NeoGen Nitrogen Plasma Skin Regeneration: Biophysical and Visible Skin Results

Plasma skin regeneration emerged 20 years ago as an effective alternative to traditional energy-based treatments, with NeoGen Plasma leading the market for the last 12 years. Unlike light-based treatments that rely on chromophores for heat generation, NeoGen Plasma is non-ablative, non-invasive, and does not depend on chromophores. The treatment provides a *distinct blend of resurfacing and regenerative actions to the epidermis and dermis*, with noticeable and quantifiable enhancements to the key aging and environmentally damage skin factors.

"Non-ablative, non-invasive and not chromophore dependant"

NeoGen generates plasma from inert nitrogen gas which is subjected to ultra-high frequency microwaves. When directed onto the skin, the plasma transfers energy to the skin's surface, causing instantaneous heating and tissue contraction without vaporisation or charring [1]. The heated epidermis remains intact, acting as a natural *dressing* to the treated area, providing protection during the healing phase. The heat stimulates cell growth factors and initiates a wound healing response that generates a smoother, healthier epidermis with fewer blemishes. Moreover, within the dermis, the impact of treatment promotes new collagen remodelling, enhancing the skins structural foundation.

The clinician can control NeoGen's thermal output, targeting specific depths in the epidermis and dermis, and choosing single or multiple treatments based on patient needs

Over 300,000 treatments performed worldwide, with circa 30 Institutional Review Board clinically controlled studies carried out to support clinical outcomes.

NeoGen Plasma treatment can be performed on the face and body, including delicate areas such as the perioral and periorbital zones, improving the common signs of aging by addressing fine lines, moderate to deep wrinkles, sun damage, uneven skin tone, pore size, acne scars and improving skin firmness/tightening*.

FDA cleared to treat 7 approved indications on the face and body [2]

Extensive clinical evidence, including circa 30 peer-reviewed studies, support nitrogen plasma skin treatment. These studies have validated its mechanism of action and demonstrated consistent, progressive skin regeneration results, even for higher melanin content skins.

- ⇒ **Tightens Skin**
- ⇒ **Fine Lines & Wrinkles**
- ⇒ **Acne Scars**

In 2005 Kilmer *et al* introduced the results of their pilot study on 24 patients having full face treatment with the plasma skin device, with histology comparing baseline skin condition to that 90 and 180 days after the procedure [3]. All patients demonstrated improvement in skin tone, texture, wrinkles and dyschromia with progressive improvements in all endpoints at Day 90 follow-up. In the same year Potter *et al* shared the findings of their investigation using the technology for the treatment of wrinkles and acne scars [4]. Objective measurement of wrinkle depth was evaluated using silicone moulding and found a significant decrease in wrinkle and acne scar depth of 39% and 35% respectively, after a single treatment. In 2008, Gonzalez *et al* undertook a double-blind study on 10 patients having a single treatment, which resulted in an average of 34% improvement in acne scarring, results which maintained,

without further intervention, 6 months post-procedure [5].

⇒ **Reduce Pore Size**
⇒ **Reduce Puffiness**

By not relying on skin chromophores, treatments are safe for higher Fitzpatrick skin types, achieving the necessary thermal injury in the papillary dermis to result in collagen remodelling without any permanent pigmentary or textural changes [1]. Results further supported by the randomised controlled study results presented by Theppornpitak *et al* in 2019, reporting improvement of periorbital wrinkles in Thai skin [6]. This split-face study on 18 patients showed significantly better improvement for wrinkles and skin melanin index in the treated side compared to the untreated controlled side of the face.

⇒ **More Even Skin Tone**
⇒ **Treat Skin Lesions**

At the end of 2024, Cutest Systems Ltd (Cardiff, Wales), an independent Contract Research Organisation in dermatology, pharma, and medical devices, conducted a study to investigate the facial skin improvement benefits of three monthly NeoGen plasma treatments at various settings, with a follow-up 30 days after the final treatment [7]. 12 patients were included in this study, male (n=3) and female (n=9), with a mean age of 54 (ranging from 39 to 69). Changes to wrinkles, skin texture, pores, blemishes, and pigmentation were assessed using the Canfield Visia II Photography system, while volume parameters were quantified with the EOTech Evaface 3D Imaging system. Additionally, skin elasticity, firmness, and collagen content were measured using Cutometer and Ultrasound techniques.

Statistically significant improvements were observed in various biophysical properties and visible surface appearance. Dermal density and skin firmness increased, indicating that NeoGen Plasma stimulates dermal remodelling for firmer skin. These findings also included reductions in wrinkle and facial fold depths, consistent with firmer skin and a restructured dermal foundation. Additionally, significant reductions in hyperpigmentation, redness and skin texture were measured, demonstrating the treatment ability to visibly improve the skins exterior, making the enhancements noticeable to the naked eye.

Patients graded their overall improvement in skin health after each treatment and at the 30-day follow up, with 100% of treatments rated as improving skin condition by at least 25% compared to skin health prior to that appointment. This rolling improvement after each treatment session also continue to be observed after treatments had concluded at the 30-day follow up, as might be expected as collagen remodelling continues. 82% of patients saw noticeable improvement in the texture of their skin and reduction in the appearance of pores. 64% noted a visible reduction in pigmentation more than one third of the group even remarked on visible improvements to acne scars or other types of scarring present. Changes were most visible in the cheek, forehead and eye anatomies. 73% of the treatment group described themselves as being more confident as a result of having treatment.

