Original Article

A Study of Efficacy of Microdermabrasion in Treatment of Facial Acne Scars-Original Research

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ABSTRACT

Background: Acne vulgaris is the most common skin disease of the youth especially in puberty age. One of the most common complications of acne is scarring. It has been found to have a significant impact on their psychological well-being and has been associated with depression and suicide ideation. Acne causes emotional upset and impact to the patient by disfiguring face and scarring skin. Multiple surgical treatments are available for acne scars, which include dermabrasion, microdermabrasion (MDA), laser treatments, and dermal fillers. **Aims:** The aim of this study is to evaluate the efficacy of MDA in facial acne scars in terms of results and patient satisfaction. **Materials and Methods:** A total number of 50 patients with acne scars, who visited the hospital outdoor patient department, were included in this study. All patients were treated with MDA for 10 sittings, 2 weeks apart. **Analysis:** Patients were evaluated and analyzed after 10 sittings or before (if the complete response occurred before 10 sittings), both objectively and subjectively (in term of patient satisfaction). **Result and Conclusion:** Of a total of 50 patients, 25 patients (50%) had moderate scarring and of these 21 (84%) showed good response, 3 (12%) showed fair response and 1 (4%) showed excellent response.

Key words: Acne vulgaris, facial scars, microdermabrasion

INTRODUCTION

Acne (synonymous: Varus) is the most common disease of the adolescent age. Acne causes emotional upset and impact to the patient by disfiguring face and scarring skin.[1]

Scars form at the site of an injury to tissue. In the case of acne, the injury is caused by the body's inflammatory response to sebum, bacteria and dead cells in the plugged sebaceous follicle.[2] There is considerable variation in scarring between one person and another, indicating that some people are more prone to scarring than others. Scarring frequently results from severe inflammatory nodulocystic acne that occurs deep in the skin.[3]

A number of treatments are available for acne scars through dermatologic surgery. The type of treatment selected should be the one that is best in terms of type of skin, the cost, what the patient want to accomplish and the possibility that some types of treatment may result in more scarring if patient is very susceptible to scar formation.

The treatments currently available are dermabrasion, microdermabrasion (MDA), laser treatments, and dermal fillers.

Following study was conducted to evaluate the efficacy of one such treatment modality, i.e., MDA in terms of results and patient satisfaction. The origin of MDA can be traced back to the ancient Egyptian kings and queen who sand blasted their skin in their attempt at facial rejuvenation.[4] Malner used various grades of silicone carbide sandpapers manually to improve acne

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scars.[5] These pioneer's demonstrated that controlled tissue abrasion that did not involve reticular dermis healed without scarring. All these factors led European esthetic surgeons and aestheticians in 1985 to develop closed-loop dermabrasion technology, now popularly referred as "MDA."

Aims and Objectives

- To study clinical types and prevalence of scarring in acne patients.
- To study the effect of MDA on different types of acne scars.
- To study compliance and satisfaction of patients of acne scarring after MDA.

MATERIALS AND METHODS

This study was carried out in the Department of dermatology, 50 patients with acne scars were included in the study.

Selection Criteria

Patients having all types and grades of acne scars were included in the study.

Exclusion Criteria

- Active acne lesions
- History of sensitivity to Aluminum oxide crystals
- History of photosensitivity
- History of keloidal tendency
- Past history of herpes labialis

In the history all the patients were asked about duration of acne, type of acne and all the previous drugs and treatment taken.

Examination included evaluation of scars (icepicks, rolling, boxcar, and hypertrophic). Approximate number of scars on forehead, cheeks, chin, and nose were counted in terms of mild (<10), moderate (10-20), severe (>20). Pigmentation if present was also examined. Size of the scars was noted in mm in a range, i.e., varying from the smallest size to the largest.

Informed consent was obtained from every patient and counseling was done. Pre-, mid-, and post-treatment photographs were taken in all patients.

All the patients were treated with MDA full face for up to ten sessions at a gap of 2 weeks. During the procedure, one pass was given to full face and second pass only to the affected area. At every visit, subjective and objective evaluations were done. In subjective evaluation patients were asked to grade the response from poor to excellent, poor ≤25% improvement, fair = 25-50% improvement, good = 50-75% improvement, excellent ≥75% improvement.

