

Chapter I

TREATMENT OF LEUKOPLAKIAS AND VASCULAR MALFORMATIONS OF THE ORAL CAVITY USING LASER

David A. Dovsak, Ale_ Vesnaver

Treatment of oral leukoplakias with laser

Introduction:

Both, leukoplakia and vascular malformations are common entities in oral pathology and there is still much debate about the appropriate treatment protocol. We have been successfully using Er - Yag laser for the treatment of leukoplakias and Nd - Yag laser for the treatment of vascular malformations over the last five years.

Leukoplakia is a clinical term used to describe a white plaque on the oral mucosa. It is certainly one of the most semantically abused terms in medical literature (1). WHO has given a definition of leukoplakia and later there have been several attempts to classify precancerous lesions more accurately (2, 3) . WHO later in 1983 suggested that the term should not be used in cases where etiology of white patches is known except in cases of tobacco use. The evidence for a relation between tobacco smoking and leukoplakia is quite strong but smokeless tobacco keratosis seems to be a different entity and carries a much smaller risk of malignant transformation than leukoplakia (4, 5).

Several other conditions as lichen planus, chronic cheek bite, frictional keratosis, tobacco pouch keratosis, nicotine palatinus, leukoedema, white sponge nevus, etc. also present as white plaques and must be ruled out before the term leukoplakia can be given. Histopathologic assessment of leukoplakia reveals hyperparakeratosis, which is variably associated with an underlying epithelial hyperplasia and / or dysplasia. Numerous follow-up studies gave different rates of malignant transformation, ranging from 3 - 20 % (6). Leukoplakias without underlying dysplastic changes are rarely associated with progression to malignancy - less than 5 % probability of malignant changes (7, 8). Some clinical features can be strong predictors of future risk (multiplicity, longer duration, irregularity, nodularity). Erythroleukoplakia or erythroplakia can be associated with carcinoma in situ or frank malignancy in nearly 40 % of lesions (9, 10, 11) Proliferative verrucous leukoplakia, as a distinct clinical form also has a higher potential to develop into verrucous carcinoma or well - differentiated squamous cell carcinoma (12). Because the rate of malignant transformation of leukoplakias is

quite unpredictable and relatively low, some still argue that leukoplakia per se needs any treatment and suggest a good follow - up protocol. Also, it has been suggested that the term precancerous lesion should be replaced by the term potentially malignant lesion (1). On the other hand the incidence of oral cancer over the past years has been increasing and the majority of patients present with advanced stage of disease. It is important for the clinician to recognize changes of the oral mucosa and to perform a thorough oral examination regularly. Most oral carcinomas probably arise without any recognizable premalignant lesions (on the other hand, patients with oral cancers usually have one or more coexisting areas of leukoplakias adjacent to the cancer) but knowledge of such lesions can help clinicians to make the diagnosis of oral cancer early and could help patients to become aware of oral mucosa changes and nevertheless about treatment options.

Clinical features:

Leukoplakia is a predominantly male disease, affecting males twice as common as females. Leukoplakia in males also has a higher risk of dysplasia and malignant transformation (5). Leukoplakias are the most common chronic lesions of the oral mucosa, affecting around 3 % of the adult population, depending on the geographical area studied. (9, 13). Oral leukoplakias account for 80 % of all leukoplakias of the upper aero digestive tract (7). Leukoplakia has a varied clinical appearance which is known to frequently change over time. Change or progression over time accounts for yet another unique aspect of leukoplakia: it is one of the few diseases in which long duration is not evidence of harmless future behavior. Lesions of long duration have a greater risk of malignant transformation than those of short duration, and the older a leukoplakia the worse its prognosis (8, 9).

Treatment:

When a patient with leukoplakia presents, a thorough history is first taken following by good examination of the upper aero digestive tract. Not all leukoplakias need surgical treatment. Decision about treatment is made upon clinical appearance, presence of risk factors and histopathological assessment of the lesions. All possible factors causing whitish lesions in oral mucosa are considered and if possible eliminated during consecutive visits. Leukoplakias usually are not associated with any discomfort and when symptoms are present these may indicate transformation and should be recognized as a risk factor. It should be emphasized again that any presence of a reddish component in whitish lesions on oral mucosa greatly increases risk of malignancy or possible malignant transformation and such lesions are usually biopsied on the first visit. The biopsy area is chosen according to clinical appearance. In larger lesions (more than 4 cm in diameter) several - usually 2 or 3 - biopsies are taken. We never treat invasive cancer with the laser and have treated only one carcinoma in situ of the upper gingiva with the laser in a 90 years old lady.

Over the past 5 years we have treated more than 120 patients with leukoplakia and results of the treatment of 83 patients are presented here. 55 patients were women and 28 men, with mean age of 58 years (31 - 88) (Table 1). Most of the patients were first followed by dentists and at some point they were referred to us. The reverse ratio between men and women in our series is thus not a reflection of prevalence but merely shows the decisions of the dentists which patients should be treated by a specialist. 57 patients were smokers and 39 patients showed symptoms, mostly discomfort in wearing dentures and discomfort during certain food intake. 37 patients had leukoplakias on at least two locations (i.e. both cheeks). Histologically most of the lesions showed hyperkeratosis with elements of chronic inflammation, 16 lesions showed mild to moderate dysplasia, 2 lesions showed

Carcinoma in situ and 1 lesion proved to be Lichen planus and was therefore not a true leukoplakia but the patient was treated anyway because of the presence of symptoms (Table 2).

