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ORIGINAL ARTICLE

Cold anesthesia for pain reduction during intralesional steroid injection for nodulocystic acne

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Abstract

Background: In any dermatologic procedure, patient acceptance of treatment is heavily influenced by intraprocedural pain. Intralesional triamcinolone injections are very important in keloid scar and nodulocystic acne treatment. However, the main problem of needle-stick procedures is pain. Cryoanesthesia is ideally intended to cool only the epidermis during treatment and has advantage which did not require application time.

Aims: The aim of this study was to investigate the pain-reducing effect and safety of CryoVIVE® (newly introduced cryoanesthesia device) during triamcinolone injections for nodulocystic acne in actual clinical settings.

Patients/Methods: In this two-staged, non-randomized clinical trial, a total of 64 subjects underwent intralesional triamcinolone injections for their acne lesions with cold anesthesia using CryoVIVE®. The pain intensity was assessed with Visual Analogue Scale (VAS) scores. Safety profile was also evaluated.

Results: The mean pain VAS scores on the lesion with and without cold anesthesia were 3.667 and 5.933, respectively ($p = 0.0001$). No side effects, discoloration, and scarring were observed.

Conclusion: In conclusion, the anesthetic use of CryoVIVE® with intralesional corticosteroid injections is a practical and well-tolerated modality.

KEYWORDS
cryoanesthesia, intralesional triamcinolone injection

1 | INTRODUCTION

According to American Society for Aesthetic Plastic Surgery data, over 3.4 million dermal filler treatments and over 4.4 million botulinum injections were performed in 2020. With increasing demands for facial rejuvenation, the use of cosmetic injectables, such as botulinum toxin, filler, and skin booster injections, has rapidly increased. However, the main problem of needle-stick procedures is pain. Hence, there is an increasing demand for methods to reduce the pain felt during procedures for safety and patient satisfaction.

The most used anesthetic method in dermatology is topical cream, such as 2.5% lidocaine and 2.5% prilocaine (eutectic mixture of local anesthetics, EMLA® cream). After application, anesthesia typically occurs after over 30 min. Anesthetic effect reaches a depth of 3 and 5 mm after 60 and 120 min, respectively, because the application time is directly related to the depth of the anesthetic effect.[1]

Thus, topical anesthetic creams have the problem of requiring application time.

Other anesthetic methods include iontophoresis, cold anesthesia, and vibration anesthesia; however, each method has its own limitations.[2] Iontophoresis of lidocaine for dermatological use is 80%–100% effective in providing anesthesia to intact skin before injections, incisions, abrasions, laser surgery, and cautery.[3] Iontophoresis also requires a typical application time of 10 min.[4]

Cryoanesthesia is ideally intended to cool only the epidermis during treatment and has advantage which did not require application time.[5] However, existing cold anesthesia method lacks ability to control the temperature. Excessive cooling has led to frostbite and other side effects in some cases. CryoVIVE® (RecensMedical), which was recently introduced to the market, is a device that can perform precision cooling by dropping the skin temperature using CO_2 gas. This device also has thermo-sensor-enabled real-time temperature and duration monitoring. However, no clinical studies have evaluated the efficacy and safety of CryoVIVE® for anesthesia during needle-stick procedures. This study aimed to investigate the pain-reducing effect and safety of CryoVIVE® during intralesional triamcinolone acetonide (TA) injections for nodulocystic acne lesions in actual clinical settings.

2 | MATERIALS AND METHODS

The study was approved by the institutional review board of Chung-Ang University Hospital (IRB No. 2205-026-508).

2.1 | Study design

2.1.1 | Stage 1

To determine the safety and efficacy of the device, 34 subjects underwent a non-randomized controlled pilot trial. The subjects received TA injections in acne lesions accompanied with cryoanesthesia.

2.1.2 | Stage 2

The effectiveness and safety of cryotherapy were evaluated using split-face comparison. This prospective study evaluated the effect of cold anesthesia with intralesional TA injections on patient comfort. Thirty adults (age > 18 years) who were scheduled to undergo intralesional TA injections for at least two acne lesions (each on their split-face) were enrolled.

The exclusion criteria for this study were the following: (1) pregnancy or breastfeeding, and (2) any other medical skin condition that could increase the risk of infection. All patients were given written informed consent regarding publication of their details and images.

