RESEARCH ARTICLE

A Comparative study between the efficacy of combined Intense Pulsed Light plus high-intensity focussed ultrasound in the treatment of atrophic and icepick scars

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Abstract

Objective: To investigate the efficiency of high-intensity focussed ultrasound with intense pulsed light in the treatment of atrophic and icepick acne scars.

Method: The interventional study was conducted between November 2021 and April 2022 at the Postgraduate Medical Physics Laboratory, Mustansiriyah University, Baghdad, Iraq, and comprised patients with atrophic scars in group A and acne scars in group B. They were treated first with intense pulsed light and then with high-intensity focussed ultrasound. All patients received 4 treatment sessions spread over 4 weeks. Outcome assessment was done using Patient and Observer Scar Assessment Scale. Data was analysed using SPSS software version 24.

Results: Of the 22 patients, 12(55%) were males with mean age 20.75±4.20 years, and 10(45%) were females with mean age 21±2.05 years. The combination technique showed significant outcomes compared to baseline ($p<0.05$). Atrophic scars exhibited significantly greater improvement compared to icepick scars ($p<0.05$). There was no significant difference between the overall opinion of the observer ($p=0.3549$) and the patients ($p=0.0956$).

Conclusion: The high-intensity focussed ultrasound and intense pulsed light techniques used in combination was found to be effective in treating atrophic and icepick scars.

Key Words: Cicatrix, Acne Vulgaris, Acne scars

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Introduction

Scars caused by atrophic acne are further subdivided into icepick, rolling, and shallow or deep boxcar categories[1]. Because of the healing process of all kinds of active acne, inflammation-induced acne may cause persistent facial scarring, which is a risk factor for poor scholastic performance, unemployment, depression and dysmorphophobia, leading to even suicide[2]. Acne scars created by atrophic acne are further classified into icepick, rolling, shallow boxcar and deep boxcar scars[3]. Intense pulsed light (IPL) treatment is often used to enhance the appearance of aging skin. This device was introduced in 1994 as a therapy option for leg telangiectasias, but its adverse effect profile restricted wide applicability[4]. Over time, this technology has become safer and simpler to operate, allowing it to be used in more clinical settings. IPL is now widely used for non-ablative skin rejuvenation, photo epilation and pigmented and vascular lesions[5,6]. The clinical acceptability of a novel ultrasound treatment is growing fast. This is called focussed ultrasound surgery, or high-intensity focussed ultrasound (HIFU)[7]. As the name implies, the method involves focussing an ultrasonic beam away from the transducer. Using ultrasound at megahertz frequencies allows this[8]. Wang et al.[9] found that IPL treatment significantly reduced inflammatory lesions and improved atrophic scarring. About 90% of patients improved significantly or moderately overall, and nearly 80% patients assessed treatment outcomes as great or good.9 HIFU is an energy-based device that establishes separate thermal coagulation spots in the dermis and subcutaneous tissue. At focal spots, the heat generated reaches temperatures >60°C, and generates micro-coagulation zones <1mm.[3] This results in collagen production. Denaturation and contraction is followed by de novo collagen synthesis and tissue regeneration[10,11]

The current study was planned to explore the clinical efficacy of HIFU plus IPL in the treatment of atrophic and icepick acne scars.

Materials and Methods

The interventional study was conducted between November 2021 and April 2022 at the Postgraduate Medical Physics Laboratory, Mustansiriyah University, Baghdad, Iraq. The research was explained to all the participants and informed written consent was obtained from all patients. The ethics committee of the college of