Objective criteria of evaluation were based on the grades:
1 = <10 scars, superficial
2 = <10 scars, superficial and deep
3 = <10 scars, deep
4 = 10-20 scars, superficial
5 = 10-20 scars, superficial + deep
6 = 10-20 scars, deep
7 = 20-30 scars, superficial + deep
8 = 20-30 scars, deep
9 = >30 scars, superficial + deep
10 = >40 scars, superficial + deep.

On every visit the change in grades was noted.

Side-effects such as erythema, pigmentation, abrasion, worsening were also recorded.

Overall response was calculated subjectively by asking each patient about the response poor to excellent, and objectively the same was calculated by subtracting the grades on starting of treatment and on last sitting. Difference of ‹2 was considered poor response, difference of 2-4 was considered fair response, difference of 4-6 was considered good response and difference of ›6 was considered excellent response.

RESULT

This study comprises of 50 patients of scarring on face following acne vulgaris. All patients were treated with MDA irrespective of the grade and type of scarring. Patients were evaluated and analyzed after 10 sittings (2 week apart) or before (if complete response occurred before 10 sittings).

Table 1: Age incidence

Age (years)	No. of patients	Percentage
Up to 10	-	-
11-20	8	16
21-30	41	82
31-40	1	2
41-50	-	-
51-60	-	-
>60	-	-

Age Incidence

As shown in Table 1, the main age group affected was between 21 and 30 years, i.e., 82% (41 patients). The second group affected was 11-20 years i.e., 16% (8) patients belonged to 11-20 years of age. 2% patients (1) belonged to age group 31-40 years. The incidence of scarring was found to be highest among age group 21-30 years.

Sex Incidence

As shown in Table 2, 31 (62%) male patients and 19 (38%) female patients were affected. The reason behind this may be due to severity and complications of acne that are more common in males.

Severity of Acne

As shown in Table 3, 24 (48%) patients had history of moderate (Grade II) acne in past, 14 (28%) patients had history of severe (Grade III) acne, 11 (22%) patients had history of nodulocystic (Grade IV) acne and 1 (2%) patients had history of mild (Grade I) acne in past.

Family History

As shown in Table 4, family history of acne and scarring was observed in 49 (98%) of patients and 1 (2%) patient did not have family history of acne and scarring.

Types of Scarring

As shown in Table 5, 49 (98%) patients had rolling scars, 37 (74%) patients had boxcar scars, 31 (62%) patients had ice pick scars. Hypertrophic/keloidal scars were not observed in any patient. Of 37 patients of boxcar scar type, 19 (51.3%) had moderate, 13 (22.4%) had severe and 5 (13.5%) had mild scarring.

Prevalence of Severity of Scarring of Different Types

According to Table 6 out of 31 patients of ice pick scars 20 (64.5%) had moderate 9 (29%) had mild and 2 (6.5%) patients had severe scarring. Out of 49 patients of rolling scars, 28 (57.6%) had moderate, 11 (22.4%) had severe and 10 (20%) had mild.

Prevalence of Scarring According to Site

Table 7 shows, cheek was involved in 50 (100%) patients, forehead in 44 (88%) patients, chin in 37 (76%) patients and nose in 35 (70%).

Table 2: Sex incidence

Sex	No. of patients	Percentage
Male	31	62
Female	19	38

Table 3: Severity of acne (in past)

Severity of acne	Grade	No. and percentage
Mild	I	1 (2)
Moderate	II	24 (48)
Severe	III	14 (28)
Nodulocystic	IV	11 (22)

Table 4: Family history of acne and scarring

Family history	Percentage
Father	12 (24)
Mother	21 (42)
Siblings	20 (40)
No history	1 (2)

Table 5: Type of scarring

Type of scar	Total number	Percentage
Ice-pick	31	62
Rolling	49	98
Boxcar	37	74
Hypertrophic/keloid	-	-

Table 6: Severity of scaring

Type of scar	No.	Mild (%)	Moderate (%)	Severe (%)
Ice pick	31	9 (29)	20 (64.5)	2 (6.5)
Rolling	49	10 (20)	28 (57.6)	11 (22.4)
Boxcar	37	5 (13.5)	19 (51.3)	13 (22.4)
Hypertrophic/keloid	0	0 (0)	0 (0)	0 (0)

