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Vol: 2 & Iss: 2

Research Article

Vacuum and Electromagnetic Fields to Regenerate Acne Scars: New Technologies in Facial Regenerative Medicine

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Citation: Scacciati C, Lombardo F, Fabris C, Busoni M, Menchini G. Vacuum and Electromagnetic Fields to Regenerate Acne Scars: New Technologies in Facial Regenerative Medicine. *Curr Res Altern Complement Integra Med 2025;* 2(2): 117-123.

Received: 14 June, 2025; **Accepted:** 23 June, 2025; **Published:** 25 June, 2025

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ABSTRACT

Introduction: Acne scars affect hundreds of millions of people around the world; these are caused by a lesion that disrupts epidermodermal junction which relevance depends on the severity of the inflammatory state. Such lesions mostly occur on the back and face, thereby significantly reducing the quality of life and social relationships of the patient.

Materials and Methods: In this study we analyzed the regeneration of acne scars on 11 patients treated with VEMFtherapy. To have a broad overview, the outcomes were evaluated adopting various assessment scales. Scoring systems adopted are DLQI related to the quality of life of the patients, Qualitative Global Scarring Grading System (GS Score), density of scar and tactile evaluation.

Results: All patients reported a clinical improvement of acne scars, appreciated both by the patients and the doctors. The improvement is evident in the overall assessment of the scars (GS score) and in tactile evaluation, on the contrary the density of scars remained almost unchanged. Improvements reduced the psychological impact of the scar on the patient.

Conclusions: The clinical improvement on all the patients, the total absence of side effects and downtime, as well as the well-tolerated therapies and the high compliance of the patient lead to the conclusion that the synergy between electromagnetic fields and vacuum is effective in the treatment of acne scars.

Keywords: VEMF Therapy, Biodermogenesi, Regenerative Medicine, Mechanotrasduction

1. Introduction

Acne vulgaris is a chronic cutaneous inflammatory disorder that can lead to scarring[1,2]. The main causes of the inflammation of the pilosebaceous unit in acne are the excess sebum production, hyper keratinization of the follicle and bacterial colonization[2,3]. This condition is characterized by the chronic or recurrent formation of comedones, erythematous papules and pustules, most frequently arising on the face, although they can extend to the neck, trunk and upper limbs. Although acne vulgaris is considered as a benign and limited condition, it may cause severe psychological issues and disfiguring scarring[2] up to 95% of the cases; it is estimated that acne vulgaris affects 1% to 11% of the world's population. Tendency to scar-formation and hyperpigmentation is higher in Hispanic and African-American patients, therefore with darker skin phototypes IV to VI, than the general population. Scarring is the result of the repair of an acne lesion disrupting epidermodermal junction. Scar tissue differs from surrounding skin tissue for visual, tactile and structural factors[4,5]. In predisposed subjects, acne may develop in scarring, especially in severe forms such as acne conglobate and acne fulminans. However, acne come Donica may lead to scars as

well, the deeper is the inflammatory process, the more likely is that acne lesions result in scars[2]. There are two main types of acne scars: 80-90% of the patients present with atrophic scars due to loss of collagen, the minority of the subjects presents with hypertrophic scars and keloids[6]. Hypertrophic scars are characterized by an increase of the vertical dimension, which, however, do not exceed the lateral margins of the original lesion. Such scars are more common in the first two months after the lesion and then they can spontaneously regress, unlike keloids. Keloids are characterized by disproportionate collagen production and deposition outside the margins of the original lesion[7]. Clinical aspects may vary depending on the location of epidermal/dermal damage and time of onset. When the damage is restricted to the epidermis, erythema and dyschromia may occur. Damage to the dermis can result in atrophic and hypertrophic scars of different shapes, marked by greater severity and depth[8]. Scars are typically less elastic than healthy skin. Furthermore, scars are usually hypopigmented after complete maturation, but they can become hyperpigmented in darkly pigmented subjects or in lightly pigmented people after UV exposure[9].

