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2 **Title: Laser treatment of epidermal nevi: A multicenter retrospective study with**
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32 nevus; Becker nevus; ILVEN; smooth-muscle hamartoma; nevus lipomatosus
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34 **Abstract**

35 **Background:** Patients with epidermal nevi strongly demand cosmetic improvement.

36 Laser treatment appears appealing and is frequently used in clinical practice.

37 Nevertheless, large series with long-term follow-up are missing, preventing definitive
38 conclusions about its real benefit.

39 **Objective:** To evaluate the long-term effectiveness and safety of lasers for epidermal
40 nevi.

41 **Methods:** Bicentric, retrospective, cohort study, including all patients treated with a
42 laser for an epidermal nevus with more than a one-year follow-up.

43 **Results:** Seventy patients were treated for different types of epidermal nevi, mostly
44 with ablative lasers: 23 verrucous epidermal nevi, 16 nevi sebaceous, 26 Becker nevi,
45 two inflammatory linear verrucous epidermal nevi, one smooth-muscle hamartoma,
46 one rounded and velvety epidermal nevus, and one nevus lipomatosus superficialis.
47 The follow-up period ranged between 12 and 127 months (median 37 months). Better
48 results, fewer recurrences, and higher patient satisfaction were noted in treatments for
49 verrucous epidermal nevi than for nevi sebaceous. Q-switched (QS) lasers failed to
50 show any degree of improvement in almost all patients with Becker nevus.

51 **Limitations:** The retrospective nature of the study.

52 **Conclusions:** Ablative lasers can treat verrucous epidermal nevi with good long-term
53 esthetic results, but they have limited long-term efficacy for nevus sebaceous. Q-
54 switched lasers failed to improve Becker nevi.

55 **Capsule summary**

- 56 • In the absence of satisfactory treatments for epidermal nevi, lasers are
57 promising.
- 58 • Our study demonstrates that improvement with ablative lasers varies between
59 verrucous and sebaceous nevi, with better long-term results for verrucous nevi.
60 It also shows that Becker nevus is not a good indication for Q-switched lasers.

61 **Introduction**

62 Epidermal nevi (EN) are a heterogeneous group of hamartomatous skin lesions
63 defined by the proliferation of keratinocytic, glandular, follicular, or muscular
64 components of the epidermis. Multiple components are usually present in a single
65 lesion, but the type is defined according to the predominant cell types. The most
66 common types are the verrucous epidermal nevus (VEN), also called keratinocytic
67 epidermal nevus, and the nevus sebaceous (NS). Other types include inflammatory
68 linear verrucous epidermal nevus (ILVEN), Becker nevus (BN), smooth-muscle
69 hamartoma (SMH), nevus comedonicus, porokeratotic eccrine nevus¹, rounded and
70 velvety epidermal nevus (RAVEN)² and nevus lipomatosus superficialis (NLS).³

71 EN has an incidence of 1–3 cases/1000 births⁴ and represents a frequent motive
72 for consultation in dermatology, with an esthetic complaint and a strong cosmetic
73 demand for removal. Because the surgical excision is often limited by the size and
74 location of EN, many nonsurgical techniques have been proposed, including
75 cryotherapy, electrocautery, dermabrasion, and chemical peels.⁵ Unfortunately, such
76 approaches give inconsistent results and carry a strong risk of scars. Lasers have been
77 also proposed for treating different types of EN, with encouraging results.
78 Nevertheless, most articles are case reports or series with small numbers of
79 participants and generally a limited follow-up, thus preventing reliable conclusions
80 about the true benefit of laser therapy for EN. ⁶⁻⁵⁰

81 The objective of this study was to assess the long-term effectiveness and safety
82 of laser approaches in treating the different types of EN.

83 **Methodology**

84 We conducted a retrospective cohort study in the dermatology departments of
85 the University Hospital of Nice in France and the Academic Medical Center of the
86 University of Amsterdam in the Netherlands.

