

# Treating vitiligo with Excimer laser: a retrospective study

## Excimer Laser no tratamento do vitiligo em 123 pacientes: estudo retrospectivo

### ABSTRACT

**Introduction:** Vitiligo is cosmetically disfiguring and can cause significant psychological morbidity. Most therapies require protracted treatments and can lead to disappointing results. More recently, 308 nm Excimer laser has proven to be effective in treating vitiligo.

**Objective:** To analyze the effectiveness and patient satisfaction of 308 nm Excimer treatment for vitiligo patches in a variety of locations on the body.

**Methods:** Patients with generalized or localized vitiligo (n = 123, 321 lesions), were studied. The patients were treated at a private practice between 2007 and 2010. Two independent examiners analyzed the response to the therapy by comparing clinical and photographic records before and after treatment.

**Results:** More than half (n = 77) of the patients presented repigmentation greater than 60%, 26 presented 40-59%, and 20% had levels less than 39%. Facial lesions responded better to treatment than those in other body parts. Elbows, hands and feet were the less sensitive areas. In general, the patients were satisfied with the treatment.

**Conclusion:** The use of Excimer laser for treating vitiligo was effective and safe, producing satisfactory cosmetic results and improving patients' self esteem.

**Keywords:** vitiligo; lasers, excimer; phototherapy.

### RESUMO

**Introdução:** O vitiligo é cosmeticamente desfigurante e pode causar significativa morbidade psicológica. A maioria das terapêuticas requer tratamento longo e pode levar a resultados decepcionantes. Recentemente, o Excimer laser-308nm revelou ser efetivo no tratamento de vitiligo.

**Objetivo:** Neste estudo retrospectivo foram analisadas a eficácia e satisfação dos pacientes que usaram Excimer laser-308nm no tratamento de manchas de vitiligo em diferentes regiões anatômicas.

**Métodos:** Participaram 123 pacientes com vitiligo generalizado ou localizado, apresentando 321 lesões. Os pacientes foram tratados em clínica privada de 2007 a 2010. A análise da resposta ao tratamento foi feita por comparação de registros clínicos e fotográficos obtidos antes e após o tratamento, por dois examinadores independentes.

**Resultados:** Setenta e sete dos 123 pacientes apresentaram repigmentação superior a 60%; 26 entre 40 e 59%; e 20% tiveram repigmentação inferior a 39%. Lesões na face responderam melhor ao tratamento do que as localizadas em outras regiões corporais. As áreas menos sensíveis foram cotovelos, mãos e pés. De forma geral, os pacientes ficaram satisfeitos com o tratamento.

**Conclusões:** O uso do Excimer laser para tratamento do vitiligo foi eficaz, seguro e levou a resultados cosmeticamente satisfatórios com melhora da autoestima dos pacientes.

**Palavras-chave:** vitiligo; lasers de excimer; fototerapia.

## Original Article

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## INTRODUCTION

Vitiligo is an acquired chronic leucoderma that is clinically characterized by single or multiple hypopigmented macules, which are often symmetrical and clearly delimited, with a localized, segmented or widespread distribution.<sup>1-2</sup> It affects 1–2% of the population, with no apparent correlation to age, gender or ethnicity.<sup>3-4</sup> All areas of the body's surface can be affected, however the face, neck, axillae, back of the hands, fingers, the inguinal region, the anterior and lateral regions of the legs and malleolar regions are most commonly affected.<sup>5</sup>

The pathogenesis of vitiligo is still unknown.<sup>6</sup> Autoimmune, cytotoxic and neural mechanisms have been investigated, however the exact physiopathology of the mechanism that causes the destruction of melanocytes is not clearly understood.<sup>7</sup> There are descriptions in the literature of associations with other autoimmune diseases such as thyroid disorders, Addison's disease, *Diabetes mellitus*, *Alopecia areata*, and pernicious anemia.<sup>8-9-10</sup>

