

# COMBINED SURGICAL ABLATION WITH SUPERPULSED CO<sub>2</sub> LASER FOR TREATMENT OF FACIAL BASAL CELL CARCINOMA

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## Abstract

Basal cell carcinoma (BCC) is the most common skin cancers in face region. The most concern for surgeons is success of treatment with high cure rate and good cosmetic result. There are several methods for treatment, including laser therapy.

The objectives of the present study were to evaluate the healing of wounds (recurrence and cosmetic outcome) after treatment by surgical ablation and irradiation by superpulsed mode of laser CO<sub>2</sub>.

A total of 18 patients with BCC, age between 58-71 years, from both gender (7 males and 11 females) were included in the study. The tumorous mass was ablated firstly, then the tumor bed was irradiated using 5-8W Pulsed CO<sub>2</sub> laser. The wounds were left open to secondary epithelization.

Recurrence and cosmetic outcomes were observed after one year follow-up. The mean age of the participants was 66 years (range 58-71 years). The mean size (maximal diameter of lesion) was 9.3 mm (range: 7.2-11.3mm). 12 tumors (66.6%) were of the superficial type, 6 tumors (33.3%) were of the nodular type.

No recurrence was observed one year after surgery. Slight scar was found in 3 cases (16.6%). There were no complications during the wound healing period.

The present study showed that the surgical ablation combined with superpulsed CO<sub>2</sub> laser is an effective option to treat BCC and to achieve high cure rates and good esthetic outcomes.

**Keywords:** Laser surgery - facial skin tumor – healing - superpulsed CO<sub>2</sub> laser – basal cell carcinoma.

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## ABLATION CHIRURGICALE COMBINÉE AVEC LE LASER CO<sub>2</sub> SUPERPULSÉ POUR LE TRAITEMENT DU CARCINOME FACIAL BASO-CELLULAIRE

### Résumé

Le carcinome basocellulaire (CBC) est le cancer de la peau le plus fréquent au niveau de la région de la face. La plus grande préoccupation des chirurgiens est le succès du traitement avec un taux de guérison élevé et un bon résultat esthétique. Il existe plusieurs méthodes de traitement, y compris la thérapie au laser.

Les objectifs de la présente étude étaient d'évaluer la cicatrisation des plaies (récidive et résultat esthétique) après ablation chirurgicale et irradiation par le mode superpulsé de laser CO<sub>2</sub> du CBC.

Un total de 18 patients, âgés entre 58 et 71 ans, des deux sexes (7 hommes et 11 femmes) ont participé à l'étude. La masse tumorale a d'abord été réséquée, puis le lit tumoral a été irradié en utilisant un laser CO<sub>2</sub> pulsé de 5 à 8 W. Les plaies ont été laissées ouvertes pour une épithélisation secondaire. Une récurrence et des résultats esthétiques ont été observés après 1 an de suivi. L'âge moyen des participants était de 66 ans (entre 58 et 71 ans). La taille moyenne (diamètre maximal de la lésion) était de 9,3 mm (entre 7,2 et 11,3 mm). 12 tumeurs étaient du type superficiel (66,6%) contre 6 tumeurs (33,3%) du type nodulaire.

Le suivi à un an n'a montré aucune récurrence. Une légère cicatrice a été retrouvée dans 3 cas (16,6%). Il n'y a eu aucune complication pendant la période de cicatrisation.

Cette étude a montré que l'ablation chirurgicale combinée au laser CO<sub>2</sub> superpulsé est une option efficace pour traiter le carcinome basocellulaire et pour obtenir un taux de guérison élevé avec de bons résultats esthétiques.

**Mots clés:** chirurgie au laser - tumeur cutanée de la face - laser CO<sub>2</sub> - carcinome basocellulaire.

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## Introduction

Basal cell carcinoma (BCC) is the most common skin cancers in the face region [1]. It's a malignant cancer, arising from the basal layer of the epidermis with a slow growth rate and a minor invasiveness; metastasis are rare [2,3]. There are many clinical type of BCC: superficial, nodular, infiltrative [4]. Success of treatment depend on the clearance of the tumor, the absence of recurrence and the optimal esthetic outcome [5].

