Long-pulsed Alexandrite Laser vs. Intense Pulsed Light for Axillary Hair Removal in Korean Women

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Background and Objectives

Although several lasers are available for treatment of unwanted hair, treatment of darker skin types is especially challenging because of increased concentrations of epidermal melanin. The laser energy absorbed by targeted hair follicles is reduced, and the risk of side effects in the epidermis is increased. While many studies have documented the safety and efficacy of different laser systems, few studies investigating laser hair removal in Korea have been reported. This study was conducted in order to compare effectiveness, satisfaction level, and safety of a long-pulsed alexandrite laser and intense pulsed light (IPL) in axillary hair removal in Korean women.

Materials and Methods

In this within-patient, right-left, assessor-blinded comparative study, 13 female patients with Fitzpatrick skin type III to IV were randomized for treatments with the long-pulsed (755 nm) alexandrite laser and IPL (600-950 nm filter) on their right or left side of the axilla. Three sessions of treatment at four week intervals were performed; follow-ups were conducted eight weeks after the last treatment. Hair counts and photographic evaluation of treated sites were performed at baseline and at the last follow-up. The patients scored satisfaction rates and degree of pain for both devices.

Results

Thirteen patients completed the study. At eight weeks after the final treatment, the decrease in hair counts on the alexandrite laser side (96%) was greater than that on the IPL side (86% vs. pretreatment). The score for patient-evaluated overall satisfaction was higher with the alexandrite laser, although higher pain scores were reported with the alexandrite laser. A burn was observed on one patient on the alexandrite laser side, but was transient and recovered without sequelae.

Conclusion

Both systems demonstrated satisfactory hair removal results, as reported by both patients and clinician. The long pulsed alexandrite laser can be used effectively and safely for hair removal in darker skin types.

Key words

Alexandrite laser; Axillary hair removal; Dark skin type; Laser hair removal; Intense pulsed light

INTRODUCTION

Unwanted body hair is a source of concern commonly encountered in cosmetic dermatology. Compared to traditional methods of hair removal including shaving, waxing and electrolysis, laser hair removal has shown to provide longer term results with a low risk of complications. Hence over the past decade, laser technology has been the subject of much interest and demand for both clinicians and patients.¹

The basis of laser hair removal is the induction of hair follicle damage through the Specific targeting of melanin in the hair bulb. Currently several lasers or light devices of different wavelengths including ruby, alexandrite, long-pulsed neodymium-doped yttriumaluminum garnet (Nd:YAG), diode lasers and intense pulsed light (IPL) are utilized in clinical practice and several studies have reported varying but good results.^{2,3}

Although previous studies have compared the efficacy between different photo-epilatory systems, no trials have been undertaken comparing alexandrite and IPL in Korean skin.⁴

In this study a randomized trial was conducted to compare the photoepilatory efficacy of long pulsed alexandrite with that of IPL in the removal of axillary hair in 13 Korean women. The primary objective of our study was to evaluate any differences between the two systems in terms of efficacy, patient satisfaction and rate of side effects.

MATERIALS AND METHODS

Participants

Subjects were female volunteer patients who presented with wanting the removal of axillary hair. Prior to treatment, subjects were assessed for their suitability for laser hair removal and exclusion criteria included underlying chronic or inflammatory systemic disease, malignancy, photosensitivity, patients younger than 19 years or older than 40 years, pregnancy and breastfeeding.

After assessment, 13 volunteers were recruited into the trial. This study was approved by Asan Medical Center institution review board and informed consent was obtained from all participants before the commencement of the trial.

Study protocol

This study was a within-patient, right-left, assessor-blinded comparative study of axillary hair removal

comparing the alexandrite laser with IPL. The right and left side of the axilla were randomly allocated to receive either IPL or long-pulsed alexandrite and each subject was treated on three occasions at 4 week intervals. Response to treatment was assessed 8 weeks after the last treatment.