87 We included all patients with any type of EN who were treated with a laser in
88 our departments between 2007 and 2018. All the patients were contacted by telephone
89 to assess their auto-evaluation and satisfaction, and asked them to send a clear picture
90 to assess the long-term effectiveness of the laser treatment. We excluded all patients
91 with a follow-up of less than one year, patients who could not be contacted, and
92 patients treated only for hair removal of BN. All patients with an immediate complete
93 failure of the laser treatment were included, because no follow-up was needed.

94 The laser treatment was performed by three dermatologists experienced with
95 lasers (FLD, AW, TP). The erbium lasers used were the 2940nm Erb:YAG supErb:
96 XL® (BAASEL Lasertech, Starnberg, Germany) and Burane® (Alma Lasers, Liege,
97 Belgium), and the CO₂ lasers were the UltraPulse® (Lumenis Inc., Santa Clara, CA,
98 USA) and Fraxel Repair® (Solta Medical, Hayward, CA, USA) in the Netherland and
99 France centers, respectively. Digital color photographs were taken at baseline, soon
100 after the last session, and at the last follow-up. All photographs were then evaluated
101 by two independent dermatologists (AA, FF) for physician global assessment (PGA)
102 after the treatment (short-term [ST-PGA]) and at the last follow-up (long-term [LT-
103 PGA]). ST-PGA and LT-PGA were graded from 0 to 6 (0= 100% improvement, 1=
104 90–99% improvement, 2= 50–89%, 3= 25–49%, 4= 1–24%, 5= no improvement, 6=
105 worsening). Patients were asked for their satisfaction (not satisfied, satisfied, very
106 satisfied) and self-evaluation from 0–5 (0 = cleared, 1 = almost cleared, 2 = good
107 improvement, 3 = slight improvement, 4 = no change, 5 = worse) at the last follow-
108 up. Any degree of recurrence or persistent side-effects, including scarring, seen by the

109 dermatologist or mentioned by the patient was noted. Age, gender, lesion
110 characteristics, and site were noted, and results were analyzed for each type of EN.

111

112 **Results**

113 A total of 88 patients with EN were treated in both centers with various lasers
114 between October 2007 and August 2018. Eight patients were lost to follow-up and
115 unreachable (four VEN, two NS, two BN), and 10 patients were treated recently with
116 a follow-up of less than one year (six VEN, one NS, two BN, one RAVEN). A total of
117 70 patients were included; 23 of them had VEN, 16 had NS, 26 had BN, two had
118 ILVEN, and the remaining three had RAVEN, NLS, and SMH. The follow-up period
119 ranged between 12 and 127 months with a mean of 47.3 months and a median of 37
120 months. Age, laser type, improvement, scarring, recurrence, and the follow-up period
121 of each patient are shown in Tables 1–4.

122 Almost all VEN were treated with CO₂ or Er:YAG ablative lasers. Only two
123 patients had hyperpigmented thin VEN and were thus treated with Q-switched lasers.
124 Among the 23 patients with VEN, only four (17%) patients showed moderate, poor,
125 or no improvement. Two patients (8.7%) had a short-term PGA of 0, and 16 patients
126 (69.6%) had a short-term PGA of 1 and 2, eight patients each, resulting in 18 patients
127 with good to complete improvement. Seven of them (39%) showed partial or
128 complete recurrence (Table 5). After a follow-up, which ranged between 12 and 106
129 months (mean 45.2 months, median 37 months), three patients had a poor response,
130 two showed no response, and one worsened. The remaining 16 patients (69.6%) kept
131 an improvement of more than 50%. At the last follow-up, 14 patients (82%) were still
132 satisfied or very satisfied with the treatment results.

133 Sixteen patients were treated for NS. Eight (50%) showed an initial
134 improvement of more than 50%. However, 14 patients (88%) had partial or complete
135 recurrence at long-term follow-up, but half of them were satisfied with the temporary
136 or partial improvement. The follow-up period ranged from 13 to 127 months (mean
137 45 months, median 36 months).