Location	No. of patients (%)
Buccal mucosa	38 (46)
Gingiva	25 (31)
Tongue	7 (8)
Floor of mouth	7 (8)
Hard palate	6 (7)

Table 1. Location of leukoplakias in 83 patients

Histopathologic diagnosis	No. of patients (%)
Hyperkeratosis with chr. inflammation without dysplasia	64 (78)
Hyperkeratosis with chr. inflammation with dysplasia	16 (19)
Ca in situ	2 (2)
Lichen planus	2 (2)

Table 2. Histopathologic assessment of oral leukoplakias in 83 patients

Er - Yag component of a combined Er - Yag Nd - Yag Twinlight laser (Fotona, Slovenia) was used for the treatment. This laser has a wavelength of 2940 nm and is well absorbed in water and thus soft tissues. With pulse frequency of 10 to 15 Hz and duration of the pulse of 200 - 450 micro seconds (self set) there is not enough time for the tissue to get heated and micro explosions that occur cause ablation of the superficial layer of the tissue. When in focus (1.5 cm from the surface) the spot diameter is 3 mm. We tend to defocus the beam to get larger spot (4 - 5 mm) and we thus increase the power to get the same effect. We usually set the fluency to 800 to 1000 mJ per pulse (more than 4 J per square cm) and the frequency is set to 8 Hz. All usual safety measures are followed (use of protection glasses, use of non-metal instruments) during the procedure.

The patient rinses his or her mouth with chlorhexidine for 30 seconds and local anesthesia is given. Ablation is then performed with several passes over the lesion and a safety margin of about 3 mm. One does not have to worry about the number of passes since uniformity of ablation is not as crucial as it is on the skin for example. We remove the tissue down to the depth of petechial bleeding. (Fig. 1) During the procedure, the ablated tissue is regularly removed with wet cotton pads and the operating field is then dried. One has to be careful when ablating tissue around salivary glands orifices because scarring could cause obstruction of saliva flow. If any bleeding is present at the end of the procedure moderate pressure with cotton pads for 15 minutes usually solves the problem. For the last year we have been using a new Er - Yag laser (Fidelis, Fotona, Slovenia) where the duration of the pulse can be set up to one millisecond (Very Long Pulse Mode). That leaves enough time

for the tissue to get heated and small vessels can be coagulated. (Fig. 1). A deeper ablation can be achieved with this laser without any bleeding. It is still too early for the conclusions but so far we had less recurrences after treatment with Fidelis laser. Patients are given instructions about oral hygiene and adjusted dietary regime. Gaseous beverages, vinegar, nuts, spicy food and hot meals should be avoided in first week postoperatively. We prescribe analgesics for the first few days and some patients need lidocaine oral gel to ease discomfort during meals.



Fig. 1. a) lesions are removed down to the depth of petechial bleeding; b) with the new Fotona Fidelis laser duration of the pulse can be set up to one millisecond and thus coagulation can be achieved.

Results:

83 patients presented in our series were followed - up for at least 12 months. Areas of leukoplakias were removed in more sessions if lesions were present on different locations or if lesions were large (Fig 2).



Fig. 2. . Larger lesions or lesions on different locations are removed in more sessions. a) before treatment, b) after second treatment, c) 16 months after 3 rd treatment

We tend to remove the lesions completely or at least to an extent where only slightly changed epithelium on the treated sites of oral mucosa is present. The patient is considered cured if treated sites are disease free after three years. All the others are carefully followed-up. In our series 36 lesions recurred and all recurrences occurred during the first year after the last treatment. All patients

with recurrences were treated again, 4 of them unsuccessfully. After at least 12 months of follow - up, 51 patients show clinically normal epithelium after treatment (Figs. 3, 4, 5) and in 27 patients mucosa is slightly changed but not to an extent that we would consider another treatment (Fig. 6). Sometimes it is difficult to decide whether the patient should be followed - up or treated again (Fig. 7). The decision is based on clinical judgment and sometimes a biopsy is repeated. In 8 patients leukoplakia emerged at a different location in oral cavity.



Fig. 3. Patient treated twice in the range of 5 months. a) before treatment (local anesthetic was given), b) during treatment, c) clinically normal epithelium 16 months after second treatment



Fig. 4. Patient a) before treatment, b) clinically normal epithelium 12 months after one treatment.



Fig. 5. Patient a) before, b) during 2nd and c) 26 months after 3rd treatment.



Fig. 6. Patient a) before and b) 18 months after second treatment. A scar is visible and the patient carefully followed up. A biopsy was taken from the reddish area and histological assessment revealed hyperplasia of the epithelium without dysplasia. The patient was not considered for another treatment.



Fig. 7. Patient a) before treatment, b) 13 months after second treatment. A scar is visible and there are discrete hyperkeratotic changes of the epithelium. We are considering to treat this patient again.

