

## The Effectiveness of Diode Laser 805 nm Hair Removal in Groups of Various Ethnicity

Izabela Zaleska<sup>1\*</sup> and Magdalena Atta-Motte<sup>2</sup>

<sup>1</sup>The Section of Professional Cosmetology, The Faculty of Motor Rehabilitation, The University of Physical Education in Krakow, Poland.

<sup>2</sup>5th Avenue Medical Clinic, London, United Kingdom.

### \*Correspondence:

Izabela Zaleska, The Section of Professional Cosmetology, The Faculty of Motor Rehabilitation, The University of Physical Education in Krakow, Poland. E-mail: izaleska@icloud.com.

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### ABSTRACT

According to the scientific publications, laser hair removal is considered to be the most effective method of permanent hair reduction. So far, no effectiveness comparison of a different ethnicity groups in regards to pubic laser hair removal was made.

The aim of the study is to show the subjective and objective effectiveness and side effects of diode (805 nm) laser hair removal in pubic area in groups of various ethnicity. The study was conducted in UK and Poland on the group of 205, 20-40 years old patients qualified for the course of 6 treatments after the initial interview and patch test. Ethnicity was defined by questionnaire in accordance with Census 2001. 111 of 205 participants were divided into the 4 groups: White 29 participants: people with white skin, Black 22 participants: people with black skin, Asian 28 participants: people from Asia, Mix Raced 32 participants: people whose ancestors had both: White, Black or Asian skin.

Effectiveness was analysed in the area of 1 cm<sup>2</sup> of the treated skin as the percentage of hair reduction. Objective effectiveness analysis in groups: 92.5% for Asians, 81.5% for participants with Black skin, 86.9% for Mix raced participants and 88.2% for White skin participants was different to the subjective analysis: 88.9% for Asians, 78.0% for Black skin participants, 84.4% for Mixed Raced participants and 82.3% for White skin participants. Side effects were correlated with ethnicity ( $p = 0.001$ ). The highest percentage of complications occurred in the group of Black skin 81,82% and Mixed Raced 81.25% participants.

The best results in the studied area were observed objectively and subjectively in a group of Asian participants. The subjective assessment of the hair reduction effectiveness was significantly lower than the objective assessment of the percentage of hair reduction in each of the studied ethnic groups.

### Keywords

Diode laser, Effectiveness, Ethnicity, Pubic hair removal.

### Introduction

According to the definition of FDA (Food and Drug Administration) permanent hair reduction, it's a long-term reduction of the number of hairs growing back after a course of treatments. Amount of regrowth. Hair must be constant over a more extended period than the time it takes to complete a full cycle a hair that lasts 4 to 12 weeks depending on the area of the body [1].

To obtain permanent results, laser hair removal requires a series of

treatments for which the patient reports in specific time intervals. The literature indicates that amount of the standard procedures to be considered effective should be determined at a minimum of 6, and the obtained treatment effects made laser hair removal the most popular method around the world [2-11].

The unwanted body hair is regularly treated to be removed not only by women but more and more by men. Pubic hair removal is one of the most popular laser treatments for patients who take into account personal factors such as cultural [12]. So far no study was made with regards to the efficacy of pubic area hair removal in the multicultural aspect. The available scientific research is limited

in the field of to the phototype, gender, and the examined area. Similar limitations have been noted in the aspect of the ethnicity and genetics of respondents, which in fact not always correlate with the phototype determined in accordance with the Fitzpatrick scale [1,3,4,13-16].

Nowadays, pubic area hair removal has become a popular treatment offered by beauty salons, aesthetic and medical clinics [13,14]. As mentioned above, patients who decide to do pubic area hair removal more often choose the methods which give permanent results [8,12,17–19]. To achieve that, photo epilation treatment is introduced on the basis of selective thermolysis with the use of various lasers with a specified light wavelength: ruby (694 nm), alexandrite (755 nm), diode (805, 810 nm), Nd:YAG (1064 nm) and incoherent xenon light – IPL (Intense Pulse Light) with the wave range between 590 and 1200 nm, described in literature as permanent methods of hair reduction [2,3,6,7,14,18-30].

In addition to the specific wavelength of the laser, it is essential to choose the right fluence [ $J/cm^2$ ] and pulse duration [ms]. To achieve best results Phototypes I- III require a broader choice of density with a shorter length of the pulse, while the darker skin types- IV-VI phototypes need lower density and longer duration of the laser pulse [31].

In the described method the melanin found in hair stem and hair follicle bulge is the chromatophore. To gain permanent hair reduction, the reproductive follicle cells are destroyed alongside the hair itself. Melanin as a skin and hair pigment absorbs light in a wavelength between 350 to 1200 nm [32]. To achieve the purpose of laser hair removal based on the selective photo thermolysis principle should be in the wavelength range between 630 - 1200 nm. The photothermal effect observed in the hair follicle in addition to the therapeutic effect can cause undesirable changes in the surrounding skin structures [32,33].

