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Fractional Microneedle Radiofrequency- A Novel Minimally Invasive Technology for Treatment of Acne Scars

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ABSTRACT: Introduction: Atrophic acne scars are dermal depressions caused by destruction of collagen after inflammatory acne. They are subclassified into ice pick, boxcar and rolling scars. Various treatment modalities have been tried in treating acne scars. MNRF is a newer concept where needles at preselected depths are introduced in the skin, RF is delivered through these needles which heats the dermis and cause tissue coagulation. Methods: Ten patients more than 18 years of age, both males and females, with depressed acne scars were included in the study. Each patient went through four sessions with interval of 6 weeks between each session. Penetration depth was kept as: 1.5 mm on forehead, temple areas and bony prominences. Ice pick scars and mixed scarring: 1.5 mm to 3.5 mm. Clinical improvement and assessment was done on the basis qualitative scarring grading system proposed by Goodman and Baron. Results: Rolling and box scars showed better response than icepick scars. 4 patients with grade 3 scars before initiation of treatment showed improvement by 2 grades at the end of therapy and remaining 2 patients of grade 3 scars improved by 1 grade. 3 patients with grade 4 scars before initiation of treatment showed improvement by 2 grades at the end of therapy and remaining 1 patient of grade 4 scars improved by 1 grade. Conclusion: Noninsulated, smooth motion, microneedling RF system can significantly improve acne scars in darker skin types, with minimal downtime and low risk for postinflammatory hyperpigmentation.

KEYWORDS: Atrophic acne scar, Microneedling radiofrequency

I. INTRODUCTION

Acne is a common disease affecting a significant proportion of the population, mostly teenagers and young adults aged 11 to 30 years.[1,2] Atrophic acne scars are dermal depressions caused by destruction of collagen after inflammatory acne.[3] The pathogenesis of the scars has been explained by thickened bands of collagen under the scars causing a retraction of skin surface. They are subclassified into ice pick, boxcar and rolling scars. Goodman and Baron proposed a qualitative scarring grading system. According to this classification, 4 different grades can be used to identify an acne scar.[4]

Various treatment modalities including non-invasive methods, minimally invasive techniques and invasive procedures have been tried in treating acne scars. These include chemical peels, dermabrasion, microdermabrasion, laser treatments, dermal grafting, punch techniques, needling, and combinations of the above. But all these procedures carry a risk of significant downtime, pain, prolonged erythema and post inflammatory hyperpigmentation.

MNRF is a newer concept where needles at preselected depths are introduced in the skin, RF is delivered through these needles which heats the dermis and cause tissue coagulation. This method works on such a principle that mainly two effects are generated: (1) mechanical disruption of the dermal fibrotic strands which are responsible for downward skin retraction of atrophic scars and (2) delivery of RF energy into the dermis triggering collagen remodeling to replace fibrotic scars tissue with new healthier pliable collagen fibers.[5] This study aims at studying the equipment, technology and functioning of MNRF as well as a retrospective evaluation of its efficacy and safety on skin types III to IV for treatment of acne scars.

II. MATERIALS AND METHODS

Ten patients more than 18 years of age, both males and females, with depressed acne scars were included in the study. Informed consent was obtained from the patients.

Patients with history of keloids, pregnant or breastfeeding females and patients with clotting and heart disorders were excluded. Each patient went through four sessions with interval of 6 weeks between each session. The area was painted with povidone iodine and cleaned with rectified surgical spirit. It was performed under topical anaesthesia

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(EMLA) for 45 minutes. Penetration depth was kept as: 1.5 mm on forehead, temple areas and bony prominences. Ice pick scars and mixed scarring: 1.5 mm to 3.5 mm. There was minimal or no overlapping. Photographic record was kept before the first session, at each visit and after completion of four sessions. For post procedure care oral NSAIDS were prescribed for 5 days along with strict sun protection, adequate skin cooling, avoidance of sweating and exercise and no harsh use of soaps, no pricking or rubbing of the skin. Clinical improvement and assessment was done on the basis qualitative scarring grading system proposed by Goodman and Baron.

III. RESULTS

Mean age was 30.4 years. Study group consisted of 7 males and 3 females. Fitzpatrick skin type was III in 6 patients and skin type IV in 4 patients. All 10 patients completed the treatment. The assessment of response to treatment was based on Goodman and Baron qualitative scar grading system. Rolling and box scars showed better response than icepick scars. Grade wise reduction of scars is depicted in Table 1. 4 patients with grade 3 scars before initiation of treatment showed improvement by 2 grades at the end of therapy and remaining 2 patients of grade 3 scars improved by 1 grade. Similarly, 3 patients with grade 4 scars before initiation of treatment showed improvement by 2 grades at the end of therapy and remaining 1 patient of grade 4 scars improved by 1 grade.

