Advanced Laser Techniques for Filler-Induced Complications

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BACKGROUND The increasing use of injectable fillers has been increasing the occurrence of disfiguring anaerobic infection or granulomas. This study presents two types of laser-assisted evacuation of filler material and inflammatory and necrotic tissue that were used to treat disfiguring facial nodules after different types of gel fillers.

MATERIALS AND METHODS Infectious lesions after hydrogels were drained using a lithium triborate laser at 532 nm, with subsequent removal of infected gel and pus (laser assisted evacuation). Granuloma after gels containing microparticles were treated using an 808-nm diode laser using intralesional laser technique. The latter melted and liquefied the organic and synthetic components of the granulomas, facilitating subsequent evacuation. Both lasers had an easily controllable thin laser beam, which enabled the physician to control tissue damage and minimize discomfort and pain.

RESULTS All 20 patients experienced reduction or complete resolution, the latter increasing with repeated treatments.

CONCLUSION Laser-assisted treatment offers a successful solution for patients who have been suffering from disfiguring nodules from injected fillers—often for many years. The procedure broadens the range of treatment options in cases of untoward reactions to fillers, in line with surgical removal but with lower morbidity and less cosmetic disfigurement.

The authors have indicated no significant interest with commercial supporters.

The constantly increasing popularity of injectable gel fillers for aesthetic purposes has raised the incidence of complications after injection.[1–4]

Resorbable substances result in a low incidence of long-lasting or late complications, but the use of partially or completely nonresorbable polymers has increased the rate of anaerobic infections and granulomatous reactions, and many of these are difficult to treat.[1–4] The only noninvasive therapeutic options are antibiotics, steroids, and 5-fluorouracil (5-FU),[5] the first being effective only if used before a biofilm has developed (anaerobic inflammatory lesions, see Bjarnsholt and colleagues, this issue) and the second and third often giving just temporary improvement and rebound effects and, for steroids, skin atrophy and telangiectasias (granulomas).[6] Although often advocated by the manufacturers, filler removal by needle aspiration is rarely successful, especially a few months after the injection, and surgical excision may be disfiguring.

The tissue swelling accompanying bacterial infection is due to edema and a heavy cellular foreign-body response, whereas the swelling following fillers containing microparticles is mainly caused by a chronic inflammatory response and excessive fibrosis —a foreign body granuloma.[1]

Long-lasting low-grade infections give rise to culture-negative nodules, which are mistaken for real foreign-body granulomas.[7] These infections, however, are seen as cysts on ultrasound, and bacteria organized in a biofilm can be seen within them using fluorescence in situ hybridization (Bjarnsholt and colleagues, this issue). Such nodules typically

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 • Published by Wiley Periodicals, Inc. • ISSN: 1076-0512 • Dermatol Surg 2009;35:1689–1695 • DOI: 10.1111/j.1524-4725.2009.01348.x

develop after the use of nonparticulate hydrogels. The bacteria progress slowly under anaerobic growth conditions, and clinical symptoms normally do not appear until 1 to 2 weeks after the injection.[7] In contrast, granulomas do not contain detectable bacteria (unpublished data). They have a different etiology and may appear up to many years after injection.[8] Granulomas typically develop after injection of fillers containing microparticles.[8]

Most gels are injected into the face, and the disfiguring infectious or granulomatous lesions are immediately apparent and palpable. Surgery is bound to be imprecise in an infected or inflamed area, where bleeding is increased, and some scarring is inevitable. This study was undertaken to determine efficacy and tolerability of minimally invasive laser techniques as an alternative and gentler treatment option for infectious or granulomatous lesions.

Materials and Methods

Patients

Twenty-one patients (20 women, 1 man) with facial lesions were treated. Presumed type of injected filler, time since last injection, time since onset of complication, type of lesion, treatment, and outcome are shown in Table 1. All patients had been treated at other clinics with local or systemic corticosteroids and antibiotics without success.