2.2 | Procedure

Initially, the treatment area was thoroughly cleansed with a gentle skin cleanser. Patients did not receive any other pretreatment for pain management. Patients received 2.5 mg/mL of TA injections using a 30-gauge needle with cold anesthesia using a portable cryotherapy device CryoVIVE®, with the temperature setting within 0–3°C, allowing for slow cooling on the one site. Patients received only TA injection without cryoanesthesia on the other side. The device is ergonomically designed to allow the physician to inject with one hand while holding the device with the other (Figure 1). Contact tip of CryoVIVE® was disinfected with benzalkonium chloride cleaner before and after use to prevent contamination.

2.3 | Evaluation

Pain intensity was evaluated using the Visual Analogue Scale (VAS) (0 = absence of pain, 10 = most severe pain) during both treatments with and without cold anesthesia. Pain assessments were performed immediately after the procedure. Overall patient satisfaction scores (scale, 0–10) were also obtained after the treatment. Any adverse events, such as dyspigmentation, pain, erythema, blistering, and edema, were observed and reported by both subjects and physicians during the laser treatment and at each visit.

2.4 | Statistical analysis

In Stage 2, the paired t-test was used to compare the score between lesions treated with and without forced cold anesthesia with SPSS 26.0 (SPSS Inc.) program. p-values <0.05 were considered statistically significant.

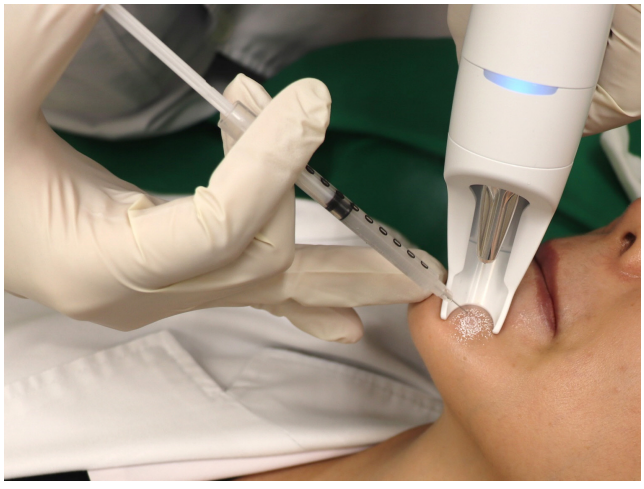

FIGURE 1 Photograph showing intralesional injection of triamcinolone with cryoanesthesia using Cryovive®.

3 | RESULTS

3.1 | Stage 1

In total, 34 patients were treated with TA injections. The mean VAS score for during TA injection with the cold anesthesia device was 2.80±0.79. Side effects, such as erythema, edema, and crusting, were not observed. Since there were no safety issues, Stage 2 was proceeded.

3.2 | Stage 2

In total, 60 acne lesions in 30 patients were treated with TA injections. The mean VAS score during treatment without cold anesthesia was 5.933±2.03. In contrast, the mean VAS score for the same patients during TA injection with the cold anesthesia device was 3.667±2.23, which was significantly lower ($p<0.05$) (Figure 2). The mean subjective satisfaction scores on the lesion with and without cold anesthesia were 3.867 and 2.5, respectively ($p=0.0004$). No side effects including discoloration or scarring were observed.

4 | DISCUSSION

Corticosteroid injections have been commonly performed since 1961 across a variety of medical specialties, including dermatology, rheumatology, and orthopedics.[6–8] In acne treatment, intralesional corticosteroid injections effectively reduce inflammation of individual acne lesions.[6] Despite common use, severe intraprocedural pain reduces patient satisfaction and compliance. There are few available anesthetic options for painful injection procedures; however, the ideal method remains unknown. The ideal anesthetic should provide painless, effective analgesia with rapid onset, prolonged duration, and minimal side effects.[4]