138 Twenty-six patients were treated with QS laser for their Becker nevi. For each
139 one of them, a test session was initially performed on one to four areas, using
140 different wavelengths, including 1064nm, 755nm, 694nm, and 532nm (total number
141 of treated areas: 56). Only three patients (5.4%) experienced any degree of
142 improvement, which was slight to moderate in two of them, with complete recurrence
143 soon after. The third had a good to excellent improvement after four sessions of QS
144 755nm laser without recurrence, but with a relatively short follow-up of 12 months.

145 Some rare forms of EN are presented in Table 4. Two cases of ILVEN showed
146 50–89% improvement, mainly with the pulsed dye laser (PDL) laser on the
147 erythematous parts of the lesion. The only case of RAVEN, or acanthosis nigricans-
148 like epidermal nevus, was slightly improved with the Er:YAG ablative laser with a
149 rapid and complete recurrence. A nevus lipomatosus superficialis was treated
150 successfully with a CO₂ laser, yet the lesion partially recurred two years later. The last
151 case showed a partial improvement of the erythema of a smooth-muscle hamartoma
152 with a PDL.

153

154 **Discussion**

155 In the present long-term follow-up study, we found a differential response
156 pattern to laser therapy based on the type of epidermal nevus. Verrucous epidermal
157 nevus patients exhibited more than 50% improvement in 81.8% of them, mainly with

158 ablative lasers. After a mean follow-up of 45.2 months, the success rate remained
159 high, with 16 good responders out of the 22 patients evaluated (72.7%). Accordingly,
160 78.3% of these patients graded their improvement as good, almost cleared, or cleared,
161 with a satisfaction rate of 82.6% after a mean follow-up of more than three years.
162 These results corroborate those of Alonso et al. with good results in 93% of VEN
163 patients. Nevertheless, they reported a lower recurrence rate (20%) than in our study
164 (50%) but a higher rate of hypopigmentation or scarring (46.6%) than in our study
165 (27%).¹¹ This might be explained by a more superficial ablation in our practice,
166 differences in the follow-up, or by recording minor recurrences in our study. Thual et
167 al. also demonstrated a good response in 86% of their 21 patients and a recurrence
168 rate of 38% with a short follow-up of seven and 11 months for some patients.¹³ Both
169 articles agreed that thickness of VEN is not predictive of poor response, which
170 conforms to our observations. Park et al. achieved good results in 15 out of 20
171 patients treated with the Er:YAG laser, with a recurrence rate of 25%, without any
172 scar after a follow-up of two years.¹⁴ A randomized controlled study revealed 100%
173 success, 0% recurrence, and 50% scarring or dyspigmentation with the pulsed CO₂
174 laser, compared to 90% success, 30% recurrence, and 10% dyspigmentation with the
175 pulsed Er:YAG laser. However, the only significant difference was the shorter healing
176 time with Er:YAG.⁷ In our series, we did not observe a statistical difference in terms
177 of recurrence when comparing the use of Er:YAG to CO₂ laser (p=0.5).

178 Regarding NS, only eight patients (50%) had more than 50% improvement;
179 88% of them (7/8) showed some degree of recurrence, and 38% developed permanent
180 scars. Among the 16 NS patients, only two patients did not experience recurrence, but
181 one of them had a superficial scar. The recurrence rate of NS was 90% for patients
182 treated in Nice and 83% for Amsterdam, compared to 50% and 40%, respectively, for

183 VEN (without statistical differences between the two centers for the two types of EN).
184 The potential bias associated with the difference between operators did not alter our
185 results. The reason is that each type of EN had the same outcome in both centers,
186 regardless of the treating physician. In both NS and VEN, many recurrences appeared
187 beyond the first year. This highlights the importance of long-term follow-up after
188 treating these lesions.