Ultrasound Imaging

For seven patients, lesions were diagnosed using ultrasound before treatment to determine the nature of the lesion (granulomatous or cystic).

Laser

Two different lasers were used.

A lithium triborate (LBO) 532-nm laser (range 5 ms to continuous; Velure SS, Lasering, Modena, Italy) with a 500-μm spot size, 25 J/cm^2, 7 Hz was used for clearing the hypervascular reaction that often enhances the visibility of the granulomata by a selective photocoagulation[6,9] and evacuation of material from infectious or cystic lesions by creating a 0.5- to 1-mm drainage hole. In selected cases of granulomas, where a transmucosal access was possible, the LBO 532 laser was also used in an ablative mode (off label in the United States) to penetrate the mucosa to vaporize or sterilize the granulomatous lumps from within so that the liquefied debris could come out by this route.

An 808-nm diode (LASEmAR 800, EUFOTON srl, Trieste, Italy) was used at 6 to 8 W with a pulse duration of 500 to 1,000 ms in an intralesional mode through a 200-μm optic microfiber. The fiber was introduced percutaneously into the granulomatous lesion (penetration depth 1–8 mm) using the Marangoni intralesional laser treatment (ILT) procedure.[10] This procedure aims at drilling several small holes with the laser fiber at greater than 65°C to 70°C, each time inserting the tip inside the infected or granulomatous tissue and evacuating the content through the holes. Apart from having a bactericidal effect from the heat, it also appears to melt and liquefy the microparticles, as judged from a typical "plastic" smell during the procedure.

Both lasers heat and penetrate skin and mucosa slowly and without bleeding. Local anaesthesia may be necessary.[6,9,10]

Results

An overview of the different filler type lesions, their onset since injection, and outcome after treatment is shown in Table 1. Because type of lesion was determined using a combination of ultrasound and clinical evaluation, the seven patients who had their lesions evaluated using ultrasound imaging are marked with an asterisk.

All patients tolerated the treatment sessions well and showed improvement, and they all expressed satisfaction after the laser treatment, reporting

TABLE 1. Gel Type, Injection Site(s), Gel Time (Time Since Injection), Complication Time (Time Since Debut of Complication), Lesion, Treatment no, Treatment Type and Outcome for 21 Patients

Patient-age	*Gel type*	*Site(s)*	*Gel time*	*Complic.t.*	*Lesion*	*Treatm. No*	*Treatm.type*	*Outcome*
woman –32	Dermalive	lips	6 years	2 years	granulomas	2	ILT	partial cure
woman –40	Dermalive	lips	5 years	2 years	granulomas	1	ILT	partial cure
woman –43	Dermalive	lips	11 years	7 years	granulomas	3	ILT	complete cure
woman –50	Dermalive	tear trough	1 1/2 years	5 months	granulomas	1	ILT	partial cure
woman –52	Dermalive	cheeks, NLF,lips	6 years	2 years	granulomas	8	ILT	partial cure
woman –58	Dermalive	lips + NLF	8 years	3 years	granulomas	1	ILT	partial cure
woman –65	Dermalive*	NLF, Lips, chin	5 years	3 years	granulomas	2	ILT	partial cure
woman –34	Artecoll	lips	4 years	1 year	granulomas	2	ILT	complete cure
woman –41	Artecoll	cheeks	4 years	1 year	granulomas	1	ILT	partial cure
woman –45	Artecoll	glabella	7 years	2 years	granulomas	1	ILT	partial cure
woman –51	Artecoll*	NLF	9 years	8 years	both		Vasc. only	surgery
woman –56	Artecoll*	MLF	8 years	6 years	granulomas	1	ILT	partial cure
woman –48	acrylate	glabella + NLF	6 years	1/2 year	granulomas	1	ILT	partial cure
woman –32	Sculptra*	lower lip	5 years	5 years	both	1	ABL + drain	partial cure
woman –52	Matridex	lip	1 day	1 day	cystic lesion	1	ABL + drain	complete cure
woman –43	Bio-A*	right CHKB	1 year	1 year	hard cyst	1	ABL + drain	partial cure
woman –45	Bio-A*	cheeks	4 years	1 1/2 years	hard cyst	3	ABL + drain	partial cure
woman –54	Bio-A	cheeks	5 years	4 years	hard cyst	2	ABL + drain	partial cure
woman –55	Bio-A*	cheeks	3 years	2 years	hard cyst	2	ABL + drain	partial cure
woman –34	Puragen-HA	lips	1 year	6 months	cyst	1	ABL + drain	complete cure
woman -50	Collagen	lips	2 years	1 month	hard cyst	1	ABL + drain	complete cure