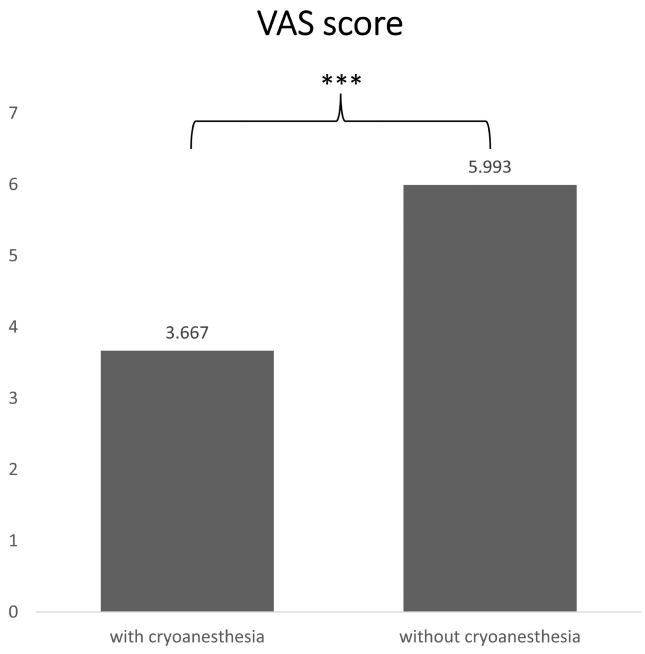

FIGURE 2 Patients' self-assessed pain score during intralesional triamcinolone injection by Visual Analogue Scale (VAS) score with and without cryoanesthesia. The pain score significantly decreased after applying cryoanesthesia (***$p<0.001$).

In the field of dermatology, topical EMLA® cream is the most commonly used anesthetic.[9] However, EMLA® cream is time-consuming because of its slow onset of analgesic effect and it can also induce tingling, burning, and pulling sensations. Meanwhile, for the last two decades, cryoanesthesia has gained interest as a convenient and relatively noninvasive pain-control modality in dermatology.[10] Cryotherapy decreases the temperature of the skin and underlying tissues 2–4 cm deep, decreasing the activation threshold of tissue nociceptors and the conduction velocity of pain nerve signals, thereby eliciting a local anesthetic effect.[11] One advantage of cryoanesthesia is that it does not require application time; instead, it induces an anesthetic effect nearly immediately after application. The vasoconstriction caused by cooling also helps reduce the risk of post-procedure edema and bruising.[12]

Previously introduced to the market, Ethyl Chloride® (Gebauer Company) delivered through a propellant spray is one cryoanesthesia medium. Upon contact with skin, it vaporizes, causing a transient drop in local temperature to between −10 and −20°C, and inducing immediate anesthesia on the affected skin through nerve receptor desensitization.[4] Liquid nitrogen has also been used as a cryoanesthesia medium. However, the most important disadvantage of cryoanesthesia is the possibility of frostbite. Prolonged freezing can lead to dyspigmentation or atrophic scarring.[10]

In contrast, CryoVIVE® has a relatively low possibility of side effects such as frostbite or dyspigmentation through monitoring and maintaining the skin temperature via real-time thermo-sensor. Unlike hyperthermic exposure, the cold temperature itself does not cause cell damage, and ice formation inside or outside the cell causes cell damage.[13] When cells are cooled below the freezing point, reaching −10 to −18°C, ice formation occurs, causing lethal cell and tissue damage. Therefore, real-time temperature monitoring can reduce the risk of frostbite. With this method, the danger of frostbite is significantly less than that with traditional cryoanesthetic methods. Some refrigerants have harmful effects associated with the ozone layer, whereas CO_2 gas is usually safe. Moreover, rapid evaporation prevents intense and prolonged skin contact, consequently reducing contact sensitization. Another advantage is that the device is small and light enough to be held in one hand, allowing for one-handed cooling and one-handed injection. This anesthetic method provides tolerable treatment for patients through an excellent safety profile, high level of patient acceptance, and ease of use.[5]

Our study shows that the cryoanesthesia reduces pain without any observed adverse events. Moreover, CryoVIVE® improves pain sensation with intralesional corticosteroid injections. Some reports have suggested local anesthetic methods for reducing pain followed by steroid injections. Wang et al.[10] compared pain induced by TA with and without prior application of the cryotip to treat keloid scars. Average

VAS pain scores were significantly lower ($p < 0.01$) in the treated group than in the control group (2.7 ± 1.37 vs. 7.87 ± 1.31, respectively). Usanakornku et al.[14] showed that the mean VAS scores of TA injections for keloid treatment in the control, lidocaine, topical (EMLA®), and combined groups were 4.18 ± 2.12, 3.82 ± 2.48, 2.03 ± 2.02, and 2.20 ± 1.99, respectively. Park et al. reported that the mean VAS scores during intralesional TA injection in keloid therapy without and with vibration anesthesia were 5.88 ± 2.34 and 3.28 ± 1.85, respectively.[2]

All other studies comparing TA injection pain in keloid treatment without anesthetic use showed average VAS pain scores of 4.18–7.8 which is similar score with our study.[10,14] Each anesthetic method reduced pain about 50%. Our study investigated the pain-reducing effects of cryoanesthesia about 40% of the pain during TA injections for acne lesions, showing favorable pain-reducing efficacy.