189 We believe that the increased rate of recurrence and scarring in NS, compared
190 to VEN, is related to the histological differences between them. NS is mainly a dermal
191 lesion whose main components are sebaceous glands, immature hair follicles, and
192 sweat glands with sometimes additional epidermal anomalies, whereas VEN is purely
193 epidermal (keratinocytic) with acanthosis, papillomatosis, and hyperkeratosis.⁴ Thus,
194 VEN can be removed completely or almost completely with excellent cosmetic
195 outcomes, whereas recurrence is expected in NS when treating only the superficial
196 part, and scarring is unavoidable if one tries to treat the dermal part deeply. Yet,
197 partial improvement of NS lesions can be achieved, but patients need to realize the
198 high risk of scarring and recurrence. For both types, we do not recommend treating
199 with aggressive laser settings or trying to treat the whole thickness deep into the
200 dermis in one session. To avoid disfiguring scars, it is wise to treat first just the
201 superficial or papillary dermis and, later, if necessary, the remaining deeper parts. We
202 recommend performing several passes to flatten the lesion first and then to decrease,
203 if necessary, the power for the last passes to avoid treating too deeply in the dermis.
204 Targeting a cosmetically acceptable scar could be considered as the endpoint to avoid
205 recurrence. Our results support this for the deeper lesions such as NS. However, most
206 patients treated for VEN in our study did not develop a scar or dyspigmentation,
207 because they were not treated too deeply. Thus, all of them have remnants of their

208 lesions (PGA-LT= 1 or more). Interestingly, although the clearance was not complete,
209 long-term results remain good, and most of the patients were satisfied or very satisfied
210 at the long-term evaluation. Some studies mentioned that the degree of improvement
211 is affected by the larger size and thickness of the lesion, this was not seen in our
212 results. Almost all non-satisfied patients have lesions of small size, while the only two
213 patients treated for large VEN were satisfied. Regarding the body site, we did not find
214 significant association with the degree of improvement. However, the only two VEN
215 located on the hand did not respond very well, and three out of the four unsatisfied
216 VEN patients were treated for neck VEN. This might be explained by the high
217 mobility of the treated areas, which could alter the healing process.

218 When evaluating the populations of the aforementioned studies together with
219 our patients, 53 VEN patients were treated only with CO₂ lasers (different modes and
220 parameters) and 42 patients with Er:YAG lasers. A total of 21 patients (39.6%)
221 developed scars or permanent hypo- or hyperpigmentation after CO₂ lasers, versus six
222 patients (14.3%) after Er:YAG lasers (p=0.006). The thermal effect of the CO₂ laser
223 might be the origin of these side-effects. We cannot exclude a potential bias linked to
224 the procedural differences between the different physicians, but the only controlled
225 comparative study was in favor of this difference, although not significant, with a
226 small number of participants. In our study, there was almost no difference; 25% of the
227 patients had scarring or hypopigmentation with Er:YAG versus 28.6% with CO₂.

228 Regarding Becker nevus, our study reveals that pigmentary lasers, regardless of
229 their wavelengths, were not effective in treating the hyperpigmentation. Only three
230 patients (11.5%) experienced any degree of improvement. Only one of them (3.8%)
231 maintained the improvement after four sessions of QS 755nm, but with a relatively
232 short follow-up of 12 months. These results argue against the use of lasers for treating

233 the pigmentary component of Becker nevus. Of note, none of our patients was treated
234 with both hair-removal and QS lasers. Thus, it is impossible to say whether
235 combining the two procedures would improve these results. Picosecond lasers do not
236 seem to bring any advantage compared to QS nanosecond lasers; the only case report
237 so far showed poor efficacy.³¹ Interestingly, an Er:YAG laser was reported to be
238 superior to QS 1064nm. A success rate of 100% was obtained without recurrence at
239 two years.³⁶ Such promising data were corroborated recently with 50% of good
240 responders and without recurrence at one year.²⁸ However, this data needs to be
241 confirmed in larger series.