Bearing in mind the above, energy, in the form of heat should go from the hair to the follicle where the reproductive cells can be found. Even though the thermal relaxation time (TRT) of the melanin, and the time required for the laser energy to diffuse, is concise, the simple destruction it would cause only hair fragmentation and quite quick regrowth. The method is therefore solely effective in anagen phase of hair growth [6,14,15].

As the melanin which is a skin pigment as well, competes with the one existing in hair, achieving a positive result and the treatment itself can be found to be difficult, especially in the body areas with increased pigmentation such as pubic areas [22-24]. Although the cooling is always carried out, laser hair removal treatment is often associated with the pain. After the procedure, the skin is irritated, the likelihood of redness occurrence, burns, and pigmented lesions are observed. The presence of purpura is also possible, same as follicle inflammation, marbled cyanosis, itchiness with no sign of urticaria [6,17,30,34-37]. Occurrence and severity of adverse effects and sensations during the treatment, affects the patient satisfaction level [24,30,34,35].

The researcher's comparison of the efficacy of using diode, alexandrite, and Nd: YAG laser has hitherto given similar results. In one of the studies, the treatment with Nd: YAG laser was assessed to be the least successful and significantly more painful. According to other reports, the effects are comparable as far as the above-mentioned photo epilation methods are concerned, and the diode laser itself is repeatedly considered not only effective but also safe [5,13,15,26,34].

The study aimed to examine the objective and subjective assessment of pubic laser hair removal effectiveness and its safety concerning the side effects occurrence and impact of the treatment parameters between the groups of participants with various ethnicity, including the level of patient's satisfaction.

### Method and Materials

Studies were carried out in Poland and UK between April 2015 and November 2017. All participants went through the interview before the patch test when informed and voluntary consent obtained.

During the initial consultation, according to the study protocol and to ensure the safety of the treatment skin type was assessed by practitioners using Fitzpatrick Scale Quiz according to manufactures guidelines.

Fitzpatrick scale is defined as a classification for human skin colour as a way to estimate the response of different types of skin to light exposure. The Fitzpatrick scale is a recognized tool for dermatological research into human skin pigmentation.

Type I always burns, never tans (pale white; blond or red hair; blue eyes; freckles).

Type II usually burns, tans minimally (white; fair; blond or red hair; blue, green, or hazel eyes).

Type III sometimes mild burn, tans uniformly (cream white; fair with any hair or eye color).

Type IV burns minimally, always tans well (moderate brown).

Type V very rarely burns, tans very easily (dark brown).

Type VI never burns, never tans (intensely pigmented dark brown to darkest brown).

To define ethnic origin, additionally to the medical questionnaire ethnicity questions were asked following Census 2001 scheme acknowledged in the UK. The examined group distinguished:

White: participants with white skin

Black: participants with black skin

Asian: participants who come from Asia

Mix Raced: White and Black African: participants whose ancestors were white and black who originally came from Africa. White and Black: participants whose ancestors had white and black skin which came from non-African countries. White and Asian:

participants whose ancestors had white skin and came from Asian countries.

The research material consisted of 205 participants undergoing

photothermolysis, among which there were 28 Asians, 22 Black, 32 mixed skins, and 123 White.

As a group of White qualified participants consists of 123 participants, to compare similar group's quantities a group of 29 White participants was chosen, including gender and Fitzpatrick scale characteristic of the whole group.

The analysis included 111 participants (Table 1) who have completed a course of six diode laser hair removal treatments, divided into four ethnic groups: Asians- 28, Black - 22, White - 29 participants and mixed 32 participants.

Ethnicity	n	Female	Male	p
Asian	28	26	2	p=0,102 NS
		92,86%	7,14%	
Black	22	19	3	
		86,36%	13,64%	
Mixed	32	24	8	
		75,00%	25,00%	
White	29	20	9	
		68,97%	31,03%	
Total	111	89	22	

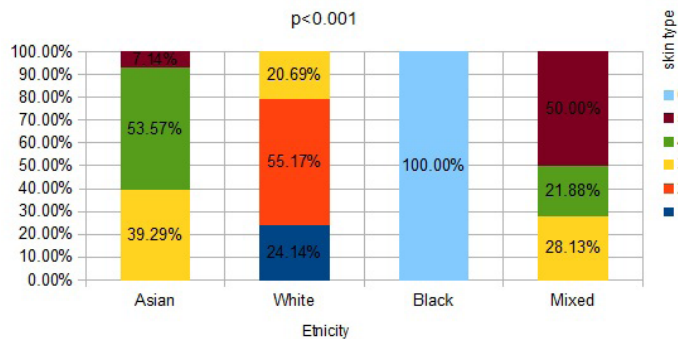
**Table 1:** Characteristic of the group of participants.

