

# 980nm laser for difficult-to-treat basal cell carcinoma

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## ABSTRACT

Basal cell carcinoma (BCC) is most common skin cancer over the world. There are around 20 modalities for BCC treatment. Laser surgery is uncommon option. We demonstrate our long term follow up results.

**Aim:** To evaluate long term efficacy of a 980nm diode laser for the difficult-to-treat basal cell carcinoma.

**Materials and Methods:** 167 patients with 173 basal cell carcinoma on the nose were treated with a 980 nm diode laser from May 1999 till May 2005 at Latvian Oncology center. All tumors were morphologically confirmed. 156 patients were followed for more than 5 years.

**Results:** The lowest recurrence rate was observed in cases of superficial BCC, diameter<6mm; but the highest recurrence rate was in cases of infiltrative BCC and nodular recurrent BCC.

**Conclusions:** 980 nm diode laser is useful tool in dermatology with high long term efficacy, good acceptance by the patients and good cosmetics results.

**Keywords:** lasers, basal cell carcinoma, treatment, skin cancer, nonmelanoma skin cancer, oncology, dermatology

## 1. INTRODUCTION

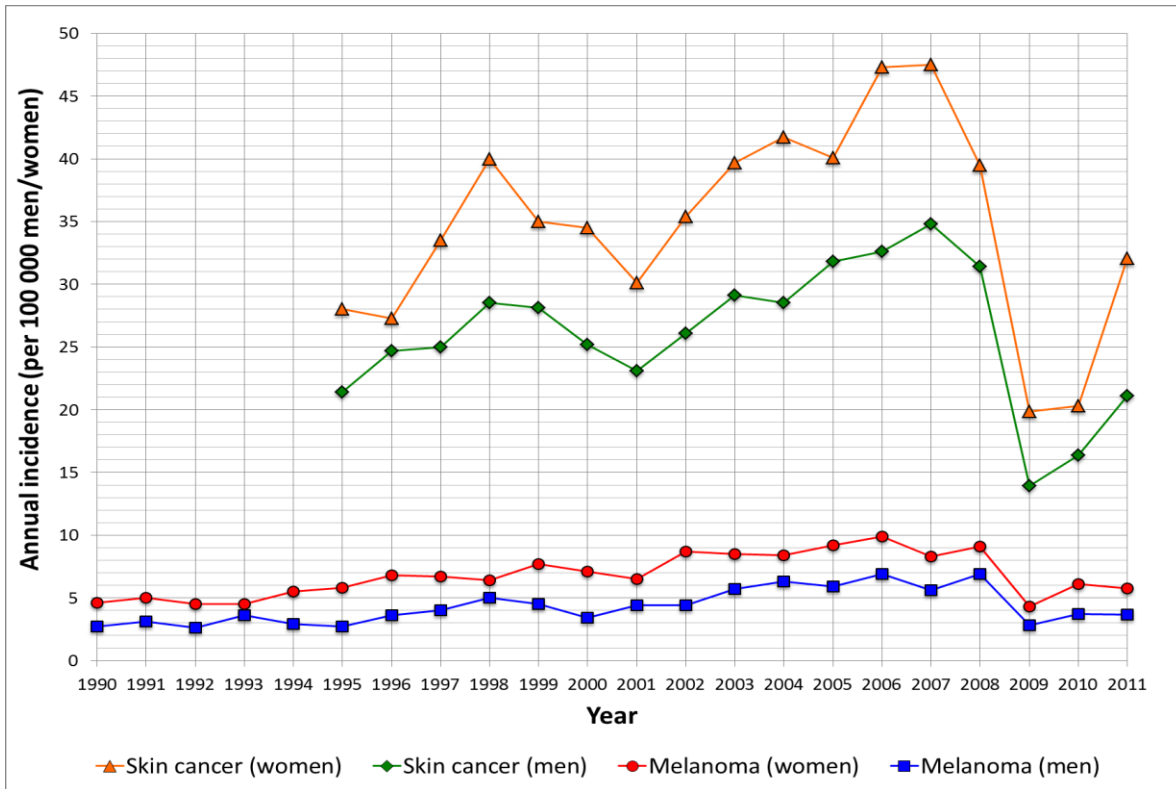
Basal cell carcinoma (BCC) is most common skin cancer over the world and affect all adults of either gender. BCC is a skin cancer derived from nonkeratinizing cells that form the basal layer of the epidermis. BCC is a non-melanocytic skin cancer with very slow growth tendency, small mortality and high risk of recurrence. BCC typically appears on sun-exposed skin (face, neck) of lighter-skinned individuals, with approximately 30% occurring on the nose. BCC has high recurrence rate – up to 40% depending on localization, size, histological subtype of tumor and other factors. There are high recurrence zones on the faces – nose, ear, lips and eyelid. With increasing sizes (more than 6mm), tumor recurred more frequently. Infiltrative forms recur more frequently as compared to nodular or superficial form. It is possible that recurrent tumor recur more aggressively. Metastasis of BCC occurs rarely, with rates from 0.0028% to 0.55% [1].

