiotics, analgesics and antineoplastics, which may interact and interfere with antiviral agents used to treat the disease and possibly may exacerbate it. The author describes laser palliation of the oral manifestations of three HIV-positive patients.

Clinical Implications. Dentists will see more patients living longer with HIV as the disease becomes more treatable. Lasers have been shown to be effective instruments in palliation of oral manifestations of HIV infection.

Because of advances in treatment of human immunodeficiency virus, or HIV, infection, more patients who are HIV-positive are living longer while being chronically infected with HIV. The Centers for Disease Control and Prevention, or CDC, has reported a significant decrease in the incidence of acquired immunodeficiency syndrome, or AIDS, deaths along with an increase in the number of people who are infected with AIDS.[1] The CDC reported a 42 percent decrease in the number of AIDS deaths between 1996 and 1997, and an additional 20 percent decrease in AIDS deaths between 1997 and 1998. The CDC further reported a 10 percent increase in the number of patients living with AIDS between 1997 and 1998. Both of these trends continued into 1999 and 2000, the latest years for which statistics were available. The table shows the CDC statistics of the estimated number of people living with AIDS in the United States and the estimated number of AIDS deaths in the same period for the five-year period of 1996 through 2000.

More patients are living longer while being chronically infected with human immunodeficiency virus.

The CDC attributes the increase in the number of people living with AIDS to the effects of new treatments. The advent of protease inhibitors and other drugs over the past few years has made a significant impact on the rate of AIDS deaths. The CDC's statistics have strong implications for dentists. Dental practitioners will be seeing more chronically infected patients and will be asked to perform more dental treatment on these patients than in the past.

Dentists should become familiar with the oral manifestations of HIV infection and how to treat them. They include, but are not limited to:

- Kaposi's sarcoma, or KS;
- aphthouslike ulcer;
- human papillomavirus, or HPV, infection;
- linear gingival erythema, or LGE (formerly HIV-associated gingivitis);
- necrotizing ulcerative periodontitis, or NUP (formerly HIV-associated periodontitis);
- hairy leukoplakia;
- candidiasis.

Oral manifestations of HIV infection may be the first signs of the disease, and the presence or progression of some lesions, such as candidiasis, NUP and hairy leukoplakia, may be used as important markers for disease staging and progression.[2] Laskaris and

TABLE

ESTIMATED NUMBER OF ACQUIRED IMMUNODEFICIENCY SYNDROME CASES AND DEATHS, BY YEAR.*

ACQUIRED IMMUNODEFICIENCY SYNDROME	YEAR					
	1995	1996	1997	1998	1999	2000
No. of Cases	215,252	238,420	266,086	290,403	314,054	338,978
No. of Deaths	51,117	38,025	21,999	18,397	17,172	15,245

* Source: Centers for Disease Control and Prevention.[1]

colleagues[3] documented one or more oral lesions in more than 90 percent of their HIV-positive population. Mascarenhas and Smith[4] noted studies that document oral manifestation in 70 percent of HIV-positive patients. Glick and colleagues[5] examined 454 HIV-positive patients and used various oral manifestations to predict HIV helper, or CD4, cell count. Their results showed that the presence of major aphthae has a predictive value of 100 percent for a CD4 count of less than 200 cells per cubic millimeter; necrotizing ulcerative gingivitis, or NUG, has a predictive value of 95.1 percent for a CD4 count of less than 200 cells/mm^3; and KS has a predictive value of 93.6 percent for CD4 of less than 200 cells/mm^3. They concluded that oral manifestations are highly predictive markers of immune system depression and disease progression. The AIDS Institute[2] stated that treatment of the oral manifestations of HIV infection can improve a patient's attitude, quality of life and general health. It also stated that poor oral health can complicate the management of medical conditions and create or exacerbate nutritional and other problems.

Physicians may call on dentists to become more active in the total health care of immunocompromised patients. Ethically and legally, dentists are obligated to treat patients who have HIV as long as the necessary treatment is within the parameters of care delivered to seronegative patients in their practices.[6,7]

There are several books and articles that document and describe the oral manifestations of HIV infection and provide thorough descriptions.[4,8-11] In this article, I briefly describe some of the more common oral manifestations of HIV infection and their treatment with lasers. I also describe the use of lasers to palliate one of the painful oral manifestations of HIV infection. I do not, however, address the use of lasers to cure or treat HIV infection.