242 The two ILVEN patients reported improvement with PDL for erythema and
243 CO₂ laser for the verrucous component, with partial recurrence in one of them. We
244 already reported the successful treatment of ILVEN with the Er:YAG laser, with a
245 partial recurrence after six months.⁴⁴ Two small case series demonstrated that ILVEN
246 has a recurrence rate of 60% to 80% after being treated with a CO₂ laser.^{11,19}

247 The main limitations of our study are its retrospective nature and the lack of
248 histological confirmation of the diagnosis in most of the patients. However, in most
249 cases, the diagnosis of EN is easy and remains clinical. Although retrospective, the
250 study was conducted in two university hospitals having large experience in treating
251 medical conditions with lasers, and all the treatments were performed by only three
252 physicians, thus reducing the variability linked to physician experience. Moreover,
253 only eight patients were completely lost to follow-up, and the 70 remaining could be
254 contacted for assessing the long-term evolution. Our results also emphasize the need
255 of an international long-term registry for these rare lesions treated with lasers to
256 assess the success rates, long-term efficacy, side-effects, and patient-reported
257 outcomes better.

258

259 **Conclusion**

260 Our study shows that ablative lasers can achieve good cosmetic results for
261 verrucous epidermal nevi, with a high rate of good to excellent immediate outcome
262 and a low rate of long-term recurrences. In contrast, nevus sebaceous has a strong
263 tendency to recur and to develop a scar when treating deeply. In Becker nevus, Q-
264 switch lasers did not provide any benefit in almost all patients and should not be
265 considered anymore for treating the hyperpigmented component of such epidermal
266 nevi.

267 **Abbreviations and acronyms**

268 **EN:** Epidermal nevus

269 **VEN:** Verrucous epidermal nevus

270 **NS:** Nevus sebaceous

271 **BN:** Becker nevus

272 **SMH:** Smooth-muscle hamartoma

273 **RAVEN:** Rounded and velvety epidermal nevus

274 **NLS:** Nevus lipomatosus superficialis

275 **ST-PGA:** Short-term physician global assessment

276 **LT-PGA:** Long-term physician global assessment

277

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426

427 **Table legends**

428 **Table 1.** Characteristics and results of verrucous epidermal nevus patients treated
429 with laser

430 **Table 2.** Characteristics and results of nevus sebaceous patients treated with laser

431 **Table 3.** Characteristics and results of Becker nevus patients treated with laser

432 **Table 4.** Characteristics and results of other rare types of epidermal nevi treated with
433 laser

434 **Table 5.** Verrucous epidermal nevus and nevus sebaceous treatment response,
435 recurrence, and long-term patient satisfaction

Patients		Lesion		Treatment		Results						Follow-
N	Age, gender	Site	Size	Type (and number of sessions)	Parameters	PGA- ST	PGA- LT	Patients' self- evaluation	Patients' satisfaction	Recurrence	Scar	up
Verrucous epidermal nevus												
1	14y,M	Nose	Small	Er:YAG ^A (1)	3 mm, 13 J / cm ²	1	1	1	S	No	No	1y
2	15y,F	Neck	Small	Er:YAG ^A (1) then CO ₂ ^B (2)	3 mm, 13 J / cm ² N/A	1	1	1	S	No	Partial	4y 6m
3	23y,M	Neck	Medium	Er:YAG ^A (1)	2.5 mm, 13 J / cm ²	1	2	2	S	Partial	No	4y 3m
4	17y,F	Sternal	Small	Er:YAG ^A (2)	2.5 mm, 13 J / cm ²	3	Absent	2	S	Partial	No	6y 2m
5	30y,F	Hand	Medium	CO ₂ ^B (2)	150-200 mJ / cm ²	4	6	5	NS	Complete	Yes	4y 8m
6	51y,M	Scalp	Medium	Er:YAG ^A (1)	2.5 mm, 13 J / cm ²	0	2	1	VS	Partial	No	1y 11m
7	16y,F	Eyelid	Small	Er:YAG ^A (2)	1.5 mm, 10 J / cm ²	1	1	1	S	No	No	2y 6m
8	16y,M	Neck	Small	Er:YAG ^A (1)	3.5 mm, 10 J / cm ²	Absent	2	4	NS	Partial	No	8y 10m
9	41y,F	Palmar	Medium	Er:YAG ^A (2)	3.5 mm, 16 J / cm ²	2	5	3	S	Complete	No	2y 10m
10	14y,F	Lower lip	Small	QS 532 (1)	2 mm, 4 J / cm ²	3	3	2	S	No	No	5y 9m
11	17y,F	Forearm	Medium	Er:YAG ^A (1)	1.5-3 mm, 10 J / cm ²	1	1	1	VS	No	Hypopigmentation	1y 8m
12	18y,F	Neck	Small	Er:YAG ^A (2)	2.5 mm, 13 J / cm ²	2	3	3	NS	No	Yes	6y 4m
13	6y,F	Hemicorpal	Large	Er:YAG ^A (2) armpit only	2.5 mm, 13 J / cm ²	1	2	1	S	Partial	No	3y 1m
14	16y,M	Scapular	Medium	Er:YAG ^A (1)	3 mm, 16 J / cm ²	2	4	2	S	No	Yes	1y 9m
15	18y,F	Scalp	Medium	CO ₂ ^B (1) then Er:YAG ^A (2)	2 mm, 225 mJ/cm ² 2.5 mm, 10 J / cm ²	1	1	1	S	No	Yes	1y 3m