Table 7: Prevalence according to site

Site	No. of patients	Percentage
Forehead	44	88
Cheek	50	100
Chin	37	76
Nose	35	70

Table 8: Severity of scarring (according to number of scars)

Severity	No. of patients	Percentage
Mild (0-20 scars)	7	14
Moderate (20-40 scars)	25	50
Severe (>40 scars)	18	36

Patients Severity According to Number of Scars

According to Table 8, 25 (50%) patients had moderate scarring (i.e., 20-40 Scars), 18 (36%) patients had severe scarring (i.e., >40 Scars) and 7 (14 %) patients had mild scarring (0-20 scars).

Psychological Effect

As shown in Table 9, 32 (64%) patients had mild psychological effect, 14 (28%) patients had moderate and 4 (8%) patients suffered from severe psychological effect due to scarring on face.

Subjective Evaluation

This was based on patients own observation regarding improvement in acne scarring. The criteria is as follows:

criteria	
<25% improvement	=Poor response
25-50% improvement	=Fair response
51-75% improvement	=Good response
>75% improvement	=Excellent response

The patients were evaluated on every visit and final evaluation was done on last visit.

As shown in Table 10, 8 (16%) patients had excellent response, 28 (56%) patients had good response, 10 (20%) patients had fair response and 4 (8%) patients had poor response.

Objective Evaluation

This was done by the observer conducting the study. All patients on their first visit were evaluated (according to objective criteria shown below) and given a Grade 0-10. On the last visit, patients were again evaluated and given a Grade 0-10 according to the same criteria. The difference between the baseline grade and last visit grade was calculated and response evaluated.

Objective Criteria of Evaluation

Grade	=Criteria
1	=<10 scars, superficial
2	=<10 scars, superficial and deep (mixed)
3	=<10 scars, deep
4	=10-20, superficial
5	=10-20, superficial and deep (mixed)
6	=10-20, deep
7	=20-30, superficial and deep (mixed)
8	=20-30, deep
9	=>30, superficial and deep (mixed)
10	=>40, superficial and deep (mixed)

Objective score = baseline score - last session score
Difference of < 2=Poor response (P)
2-4=Fair response (F)
2-6=Good response (G)
>6=Excellent response (E)

As shown in Table 11, 8 (16%) patients had excellent response, 28 (56%) patients had good response, 10 (20%) patients had fair response and 4 (8%) patients had poor response.

Overall Response

As shown in Table 12, out of 7 patients with mild scarring 7 (100%) patients had excellent response, out of 25 patients of moderate scarring, 21 (84%) had good response, 3 (12%) patients had fair response, 1 (4%) patients had excellent response, out of 18 severe scarring patients, 8 (44.4%) had fair response, 6 (33.3%) had good response, 4 (22.2%) had poor response [Figures 1-4].

Side Effects

As shown in Table 13, 9 (18%) patients had side effects, 5 (10%) had erythema, 2 (4%) had abrasion, 1 (2%) had freckles, 1 (2%) had freckles, 1 (2%) had gouging and grooving, 41 (82%) patients did not have any side-effects.

DISCUSSION

Acne Vulgaris

Acne is a polymorphic disease. It mainly occurs on the regions of body rich in sebaceous glands mainly face, mid chest, shoulders and upper arms. Many factors like circulating sex hormones, alteration in pattern of keratinization within the sebaceous follicle,

Table 9: Prevalence of psychological effect

Effect	No. of patients	Percentage
Mild	32	64
Moderate	14	28
Severe	4	8

Table 10: Subjective evaluation

Response	No. of patients	Percentage
Excellent (E)	8	16
Good (G)	28	56
Fair (F)	10	20
Poor (P)	4	8

Table 11: Objective evaluation

Response	No. of patients	Percentage
Excellent (E)	8	16
Good (G)	28	56
Fair (F)	10	20
Poor (P)	4	8

