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## **"An innovative lifting serum that mimics the effect of microcurrents home devices to improve skin appearance"**

**Tamara Martínez<sup>1\*</sup>, Elisa Suñer<sup>2</sup>, Mayra Camarasa<sup>3</sup>, and Nerea Tielve<sup>3</sup>,**

<sup>1</sup> Medical ; <sup>2</sup>Corporative; <sup>3</sup> R&D; Martiderm, Barcelona, Spain

### **1. Introduction**

Facial ageing is a multifactorial process whereby intrinsic and extrinsic factors lead to a progressive loss of structural integrity and physiological function of the skin. It is characterized by the appearance of wrinkles, skin laxity, hyperpigmentation, thinning epidermis, and progressive dermis' atrophy [1].

As the global population continues to age and consumer interest grows, there is increasing focus on strategies aimed at delaying visible signs of skin ageing, such as sagging, deep wrinkles, and loss of elasticity [2]. Skin rejuvenation can be achieved in several ways, ranging from laser and device-based treatments to chemical peels and injectables; however, topical skin care regimes are a mainstay treatment for ageing skin and all users seeking skin rejuvenation can benefit from this relatively low-risk intervention [3].

In this context, home anti-ageing beauty devices have gained widespread popularity among consumers due to their low cost, convenience, and personalization advantages. These devices utilize technologies such as radiofrequency, LED, and microcurrent to achieve the improvement of skin ageing through the effects of light, heat, and electric stimulation on different layers of the skin [4-5]. Microcurrent utilizes low- to medium-frequency pulsed electric currents to generate an electric field as it passes through the skin. This stimulation affects the skin, subcutaneous tissues, and muscles, achieving anti-ageing effects such as skin tightening, wrinkle reduction, and improvement of facial contours [6].

Regarding topical treatments, while topical tretinoin—available only by prescription and widely regarded as the clinical gold standard—remains the most effective treatment for skin rejuvenation, a new class of hybrid 'cosmeceutical' products has emerged, occupying an intermediate space between conventional cosmetics and pharmaceuticals [3] including those that contain retinoids, peptides and antioxidants, mainly.

Naturally occurring peptides found in the human skin can serve particular biological activities and play roles as signaling molecules of various physiological processes such as homeostasis,

growth, defense or immunity. Researchers consider peptides either promising compounds with potential applications in human diagnosis, therapy or cosmetics [7]. Peptides have played a significant role in cosmeceuticals since 1973, beginning with the GHK tripeptide, which enhances collagen production and wound healing. Since then, numerous peptides have been developed to stimulate extracellular matrix (ECM) protein synthesis and skin regeneration. Notable examples include KTTKS, which boosts collagen production, and GEKG, which promotes ECM deposition and improves skin texture. PKEK targets pigmentation by modulating inflammatory and melanogenic pathways. Neurotransmitter-inhibiting peptides like mimic botulinum toxin effects, reducing wrinkles safely. These peptides, often combined with other active ingredients, have shown clinical efficacy in improving skin appearance, elasticity, and pigmentation with minimal side effects [3].

The objective of this study was to formulate and evaluate the antiageing efficacy of an innovative lifting serum that mimics the effect of microcurrents home devices compared to a facial microcurrent home device.

## 2. Materials and Methods

### 2.1 Product design

In the development of the topical formulation aimed at providing lifting and firming effects, a selection of active ingredients was made based on their demonstrated efficacy in enhancing skin structure and biomechanical properties. The final formulation incorporates two newly innovative synthesized biotechnological peptides specifically designed to target both the upper and lower thirds of the face. Thus, Peptide-1 (Acetyl Tetrapeptide-1) has efficacy studies demonstrating the firming power in the upper third of the face, it mimics microcurrents mechanism of action; increasing levels of the MBNL1 protein, which is known to induce transdifferentiation from fibroblasts to myofibroblasts. Myofibroblasts induce collagen contraction, helping to minimize the loss of tension in the dermis caused by ageing and achieving firmer and smoother skin. Peptide-2 (Acetyl Tetrapeptide-2) was designed to combat the unwanted effects of lack of firmness and cohesion by stimulating the natural elements that keep collagen levels and elastin fibers properly assembled, facilitating the union between cells and the extracellular matrix. The studies to evaluate the effectiveness of this new molecule were carried out on the lower third of the face. Additionally, a plant-derived proteoglycan of very low molecular weight was included to support the structural integrity of the ECM, thereby enhancing skin resilience and elasticity.

