

# Efficacy of a new cryotherapy device on pain relief during the laser tattoo removal

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## Background and Objectives

Laser tattoo removal is a painful procedure and its treatment presents a major challenge. Cooling therapy (cryotherapy) is a therapeutic modality that provides pain relief. Recently, a non-contact type cooling device (TargetCool™) was introduced that provides rapid precision-controlled cooling.

## Materials and Methods

In this prospective split-body study with 12 subjects, we investigated the efficacy of a non-contact type cooling device compared to a topical anesthetic cream for pain relief during laser tattoo removal. The severity of pain was measured using the visual analogue scale (VAS) at the time of tattoo removal. The satisfaction of the subjects with the treatments was also measured.

## Results

The VAS scores of the cryotherapy group ( $4.33 \pm 1.55$ ) were significantly lower than those of the topical anesthetic group ( $7.58 \pm 1.16$ ). Seventy five percent of the subjects reported a willingness to use cryotherapy instead of the topical anesthetic cream.

## Conclusion

These results suggest that the non-contact type cooling device is effective and safe for alleviation of pain during laser tattoo removal.

## Key words

Cryotherapy; Target cool; Pain relief; Laser tattoo removal

Received July 14, 2022  
Accepted August 1, 2022

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## INTRODUCTION

Lasers such as nanosecond Q-switched laser and picosecond laser have been used to be an effective treatment for removing tattoo.<sup>1,2</sup> However, the painful procedure presents a major challenge for laser tattoo removal.<sup>3</sup> The laser induced pain is not alleviated by any topical anesthetic cream and it can be so severe that patient decline to undergo any future laser session. In addition, manifestation of allergic or irritant contact dermatitis due to topical anesthetic cream represents a significant barrier to achieving therapeutic outcomes.

Cooling therapy is therapeutic modality to address the pain relief. It is used for alleviating pain on specific area through topical application such as ice pack or for broader range pain relief through non-topical application such as cold bath, cold massage, refrigerant sprayer, and cold water perfusion.<sup>4</sup> Recently, a non-contact type cooling device (TargetCool™; RecensMedical Inc., Republic of Korea) was introduced providing rapid precision cooling within very short time of approximately 2-3 seconds.

In this prospective split body study, we investigate the efficacy of a TargetCool™ in alleviation of pain during laser tattoo removal.

## SUBJECTS AND METHODS

### Subjects

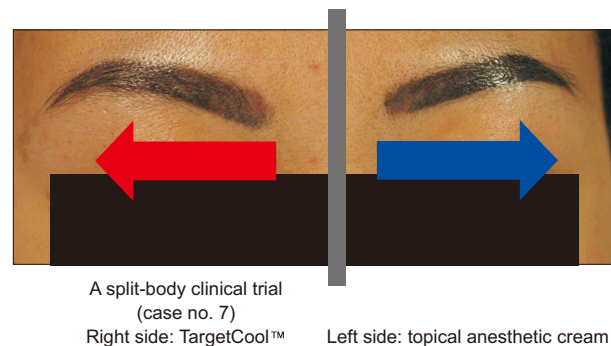
Twelve subjects (2 males and 10 females) aged 24-58 years (mean age:  $38.0 \pm 13.0$  years) with body tattoo were enrolled. This study was approved by the Institutional Review Board of the Chung-Ang University Gwangmyeong Hospital (IRB no. 2208-021-029). All subjects provided written informed consent prior to the study. Subjects who are currently pregnant or breast feeding and hypersensitive to cold temperature were excluded. Tattoos were situated at various parts of the body with 8

subjects with eyebrows tattoo (66.7%) accounting for the largest proportion followed by 2 subjects with tattoos on hand and finger (16.7%) and 1 subject each with tattoo on arm (8.3%) and leg (8.3%).

### Study design

A split-body clinical trial was conducted. TargetCool™ applied on one side of each subject (Treat Arm, TA) and the other side applied topical anesthetic cream (9.6% Lidocaine cream; Ostin Pharmaceutical Co., Republic of Korea) (Control Arm, CA) before laser tattoo removal (Fig. 1). The target cryotherapy temperature using TargetCool™ was set consistently at 2°C with application duration of 3 seconds for each point of application (Fig. 2).

The laser treatment was performed with 1,064 nm picosecond Nd:YAG laser (PICOHI; Hironic Co., Republic of Korea) with parameters of pulse duration of 300 pico seconds, spot size of 4 mm and fluence of 1.5 J/cm<sup>2</sup> to both the control and treatment groups.



**Fig. 1.** A split-body clinical trial. TargetCool™ (RecensMedical Inc., Republic of Korea) applied on one side of each subject (Treat Arm) and the other side applied topical anesthetic cream (Control Arm) before laser tattoo removal.