Acne and scarring-induced psychosocial distress occurs early in the active phase and continues over time because of the scarring, which may have negative impact in terms of emotional, psychological and social well-being of the patients[10]. Therefore, preventing scarring becomes one of the most important goals of acne treatment[11]. In the vast majority of cases, facial scars have the greater psychological impact as they are most visible and difficult to conceal. Face perception is crucial for interpersonal communication and patients with facial scars may suffer a decline in social relationship; for example, when observers focus on the scar instead of maintaining eye contact. Faces serve as unique identifiers for each individual and contribute greatly to our self-image. Acne scars on the face can cause a reduction in self-confidence and social engagement[12]. Acne scars are perceived badly: one study showed that a statistically significant number of people who looked at photos of people with and without acne scars believed that people with scars were less likely to succeed, less attractive, shyer and less confident[13]. This discomfort originates in adolescence and continues decades after their onset, when patients continue to request therapies to treat their scars[13], especially for severe forms of acne and atrophic scar sequelae, which greatly limit the patient's quality of life[14]. Facing such inconveniences, the clinical relevance of treatments aimed at the aesthetic and functional improvement of scars is evident. Although there is no treatment of choice for acne scars, we have witnessed the consolidation of various technologies which have demonstrated their effectiveness in this therapeutic field over time. Among these is dermabrasion, aiming at removing the external layer of the epidermis[15,16]; this therapy is not recommended in patients with a history of keloids or hypertrophic scars and, of high skin phototype as they are exposed to a higher risk of permanent hypopigmentation. The use of ablative and non-ablative lasers is very widespread. Ablative lasers are generally effective in this therapy but the patients are exposed to side effects in the short and medium-term such as persistent erythema, hyperpigmentation and, scars more evident than the original acne ones[17,18]. The risk of side effects resulting from ablative lasers has progressively been reduced thanks to the improvement of technology and operating protocols[19]. Non-ablative lasers are less effective[20] but safer[21,22] considering the lower incidence of side effects. Rathod et al. reported greater than 30% improvement in 92,9% of treated patients three months after the end of the therapies[20]. Also in this case, therapy is not recommended for use in patients of phototypes IV to VI[17]. Also interesting is the application of PDL (Pulsed Dye Laser), which side effects are limited to purpura lasting 7-10 days, provided that this technology is suggested only for phototypes I, II and III[23,24]. It has been found that also needling provides improvements in acne scars; this has a lower risk of hyperpigmentation than other technologies, but it should not be used in patients who have had keloids or hypertrophic scars in the past[25-27]. Fractional radiofrequency has also shown positive results on acne scars; Kim et al. found an improvement in 73.1% of patients treated against the following side effects: pain, erythema, edema and hyperpigmentation[28].

This study aims at demonstrating the effectiveness and safety of the synergy between electromagnetic fields and vacuum, also known as Biodermogenesi® or VEMFtherapy, in acne scars treatment.

2. Materials and Methods

The study involved 11 patients who underwent treatments for acne scars on the face at our facility in the period from February 2022 to May 2023. This clinical trial is a preliminary study on acne scars treatment performed with the synergy between electromagnetic fields and vacuum. This study included 11 healthy adult subjects presenting on their face acne scars of at least 10 years. Patients selected were 6 males and 5 females between the ages of 17 and 64, with an average age of 29.1 years and a median age of 26 years. All patients had atrophic facial acne scars, no one presented hypertrophic scars or keloids. One patient discontinued the treatment after just one session for personal reasons and was not included in the statistics of this study. Four patients are of phototype II, five of phototype III, one of phototype IV and one of phototype VI. The exclusion criteria are people wearing pace-maker, epileptic, post-oncologic for 5 years from the last therapy or surgery, using anticoagulants, breastfeeding, pregnant, with damaged, peeled, abraded and in any case not perfectly intact skin, with red, inflamed, irritated and/or sensitized skin, with skin subject to rashes of any kind, edema or hematomas, with skin presenting sequelae of burns arose in the last six months and in any way not perfectly healed, patients who have shown intolerance to any kind of cosmetic in the past and subjects with ongoing acne phenomena. The study was conducted in compliance with the Declaration of Helsinki (1975) and its amendments of 1983 and was authorized by the Ethics Committee of the University of Pavia on September 19th, 2013 protocol no. 5/2013 concerning the use of Biodermogenesi® method in the treatment of scars. All patients signed informed consent before starting the therapies and authorized the use of their data and photographs for this publication. The patients underwent 5 weekly sessions, lasting 20-25 minutes each, with Bi-one® LifeTouchTherapy medical device (Expo Italia Srl - Florence - Italy), a Class IIB device which simultaneously delivers electromagnetic fields, vacuum and square wave stimulation (VEMFtherapy or Biodermogenesi®). The device delivers an electromagnetic field with a frequency ranging from 0.5 to 2 MHz and an average power level variable between 4 to 6 w. Variations in frequency and intensity occur autonomously with an AI system capable of reading the characteristics of the skin tissue through a biofeedback system and consequently modifying the energy supply and vacuum action (variable between 90 and