16	13y,M	Armpit	Large	CO ₂ ^B (1)	5-7 W	0	2	1	VS	Superficial	No	1y 6m
17	5y,M	Neck	Small	Er:YAG ^A (1)	10-13 J / cm ²	2	5	4	NS	Complete	No	4y 9m
18	9y,M	Neck	Small	CO ₂ ^B (1)	5W then 2.5 W	1	1	1	VS	No	No	1y 10m
19	12y,M	Axilla, groin	Small	CO ₂ ^C (2)	2 mm, 15-25 W - 225 mJ	2	2	2	S	No	No	1y
20	49y,F	Shoulder, elbow	Medium	QS 755 (3)	2-3 mm, 10-16 J / cm ²	4	2	1	S	Partial	No	7y
21	24y,F	Abdomen	Small	CO ₂ ^C (2)	N/A	2	0	0	S	No	No	5y
22	12y,F	Thorax	Small	Fr CO ₂ ^C (2)	N/A	2	0	0	S	Complete	No	7y
23	11y,F	Forehead	Small	CO ₂ ^C (1)	2 mm, 200 mJ, 17 W	2	1	1	S	No	Yes	2y

436 **Table 1**

437 PGA-ST = short-term-physician global assessment; PGA-LT = long-term-physician global assessment; VS = very satisfied; S = satisfied; NS = not satisfied

438 A= Burane® (Alma Lasers, Liege, Belgium). B= Fraxel Repair® (Solta Medical, Hayward, CA, USA). C= UltraPulse® (Lumenis Inc., Santa Clara, CA, USA).