**Fig. 2.** Laser tattoo removal procedure using TargetCool™ (RecensMedical Inc., Republic of Korea). (A) Case no. 1: A 32-year-old female with leg tattoo. (B) Case no. 2: A 28-year-old female with hand tattoo.

### Assessment

Extent of pain was measured using visual analogue scale (VAS) [scale range: 0-10] at the time of tattoo removal. Subject's satisfaction was asked whether they are willing to use cryotherapy instead of topical anesthetic cream for future laser treatment.

Side effects were evaluated by the investigator by using open questionnaire. Subject was required to describe the subjectively experienced side effects and the investigator evaluated the presence and extent of side effects and adverse events including their causal relationship with the medical device by evaluating objective symptoms.

### Statistical analysis

Statistical analysis was carried out using the SPSS Statistics version 18.0 (IBM Corp., USA). The Student's t-test of SPSS was used to identify variance in the VAS

score at each visit between the tested and control-side. In addition, repeated-measures analysis of variance was used to assess differences in the VAS score over time in each group. A *p*-value of <0.05 was considered to be statistically significant.

### RESULTS

Twelve subjects (2 males and 10 females) aged 24-58 years (mean age: 38.0 ± 13.0 years) with body tattoo completed treatments and assessments (Table 1). Pain during laser tattoo removal was assessed using VAS scores. The VAS scores on the treatment group (TA) (4.33 ± 1.55) were lower than that of the control group (CA) (7.58 ± 1.16) (Fig. 3). This difference was statistically significant, with a *p*-value of less than 0.01.

As the results of evaluation by the subjects on the question of whether they are willing to use cryotherapy instead of topical anesthetic cream for the future laser treatment, 75% of the subjects chose 'want to use slightly' and 'want to use very much', thereby illustrating conspicuously high level of satisfaction (Table 2).

There was no serious adverse events. Two subjects complained of mild tingling sensation.

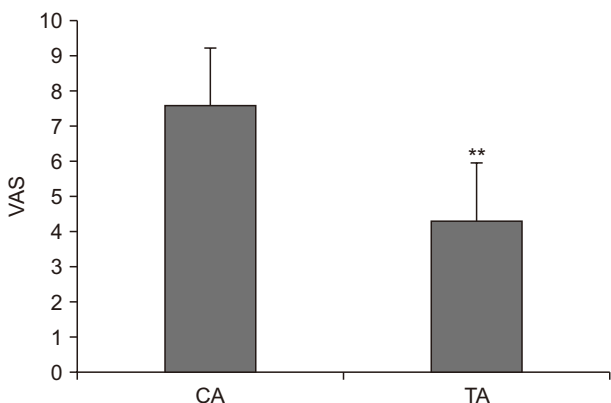
**Table 1.** Demographics and data of included subjects

Subject no.	Sex	Age (yr)	Tattoo location	VAS score	
				CA	TA
1	Female	32	Leg	8	3
2	Female	28	Hand	8	5
3	Female	45	Eyebrow	8	3
4	Male	25	Finger	6	2
5	Female	42	Eyebrow	9	4
6	Male	24	Arm	7	5
7	Female	25	Eyebrow	9	5
8	Female	58	Eyebrow	6	3
9	Female	54	Eyebrow	6	6
10	Female	52	Eyebrow	8	3
11	Female	47	Eyebrow	7	6
12	Female	24	Eyebrow	9	7

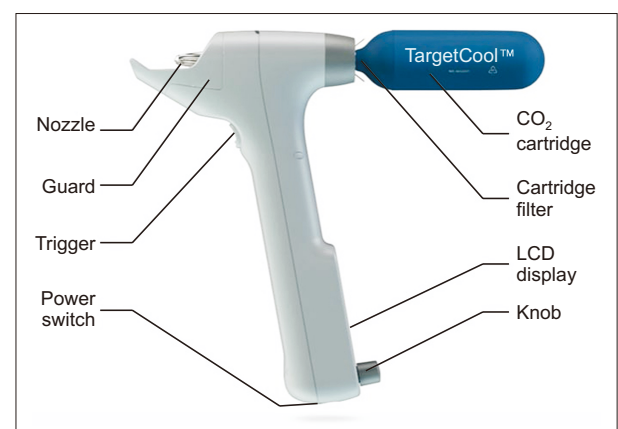
VAS, visual analogue scale; TA, treatment group; CA, control group.