Vitiligo's natural course is variable, however most of the time it progresses slowly. In 10–20% of cases spontaneous repigmentation, which is rarely complete, takes place. Vitiligo lesions are asymptomatic, but can be disfiguring, above all on darker skin, and entail significant psychological morbidity and negative effects on quality of life.<sup>1-5</sup>

Several therapeutic approaches have been described for vitiligo, however they require long treatment courses and often lead to disappointing results.<sup>11</sup> The most common therapeutic options include corticosteroids; topical immunomodulators; topical and systemic psoralens that can be associated with sun radiation or artificial UVA (PUVA) and broadband and narrowband ultraviolet B radiation (UVB)-based phototherapy; and excimer or monochromatic light. Surgical options include autologous mini-grafts with punch, suction blister epidermal grafts, and epidermal cell transplants.<sup>9</sup>

A meta-analysis carried out in 1998 showed that the use of class 3 and 4 corticoids resulted in greater than 75% repigmentation in 56% of patients with segmental vitiligo, and in 55% of those with widespread vitiligo. Other studies have shown that class 3 corticoids constitute the most effective and safe treatment for segmental vitiligo.<sup>12</sup> The introduction of topical immunomodulators meant the possibility of a more appropriate treatment for several cutaneous disorders, including vitiligo. Many studies demonstrated an efficacy similar to that of topical corticosteroids, however without their adverse effects, such as atrophy.<sup>13-14</sup>

Phototherapy aims to promote the activation and migration of melanocytes located in hair follicles to the depigmented basal layer of the skin, and to induce the apoptosis of cytotoxic T cells, which are responsible for the destruction of the melanocytes.<sup>7</sup> Repigmentation success rates of 50–60% have been observed after months or years of PUVA treatment,<sup>15</sup> in addition to many adverse effects, such as phototoxicity reactions, nausea, vomiting, cataracts and the risk of developing several skin cancers, such as epidermoid carcinoma and melanoma.<sup>8</sup>

Studies have demonstrated that narrowband UVB-based

(NBUVB) phototherapy is as effective as topical PUVA, nevertheless producing fewer adverse effects in addition to a smaller accumulated UVB dose. However, both modalities require regular phototherapy sessions (several times per week), and treatment takes up to a year to reach the appropriate therapeutic response.<sup>11</sup> Although the treatments described above can produce good results, a quicker, straightforward and effective therapy was thought to be necessary.

More recently, the 308 nm Excimer laser has proven to be effective in the treatment of localized vitiligo.<sup>16</sup> Evidence suggests that laser therapy can trigger follicular repigmentation after a few weeks of treatment and produce cosmetically satisfactory results. Comparative studies have shown that Excimer laser presents biological and clinical effects that are similar – and often superior – to those of NBUVB phototherapy.<sup>8</sup>

Phototherapy devices, such as Excimer laser, allow high intensity radiation to be applied only to the affected skin, protecting the healthy skin from UV damage. This selectivity limits the hyperpigmentation of the skin adjacent to the lesion, a side effect that is commonly observed with other types of phototherapy. Furthermore, the Excimer laser equipment has an articulated arm that makes it easier to reach difficult areas such as skin folds and mucous membranes.<sup>17</sup>

Studies have shown that lesions in UV-sensitive areas (face, neck, back, trunk and arms) respond better to Excimer laser treatment than those located in UV-resistant areas (knees, elbows, wrists, hands, ankles and feet).<sup>18-19</sup> All UV-sensitive areas present similar results when treated with laser therapy, while among UV-resistant areas, knees, elbows and wrists respond significantly better than hands, ankles and feet.<sup>18</sup>

This study investigated the efficacy – degree of repigmentation and patient satisfaction – of Excimer laser treatment of vitiligo lesions in different parts of the body.