Clinically, BCC appears as a flesh pink plaque; 85% of the cases occur in the face and neck region [6].

Several therapeutic protocols are used in case of BCC, including surgical excision [5,7-9], Mohs Micrographic Surgery (MMS) [10,11], photodynamic therapy [12,13], cryosurgery [14], electrocoagulation [15], application of topical Imiquimod [16,17] and Laser therapy [18-20].

The first gas Laser was produced by Patel in 1964. Lasers emit long wave infrared light at a wavelength of 10600 nm. This laser in its continuous wave (CW) has the greatest power compared to the other Lasers[21]. Water-containing tissue absorbs 90% of the laser energy that causes tissue vaporization and destroys connections between cells. This biological interaction is the basis of the use of laser CO2 when treating soft tissue lesions [22]. Several studies used CO2 laser in treatment of BCC and demonstrated good outcomes [23-25].

The present study was carried out to evaluate the healing of BCC (recurrence and esthetic outcome) after surgical excision and irradiation with superpulsed laser CO2 .

## Materials and methods

A total of 18 patients who visited the Department of Oral and Maxillofacial Surgery at Tishreen Hospital between November 2017 and February 2019, and were diagnosed with BCC in the face region by scraping biopsies were included in the study. The participants

were of both gender (7 males and 11 females) with the age comprised between 58-71 years. The medical history and clinical examination of the lesions were recorded.

The inclusion criteria were: tumorous lesions diameter  $\leq$  12 mm, tumor classification T1, no metastasis and no metabolic diseases such diabetes.

Under local anesthesia (Lidocain 10%, 1:200 000 epinephrine), the tumor was excised using a surgical blade #15 with 3 mm of surrounding skin as a safety margin [26]. Incision around the base of the lesion was performed, and the lesion was then removed completely. Tumor bed appeared as a pink bleeding surface. Pressure for 5 minutes was exerted with a gauze soaked in saline solution, to stop the bleeding.

Laser power adjusted to 5-8 W, superpulsed wave, spot size 3 mm were used to irradiate the tumor bed after excising the lesion. The wounds were left open to secondary epithelization.

10.6  $\mu$ m CO2 laser, guide wave laser He-Ne laser 632  $\mu$ m (Biopixel, Bios, Italy) was used. Specifications of the device are maximum output 45 W, the delivery system depending on articulated arms and straight head-piece, with noncontact mode within the procedure.

Antibiotic ointment was applied on the wound after laser, and oral analgesic drugs were given directly after surgery.

Recurrence and esthetic outcomes were observed after 1 year follow-up.

### Statistical analysis

Statistical package for Social Science (SPSS version 25.0) software was used to statistically analyze the results. Level of significance was set at 0.05.

## Results

18 BCC in the face region were ablated with 3 mm of surrounding tissue, followed by vaporization of the tumor bed.

The distribution of sample according to gender : 7 males (39%), 11 females (61%) . The mean age was 66 years (range 58-71 years).

The mean size ( maximal diameter of lesion) 9.3 mm with a range 7.2-11.3mm.

Superficial type of tumors was the most common type (66.6%) (Fig. 1), while nodular type was observed in 6 patients (33.3%) (Fig. 2).

The distribution of the lesions location was: 5 (27.7%) on forehead, 5 (27.7%) on the temple, 4 (22.2%) on the upper lip, 3 (16.6%) on the nasal alar and 1 (5.5%) on the ear lobe.

The one-year follow showed no recurrence. Slight scar was found in 3 cases (16.6%) There were no complications during the wound healing period.

There was a statistically significant difference between the type of tumor and the esthetic outcome ( $p>0.05$ ).

The distribution of lesions and outcomes are presented in table 1.