Patients		Lesion		Treatment		Results					Follow-up	
N	Age, gender	Site	Size	Type (and number of sessions)	Parameters	PGA-ST	PGA-LT	self-evaluation	Patients satisfaction	Recurrence	Scar	
Nevus sebaceous												
24	13y,M	Forehead	Small	Er:YAG ^A (1)	2.5 mm, 16 J / cm ²	3	3	2	VS	Partial	Minimal	2y 3m
25	10y,M	Cheek	Small	Pulsed CO ₂ ^B (1)	150 mJ, 10 Hz	5	Absent	4	NS	Complete	No	5y 4m
26	10y,F	Retro auricular	Small	Er:YAG ^A (2)	2.5 mm, 10 J / cm ²	1	Absent	3	NS	Complete	Yes	10y 7m
27	18y,F	Cheek	Small	Er:YAG ^A (2)	2.5 mm, 10 J / cm ²	3	2	2	S	No	Yes	7y 5m
28	7y,F	Cheek	Small	Er:YAG ^A (2)	2.5 mm, 10 J / cm ²	4	5	3	S	Complete	No	5y 6m
29	13y,M	Cheek	Small	CO ₂ and Fr CO ₂ ^B (1)	8 and 150 mJ / cm ²	2	2	2	S	Partial	Yes	4y 6m
30	7y,F	Forehead	Small	Test Er:YAG ^A (1)	13 J / cm ²	4	5	4	NS	Complete	No	4y 9m
31	17y,M	Neck	Small	SP CO ₂ ^B (1)	8 W then 3 W	1	2	1	VS	Partial	No	3y 6m
32	16y,M	Cheek	Small	SP CO ₂ ^B (1)	5 W	6	5	4	NS	Complete	No	1y 7m
33	16,F	Nasal	Small	Er:YAG ^A (2)	3.5 mm, 16 J / cm ²	3	Excised	4	NS	Complete	No	1y 1m
34	16y,M	Neck	Small	CO ₂ ^C (1)	2 mm, 7-10W, 225mJ	2	6	5	NS	Partial	Keloid	2y
35	29y,F	Cheek	Small	CO ₂ ^C (1)	2 mm, 20 then 3.5W	2	1	1	S	Partial	No	3y
36	20y,M	Chin	Small	CO ₂ ^C (1)	N/A	3	6	5	NS	complete	Yes	1y 6m
37	14y,M	Neck	Small	CO ₂ ^C (1)	1 mm, 3W, 225mJ	2	1	1	S	Partial	No	2y
38	16y,F	Earlobe	Small	CO ₂ ^C (1)	2 mm, 15 then 6 W	2	1	1	S	Partial	No	3y
39	16y,M	Forehead	Small	CO ₂ ^C (1)	7 W, 225 mJ	2	0	0	VS	No	No	2y

439 **Table 2**

440 PGA-ST = short-term-physician global assessment; PGA-LT = long-term-physician global assessment; VS = very satisfied; S = satisfied; NS = not satisfied

441 A= Burane® (Alma Lasers, Liege, Belgium). B= Fraxel Repair® (Solta Medical, Hayward, CA, USA). C= UltraPulse® (Lumenis Inc., Santa Clara, CA, USA).

N	Age, gender	Site	Size	Type (and number of sessions)	PGA- ST	PGA- LT	Patients' self- evaluation	Patients satisfaction	Recurrence	Scar	
Becker Nevus											
40	16y,M	Flank	Large	Test QS 755 and QS 532	5 both	5	4	NS	No improvement	No	1y 3m
41	22y,F	Cheek	Small	Test QS 755 and QS 532	5 both	-	4	NS	No improvement	No	4y 5m
42	15y,F	Shoulder	Large	Test QS 1064, QS 755 and QS 532	5 all	5	4	NS	No improvement	No	8y 4m
43	18y,M	Forearm	Medium	Test QS 755	5	5	4	NS	No improvement	No	2y 7m
44	40y,F	Arm	Large	Test QS 755 and QS 532	5 both	5	4	NS	No improvement	No	2y 3m
45	18y,M	Arm	Large	Test QS 755 and QS 532	5 both	5	4	NS	No improvement	No	3y 9m
46	19y,F	Arm	Large	QS 755 (1)	5	-	4	NS	No improvement	No	3y 8m
47	38y,F	Hip	Large	Test QS1064, QS532, QS755 and LP755	5 all	5	4	NS	No improvement	No	8y 3m
48	13y,M	Thorax	Large	Test QS 755 and QS 532	5 both	5	4	NS	No improvement	No	5y 3m
49	16y,M	Flank	Large	Test QS 1064, QS 755 and QS 532	5 all	5	4	NS	No improvement	No	8y 10m
50	29y,F	Abdomen	Large	Test QS 755 and QS 532	5 both	5	4	NS	No improvement	No	3y 3m
51	20y,M	Arm	Large	Test QS ruby	5	5	4	NS	No improvement	No	10y 1m
52	17y,M	Arm	Medium	Full treatment QS755 (2)	3	5	4	NS	Complete	No	1y 11m
				Test QS 532	4	5	4				
53	61y,M	Scapular	Medium	Test QS 532, QS 755	5	-	4	NS	No improvement	No	1y
54	36y,M	Scapular	Large	Full treatment QS755 (2)	3	5	4	NS	Complete	No	7y 8m
				Test QS 1064, QS 532	5 both	5					
55	15y,F	Thigh	Large	Test QS 755, QS 532	6 both	5 both	4	NS	No improvement	No	2y 6m
56	26y,F	Shoulder	Large	QS 755 (4)	2	1	-	-	No	No	1y
57	13y,M	Shoulder	Large	Test QS 755	5	-	-	-	No improvement	No	-

