

• Cosmetic dermatology •

Clinical Comparative Study of Treating Armpit Hair Between Two Semiconductor Laser Therapeutic Instrument

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[Abstract] **Objective** To evaluate the efficacy and safety of neotype semiconductor laser hair removal device GP900A for armpit hair removing. **Methods** One hundred of twenty cases of female subjects were selected. Both armpits were divided into two groups randomly. Treatment group was treated with GP900A laser device, and the control group with Light Sheer semiconductor laser treatment therapy. Two groups were treated every 20 ~ 60 days for four times. Effectiveness, doctors and subjects satisfaction and adverse reactions were evaluated at the end of treatment. **Results** Effective rate in treatment group was 98.33%, and 98.32% in control group. In treatment groups, the doctor satisfaction rate was 98.15%, and the patients was 97.28%. In control groups, the doctor satisfaction rate was 97.35%, and the patients was 98.04%. There was no significant difference between two groups ($P > 0.05$). All subjects showed no adverse events. **Conclusion** The depilatory efficacy and clinical safety of GP900A semiconductor laser hair removal treatment instrument was similar to the Light Sheer treatment instrument. Meanwhile, owning lower costs and epidermal cooling temperature, GP900A treatment instrument is worth to clinical promotion.

[Key words] Semiconductor laser, Hair removal, Clinical effect, GP900A

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Nowadays people's pursuit of beauty has become a kind of habit and fashion, but excess hair may have a serious impact on beauty and even on mental health. Traditional hair removal methods include shaving, hair removal wax, depilatory and electrolysis, but most of these methods only show short-term effect, less than ideal efficacy and many adverse reactions such as scars left over and sweat gland secretion affected^[1]. Since 1998, diode laser hair removal (DLHR) has been applied in human body hair removal treatment. Characterized by safety, efficiency and permanent hair removal, this technology has become the hotspot of cosmetology study gradually^[2]. Light Sheer diode laser therapeutic instrument is a classical representative, but the cost is relatively high. Domestic GSD GP900A (Coolite Pro XL) laser

hair removal instrument is a new generation of diode laser equipment, the cost is relatively low. This research compares the efficacy and safety of Coolite Pro XL and Light Sheer through 120 patients. The results are as follows:

1 Data and methodology

1.1 Instrument and treatment parameters: GP900A diode laser hair removal instrument (Coolite Pro XL, Shenzhen GSD Tech Co., Ltd.): wavelength 810 ± 10 nm, spot area $12 \text{ mm} \times 12 \text{ mm}$, pulse width 5~850 ms, energy density $1 \sim 120 \text{ J/cm}^2$, repetition frequency 1~10 Hz. Light Sheer diode laser therapeutic instrument (LUMENIS): wavelength 800 nm, spot area $9 \text{ mm} \times 9 \text{ mm}$, pulse width 5~400 ms, energy density $10 \sim 100 \text{ J/cm}^2$, repetition frequency 2 Hz.

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1.2 Clinical data and grouping This hospital selected 120 normal patients (Tab. 1) from May 2015 to August 2015 according to the inclusion criteria and exclusion criteria. Inclusion criteria: ①signed the consent form; ② aged from 18~65 years old, either sex; ③didn't accept systemic immune therapy in recent 3 months. Exclusion criteria: patients with keloidosis history and photosensitivity disease; ②patients who has accepted hair removal treatment by other methods in recent 6 weeks; ③patients with skin infection or herpes simplex history on the treatment zone; ④ patients who are allergic to hydroquinone or other bleaching agents; ⑤pregnancy women; ⑥patients with malignancy complication; ⑦clinical patients who has participated in other similar laser treatments in recent 3 months; ⑧patients who the researchers thought should not be included for other reasons. The hair removal part is armpit. Patient skin was divided into Type III-Type IV according to Fitzpatrick skin typing standard. Hair color is black to black brown. Both armpits of included patients were divided into treatment group and contrastl group by random number table pairing method. The treatment group was treated with Coolite Pro XL, and the contrast group with Light Sheer LUMENIS.

1.3 Treatment method Before treatment, warm water was used to clean armpits, disposable knife for skin cleaning was used to shave armpit hair on the treatment zone, and 0.5% chlorhexidine was used for disinfection. The patients took the supine position, both upper limbs extended outward naturally to expose the armpit proposed to be treated completely, then a thin layer of gel was applied. In the process of treatment, the cooling head contacted with skin perpendicularly and then was pressed. During treatment, spot overlapping should be avoided as far as possible and uniform irradiation should be ensured. The surgeon and the patients should wear goggles. The treatment group was treated with Coolite Pro XL, and the contrast group with Light Sheer. For both groups, the energy density is 30J/cm², pulse width is 100ms, frequency is 2Hz, irradiation time is 2min. The patients were treated every 20~60 days for four times and observed for 90 days after the treatment. Patients who suffered local slight red swelling and burning sensation after treatment were given cold compresses with ice bag for 15~20 min. The treatment zone should be kept clean. Hot water and soap should not be used on local treatment zone within 1~2d after treatment.

Besides, attention should be paid to protection from the sun after treatment, but sunscreen cream is not allowed.