Abbreviations: Both: granuloma(s)s and cystic lesion(s) ILT: intralesional laser treatment, Abl + drain: ablative laser therapy and drainage. NLF: nasolabial fold, MLF: mentolabial fold, CHKB: cheekbone, Bio-A: Bio-Alcamid, Acrylate: Dermalive or Artecoll. *Patients who had their lesions diagnosed by ultrasound. Different gel types: Dermalive: Poly-hydroxy-ethyl-metacrylate/ethyl metacrylate microfragments in hyaluronic acid gel. Artecoll: Poly-methyl-metacrylate microspheres in collagen gel. Sculptra: Poly-L-lactic acid microspheres in a gel of sodium carboxymethylcellulose, non-pyrogenic mannitol, sterile water. Matridex: Dextranomer microspheres in hyaluronic acid gel. Puragen: Double cross-linked hyaluronic acid gel. Bio-Alcamid: Polyalkylimide polymer hydrogel.
Dermalive, Dermatech, Paris, France; Artecoll, Artes Medical, San Diego, CA; Sculptra, Sanofi-Aventis, Paris, France; Matridex, BioPolymer Gmbh&Co, Siershahn, Germany; Bio-Alcamid; Polymekon S.r.l., Brindisi, Italy; Puragen, Mentor Corp, Santa Barbara, CA.

Figure 1. Cystic lumps in lower lip 3 months after cross-linked hyaluronic acid and dextranomer microsphere injections. Antibiotics and steroids were administered for 6 weeks with no resolution. Top left shows the lip (with surrounding older tattoo) before laser treatment (1). The nodule is marked with an arrow. The lip right after treatment is seen bottom left with treatment site indicated with an arrow (2a), and the extracted material is seen to the right (2b). Top right shows the lip 2 months after treatment. Note the overall reduction in volume due to degradation of the gel as well as the defect (arrow) after the laser treatment (3).

significant reduction in pain, stiffness, tenderness, and size of the lesion. Objectively, a partial or complete reduction in size was seen in all cases (Figures 1–3), and histology of the evacuated material showed complete necrosis and fragmentation (Figure 4, right side).