There was a statistically significant correlation between ethnicity of the study participants and their skin type determined by the Fitzpatrick scale (Table 2, Figure 1). Among four ethnic groups only Black skin participants group was mono- phototype, and consist of skin type VI according to Fitzpatrick scale.

Ethnicity	n	Fitzpatrick scale phototype						P
		1	2	3	4	5	6	
Asian	28	0	0	11	15	2	0	<0,001
		0,00%	0,00%	39,29%	53,57%	7,14%	0,00%	
Black	22	0	0	0	0	0	22	
		0,00%	0,00%	0,00%	0,00%	0,00%	100,00%	
Mixed	32	0	0	9	7	16	0	
		0,00%	0,00%	28,13%	21,88%	50,00%	0,00%	
White	29	7	16	6	0	0	0	
		24,14%	55,17%	20,69%	0,00%	0,00%	0,00%	

**Table 2:** Ethnicity and Fitzpatrick scale correlation.

**Figure 1.** Ethnicity and skin type correlation



The diode laser with the wavelength 805 nm, minimum peak power 2100 W and a pulse duration between 5 and 400 ms, ET handle 9x9 mm large and pulse energy density between 10 and 100 J/cm<sup>2</sup> was used for all treatments. The treatment parameters according to study protocol were adjusted to the skin phototype determined after the interview following Fitzpatrick scale, hair colour, hair thickness and skin reaction to Patch Test in accordance with manufacturer's guidance.

In hair removal, hair melanin is the chromophore and has greater optical absorption at the laser wavelength than surrounding tissue. During the pulse, absorption converts radiant energy into heat within the target, raising its temperature. The heat is initially confined to the target but will begin to conduct to the cooler surrounding tissue. Thus, higher fluence and pending pulse duration generally result in greater heating since more optical energy is delivered to the absorbing chromophore. Taking into account the fact that maximum tolerated fluence is inversely proportional to skin pigmentation for given pulse width. As the skin pigmentation increases, the fluence is usually decreased to reduce laser absorption and heating in the epidermis. Therefore, when treating darker skin, delivering the fluence over longer pulse duration can also minimize epidermal heating.

This research adhered to initial treatment parameters such as fluence (J/cm<sup>2</sup>) and pulse duration (ms) according to manufactures guidelines for different Skin Type, Hair Color, Hair Texture.

To achieve best results, during each treatment fluence and pulse width were adjusted to the individual participants' skin reaction. Initial settings and final settings of pulse duration (ms) and fluence (J/cm<sup>2</sup>) were documented for purposes of this study.

During the initial consultation, practitioners had explained the realistic expected outcome of the course of six treatments and participants agreed to indicate the exact estimation of their hair loss percentage and express their satisfaction level in 5-grade scale six weeks after last treatment. Participants were familiarized with the definition of permanent hair reduction issued by the FDA and possible outcome of the treatment as a long-term, stable reduction in the number of hairs re-growing after the course of treatments. Participants were aware that hair reduction would last for four to twelve months and permanent hair reduction doesn't mean the elimination of all hairs in the treatment area. The reference point for very good result according to the definition was 80% of hair loss. Participants were aware of side effects and adverse effects possibility.

Before carrying out the treatment, the patients' skin was shaved and cleaned, and during the course of six treatments, the patients had not been using any other methods of hair removal and followed the therapist's pre- and post- indications. Before and after each treatment, with cooperation with participants side effects such as skin hyperpigmentation, skin redness, skin irritation, skin hypersensitivity, skin burns or adverse effects such as discomfort, damage to the natural skin texture, scarring, excessive swelling,

blisters, bruising when observed were documented.

The factors which contributed to exclusion from undergoing the treatment were all the objective, as described :

- Cancer diseases
- The use of hormonal drugs, photosensitizing drugs, antibiotic therapy,
- The use of cosmetics containing retinol, vitamins A, E, C, fruit acids,
- Intake of agents with herbal origin can be photosensitizing,
- suntan,
- Chemical or mechanic depilatory, or hair bleaching
- Irritated skin,
- Skin with the tendency to hypo and hyperpigmentation,
- Dermatitis of various etiology,
- Reticularis,
- Photodermatitis,
- Epilepsy,
- Pregnancy and breastfeeding.

All the respondents had six treatments planned with intervals of six weeks, in accordance with pubic area hair growth cycle. The duration of telogen phase in this pubic area is three months, 30% of hairs are in anagen phase of growth therefore authors adhered study protocol to the manufacturers guidance.

Subjective and objective percentage assessment of hair reduction was indicated.

In the objective method, reliable assessment of hair reduction was introduced by taking photographs with zoom x 20 in 1cm<sup>2</sup> area, 4cm lower from the middle distance between iliac spines. The number of hair was counted, and the assessment of its percentage reduction was introduced before the first treatment and six weeks after the last one was carried out. Simultaneously, six weeks after the completion of treatment cycle the patients were asked to share their opinion regarding the hair loss percentage and satisfactory level of the introduced therapy.