58	20y,F	Shoulder	Large	Test QS1064, QS755, QS 694, QS 532	5 all	-	-	-	No improvement	No	-
59	17y,F	Thorax	Large	Test QS 1064, QS 755, QS 532	5 all	-	-	-	No improvement	No	-
60	15y,M	Cheek	Small	Test QS 1064, QS 755	5 both	-	-	-	No improvement	No	-
61	37y,F	Breast	Large	Test QS 755, QS 532	5 both	-	-	-	No improvement	No	-
62	30y,M	Face	Large	Test QS 1064, QS 755, QS 532	5 all	-	-	-	No improvement	No	-
63	22y,F	Arm	Large	Test QS 755, QS 532	5 both	-	-	-	No improvement	No	-
64	16y,M	Thorax	Large	Test QS 755, QS 532	5 both	-	-	-	No improvement	No	-
65	18y,M	Cheek	Large	Test QS 755, QS 532	5 both	-	-	-	No improvement	No	-

442 **Table 3**

443 PGA-ST = short-term-physician global assessment; PGA-LT = long-term-physician global assessment; VS = very satisfied; S = satisfied; NS = not satisfied

Patients		Lesion		Treatment	Results					Follow-up	
N	Age, gender	Site	Size	Type (and number of sessions)	PGA-ST	PGA-LT	Patients' self-evaluation	Patients satisfaction	Recurrence	Scar	
ILVEN											
66	51y,M	Right trunk and leg	Large	Verrucous: CO ₂ (8) Erythematous: PDL (3)	2	2	3	S	Partial	No	3y
67	61y,M	Pretibial	Small	Erythematous: PDL (3)	2	Absent	2	S	No	No	2y
RAVEN											
68	15y,F	Shoulder	Small	Er:YAG (1)	4	5	4	NS	Complete	No	5y 4m
Nevus lipomatosus superficialis											
69	28y,F	Buttocks	Small	CO ₂ (1)	2	4	3	S	Partial	No	2y 6m
Smooth-muscle hamartoma											
70	18y,F	Cheek	Medium	PDL (1)	3	3	-	-	Yes	No	5y 5m

444

445 **Table 4**

446 ILVEN = inflammatory linear verrucous epidermal nevus; RAVEN = rounded and velvety epidermal nevus; PGA-ST = short-term-physician global assessment; PGA-LT =

447 long-term-physician global assessment; S = satisfied; NS = not satisfied

448

PGA-ST	Patients n	Recurrence n (%)	Scar n (%)	Satisfaction: n (%)		
				Very satisfied	Satisfied	Not satisfied
VEN						
Good response	18	7 (39)	6 (33)	4	12	2
Poor or no response	4	3 (75)	1 (25)	0	3	1
Absent PGA-ST	1	1	0	0	0	1
Total	23	11 (48)	7 (30)	4 (17.4)	15 (65.2)	4 (17.4)
NS						
Good response	8	7 (88)	3 (38)	2	4	2
Poor or no response	8	7 (88)	3 (38)	1	2	5
Total	16	14 (88)	6 (38)	3 (18.8)	6 (37.5)	7 (42.8)

449 **Table 5**

450 VEN = verrucous epidermal nevus; NS = nevus sebaceous; PGA-ST = short-term-physician global assessment

451 *The only patient without PGA-ST was lost to follow-up from the laser treatment until more than eight years later.

452