## Discussion

The successful treatment of BCC depends on reliable ablation of the entire cancerous lesions. Many therapeutic options are currently available, such as surgical excision, Mohs micrographic surgery, curettage with and without cautery, cryosurgery and laser ablation.

Topical treatment with Imiquimod is particularly indicated in cases of genital and external perianal warts (condyloma acuminata) in adults, in small superficial basal cell carcinomas in adults and in clinically typical actinic keratoses, non-hypertrophic, non-hyperkeratotic of the face or scalp in immunocompetent adults. The doctor in charge of the patient will choose this first-line treatment when the size or number of lesions limits the effectiveness and / or tolerance of cryotherapy and if other topical treatments are contraindicated or less appropriate.

The surgical excision is the standard and the most effective treatment of BCC of the skin. This technique requires wide elimination of tissue,

Patients	Diagnosis	Gender	Age	Location	Size	Recurrence	Esthetic outcomes
1	Superficial BCC	F	58	Forehead	11.2	No	No scar
2	Superficial BCC	M	72	Nose alar	7.6	No	No scar
3	Nodular BCC	F	70	Upper lip	7.3	No	No scar
4	Nodular BCC	F	62	Forehead	8.2	No	No scar
5	Superficial BCC	M	71	Nose alar	10.5	No	No scar
6	Superficial BCC	F	61	Upper lip	11.3	No	No scar
7	Nodular BCC	M	71	Temple	8.1	No	No scar
8	Superficial BCC	M	71	Forehead	11	No	Slight scar
9	Nodular BCC	M	66	Upper lip	8.2	No	No scar
10	Superficial BCC	M	69	Temple	9.7	No	No scar
11	Superficial BCC	F	70	Nose alar	7.5	No	No scar
12	Superficial BCC	F	64	Temple	11	No	No scar
13	Nodular BCC	F	66	Upper lip	9.5	No	Slight scar
14	Superficial BCC	F	67	Forehead	7.2	No	No scar
15	Superficial BCC	F	59	Temple	10.3	No	No scar
16	Nodular BCC	F	69	Temple	8	No	No scar
17	Superficial BCC	F	60	Forehead	10.5	No	Slight scar
18	Superficial BCC	M	65	Ear lobe	9.4	No	No scar

Table 1: Patient details and outcomes of treatment.

			Esthetic outcomes					
			No Scar		Scar			
			N	%	N	%	P	
Tumor type	Superficial	12	10	83.3	2	16.7	9.6	0.002
	Nodular	6	5	83.3	1	16.7		
Sex	Male	7	6	85.7	1	14.3	0.036	0.95
	Female	11	9	81.8	2	18.2		
Lesion location	Forehead	5	3	60	2	40	4.26	0.921
	Temple	5	5	100	0	0		
	Upper lip	4	3	75	1	25		
	Nose alar	3	3	100	0	0		
	Ear lobe	1	1	100	0	0		
Tumor size	<9	8	8	100	0	0	2.91	0.09
	>9	10	7	75	3	25		

Table 2: Distribution of esthetic outcomes.



Fig. 1: Patient with superficial BCC on the forehead. A) before treatment, B) after surgical excision and application of pulsed CO2 laser, C) at 1 year follow-up.

Fig. 2: Patient with nodular BCC on the temple; A) before treatment, B) after surgical excision and application of pulsed CO2 laser, C) at 1 year follow-up.

followed by skin grafts or local flaps from surrounding skin to reconstruct the wound bed, that often results in less ideal esthetic outcomes [27]. In addition, surgical excision of BCC can be sometimes difficult especially in sensitive anatomic areas like the lower eyelid, leading to severe complications such as distortion of anatomical landmarks [28].

The cancerous lesion is usually excised with a safety margin. The value of the safety margin varies in the different studies, a margin of 5mm being considered as the safest for all the BCC

[29]. However, the anatomical localization of the BCC might constrain the choice of a wide safety margin. That's why a 3-4 mm safety margin or even 2 mm safety margin can be applied in some cases with low-risk small (<10mm) lesions [26].