110 millibars) and a square wave stimulation at 10 Hz. Through a handpiece held by the patient, the electromagnetic field works on the skin tissue and sends a return signal to the device. Thanks to the latency time and amount of energy returned, the device turns these data into information on the depth and electrical and electromagnetic conductivity of the tissue; on such bases it adjusts in real time the frequency and intensity of the signals delivered. Analogously, a vacuum sensor (NXP Semiconductor, Eindhoven, Netherlands) monitors in real time the level of vacuum supplied, modifies it when necessary and reports any anomalies in the negative pressure applied to the patient. The three forms of energy are delivered by different handpieces; the applied part is covered by an ISO10993 non-cytotoxic certified disposable cap. The electromagnetic field is capable of performing a double action; the first is given by pumping of sodium (Na^+) and potassium (K^+) across the cell membranes, delivering nutrients and oxygen necessary to increase metabolism and cellular and molecular regeneration[29]. The second action allows to exploit the remarkable piezoelectric properties of collagen to progressively increase its size and stretch its fibers again[30-32]. The vacuum reactivates blood and lymphatic microcirculation and at the same time activates mechanotransduction[33]. Simultaneously, the square wave, commonly referred to as electroporation, enables the absorption of topically applied cosmetics[34]. The findings were assessed using different indicators. The first is the photographic documentation, acquired by always adopting the same standards (digital camera, set-up, environment, position and light). Digital images of the patients' faces were acquired at the beginning of the treatment and at each session: frontal, ¾ right, ¾ left, right profile and left profile views. The second indicator is related to the patient's quality of life, on which it is known that acne has a relevant impact[10,11,12,14,35]. Assessing the quality of life through questionnaires is a common method to evaluate the impact of different pathologies on patient well-being, especially in dermatology where appearance-changing conditions are common[14]. Quality of life of the patients was assessed adopting Dermatology Life Quality Index (DLQI).

2.1. Qualitative global scarring grading system - GS score

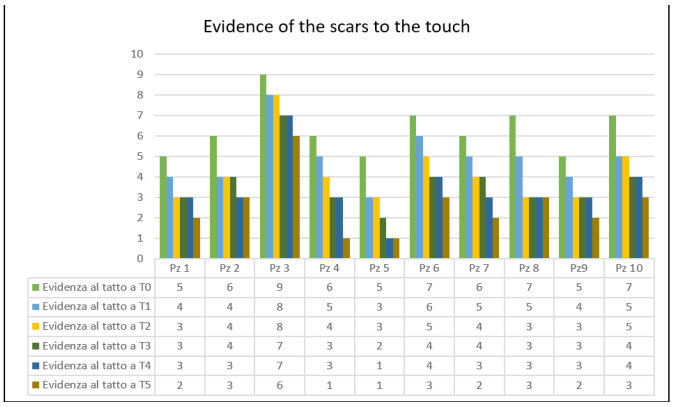
Although acne scars grating scales exist, there are many restrictions and many of these depending on their application in daily clinical practice and a well-validated gold standard scale for use in clinical practice or research studies is still needed [(01)]. To assess the severity of the scars subject of this study we adopted the Qualitative Global Scarring Grading System (GS Score). The acne scar global classification system is different from the classification of individual scars; its purpose is to establish a severity index of an individual acne scars that can be easily recognized, recorded and compared over time[36]. Parameters of this index are: visibility of the scar at a so called "social" distance, i.e., 50 cm or more, possibility to conceal the scar and reducing its appearance with makeup or beard and its disappearance when the skin is stretched[36].

2.2. Density of the scars

Another value taken into account in the study was density of the scar at the time of the first medical examination and at the end of the five treatment sessions. This numerical value is related to the average distance of the scars from each other and has 3 levels: level 1, the average distance between the scars is equal to or greater than 1 cm; level 2, the distance is between 0,9 and 0,5 cm and level 3, the distance is less than 0,4 cm.

2.3. Evidence of scars to the touch

The last parameter taken into account for the evaluation of the scars was the evidence of scars to the touch at the time of the first visit and at the end of the treatment protocol. Patients were asked to assess subjectively the tactile sensation of their skin on the face affected by the scars, attributing to this sensation a numerical value ranging from 0 (no evidence to the touch) to 10 (maximum evidence to the touch). The difference of a scar to the touch compared to a healthy tissue is due to the fact that scar tissue contains fewer elastic fibres than normal skin and many times there is fibrous connective tissue, which makes the scar more rigid than intact skin. Although the evidence of scars is an extremely subjective assessment, we decided to adopt it at the same time with other universally recognized scales such as GS Score and DLQI. By doing so, we can verify whether the objective evaluation given by the aforementioned scales is confirmed or not by the perception of patients, whose satisfaction remains the primary goal of any therapy **(Figures 1-3)**.



	Pz 1	Pz 2	Pz 3	Pz 4	Pz 5	Pz 6	Pz 7	Pz 8	Pz9	Pz 10
Evidenza al tatto a T0	5	6	9	6	5	7	6	7	5	7
Evidenza al tatto a T1	4	4	8	5	3	6	5	5	4	5
Evidenza al tatto a T2	3	4	8	4	3	5	4	3	3	5
Evidenza al tatto a T3	3	4	7	3	2	4	4	3	3	4
Evidenza al tatto a T4	3	3	7	3	1	4	3	3	3	4
Evidenza al tatto a T5	2	3	6	1	1	3	2	3	2	3

Figure 1: Evidence of scars to the touch on each patient throughout the course of five treatment sessions, from which it can be noticed that this parameter decreased throughout the course of the sessions in all of the patients considered.