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ORAL MANIFESTATIONS AND THEIR LASER TREATMENT

KS. KS is the most common oral malignancy associated with HIV. Flaitz and colleagues[12] stated that KS accounts for 90 percent of all cancers in HIV-positive patients. The presence of KS in seropositive males younger than age 60 years is a diagnostic marker for AIDS under the CDC's guidelines.[13] Lesions occur most commonly on the palate and the maxillary gingiva. They initially are flat purple areas and tend to proliferate quickly.[14] Though KS lesions can be recognized easily by their clinical appearance, the AIDS Institute[2] wrote that biopsy is the most reliable tool for definitive diagnosis of KS.

Performing an excisional biopsy with a laser has many advantages over electrosurgical procedures or those using blades. The most important advantage is that of hemostasis. The ability of dental lasers to act as hemostatic instruments is well-documented in the literature. Strauss[15] described a technique for hemostasis of lesions even if the laser is not used for primary management of the lesions. Pick[16] advocated lasers for coagulation of soft-tissue grafts. Miller and Truhe[17] discussed laser use for removal and control of hemorrhage of vascular lesions, such as hemangiomas. Kutsch[18] advocated using lasers for hemostasis and coagulation and described the removal of a hemangioma of the tongue with a carbon dioxide, or CO_2, laser.

Since HIV-positive patients may be at an increased risk of experiencing postoperative bleeding due to thrombocytopenia, liver involvement or coagulation abnormalities, the laser's ability to cauterize and coagulate as it cuts the tissue is a significant advantage over other modalities. The hemostatic ability of lasers also is

helpful in creating a bloodless surgical field. This has two distinct advantages for surgeons. The first is that there is a clear surgical site; there is excellent visualization of the surgical site during a bloodless laser procedure. The second advantage is the decreased amount of blood that the surgeon is exposed to during the procedure. This may have a tremendous psychological effect on the surgeon, who does not need to worry as much about inadvertent or excessive exposure to contaminated blood during the procedure, even while observing universal barrier protection.

Another benefit lasers have when being used as biopsy instruments lies in their bactericidal effect, which is well-documented in the literature.[19-26] Since HIV-positive patients may have delayed wound healing owing to their compromised immune systems, contamination of the surgical site with the normal oral bacterial flora or opportunistic oral bacterial flora could create a delay in wound healing or possibly an infected wound site. As lasers have the ability to destroy bacteria at the surgical site, there is less chance of the biopsy wound becoming infected.

Lasers also have been shown to create less postoperative pain than other surgical modalities.[15] This means that patients may be less likely to need analgesics after the procedure is performed. This is a distinct advantage, as HIV-positive patients usually take several drugs to control the virus and this would mean one less drug to take, as well as less possibility of interactions between analgesics and antiviral medications.

There is a potential disadvantage to the use of lasers in any patient, no matter what his or her HIV status is. Laser plume has the potential to carry live viral particles through the air to the surgeon, the dental assistant and other personnel in the operatory. The literature on infectivity of laser plumes in medicine is not definitive. Hughes and Hughes[27] investigated the laser plume from erbium:yttrium-aluminum-garnet, or Er:YAG, laser ablation of human warts. Though human papillomavirus 2, or HPV2, DNA was found in all of the warts, no HPV2 DNA was detected in the plume. Kunachak and colleagues[28] used a CO_2 laser to ablate laryngeal papillomas. Investigation of the plume revealed no viable viral particles. I know of no literature to date that discusses the infectivity of laser plume in dental or oral surgical procedures. No matter what the outcome of laser plume studies, the critical point is that universal precautions must be adhered to scrupulously. This includes the use of laser plume masks, appropriate eyewear, high-speed suction and smoke evacuation equipment where indicated.