Patients were asked about the subjective improvement and 7 out of 10 patients (70%) of the treated patients experienced good improvement, 10% experienced very good to excellent improvement and 2% reported some or little improvement.

The treatment was generally well tolerated. Six patients (60%) reported none to minimal pain, three (30%) reported moderate discomfort and only one (10%) reported significant pain. Nine patients reported mild erythema (90%). One patient reported post inflammatory hyperpigmentation. Social activity could resume as early as one day after treatment.

Table 1: Grade wise reduction of scars in patients at the end of treatment

Grade of acne scars	No. of patients	Post treatment reduction by 3 grades (%)	Post treatment reduction by 2 grades (%)	Post treatment reduction by 1 grade (%)	No post treatment reduction in acne scars (%)
Grade 3	6	0(0)	4(66.6)	2(33.3)	0(0)
Grade 4	4	0(0)	3(75.0)	1(25.0)	0(0)

IV. DISCUSSION

Equipment and technology:

Microneedle RF works by the principle of dermal remodelling with the use of microneedles. The microneedles are inserted into the skin to desired depth and RF current is passed. It is delivered through probe tip which consists of an array of microneedles over a minimum area of 1 cm2 that form an array of positively and negatively charged electrodes. The microneedles delivered bipolar radiofrequency energy in a fractional manner that can be inserted into the skin at a depth of 0.5 to 3.5 mm depending on level of treatment in the dermis.

Highest energy output of our machine is 61 W with 9 equally graded energy level settings. On passing the energy a temperature as high as 67°C is achieved in the dermis. Pulse duration was 800 msec and it is equipped with an option of dual frequency: 1 MHz and 2 MHz. Lower frequency can be used for fine lines and wrinkles.[6,7,8]

Microneedles

There is a disposable tip with 36 gold-plated needles with depth ranging from 0.5 mm - 3.5 mm. There are two types of needles: Insulated needles are coated with gold for better conductivity and double coated with silicone insulation except the distal 0.3 mm at the tip. This restricts RF energy delivery to the tip and no thermal damage occurs to the epidermis. Coagulation occurs only at tip which results in oozing and pinpoint bleeding. This type of microneedle array is optimum for anti wrinkle, tightening, lifting effect. On the other hand, non insulated needles act as active electrodes all the way from epidermis to tip. They cause light epidermal thermal damage. There is more coagulation and hence no pinpoint bleeding. These type of needles are optimum for acne scars, pores and stretch marks.

[6,7,8]

Pathogenesis:

Radiofrequency (RF) is non-ionizing electromagnetic radiation used in medicine for nearly 100 years. In contrast to most lasers that target specific chromophores, RF is chromophore-independent and has better penetration to the dermis and hypodermis as compared to light based technologies. Clinical treatment systems using radiofrequency energy (RF) were proven in the last decade to be safe and effective for both non-ablative skin tightening of the face and body, and fractional RF skin resurfacing for skin. [6,7,8]

The first generation of microneedle RF delivery technology used insulated needles for skin rejuvenation and acne scars with promising results. These microneedles allowed the heating of small volume of tissue near their needle tip while the rest of the needle was insulated. With these needles the energy flows only through the tip of the needle, resulting in a small coagulated sphere-like shape in the dermis. Each needle tip generates separate coagulation columns. Longer the RF conduction time, larger is area of coagulation. Higher the RF energy, greater is the tissue destruction. And deeper the needles penetrate, larger is the area of coagulation.

The advantage in efficacy as compared to fractional lasers is due to considerable higher skin penetration of the microneedles and controlled depth of penetration. Ablative fractional laser are usually associated with longer post treatment erythema, higher percentage of post inflammatory hyperpigmentation and pain. The non-thermal penetration of epidermis with smooth motion, extra sharp microneedle is less traumatic to epidermis and epidermal dermal junction leading to a decreased risk of developing post inflammatory hyperpigmentation. All these factors give high rate of patient satisfaction. Addition of RF emission through the whole needle provides a coagulation effect eliminating bleeding. Various studies have previously reported the use of MNRF in treating acne scars. Lee and colleagues showed 50% or more improvement in 55.6% of all patients for inflammatory acne vulgaris and its related dermatologic conditions, such as acne scars and enlarged facial pores.[9] This study performed on dark skin types (III–V) showed an improvement of 50% or more in 78% of all patients. Cho and colleagues used fractional microneedle RF device with 49 electrodes and found improvement in 73% of patients after 2 treatment sessions.[10]Naouri and colleagues used noninsulated microneedle RF handpiece on 20 patients and found an average improvement of 6.25 (scale of 1–10).[11] Chandrashekar and colleagues treated 31 patients, skin Types III to V, with a system with noninsulated RF microneedles.[12] Their data showed improvement in all patients, good or very good in 12%, moderate in 58%, and minimal in 29%.The only disadvantage is cost and sterility of the disposable tip.