Four patients continue to have recurrences despite several treatments (Fig. 8). Three of them were treated four times and we do not intend to treat them again. One of them has Lichen planus and is symptom free after one treatment. The lesion recurred but to a much lesser degree. These patients are all carefully followed - up (once every 3 months in the first year after treatment and then twice

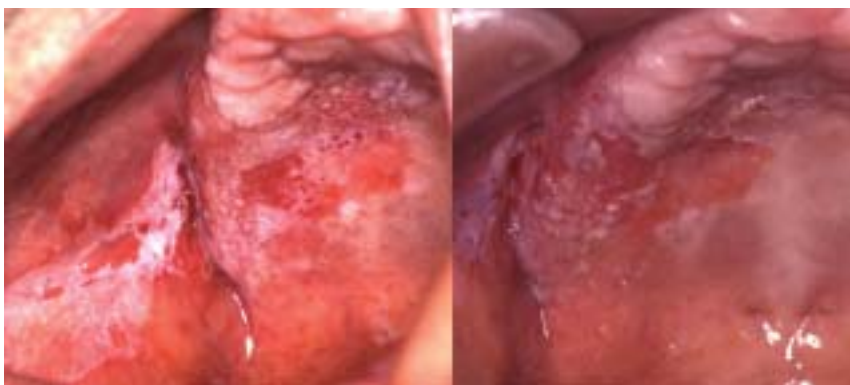


Fig. 8. One of the four patients where we could not remove the lesion. a) before treatment; b) mucosa 1 year after 4 treatments in the range of two years. Histology revealed hyperkeratosis and severe hyperplasia with moderate dysplasia of the epithelium. The patient was carefully followed up and biopsies were taken 8 months after the last treatment. Results of the biopsies were the same as before treatment.

a year) and if any suspicion arises a biopsy is taken.

All patients that showed symptoms before treatment were symptom free or “felt” the lesions to a lesser degree after treatment. We had no complications during or after the treatments.

Conclusion:

Er - Yag laser proved to be a useful tool in soft tissue lesion removal. Several treatment options exist for the treatment of oral leukoplakias and over the past two decades the laser has been gaining more and more attention. Laser removal of intraoral lesions hinders pathologists ability to evaluate the lesion so pretreatment biopsies are necessary. Not all leukoplakias need to be removed but all patients with leukoplakias should be followed - up, regardless of treatment. Surely we remove some lesions that would never transform into cancer but the procedure is simple, not expensive and does not expose patient to any harm. Nevertheless both, the patient and the clinician, prefer oral mucosa without any suspicious lesions.

Treatment of Vascular Malformations Using the Nd:YAG Laser

Introduction:

Congenital vascular lesions, including hemangiomas and vascular malformations, are a common pathological entity. More than 50% of these benign lesions are located in the head and neck region. The International Society for the Study of Vascular Anomalies adopted Mulliken and Glowacki's classification of vascular lesions in 1996 (14). This classification divides vascular lesions into tumors (hemangiomas, others) and malformations (capillary, venous, arteriovenous, lymphatic, combined).

Hemangiomas, although called birthmarks, are rarely seen at birth and tend to develop after birth. They have a tendency to grow during the first year of life and then slowly involute. Endothelial structure is characteristic for hemangiomas. More than 50% of hemangiomas involute completely by the age of 4 or 5 (14,15). That is why, in the first years of life, physicians tend to adopt a wait and see policy, rather than treating hemangiomas primarily. The process of involution is often, however, accompanied by more or less visible scarring, especially in the facial region. Vascular malformations, on the other hand, are usually noted at birth, grow according to body growth and do not have a tendency to regress (14). Some vascular malformations can also appear later in life as a result of hormonal changes and connective tissue changes connected with aging or due to hydrostatic changes.

Many different treatment modalities for removal of vascular lesions have been used so far: surgery, embolization, steroid and cytostatic therapy, cryosurgery, electrodesiccation etc (15). In the past decade, therapy with the neodimium:yttrium-aluminium-garnet (Nd:YAG) laser has emerged as new alternative for the treatment of some vascular lesions. Treatment with the Nd:YAG laser is fast, safe, effective and easy to learn. The Nd:YAG laser has the wavelength of 1064 nm. This wavelength is poorly absorbed in water and thus penetrates deeply into tissue, down to the depth of 4 - 5 mm. As it passes through the tissue, the laser ray emits heat and thus coagulates tissue down to the depth of about 10 mm, a process called photocoagulation. The Nd:YAG laser beam is delivered by a flexible optic fiber, which makes it very easy to handle. These properties are excellent for treatment of some vascular malformations (15, 16, 17, 18).

Performing the procedure

The vast majority of vascular lesions in the head and neck region are small, of the low flow type, measuring less than 3 cm. They can be treated in local anesthesia as outpatients (16, 17, 18) (Fig. 9a).



Fig. 9a. Small lesion of the lip; b) large vascular lesion of the right cheek

In patients with large lesions, measuring more than 3 cm in at least two dimensions, one has to rule out the high flow type, i.e. vascular malformations with a feeder artery (Fig. 9b). Clinically, a characteristic bruit can often be palpated over such a lesion. Angiography prior to laser treatment in large vascular lesions is mandatory, to ensure that the lesion is of the low flow type. In high flow lesions, the feeder artery has to be identified and ligated, and only later can photocoagulation be performed (15). Otherwise we run the risk of a possibly life threatening hemorrhage. (Fig. 10)



Fig. 10. a) High flow arterio-venous malformation of the lip, b) angiography to observe the feeder arteries)

The laser we use is the Nd:YAG component of the combined Er:YAG / Nd:YAG Twinlight laser (Fotona, Slovenia). Power settings are in the range of 8.00 to 12.00 W per pulse, pulse frequencies 35 to 55 Hz and pulse durations (self set) 125 to 150 microseconds. The wavelength is a constant 1064 nm, and the optic fiber diameter 320 micrometers. During treatment, the fiber tip is in direct or very near contact with the tissue surface. In rare cases of bleeding, we switch to defocused mode, moving the fiber tip 1 to 2 cm from the tissue surface, and thus achieve hemostasis.