Other treatments are available for KS. Vinblastine, vincristine and alpha-interferon have all been injected into KS lesions.[8,29-31] Chockley and Coke[30] described the side effects of intralesional vinblastine as pain for one to three days, which necessitated the use of narcotic medications such as oxycodone. Lesions also have been sclerosed with injections of sodium tetradecylsulfate. Radiation therapy has been used; however, Scully and McCarthy[8] pointed out that patients treated with radiation can develop mucositis and xerostomia. In Chockley and Coke's[30] discussion of radiation as a treatment for intraoral KS, they stated that effective dosages of radiation often are tolerated poorly. Side effects included severe mucositis and severe pain. They also reported that radiation therapy cost between $3,800 and $4,000 per completed treatment, and they discuss lasers as a palliative treatment for KS. Other articles also have discussed laser treatment as an effective palliative treatment for KS.[9,10,29]

The appearance of aphthous lesions is one of the clinical markers for the diagnosis of acquired immunodeficiency syndrome.

Aphthouslike ulcers. The appearance of aphthous lesions is one of the clinical markers for the diagnosis of AIDS. The CDC states that the presence of persistent herpetic oral ulcers that do not resolve after one month is a clinically acceptable diagnosis of AIDS.[13] Apthouslike ulcers in HIV-positive patients may have many etiologies, such as lymphoma; infection by herpes simplex virus, herpes zoster virus, cytomegalovirus or histoplasmosis; or as a side effect of such antiviral medications as foscarnet and zalcitabine.[2,8] Acyclovir usually is prescribed for treatment of aphthous ulcers; acyclovir-resistant ulcers may respond to foscarnet.

Topical treatments for ulcers in HIV-positive patients are similar to those for ulcers in seronegative patients. These treatments may include topical corticosteroids, such as fluocinonide and dexamethasone,[14] and topical tetracycline.[2] Scully and McCarthy,[8] however, advised that ulcers in

HIV-positive patients may be resistant to conventional treatment.

Laser palliation of oral ulcers is documented in the literature. Colvard and Kuo[32] showed that CO_2 laser treatment relieved pain on application of laser energy. Convissar and Massoumi-Sourey[33] found the same results when using neodymium:YAG lasers. Though the number of patients in these studies was small, the results were dramatic. More university-based controlled studies are needed to further corroborate these studies.

The advantages of laser treatment over systemic pharmacological intervention include avoidance of the deleterious interactions with other medications and the side effects of the medications themselves. Acyclovir can cause nausea, diarrhea and headaches. Foscarnet can impair kidney function, cause or exacerbate anemia and thrombocytopenia and may exacerbate the oral ulcers, rather than heal them. Foscarnet also may cause xerostomia, which can lead to rampant caries.[34]

The advantages of laser treatment over systemic pharmacological intervention include avoidance of the deleterious interactions with other medications and the side effects of the medications themselves.

In some cases, the practitioner may want to perform a biopsy of the ulcer to determine its cause. Scully and McCarthy[8] advocated performing a biopsy of persistent oral ulcers to rule out other etiologies. Ulcers caused by cytomegalovirus, histoplasmosis, aspergillosis or other infective agents may indicate further progression of AIDS and require more immediate medical attention.[2] Biopsy and subsequent laser palliation of the lesions are excellent treatment options for aphthous lesions.

HPV infection. HPV lesions are multiple small cauliflowerlike papillary projections usually found on the lips. These lesions should be removed because of the high correlation between HPV infection and oral squamous cell carcinoma, or OSCC. Premoli-De-Percoco and colleagues[35] analyzed 50 OSCC biopsies and found that 70 percent of OSCCs were positive for HPV DNA. Al-Bakkal and colleagues[36] examined the frequency of HPV type 16 in oral exophytic lesions that showed either epithelial hyperplasia or dysplasia in immunocompromised and immunosuppressed patients. Their results showed that mild-to-severe dysplasia and OSCC were 16 times more likely to contain HPV viral DNA than were benign lesions.