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medicine, Mustansiriya University, 2022) approved the study. The sample for the study was raised using consecutive nonprobability sampling technique. Those included were adult patients with acne scars with no recent acneiform eruptions and not having received any local therapy for the scar in the preceding 3 months or exposed to any type of laser at all. Those excluded were pregnant and nursing women, patients with other types of a scar than keloid or hypertrophic, patients with infected scars, patients who had received any topical therapy, laser and HIFU treatment in the preceding 1 month. The enrolled patients with atrophic scars in group A and icepick scars in group B. Demographic and clinical data was collected using a questionnaire. Each group received IPL (Fuqeng Medical Technology Co. Ltd.; Hong Kong), followed by HIFU (model Ulthera manufactured by Handel Kurea, China). First, a baseline pre-treatment picture of each patient was taken with camera (Canon 20 Megapixels, China) and light ring for more visual clarity. A dermatologist assessed the score of patients for the treated area before and after each session by using Patient and Observer Scar Assessment Scale (POSAS).[12]

All male patients had to have a clean face before any treatment. For females, the makeup was removed. A water gel was carefully applied on the selected facial areas, with the patient and the therapist wearing protective eyewear. The patients were first treated with IPL 30Joule/cm2, and after about 20 minutes of relaxation, the HIFU therapy began with 30-40J/cm^2. Patients received 4 treatment sessions spread over 4 weeks. Baseline and post-intervention POSAS scores related to vascularity, pigmentation, thickness, relief, pliability and surface area were compared.

Data was analysed using SPSS 24. P<0.05 was considered significant.

Results

Of the 22 patients, 12(55%) were males with mean age 20.75±4.20 years, and 10(45%) were females with mean age 21±2.05 years. There was a highly significant difference between baseline and post-intervention scores for atrophic patients for domins (Figure 1). Significant healing was also observed in patients with icepick scars among whom vascularity and pigmentation scores were

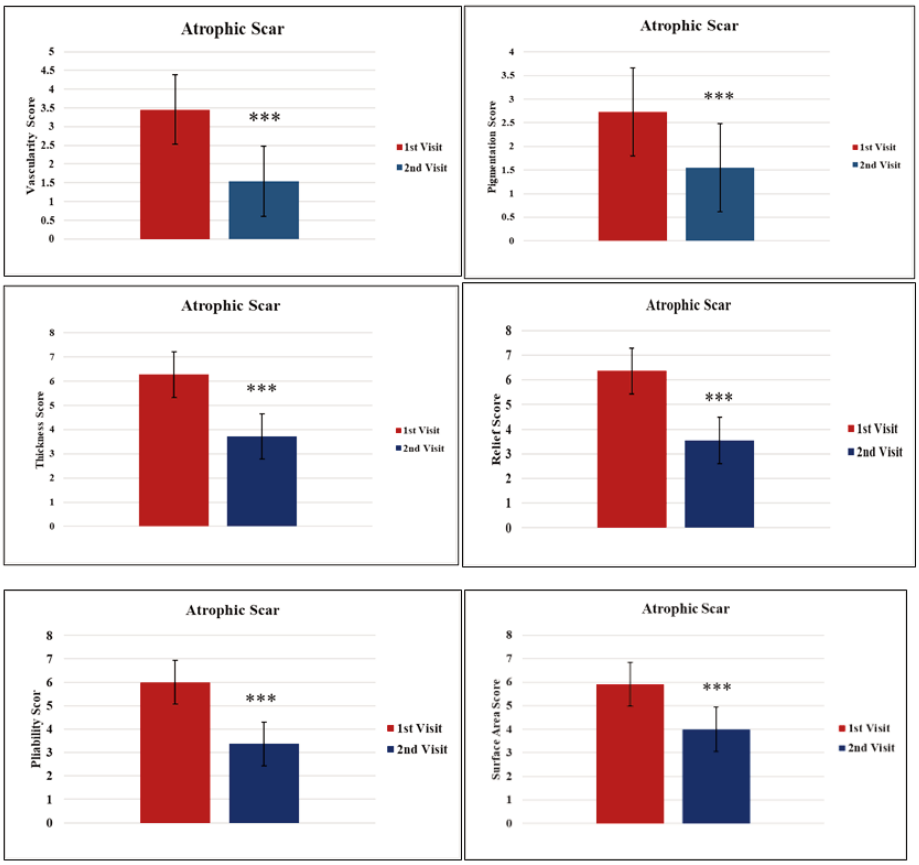

Figure-1: Vascularity (A), Pigmentation (B), Thickness (C), Relief (D), Pliability (E), and Surface Area (F) scores for patients with atrophic scars. (* = P<0.05, **= P<0.001, ***= P<0.0001).