While performing the treatment, the borders of the lesion are first outlined on the mucosa, with a safety margin of 1 - 2 mm. Afterwards, one systematical pass is first made over the lesion. Shrinkage and blanching are observed, and one or two more passes are made. (Fig. 11)



Fig. 11. Small vascular lesion of the lip immediately post treatment. Observe shrinkage and blanching (same patient as in Fig. 1)

Smaller vascular lesions are treated without compression, as the penetration depth of the Nd:YAG laser is sufficient to treat them throughout their whole volume. In larger lesions however, the penetration depth of the Nd:YAG laser ray is too small to reach to the bottom of the lesion. That is why compression is used. By compressing the lesion we flatten it and thus enable the laser beam to coagulate throughout its whole thickness (16,18). For lesions of the tongue and cheek, glass slides are used for compression. Photocoagulation with the Nd:YAG laser is done through the slide. For lesions of the palate and vestibule, a modified test tube with a side window is used as a compression tool (Fig. 12).



Fig. 12. Modified test tube in use. The side window serves for insertion of the laser fiber tip. Photocoagulation is performed directly through the bottom of the test tube, which at the same time is used for compression.

In cases of intraoral vascular lesions extending beneath the skin, a combination of glass slide compression and intralesional photocoagulation is used (19). Direct transcutaneous photocoagulation would damage the skin surface, leading to scarring. The fiber is thus inserted into the vascular lesion subcutaneously through a wide bore needle, and at the same time the lesion is compressed. Systematic intralesional passes are made and shrinkage is observed. (Fig. 13)



Fig. 13. Intralesional photocoagulation

Patients with smaller lesions are treated in one session, whereas patients with larger lesions are treated in two or more sessions, with subsequent sessions serving as touch-ups. Sometimes, a corrective surgical procedure is necessary as the final step.

After treatment, patients are given non steroid analgesics and sometimes oral lidocain gel to ease discomfort during meals. Tissue sloughs off during the first few days, the result is an intraoral wound covered with fibrin. Reepithelization starts from the wound margins and is complete in 2 to 4 weeks, depending on the size of the original lesion. (Fig. 14)



Fig. 14. A large venous malformation of the tongue a) before treatment, b) immediately post treatment, c) tongue covered with fibrin, d) tongue healed

In patients that undergo intralesional photocoagulation, there is no tissue sloughing, as the surface remains undamaged. Interstitial scarring, however, does occur.

Over the past 5 years we have treated more than 150 patients with oral vascular lesions. 112 patients that have been followed-up for at least a year are presented in our series (Table 3).

Most patients had small vascular lesions, measuring less than 3 cm. Six patients had large lesions, measuring more than 3 cm in two dimensions. Excellent results with very few complications were achieved in both groups of patients, the ones with smaller as well as the ones with larger lesions. In patients with smaller vascular lesions, one session of laser treatment was always sufficient. Treatments were performed in local anesthesia. Tissue sloughing occurred in 2 to 3 days, and complete healing with reepithelization within 2 to 3 weeks post treatment. None of the patients experienced bleeding or pain of greater intensity. Scarring was practically non-existent. (Fig. 15)

Location of the lesion	No. of patients (%)
Lips	52 (46)
Tongue	35 (31)
Buccal mucosa	21 (19)
Hard palate	2 (2)
Subcutaneous	2 (2)

Table 3: Locations of vascular lesions



Fig. 15. A small lesion of the lip a) before treatment, b) immediately post treatment, c) 10 days post treatment - lip covered with fibrin, d) 4 weeks post treatment - lip healed

In patients with larger vascular lesions, treatments were performed in one to two sessions. The first session was always the most extensive, with the following sessions serving as touch-ups. Here, tissue sloughing also occurred within 2 to 3 days, but complete healing took a bit longer, usually 3 to 4 weeks, because of the greater size of the wound. There were no cases of serious bleeding, and pain was well controlled with the use of oral analgesics and topical anesthetics. Tissue scarring was slightly more prominent here. Patients in the group with large vascular lesions were treated in general anesthesia for fear of bleeding. A female patient, age 73, experienced a recurrence of a large venous malformation of the right side of the tongue and floor of the mouth one year after complete laser removal. The lesion was treated again, this time using compression. After the second treatment, the patient developed an infection of the treated site, which was controlled with oral antibiotics. One year and a half after treatment, the tongue remains free of recurrence (Fig. 16)



Fig. 16. Large venous malformation of the tongue a) 6 months after first treatment, b) 11 months after first treatment and c) 18 months after second treatment, (same patient as in fig. 14)

A 29 year old female patient with a large venous malformation of the left side of the tongue had been treated 20 times previously during a period of 8 years using sclerosing agents. The last of these treatments was performed in 1990. In the year 2000, the lesion started to grow again, and in 2001, she was treated with the Nd:YAG laser for the first time. After laser therapy, the lesion shrunk, but a bulk of scar tissue from previous sclerosing treatments remains. However, this is not bothersome to the patient, and she declined excision of the scar. (Fig. 17, 18)

