

## **Epilation with alexandrite lasers – Is a low dose treatment feasible?**

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### **Introduction**

Epilation with light is a modern method to reduce hair growth that is considered as painless, permanent and rare of side effects especially in low doses. During the last years a great number of lasers was developed and promoted for epilation purposes. The efficacy of these devices was verified in few studies only (1, 2, 3, 4).

There are several alexandrite lasers that emit their energy in the form of so called burst pulses, that means, the light emission is not in the form of a continuous pulse, but consists of a sequence of pulses (subpulses). The parameters of these bursts differ considerably between the different lasers, that means the number of subpulses in a burst, the time delay between these subpulses and the pulse duration of these subpulses differ from device to device. Thus the energy transferred to the tissue shows a different temporal sequence as well. Therefore it is speculated that there might be differences in efficacy between the different types of lasers.

## **Materials and methods**

### **Hair counting method (TSM)**

Manual hair counts were obtained before the first and before each further treatment by using the transparent sheet method (TSM) as follows. First areas in symmetric body parts with a similar density of hair were identified and related to the rest of the body by more than 3 anatomic marks (as nevi, scars, nose, eyebrows, lips, bones). Hair in these areas was shaved down to a length of 1 mm by a long hair shaver (Braun exact 6 universal) and rectangular treatment areas marked on a transparent sheet placed over the entire area under consideration. The hair counts were performed in areas with at least 6,25 cm<sup>2</sup> or larger. The sheet served again as the pattern for further hair counts (figure 1).

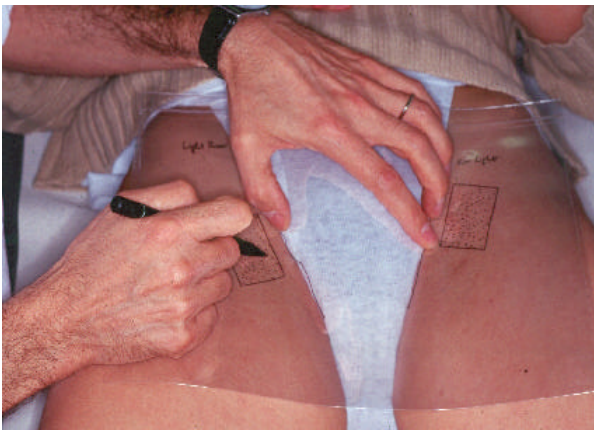


Figure 1:  
Manual haircounts using a transparent sheet for documentation

## Epilation treatment

Patients were treated in 4 or 8 weekly intervals. The subsequent treatment was planned according to the individual regrowth rate. Hair was shaved with disposable one way shavers before every laser treatment after having counted the hairs in those defined areas that were marked with white skin protecting pens, to guarantee an exact treatment in these rectangles. Ultrasonic gel and cold air were used to cool the skin and avoid side effects. Cold packs and cold air were applied in case of more severe side effects caused by heat as confluent perifollicular edema or heavy erythema.

In this study we compared 2 different alexandrite lasers regarding their efficacy at fluences in the range of 5-20 J/cm<sup>2</sup>. This therapeutic modality is more comfortable for patients as pain is reduced because of the low fluence used. The treatment time is reduced as well. The alexandrite lasers used were EpiXan XL™ by Carl Baasel Lasertech GmbH (figure 2), and EpiLase™ by ESC Sharplan GmbH.



Figure 2:  
Treatment of a test area with an alexandrite laser with scanner (9 mm spotsize)

## Volunteers

Volunteers were women and men with unwanted hair growth (hypertrichosis). Patients that suffered from hormonal disorders and related hirsutism were excluded from this study. All patients were informed exactly about risks, possible side effects and problems of this special treatment (changes in pigmentation of the skin, cicatrices, insufficient succes of the treatment, regrowth of hair and complete hairloss).

## Statistics

For statistic evaluation non parametric tests were used. The Friedman test was done if more parameters were compared. If it was significant the Wilcoxon rank test or Student t-test were applied to get more defined statistics. To manage data Microsoft Excel, to calculate statistics SPSS was used.