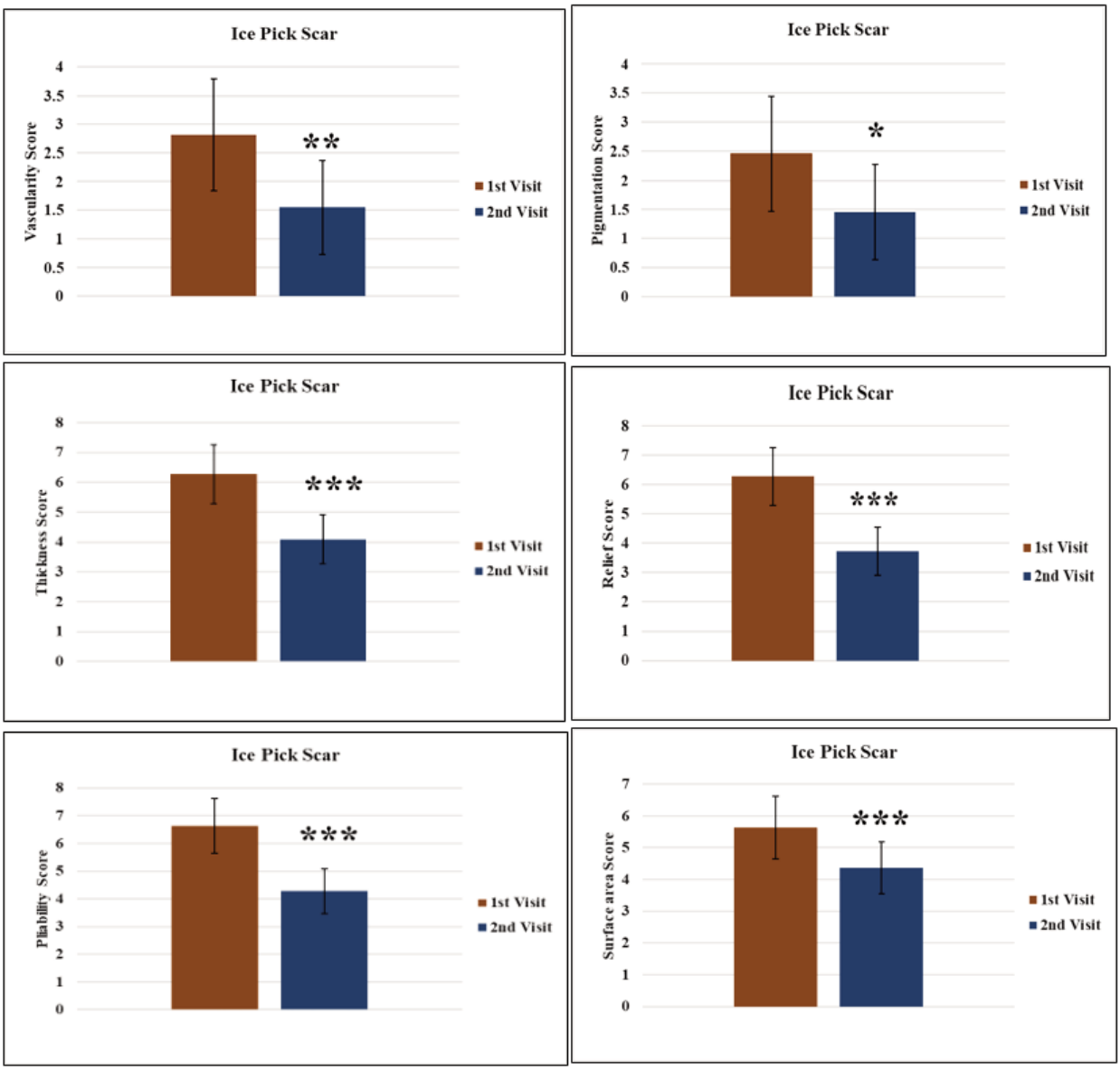

Figure-2: Vascularity (A), Pigmentation (B), Thickness (C), Relief (D), Pliability (E), and Surface Area (F) for patients with icepick scars. (* = P<0.05, **= P<0.001, ***= P<0.0001)..

less significant than the other scores (Figure 2).

Patients with atrophic scars had a better healing effect than those with icepick acne scars (Figure 3).

There was no significant difference between the overall opinion of the observer (p=0.3549) and the patients (p=0.0956).

Discussion

The indication of HIFU is to treat skin malformation[13], while the IPL treats hypertrophic and keloid acne scars over 5 or more sessions[14]. Atrophic and icepick scars are the two most prevalent forms of scars. According to Bagatin et al., post-adolescent acne in females can be split into two types: persistent acne, which refers to acne that persists from adolescence into adulthood, and late-onset acne, which characterises severe acne that appears later in life. Each of these kinds of acne in adult females has a slightly different clinical presentation than typical adolescent acne[15]. Wrinkle reductions, straightening saggy skin on the neck (also known as turkey neck), raising the cheekbones, eyebrows and eyelids, increasing jawline definition, tightening the décolletage, and smoothing the skin are just a few of the cosmetic benefits of HIFU.