To conclude, noninsulated, smooth motion, microneedling RF system can significantly improve acne scars in darker skin types, with minimal downtime and low risk for postinflammatory hyperpigmentation.

REFERENCES

[1]. Jacob CI, Dover JS, Kaminer MS. Acne scarring: a classification system and review of treatment options. J Am Acad Dermatol 2001;45:109–17.

[2]. Sobanko JF, Alster TS. Management of acne scarring, part I. A comparative review of lasers surgical approches. Am J Clin Dermatol 2012;13:319–30.

[3]. Harth, Y., et al. (2014) Depressed Acne Scars—Effective, Minimal Downtime Treatment with a Novel Smooth Motion Non-Insulated Microneedle Radiofrequency Technology. Journal of Cosmetics, Dermatological Sciences and Applications, 4, 212-218.

[4]. Goodman GJ, Baron JA. Postacne scarring: a qualitative global scarring grading system. Dermatol Surg 2006;32:1458–66.

[5]. Pudukadan Ong, M.W. and Bashir, S.J. (2012) Fractional Laser Resurfacing for Acne Scars: A Review. British Journal of Dermatology, 166, 1160-1169.

[6]. De la Torre, J.R., Moreno-Moraga, J., Muñoz, E. and Navarro, P.C. (2011) Multisource, Phase-Controlled Radiofrequency for Treatment of Skin Laxity: Correlation between Clinical and In-Vivo Confocal Microscopy Results and Real-Time Thermal Changes Multisource, Phase-Controlled Radiofrequency for Treatment of Skin Laxity: Correlation between Clinical and In-Vivo Confocal Microscopy Results and Real-Time Thermal Changes. Journal of Clinical and Aesthetic Dermatology, 4, 28-35.

[7]. Elman, M. and Harth, Y. (2011) Novel Multi-Source Phase-Controlled Radiofrequency Technology for Nonablative and Micro-Ablative Treatment of Wrinkles, Lax Skin and Acne Scars. Laser Therapy, 20, 139-144.

[8]. Lee SJ, Goo JW, Shin J, Chung WS, et al. Use of fractionated microneedle radiofrequency for treatment of inflammatory acne vulgaris in 18 Korean patients. Dermatol Surg 2012;38:400–5.
[9]. Cho SI, Chung BY, Choi MG, Baek JH, et al. Evaluation of the clinical efficacy of fractional radiofrequency microneedle treatment in acne scars and large facial pores. Dermatol Surg 2012; 38:1017–24.
[10]. Naouri M, Mazer JM. Non-insulated microneedle fractional radiofrequency for the treatment of scars and photoaging. J Euro Acad Dermatol 2016;30:499–502.
[11]. Chandrasekhar BS, Sriram R, Mysore R, Bhaskar S, et al. Evaluation of microneedling fractional radiofrequency device for treatment of acne scars. J CutanAesthet Surg 2014;7:93–7.
[12]. Anderson, M; Tsao, T-C; and Levin, M., 1998, "Adaptive Lift Control for a Camless Electrohydraulic Valvetrain," SAE Paper No. 98102
[13]. Ashhab, M-S; and Stefanopoulou, A., 2000, "Control of a Camless Intake Process – Part II," ASME Journal of Dynamic Systems, Measurement, and Control – March 2000
[14]. Gould, L; Richeson, W; and Erickson, F., 1991, "Performance Evaluation of a Camless Engine Using Valve Actuation with Programmable Timing," SAE Paper No. 910450.
[15]. Schechter, M.; and Levin, M., 1998, "Camless Engine," SAE Paper No. 960581
[16]. INTERNATIONAL JOURNAL OF ROBUST AND NONLINEAR CONTROL, Int. J. Robust Nonlinear Control 2001; 11:1023}1042 (DOI: 10.1002/rnc.643)