## Results

### Dosimetry investigation for low dose treatment

Are low energy densities effective for epilation? A dosimetry investigation gives a preliminary answer. For the treatment the alexandritelaser EpiXan XL™ manufactured by Baasel Lasertechnik was used. 13 volunteers (6 female, 7 male, average age 30.4 years) were treated in 4 areas with energy densities of 5, 10, 15 and 20 J/cm<sup>2</sup> respectively using a total pulse length of 7 ms. Figure 3 shows the results after 3 consecutive treatments.

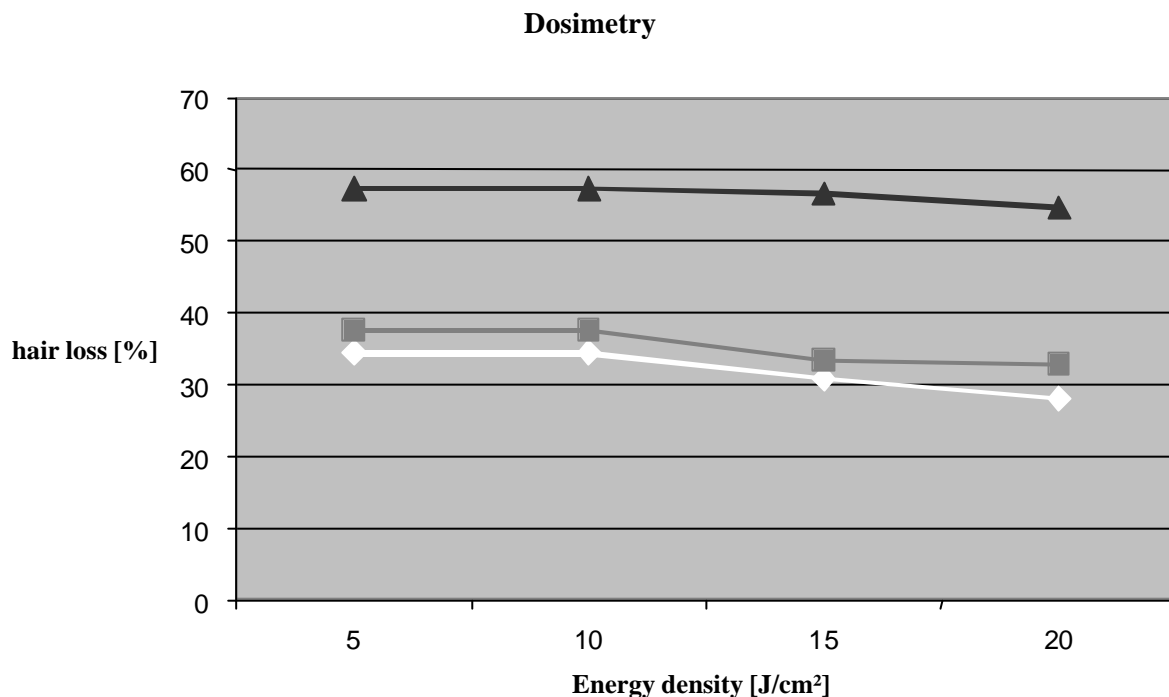


Figure 3:  
Hair loss (%) after three treatments with an alexandrite laser with 4 different energy densities (5, 10, 15, 20 J/cm<sup>2</sup>; diamond: 1<sup>st</sup> treatment; square: 2<sup>nd</sup> treatment; triangle: 3<sup>rd</sup> treatment)

Statistical calculation did not show significant differences between the three treatments and investigated energy densities (table 1).

Treatment	P (Friedman-test)	N
1 <sup>st</sup> treatment	0.144	13
2 <sup>nd</sup> treatment	0.022	10
3 <sup>rd</sup> treatment	0.287	4

Table 1: Statistics of the dosimetry investigation for low dose epilation with Alexandrite lasers

These data suggest a sufficient hair reduction being achieved with low energy doses. With an energy density of 5 J/cm<sup>2</sup> a hair reduction of over 50% could be reached within 3 treatments. In the mean time preliminary data of a 6 months follow up support the successful epilation with low dose alexandrite laser treatment showing only little regrowths.