An emulsion-based galenic form was selected to optimize the delivery and penetration of the active ingredients into the skin. This vehicle was chosen for its favorable physicochemical properties, which facilitate the bioavailability of both hydrophilic and lipophilic compounds. Furthermore, a soft, powdery fragrance was incorporated into the formulation to ensure compatibility with other products commonly used in facial skincare routines, thereby enhancing the overall sensory experience without interfering with subsequent product application.

### 2.2 Clinical study

A clinical study was designed. All investigations were conducted in accordance with the rules of the 1975 Declaration of Helsinki in its current 2013 version, and an independent ethics committee approved the study protocol (code: PT.06.01). An *in vivo* clinical trial under dermatological control was performed on 36 women aged between 40 to 60 with signs of skin sagging, divided into two groups. Group A (hereafter, Lifting serum group) who applied the product twice a day for 8 weeks and group B (hereafter, Device group) who used the microcurrent home device following the manufacturer's instructions, 5 minutes per session, 5 sessions per week for 8 weeks.

The efficacy of the product was assessed by evaluating instrumentally: anti-wrinkle efficacy, improvement of facial sagging, skin firmness and elasticity and redensifying effect.

Skin wrinkles and facial oval contour definition were assessed by the AEVA 3D system after obtaining the defined photographs and submitting the series to the proper alignment.

Skin biomechanical properties (firmness and elasticity) evaluation was performed by a Cutometer® dual MPA 580 using a 2mm probe. This system is used to measure elasticity of the upper skin layers using negative pressure which mechanically deforms the skin. The measuring principle is based on the suction method. Negative pressure is created in the device (450 mbar) and the skin is drawn into the aperture of the probe (2s) and after a defined time released again (2s).

Standardised 3D images were obtained before, during and after the treatment with the system VECTRA - XT (Canfield, USA), to quantify the evolution of the reshaping (facial contour) effect. This device consists of six high-resolution cameras strategically aligned to capture various angles of the targeted area. The photograph is then processed by imaging software and generated to a computer as a three-dimensional digital image.

A Dermascan® C ultrasound system (Cortex technology, Denmark) with a special modified 20 Mhz ultrasound probe was used to evaluate the redensifying effect.

Table 1 summarises the technologies used and the measurement areas for each study parameter. Measurements were taken before the start of the study (D0), after 28 days of application (D28), and at the end of the study (D56).

**Table 1.** Summary of the technologies used for efficacy assessments.

| Parameter               | Measurement area | Methodology                | Evaluated variables                         |
|-------------------------|------------------|----------------------------|---|
| Anti-wrinkle effect     | Crow's feet      | AEVA-HE                    | Number of wrinkles                          |
| Improved facial sagging | Facial contour   | AEVA-HE<br>Vectra XE       | Volume and definition of the facial contour |
| Firmness and elasticity | Malar area       | Cutometer®<br>Dual MPA 580 | R0: Firmness<br>R2: Elasticity              |
| Redensifying effect     | Cheek            | Ultrasound<br>(DermaScan®) | Skin density                                |

The individual results were expressed as follows: in absolute values of the parameter for each experimental time, and as percentage changes compared to baseline (D0) at intermediate time points. Wilcoxon Signed Ranks test comparison regarding D0 were performed to study

statistical differences between groups or control points. Statistical significance was set at  $p < 0.05$ , with a 95% confidence level.

