Applications of plasma exeresis in dermatology

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Plasma-technology in dermatology

ABSTRACT

Plasma exeresis is an innovative, minimally invasive technique that allows for the removal of skin blemishes, the improvement of wrinkles in different anatomical districts and the treatment of certain dermatological diseases.

The technology works by ionizing the atmospheric gases present in the gap between the 'sprayer' and the tissue to be treated in order to generate the plasma. The amount of plasma produced depends on the flow of air in this ionization gap.

Depending on the treatment to be performed the handpiece can be used in spray or continuous mode.

The clinical cases involved 250 patients treated for the removal of benign skin formations (dermal nevi, fibroma, keratosis, xanthelasma), non-surgical blepharoplasty, wrinkles (perioral, glabellar,neck and preauricular regions), active acne and scarring (post-acneic and post-traumatic).

The technique has proven to be extremely reliable and safe, without permanent side effects for the patient.

The limitation of the technique is that it is an operator-dependent method.

KEY WORDS

plasma exeresis, skin blemishes, technology, aesthetic dermatology

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An application of various technologies in order to achieve satisfactory results in the field of cosmetic dermatology, reducing discomfort for patients to the shortest possible timeframe, one of the essential objectives of clinical practice:

Among the various techniques available to dermatologists today, plasma exeresis has a wide range of applications. The technique varies from laser and electro surgery in that it makes use of the plasma generated by the instrument. Plasma exeresis works by ionizing the gases in the gap between the tip of the instrument, called the sprayer, and the tissue to be treated. The quantity of plasma produced depends on the flow of air in this ionization gap.

Plasma, a term derived from the Greek for 'entity' or 'form', is considered to be the fourth state of matter and is constituted by negatively charged electrons and positively charged ions with an overall neutral net charge.

The instrument used does not work if held in direct contact with the tissue to be treated, since it requires a small gap to be left for the generation of the plasma forming electric arc. The electric arc is similar to a tiny lightning bolt (Fig. 1) that acts on the epidermis sublimating punctiform areas less than one square millimetre.

The sublimation, or direct transformation from solid to gas, of the tissue reduces the damage to surrounding tissues compared with electro surgery as demonstrated by Scarano et al. (1) in animals.

More recently Sotiris (2) has performed histological assessments before and after plasma exeresis on human skin that indicate that method does not exceed the basal membrane. Sotiris has also showed that just under the basal membrane there occurs a contraction of elastic fibres, which is most probably responsible for the clearly clinically objectivisable "lifting" effect. Clinical studies have already proven the effectiveness of the technology for the treatment of perioral wrinkles, acne and non-surgical blepharoplasty (3, 4, 5), but its applications and versatility make it suitable for a wide range of dermatological and cosmetic situations.

Materials and methods

Patients:

250 patients of skin phototypes I-III and ages between 12 and 80 years old were treated at a private clinic.

Tools:

Images: Images were collected via an 8-mega pixel iSight camera with pixel size of 1.5µ.

Plasma exeresis: The instrument used was the Plexr (GMV, Rocca Priora, Rome, Italy). It has three handpieces with different power settings (low, medium and high).