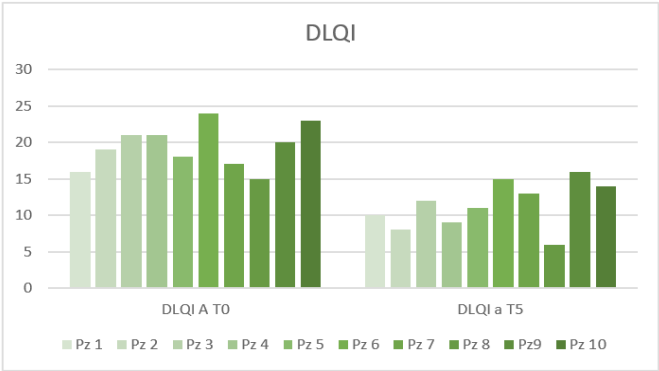


Figure 2: Evidence to the touch at the beginning and at the end of the sessions (T0/T5).

2.4. Photographic documentation

The photographs are aimed at documenting the minor evidence in atrophy and color alteration of the scars.

2.5. DLQI

DLQI allows to assess the effects of acne scars on the life quality of the patients on a scale ranging from 0 to 30. Our aim is to reduce the discomfort caused by acne scars in the treated subjects helping them to improve personal relationships.

All the results were evaluated using the Wilcoxon Signed Rank, by which the final data were compared with those obtained

at the beginning of the current study; p-values less than 0.05 was considered significant.

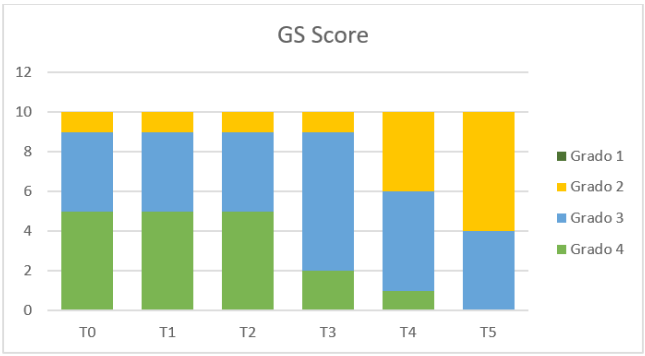


Figure 3: Variation of the Qualitative Global Scarring Grading System - GS SCORE throughout five sessions (T0/T5).

3. Results

Analysing the results, we noticed immediately that all the patients, including the one who had to suspend the therapy due to personal reasons, showed a high level of satisfaction with the results, with the therapy which turned out to be pleasant and relaxing and with the total absence of side effects and down-time. The photographs were taken right after the therapy and in no case was there any evidence of unwanted event. The outcomes are described in detail below.

3.1. DLQI (Dermatology Life Quality Index)

The initial impact of scars on quality of life at T0 was on average 19.4 points out of 30. At the end of the treatment protocol, the DLQI was 11.4 points with a reduction of 8 points. The maximum reduction recorded was 12 points and the minimum reduction was 4 (Table 1). The DLQI average of the female patients was 20.6 points at the beginning of the treatment compared to 18.2 points of the male patients instead, with an average reduction at the end of the course of treatment of 7.8 points in men and 8.2 in women.

3.2. GS scale (GS sCORE - A qualitative global scarring grading system)

At the time of the first evaluation, no patient had scars at level 1, only one patient had scars at level 2, 4 patients had scars at level 3 and 5 patients had scars at level 4. At the end of the last session, the parameters were modified as follows: still no patient had scars at level 1, 6 patients had scars at level 2, 4 patients had scars at level 3 and no patient had scars at level 4 **(Table 1)**. If we calculate the average level of scar severity on ten patients who finished the cycle of sessions, we see that this was 3.4 at T0; whereas it dropped to 2.4 at T1 with an average improvement of one level per patient.

Table 1: From the analysis of the synoptic table, it is shown an overall improvement in acne scars.