The respondents were to determine their satisfaction level according to the 5-grade scale where:

- 1 – meant “treatment has not met any of my expectations”
- 2 – meant “lack of satisfaction from the treatment effect”
- 3 – meant “moderate satisfaction”
- 4 – meant “satisfactory effect”
- 5 – meant “the treatment met all my expectations”

The STATISTICA 12 PL tool licensed by the Jagiellonian University of Krakow was used for statistics.

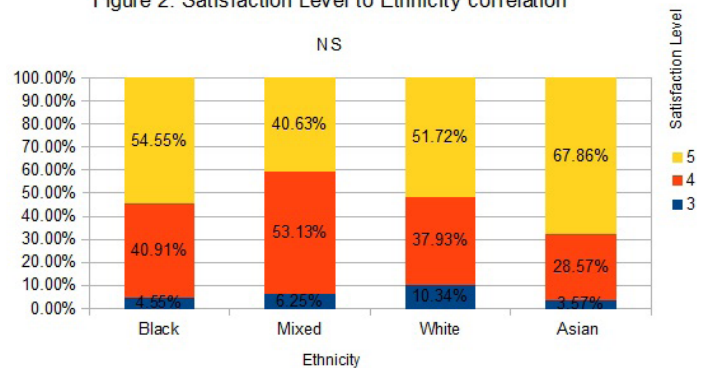
The Wilcoxon signed-rank test used for comparison of exposure parameters of first and sixth treatment and the hair loss percentage in the subjective and objective assessment according to the study methodology in the area of 1 cm<sup>2</sup>. Kruskal–Wallis one-way analysis of variance used for comparison of laser parameters and radiation results between ethnic groups. Spearman's rank correlation coefficient used for the results of exposure and selected

parameters of laser radiation analysis. Multivariate Modeling by Multiple Regression was also applied. In the obtained study model, the dependent variable was the hair loss percentage according to the study methodology in the area of 1 cm<sup>2</sup>, and the independent variables were the parameters of the 1st and 6th treatments and changes in the observed area of 1 cm<sup>2</sup> between 1st and 6th treatment. The results were statistically significant when significance level was less than or equal to 0.05. Lack of statistical significance was marked with the abbreviation NS (Statistically nonsignificant).

## Results

The level of subjective satisfaction from the treatment was assessed by the participants after the sixth treatment and was not significantly divergent in relation to ethnicity (Figure 2).

Figure 2. Satisfaction Level to Ethnicity correlation

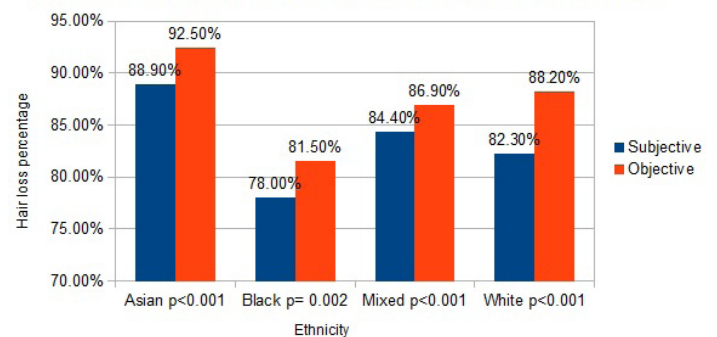


The subjective assessment of the efficiency of six treatments assessed by the respondents as a percentage of hair loss was not significantly correlated to ethnicity.

Objective assessment of hair loss percentage after six treatments according to the methodology in the area of 1 cm<sup>2</sup> was not significantly correlated with ethnicity.

The subjective assessment of percentage hair loss varied statistically significantly ( $p < 0.001$ ) and was lower than the objective evaluation (Table 3 and Figure 3).

Figure 3. Subjective and Objective assessment of hair loss percentage



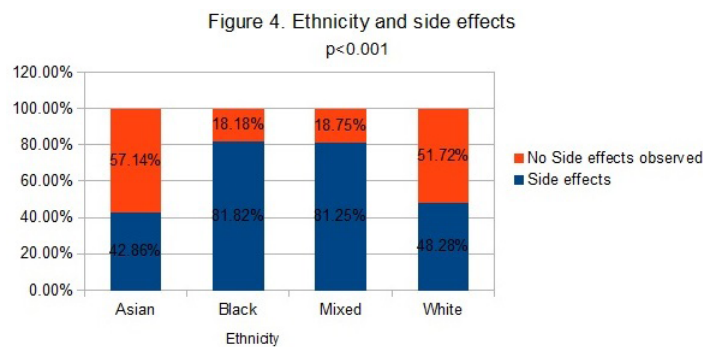
The occurrence of side effects depended on ethnicity ( $p = 0.001$ ) (Table 4, Figure 4). The smallest percentage of complications was observed in the group of Asian (42.86%) and White (48.28%). Adverse effects of the treatment such as discomfort, damage to the natural skin texture, scarring, excessive swelling, blisters, bruising were not observed.