## METHODS

### Studied population

The study population comprised patients treated at a private practice located in the city of São José do Rio Preto, State of São Paulo, Brazil, between 2007 and 2010. This retrospective study was presented and approved by the Faculdade de Medicina de São José do Rio Preto research ethics committee. Patients (n = 123, 47 men and 76 women) between 4 and 76 years old (average age 32) were included in the study. Study participants presented lesions in different parts of the body (face, trunk, arms, elbows, back of the hands/fingers, legs, genitalia, knees and soles of the feet).

Before starting the therapy, the patients were clinically assessed to determine the type of vitiligo and the sites of the lesions. Patients with less than 30% of the surface area of the body affected were included. Patients who had been treated with topical or systemic immunosuppressants or had undergone phototherapy in the previous six months were excluded. Patients who were pregnant or had a history of skin cancer or photosensitivity were also excluded.

### Source of Light, Application and Dosage

The treatment of the vitiligo lesions was carried out with collimated Excimer laser radiation, which beams 308 nm wavelength monochromatic light, generated by xenon-chloride gasses (Xtrac, Photomedex, Carlsbad, CA, USA). The laser beam was transmitted using an articulated arm with a spot diameter of 4-30 mm. The UV radiation was conveyed by a flexible fiber optics cable, and was transmitted to the hand piece that beamed it in a circular shape with an area of 1-10 cm<sup>2</sup>. The laser used energy pulses of 3 mJ/cm<sup>2</sup>, with a 30 ns duration and frequency below 200 Hz. The sessions were carried out twice a week, with at least 72 hours between sessions.

All patients were exposed to the radiation through progressively increasing energy levels according to the skin's degree of tolerance to the irradiation, aiming at reaching or exceeding a 60% rate of repigmentation. The initial irradiation doses were determined by skin type. The average initial dose used was 100 mJ, with subsequent increments determined as follows: (i) a 100 mJ/cm<sup>2</sup> increment if no erythema occurred after the initial treatment and (ii) a 50 mJ/cm<sup>2</sup> increment if erythema occurred but lasted less than 24 hours. The initial dosage was maintained if the erythema lasted 24 hours or longer. In cases of serious erythema, pain, burning sensation or presence of blisters, the treatment was suspended until the situation was resolved, and the dose was reduced to the last well-tolerated level.

The irradiation dose for each treatment ranged from 100-2,800 mJ/cm<sup>2</sup>, with a minimum of 8 and a maximum of 110 sessions (average of 23 sessions). During the treatment, the patients' eyes were covered with UV protection glasses.

### Response to the Treatment and Degree of Satisfaction

The variables representing the clinical examination, as well as the photographic records and the patients' satisfaction with the treatment, all registered in the medical records, provided the data for this study. The analysis of the treatment response was carried out by comparing clinical and photographic records obtained by two independent evaluators, before and after treatment. That process yielded a rate, which was evaluated quantitatively according to the percentage of repigmentation achieved in the treated area and scored by each examiner according to the

following classification: 1 = 0% (poor), 2 = 1-19% (very bad), 3 = 20-39% (bad), 4 = 40-59% (average), 5 = 60-79% (good), 6 = 80-99% (very good) and 7 = 100% (excellent). Patients who presented no repigmentation were defined as non-responsive.

The degree of erythema and patient satisfaction were assessed qualitatively. Erythema was classified according to the following scale: 1 = absent, 2 = mild, 3 = moderate and 4 = serious. Patient satisfaction was assessed using a 3-point scale: 1 = bad, 2 = good or 3 = excellent.

### RESULTS

In order to evaluate the therapeutic effects of the Excimer laser, all 123 patients' vitiligo patches were considered. Ninety-four patients (59 women, average age 33, range 4-76 years old) presented the generalized type of vitiligo while 29 patients (17 women, average age 26, range 4-62 years old) presented the localized type of vitiligo. Seventy-seven patients (62.60%) presented lesions with more than 60% repigmentation (Figure 1). The average number of sessions needed to achieve this target was 23. Among these patients, 25 (20.33%) presented total repigmentation of their macules after an average of 20 sessions (Figure 2).