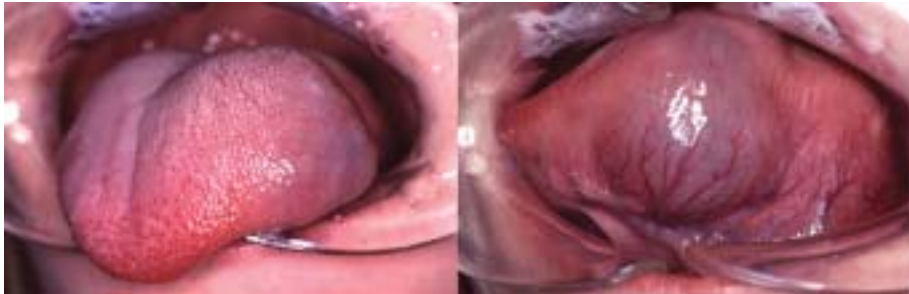


Fig. 17. Tongue before treatment



Fig. 18. Tongue 13 months after treatment

A 38 year old male patient had a large vascular lesion of the right side of the hard and soft palate, extending interdentially into the right superior vestibule. The first session of photocoagulation was performed without the use of compression. The lesion shrunk, but centrally still remained quite voluminous. The second session was done using compression with the modified test tube and the lesion was completely removed. (Fig 19)



Fig. 19. Palate a) before and b) after second treatment

In an 11 year old female patient a large venous malformation of the upper lip was present. Before she came to our department for laser treatment, she had been treated 20 times unsuccessfully with sklerosation. She was treated twice with intralesional photocoagulation within a 6 month interval, both times in general anesthesia. The lesion became smaller and firmer, due to scarring. 16 months after the second laser treatment, the residual lesion was excised, again in general anesthesia. The final result is aesthetically pleasing (Figs. 20, 21)



Fig. 20. Before laser treatment



Fig 21. a) After two sessions of laser treatment, the lesion is smaller and b) final result after surgical excision

The most extensive lesion was present in a 73 year old female patient. It extended from the right side of the tongue onto the floor of the mouth, further into the left inferior vestibule, lower lip mucosa and skin of the chin. She was treated in two sessions. In the first session, we treated the vestibule, lip and, very carefully, the chin. The chin was photocoagulated intralesionally. In the second session, one month later, we treated the tongue, floor of the mouth, and again, the chin intralesionally. This time, a small area of skin necrosis developed (10 x 7 mm), where the skin covering the vascular lesion was very thin. This area healed with a small scar, which is barely visible. All the

other treated sites healed uneventfully. The vascular lesion is not completely eradicated, but the patient refused further treatments. (Fig 22, 23)



Fig. 22. Before treatment



Fig. 23. 16 months after second treatment

All patients were followed up weekly after treatment until complete healing took place. After healing, the patients were seen again at three months and a year after treatment. Patients in whom large lesions were removed are then followed-up once a year. In patients where small lesions were removed, that is not necessary, as the lesions are benign. The patients are advised, however, to regularly self-inspect the site and return in case of any changes.

Complications

In patients with smaller vascular lesions, two complications did occur. In one patient that was treated for a small varix of the vermillion of the lower lip, an extensive tissue necrosis occurred all the way down to the orbicularis muscle. The necrotic portion was excised and the lip sutured by layers, upon which healing was uneventful. (Fig. 24)

A similar situation occurred in another patient with a venous malformation of the right side of the tongue. The necrosis was so extensive it was reminiscent of a well developed carcinoma. However, it was allowed to heal by secondary intention and the scar is now, 1 year post treatment, practically invisible. (Fig. 25)



Fig. 24 a) necrosis after treatment; b) after surgical correction



Fig. 25. a) tongue before treatment; b) necrosis after treatment; c) tongue

We experienced an episode of mild, transient paresthesia of the right half of the lower lip after photocoagulation of a small lesion of the right lower oral vestibule, in close vicinity to the mental foramen. Sensibility returned completely within 2 weeks. One of the patients in the group with the large lesions developed an infection of the tongue, which was controlled with oral antibiotics, as described above.

Precautions and observations

As vascular lesions of the head and neck are quite common and often difficult to remove, the Nd:YAG laser can serve as an effective tool for the removal of low flow venous malformations. There are, however, certain precautions and limitation which must not be overlooked (15,16,18,19). All procedures have to be done with everyone in the room wearing special safety glasses, because the high power laser beam can irreversibly damage the eyes. Especially in large lesions, one has to make sure they are of the low flow type prior to laser treatment. If a feeder artery is found, it must be obliterated first. Otherwise, a disastrous hemorrhage can occur during the period of tissue sloughing. Photocoagulation has to be performed with a safety margin, slightly beyond the extent of the lesion. In this way, we avoid tissue sloughing within the hypervascularized area, which could again lead to hemorrhage. Perforation of the mucosa covering the lesion should also be avoided. The fiber tip with the emitting laser beam should not be held in the same place too long and should be slowly moved over the lesion, observing tissue shrinkage and blanching. Nerves may be damaged irreversibly by photocoagulation. Some authors advise the employment of cryosurgery in the areas adjacent to the nerves, because it does not cause irreversible damage. As already described, the paresthesia we observed was transient. When treating around salivary gland orifices, one has to bear in mind the risk of post treatment stenosis. Again, some authors advise cryosurgery in these areas.