Ethnicity	n	Objective assessment of hair loss percentage after 6 treatments according to metology in the area of 1 cm <sup>2</sup>					ANOVA	Subjective participants assessment of hair loss percentage					ANOVA	P
		mean	SD	Me	min	max		mean	SD	Me	min	max		
Asian	28	92.5	7.7	96	70	100	p=0.261 NS	88.9	8.4	92.5	60	95	p=0.844 NS	p<0.001
Black	22	81.5	9.0	79	70	98		78.0	10.6	79	60	90		p=0.002
Mixed	32	81.9	5.6	88	72	95		81.4	5.6	85	70	95		p<0.001
White	29	88.2	9.1	90	60	98		82.3	9.8	80	50	98		p<0.001

**Table 3:** Comparison of objective and subjective hair loss percentage assessment.

Ethnicity	n	Side effects	No Side effects observed	p
Asian	28	42,86%	57,14%	0,001
Black	22	81,82%	18,18%	
Mixed	32	81,25%	18,75%	
White	29	48,28%	51,72%	

**Table 4:** Ethnicity and side effects.



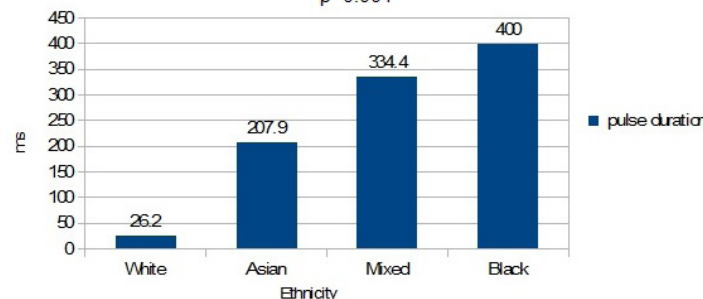
**Figure 4:** Ethnicity and side effects  
p<0.001

Pulse duration setting during first and 6th treatment was correlated to ethnicity (p<0,001) and was lowest in a group of White participants and the highest in Black participants (Table 5, Figure 5).

Ethnicity	Treatment	n	ms					ANOVA	
			mean	SD	Me	min	max		
Asian	1st	28	207,9	159,1	100	30	400	p<0,001	
Black		22	400,0	0,0	400	400	400		
Mixed		32	334,4	126,0	400	100	400		
White		29	26,2	16,0	30	10	100		
Asian	6th	28	202,9	163,7	100	30	400		p<0,001
Black		22	400,0	0,0	400	400	400		
Mixed		32	334,4	126,0	400	100	400		
White		29	27,2	15,2	30	14	100		

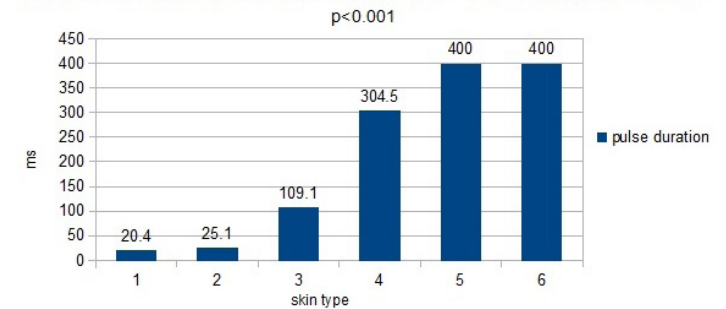
**Table 5:** Pulse duration (ms) according to ethnicity during 1st and 6th treatment.

**Figure 5:** Pulse duration (ms) according to ethnicity during 1st and 6th treatment  
p<0.001



As ethnicity correlates to skin type according to Fitzpatrick scale, pulse duration during 1st treatment was examined. Correlation between skin type and pulse duration was proved as statically important. Pulse duration increase as skin type increase (Figure 6).

**Figure 6:** Skin type and pulse duration (ms) correlation during 1st treatment  
p<0.001

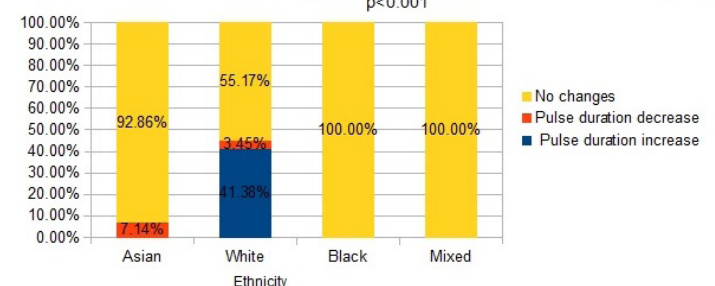


Pulse duration was adjusted and changed between 1st and 6th treatment. Those changes correlates to ethnicity (p<0,001). It was noticed as among groups of Black, and Mixed participants pulse duration was not changed, when among a group of White participants most significant changes were found (Table 6, Figure 7).