“82% of patients reported noticeable changes to the texture of their skin and reduction in the appearance of pores.”

These epidermal and dermal changes were made with minimal downtime, the maximum reported recovery time after any treatment was 4-6 days with 64% of patients recording recovery within 3 days. Reported side effects were some swelling in 2 subjects. All patients found the treatment tolerable with 73% of them indicating it was only slightly uncomfortable or had no discomfort at all.



Fig 1: *Full face at baseline and 30 days after 3 medium energy (1.0-1.5 Joules) treatments show a reduction in the appearance of wrinkles and A more even skin tone with a noticeable reduction in red areas.*



Fig 2: *Full face at baseline and 30 days after 3 medium energy (1.0-1.5 Joules) treatments showing epidermal changes and reduction of hyperpigmentation.*



Fig 3. *Dermal remodelling, reduction in appearance of lip lines, before and 30 days after three low energy (0.7-0.8 Joules) treatments*



Fig 4: *Improved appearance of periorbital area and increase in the density of the cheek folds at 30 days following 3 medium energy (1.0-1.5 Joules) treatments.*

NeoGen White Paper, March 2025. Freeman, Donna.

Key study findings:
NeoGen plasma treatment provides a distinct blend of resurfacing and regenerative actions on and below the skins surface:
(1) Rapid visible surface improvement to the epidermis:
- Improvement in Skin Texture (Smoothness)
- More Even Skin Tone – 9% reduction in brown pigmentation, 8% reduction in redness
(2) Longer term regeneration effects to remodel the Dermal foundation
- Skin density increased by an average of 80%
- Improvement in Elasticity and Firmness by 21%
- Wrinkle depth reduction by an average of 54% in cheek, 22% in Lip lines, Nasolabial fold volume decreased by an average of 6%

Measurements on this patient group continue and data at 6-months post the last treatment will be reported shortly to highlight the *long-term* benefit of NeoGen Plasma.

A secondary objective of this study was to evaluate the outcomes of different energy parameters for treatment. Although the cohort size was too small to establish statistically significant trends, it highlighted that visible clinical effects are achieved with both low and medium energies. It also suggested that three low-energy sessions could produce similar results to a single medium-energy treatment**. This finding is valuable for clinicians when tailoring treatment plans to individual patient skin requirements, allowing precise thermal modification and minimizing side effects (see Fig 3).

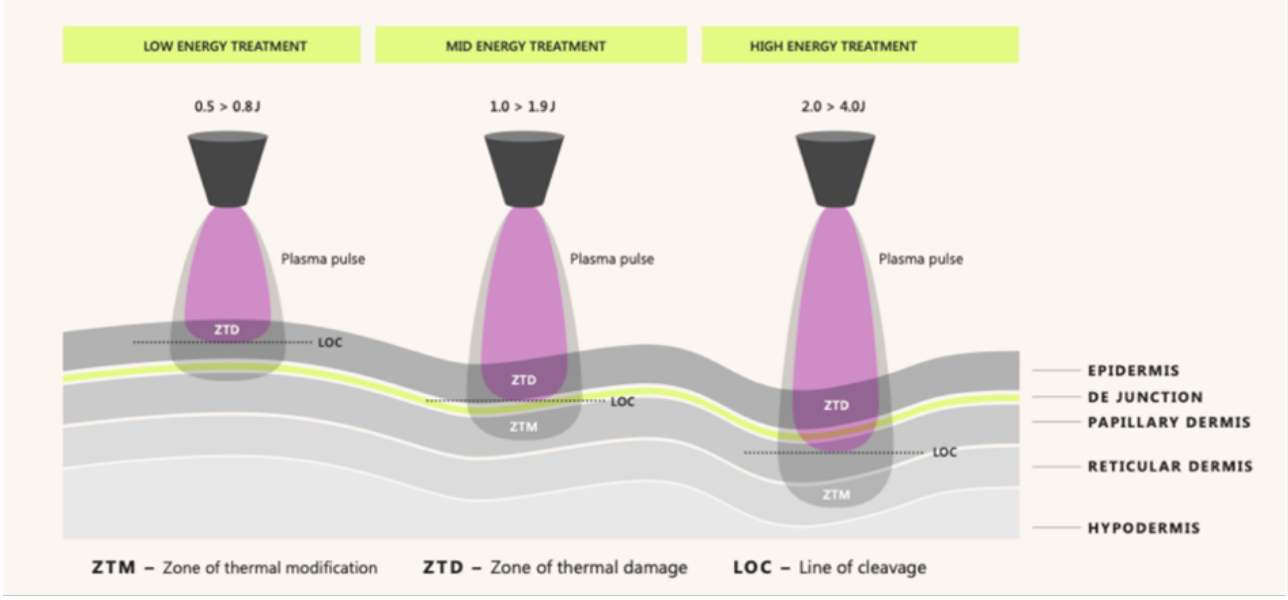


Fig 3. Focal effect of varying energy parameters of NeoGen Plasma

Further imaging and skin measurements will continue to expand on these pilot learnings. The NeoGen Plasma system demonstrates significant improvement in skin biophysical properties and appearance. It consistently delivers reproducible results in skin resurfacing and tightening, making it a valuable addition to your practice toolkit.

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References:

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* Tissue tightening via soft tissue coagulation
** Data on File