**Table 2.** Subjects' satisfaction score

Range	Results (%)
Do not want to use at all	0
Not keep to use	25
Want to use slightly	25
Want to use very much	50



**Fig. 3.** The visual analogue scale (VAS) scores on the treatment group (TA) (4.33 ± 1.55) were significantly lower than that of the control group (CA) (7.58 ± 1.16). Data are presented as mean ± standard deviation (\*\**p* < 0.01).



**Fig. 4.** TargetCool™ (RecensMedical Inc., Republic of Korea), new cryo-device providing rapid precision controlled cooling. LCD: liquid crystal display.

## DISCUSSION

In the present study, we showed TargetCool™ (Fig. 4) is a safe and useful therapeutic tool for alleviation of pain during laser tattoo removal. The mean VAS score was 7.58 on the control group, suggesting tattoo removal with laser is a painful, not tolerable process and topical anesthetic cream is not enough to control pain during treatment. The effect of TargetCool™ was superior in comparison to the topical anesthetic cream. Also, there was no specific side effects such as contact dermatitis that can occur due to the use of topical anesthetic cream. Moreover, the TargetCool™ is equipped with precision cooling temperature control function for maintenance of consistent temperature. The device provides rapid precision cooling that temporarily anesthetizes skin within very short period of time of approximately 2-3 seconds by controlling the temperature in the unit of 1°C. Built-in Infrared sensor measures the skin temperature in real-time to control consistent temperature throughout the spraying period. Therefore, it prevents unwanted excessive cooling resulting in frostbite or postinflammatory hyperpigmentation, which are common adverse events of conventional cryo-device.

The mechanism of cryotherapy has been suggested to be the reduction of nerve transmission velocity in pain fiber, which could be a means of cryotherapy inducing analgesic effect and pain relief.<sup>5</sup> Numerous previous literatures concluded that cryotherapy significantly reduce both motor and sensory nerve conduction velocity.<sup>6</sup> In addition, it was discovered that nerve conduction velocity decreased at the site of cryotherapy application, thereby increasing the pain threshold and tolerance level.<sup>7</sup> In particular, although the effect on pain threshold and tolerance is extended distally to an area beyond the site of application, it is supplied by the same nerve.<sup>7</sup>

Cryotherapy using TargetCool™ could be useful not only in laser tattoo removal but also for highly diversified applications. The most representative applications include botulinum toxin injection (so-called cryo-toxin) and triamcinolone intralesional injection used for the treatment of dermatology diseases including keloid and alopecia areata. Also, recent study reported that TargetCool™ is also a safe and effective treatment device for alleviation of itch of atopic dermatitis patients.<sup>8</sup>

In conclusion, TargetCool™ is an effective and safe device for alleviation of pain in laser tattoo removal.

## FUNDING

This research was supported by RecensMedical Inc.,

which provided the cryotherapy device.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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## AUTHOR CONTRIBUTIONS

Concept and design: All authors. Analysis and interpretation: SJ, SN. Data collection: SN. Writing the article: JK. Critical revision of the article: KHY, JK. Final approval of the article: KHY, JK. Statistical analysis: SJ. Obtained funding: JK. Overall responsibility: JK.

## REFERENCES

1. Torbeck RL, Schilling L, Khorasani H, Dover JS, Arndt KA, Saedi N. Evolution of the picosecond laser: a review of literature. *Dermatol Surg* 2019;45:183-94.
2. Kim JH, Jung SE, Park YH. Efficacy of a laser with a pulse duration of 300 ps in skin rejuvenation and treatment of pigmentation disorders in Asians: a series of four cases. *J Cosmet Laser Ther* 2021;23:159-62.
3. Lapidoth M, Aharonowitz G. Tattoo removal among Ethiopian Jews in Israel: tradition faces technology. *J Am Acad Dermatol* 2004;51:906-9.
4. Chanliongco PM. Cold (cryo) therapy. In: Lennard TA, Walkowski S, Vivian DG, editors. *Pain Procedures in Clinical Practice*. Philadelphia: Elsevier; 2011. p.555-8.
5. Garcia C, Karri J, Zacharias NA, Abd-Elsayed A. Use of cryotherapy for managing chronic pain: an evidence-based narrative. *Pain Ther* 2021;10:81-100.
6. Herrera E, Sandoval MC, Camargo DM, Salvini TF. Motor and sensory nerve conduction are affected differently by ice pack, ice massage, and cold water immersion. *Phys Ther* 2010;90:581-91.
7. Algafly AA, George KP. The effect of cryotherapy on nerve conduction velocity, pain threshold and pain tolerance. *Br J Sports Med* 2007;41:365-9; discussion 369.
8. Lee EH, Lee HJ, Park KD, Lee WJ. Effect of a new cryotherapy device on an itchy sensation in patients with mild atopic dermatitis. *J Cosmet Dermatol* 2021;20:2906-10.