The AIDS Institute[2] advocated cauterization after the lesions are excised to minimize reinfection from the wound site. HPV lesions have been treated successfully by total excisional laser biopsies.[8] As I discussed previously, lasers are able to cauterize and coagulate tissue well, and they can decrease bacteria at the surgical site. Other authors also have discussed laser excision as a viable treatment modality for HPV-induced oral papillomas.[8-10]

LGE and NUP. Ceballos-Salobrena and colleagues[37] diagnosed NUP in 54.3 percent of an HIV-positive population and LGE in 31.5 percent of the population. Aguirre and colleagues[38] diagnosed NUP in 31.9 percent of an HIV-positive population and LGE in 48.6 percent of the population. Both of these periodontal diseases are diagnosed by their clinical characteristics. LGE appears as a linear area of erythema 2 to 3 mm from the gingival margin. LGE is not necessarily associated with plaque, as is conventional gingivitis in seronegative patients. NUP is a form of periodontitis characterized by a severe and rapid loss of bone. The AIDS Institute[2] described NUP as creating up to 90 percent bone loss in less than three months. As with conventional periodontitis and gingivitis, the primary treatment modality for NUP is meticulous débridement of the area combined with strict home care. Use of systemic antibiotics is strongly suggested[2]; however, candidiasis may occur as a result of systemic administration.

Scully and McCarthy[8] stated that any treatment regimens must take into account adverse drug reactions and possible drug interactions. Use of antifungal medications is suggested to prevent or control candidiasis. Since both NUP and LGE are bacterial infections caused by normal bacterial flora in an immunocompromised host or by opportunistic bacteria, I suggest using lasers to control these diseases. In their discussion of HIV-associated periodontal disease, Lamster and colleagues[39] concluded that the microflora of HIV-positive and seronegative patients are similar. Moore and colleagues[40] compared the anaerobic microflora from seropositive and seronegative patients with periodontal disease and determined that the microflora essentially was the same.

Figure 1. Buccal view of large Kaposi's sarcoma lesion of the anterior maxilla preoperatively. Note its location in the gingival embrasure between teeth nos. 8 and 9.

Figure 2. Preoperative palatal view of the same lesion as shown in Figure 1.

Murray[41] used DNA probes to compare the pathogens for NUP and adult periodontitis and discovered that the DNA probe profiles of both diseases were similar. Itin and colleagues[9] stated that the predominant microflora of sites with HIV-associated gingivitis include *Porphyromonas gingivalis, Bacteroides intermedius* and *Actinobacillus.* Moritz and colleagues[42] used a diode laser in periodontal pockets of seronegative patients and evaluated total bacterial count and specific bacteria, including *P. gingivalis* and *Actinobacillus.* The results showed that total bacterial count reduction was achieved in 100 percent of the patients. Greenspan and Greenspan[10] advocated treatment measures that eliminate the anaerobic subgingival flora implicated in the disease.

As I mentioned previously, there are many articles that describe the successful use of lasers as bactericidal instruments. Pinero's[26] study stands as one of the most definitive examples of intraoral laser use resulting in decreased bacterial count. Pinero performed laser curettage before oral surgical procedures, including extraction. Patients treated in this manner showed no bacteremia postextraction or after periodontal surgery. Patients not treated preoperatively with laser curettage had an average of 52 percent positive blood cultures. Though this preliminary study has not yet been corroborated by other studies, it showed that lasers are able to decrease the incidence of bacteremias associated with intraoral procedures.

CASE REPORTS

The following case reports illustrate the use of dental lasers for treatment of oral manifestations of AIDS.

Case report 1. A 34-year-old man came to the dental clinic at New York Hospital Medical Center of Queens, Flushing, New York, complaining of severe mouth pain. His medical history revealed advanced AIDS, for which he was receiving treatment in the medical center's outpatient medical clinic. Clinical examination revealed multiple large lesions throughout the mouth, including the gingivae and hard palate. These lesions had had biopsies performed on them and had been diagnosed as KS secondary to HIV infection. One large lesion extended from the maxillary anterior gingiva through the embrasure between the central incisors and onto the palate, where it measured approximately 16 mm (Figure 1 and Figure 2). The patient said that every time he attempted to chew, his lower anterior teeth contacted the palatal lesion, which resulted in bleeding and severe pain. I explained the treatment options to the patient, including the use of a dental laser to ablate the lesions.