When treating subcutaneous vascular malformations, one has to be careful not to damage the skin surface, as this leads to scarring. To avoid this, the optic fiber is inserted into a wide bore needle, which is then passed into the lesion. Intralesional photocoagulation is then performed (19). Ultrasound can be used for better guidance and control (18).

The modified test tube proved to be a useful compression tool in areas where compression cannot be achieved with glass slides. It is heat resistant, easy to make and cheap. We got the idea after the first session of treatment of a large vascular lesion of the hard palate, when the lesion was incompletely removed and it became obvious that compression would be necessary.

It is unclear to us as to why the two above described complications occurred on the lower lip and tongue. The two patients were treated identically as all the other patients with small lesions. These two cases strongly support a careful approach when treating vascular lesions with the Nd:YAG laser. During treatment, all that is clinically obvious is shrinkage and blanching of the lesion. The degree and extent of deep coagulation become obvious only when tissue sloughing occurs, within a few days after treatment, and can be a lot more extensive than expected. It takes some experience before the clinician can well estimate the degree of deep coagulation during treatment. That is why, particularly before we are well experienced, it is better to be less radical and to later perform one or two touch-up treatments, to remove residual hypervascular tissue.

Conclusion

In the past decade, the Nd:YAG laser has been used increasingly in the treatment of vascular malformations. Treatments are quick, clean and bloodless. Postoperative problems and discomfort are minimal, and so is scarring. It must, however, be used with certain precautions, as the degree of tissue coagulation is not immediately clinically obvious. We can conclude that when used appropriately, the Nd:YAG laser is a very useful tool for removal of vascular lesions in the head and neck region.

References:

1. Suarez P, Batsakis JG, El-Nagar AK. Leukoplakia: Still a Gallimaufry or Is Progress Being Made?. *Advances in Anatomic Pathology*. 5:1998; 137-155
2. WHO Collaborating Centre for Oral Precancerous Lesions. Definitions of leukoplakia and related lesions: an aid to studies on oral precancers. *Oral Surg* 46:518-539, 1978.
3. Axell T et al. Oral white lesions with special reference of precancerous and tobacco related lesions: Conclusions of an international Symposium held in Upsala, Sweden. *J Oral Pathol Med*, 1996; 25: 49 - 54
4. Axell, T. The relation of the clinical picture to the histopathology of snuff dipper's lesions in a Swedish population. *J Oral Path* 5:229-236, 1976.
5. Pindborg, J.J. Oral cancer and precancer. Bristol: John Wright and Sons, Ltd, 1980
6. Bouquot, J.E., Gorlin, R.J. Leukoplakia, lichen planus and other oral keratoses in 23,616 white Americans over the age of 35 years. *Oral Surg* 61:373-381, 1986.
7. Bouquot, J., Weiland, L., Ballard, D., Kurland, L. Leukoplakia of the mouth and pharynx in Rochester, MN, 1935-1984; incidence, clinical features and follow-up of 463 patients from a relatively unbiased patient pool. *J Oral Path* 17:436, 1988.
8. Silverman, S., Gorsky, M., Lozada, F. Oral leukoplakia and malignant transformation. A follow-up study of 257 patients. *Cancer* 53:563-568, 1984.
9. Bouquot, J.E. Common oral lesions found during a mass screening examination. *J Amer Dent Assoc* 112:50-57, 1986
10. Cawson RA. Premalignant lesions in the mouth. *Br Med Bull* 1975; 31: 164.
11. Shafer WG, Waldron CA: Erythroplakia of the oral cavity. *Cancer (Phila)* 1975; 36: 1021.
12. Hansen, L.S., Olson, J.A., Silverman, S.: Proliferative verrucous leukoplakia. *Oral Surg* 60:285-298, 1985.
13. Axell, T. A prevalence study of oral mucosal lesions in an adult Swedish population. *Odont Revy* 27 (suppl 26):1-103, 1976
14. Mulliken JB, Glowacki J. Hemangiomas and vascular malformations in infants and children: a classification based on endothelial characteristics. *Plast Reconst Surg* 1982; 69: 412-20.
15. Shapshay SM, David LM, Zeitels S. Neodymium-YAG laser photocoagulation of hemangiomas of the head and neck. *Laryngoscope* 1987; 97: 323-30.
16. Bradley PF. A review of the use of the neodymium YAG laser in oral and maxillofacial surgery. *Br J Oral Maxillofac Surg* 1997; 35: 26-35.
17. Burkey BB, Garrett G. Use of the laser in the oral cavity. *Otolaryngol Clin North Am* 1996; 29: 949-61.
18. Werner JA, Lippert BM, Gottschlich S et al. Ultrasound-guided interstitial Nd:YAG treatment of voluminous hemangiomas and vascular malformations in 92 patients. *Laryngoscope* 1998; 108: 463-70.
19. Achauer BM, Chang CJ, VanderKam VM, Boyko A. Intralesional photocoagulation of periorbital hemangiomas. *Plast Reconst Surg* 1999; 103: 11-6.