The acceptability was checked daily by the subjects at home, monitored by the dermatologist (D0, D28 and D56), and finally questioning the subjects after product application (D28 and D56). The skin tolerance was monitored via visual examination of the experimental area by the dermatologist under standard “daylight” light source and after questioning the subjects after product application.

The subjective qualities and efficacy of the product were assessed during and at the end of the study (D56) using a target questionnaire, according to the category and target market of the test product, using the following scale: totally agree (1), slightly agree (2), slightly disagree (3), and totally disagree (4).

### 3. Results

#### 3.1. Study population

The population included in the study had the characteristics specified in Table 2.

**Table 2.** Population characteristics

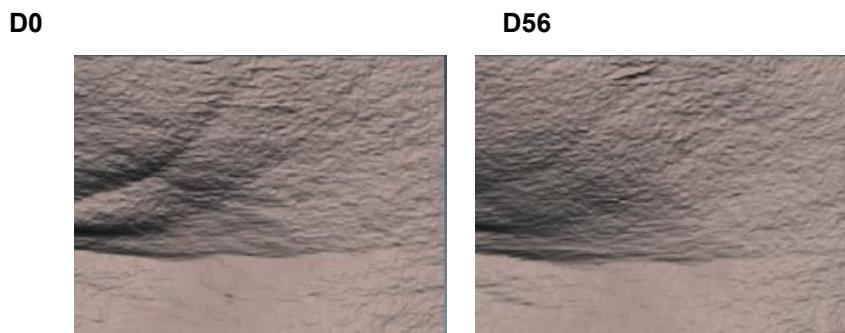
| <b>Group A – Lifting serum group</b> |           |                        |          |                       |            |
|--------------------------------------|-----------|------------------------|----------|-----------------------|------------|
| <b>Demographic Data</b>              |           | <b>Skin reactivity</b> |          | <b>Skin condition</b> |            |
| Included                             | 28 (100%) | Normal                 | 16 (57%) | Normal                | 1 (3.6%)   |
| Analysed                             | 26 (93%)  | Sensitive              | 12 (43%) | Combined              | 15 (53.6%) |
| Mean age                             | 51.1      |                        |          | Oily                  | 3 (10.7%)  |
| Age - min                            | 40        |                        |          | Dry                   | 9 (32.1%)  |
| Age - max                            | 59        |                        |          |                       |            |
| <b>Group B – Device group</b>        |           |                        |          |                       |            |
| <b>Demographic Data</b>              |           | <b>Skin reactivity</b> |          | <b>Skin condition</b> |            |
| Included                             | 11 (100%) | Normal                 | 7 (36%)  | Normal                | 3 (27.3%)  |
| Analysed                             | 10 (91%)  | Sensitive              | 4 (64%)  | Combined              | 4 (36.4%)  |
| Mean age                             | 51.3      |                        |          | Oily                  | 1 (9.1%)   |
| Age - min                            | 43        |                        |          | Dry                   | 3 (27.3%)  |
| Age - max                            | 58        |                        |          |                       |            |