Depending on the skin blemish to be treated, one of two particular methods

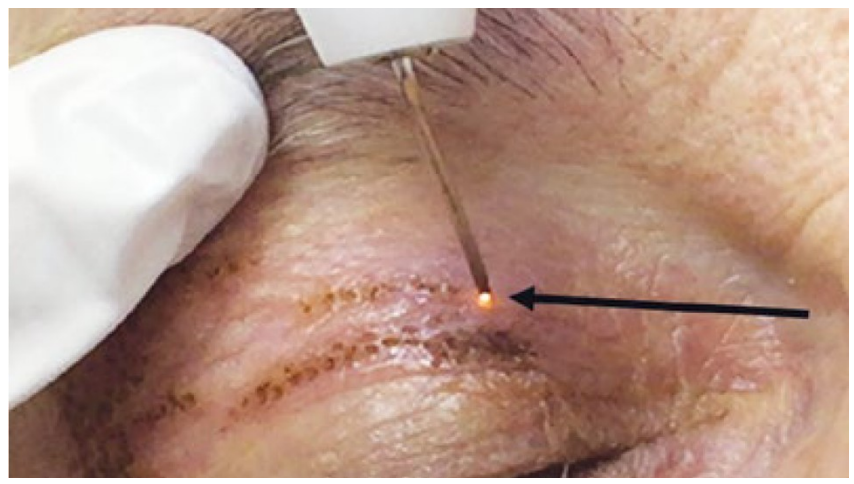

Fig. 1: Tiny visible electric arc

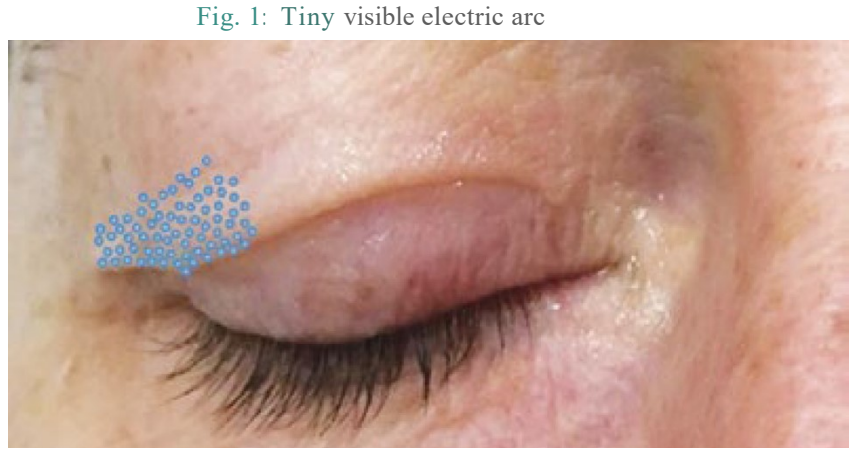

Fig. 2: Ideal distribution of treatment spots in the lateral region of the upper eyelid for the first step in non-surgical blepharoplasty.

Type of blemish	Instrument method	Handpiece setting	No. of sessions	No. of patients
Non-surgical blepharoplasty	Single spot	low	3-6	45
Perioral wrinkles	Single spot	medium	1-2	25
Glabellar wrinkles	Single spot	medium	1	10
Lentigo solaris	Continuous	low/medium	1	47
Seborrheic keratosis	Continuous	medium/high	1	53
Dermal nevi	Continuous	medium/high	1	44
Active acne	Single spot	medium	3-6	9
Post-acneic scarring	Single spot	medium	2	8
Post-traumatic scarring	Continuous	low/medium	1	9

were applied:
1) Spray or continuous method - use of the handpiece in continuous mode in order to sublimate lesions such as seborrheic keratosis, lentigo solaris, fibroma, etc. In cases of melanocytic lesions, a histological analysis was performed on exported tissue.
2) Spot method - individual tissue spots of excessive skin laxity are sublimated according to a triangular or zigzag distribution over the excessive skin, without penetrating into wrinkles or folds (Fig. 2). Applications have a duration of less than two seconds.
Before treatment, an anaesthetic cream was applied (EMLA) with an occlusive dressing for 60 minutes. A non-alcoholic disinfectant was used for disinfection. Intervals for multiple treatment sessions for 25-32 days. Informed consent was obtained in all cases.
The table shows the various applications, the number of patients treated per blemish and the method and settings used.

Immediately after the treatment and disinfection, a fluid foundation cream (La Roche Posey's Toleriane Teint) was applied.
Patients all received written post-surgical instructions: application of ice for 30 minutes exclusively in cases of patients treated in the upper or lower eyelid region, cleansing only with water and pH neutral soap, disinfection with non-alcoholic disinfectant twice a day, application of foundation cream at least once a day and total solar photo-protection for at least 40 days.

Image acquisition

Photographic documentation, with prior informed consent, was acquired before treatment, immediately after treatment and after 30-90 days after the last treatment.

Results

250 patients were treated, of which 75.2% female (188) and 24.8% male (62).

No other treatment was performed in the treatment area in order not to alter the clinical outcome in any way.
No patients dropped out of the multiple treatment plans.
18% of patients (45) underwent "non-surgical blepharoplasty" (Fig. 3), which consisted of a dynamic remodelling of the eyelid (upper in 38 patients in lower in 7 patients) in multiple sessions from 3 to 6.
In order to improve glabellar lines (10%, 25 patients) and perioral lines (4%, 10 patients) a single spot method treatment was almost always sufficient (Fig. 4). Only in two cases (females of 68 and 72 years old, of phototype II and with pronounced perioral lines) was a second session necessary.
In 57.6% of patients (144) benign skin formations (dermal nevi, seborrheic keratosis and lentigo solaris) were removed with the spray method.