Curriculum Vitae



A. Dovsak

Name: David Aleksander Dovsak
Born: Ljubljana, Slovenia, Jan 20, 1967
Nationality: Slovene
Citizenship: Slovenian
Home address: Cesta v Rocno dolino 18 b, 1111 Ljubljana, Slovenia
 Tel.: +386-1-4259 456, Mobile: +386-41-385 046
E - Mail: david.dovsak@kclj.si, ddovsak@hotmail.com
Marital status: Married, wife Petja, born Mr_a in 1973, DDS
Children: daughter Inja, born December 2000
Parents: Peter Dovsak, MD,
 Nina Dovsak, born Svetlin, chemical engineer
Primary school: First grade (1973) in Ljubljana other grades in Velenje, finished in 1981
High school: Celje, natural sciences and math oriented, graduated in 1985
Military: Aug. 1985 - Sept. 1986
University: Started my studies at the Ljubljana Faculty of Medicine in Oct. 1986

Additional work as a student:

- Teaching assistant at anatomy lab work (5th - 7th semester)
- Voluntary work in General Hospital Slovenj Gradec, Department of Internal Medicine (summer 1989)
- Voluntary work in the Emergency department, in the Operating room for minor trauma and in Department of Plastic Surgery from my 7th semester onwards
- Research work in University Eye Clinic and Department of Pathology in Graz (I got scholarship from Austrian government and worked in Graz from Nov. 1992 to Feb. 1993 together with Prof. Gorazd Kolar, MD, Ph.D., former Head of University Eye Clinic in Ljubljana. Purpose of research was to show changes in retinal vessels in diabetic patients with Scan Electronic Microscope).

Graduation: Mar. 24, 1994, Ljubljana Faculty of Medicine

Internship: 12 months, May 1994 - Apr. 1995

State license exam: Apr. 25, 1995

Compulsory post-internship rotation (I chose the surgically oriented version):

- Clinic of Burns and Plastic Surgery: Jun. 1, 1995 - Nov. 30, 1995

- Clinic of Otorhinolaryngology: Dec. 1, 1995 - Jan. 31, 1996

Present employment and residency:

As of Feb. 1, 1996, I am employed at the Department of Oral and Maxillofacial Surgery, Division of Surgery, University Medical Center, Zalo_ka 2, 1525 Ljubljana,

Slovenia

In Feb. 1997 I was elected and partially employed by Medical Faculty as an assistant in the field of Maxillofacial Surgery.

On February 16, 2001, I passed the residency exam in Ljubljana and became a Specialist Maxillofacial Surgeon. I started my residency on July 4, 1996.

Since June 2001 I am the head of oncology division at our department. My scope of interests is mainly oral and oropharyngeal tumors and reconstructive surgery of the head and neck.

Work address:

Department of Oral and Maxillofacial Surgery

Division of Surgery

University Medical Center

Zalo_ka 2

1252 Ljubljana, Slovenia

Head of Department: Andrej Kansky, DDS, Ms

Tel: +386-1-522 42 35

Fax: +386-1-522 24 95

Post graduation studies:

I am enrolled in MSc studies at the Ljubljana Medical Faculty. My thesis will be dealing with treatment of oral leukoplakia.

Mentor: Prof. Nina Gale, MD, Ph.D., Institute of Pathology, Medical Faculty, Ljubljana.

Fellowships

- 4 weeks visit in April 1998 at Department of Oral and maxillofacial surgery in Head Clinic, Heidelberg. Head: Prof. Mühling.

- 2 weeks visit in May 1998 at department of Plastic surgery in III. Teaching Hospital in Prague. I was learning about cleft patients' treatment under the mentorship of Prof. Fara, MD, PhD.

- A 14 weeks fellowship at the Department of Maxillofacial Surgery in Dubrava Hospital in Zagreb, March 2000 - June 2000. I was learning about treatment of head and neck cancer under the mentorship of Prof. Mi_o Virag, MD, PhD.

Publications:

- U. Ah_an, Z. M. Arne_, M. Janko, D. Dov_ak: Regeneration of sudomotor and sensory nerve fibers after digital replantation and micro vascular toe-to-hand transfer. *Brit J Plast Surg* (1997), 50

- D. Dov_ak: Panoramic tomography of the Maxillofacial Region. *Zobozdr Vest* (1997), 52; 95

- Dov_ak D. Odontogenic inflammatory diseases. In: Smrkolj V ed. *Proceedings of the 36th Annual Meeting of Slovenian Surgeons, Ljubljana, Slovenia, 2000.*

- Dov_ak D, Vesnaver A, Drnov_ek-Olup B. Treatment of leukoplakia and hemangiomas using the combined Er:YAG / Nd:YAG laser. *Lasers in Surgery and Medicine* 2000; Suppl 12: 12.

- Vesnaver A, Dov_ak D: Oral hemangioma treatment using the Nd:YAG laser. In: *Book of*

abstracts of the 7th international congress of European medical laser association. Dubrovnik, 2000: 61.

- Dov_ak D. Condylar fractures treatment - a study of treatment of 210 patients. Med Razgl, 39; Suppl 3, 297 - 303
- Vesnaver A, Dov_ak D: Treatment of Large Hemangiomas Of the Oral Cavity Using the Nd:YAG Laser. Lasers in Surgery and Medicine 2001; Suppl 13: 15.
- Vesnaver A, Dov_ak D. Hemangioma Treatment Using the Nd:YAG Laser - a New Method. Zdrav Vestn 2002; 71: 353-5.