PatientGender	GS score				(Density)				(Touch)				DLQI			
	T0	T5	VA	V% *	T0	T5	VA	V% *	T0	T5	VA	V% *	T0	T5	VA	V% *
n. 01 / M	4	3	-1	-25%	2	2	0	0%	5	2	-3	-60%	16	10	-6	-37%
n. 02 / M	4	3	-1	-25%	3	3	0	0%	6	3	-3	-50%	19	8	-11	-58%
n. 03 / M	4	3	-1	-25%	3	3	0	0%	9	6	-3	-33%	21	12	-9	-43%
n. 04 / F	2	2	0	0%	2	1	-1	-50%	6	1	-5	-83%	21	9	-11	-52%
n. 05 / F	3	2	-1	-33%	2	1	-1	-50%	5	1	-4	-80%	18	11	-7	-39%
n. 06 / F	4	3	-1	-25%	3	2	-1	-33%	7	3	-4	-57%	24	15	-9	-38%
n. 07 / F	3	2	-1	-33%	2	2	0	0%	6	2	-4	-66%	17	13	-4	-24%
n. 08 / M	3	2	-1	-33%	2	2	0	0%	7	3	-4	-57%	15	6	-9	-60%
n. 09 / M	3	2	-1	-33%	2	2	0	0%	5	2	-3	-60%	20	16	-4	-25%
n. 10 / F	4	2	-2	-50%	2	2	0	0%	7	3	-4	-57%	23	14	-9	-39%
Average	3,4	2,4	-1	-29%	2,3	2	-0,3	-13%	6,3	2,6	-3,7	-59%	19	11	-8	-42%

* Percentage value rounded down with fraction from 0 to 4 and excess for fraction from 5 to 9.

Regarding the GS Score scale, there is a decrease of a level with severity of the scars which drop from 3.4 to 2.4, equal to an average attenuation of 29%, while the analysis of the scar density shows a more statistically contained result (-13%) with many patients who do not reveal any change. The evidence to the touch showed a clear improvement with evidence which dropped from 6.3 to 2.6 with an average attenuation of 59%, just as the psychological impact of the scars on the patients reduced on average of 42%, improving their self-esteem, relationship with others and quality of life.

The average level of improvement obtained in all rating scales is considered significant (>0.05), as observed in 3 out of 10 cases in the assessment of scar density, in 9 out of 10 cases for the GS Score and in 10 out of 10 cases for the tactile assessment and DLQI scale.

Where present, the improvements were significant; 33 to 50% for the scar density with 13% average improvement, 25 to 50% for the GS Score with 29% average improvement, 25 to 60% for the DLQI scale with 42% average improvement and 33 to 80% of evidence to the touch with 59% average improvement.

3.3. Density of the scars

The parameter of the density of the scars, assessed at T0 and at the end of the protocol, did not change particularly. Especially, only 3 out of 10 patients saw a 1-point reduction from the initial density value **(Table 1)**.

3.4. Evidence of scars to the touch

At the beginning of the study the average value was 6.3; at the end of the study the average value was 2.6; in other words, 3.7 points lower than at the start with a maximum improvement of 5 points and a minimum improvement of 3 points **l**.