Our study had limitations. We evaluated pain-reducing efficacy of CryoVIVE® compared to a control group without any anesthetic preparation. For instance, we could have further minimized the placebo effect by using a sham cooler to blow room-temperature air over the skin before the injection, which would have served as a control. Additionally, randomizing the order of real and sham cryoanesthesia could have improved the study design. We plan to address these limitations in future research by conducting studies with larger sample sizes.

In conclusion, the anesthetic use of CryoVIVE® with corticosteroid injections is a practical, well-tolerated modality that minimizes discomfort during dermatological procedures, in the absence of any other anesthetic methods.

AUTHOR CONTRIBUTIONS

Kui Young Park and Nark Kyoung Rho involved in conceptualization; Su Jung Park involved in data curation; Sun Hye Shin and Young Gue Koh involved in formal data analysis; Gun-Ho Kim involved in funding acquisition; Kui Young Park and Nark Kyoung Rho involved in investigation and project administration; Sun Hye Shin involved in methodology; Gun-Ho Kim involved in resources. Nark Kyoung Rho involved in supervision. Kui Young Park involved in validation; Young Gue Koh involved in visualization; Su Jung Park involved in writing–original draft preparation; Sun Hye Shin, Kui Young Park, and Nark Kyoung Rho involved in writing–review and editing.

ACKNOWLEDGMENT

The authors have nothing to report.

CONFLICT OF INTEREST STATEMENT

Nark Kyoung Rho and Kui Young Park have served as advisors for RecensMedical Inc. Gun-Ho Kim is Chief Executive Officer of RecensMedical Inc. The remaining authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

The patients in this manuscript have given written informed consent to publication of their case details. The study protocol was approved by the institutional review board (IRB) of Chung-Ang University Hospital (IRB number: 1920-002-398).

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REFERENCES

1. Tadicherla S, Berman B. Percutaneous dermal drug delivery for local pain control. *Ther Clin Risk Manag*. 2006;2(1):99-113.
2. Park KY, Lee Y, Hong JY, Chung WS, Kim MN, Kim BJ. Vibration anesthesia for pain reduction during Intralesional steroid injection for keloid treatment. *Dermatol Surg*. 2017;43(5):724-727.
3. Maloney JM, Bezzant JL, Stephen RL, Petelenz TJ. Iontophoretic administration of lidocaine anesthesia in office practice. An appraisal. *J Dermatol Surg Oncol*. 1992;18(11):937-940.
4. Huang W, Vidimos A. Topical anesthetics in dermatology. *J Am Acad Dermatol*. 2000;43(2 Pt 1):286-298.
5. Tierney EP, Hanke CW. The effect of cold-air anesthesia during fractionated carbon-dioxide laser treatment: prospective study and review of the literature. *J Am Acad Dermatol*. 2012;67(3):436-445.
6. Gallagher T, Taliercio M, Nia JK, Hashim PW, Zeichner JA. Dermatologist use of Intralesional triamcinolone in the treatment of acne. *J Clin Aesthet Dermatol*. 2020;13(12):41-43.
7. Pariser H, Murray PF. Intralesional injections of triamcinolone. Effects of different concentrations on psoriatic lesions. *Arch Dermatol*. 1963;87:183-187.
8. Firooz A, Tehranchi-Nia Z, Ahmed AR. Benefits and risks of intralesional corticosteroid injection in the treatment of dermatological diseases. *Clin Exp Dermatol*. 1995;20(5):363-370.
9. Lee JJ, Rubin AP. EMLA cream and its current uses. *Br J Hosp Med*. 1993;50(8):463-466.
10. Wang X, Wu X, Liu K, et al. Topical cryoanesthesia for the relief of pain caused by steroid injections used to treat hypertrophic scars and keloids. *Medicine (Baltimore)*. 2017;96(43):e8353.
11. Nadler SF, Weingand K, Kruse RJ. The physiologic basis and clinical applications of cryotherapy and thermotherapy for the pain practitioner. *Pain Physician*. 2004;7(3):395-399.
12. Ernst E, Fialka V. Ice freezes pain? A review of the clinical effectiveness of analgesic cold therapy. *J Pain Symptom Manage*. 1994;9(1):56-59.
13. Fowler A, Toner M. Cryo-injury and biopreservation. *Ann N Y Acad Sci*. 2005;1066:119-135.
14. Usanakornkul A, Burusapat C. A topical anesthetic and lidocaine mixture for pain relief during keloid treatment: a double-blind, randomized controlled trial. *Dermatol Surg*. 2017;43(1):66-73.

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