Min: minim, max: maximum

#### 3.2. Skin tolerance

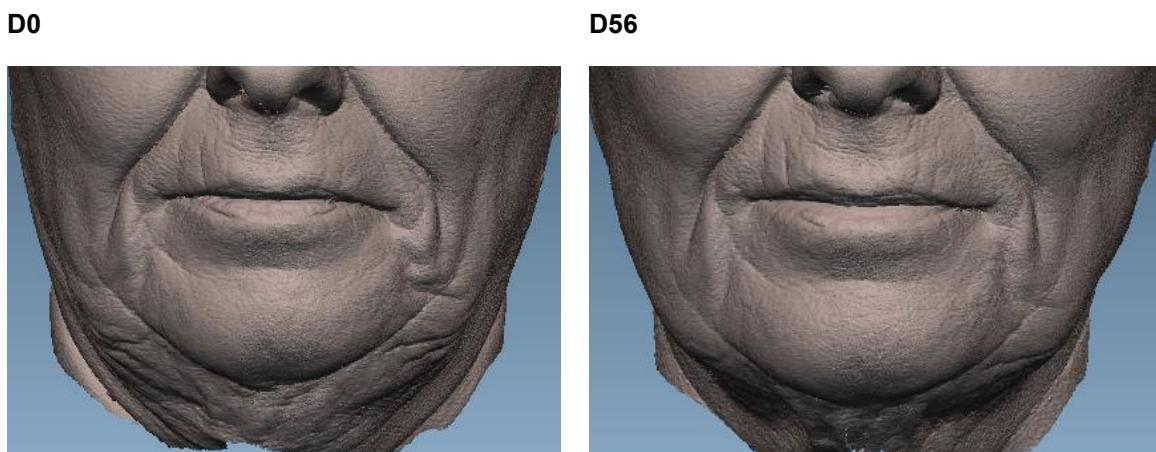
*Regarding skin tolerance, the dermatologist did not observe any skin reactions ascribable to the test products. No subject experienced any discomfort during the study. Therefore, the products presented a very good skin acceptability and compatibility during the study.* 3.2. Instrumental evaluations

Regarding wrinkles count evaluation, Lifting serum group presented a 12.2% and 6.8% decrease, after 28 and 56 days of application, respectively. At the same time, the Device group procedure presented a 6.3% and a 0.5% decrease in wrinkles count, after 28 and 56 days, respectively. The comparison between both groups produced no statistically significant difference for wrinkles count. Figure 1 illustrates the results of anti-wrinkle efficacy and tightening effect on the eye contour area.



**Figure 1.** Images of a representative case of the anti-wrinkle effect obtained using AEVA. **D0:** before product use; **D56:** after 56 days of product use.

Regarding lower face sagging volume, Lifting serum group presented a 14.7% and 8.0% decrease after 28 and 56 days of application, respectively. At the same time, the Device group presented a 4.4% increase and a 10.2% decrease after 28 and 56 days, respectively. The comparison between both groups produced a statistically significant difference in favour of Lifting serum group after 28 days of application. However, after 56 days, the comparison between both groups did not produce a statistically significant difference. Figure 2 illustrates the lifting effect found for the Lifting serum group in a representative volunteer.



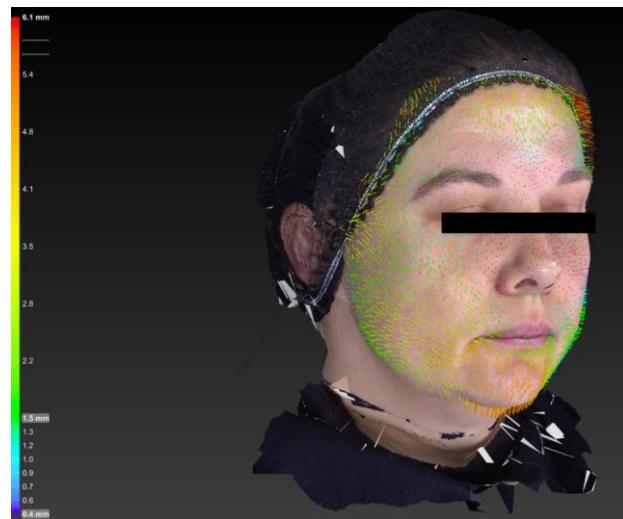
**Figure 2.** Images of a representative case of the lifting effect obtained using AEVA. **D0:** before product use; **D56:** after 56 days of product use.

Regarding skin firmness (R0 parameter), Lifting serum group presented a 5.4% and 24.3% improvement, after 28 and 56 days of application, respectively. At the same time, the Device group presented a 9.5% and 0.7% improvement in R0 parameter, after 28 and 56 days, respectively. The comparison between both groups produced a statistically significant difference in favour of Lifting serum group, after 56 days of application.