The Mohs micrographic surgery (MMS) consists of excising the BCC lesion and histologically examining the entire margin intraoperatively. Depending on the result, if any margin is still involved, further excision can be performed. This technique permits accurate histologic analysis,

thus lower recurrence of the cancerous lesion [28]. Despite these advantages, this technique should be reserved to high-risk or recurrent BCC due to its time and cost limitations [29].

Curettage consists of scraping off the tumor using a curette. Electrocautery is then used to control the bleeding and to destroy any residual tumor. This technique necessitates the biopsy of the lesion prior to the curettage / electrocautery to confirm the diagnosis [30].

In cryosurgery, liquid nitrogen is used to destruct the cancerous tissue.



Biopsy and histologic analysis should be done to confirm the diagnosis. This technique is operator dependent. It can be applied when treating low risk BCC, either alone or combined to curettage [31].

BCCs on the face can be also managed non-surgically, using radiotherapy, topical 5% Imiquimod cream (Aldara), photodynamic therapy or topical 5-Fluorouracil 5% (Efudex) [29].

Carbon dioxide laser ablation has been used in the treatment of BCCs [31].

In this study, we evaluated the efficacy of surgically ablating BCC combined with the vaporization of bed tumor using one pass of superpulsed CO2 laser.

Several studies have shown that CO2 laser in superpulsed wave is an effective alternative method for treating BCC with good esthetics outcomes and less recurrence rate [24,32,33]. Usually, this method necessitates several laser passes to eliminate all tumorous cell. This depends on clinical appearance of the wound or the histopathological examination result.

Horlock vaporized 21 superficial, 28 nodular and 2 infiltrative BCC with multiple passes of superpulsed laser. He demonstrated that Co2 laser is effective in completely ablating all superficial BCC and nodular types of less than 10 mm diameter when it lase-red the lower dermis or deeper [32].

Compolmi et al. used multiple passes to treat 140 patient with superficial and nodular BCC. Histopathological examination was done three times (before, during and at the end of treatment). After 1 year follow-up no recurrence were observed and no tumorous cells were detected in biopsy after laser surgery [24].

Del Pozo and Rosende reported the use of multiple passes of superpulsed CO2 laser and focused mode to vaporize skin BCC in the face. After one year follow-up, no recurrence was detected. However, three secondary complications in cosmetic outcomes were presented: persistent and transitory

erythema, hypopigmented area and textural alterations [34].

In our study, we used superpulsed CO2 laser to vaporize the wound bed after entire ablation of the tumor, with no wound closure; the surgical bed was left to second epithelialization. The advantages of this combination lies in gain of histological test of the excised lesion margin, and reduction of aggressive manipulation in surrounding tissue to close the wound with local flaps.

In a study of 113 BCC in the face skin, 57% of the lesions were of the nodular type. The tumor mass was ablated with 2-5 mm of marginal tissue, then the area exposed to 2 or 4 passes of pulsed CO2 laser. Recurrence occurred in 6.3% of all lesions, and a good to excellent outcomes was observed in 85.8%. All recurrent tumors showed a complete cure after retreatment with the same protocol [34].

In the present study, no recurrence were observed after 1 year follow-up. The lesions showed a total cure, and good cosmetic outcomes in 15 cases (83.3% no scar). 3 cases showed slight scar (16.6%), 2 on the forehead and 1 on the upper lip.

No statistically significant differences was found between esthetic outcomes and gender of patient or location of the lesion. However, there was a statistically significant difference between esthetic outcomes and the type of tumor. Although nodular type is more aggressive in tissue, one case showed slight scar versus 2 cases of superficial type. This result might be attributed to the incomplete surgical excision of the lesion before laser irradiation.