4. Discussion

This kind of experimental studies are quite rare in scientific

literature for several reasons, the most significant of which is probably related to the fact that the evaluation of the various parameters related to scar severity is not only difficult, but also poorly standardised. Exactly this difficulty, already discussed widely in other studies, encouraged us to take a multi-evaluative approach to the problem of acne scars, in order to study these lesions from several points of view, both objective and subjective and to try to get a picture as complete as possible. The difficulties in realization of this study are related both to the amount of data assessed for each individual patient session and to the size of the skin samples which rarely exceed one millimetre; these are the reasons that limited the number of patients in question, but considering the results we intend to increase it in the near future developing a multicentre study on a few dozen of subjects. In addition to the small number of patients, another limit of this study is the lack of a control group who checks that the improvements obtained are not the result of the normal scar evolution, even though these improvements are unlikely in scars older than 10 years. The evaluation of ten patients took fifteen months and a team of four doctors. A very interesting aspect was certainly the one regarding the subjective sensation of patients in relation to the condition of their skin; in fact, the evidence of scars to the touch was the parameter that showed the greatest reduction from beginning to the end of treatment and that was of high importance to the patients, who all expressed satisfaction with the result obtained. In particular, we observed a reduction of points already during the first sessions and at the end of the third session, all patients stated that they found clear benefits in terms of reduced evidence of scars to the touch. These results point out both the effectiveness of the treatment itself in terms of improving the elasticity and quality of the skin and the importance of the patient's subjective sensation towards his own skin and scars. In fact, patients appreciated a considerable reduction in scarred depression, where present and a greater skin uniformity. Interesting, although not significant given the small number of patients, it is the correlation between improvement to the touch of one's scars and skin phototype. In this study, in fact, the subjective result in terms of improvement of scars to the touch was greater in the higher phototypes; interesting fact that should be investigated, especially if we consider that averagely the subjects with dark phototypes have worse scars than the light phototypes. In accordance with numerous studies that evaluated the quality of life of patients with acne scars through DLQI questionnaire, also our study showed that acne scars compromise the quality of life of the patients suffering from them[10,11,14,35]; especially, their improvement led to an average reduction of 8 points at the end of the treatment cycle and thus confirmed the importance of acne scar treatment regarding the quality of life of patients. DLQI score in the group of female patients reached higher values in general terms; we can assume a greater sensitivity and attention by the female sex regarding its image. As a general tendency, we observed a higher DLQI score in the patients with more severe acne scars, however, even in the patients with less noticeable scars, the evaluation of the impact on the quality of life, calculated through DLQI and valued at T0, was significant. This proves that the presence of acne scars, especially on the face, significantly effects on patients' quality of life, even when they are small. These results confirm that the use of questionnaires on patients' quality of life related to the presence of acne scars, provide unique information on physical, functional and relational impact of the scars: information that allow not only to define the impact of the disease in a more comprehensive manner, but also to evaluate the effectiveness of the treatment and to guide to the correct management of the patient[14]. GS Score evaluation showed an improvement in the level of acne scars in all the patients except one, reaching a lower level of scar than the one at the beginning. In particular, we observed an acceleration for grade improvement over the last 2-3 sessions. Studying the GS Score variation based on the patients phototype it emerged that the patients with higher skin phototypes (phototype III and IV in our study) showed a greater improvement in many cases and almost always faster than the patients with a lower phototype **(Figure 4)**. The only patient whose GS Score did not change started from the level 2 at T0 and remained at the same level for a reason which is related to the type of classification used; however, that patient noticed a significant improvement of the scars to the touch and also in density. This fact also confirms the necessity of finding an even more precise and standardizable gold standard model of global classification of the scars. Scar density parameter is the one that has undergone less variations in our group of patients compared to the other parameters taken into account **(Figure 5)**. In particular, having a variation of one point in only three patients of our study group from the beginning to the end of the treatments confirms that the treatment of the scars is always complex, the result is often uncertain and it is important to warn the patient that improvement is possible, but that 'restitutio ad integrum' (restoration to original condition)[37] will never be achieved. Scar's reduced evidence to the touch, visible in all subjects and its reduced density, identified only in some subjects, lead to further considerations. The reduced evidence to the touch is given by greater elasticity and filling up of the scar. In order to feel less thickness of these lesions, it is necessary for them to completely regenerate and fill until leveling off to the surrounding healthy tissue. Therefore, we believe that all treated scars significantly improved and some of them perfectly regenerated until evening out with the healthy skin making them no longer evident at the time when the density of the scars was assessed. For this reason, 33% improvement in one patient means that one scar out of three levels with the surrounding tissue and 50% improvement in two patients means that one scar out of two is no longer visible, showing a remarkable healing. In all other cases, the improvement to the touch indicates a mitigation in depth and stiffness of the scars without being completely regenerated. In conclusion, although scarring is still a functional and cosmetic problem which has not been resolved despite the large number of treatments available, our study demonstrated that the sequential local treatment of acne scars combing electromagnetic fields, electrical stimulation and vacuum is effective to improve this condition. In confirmation of the data deriving from Veronese, et al.[38] (study of scars by sulfuric acid), not only a reduction in the visibility of scars but also a general improvement of the skin to the touch and its elasticity were observed, also evaluated by individual patients. The two severity parameters (GS Score) and scar density, which can be considered as an objective evaluation of the improvement of acne scars, confirmed the effectiveness of treatment with combined electromagnetic field technology, electrostimulation and vacuum and their synergy, probably related to collagen remodelling enabled by its marked piezoelectric activity[30-32] as demonstrated also in other studies[2] **(Figure 6)**. The overall improvement of the scars was always accompanied by an improvement of DLQI, reaffirming the importance of an effective facial acne scar treatment for an improvement in the patients' quality of life. A remarkable

improvement of the acne scars was observed in the patient who was unable to continue with the sessions for personal reasons and only underwent one treatment session with combined technology of electromagnetic field, radiofrequency and vacuum; in this case, GS Score progressed from level 3 to level 2 and the parameter of evidence of the scars to the touch reduced of 3 points compared to the first session. These considerations, associated with the fact that it was the only patients of phototype VI and there is a significant trend of improvement in darker-skinned patients comparing to the lighter one, open to a path for new studies on the treatment of acne scars based also on the different phototype in question. To confirm the obtained results in high, phototype patients larger sample sizes are needed. This immediate improvement is supported also by a previous study[39] that proves the efficacy and safety of VEMFtherapy in the treatment of burn scars on the face of a subject with phototype VI. All of this is combined with a consideration based on the other known therapies for acne scars. The synergy between electromagnetic fields, electrostimulation and vacuum, otherwise known as VEMFtherapy or Biodermogenesi, is characterized by the absolute lack of side effects[7,40,41] and of specific limitations such as skin phototype, which we also found out and the patients' historical predisposition to the formation of hypertrophic scars or keloids.