Ethnicity	n	ms change			ms change		
		ms no changes	ms decrease	ms increase	mean	min	max
Asian	28	26	2	0	-70	-70	-70
		92,86%	7,14%	0,00%			
Black	22	22	0	0			
		100,00%	0,00%	0,00%			
Mixed	32	32	0	0			
		100,00%	0,00%	0,00%			
White	29	16	1	12	2,1	-10	5
		55,17%	3,45%	41,38%			

**Table 6:** Pulse duration (ms) changes between 1st and 6th treatment in ethnic groups.

**Figure 7:** Pulse duration (ms) changes between 1st and 6th treatment in ethnic group.  
p<0.001

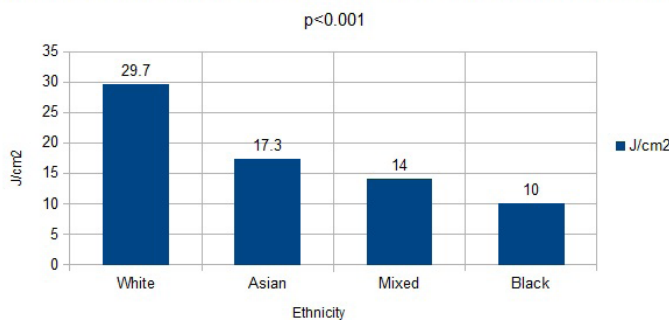


Fluence ( $J/cm^2$ ) was correlated to the ethnicity ( $p < 0,001$ ). The lowest fluence during 1st and 6th treatment was observed in the group of Black participants and the largest in the group of White participants as shown in (Table 7, Figure 8).

Ethnicity	Treatment	n	J/cm <sup>2</sup>					ANOVA	
			mean	SD	Me	min	max		
Asian	1st	28	17,3	7,3	14	10	32	p<0,001	
Black		22	10,0	0,0	10	10	10		
Mixed		32	14,0	5,2	12	10	26		
White		29	29,7	5,0	30	16	35		
Asian	6th	28	26,8	3,5	26	22	35		p<0,001
Black		22	17,9	1,7	18	15	20		
Mixed		32	23,6	3,6	24	18	30		
White		29	35,2	4,5	35	25	40		

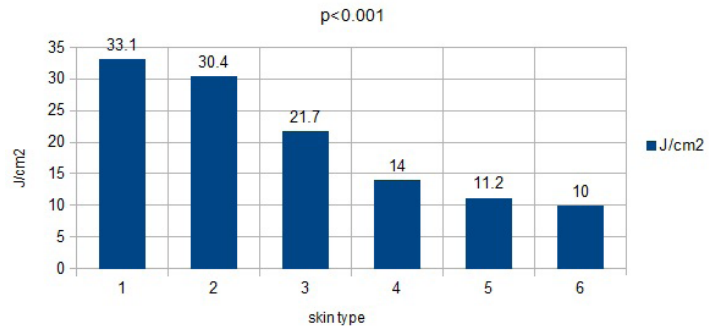
**Table 7:** Fluence ( $J/cm^2$ ) in different ethnic groups during 1s and 6th treatment.

**Figure 8.** Fluence ( $J/cm^2$ ) in different ethnic groups during 1st and 6th treatment



As ethnicity correlates to skin type according to Fitzpatrick scale, pulse fluence during 1st treatment was examined. Correlation between skin type and pulse duration was proved as statically important. Pulse fluence decrease as skin type increase (Figure 9).

**Figure 9.** Skin type and fluence ( $J/cm^2$ ) correlation during 1st treatment



Pulse fluence ( $J/cm^2$ ) increase was observed and correlated with ethnicity. The highest increase of pulse fluence was noticed in the group of Mixed and Asian participants and the lowest in the group of White participants (Table 8, Figure 10).

Ethnicity	n	J/cm <sup>2</sup> increase					ANOVA
		SD	Me	min	max		
Asian	28	9,5	5,0	11	0	16	p=0,002
Black	22	7,9	1,7	8	5	10	
Mixed	32	9,6	3,0	10	4	15	
White	29	5,6	2,1	5	2	10	

**Table 8:** Ethnicity and fluence ( $J/cm^2$ ) changes between 1st and 6th treatment.

During univariate analysis, no correlation between treatment effectiveness and parameters settings was observed in groups of Asian, Black and White participants. In group od Mixed participants correlation between treatment effectiveness was noted in an objective method and it was statistically important (Table 9).