Twenty-six patients (21.14%) presented repigmentation of 40-59%, with an average of 23 sessions. Thirteen patients (10.57%) presented repigmentation of 20-39% and 7 (5.69%) presented a repigmentation rate below 19%. Lesions on the face responded better to the treatment than those located on other parts of the body. Eighty-nine of the 105 patients (84.76%) with achromic patches on the face presented repigmentation rates above 60%. Ten of the individuals with facial lesions (9.52%) presented repigmentation rates of 40-59%. Only 6 (5.71%) patients presented rates below 39%.

This study showed that although patches located on the arms responded well to the treatment, those located on the face had a better response. Ten of the 20 patients (50%) with lesions on the arms presented repigmentation above 60%. Four of the 20 patients (20%) presented a repigmentation rate of 40-59%. Lesions on the trunk showed a favorable response, however not as much as those on the face and arms. Eighteen of 38 patients (47.37%) with patches on the trunk presented repigmentation

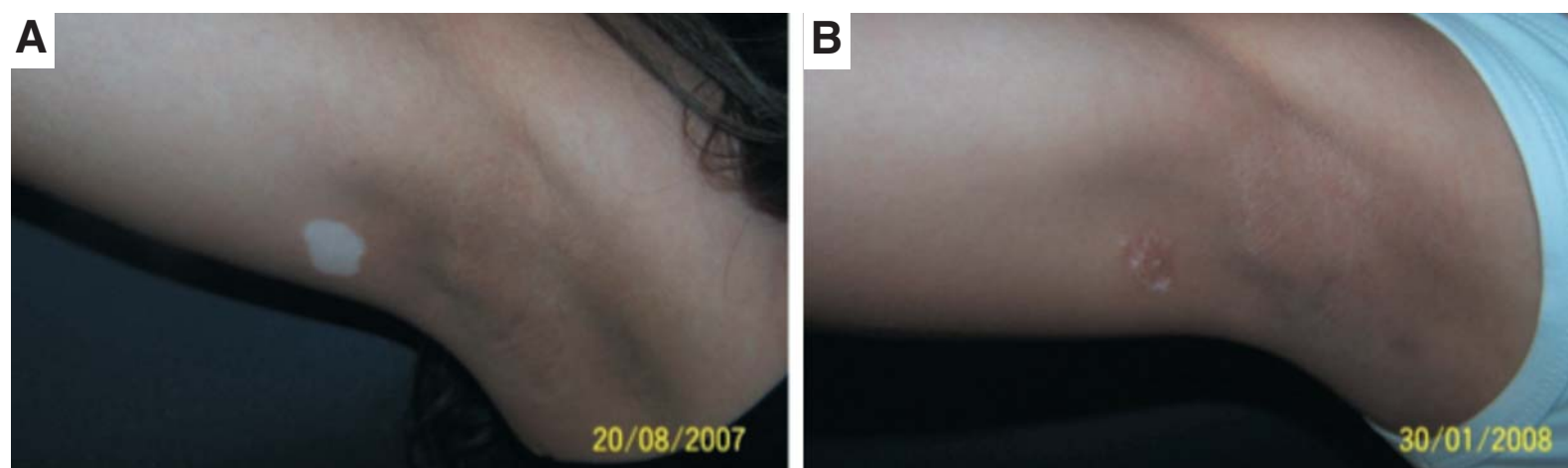


Figure 1 - Repigmentation of vitiligo lesion in 5 months



Figure 2 - Repigmentation of vitiligo lesion after 20 sessions

above 60%; 8 in 38 (21.05%) repigmented from 40-59%. Results at levels above 60% were obtained in 9 of the 22 lesions (40.91%) located on the genitalia, in 5 of the 11 lesions (45.45%) located in the legs and in 7 of the 18 lesions (38.89%) located on the knees. Lesions located on the extremities and elbows were less responsive to treatment.