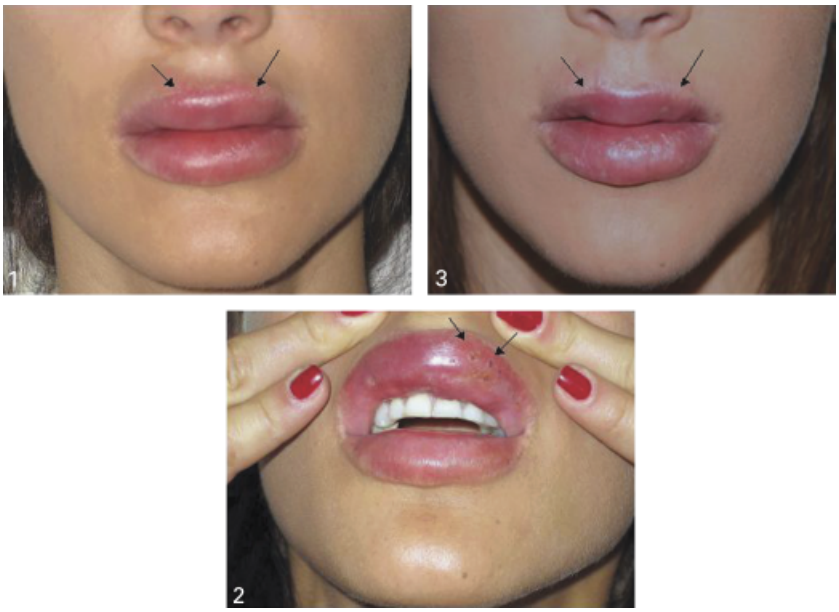

Figure 2. Multiple granulomas in lips after Dermalive injections topped up with Aquamid. The sessions involved only the upper lip, which had previously been operated upon surgically (top left and right, arrows). The lip just before treatment is seen top, left side (1). The lip shown from the inside with holes drilled by the laser (arrows) is seen bottom center (2). The upper lip 3 months after treatment is seen at top right (3).

Figure 3. Multiple granulomas in nasolabial and mentolabial folds, bilaterally, after Artecoll injections. A prominent granuloma on the left side (top left, arrow) was treated using intralesional laser treatment. A minute hole after the invasive procedure was seen after 2 days (top right, arrow), but it had disappeared completely 2 months later. Hypervascular reaction of the skin is marked with a circle (top right). This was treated successfully with the noninvasive technique by the lithium triborate laser at 532 nm (bottom photos).

Lesions diagnosed as cysts on preceding ultrasound imaging (Figure 5) were treated more superficially by drilling holes in skin or mucosa so that access to the cavity was secured and the content drained or squeezed out (Figure 1). Cystic lesions reflected edematous tissue with collections of serosanguineous liquid or pus and were characteristically seen after injection with nonparticulate hydrogels such as hyaluronic acid (Puragen) and polyalkylimide hydrogel (Bio-Alcamid) (Table 1).

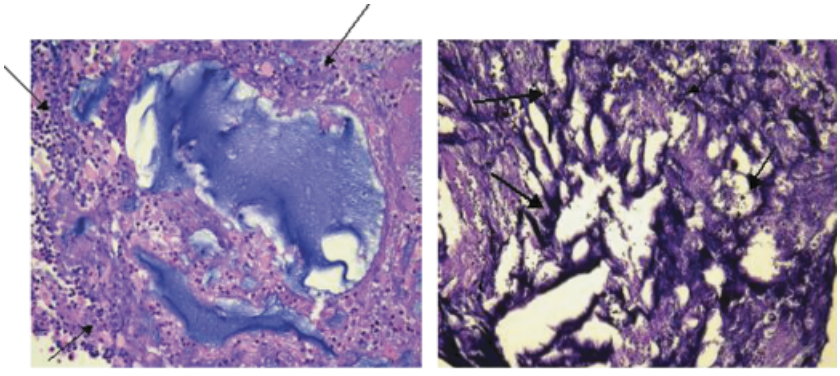

Figure 4. Histologic photo of infected Bio-Alcamid polyalkylimide hydrogel with numerous polymorph nuclear granulocytes (arrows). Only necrotic (burnt) and fragmented material remained (right, arrows) (HE $\times$ 40).

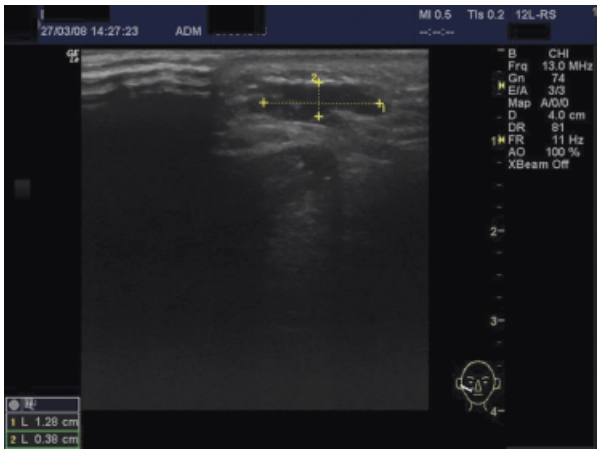

Figure 5. Ultrasound photo of a cystic lesion (yellow crosses) located in the right nasolabial folds.