Fig. 3: Photo of a patient before and after four sessions of non-surgical blepharoplasty by plasma exeresis.

Fig. 4: Perioral lines before and two months after a single treatment.

Fig. 5: Dermal nevus of the cutaneous portion of the right upper lip before and one month after treatment.

Concerning superficially removed dermal nevi (Fig. 5) (17.6%), diagnostic tests performed on the fragment confirmed the clinical diagnosis in all cases. Only in one case of seborrheic keratosis had a cutaneous biopsy been performed before the plasma exeresis treatment (Fig. 6).

9 (3.6%) patients were treated for mild and moderate active acne, for which no local or systematic therapy was administered before or after the plasma exeresis treatment.

The clinically objectivisable results shown in the images in terms of the reduction of comedones, papules and pustules (Fig. 7) were stable over 3 months of clinical follow-up.

Patients treated for post-acneic scarring (3.2%, 8 patients) showed improvements in all cases of more than 30% of the scarring in a maximum of two spot method sessions (Fig. 8). Patients with post-traumatic scarring (3.6%, 9 patients) all showed clinical improvements (Fig. 9).

In cases of eyelid treatment a temporary oedema was sometimes observed of a variable duration between 24 and 72 hours, the extent of which was proportional to the area treated.

Scabs resulting from the sublimation process has a variety of durations:

- Much less in the application of the spot method with scab detachment in 3-7 days.
- Slightly more persistent scabs in the application of the continuous method: 3-5 days in cases of surface lesions such as lentigo and seborrheic keratosis and 7-14 days in cases of dermal nevi.

After detachment of the scabs, skin appeared a little pinkish with slight erythematous, although the phenomenon was transient, lasting variably for 20-45 days.

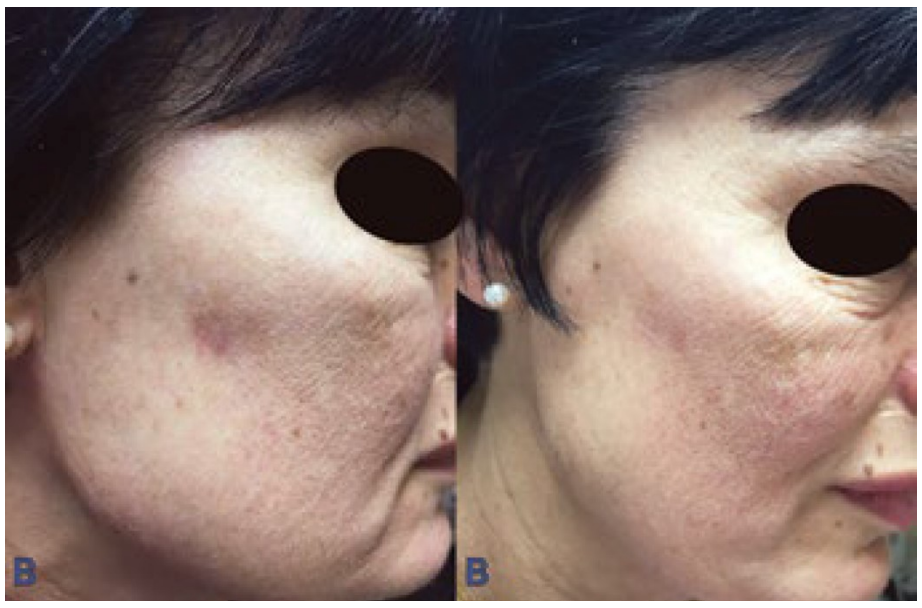

Fig. 6: Seborrheic keratosis with skin biopsy by histological definition. After 3 months only a small scar of the previous surgery is visible.

Fig. 7: Active acne before and after 3 sessions of plasma exeresis (outcome three months after the last treatment).

Fig. 8: Post-acne scarring of the left temporal region: before, immediately after and 20 days after the plasma exeresis.

Fig. 9: Foreign body granuloma (determined by ultrasound) resulting from a car accident: photos before and 30 days after treatment.