Image 1, taken with VECTRA system, illustrates the vector matching representation of one of the changes in the face regarding D0. The images were aligned and then area by area the system compared the images before and after application. The system, by detecting a different position of the area, designed a vector showing the directionality and intensity of the movement. Note the increase in the size of the vectors as the study evolves, and the direction of

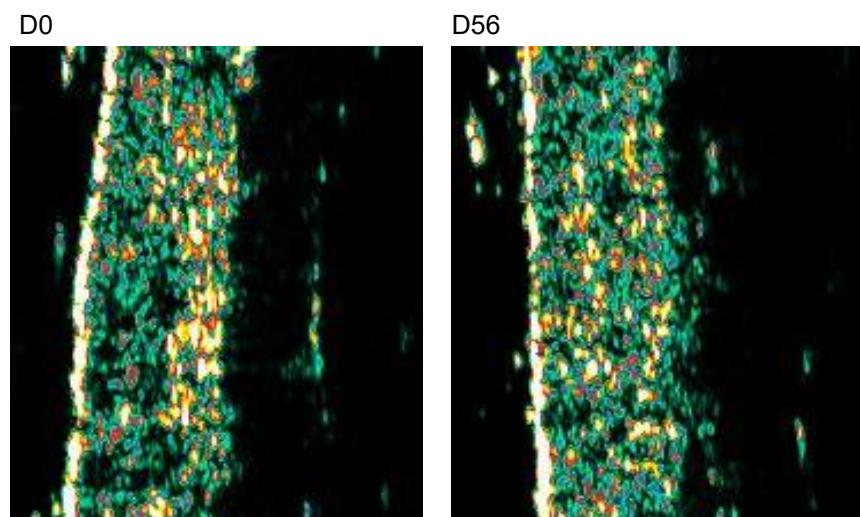
them to the upper face, illustrating an improvement on the sagging skin, promoted by the Lifting serum.

Regarding skin elasticity, Lifting serum group presented an 8.0% and 9.3% increase, after 28 and 56 days of application, respectively. At the same time, the Device group presented a 5.8% and 6.3% increase, after 28 and 56 days, respectively. The comparison between both groups did not produce a statistically significant difference, after 28 and 56 days.



**Image 1.** Evolution of the vector image obtained by VECTRA.

Regarding dermal density, Lifting serum group presented a 2.6% increase after 56 days of application. At the same time, the Device group presented a 1.6% increase after 56 days. The comparison between both groups produced no statistically significant difference. Both procedures associated to each group were not able to statistically increase dermal density, however, despite the lack of statistical significance, the results show a tendency for Lifting serum group in the increase of dermal density, after 56 days of application. Figure 3 illustrates the redensifying effect of the lifting serum.



**Figure 3.** Redensifying efficacy. Representative images obtained by ultrasound. Fewer dark areas, greater thickness.

Table 3 summarises the main obtained results. The results are presented as a mean improvement.

**Table 3.** Main obtained results for the different evaluated parameters.

| Parameter               | Lifting serum group– D28  | Device group – D28 |
|-------------------------|---------------------------|--------------------|
| Anti-wrinkle effect     | 12.2%                     | 6.3%               |
| Improved facial sagging | 14.7%*◊                   | 4.4%               |
| Firmness - R0           | 5.4%*                     | 9.5%               |
| Elasticity - R2         | 8.0%*                     | 5.8%               |
| Parameter               | Lifting serum group – D56 | Device group – D56 |
| Anti-wrinkle effect     | 6.8%                      | 0.5%               |
| Improved facial sagging | 8.0%                      | 10.2%              |
| Firmness - R0           | 24.3%*                    | 0.7%               |
| Elasticity - R2         | 9.3%*◊                    | 6.3                |
| Redensifying effect     | 2.6%                      | 1.6%               |

\* Statistically improvement vs D0. ◊ Statistically improvement vs Device group.

There was a 15% improvement in sagging after 28 days of using the lifting serum. This was statistically significant and 3 times higher than the result obtained for the microcurrent device.