Ethnicity	Effectiveness	ms 1st treatment	J/cm <sup>2</sup> – 1st treatment	J/cm <sup>2</sup> – 6th treatment	Delta J/cm <sup>2</sup>
Asian	Objective assesment of hair loss percentage after 6 treatments according to metology in the area of 1 cm <sup>2</sup>	r= 0,1438	r=-0,1053	r=0,2117	r=0,3043
		N=28	N=28	N=28	N=28
		p=0,465	p=0,594	p=0,279	p=0,115
	Subjective participants assesment of hair loss percentage	r=0,1432	r=-0,0496	r=0,2098	r=0,2213
		N=28	N=28	N=28	N=28
		p=0,467	p=0,802	p=0,284	p=0,258
Patient subjective satisfaction Level (1-5)	r=-0,0506	r=-0,1134	r=0,1663	r=0,2840	
	N=28	N=28	N=28	N=28	
	p=0,798	p=0,566	p=0,398	p=0,143	
Black	Objective assesment of hair loss percentage after 6 treatments according to metology in the area of 1 cm <sup>2</sup>	--	--	r=-0,0907	r=-0,0907
		N=22	N=22	N=22	N=22
		p= ---	p= ---	p=0,688	p=0,688
	Subjective participants assesment of hair loss percentage	--	--	r=-0,0440	r=-0,0440
		N=22	N=22	N=22	N=22
		p= ---	p= ---	p=0,846	p=0,846
Patient subjective satisfaction Level (1-5)	--	--	r=-0,1154	r=-0,1154	
	N=22	N=22	N=22	N=22	
	p= ---	p= ---	p=0,609	p=0,609	

Mixed	Objective assesment of hair loss percentage after 6 treatments according to metology in the area of 1 cm <sup>2</sup>	r=0,2823	r=-0,4293	r=-0,3848	r=-0,2884
		N=32	N=32	N=32	N=32
		p=0,117	p=0,014	p=0,030	p=0,109
	Subjective participants assesment of hair loss percentage	r=0,1446	r=-0,3123	r=-0,2456	r=0,2504
		N=32	N=32	N=32	N=32
		p=0,430	p=0,082	p=0,175	p=0,167
Patient subjective satisfaction Level (1-5)	r=-0,0758	r=-0,0683	r=-0,0531	r=0,0554	
	N=32	N=32	N=32	N=32	
	p=0,680	p=0,710	p=0,773	p=0,763	
White	Objective assessment of hair loss percentage after 6 treatments according to metology in the area of 1 cm <sup>2</sup>	r=-0,0802	r=0,0286	r=0,0725	r=0,0863
		N=29	N=29	N=29	N=29
		p=0,679	p=0,883	p=0,709	p=0,656
	Subjective participants assessment of hair loss percentage Patient subjective satisfaction Level (1-5)	r=-0,0387	r=0,1474	r=0,1585	r=-0,0147
		N=29	N=29	N=29	N=29
		p=0,842	p=0,445	p=0,411	p=0,940
Patient subjective satisfaction Level (1-5)	r=-0,2573	r=-0,0194	r=0,0177	r=0,0843	
	N=29	N=29	N=29	N=29	
	p=0,178	p=0,921	p=0,927	p=0,664	

**Table 9:** Correlation between treatment settings and effectiveness in ethnic groups. r- Correlation ratio; N -number of participants, p- statistical significance.

During multivariate analysis multivariate regression was used in which the dependent variable was determined by the hair loss percentage after 6 treatments according to methodology in the area of 1 cm<sup>2</sup> and the independent variables were the treatment parameters settings of the 1st and 6th treatments and changes in fluence (J/cm<sup>2</sup>) between treatments 1st and 6th. Modeling was carried out in each of the individual ethnic groups.

In the Asian group of participants the treatment parameters settings (J/cm<sup>2</sup>) and the change (delta) J/cm<sup>2</sup> between the 1st and 6th treatments were included in the model. Both of these parameters have a statistically significant proportional effect on the therapy results, with the influence of the change in fluence J/cm<sup>2</sup> between treatments 1st and 6th having a more significant impact on the outcome that the level of fluence J/cm<sup>2</sup> in the first treatment (Table 10).

N=28	Regression Summary for Dependent Variable: hair loss percentage after 6 treatments according to metology in the area of 1 cm <sup>2</sup> R=,49771429 R2=,24771952 Adjusted. R2=,18753708 F(2,25)=4,1161 p<,02849 Std.Error of estimate: 6,9754 Include condition: Ethnicity=Asian					
	b*	Std. Err of b*	b	Std. Err of b	t(29)	p-value
Intercept			59,069	13,080	4,516	0,0001
Difference J/cm <sup>2</sup>	1,131	0,403	1,756	0,626	2,804	0,0096
J/cm <sup>2</sup> - First	0,916	0,403	0,970	0,427	2,270	0,0321

**Table 10:** Multiple Regression in Group of Asian participants.

For a model carried out in a group of Mix Raced Participants only fluence J/cm<sup>2</sup> had a statistically significant inversely proportional effect on the therapy results. Although pulse duration (ms) MS was included in the regression model, its impact on the outcome of the

therapy was statistically insignificant (Table 11).