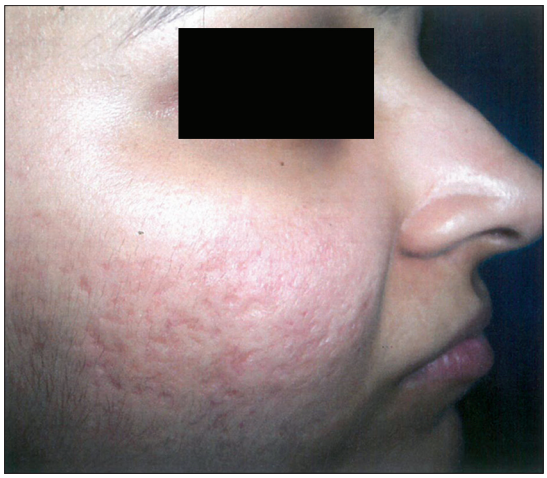

Figure 1: pre-treatment

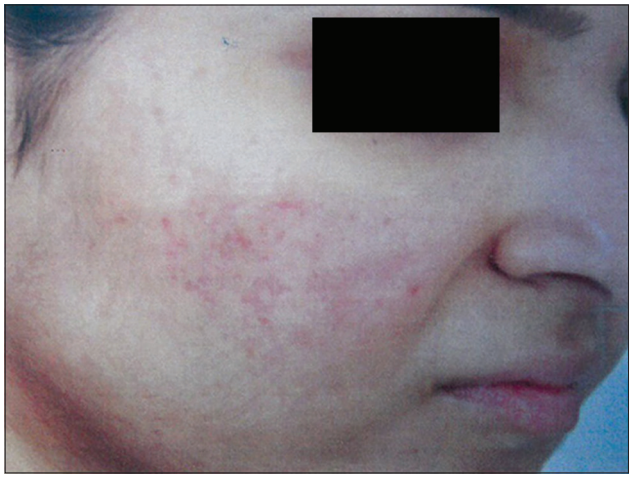

Figure 2: post-treatment

Table 12: Overall response

Grade of scarring response	Mild (7 patients)	Moderate (25 patients) (%)	Severe (18 patients) (%)
Excellent (E)	7 (100%)	1 (4)	-
Good (G)	-	21 (84)	6 (33.3)
Fair (F)	-	3 (12)	8 (44.4)
Poor	-	-	4 (22.2)

Table 13: Side-effects

Side effects	No. of patients	Percentage
Erythema (E)	5	10
Abrasion (A)	2	4
Freckles (F)	1	2
Gouging and grooving	1	2
No side-effects	41	82

quantity and quality of sebum secretion, colonization of follicular canal by microbial flora, immunological factors, environment factors and genetic susceptibility play important role in etiology of acne vulgaris.

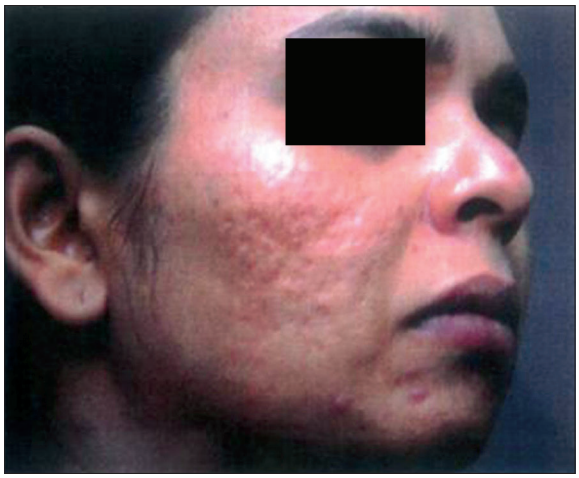

Figure 3: pre-treatment

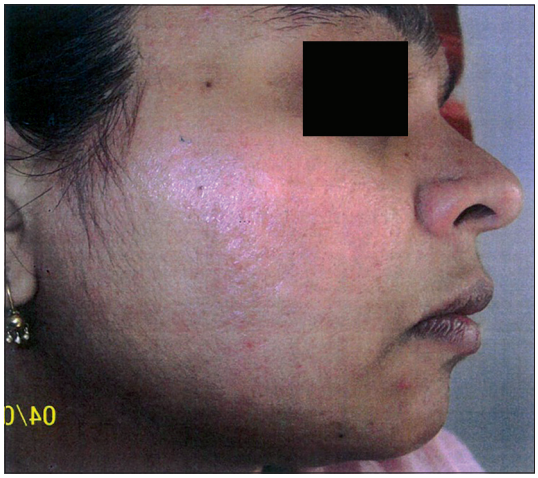

Figure 4: post-treatment

Classification

Following table shows grading according to number of lesions in comedonal and papulopustular forms.