After I applied topical anesthetic gel, I injected two carpules of lidocaine with epinephrine 1:100,000 into the mucosa surrounding the lesions. I set a CO_2 laser at 5 watts of continuous power and placed an 800-micrometer ceramic tip into a contra-angle handpiece 1 mm from the lesions. The lesions were exposed to the laser energy until they were ablated. The wound sites coagulated instantly (Figure 3 and Figure 4).

The patient tolerated the procedure well and had no adverse effects. I dismissed him with routine postoperative instructions and did not prescribe analgesics or antibiotics. At the one-week follow-up appointment, the patient was pain-free and able to chew for the first time in weeks. The patient died as a result of the systemic

Figure 3. Buccal view of the Kaposi's sarcoma lesion immediately postoperatively. Note the excellent surgical result and hemostasis of the lesion.

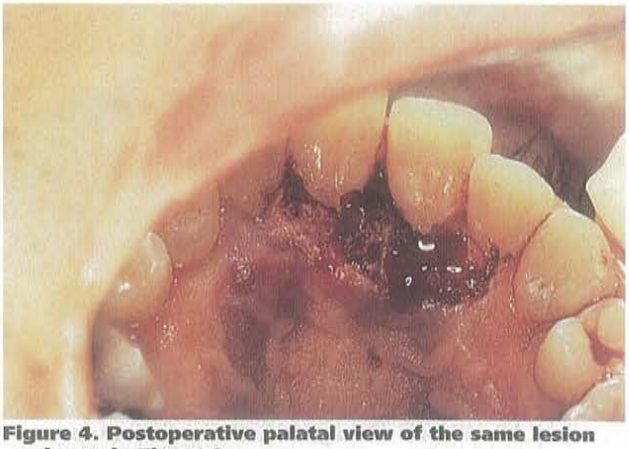

Figure 4. Postoperative palatal view of the same lesion as shown in Figure 3.

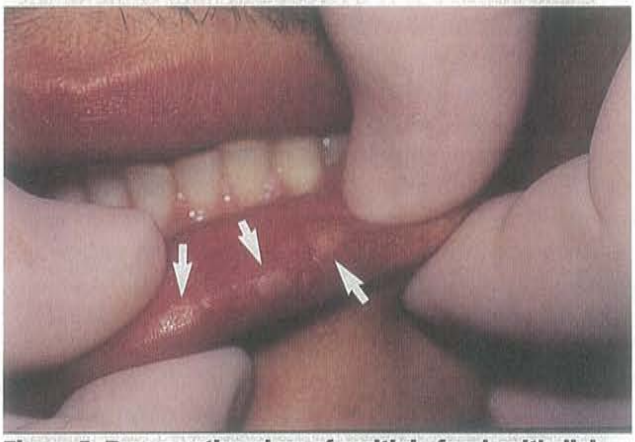

Figure 5. Preoperative view of multiple focal epithelial hyperplasia lesions secondary to human immunodeficiency virus infection (arrows).

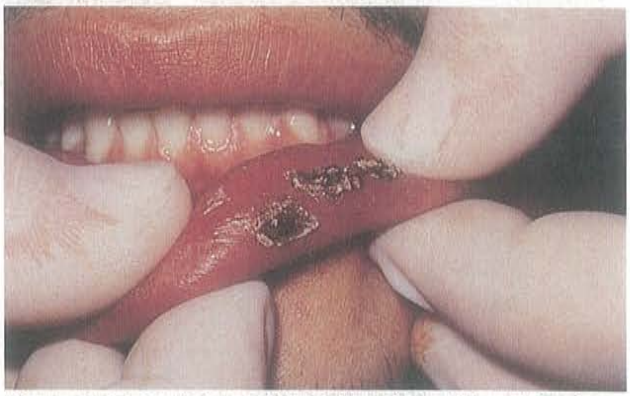

Figure 6. Immediate postoperative view of lased focal epithelial hyperplasia lesions.

effects of HIV infection shortly after the one-week follow-up.