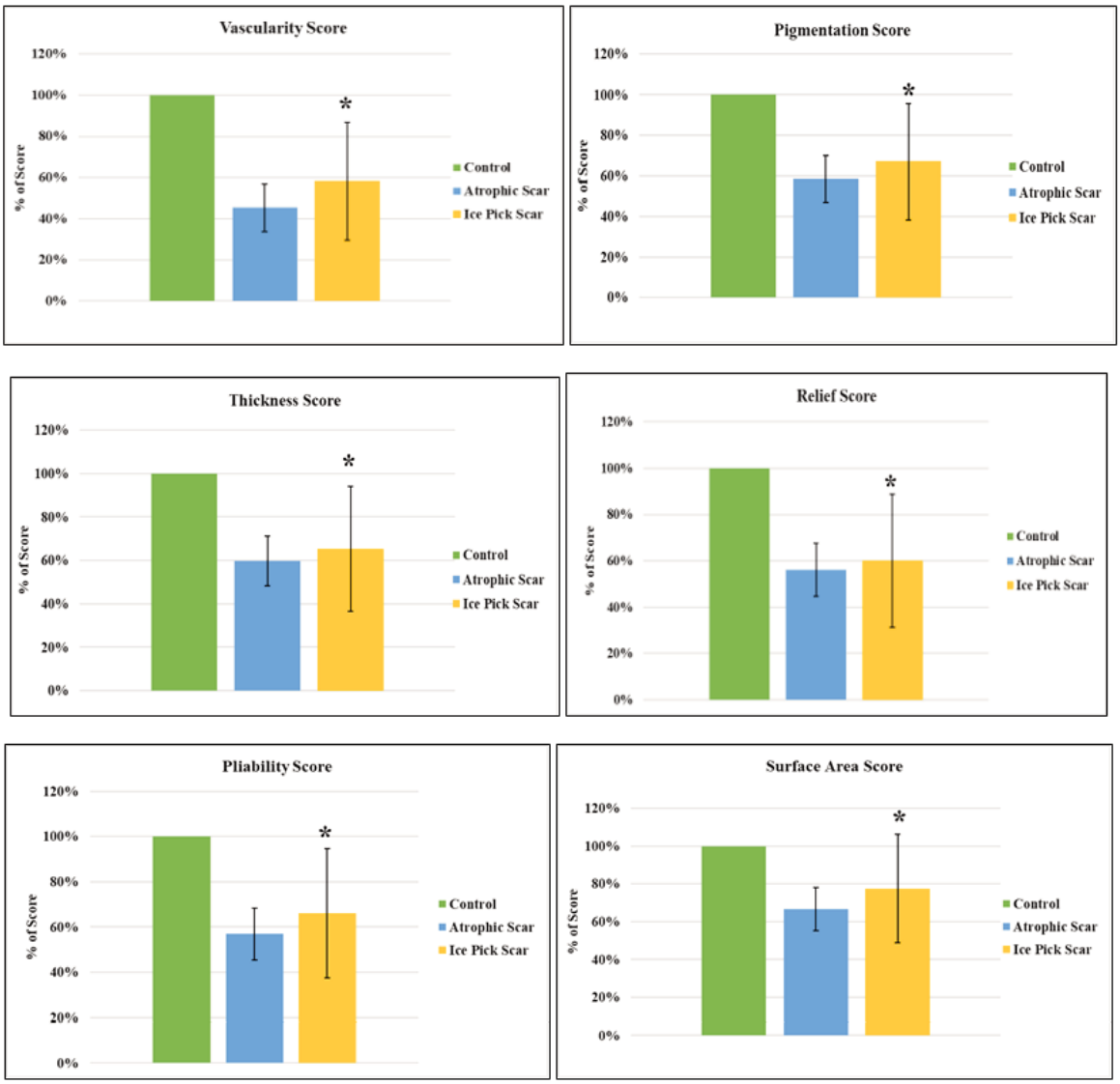

Figure-3: Comparison of the atrophic, and icepick scar groups with respect to vascularity (A), Pigmentation (B), Thickness (C), Relief (D), Pliability (E), and Surface Area (F) . (* = P<0.05, **= P<0.001, ***= P<0.0001).

The current study applied the IPL in the first session on acne scars, and after 20 minutes, the HIFU was applied. According to POSAS scores, atrophic scars healed better, and the skin became smoother after 4 sessions. Daoud et al.[16] demonstrated the efficacy of combining IPL and fractional ablative carbon dioxide (CO2) laser therapy in a single session versus fractional ablative CO2 laser treatment alone or control groups. Compared to their results,[16] the current study showed that combining IPL with HIFU resulted in significant improvement across a wider number of scar domains, and there were no side effects, except for the pain linked to IPL treatment which was temporary, and vanished soon after the end of the session.

IPL has a significant anti-inflammatory impact on lesions, skin pigmentation and redness, as well as sebum production on the surface level, and it has been claimed that the visible light wavelength of IPL is primarily the bacterium Propionibacterium (P.) acnes which is targetted in order to activate endogenous porphyrins[17]. Judicious IPL use can target melanin and haemoglobin, and successfully treat vascular and pigmented lesions of the skin. In addition, IPL stimulates the activation of fibroblasts. Collagen and extracellular matrix synthesis result is reduced atrophic scarring. The IPL treatment decreased atrophic scarring and reduced skin redness and pigmentation and dermatologist's evaluation and approximately 90% patients saw a significant or moderate

improvement in their overall health[18].

HIFU was a safe and effective treatment for atrophic scar acne in the current study in which HIFU was used with a 10MHz (0.30J) transducer at 1.5mm focal depth. This significantly improved wrinkles and skin texture, suggesting that HIFU was able to regenerate collagen, was effective in regenerating dermal tissue and in increasing the vascularity of the targeted tissue. No complications were recorded after the treatment, indicating that both IPL and HIFU in combination were safe.

Limitation: The current study has limitations as the sample size was not calculated which could have affected the power of the study.

Conclusion

The new developing technique using HIFU and IPL in combination was found to be effective in treating atrophic and icepick scars, especially the atrophic ones, in shorter time duration than the two techniques when used alone.

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Conflict of Interest: None.

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