The set-up and fluence used for both systems were in accordance with the manufacturer recommendations and the hospital laser clinic protocols.

Alexandrite laser

The long pulsed alexandrite laser (CLARITY™, Lutronic Corp, Korea) used had an output wavelength of 755 nm and the parameters used were 3 ms pulse duration, 10-15 J cm⁻² fluence, and 15, 18 and 20 mm round-spot cartridges.

Accompanying cryogen spray system (Intelligent Cooling Device, ICD, Lutronic Corp, Korea) was used in all patients for epidermal preservation with 20 ms pre spray and 10 ms delay.

Intense pulsed light

The Ellipse Flex IPL (Danish Dermatologic Development, Denmark) used an output wavelength range of 600-950 nm filter and the parameters used were 40 ms pulse duration, 11-15 J cm⁻² fluence, and 5 cm² spot size (rectangular spot).

A transparent thin cooling gel (Danish Dermatologic Development, Denmark) was applied to the skin at IPL side in all patients.

Outcome methods

Hair counts were conducted prior to and at 8 weeks following the cessation of treatment. Photographic evidence of axillary hair was obtained using a videoscope. The assessment was blinded to the study protocol.

After each treatment, patients were asked to complete a questionnaire comparing both sides in regards to degree of pain or discomfort, postinflammatory hyperpigmentation, erythema, burn or scarring. Pain was scored on visual analog scale (VAS).

Eight weeks after the last treatment session, an evaluation of hair reduction was conducted through a questionnaire asking to score their questionnaire levels with both the alexandrite and IPL systems. The improvement level was determined by each volunteer using a 1-4 scale: 1, poor (< 25% improvement); 2, slightly improved (> 25-50% improvement); 3, moderately improved (> 50-75% improvement); 4, excellent (> 75% improvement). They also were asked to score their

satisfaction with both IPL and laser systems. They used a 0-10 scale: 0 for very disappointed up to 10 for very satisfied.

Results were analysed using SPSS version 10 (SPSS, Inc., Chicago, IL, USA) and statistical analysis was conducted by using the Wilcoxon signed rank test and Student's t-test. $p < 0.05$ was considered statistically significant.

RESULTS

Thirteen female patients completed the study. Their mean age was 28.9 years (range 20-39 years) and all subjects were Fitzpatrick skin type III to IV.

Hair counts

There was no statistically significant difference in pretreatment hair count between both sides: 151 ± 22 (mean $\pm$ SEM) on the IPL side vs. 148 ± 22 on the alexandrite side ($p = 0.46$). After 2 months of the last

treatment, the decrease in hair counts on the both side remained static at 21 ± 3 on IPL side (86% decrease, $p < 0.01$ vs. pre-treatment) and 5 ± 2 on alexandrite side (96% decrease, $p < 0.01$ vs. pre-treatment). All women showed statistically significant hair reduction after treatment on both sides ($p < 0.01$). The decrease in hair counts on the alexandrite side was greater than that seen on the IPL side ($p < 0.05$) (Fig. 1).

Ranks of improvement by patients

Final evaluations by patients regarding overall improvement are displayed in Fig. 2. Alexandrite laser was awarded high final improvement scores by patients. At the IPL side, 9 (70%) patients reported > 50 -75% improvement, while 8 (62%) reported $> 75\%$ improvement on alexandrite side.

Satisfaction scores reported by patients

At the end of the study median satisfaction score was 7.0 ± 0.5 and 8.5 ± 0.5 on the sides treated with IPL and laser, respectively, and the difference was statistically significant ($p < 0.05$) (Fig. 3).

Side-effects of treatment

Patients reported less pain sensation at the IPL side (VAS: 2.1 ± 0.3) compared with the alexandrite side (VAS: 2.6 ± 0.2); but, the difference was not statistically significant ($p = 0.14$). Pain at the both sides was well tolerated by majority of patients.