*Is there a difference between alexandrite lasers in this range of energy densities? To answer this question the following investigation was performed.*

### **Comparison of two alexandrite lasers (EpiLase<sup>®</sup>, ESC Sharplan GmbH, EpiXan XL<sup>®</sup>, BAASEL Lasertechnik GmbH) at an energy density of 10 J/cm<sup>2</sup>**

The lasers mentioned were compared at an energy density of 10 J/cm<sup>2</sup> to see if low dose epilation works on different laser systems. The volunteers were recruited of two groups of patients (not paired groups). 12 volunteers (8 female, 4 male, mean age 29,8 years) were treated with EpiXan XL<sup>™</sup> by BAASEL Lasertechnik GmbH, 9 (5 female, 4 male, mean age 32,4 years) with EpiLase<sup>™</sup> by ESC Sharplan GmbH.

A more effective epilation is reached when treating with the alexandrite laser EpiXan XL<sup>™</sup> (see figure 4).

Figure 4:

Efficacy of hair removal by two alexandrite lasers: EpiXan XL<sup>™</sup> compared to EpiLase<sup>™</sup> at a low fluence of 10 J/cm<sup>2</sup> and a pulse duration of 7 ms

Number of treatment	p-value (T-test)	N of volunteers	
		EpiLase <sup>™</sup>	EpiXan XL <sup>™</sup>
1 <sup>st</sup> treatment	0.078	9	12
2 <sup>nd</sup> treatment	0.001	9	9
3 <sup>rd</sup> treatment	0.206	8	5

Table 2:

Statistics of the comparison study of EpiXan XL<sup>™</sup> and EpiLase<sup>™</sup> at a low fluence of 10 J/cm<sup>2</sup>.

### **Follow up investigation concerning the comparison of two alexandrite lasers(EpiLase<sup>®</sup>, ESC Sharplan GmbH, EpiXan XL<sup>®</sup>,Carl BAASEL Lasertechnik GmbH) at an energy density of 10 J/cm<sup>2</sup> and a pulse duration of 7 ms.**

Three volunteers (1 female, 2 male, average age 30.4 years) were seen three months after the last treatment to performe an additional hair count. The average number of treatments was 6.3 (5-8). Patients were treated as described below.