N=32	Regression Summary for Dependent Variable: hair loss percentage after 6 treatments according to metology in the area of 1 cm <sup>2</sup> R= ,50801394 R2= ,25807816 Adjusted. R2= ,20691114 F(2,29)=5,0438 p<,01319 Std.Error of estimate: 4,9812 Include condition: Ethnicity=Mixed					
	b*	Std. Err of b*	b	Std. Err of b	t(29)	p-value
Intercept			112,466	11,537	9,748	0,0000
Fluence: (J/cm <sup>2</sup> ) – First treatment	-1,042	0,395	-1,115	0,422	-2,640	0,0132
Pulse duratoin (ms) - First treatment	-0,670	0,394	-0,0298	0,018	-1,698	0,1001

**Table 11:** Multiple Regerssion in Group of Mixed participants.

For a model carried out in groups of Black and White Participants, there are no variables in the regression equation. Thus, none of the independent variables has a significant impact on the outcome of the therapy.

## Conclusion

This research compares results of 805 nm diode laser hair removal in the pubic area in different ethnic groups. Previous studies were focused and limited to single ethnic groups, different to pubic parts of the body, and literature does not provide information on possible effects, side effects in various ethnic groups of the participants, therefore authors have decided to compare different ethnic groups in laser hair removal on pubic area. In connection with numerous experiments of researchers regarding to the excellent treatment effects using 805 nm diode laser in people with a skin type I- VI, with minimal and reversible side effects, the study proves that a diode laser with a wavelength of 805 nm using the appropriate

treatment parameters can be successfully applied in pubic area regardless of the ethnic origin of participants.

Additionally in the study authors used satisfaction 1-5 grade scale. Each of grade was not correlated to the percentage of hair loss but to assess participants satisfaction level after the course of the treatment. In the study participants indicated their satisfaction level at the following grades only: 3 – meant “moderate satisfaction”, 4 – meant “satisfactory effect”, 5 – meant “the treatment met all my expectations”. Accordingly, participants were aware as permanent hair reduction is the long-term, stable reduction in the number of hairs re-growing after the course of treatment. Participants were informed that hair reduction would last for four to twelve months and permanent hair reduction doesn’t mean the elimination of all hairs in the treatment area.

The respondents of each of groups have very high expectations in comparison to the possible effects of treatment using the method of selective thermolysis with the diode laser. The study confirms the effectiveness of selective thermolysis using 805 nm diode laser in the pubic area regardless of the ethnicity of the participants.

Carrying out the analysis, it was noted that the subjective assessment of percentage hair loss statistically significantly varies from the objective assessment. Simultaneously,

the subjective assessment of percentage hair loss after the course of 6 treatments correlates with the level of satisfaction after six treatments and strongly correlates with the objective assessment of percentage hair loss in the area with 1cm in diameter after six procedures. It was also noted that the level of satisfaction after six treatments correlates with the objectively assessed percentage hair loss after six treatments in an area of 1cm in diameter.

It is shown of each of groups as :

Asian skin participants: subjective assessment of percentage hair loss: 88.9%, objective assessment of percentage hair loss 92,5 %, 67.86 % of participants indicated that the treatment met all their expectations. It was best results of the study. It is worth to highlight as Asian participants skin types were: III (39,29%), IV (53,57%), V (7,14%). Black skin participants: subjective assessment of percentage hair loss 78 %, objective assessment of percentage hair loss 81%, 54,55% of participants indicated that the treatment met all their expectations. These were the only group of participants with skin type VI (100%), who were aware of all risks related to high skin pigmentation, and even with the lowest hair loose percentage were more satisfied to Mixed skin participants. Mixed skin participants: subjective assessment of percentage hair loss 84.4%, objective assessment of percentage hair loss 86,9%, 40,63% of participants indicated that the treatment met all their expectations. Mixed raced participants skin types were III (28,13%), IV (21,88%), V (50%), and authors would like to find out later on in their research the impact of genetics, and different background of Mixed raced skin participants ancestry. White skin participants: subjective assessment of percentage hair loss 82.3%, objective assessment of percentage hair loss 88,2%, 51,72% of

participants indicated that the treatment met all their expectations. White skin participants skin types were I (24,14), II (55,17%), III (20,69%). In this group of participants, authors find the highest difference between objective and subjective assessment of hair loss percentage.

Side effects observed are significantly correlated with ethnicity and are most common in groups of Black (81,82%) and Mixed (81,25%) skin participants and less common among Asian (42,86%) and White (48,28%) skin groups of participants, however, the study proves the safety of the diode laser 805 nm treatment in the group of participants of different ethnicity. Despite occurrence of side effects it is effective in each of the studied groups, side effects are reversible, and no adverse side effects were observed.

Treatment parameters settings during first and sixth treatment adjusted to the skin type according to the manufactures guidelines were correlated to ethnicity of the participants. The multivariate analysis and multivariate regression models confirm as the safety and effectiveness of therapy were not affected by fluctuations in the treatment parameters settings.

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