The most significant guidelines for BCC management are National Comprehensive Cancer Network Guidelines & Clinical Resources, British Association of Dermatology guidelines and Cochrane review interventions for basal cell carcinoma of the skin. The first goal of skin cancer management is complete cure of the BCC. Secondary goals are preservation of normal tissue, preservation of function, and optimal cosmetic results[2-4].

There are different treatment modalities (about 20). There are difficult-to-treat places on the face – eyelids, lips, eyes and nose [5]. Ways of BCC treatment: surgery (including Moh's micrographic surgery (MMS), operation with postoperative margin assessment (POMA) and curettage), radiotherapy, cryosurgery, laser surgery, photodynamic therapy and immunomodulators. Each method has positive and negative aspects.

MMS is the "gold standard" for BCC treatment in countries where it is possible. POMA and MMS enables to control the edge of wound for presence of residual tumor.

Table 1 Skin cancer incidence in Latvia 1990-2011



However, operation in case of BCC needs a retreat of 3-5 mm from healthy skin which may result in difficulties to close the wound. This complicates the operation and demands transplantation of skin, which can reduce the cosmetic result (scars are possible). Such surgical procedures are done in the hospital, sometimes using general anesthesia, which significantly increases postoperative period. Besides, patients may have contraindications towards operation (myocardial infarction, cerebrovascular accident, use of anticoagulants and other). Radiotherapy is not used for patients until the age of 50-60 as it can induce new and more complicated tumor after 20-30 years. Radiotherapy needs 12-15 procedures (3 weeks) and 3-5 weeks for wound healing. Radiotherapy very often complicates with skin inflammation what reduces the quality of life. Cryosurgery is another treatment option, but is painful procedure. Face edema is possible after this treatment for one week. Wound heals with inflammation, sometimes with suppuration. Postoperative period lasts for 3-4 weeks. Treatment with immunomodulators is also a long procedure – 4 to 6 weeks or even longer. Face edema can be present and painful. Wound can heal with inflammation, sometimes with pus.

Laser surgery is uncommon form of treatment, although the interest to laser surgery increases [6]. Laser surgery can be done in an outpatient unit what is a main advantage in compares to other treatment options . Local anesthesia is used and the operation lasts 2-3 times faster than ROMA, which reduces complications in postoperative period and ensures good cosmetic results, increasing the satisfaction of patient. Historically CO<sub>2</sub> and Nd:YAG lasers are used [7,8]. However they have many limitations. In past 10-15 years diode lasers have developed a lot. Although primary results were very promising [9-12] data on long-term studies are not available [13].

Efficiency analysis of laser surgery in case of BCC in difficult localizations (on nose) is analyzed in this work. Term “efficiency” in this work has been analyzed from two perspectives: 1) the number of residual tumors that have found in 6 months after the treatment; 2) number of recurrences. As BCC recurrence developed over many years with 30% in the first year, 50% - second year and up to 66% in the third year - this work includes observations for results over 5 years [14].

## 2.Objectives

To evaluate long term efficiency of BCC laser treatment for difficult-to-treat tumors in nose region.

## 3. Methods and Patients

Retrospective, descriptive, non-comparative, single institution study was performed. According to Latvian Cancer registry and medical documentation of Latvian Oncology center (LOC) we collected information about patients treated with laser. 167 patients with 173 BCC on the nose were treated with the 980nm diode laser from May 1999 till May 2005 in Outpatient department of LOC. Analysis on illness treatment and further illness history was performed from the moment of occurrence until 31.12.2012. We collected information about age, gender, localization of tumor, histological types, treatment modalities (power, continues or pulse type, bare fiber type), complication – operation pain, inflammation, postoperative course for each patient and history of live for more than 5 years (live or dead, recurrence rate). All tumors were morphologically confirmed by histological or cytological examination. Informed consent was obtained from all patients. The inclusion criteria were age from 18 years, basal cell carcinoma - T1-T2N0M0. Patients with follow up period less than 5 years were excluded.