follow up EpiXan XL-EpiLase 10 J/cm<sup>2</sup>

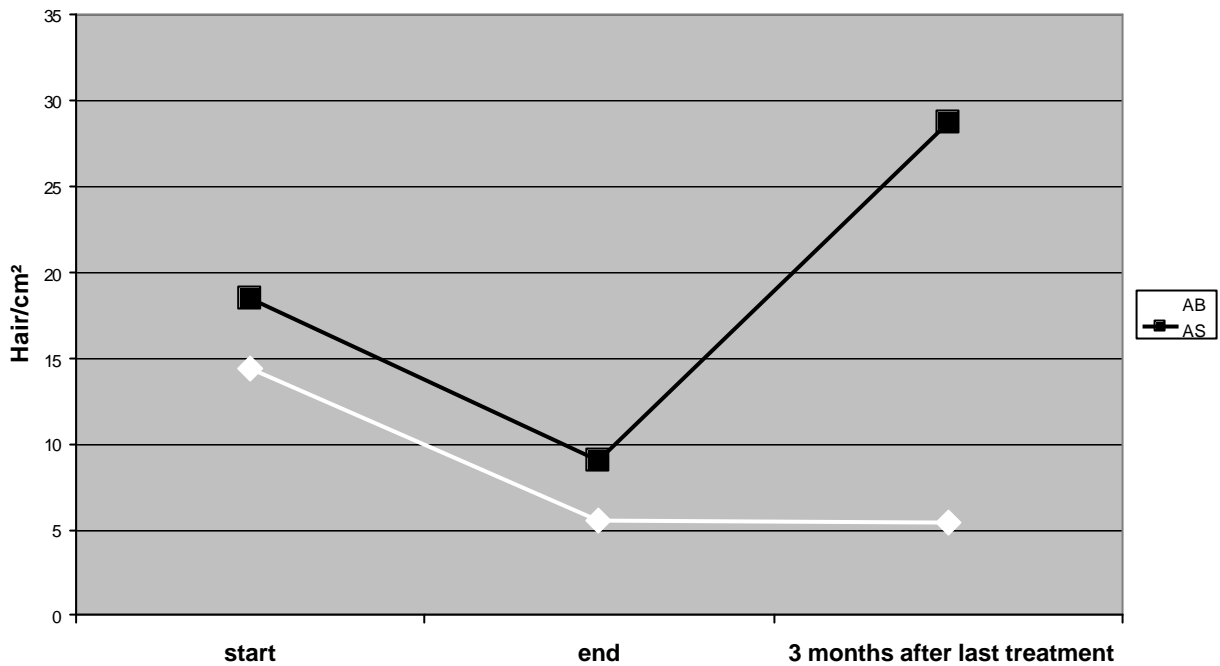


Figure 5:

Three months follow up comparing the efficacy of two alexandrite lasers: EpiXan XL™ compared to EpiLase™ at a low fluence of 10 J/cm<sup>2</sup> and a pulse duration of 7 ms

A stable hair reduction of about 67% could be reached with EpiXan XL™ and lasted up for three months. A similar result at the end of the treatment was observed after a mean value of 6.3 treatments with EpiLase™, but a much more pronounced regrowth was to be seen. The cause of this observation is not yet clear. Certainly the small number of volunteers is one reason. The other could be a significant difference between the two lasers.

Figure 6a and 6b shows the differences in pulses of the two alexandrite lasers used. Both lasers emit burst pulses. On the left side a laser pulse lasting 40 ms overall at an energy density of 20 J/cm<sup>2</sup> of the EpiLase™ is shown. During this time there are evenly distributed 4 subpulses that last between 0.6 and 0.8 ms with a delay time between these subpulses of between 12 and 13 ms. In contrast to this there are as well 4 subpulses, but of a longer duration of 1.5 - 2 ms each for the EpiXan XL™. The delay time of 14 ms between these subpulses has been arranged to match with the delay time of the EpiLase™. This difference in the heating process of hair could be an explanation observed especially when using low doses.

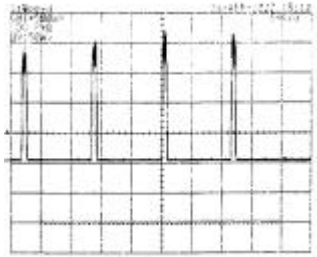


Figure 6a:  
EpiLase™ ESC Sharplan GmbH  
(pulse duration 40 ms,  
energy density 20 J/cm<sup>2</sup>)

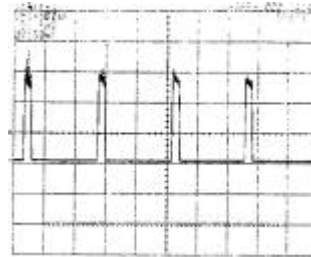


Figure 6b:  
EpiXan XL™ Baasel Lasertech GmbH  
(pulse duration 40 ms,  
energy density 20 J/cm<sup>2</sup>)

## Discussion

Unwanted hair growth is a cosmetic problem not only for women. Electroepilation was considered for a long time to be the only possibility to eliminate hair permanently (1). This method is quite time consuming and is not very comfortable for patients (2). Therefore selective photothermolysis of hair follicles (3) is a new and innovative method for permanent epilation by destruction of germinative epithelium.

### General discussion of methods

A comparison of different laser systems for epilation can reasonably be conducted after several treatments (3 to 4 repeats) only. Every treatment reduces hair growth permanently by about 30%. Therefore first differences in efficacy can be noticed from the 2<sup>nd</sup> treatment onwards. Until then there are many irregularities in between the methods.

To stabilize the epilation level achieved and to get satisfying results several treatments (4-8) are necessary. After this period a long term observation could be planned. Up today this study can only give preliminary information about permanent effects of different laser systems.

The compliance of volunteers is a difficulty as many patients are satisfied with the cosmetic result and do not follow further appointments. In this period of treatment repeats and long term observation many volunteers do not attend the treatments any more.

Reason for this behaviour is a different view of epilation results. Quality of treatment not only should be measured by objective methods (hair counts), but also by opinion and satisfaction of patients. Three to four treatments let hair become thinner and brighter. Many patients are satisfied by this change in hair colour and texture as hair gets invisible. Objective results are worse as blond and thin hairs are counted as well. This subjective component of efficacy can not easily be verified by scientific methods.