Table 4 shows the subjective efficacy of the product, according to the subject's evaluation. The results are expressed as the percentage of satisfied subjects.

**Table 4.** Subjective efficacy.

| Question about Cosmetic Efficacy        | Lifting serum group | Device group |
|---|---------------------|--------------|
| Moisturises the skin                    | 96%                 | 100%         |
| Improves skin suppleness                | 96%                 | 100%         |
| Produces an immediate tightening effect | 92%                 | 78%          |
| Produces a long-term lifting effect     | 85%                 | 89%          |
| Firmer-looking skin                     | 96%                 | 100%         |
| Reduces fine lines                      | 88%                 | 89%          |
| Smoother skin                           | 96%                 | 89%          |
| Gives the feeling of rejuvenated skin   | 85%                 | 78%          |
| Improves skin texture                   | 96%                 | 89%          |
| Soft and delicate skin                  | 92%                 | 78%          |
| Reshapes/redefines the facial contour   | 85%                 | 89%          |
| Has a redensifying effect               | 88%                 | 89%          |

Results expressed as a percentage of satisfaction after 56 days of use.

#### 4. Discussion

Skin ageing is inevitable, but measures can be taken to reduce the impact, particularly changes that are caused by environmental factors. Cosmetic products can play a significant role in skin health, including broad-spectrum photoprotection to prevent UVR-induced premature ageing,

topical antioxidants that help neutralise various sources of oxidative stress, and certain peptides that, beyond their epidermal effects, promote dermal repair—resulting in more substantial clinical improvements in deep wrinkles and skin firmness [8-9].

As previously mentioned, peptides are becoming increasingly interesting cosmetic ingredients with functions such as reducing premature skin ageing, improving the skin's barrier function, moisturising the skin, protecting it from UV damage, and providing anti-inflammatory properties that alleviate acne and irritation. Until now, peptides of different origins were investigated in formulation developed to enhance collagen or elastin production, increase fibroblast proliferation, improve wound healing or skin condition [7]. In this way, this innovative lifting serum, that contains two peptides, reduces wrinkles, improves firmness and elasticity, and reshape the facial oval contour for a rejuvenated skin appearance.

As Pengzh Bu P et al concludes, although a wide range of home-use beauty devices for facial rejuvenation is currently available on the market, the supporting body of scientific literature remains limited. Existing studies are often constrained by small sample sizes and brief follow-up durations, underscoring the need for a more robust and standardised framework for evaluating clinical efficacy [4]. In our study, we evaluated and compared the efficacy of a home-use microcurrent device with that of a topical lifting serum in the context of facial rejuvenation. The results demonstrated that both interventions yielded comparable outcomes in terms of wrinkle reduction and improvement in skin elasticity. However, the microcurrent device showed inferior performance relative to the serum in enhancing skin firmness and producing a lifting effect. These findings suggest that while microcurrent technology may offer certain anti-ageing benefits, its effectiveness in promoting structural skin improvements may be limited compared to topical formulations with targeted active ingredients.

## 5. Conclusion

During the ageing process, a decrease in the synthesis of extracellular matrix proteins occurs and skin becomes more fragile and lose its firmness; therefore, the application of cosmetics with a proven efficacy may delay or prevent ageing, helping to hydrate, tight and repair the cutaneous tissue. Moreover, at-home microcurrent devices are gaining in popularity thanks to consumer interest in non-surgical medical aesthetic treatments and the fact that visibly noticeable and fast results after use are promised. However, accessibility due to high price and potential side effects limits their acceptance. This study presents an innovative lifting serum that mimics the effect of microcurrents home devices to improve skin appearance. It contains two last generation peptides that act synergistically to reduce wrinkles, improve skin firmness and elasticity, and reshape facial contours with a very good skin tolerance. Its anti-ageing effect was demonstrated *in vivo* compared to a microcurrent home device, demonstrating 3 times more efficacy on lifting effect.

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**Conflict of Interest Statement.**

NONE.

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