The oedema varies according to the extent of the treatment. It is therefore recommended to determine the area to be treated together with the patient, after informing him or her of the likely temporary discomfort.

All the blemishes treated resolved themselves without scarring.

The *restitutio ad integrum* of the sublimated tissue varied according to applied method; the single spot method treatment in 2-9 days and the continuous method in 3-14 days.

Two patients, both female, exhibited some hyper-pigmentation of the treated areas, one in the bilateral lower eyelid region, one in upper perioral region. Both chromatic manifestations completely resolved themselves naturally within 3 months.

Discussion

Plasma exeresis, in our clinical experience, is extremely versatile and manageable. All patients willingly underwent the sessions required to treat the skin blemishes. The zero drop-out rate substantiates the tolerability of the treatment itself.

The exclusive application of a topical anaesthetic, without the need for local anaesthesia, minimizes treatment risk and renders the treatment highly acceptable for the patient.

Due to the fact that the mechanism of action limits tissue damage and that there are no harmful light rays or electric currents that may propagate into surrounding areas, plasma exeresis has almost no absolute contraindications if mandatory clinical-pathological anamnesis assessments are properly executed.

The post-treatment management of scabs is particularly facilitated by the application of foundation cream, which masks the affected area, making subsequent social interaction easy for patients.

The most relevant transitional effect is oedema in the eyelid region. This phenomenon and dependencies should therefore discussed carefully with the patient in consideration of his or her wishes and expectations. The same overall outcome may also be achieved in several more sessions of a lower intensity, with a reduction of the oedema effect, or fewer sessions covering a larger area of the eyelid, with greater risk of increased oedema. Such considerations and operating procedures must therefore be agreed with the patient.

Post-treatment erythema is a spontaneous phenomenon due to tissue repair and is found to be more persistent in patients with facial erythrosis.

Plasma exeresis, however, seems to be an operator-dependant method. There are no predefined parameters and consequently the experience of the physician is of particular importance both in the distribution and the timing of the treatment.

The speed of execution, the practically inexistent down-time for the patient and the versatility of the instrument make it a good ally of the dermatologist and cosmetic practitioner.

The favourable cost to benefit ratio of the instrument must also be considered. It allows patient and practitioner to proceed with treatment at affordable cost for both.

A study is currently underway with the application of confocal microscopy in order to further substantiate the collagenic remodelling that occurs in areas treated with the spot method. Further research is surely needed in relation to this method, which already for some years has been applied in various fields of dermatology and aesthetic medicine, but the clinical basis of the results obtained can only encourage its wider use.

Bibliography

1. Scarano A, Carinci F, Sinjari B, et al. Skin lesions induced from the radiosurgical unit and voltaic arc dermoabrasion: a rabbit model. Eur J Inflamm: vol. 9, no. 3 (S), 89-94 (2011).

Scarano A, D'Andria D, Fippi G, Di Carlo F, Carinci F, Lauritano D. Treatment of perioral rhytides with voltaic dermoabrasion. Eur J Inflamm: vol. 10, no. 1 (S2), 25-29 (2012).

2. Sotiris TS, Dimitris V, Nikolaos G. Clinical And Histological Presentation After Plexr Application, Needle Sha- ping (Vibrance) And O.F.F. Pinnacle Medicine & Medical Sciences ISSN: 2360-9516, Vol. 2 (3), 2014, Article ID pmms_1 78, 522-530, 2015.

3. Scarano A, D'Andria D, Fippi G, Di Carlo F, Carinci F, Lauritano D. Treatment of perioral rhytides with voltaic dermoabrasion. Eur J Inflamm: vol. 10, no. 1 (S2), 25-29 (2012).

4. Sotiris TG, Irini G, Ioannis N. No- ninvasive Upper Blepharoplasty In Relation To Surgical Blepharoplasty, Pinnacle Medicine & Medical Sciences ISSN: 2360-9516, Vol. 1 (5), 2014, Arti- cle ID pmms_163, 436-440, 2014.

5. Stamatina G, Sotiris T, Aglaia V. Plexr In Acne Treatment. Pinnacle Medicine & Medical Sciences ISSN: 2360-9516, Vol. 2 (1), 2015, Article ID pmms_1 71, 482-486, 2015.