**Laser equipment.** Diode laser (Ceralas D15) was installed in 1999 for treatment procedures at the outpatient department LOC. 980nm laser is gallium-aluminum-arsenide (GaAlAs) laser system with 15W output power and bare fiber light delivery (400 or 600  $\mu\text{m}$ ). Diode laser was used in continuous or in pulse mode. In pulse mode the pulse duration was 0.1-1.0 sec. Laser surgery is registered technology for malignant and benign lesions treatment in Latvia from 2000.



Figure 1. Compact size air-cooled diode laser Ceralas D15

**Surgical Technique.** The laser surgery was performed under topical (with EMLA cream) or local infiltrative anesthesia (with 0,5% solution of lidocaine hydrochloride). Diode laser beam was sent via bare optical fiber. Malignant lesions were treated from normal skin around the tumor following from the periphery to the center. We sampled tissue from lesion for histological conformation during the operation sometimes. The eyes of the patients and oncologist were protected by glasses absorbing diode laser radiation. All patients were treated in a single session on an outpatient department.

## 4. Results and discussion

The study considers a group of 167 patients affected by basal-cell carcinoma (BCC) on the nose. 11 patients were observed less than 5 years, these were omitted from the research. There were 112 females and 26 males patients. The mean age of the cohort was 64.51 years (range 35-91, median 66 years). The average length of the illness was 13 months. Primary tumor was observed in 138 and recurrent tumor in 24 cases.



Figure 2. Nodular basal cell carcinoma of the nose before treatment



Figure 3. Nodular basal cell carcinoma of the nose 5 years after treatment

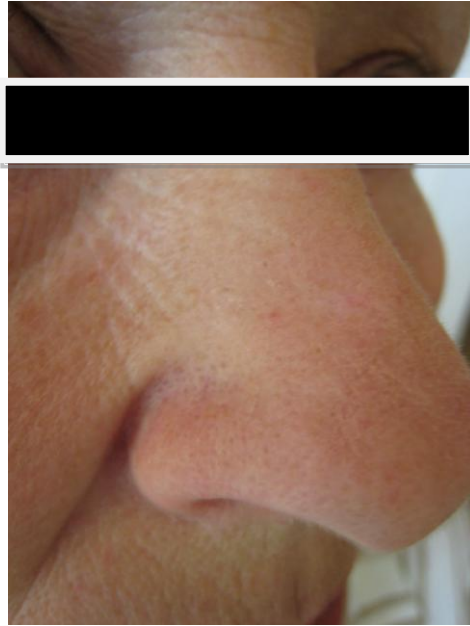


Figure 4. Nodular basal cell carcinoma of the nose 5 years after treatment (Macro)



Figure 5. Multiple nodular basal cell carcinoma of the nose before treatment

Among 162 cases of BCC residual tumor appears in 7 cases (4,32%); Recurrence rate was from 4.11% till 33,33%. The lowest recurrence rate was observed in cases of superficial BCC, <6mm; but the highest recurrence rate was in cases of infiltrative BCC and nodular recurrent BCC.

Table 2. Residual tumor (RT) and recurrence rate (RR) depending on histological subtype and size

Histological subtype	primary/recurrent BCC	size <6mm cases	RT, cases	RR, (%)	size >6mm cases	RT, cases	RR, (%)
superficial BCC (sBCC)	pBCC	31	0	1 (4,11%)	16	0	4 (25,0%)
	rBCC	2	0	0	1	0	0
nodular (nBCC)	pBCC	32	4	4 (12,5%)	55	2	11 (16,6%)
	rBCC	5	0	5 (33,3%)	15	1	1 (20,0%)
infiltrative iBCC	pBCC	2	0	2 (100%)	2	0	2 (100%)
	rBCC	3	0	3 (100%)	0	0	-

BCC recurrence rate varied according histological subtype and localization. Among 162 cases of BCC the lowest recurrence rate ascertained in cases of superficial BCC, localization on “body of nose”; the highest - in cases of infiltrative BCC, localization on “body of nose” (there are no data about other localization) and nodular recurrent BCC localization on “fossa nasolabialis”.