### Discussion of results

#### Burst pulses

While other investigators didn't find differences in response between a 2 ms and a 10ms alexandrite laser (5) we got differences even when applying the same pulsewidth of different alexandrite lasers. This comparison study of different alexandrite lasers is limited to lasers with so called burst pulses. Burst pulse means that the pulses are emitted in a sequence of subpulses. Measurement of a 40 ms pulse shows the following: both pulses consist of 4 subpulses. The duration of a single pulse of the EpiXan XL™ is 1.5 - 2 ms, of the EpiLase™ between 0.6 and 0.8 ms. The integral energy of all emitted subpulses is 20 J/cm<sup>2</sup> (see figure 4). The EpiLase™ shows a shorter pulse duration of the subpulses than the EpiXan. The delay time between the subpulses (T OFF-time) for the bursts shown has been made identical for EpiLase™ and EpiXan XL™ so the differences in efficacy noted have to be attributed to the differences in the duration of the subpulses.

Using the standard programs both lasers show additional differences in that respect showing generally much shorter delay times between the subpulses for the EpiXan™ than for the EpiLase™.

So in conclusion the pulse length shown on displays does not give a precise information about effective pulse lengths supplied by a laser emitting burst pulses. These different timing parameters could cause different heating effects to hair follicles and therefore be important for efficacy of the treatment.

### **Low dose dosimetry**

Application of low energies deals with patients' comfort mostly. Treatment with low doses is less painful and has a lower risk of side effects. The dosimetry study with the alexandrite laser of Carl Baasel Lasertech GmbH<sup>TM</sup> showed efficacy in epilation at low energy densities when using the short pulse duration of 7 ms. At higher energy densities of 20 J/cm<sup>2</sup> there is no such a pronounced difference between the Alexandrite lasers, but at lower energy density a significant difference could be observed. The three months follow up did also show differences. Apart from that a greater number of patients is necessary to have statistically supported results.

In the comparison and follow up of the low dose (10 J/cm<sup>2</sup>) epilation study one group of volunteers showed even a higher counting rate compared to the counts taken before the treatments with alexandrite lasers. The reason for that could be a stimulation of the hair roots by subthermolytic pulses. Other reasons could be the omission of depressing influences on the hair regrowth capacity. In some cases for instance we had seen a suppression of the hair growth due to pre-treatment. Plucking slows down the regrowth speed. As all patients are asked not to pluck hairs while the laser epilation study is performed, this cease of plucking also may cause higher hair counts in subsequent examinations.

### **Summary**

Sufficient epilation results can be reached even at low energy doses (-10 J/cm<sup>2</sup>). At this energy density there are differences between the two investigated lasers: EpiLase<sup>TM</sup> (ESC Sharplan GmbH) and EpiXan XL<sup>TM</sup> (Carl Baasel Lasertech GmbH<sup>TM</sup>). Even in preliminary long term results these differences remain: whereas with the EpiXan no regrowth appeared in the first 3 months follow up, the hairs treated with EpiLase grew back towards normal or even more.

*Literature:*

- (1) Nanni CA, Alster TS Lasers Surg Med 1999, 24(5):332-7 → Long-pulsed alexandrite laser-assisted hair removal at 5, 10 and 20 milliseconds pulse durations*
- (2) Nanni CA, Alster TA Dermatol Surg 1998 Dec; 24 (12): 1399-405; discussion 1405 → A practical review of laser-assisted hair removal using the Q-switched Nd:YAG, long pulsed alexandrite lasers*
- (3) Dierickx C, Alora MB, Dover JS Dermatol Clin 1999 Apr; 17(2): 357-66 → A clinical overview of hair removal using lasers and light sources*
- (4) Lloyd JR, Mirkov M Dermatol Surg 2000; 26:633-637 → Long-Term Evaluation of the Long-Pulsed Alexandrite for the Removal of Bikini Hair at Shortened Treatment Intervals*
- (5) Goldberg DJ, Ahkami R Lasers Surg Med 1999; 25 (3): 223-8 Evaluation comparing multiple treatments with a 2-msec and 10-msec alexandrite laser for hair removal*

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