## Conclusion

The present study showed that surgical excision combined with superpulsed CO2 Laser in treatment of BCC is an effective option to achieve high cure rate and good esthetic outcomes. This method is non aggressive compared with surgery alone.

However, this study presents many limitations:

- The number of participants included in the study was small.
- A one-year evaluation is a very short follow-up in cancerology even though BCC have good prognosis.

This study could be considered a pilot study. A future study with a larger sample and a longer follow-up should be programmed to confirm the reliability and the effectiveness of this protocol in the treatment of BCC.

## References

- Bulliard JL, Panizzon RG, Levi F. Epidemiology of epithelial skin cancers. *Rev Med Suisse*. 2009; 5(200):882–884–8.
- Breuninger H, Dietz K. Prediction of subclinical tumor infiltration in basal cell carcinoma. *J Dermatol Sur Oncol*. 1991;17:574–578.
- Lo JS, Snow SN, Reizner GT. Metastatic basal cell carcinoma: report of twelve cases with a review of the literature. *Journal of the American Academy of Dermatology*. 1991;24: 715–19.
- Tefler NR, Golver GB, Bowers D. Guideline for the management of basal cell carcinoma. *British Association of Dermatologists. Br J Dermatol*. 1999; 141:415-422.
- Walker P, Hill D. Surgical treatment of basal cell carcinoma using standardised postoperative histological assessment. *Australasian journal of Dermatology*. 2006;47:1-8.
- Kyrgidis A, Vahsevanos K, Tzellos TG, et al. Clinical, histological and demographic predictors for recurrence and second primary tumours of head and neck basal cell carcinoma. A 1062 patient cohort study from a tertiary cancer referral hospital. *Euro J Dermatol*. 2010;20(3):276–282.
- Hamada S, Kersey T, Thaller VT. Eyelid basal cell carcinoma: non-Mohs excision, repair, and outcome. *British Journal of Ophthalmology*. 2005;89:992–994.
- David DB, Gimblett ML, Potts MJ, Harrad RA. Small margin (2mm) excision of peri-ocular basal cell carcinoma with delayed repair. *Orbit*. 1999;18(1):11–15.
- Kakudo N, Ogawa Y, Suzuki K, Kushida S, Kusumoto K. Clinical outcome of surgical treatment for periorbital basal cell carcinoma. *Annals of Plastic Surgery*. 2009;63(5):531–535.
- Malhotra R, Huilgol SC, Huynh NT, Selva D. The Australian Mohs database, part I: periocular basal cell carcinoma experience over 7 years. *Ophthalmology*. 2004;111(4):624–630.
- Lindgren G, Lindblom B, Lark O. Moh's micrographic surgery for basal cell carcinomas on the eyelids and medial canthal area. II. Reconstruction and follow-up. *Acta Ophthalmologica Scandinavica*. 2000;78(4):430–436.
- Chapas AM & Gilchrist BA. Broad area photodynamic therapy for treatment of multiple basal cell carcinomas in a patient with nevoid basal cell carcinoma syndrome. *Journal of drugs in dermatology* 2006;5(2 Suppl): 3-5 .
- Braathen LR, Szeimies RM, Basset-Seguín N, et al. Guidelines on the use of photodynamic therapy for nonmelanoma skin cancer. An International Consensus. *Journal of the American Academy of Dermatology*. 2007;56:125–43.
- Kokoszka A & Scheinfeld N. Evidence-based review of the use of cryosurgery in treatment of basal cell carcinoma. *Dermatologic Surgery*. 2003;29:566–71.
- Spiller RF. Treatment of basal cell carcinoma by curettage and electrodesiccation. *J Am Acad Dermatol*. 1984;11:808-14.