Table 3. Recurrence rate (RR) depending on tumor localization

histological subtype	primary/recurrent BCC	RR body of nose cases, %	RR apex of nose cases, %	RR ala nasi cases, %	RR fossa nasolabialis, %
superficial BCC (sBCC)	pBCC	4 (10,00%)	0	0	2 (50%)
	rBCC	0	*	*	*
nodular BCC, (nBCC)	pBCC	6 (19,35 %)	2 (28,57 % )	2 (33,33)	2 (50%)
	rBCC	6 (28,57%)	*	*	2(100%)
infiltrative BCC, (iBCC)	pBCC	4 (100%)	*	*	*
	rBCC	3 (100%)	*	*	*

\* - no cases

In our study population there were no postoperative complications such as pain, bleeding, inflammation. Mean wound healing was from 7 to 10 days. All patients were satisfied with the laser treatment procedure and the results after surgery. Cosmetic results were excellent or good in cases if there was hipo- or hiperpigmentation.

## 5. Conclusions.

980nm laser shows high efficiency in difficult-to treat BCC in nose region. The given data allows to conclude that laser treatment is most effective in cases of primary superficial BCC, nodular BCC and recurrent superficial BCC, diameter <6mm, located on body of nose. Laser surgery is not effective in any form of infiltrative BCC. In cases of recurrent nodular BCC the decision about laser surgery must be discussed. Diode laser is useful tool in dermatology with good acceptance by the patients and good cosmetics results. However, not for all BCC on the nose laser treatment is the most efficient way of treatment. Therefore additional research has to be carried out, in order to find the most appropriate treatment method. Future prospective comparative randomized studies with diode laser are needed.

## REFERENCES

- [1] Rigel S.D., Robinson K.J., Ross I.M., Friedman R. Cancer of the Skin: Expert Consult, 2nd Edition. Saunders, 99-123 (2011)
- [2] Basal Cell and Squamous Cell Skin Cancers. National Comprehensive Cancer Network. 2012 v.2, [http://www.nccn.org/professionals/physician\\_gls/f\\_guidelines.asp#site](http://www.nccn.org/professionals/physician_gls/f_guidelines.asp#site) (1 May 2013)
- [3] Telfer N.R., Colver G.B., Morton C.A. Guidelines for the management of basal cell carcinoma. The British journal of dermatology 159(1), 35-48 (2008)
- [4] Bath-Hextall F.J., Perkins W., Bong J., Williams H.C. Interventions for basal cell carcinoma of the skin. Cochrane database of systematic reviews (1) CD003412, ( 2007)
- [5] Stockfleth E, Rosen T, Schumaak S. Managing Skin Cancer. Basal cell carcinoma. Springer, 37-50 (2010)
- [6] Choudhary S, Tang J, Elsaie M.L., Nouri K. Lasers in the treatment of nonmelanoma skin cancer. Dermatologic surgery : official publication for American Society for Dermatologic Surgery 37(4), 409-25 (2011)
- [7] Horlock N, Grobbelaar A.O., Gault D.T. Can the carbon dioxide laser completely ablate basal cell carcinomas? A histological study. British journal of plastic surgery 53(4), 286-93 (2000)
- [8] Moskalik K, Kozlov A, Demin E, Boiko E. The efficacy of facial skin cancer treatment with high-energy pulsed neodymium and Nd:YAG lasers. Photomed Laser Surg 27(2):345-9, (2009)
- [9] Romanos G, Nentwig G.H. Diode laser (980 nm) in oral and maxillofacial surgical procedures: clinical observations based on clinical applications. Journal of clinical laser medicine & surgery 17(5):193-7 (1999)
- [10] Newman J, Anand V. Applications of the diode laser in otolaryngology. Ear Nose Throat J. 81(12):850-1 (2002)
- [11] Volkov V. Dermatology Studies. 1997  
[http://laserevolve.com/specialties/sub\\_trials.asp?SubnavID=18&ThirdnavID=42](http://laserevolve.com/specialties/sub_trials.asp?SubnavID=18&ThirdnavID=42) (31 December 2012)
- [12] Kawalec J.S., Reyes C, Penfield V.K., Hetherington V.J., Hays D, Feliciano F, et al. Evaluation of the Ceralas D15 diode laser as an adjunct tool for wound care: a pilot study. The Foot 11(2), 68-73 (2001)
- [13] Desiate A, Cantore S, Tullo D, Profeta G, Grassi F.R, Ballini A. 980 nm diode lasers in oral and facial practice: current state of the science and art. International journal of medical sciences 6(6), 358-64 (2009)
- [14] Rowe D.E., Carroll R.J., Day C.L., Jr. Long-term recurrence rates in previously untreated (primary) basal cell carcinoma: implications for patient follow-up. The Journal of dermatologic surgery and oncology 15(3), 315-28 (1989)