One patient sustained small area of mild burn on the alexandrite-treated side. Side effect was only temporary and the patient healed without any sequelae. No postinflammatory hyper- or hypopigmentation and no

Fig. 1. Mean hair counts are displayed for the alexandrite and IPL.

Fig. 2. The overall evaluation of improvement by patients of the results obtained by IPL and alexandrite laser 2 month after the last treatment.

Fig. 3. Satisfaction scores reported by volunteers after hair removal with IPL and alexandrite laser. 0 for very disappointed and 10 for very satisfied.

Fig. 4. Axillary hair before treatment: Left (A) and right (C) sides of the same patient. Hair reduction, 2 months after three treatments with alexandrite (B) vs. IPL (D).

scarring was detected.

DISCUSSION

Hair removal using lasers or IPL is an effective, non-surgical cosmetic procedures commonly performed in Korea. A variety of devices with different wavelengths are currently available and used widely for this purpose by Korean dermatologists.²

Amongst the factors that determine responses to laser hair removal are skin type, hair color and ethnicity. Although published data about hair removal by the laser or IPL exists, most appears to be focused to Western patients, and few studies about Korean cases have been undertaken.

Central to the mechanism of action of light-mediated hair removal is the concept of selective photothermolysis. The targeted chromophore in light-mediated hair removal is melanin in hair shaft. However, melanin is also found in epidermis, and complications of laser hair removal include unwanted thermal damage to the epidermis, especially in darker skin types.⁵

For safe laser treatment for darker skin, the parameters including the wavelengths, pulse duration and fluence of lasers or IPL should be adjusted based on each

patient's skin characteristics. As expected, the amount of thermal damage to epidermis is greater in darker skin types by using higher fluence. Unwanted adverse effect during laser hair removal can be minimized by using lower fluence, but lower fluence also decrease treatment effectiveness.

Another effective way of protecting the dark epidermis without diminishing the effectiveness of treatment is longer pulse duration. In previous clinical trials, lengthening the pulse duration is effective in delivering thermal damage to the hair follicle, while minimizing thermal damage in epidermis.⁶

Matching the proper pulse duration and fluence to various hair densities on dark skin type remain the important factors in laser hair removal. One study reinforces that lower fluence are more appropriate for sites with high hair densities. On the other hand, lengthening the pulse duration will protect epidermis from unwanted damage when hair removal lasers are going to be used for sites with low hair densities.⁶

Recently, the preference of the long wavelengths lasers for laser hair removal on darker skin type was reported. Galadari⁷ compared Nd:YAG, alexandrite and diode laser in skin type IV-VI, and concluded that there is no significant difference among the three lasers. But

the safer laser system for darker skin type was the long pulsed Nd:YAG. The long wavelength of lasers allowed deeper penetration into the dermis without the damage of the epidermis. The report supported that the longer wavelength is more suitable for darker skin type.

In addition to determining optimal parameters, clinicians should also consider additional methods to reduce the laser induced adverse effects including test shots, epidermal cooling and advice of minimizing sun exposure before and after laser treatment to prevent potential complications.⁸

In this study, at 8 weeks after the last treatment, hair reduction was 86% and 96% in sides treated with IPL and alexandrite laser, respectively. The results showed that both systems are effective, with the alexandrite laser shown to have result in more significant reduction of axillary hair than IPL. Previous study found in the literature comparing IPL and alexandrite laser in facial hair removal reported that alexandrite-treated side needed seven sessions to reach about 80% improvement, while the IPL-treated side needed 10-12 sessions to reach about 50% improvement.⁹

In this study the patients reported higher levels of satisfaction for the alexandrite laser when compared with the IPL. Despite the higher pain score reported with laser treatment, more patients preferred the alexandrite laser treatment. Patients reported that pain was tolerable for greater efficacy of laser treatment. There was one patient with burn on the alexandrite-treated side, but it was temporary.

In conclusion, both photoepilatory systems demonstrated satisfactory hair removal results as reported by both patients and clinician, with the alexandrite laser can be used effective and safety for axillary hair removal in Korean patients.

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