Figure 4: 28-year-old female patient of skin phototype III presenting acne scars of 4 years on the face, before (a) and after (b) a cycle of treatment with the technology combining electromagnetic fields and vacuum. GS score at the beginning of the treatment was of 3, GS score at the end of the treatment cycle was of 2.

Figure 5: 39-year-old female patient of skin phototype III presenting acne scars of 18 years on the face, before (a) and after (b) a cycle of treatment with the technology combining electromagnetic fields and vacuum. GS score at the beginning of the treatment was of 4, GS score at the end of the treatment cycle was of 2.

Figure 6: 64-year-old male patient presenting acne scars of 45 years on the face, before (a) and after (b) 5 sessions. We appreciate an evident improvement in scar level but not a reduction in density.

5. Conclusions

Certainly, this study represents a starting point for the research of VEMFtherapy applied to acne scarring, since 10 patients are not sufficient for a thorough clinical study. That being said, these results suggest that the synergy between electromagnetic fields, electrostimulation and vacuum resulted as effective and safe on all patients treated regardless of their phototype and the severity of the lesions treated. These results, together with the pleasantness of the therapy, the absence of side effects and of down-time, allow us to affirm that this synergy can establish one of the most interesting and safest therapeutic approaches for the cure of acne scars.

6. Author Contributions

Each author, Dr. Camilla Fabris, Dr. Giovanni Menchini, Dr. Fabrizio Lombardo and Dr. Chiara Scacciati, have contributed equally to the writing and planning of the article in every part and have read and approved the final manuscript, Maurizio Busoni developed the therapeutic protocols and contributed to the writing of the article.

7. Conflict of Interest

M. Busoni is a member of Board of Director of Expo Italia Srl; all other authors report non conflict of interest.

8. References

1. Clark AK, Saric S, Sivamani, RK. Acne Scars: How Do We Grade Them? Am J Clin Dermatol, 2018;19(2): 139-144.
2. Leung AK, Barankin B, Lam JM, et al. Dermatology: how to manage acne vulgaris. Drugs Context, 2021.
3. Boen M, Jacob C. A Review and Update of Treatment Options Using the Acne Scar Classification System. Dermatol Surg, 2019;45(3): 411-422.
4. Fife D. Evaluation of Acne Scars. Dermatol Clin, 2016;34(2): 207-213.
5. Knutsen-Larson S, Dawson AL, Dunnick CA, et al. Acne Vulgaris: Pathogenesis Treatment and Needs Assessment. Dermatol Clin, 2012;30(1): 99-106.
6. Fabbrocini G, Cacciapuoti S. Evaluation Prevention and Management of Acne Scars: Issues, Strategies and Enhanced Outcomes. J Drugs Dermatol, 2018;17(12): 44-48.
7. Rivera AE. Acne scarring: A review and current treatment modalities. J Am Acad Dermatol, 2008;59(4): 659-676.
8. Dreno B, Khammari A orain N, et al. ECCA Grading Scale: An Original Validated Acne Scar Grading Scale for Clinical Practice in Dermatology. Dermatology, 2007;214(1): 46-51.