Grade	No. of comedones on one side	No. of populopustular lesions on one side
I	<10	<10
II	10-25	10-20
III	25-50	20-30
IV	> 50	>30

Another classification is based on clinical grounds:
Grade I (Mild): Comedones, occasionally papules.
Grade II (Moderate): Comedones, papules, few pustules.
Grade III (Severe): Predominant pustules, nodules, abscesses.
Grade IV (Cystic): Mainly cysts and abscesses wide spread scarring.

Complication of Acne Vulgaris

Hyperpigmentation (acne hyperpigmented macule) these are lesion well on way to regression but can persist for many weeks. They are more common in dark skin persons. Solid non-pitting persistent facial edema - is a rare complication.

Calcification-very rare complication of scarring.

Psychological effect[2,6] - Acne and scarring causes increased levels of anxiety, low self-esteem and lack of confidence.

Scar formation - depressed or keloidal.

Acne Scarring and Its Classification

Pathogenesis: Scars form at the side of an injury to tissue. In case of acne, the injury is caused by the body's inflammatory response to sebum, bacteria and dead cells in the plugged sebaceous follicle. That's why the healing occurs with formation of fibrous scar tissue.

Classification

There are two general type of acne scars defined by tissue response to inflammation: (1) Scars caused by increased tissue formation and (2) Scars caused by loss of tissue.

Scars caused by increased tissue formation: The scars caused by increased tissue formation are called keloids or hypertrophic scars. Both hypertrophic and keloid scars are associated with excessive amounts of cell substance collagen. Overproduction of collagen is a response of skin cells to injury. The excess collagen becomes piled up in fibrous masses, resulting in a characteristic firm, smooth, usually irregularly-shaped scar. The typical keloid or hypertrophic scar is 1-2 mm in diameter but some may be 1 cm or larger.

Scars caused by loss of tissue (atrophic scars). These are more common than hypertrophic scars. Scars associated with loss of tissue are:

Ice pick scars: They are small, with a somewhat jagged edge and steep sides like wounds from an ice pick.

Depressed fibrotic scars: Are quite large, with sharp edges and steep sides. The base of these scars is firm to touch.

Soft scars, superficial or deep: Are soft to touch. They have gently sloping rolled edges that merge with normal skin. They are usually small and either circular or linear in shape.

Atrophic macules: Are usually fairly small when they occur on the face but may be a centimeter or larger on the body. They are soft, often with a slightly wrinkled base, and may be bluish in appearance due to blood vessels lying just under scar.

Follicular macular atrophy is more likely to occur on the chest or back of a person with acne.

These are small, white, soft lesions, often barely raised above the surface of skin.

A more descriptive, single, universally applicable acne scar classification system scar is[7] [Figure 5].

Ice pick scars: Ice pick scars are narrow (< 2 mm), deep, sharply marginated epithelial tracts that extend vertically to the deep dermis or subcutaneous tissue. The surface opening is usually, but not always, wider that the deeper infundibulum as the scar tapers from the surface to its deepest apex.

Rolling scars: Rolling scars occur from dermal tethering of otherwise relatively normal appearing skin and are usually wider that 4-5 mm. Abnormal fibrous anchoring of the dermis to the sub cutis leads to superficial shadowing and a rolling or undulating appearance to the overlying skin. Although they tend to be shallow, the sub dermal tether precludes treatment from surface above correction of the sub dermal component is essential for treatment success.