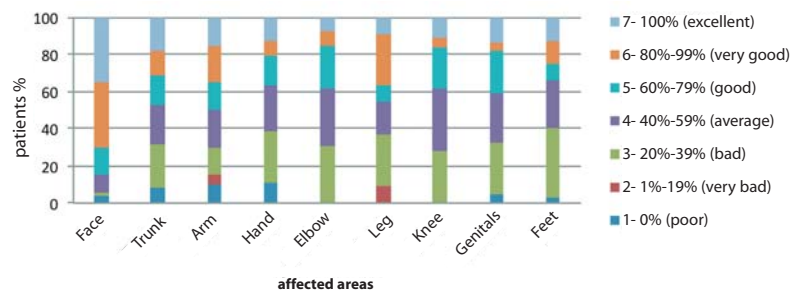
Of the 32 patients with hypochromic patches on the feet, 12 (37.5%) presented repigmentation of 20-39% and 1 (3.13%) did not repigment. Of the 62 patients with lesions on the hands, 17 (27.42%) also presented repigmentation rates of 20-39% and 7 (11.29%) did not repigment. Four of the 13 patients (30.76%) with patches on the elbows presented repigmentation rates of 20-39%, while 4 presented repigmentation rates of 40-50%. Of the patients with lesions on the hands, 24 (38.71%) presented repigmentation greater than 60%; 11 with lesions on the feet (34.38%) and 5 with lesions on the elbows (38.46%) also presented rates greater than 60% (Table 1, Graphs 1 and 2).

According to the Fitzpatrick classification, the study patients had phototypes between II and IV. Of the 77 patients who experienced repigmentation greater than 60%, 13 (16.88%) were phototype II, 37 (48.05%) were phototype III and 27 (35.06%) were phototype IV. The majority of the 26 patients who presented repigmentation rates of 40-59% were phototypes III (53.85%) and IV (38.46%) (Graph 3).

The treatment presented minimal side effects, including mild (2 events in 17 of the 123 patients) and moderate (1 event in 4 patients) erythema. Serious side effects were not observed (Graph 4).

Table 1 - Number of lesions and rates of repigmentation								
Affected areas	Repigmentation scale*							Total
	1	2	3	4	5	6	7	
Face	4	0	2	10	15	37	37	105
Trunk	3	0	9	8	6	5	7	38
Arm	2	1	3	4	3	4	3	20
Hand	7	0	17	15	10	5	8	62
Elbow	0	0	4	4	3	1	1	13
Leg	0	1	3	2	1	3	1	11
Knee	0	0	5	6	4	1	2	18
Genital	1	0	6	6	5	1	3	22
Feet	1	0	12	8	3	4	4	32

\*1 = 0% (poor), 2 = 1-19% (very bad), 3 = 20-39% (bad), 4 = 40-59% (average), 5 = 60-79% (good), 6 = 80-99% (very good) and 7 = 100% (excellent)



Graph 1 - Comparison of the repigmentation rates (%) of affected areas

At the end of the treatment, all patients were asked about the results of the therapy. Given a choice between excellent, good and bad, 88 patients (71.54%) classified the treatment as excellent, 29 (23.58%) as good and only 6 (4.88%) as bad (Graph 5).