In organized granulomatous lesions, which were subjected to ILT, the heat "melting" the microparticles gave out a characteristic "plastic" smell. Acellular, necrotic debris similar to that seen in Figure 4, right side, was identified. Several lesions needed more than one treatment, but all had improved, and the content was eliminated with a minimum of bleeding, scarring, and pain. Granulomas up to 5 mm in diameter were cured in one treatment (Figure 3). The larger ones required up to four treatments. All of the granulomas arose after injection with Dermalive or Artecoll (Table 1). Postoperative undesired effects were immediate mild swelling that subsided within 2 to 7 days, depending on the area of the face. Some of the patients were satisfied with partial improvement. Others with granulomatous lesions underwent continuous removal of just a few granulomas at a time (Figure 2), or they had their granulomas diminished to asymptomatic lumps, after which they did not want any further treatments because they had ceased to cause cosmetic concern (Figure 3).

Steroid-induced erythema and telangiectasias on the skin overlying the granulomas were removed using selective photocoagulation with the LBO 532 laser (500 µm, 20 J/cm^2, 7 Hz) in three patients: two who had been injected with Dermalive in the nasolabial folds and chin and lips and one who had received Artecoll injections in the nasolabial folds (Figure 3).

Discussion

To fill the treatment gap between drugs and surgical excision, standardized procedures of laser-assisted evacuation of cystic lesions or ILT of granulomas were developed and applied to 20 of 21 patients (one had only superficial erythema treated) who had been injected in the face with different gel fillers.

The study was performed to determine the efficacy and tolerability of a minimally invasive laser technique that has been used previously in the treatment of vascular lesions, scars, and benign tumors.[6,9–13]

Until now, treatment of granulomas or infectious or cystic lesions from injected gels has primarily been medical—antibiotics, steroids, fluorouracil, or hyaluronidase locally and systemically. From there, treating physicians have jumped to incision, but surgery with local anesthesia can be imprecise in an inflamed area. There is bleeding during the procedure, and some scarring is inevitable.

Therefore, if invasive or intralesional laser-assisted treatment proved to be 100% effective, surgery could be completely avoided. If one treatment was only partially effective, more could be added or dimensions of the lesions could be reduced to the point at which subsequent surgical excision would minimize scarring.

The treatments were completely or partially effective in all cases by reducing the size of granulomas or emptying purulent or necrotic debris in infectious or cystic lesions (Figure 2). This minimally invasive laser technique, which the late Professor Ovidio Marangoni originally introduced,[14] has proven effective in melting tissue, filler material, and inflammatory cells into a necrotic debris that can be removed immediately through the drilled holes. The heat from the laser beam (65–70°C) will most likely

kill the bacteria within the biofilm community and melt the the microparticles, as evidenced by the characteristic "plastic" odor smelled during the procedure. Furthermore, developing it for use in the lips by drilling multiple holes and inserting the fiber longitudinally, energy was released directly into the deep granulomatous tissue, and necrotic material resulting from the thermal influence could be drained through the little holes, with no need for digital pressure. This use of the LBO 532 laser has been known for 2 years.[14,15]

Evacuation of infectious or cystic lesions and the melting and liquefying therapy of granulomas were accomplished by using a slow and easily controllable thin laser beam, which enabled the physician to control tissue damage and minimize discomfort and pain.

In our experience, the two different types of laser-assisted treatments described in this article have been the only successful solution for a number of patients who had been suffering from disfiguring inflamed nodules from injected fillers for years. They broaden the range of treatment options in cases of untoward reactions to fillers, in line with surgical removal, but with lower morbidity and better cosmetic result.

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