Boxcar scars: Boxcar scars are round to oval depressions with sharply demarcated vertical edges, similar to

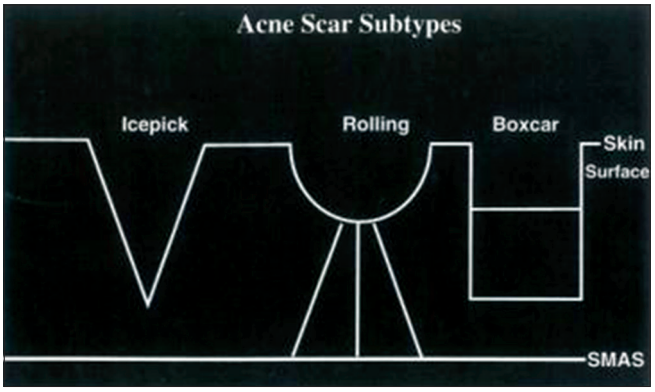

Figure 5: Three basic scar types - icepick, rolling and boxcar, SMAS: Superfical musculoaponeurotic system to which fibrous bands adhere creating rolling rolling scars

varicella scars. They are clinically wider at the surface that ice pick scars and do not taper to a point at the base. They may be shallow (0.1-0.5 mm) or deep (< 0.5 mm) and are most often 1.5-4.0 mm in a diameter. Shallow boxcar scars are within the dermal reach of skin resurfacing treatments (such as laser skin resurfacing), but deeper boxcar scars are resistant to improvement in the absence of full thickness treatment of the scar.

Management of Acne Scarring[8-12]

The scar treatments that are currently available include:

Medical Treatment

Topical steroids: Have role in hypertrophic acne scars through their atrophogenic effect or collagenolytic effect. It also has anti-inflammatory effect.

Topical retinoids: Retinoids like all-trans retinal (tretinoin) and all-trans retinoic acid can be helpful in treatment of acne scarring as they cause epidermal thickening, dermal regeneration and pigment lightening.

Alpha hydroxyl acids (AHA): AHA like lactic acid and gluconic acid are used for facial acne scars as their mechanism of action is that they increase collagen, elastin and glycosaminoglycan systhesis in dermis through regeneration of proteins.

Topical heparin and allantoin gel: Heparin promotes the hydration (water binding capacity) of the hardened tissue of keloid and hypertrophic scar and cause relaxation of scars.

Surgical Treatment

Chemical peels: Chemical peeling is the process of causing controlled chemical burns to skin. Depth of induced wound depends upon the depth, the wounding agent will attain. This produces a partial thickness wounds that heal by secondary intention the end resuls is thinning of stratum corneum, regulation of epidermal thickness, laying down of new collagen and ground substance in the dermis, trichloroacetic acid peels (10-35%)- full face and GA (20-70%)- spot/full face are beneficial in rolling and superficial boxcar acne scars.

Dermal fillers/collagen injection[13,14]: Fillers are injected under the skin to "Stretch" and "Fill out" certain types of superficial and deep acne scars. They do not work well for ice-pick scars and keloids. Cosmetic benefit from these injection usually lasts 3-6 months. Classification of dermal fillers.

Autologous fat transfer[15]: Fat is taken from another site of body and injected beneath the surface of skin to elevate depressed scars.

Dermabrasion: Under local anesthetic, a high speed brush or fraise used to remove surface skin and alter the contour of scars. Super facial scars may be removed altogether and deeper scars may be reduced in depth.

MDA: This new technique is a surface form of dermabrasion. Rather than a high speed brush, MDA uses aluminum oxide crystals passing through a vaccum tube to remove surface skin. Only the very superficial cells of skin are removed, so no additional wound is created.

Laser treatment: Lasers of various wave length and intensity may be used to recontour scar tissue and reduce the redness of skin around healed acne lesions. Fractional carbon di oxide laser has shown promising results.

Skin surgery: Punch excision: Some Ice pick scars may be removed by this process. In this procedure each scar is excised down to the layer of subcutaneous fat, the resulting hole in the skin may be repaired with sutures or with a small skin graft.

Punch elevation: Punch elevation combines the techniques of punch excision and grafting. With the help of punch biopsy tools careful elevation of tissue is performed so that it sits slightly higher that the surrounding skin. The "floating" punched specimen is affixed to surrounding tissue. Cyanoacrylate glue can be used for this purpose.

Subcision: Is a technique in which a surgical probe is used to lift the scar tissue away from unscarred skin, thus elevating a depressed scar.

Treatment of keloids: Surgical removal is seldom if ever used to treat keloids. Sometimes keloids are treated with intra-lesional injection of steroid.