9. Nicoletti G, Perugini P, Bellino S, et al. Scar Remodeling with the Association of Monopolar Capacitive Radiofrequency, Electric Stimulation and Negative Pressure. Photomed Laser Surg, 2017;35(5): 246-258.
10. Zhou C, Vempati A, Tam C, et al. Beyond the Surface: A Deeper Look at the Psychosocial Impacts of Acne Scarring. Clin Cosmet Investig Dermatol, 2023:16: 731-738.
11. Hayashi N, Miyachi Y, Kawashima M. Prevalence of scars and mini-scars and their impact on quality of life in Japanese patients with acne. J Dermatol, 2015;42(7): 690-696.
12. Ngaage M, Agius M. The psychology of scars: a mini-review. Psychiatr Danub, 2018;30(7): 633-638.
13. Taub AF. The Treatment of Acne Scars, a 30-Year Journey. Am J Clin Dermatol, 2019;20(5): 683-690.
14. Reinholz M, Poetschke J, Schwaiger H et al. The dermatology life quality index as a means to assess life quality in patients with different scar types. J Eur Acad Dermatol Venereol, 2015;29(11): 2112-2119.
15. Shim EK, Barnette D, Hughes K, et al. Microdermabrasion: A clinical and histopathologic study. Dermatol Surg, 2001;27(6): 524-530.
16. Freedman BM, Rueda-Pedraza E, Waddell SP. The epidermal and dermal changes associated with microdermabrasion. Dermatol Surg, 2001;27(12): 1031-1033.
17. Graber EM, Tanzi EL, Alster TS. Side effects and complications of fractional laser photo thermolysis: experience with 961 treatments. Dermatol Surg, 2008;34(3): 301-305.
18. Chan HHL, Manstein D, Yu CS, et al. The prevalence and risk factors of post inflammatory hyperpigmentation after fractional resurfacing in Asians. Lasers Surg Med, 2007;39(5): 381-385.
19. Verma N, Yumeen S, Raggio BS. Ablative Laser Resurfacing. In: Stat Pearls. Treasure Island (FL): StatPearls 2025.
20. Rathod D, Foroughi A, Mekokishvili L, et al. A cross-sectional, multi-center study on treatment of facial acne scars with low-energy double-pass 1450-nm diode laser. Dermatol Ther, 2020;33(3): 13326.
21. Tanzi EL, Alster TS. Comparison of a 1450-nm diode laser and a 1320-nm Nd: YAG laser in the treatment of atrophic facial scars: a prospective clinical and histologic study. Dermatol Surg, 2004;30(2): 152-157.
22. Alster TS, Tanzi EL, Lazarus M. The use of fractional laser photo thermolysis for the treatment of atrophic scars. Dermatol Surg, 2007;33(3): 295-299.
23. Manuskiatti W, Wanitphakdeedecha R, Fitzpatrick RE. Effect of pulse width of a 595-nm flashlamp pumped pulsed dye laser on the treatment response of keloidal and hypertrophic sternotomy scars. Dermatol Surg, 2007;33(2): 152-161.
24. Goldman MP, Fitzpatrick RE. Laser treatment of scars. Dermatol Surg, 1995;21(8): 685-687.
25. Fernandes D. Minimaly invasive percutaneous collagen induction. Oral Maxillofac Surg Clin North Am, 2005;17(1): 51-63.
26. Fabbrocini G, Fardella N, Monfrecola A, et al. Acne scarring treatment using skin needling. Clin Exp Dermatol, 2009;34(8): 874-879.
27. Chandrashekar BS, Sriram R, Mysore R, et al. A. Evaluation of microneedling fractional radiofrequency device for treatment of acne scars. J Cutan Aesthet Surg, 2014;7(2): 93-97.
28. Thi Kim CN, Thi LP, Van TN, et al. Successful Treatment of Facial Atrophic Acne Scars by Fractional Radiofrequency Microneedle in Vietnamese Patients. Open Access Maced J Med Sci, 2019;7(2): 192194.
29. Scarano A, Sbarbati A, Amore R, et al. A New Treatment for Stretch Marks and Skin Ptosis with Electromagnetic Fields and Negative Pressure: A Clinical and Histological Study. J Cutan Aesthet Surg, 2021;14(2): 222-228.
30. Lay R, Deijs G S, Malmström J. The intrinsic piezoelectric properties of materials A review with a focus on biological materials. RSC Adv, 2021;11: 30657-30673.
31. Kim D, Han SA, Kim JH, et al. Biomolecular piezoelectric materials: From amino acids to living tissues. Adv Mater, 2020;32(14): 1906989.
32. Fukada E, Ueda H, Rinaldi R. Piezoelectric and related properties of hydrated collagen. Biophysical Journal, 1976;16(8): 911-918.
33. Martino F, Perestrelo AR, Vinarský V, et al. Cellular Mechanotransduction: From Tension to Function. Front Physiol, 9: 824.
34. Pacini S, Punzi T, Gulisano M, et al. Transdermal Delivery of Heparin Using Pulsed Current Iontophoresis. Pharmaceutical Research, 2006;23(1).
35. Tan J, Beissert S, Cook Bolden F, et al. Impact of Facial Atrophic Acne Scars on Quality of Life: A Multi country Population Based Survey. Am J Clin Dermatol, 2022;23(1): 115-123.
36. Goodman GJ, Baron JA. Postacne Scarring: A Qualitative Global Scarring Grading System. Dermatol Surg, 2006;32(12): 1458-1466.
37. Chivot M, Pawin H, Beylot C, et al. Cicatrices d'acné: épidémiologie, physiopathologie, clinique, traitement. Ann Dermatol Venereol, 2006;133(10): 813-824.
38. Veronese S, Brunetti B, Minichino AM, et al. Vacuum and electromagnetic fields treatment to regenerate a diffuse mature facial scar caused by sulfuric acid assault. Bioengineering, 2022;9: 799.
39. Veronese S, Aggarwal R, Giovanelli T, et al. Hyper- and Hypopigmentation in a Subject with Fitzpatrick Skin Phototype VI: A New Treatment Option. J Clin Med, 2024;13: 1036.
40. Veronese S, Beatini AL, Urbani C, et al. V-EMF treatment of facial scar: First results. J Tissue Viability, 2022;31(4): 614-618.
41. Laura S, Veronese S, Alberti G, et al. Vacuum and electromagnetic field in synergy for skin rejuvenation: A retrospective study on 217 patients. J Cosmet Dermatol, 2023: 1-7.