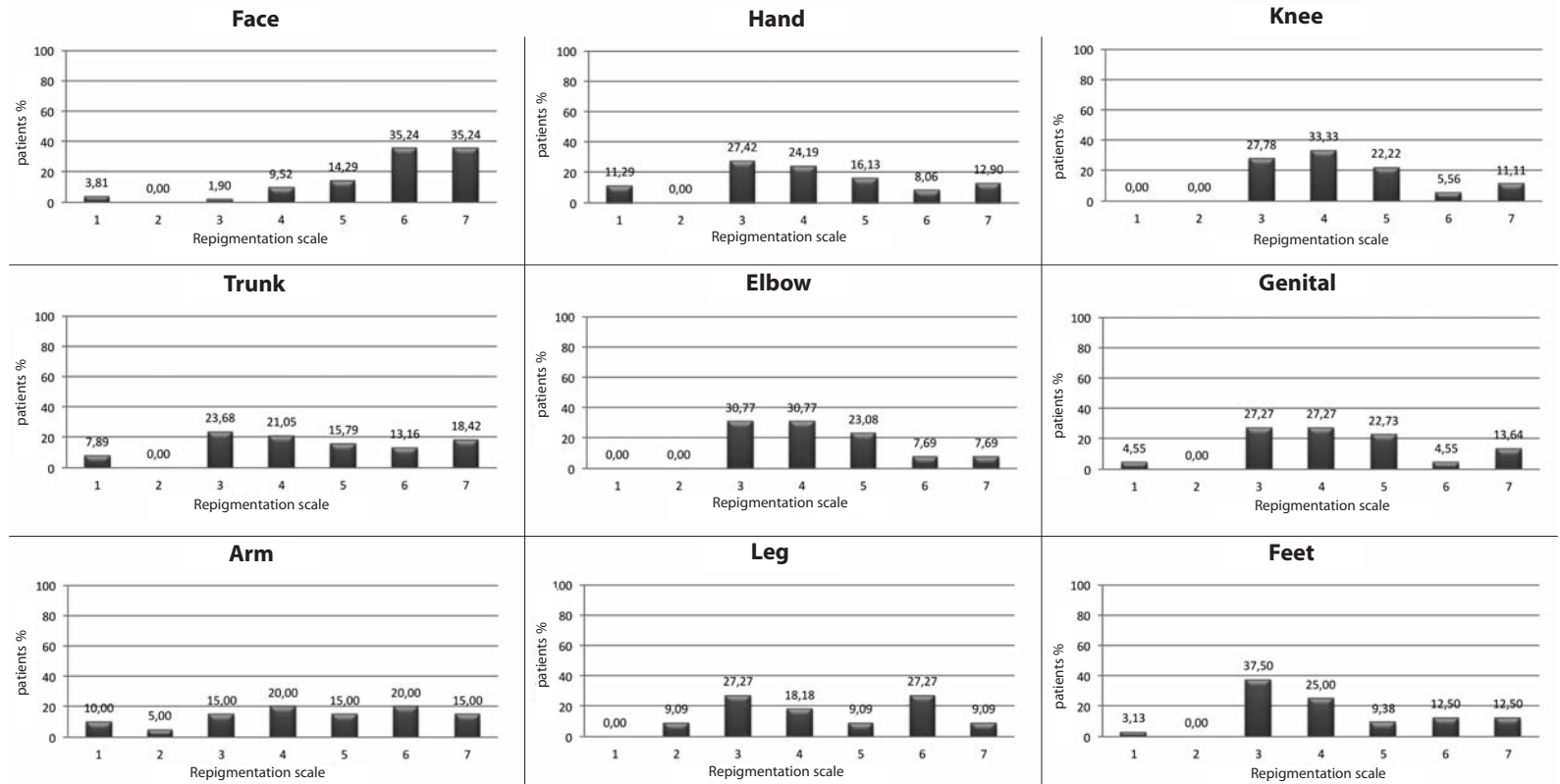
## DISCUSSION

Most currently available therapies for treating vitiligo are not very effective or present significant adverse effects. Among non-surgical repigmentation methods, narrowband UV presented good results, followed by broadband UV, class 3 and 4 topical corticoids, and psoralen combined with long-wave UV radiation<sup>17-19</sup>.