Courses:

- Face to Face, International Workshop on Facial Plastic and Reconstructive Surgery, Zagreb, Croatia, Apr. 11 - 13, 1996
- 3rd International Symposium on Emergency Medicine, Portoro_, Slovenia, Jun. 26 - 29, 1996
- AO Maxillofacial Course, Davos, Switzerland, Dec. 1 - 6, 1996
- 4th International Symposium on Emergency Medicine, Portoro_, Slovenia, Jun. 18 - 21, 1997
- Microsurgical Course, Canniesburn Hospital - Glasgow, UK, Mar. 16 - 21, 1998
- Face to Face, International Workshop on Facial Plastic and Reconstructive Surgery, Zagreb, Croatia, Apr 28 - 29, 1998
- Cystic lesions of the Maxillofacial Area, Salzburg, Austria, Oct 25, 1998
- Advanced Laser Skin Resurfacing Course, 20th Annual Meeting of the American Society for Laser Medicine and Surgery, Reno, Nevada, USA, April 6, 2000
- Advanced vascular course, 21st Annual Meeting of the American Society for Laser Medicine and Surgery, New Orleans, Louisiana, USA, April 20, 2001
- Neck Metastasis, Croatian Society for ENT and Maxillofacial Surgery, Slavonski Brod, Croatia, May 19, 2001
- Malignant melanoma - Diagnostics and treatment, Dubrava Hospital, Zagreb, Dec. 13, 2002
- Bone tumors of the Maxillofacial Area, Salzburg, Austria, Oct 22, 2002

Conferences:

- D. Dov_ak: "Panoramic Tomography in Maxillofacial surgery," 1st Congress of Slovenian Radiologists, Portoro_, Slovenia, Oct. 10 - 12, 1996 - LECTURE
- D. Dov_ak: "Panoramic Tomography in Maxillofacial surgery," _ele_nik Days: Slovene Physicians and Dentists Biannual Congress, Ljubljana, Oct. 25 - 26, 1996 - LECTURE
- D. Dov_ak: "A computerized system for management of cleft patients" 2nd international congress on Malformations and Rare Tumors of the Head and Neck, Zagreb, 24 - 27 Nov., 1998 - LECTURE
- Dov_ak D: "Acute odontogenic infections," 36th Annual Meeting of Slovenian Surgeons, Ljubljana, Slovenia, Feb 3 -5., 2000 - LECTURE
- Dov_ak D, Vesnaver A: "Treatment of Leukoplakias Using the Combined Er:YAG/Nd:YAG Laser," 20th Annual Meeting of the American Society for Laser Medicine and Surgery, Reno, Nevada, USA, April 5 - 9, 2000 - LECTURE

- Vesnaver A, Dov_ak D: "Treatment of Hemangiomas Using the Combined Er:YAG/Nd:YAG Laser," 20th Annual Meeting of the American Society for Laser Medicine and Surgery, Reno, Nevada, USA, April 5 - 9, 2000 - LECTURE
- Dov_ak D: "Treatment of Condylar Fractures - follow up study of 210 patients", 3 rd congress of ENT surgeons of Slovenia, Maribor, Slovenia, June 15 - 17, 2000 - LECTURE
- Kansky A, Soto_ek B, Dov_ak D: "Primary care of Orbital Trauma," Congress of European Ophthalmologic Society, Ljubljana, Sept. 7 - 9, 2000 - LECTURE
- Vesnaver A, Dov_ak D: Oral hemangioma treatment using the Nd:YAG laser. 7th international congress of European medical laser association. Dubrovnik, Croatia, June 22 - 25, 2000 - LECTURE
- Dov_ak D: "Kerubism," 6th Pedontologic days of Slovene Pedontologic society, Oct 6 - 7, 2000 - LECTURE
- Vesnaver A, Dov_ak D: "Treatment of Large Hemangiomas Of the Oral Cavity Using the Nd:YAG Laser," 21st Annual Meeting of the American Society for Laser Medicine and Surgery, New Orleans, Louisiana, USA, April 18 - 22, 2001 - AWARDED LECTURE
- Dov_ak D: "Treatment of vascular malformations using laser," 4th International Danubius Conference, Rovinj, Croatia, April 25 - 27, 2002 - LECTURE
- Dov_ak D: "Orbital fractures - Diagnostics and Treatment," 3rd Annual Meeting of Slovenian Surgeons, Portoro_, Slovenia, May 22 - 27, 2002 - LECTURE
- Dov_ak D: "Anatomic basis for implant surgery in the jaws," 2nd international meeting of Slovenian association of Oral and Maxillofacial Surgery, Nov 29 - 30, 2001
- Dov_ak D: "Treatment of frontal sinus and orbital fractures" 3rd international meeting of Slovenian association of Oral and Maxillofacial Surgery, Nov 30, 2002

Foreign languages:

- Active: English, Serbo-Croatian, German
- Passive: Italian

Memberships:

- Slovenian Association of Oral and Maxillofacial Surgery
- Slovenian Association for Lasers in Surgery
- Slovenian Association for Emergency Medicine
- American Society for Lasers in Medicine and Surgery
- European Association of Cranio - maxillofacial Surgery

Hobbies

- Active Karate instructor (2nd Dan), president of Martial art Club in Slovenian army.
- Skiing, sailing