- Kagy MK & Amonette R. The use of Imiquimod 5% cream for the treatment of superficial basal cell carcinomas in a basal cell nevus syndrome patient. *Dermatologic Surgery*. 2000; 26:577-579.
- Schulze HJ, Cribier B, Requena L, et al. Imiquimod 5% cream for the treatment of superficial basal cell carcinoma: results from a randomized vehicle-controlled phase III study in Europe. *British Journal of Dermatology*. 2005;152:939–47.
- Shah SM, Konnikov N, Duncan LM & Tannous ZS. The effect of 595nm pulsed dye laser on superficial and nodular basal cell carcinomas. *Lasers in Surgery and Medicine*. 2009;41:417-22.
- El-Tonsy MH, El-Domyati MM, El-Sawy AE, El-Din WH, Anbar Tel-D & Raouf HA. Continuous-wave Nd:Yag Laser hyperthermia: A successful modality in treatment of basal cell carcinoma. *Dermatology Online Journal*. 2004;15;10(2): 3.
- Konnikov N, Avram M, Jarell A & Tannous Z. Pulsed dye laser as a novel non-surgical treatment for basal cell carcinomas: response and follow-up 12-21 months after treatment. *Lasers in Surgery and Medicine*. 2011;43:72-8.
- Waseem J, Hopper C. CO2 lasers in the management of potentially malignant and malignant oral disorders. *Head & Neck Oncology*. 2012;30;4:17.
- Fitzpatrick RE, Goldman MP, Esparza JR. Clinical advantage of the CO laser superpulsed mode. *J Dermatol Surg Oncol*. 1994;20:449-456.
- Kavossi H, Ibrahimi A, Rezei M. Treatment and cosmetic outcome of superpulsed CO2 laser for basal cell carcinoma. *Acta Dermatovenerologica*. 2013;22:57-61.
- Camplomi P, Brazizini B, Urso C, Gherstich I, Mavilia, Hercogova J. Superpulsed CO2 laser treatment of basal cell carcinoma with intraoperative and cytologic examination. *Dermatol Surg*. 2002;28:909-11.
25. Humphrys TR, Malhotra R, Scharaf MJ, Marcus SM, Starcus L, Calegari K. Treatment of superficial basal cell carcinoma and squamous cell carcinoma in situ with a high-energy pulsed carbon dioxide laser. *Arch Dermatol*. 1998;134:1247-52.
- Quazi S, Aslam N, Saleem H, Rahman J, Khan S. Surgical margin of excision in basal cell carcinoma: A systematic review of literature. *Cureus*. 2020;12(7):e9211.
- Berking C, Hauschild A, Kolblo. Basal cell carcinoma treatments commonest for skin cancer. *Dtsch Arztebl Int*. 2014;111:389-395.
- Mosterd K, Thissen MR, van Marion AM, Nelmans PJ, Lohman BG, Steijlen PM et al. Correlation between histologic findings on punch biopsy specimens in recurrent basal cell carcinoma. *J Am Acad Dermatol*. 2011;64:323-7.
- Smith V and Walton S. Treatment of facial basal cell carcinoma: A review. *Journal of Skin Cancer* 2011; Article ID 380371, 7 pages.
- Lindemalm-Lundstam B and Dalenback J. "Prospective follow-up after curettage-cryosurgery for scalp and face skin cancers". *British Journal of Dermatology* 2009;161:568–576.
- Telfer NR, Colver GB, Morton CA. "Guidelines for the management of basal cell carcinoma," *British Journal of Dermatology* 2008;159:35–48.
- Horlock N, Groobbelaar AO, Gault DT. Can the carbon dioxide laser completely ablate basal cell carcinoma? *Histological study*. *Br J Plast Surg*. 2000;53:286-93.
- Pozo JD and Rosende L. Basal cell carcinoma. Treatment with carbon dioxide laser vaporization. *Advances in Cancer Research & Treatment* 2013; Article ID 442049, 11 page.
- Kavoussi H, Ebrahimi A, and Rezaei M. Treatment and cosmetic outcome of superpulsed CO2 laser for basal cell carcinoma. *Acta Dermatovenerologica Alpina, Pannonica et Adriatica*, 2013;22(3):57–61.