

Are There Any Genotoxic Effects of Laser Epilation Applications on Human? An Observational Study

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ABSTRACT

Background: Laser epilation is a method of removal of unwanted hair from the body and its use for this cosmetic purpose is gaining increasing popularity. Sister chromatid exchange (SCE) is a critical method for determining genotoxicity caused by several mutagens and carcinogens under in vivo and in vitro conditions.

Aims & Objective: In this study, we aimed to determine whether removal of unwanted hair by laser epilation causes genotoxicity in women undergoing this procedure.

Materials and Methods: 40 voluntary women who admitted to the dermatology clinics for the removal of unwanted hair by laser epilation were included. Skin types of all patients were classified according to Fitzpatrick Scale. Laser epilation was applied by Alexandrite (Light Age Epicare Duo) at a 755 nm wavelength laser. The possible genotoxic effects in women who had laser epilation to the whole leg (upper and lower leg) and face was investigated by the SCE method.

Results: The blood samples that were drawn before and 24 hours after the laser application showed no significant differences between the SCE frequencies ($p>0.05$).

Conclusion: We could not find any significant genotoxic effect of laser epilation in women undergoing this procedure. As far as we know, this is the first study that investigates the relationship between laser applications and genotoxic effects.

Key Words: Laser; Hair Removal; Sister Chromatid Exchange

INTRODUCTION

Removal of unwanted hair from the body is an important concern for women of any age and even for men for cosmetic reasons. Increased hair development in some body areas also comprises an important cosmetic/psychosocial problem for some people. Light Amplification by the Stimulated Emission of Radiation (LASER) has largely replaced the traditional methods of hair removal because of the relatively permanent results obtained by this method when compared with the other methods. It was reported that, by this method which is based on the use of selective photothermolysis, the melanin pigment within the hair follicle is targeted without giving any damage to the surrounding tissue.^[1] Conversion of laser to thermal energy at the hair follicle that absorbs laser causes thermal damage to the hair follicle.^[2]

New applications that are implemented to our daily lives with the technological developments remind us the possibility of mutations in human beings that can be caused by the new application. For this reason, different in vitro, short term mutagenicity tests that can be used to investigate the potential mutagenic and carcinogenic effects of these new applications have been developed. Sister chromatid exchange (SCE) test is one of these. It is a sensitive and simple test as well as being safe and reliable.^[3] SCE arises by reciprocal DNA interchanges between sister chromatids during replication of damaged DNA templates. Exposure to some chemical, viral or environmental hazards, ionizing radiation, ultraviolet light, psoralen+ultraviolet A (PUVA) therapy and malignancies can lead to certain levels of SCE.^[4] In this study, we investigated whether laser hair removal has chromosomal side effects by using SCE analysis.

MATERIALS AND METHODS

Patient Selection

This study was planned in a prospective manner. Forty healthy volunteer women that admitted to the dermatology clinics for the removal of unwanted hair by laser epilation were enrolled to

the study. The patients were also followed in terms of the dermatologic complications that could occur as a result of the laser epilation procedure. Exclusion criteria were the presence of any chronic systemic disease like cardiovascular diseases, any malignancy, history of radiotherapy or chemotherapy, cigarette smoking or substance addiction, use of alcohol, current use of oral contraceptive pills, known hormonal disorders and history of laser hair removal or laser electrolysis. No topical anesthetics were used during the laser application. The laser session intervals were decided to be kept as at least 1 month. Alexandrite laser system (Light Age Epicare Duo) at 755 nm wavelength was used for the epilation procedure. Only patients that had laser epilation to the whole leg (lower leg + upper leg) and face were included. Skin types of all patients were classified according to the Fitzpatrick Scale.^[5] The spot size, shooting time (millisecond) and energy (joules/cm²) were adjusted according to the Fitzpatrick skin type and the area of the skin in the body to which the procedure would be applied.

Analysis of Sister Chromatid Exchange

For SCE analysis, 1 mL of blood was drawn to heparinized tubes from each individual before and 24 hours after the 1st laser application. Cultures were established by adding 0.5mL of blood to 5mL karyotyping medium (Biological Industries, Beit Haemek, Israel) with 2% phytohaemagglutinin M (PHA) (Biological Industries, Beit Haemek, Israel), and incubating for 24 h at 37 °C. A 5-bromo-2'-deoxyuridine (BrdU) (Sigma, St. Louis, MO, USA) solution was added to a final concentration of 5mg/mL. Lymphocytes were cultured in the dark for 48 h and metaphases were blocked during the last 2 h with colcemid (Biological Industries, Beit Haemek, Israel) at a final concentration of 0.1 g/mL. The preparations were stored at room temperature for 3 days. At the end of this duration, each preparation was stained with fluorescence-plus-Giemsa (FPG) technique. Fifty second-division metaphases were scored on coded slides by a single observer, and expressed as the number of SCEs/cell per subject. Staff

performing the SCE analysis was blinded to the study. At least 20 metaphases/sample were investigated under microscope (Olympus BX50) at 100x amplification. In each chromosome, the dark stained areas where the SCE regions skip from one chromatid to the other were accepted as 1 change. By this way, mean SCE frequency of each case was evaluated.