Gastrointestinal side effects (nausea and vomiting) and phototoxicity are expected with the use of psoralen and long-wave UV radiation. In turn, skin atrophy, striae and telangiectasias are common adverse events in the prolonged use of corticoids. Narrowband UVB radiation has fewer side effects, however good results are only obtained with long-term treatment.<sup>15</sup>

The use of 308 nm Excimer laser – recently established for treating vitiligo – presented great efficacy, given that improvements were observed after only 10 sessions and repigmentation rates increased as the treatment progressed. Considering that in other UV treatment modalities initial repigmentation can rarely be expected to take place before the tenth week, the results obtained with the Excimer laser represent an advance in the treatment of vitiligo.<sup>17-19</sup>

The present study confirmed that the 308 nm monochromatic UVB radiation generated by the Excimer laser is effective in repigmenting patches of localized and generalized vitiligo in different areas of the body. Greater than 60% repigmentation rates were observed in 62.60% of the patients, with an average of 23 sessions or 11.5 weeks. Of those patients, 32.47% pre-



**Gráfico 2** - Repigmentation rates (%) by affected area

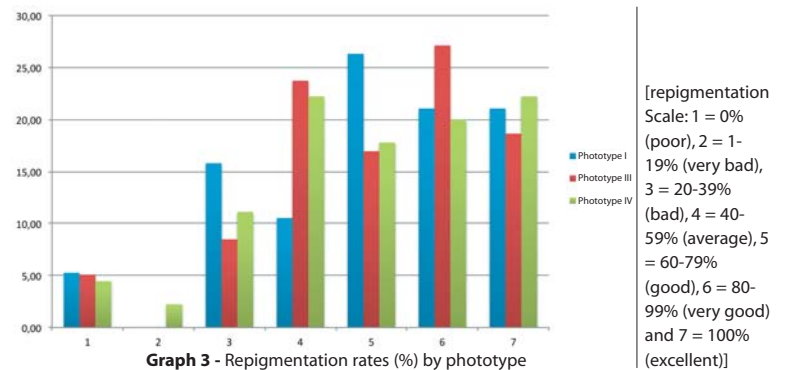
[repigmentation Scale: 1 = 0% (poor), 2 = 1-19% (very bad), 3 = 20-39% (bad), 4 = 40-59% (average), 5 = 60-79% (good), 6 = 80-99% (very good) and 7 = 100% (excellent)]

sented 100% repigmentation of their lesions after an average of 20 sessions. Among patients with total repigmentation, 11 were exposed to 10 or fewer sessions, meaning that a cure was achieved in less than 5 weeks.

In 1997, Westerhof and colleagues<sup>20</sup> observed that 67% of vitiligo patients obtained some degree of repigmentation after 4 months of treatment with 311 nm UVB. Those results corroborate previous studies, which show that Excimer laser treatment can lead to faster and more effective repigmentation than that obtained with 311 nm UVB.<sup>8-19</sup>

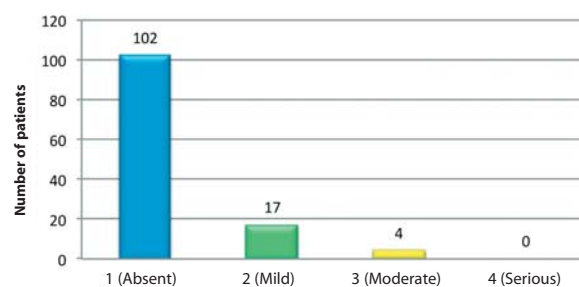
The Fitzpatrick phototype evaluation plays a key role in the patient's response to the treatment. Individuals with III-IV skin types were more tolerant to the irradiation doses and presented fewer adverse effects (such as burns and blisters) than those with fairer skin (type II). Greater repigmentation rates (above 60%) were achieved in phototype III and IV patients (83.12%). In the present study, the use of the Excimer laser was found to be well tolerated and caused minimal side effects, evidence of this new technique's safety level. In addition, this treatment modality can be considered less harmful than combined psoralen and long-wave UV radiation therapy or conventional UVB phototherapy regarding the aging affects on the skin and carcinogenesis. This is because healthy skin is not damaged by the laser.<sup>15</sup>