Case report 2. A 27-year-old man came to the dental clinic at New York Hospital Medical Center of Queens complaining of multiple growths around his mouth and lips. Clinical examination revealed multiple white cauliflower-like projections on his lower lip extending from commissure to commissure (Figure 5). His medical history revealed that he was in the advanced stages of AIDS, for which he was being treated in the medical center's outpatient medical clinic. One of the lesions on the lip had had a biopsy performed on it and had been diagnosed as HPV-induced focal epithelial hyperplasia. I explained the treatment options to the patient, including the use of dental lasers. We agreed that dental laser treatment would be superior to conventional scalpel surgery because of the large surface area over which the lesions were spread.

After I applied topical anesthetic gel, I infiltrated two carpules of lidocaine with epinephrine 1:100,000 around the lesions. I set a CO_2 laser at 5 W of continuous power and placed an 800-μm ceramic tip in a straight handpiece to within 1 mm of the lesions. The lesions were exposed to the laser energy until they were ablated and then the wound sites coagulated immediately (Figure 6).

The patient tolerated the procedure well and had no adverse effects. I dismissed the patient with routine postoperative instructions and did not prescribe analgesics or antibiotics. At both the one-week and one-month follow-up appointments, the patient was pain-free and lesion-free in the surgical site.

Case report 3. A 57-year-old man came to my private practice office in New York City complaining of a large cold sore inside his lower lip. Clinical examination revealed a solitary major

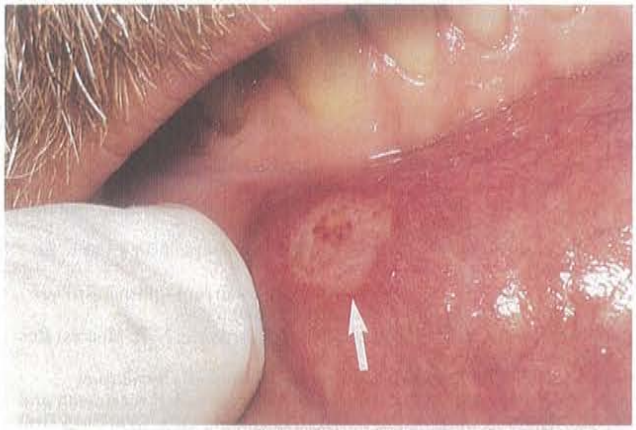

Figure 7. Preoperative view of major aphthous lesion on inner surface of lower lip (arrow).

Figure 8. Postoperative view of lased lesion from Figure 7.

aphthous ulcer on the buccal mucosa near the lower left canine (Figure 7). The patient said that the lesion had been present for five days and had made eating impossible. His medical history revealed that he was HIV-positive and that his primary care physician was treating him. I discussed treatment options with the patient, including the use of a dental laser to ablate the lesion.

After I applied topical anesthetic gel to the area, I infiltrated one carpule of lidocaine with epinephrine 1:100,000 around the lesion. I used an Nd:YAG laser with a 320-µm fiber-optic cable in a laser handpiece set to 2 W and 20 pulses per second. I brought the laser handpiece into contact with the lesion and exposed the entire lesion to laser energy until the surface epithelium was ablated. The lesion bled slightly and then coagulated within five seconds (Figure 8).

The patient tolerated the procedure well and had no adverse effects. I dismissed him with routine postoperative instructions and did not prescribe analgesics or antibiotics. At the one-week follow-up appointment, there was no evidence of the lesion. The patient reported that he was pain-free and able to eat as soon as the lidocaine wore off. At subsequent routine follow-up appointments for prophylactic dental care, the patient was pain-free and lesion-free in the surgical site.

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CONCLUSIONS

In all three cases in which I used laser energy to palliate oral manifestations of AIDS, there were no adverse effects, the procedures were well-tolerated by the patients, no postoperative medications were needed and the costs to the patients were minimal. Dental lasers should be considered viable alternatives to other modalities when palliating oral manifestations of HIV. The dental team must ensure that universal barrier precautions are used, and sufficient high-speed suction or smoke evacuation devices are available to deal with the potential biohazard of laser plume.

I did not address the use of dental lasers for treatment or curing of HIV; instead, I addressed using lasers to palliate the painful oral manifestations of the disease. ■

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