Statistical Analysis

All statistical analyses were performed using the SPSS software package 15.0 (SPSS Inc, Chicago, IL, USA). Data were presented as frequencies and percentages for categorical variables and mean \pm SD or median for continuous variables, unless otherwise indicated. A Wilcoxon's Rank Test was performed for the assessment of any differences between the first and second values of the dependent groups. Correlation between continuous variables was determined by Pearson correlation coefficients. A p-value of <0.05 was considered as statistically significant.

RESULTS

Forty voluntary women that had laser epilation to the whole leg (lower + upper) and face were included in the study. The mean age of the women was 24.9 ± 2.14 . The SCE frequencies that were obtained prior to the laser epilation were compared to those obtained after the laser epilation and no statistically significant differences were observed (Table 1). According to the skin types, eight (20%) cases were evaluated as type II, 18 (45%) cases were evaluated as type III, 14 (35%) cases were evaluated as type IV using the Fitzpatrick scale. Short-term adverse effects, including erythema, pruritus, and folliculitis were seen in a few case. They generally occurred in subjects with darker skin types. There were no long-term permanent pigmentary changes.

Table-1: SCE Frequencies in the Groups during the Study

	Prior to Laser Epilation	After Laser Epilation	p-Value*
Min-max-median	3.30-4.30-4.15	3.40-4.35-4.10	0.443

Wilcon Signed Ranks Test; SCE: sister chromatid exchange; * Value resembles all groups

DISCUSSION

Electromagnetic radiation (EMR) is the primary form of energy that includes photons and shows wave properties. It includes X rays, gamma rays, ultraviolet radiation, visible light, infrared radiation, microwave and radio waves, from shorter to longer wavelengths, respectively. Laser beams are reported to be in a spectrum between the visible light and infrared wavelength.^[6] Because of the infrared energy it includes, it is reported that laser beam has a propensity to cause an increased temperature within the tissue which could result in thermal damage.^[7]

There are many temporary or permanent side effects that are reported to occur due to laser epilation procedures. Most of these are the dermatologic side effects that occur as a result of increased temperature within the tissues and include pain, erythema, hyper- or hypopigmentation.^[8] However, as far as we know, the relation of laser epilation with genotoxicity has not been studied before. Previously, it was known that visible light would have no effect on DNA since it is not absorbed by DNA. But in a recent study, Kamil et al. reported that visible light on its own, without an additional exogenous light source could lead to local sublethal DNA damage.^[9] But, the study conditions and methods in this study were different from ours and they used HeLa cells instead of the lymphocytes. Absence of chromophores in lymphocytes and the different methods that we used may be the cause of the different results that we obtained in our study.

In a similar study performed by Kong et al. by using phase contrast microscope, it was found that some of the high power and pulsed lasers could lead to nuclear damage and some morphologic changes.^[10] But the parameter evaluated in this study was the nuclear damage instead of the change in SCE frequencies. Also the laser system they used was also different and at a different wavelength from the system that we used (Alexandrite).

The mutagenic and carcinogenic effects of the phototherapy lamps which emits short wavelength visible light similar to laser have been demonstrated in an in vitro study.^[11] But since the spectrum of the phototherapy lamps also includes ultraviolet lights, different from our study, the SCE changes that were observed in this study could have been occurred due to the ultraviolet light.

In contrast to all of these studies, we found that the laser application for epilation, the light given by which is in a spectrum between visible light and the infrared wavelength, does not cause genotoxic changes. This may be due to that the tissue absorption of laser does not differ according to the wavelength of the light and that the 755 nm wavelength of the device we used is more selective for melanin. But we could not meet any other study in the literature about the genotoxic effect of laser devices with other wavelengths, either. For this reason, we could not compare our results with the effects of laser applications at different wavelengths and this was an important limitation of our study.

Together with some recent studies, the permanent results obtained by the laser for the removal of unwanted hair as well as its use in the treatment of many dermatologic diseases because of its stimulating effect on collagen synthesis have been accepted as advantages of laser.^[12] But, in spite of these favorable developments, what kind of effects the laser can have over apoptosis genes and DNA repair mechanisms is not known. There is no clear data about how the laser affects the surrounding tissues while targeting the hair roots. For this reason, further studies may be needed to clarify whether laser epilation procedures have an inducing effect on frequent cancers which originate from the skin appendages, and especially from the epithelium around the hair follicle such as basal cell carcinoma. For this purpose, studies that are performed on a greater number of patients with more intensive sequences and by the examination of skin biopsy samples may be more valuable. Since it will be

unwise to perform biopsy for such a reason on human, in vivo studies performed on laboratory animals can be planned.

CONCLUSION

Although our study could not demonstrate an in vitro genotoxic effect of laser wavelength that is used for epilation procedures, our results need to be supported by studies that will be performed on different patient groups with a greater number of cases.

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