Although a number of studies show that the location of the lesions seems to play a crucial role in the clinical response to treatment, the main reason for this fact remains unclear. In body sites where the skin is thicker, such as elbows and knees, the

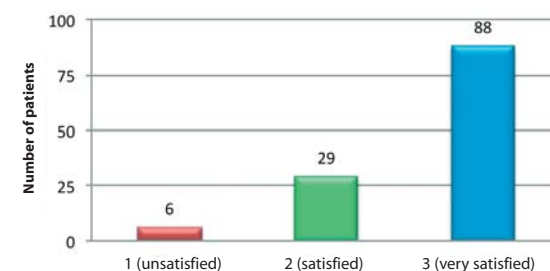


**Gráfico 3** - Repigmentation rates (%) by phototype

[repigmentation Scale: 1 = 0% (poor), 2 = 1-19% (very bad), 3 = 20-39% (bad), 4 = 40-59% (average), 5 = 60-79% (good), 6 = 80-99% (very good) and 7 = 100% (excellent)]



**Gráfico 4** - Side effects in patients who received treatment with Excimer laser according to degree of erythema [1 (absent), 2 (mild), 3 (moderate) and 4 (serious)]



**Gráfico 5** - Satisfaction degree of patients who received treatment with Excimer laser [1 (unsatisfied), 2 (satisfied), 3 (very satisfied)]

response is limited. The present research indicated that lesions on the face, trunk, arms, legs and genitalia (UV sensitive areas) presented a better response to treatment with Excimer laser than those located on the elbows, back of the hands, knees and soles of the feet (UV resistant areas). Nevertheless, repigmentation rates in the extremities were greater than those found in other recent studies.

Hofer and contributors (2006) 19 observed that lesions on the back of the hands and soles of the feet reached a repigmentation rate of less than 10%, on average, during the 10-week treatment interval. Al-Otaibi and others (2009) 8 did not find improvement greater than 25% in nine patients with lesions on their feet and observed that only 1 of the 11 patients with patches on their hands presented a repigmentation rate greater than 75%. This study demonstrated repigmentation greater than 60% in 24 patients with lesions on the hands (38.71%) and in 11 patients with lesions on the feet (34.38%). In 12.90% and 12.50% of patients with macules on the hands and feet, respectively, total repigmentation was observed.

The present study verified a direct correlation between a lack of treatment success and patient dissatisfaction in only 6 cases (4.88%). In general, patients were satisfied with the Excimer laser treatment. This finding is important in the case of vitiligo, because this condition can cause emotional alterations and compromise self-esteem and social relationships.<sup>10</sup> The results of this study confirm that Excimer laser-based phototherapy is an important tool in the treatment of vitiligo.

## CONCLUSION

In this study Excimer laser-generated 308 nm UVB radiation was found to be a promising option to treat vitiligo. Its use in vitiligo treatment was effective and safe, and produced a faster response than other modalities described in the literature.

The location of vitiligo patches on the body seems to have an important effect on treatment success. Lesions on the face presented the best results, while those on the elbows, hands and feet were less responsive. Nevertheless, the degree of repigmentation on the extremities (feet and hands) was greater than those found in other recent studies.

The tolerance to the treatment was helpful. Minimal side effects, such as erythema and rare blisters, appeared mainly in phototype II patients. The degree of satisfaction with Excimer laser treatment was significant. The rapid repigmentation after the start of the treatment led to cosmetically satisfactory results, with an improvement in the patients' quality of life and self-esteem. Based on the fact that it is difficult to treat – and that although it does not cause functional incapacity, it has a significant psychological/social/cultural impact – patient satisfaction is considerably relevant in the case of vitiligo. ●

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