1.4 Efficacy judgment standard Satisfaction and efficacy were evaluated at the 3rd month after treatment [3]. Cured: Hairs were reduced by over 60%, newly grown hairs are thinner, the color is lighter. Effective: Hairs were reduced by 40~60%, newly grown hairs are thinner, the color is lighter. Ineffective: Hairs were reduced by under 40%, newly grown hairs still are thick, the color is darker. Effective rate=(cured cases + effective cases)/total cases ×100%. Researchers and patients conducted satisfaction evaluation (including four ratings, i.e., very satisfactory, satisfactory, common and dissatisfactory) respectively. First two ratings were included in satisfaction rate.

1.5 Adverse reactions The researchers evaluated skin reactions visually. Erythema, blister, purpura, scar, pigmentation and depigmentation, etc. shall be recorded as adverse reactions.

1.6 Statistical processing method The density of hair of patients was compared between the two groups by **FAS/PPS**. Non-inferiority test of main efficacy indexes was established (**FAS/PPS**).

2 Results

2.1 Efficacy 1 subject dropped out. As shown in Tab. 1, the effective rate of Coolite Pro XL used by the treatment group is 98.33%, and the effective rate of Light Sheer used by the contrast group is 98.32%. Both treatment methods showed good efficacy. Comparison of the two groups has no statistical significance ($P>0.05$).

2.2 Safety analysis No adverse events such as pain and erythema after operation occurred in both of treatment group and contrast group.

Tab.1 Comparison of the therapeutic effects of two different treatments

G (FAS)	L		G (PPS)	L	
	Effecti ve	Ineffect ive		Effecti ve	Ineffect ive
Effectiv e	115	2	Effectiv e	114	2
Ineffect ive	3	0	Ineffect ive	3	0

Note: GSD Coolite Pro XL=G Light Sheer=L

2.3 Treatment satisfaction In treatment group, the doctor satisfaction rate was 98.15%, and the patients satisfaction rate was 97.28%. The difference wasn't statistically significant

($P>0.05$). In contrast group, the doctor satisfaction rate was 97.35%, and the patients satisfaction rate was 98.04%. The difference wasn't statistically significant ($P>0.05$).

3 Discussion

Diode laser was first applied in hair removal treatment in 1997^[4]. Through the improvement of several generations of instruments, now it has been widely applied in clinical treatment. The treatment principle is based on "theory of selective photothermolysis"^[5], i.e., the melanocyte dispersed in human hair follicle is a natural chromophore which can absorb laser of certain wavelength; when the energy of absorbed laser gets great enough, it will destroy the hair follicle selectively and reduce the regeneration function of hairs so as to remove hairs eventually. Since hair follicle is deep, it was regarded that laser wavelength of 695~1,064nm is the best^[6]. Light Sheer diode laser therapeutic instrument can generate 800nm laser. The 800nm laser is in the near infrared region of spectra. It has good melanin absorbing capacity and can penetrate into the deep dermis and subcutaneous adipose tissue and act on hair follicle at different parts and depths to remove the hairs at different parts and depths effectively. Besides, this method will not destroy peripheral tissues, so scars will not be formed^[7-8]. Its efficacy and safety has been proved in domestic and overseas clinical application^[9-10].

Coolite Pro XL generates 810nm laser, being the new generation of hair removal laser. Laser in this wave band has good melanin absorbing capacity and can minimize the absorption of laser by hemoglobin or water^[11]. A new research finds that, 810nm laser can induce the reduction of quantity, thickness and color of stably growing hairs^[12]. This research, from the treatment of 120 patients for four times, finds that the clinical effective rate of Coolite Pro XL hair removal treatment reaches 98.33%, there isn't statistical different between clinical effective rate of Light Sheer. Meanwhile, there isn't statistical difference of treatment satisfaction between the doctor and patients. This indicates that the hair removal efficacy of Coolite Pro XL is comparable to classical Light Sheer. At the same time, all patients treated with Coolite Pro XL and Light Sheer didn't suffer adverse reactions such as erythema, blister, purpura, scar, pigmentation and depigmentation during treatment and within 3 months after treatment, indicating that the safety of Coolite Pro XL is comparable to Light Sheer and worth for clinical promotion.

This research conducted four times of repeated laser treatment under low energy density and high average power, and both the Coolite Pro XL used by treatment group and the Light Sheer used by contrast group reached an effective rate of over 98%, indicating that using diode laser under low energy density and high average power is an effective hair removal method^[13] and that the course of clinical hair removal treatment shall not be less than four times because 70%~85% hairs are in growth phase and 15%~30% hairs are in resting phase or catagen phase. In growth phase, hair matrix division happens rapidly, melanocyte is in large quantity and very sensitive to laser and can absorb laser of special wavelength easily; but in catagen phase, cell division is stopped, quantity of melanocyte is reduced and laser absorbed is reduced correspondingly^[14] leading to poor efficacy. Hair removal treatment was conducted every 20~60 days, 4 courses of treatment can ensure that almost all of hair follicles are destroyed.

Furthermore, although both G Coolite Pro XL and Light Sheer adopt the sapphire touch cooling, Coolite Pro XL can cool the epidermis to 0~4 °C, which exceeds the epidermis cooling temperature (about 5°C) of Light Sheer. This not only makes the patients feel more comfortable but also protects normal skin tissue better, not only reduces pain (without using anesthetic and condensing agent) but also increases treatment energy and improves efficacy^[15].

In conclusion, this research shows that Coolite Pro XL provides hair removal effect and safety comparable to Light Sheer and can achieve a long-term hair removal effect. Meanwhile, the instrument provides lower epidermis cooling temperature so as to facilitate the operation and make the patients feel more comfortable, hence it is a treatment method worth for clinical promotion.

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