MDA[16]

"MDA" as the name suggests is one of the superfacial resurfacing technique in which skin surface is abraded with rough aluminum oxide (Al_2O_3) crystals.

Mechanism of Action[17-20]

MDA produces epidermal and dermal changes through superficial wounding. Superficial epidermis including stratum corneum, surface debris, oil and dirt are removed immediately on direct impact of Al_2O_3 crystals on the skin surface. Resultant superficial wounds are then allowed to heal by secondary intention with partial re-epithelialization and remodeling of dermal collagen.

Following are the mechanism through which it act. Mechanical disruption of the stratum corneum. Partial epithelialization and stimulation of epidermal cell turnover (production of new cells) Vasodilatation of dermal blood vessels and dermal edema. Stimulation and remodeling of dermal collagen. The MDA system and its mechanism.[21-24]

MDA unit consists of two systems projection and suction. Projection of system has a compressor generator (power line) responsible for the controlled projection of sterile Al_2O_3 crystals. Suction system on the other hand creates vacuum and aspirates epidermal debris, grime and used Al_2O_3 crystals. There are two designated independent glass/plastic containers along with their flexible tubings for each of these systems. The connecting tubes of both these system open into the unit's hand piece [Figure 6] near its tip and is the only connection link between the two systems.

When the tip is placed on the surface of the skin and the system is activated, the hand piece gently pulls the skin in. The power line projects the Al_2O_3 crystals on to the skin surface through one opening [Figure 7]. These abrade the skin surface and the used crystals along with the epidermal debris and grime are collected by the tubings of the suction system through another opening housed in the tip of same hand piece; thus establishing a close circuit loop of continuous flow and collection simultaneously. The operator can control the pressure (treatment intensity) with the control panel located on the main body and can stop the treatment at any stage by simply removing the hand piece. The Al_2O_3 crystals used are inert, non-toxic and insoluble in water and organic solvents.

1. Histopathological changes induced by MDA[18-20]:
2. Normalization (thinning) of stratum curneum.
3. Increased thickness of epidermis.
4. Even and regular distribution of melanosomes.

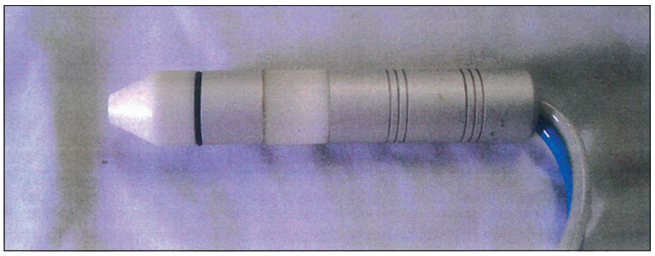

Figure 6: Hand piece of microdermabrasion unit

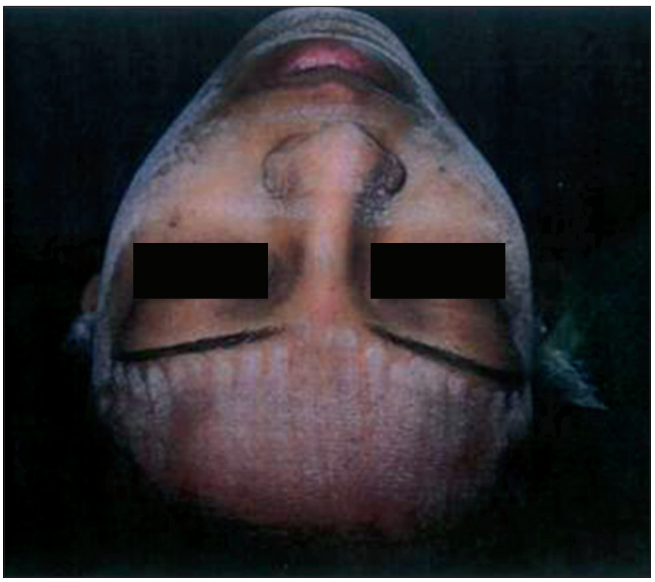

Figure 7: Technique of doing microdermabrasion

5. Remodeling of collagen, elastic tissue and dermal oedema.
6. Vascular ectasia with perivascular mononuclear cellular infiltrate.

Indications[22-26]

1. Facial rejuvenation: Rough texture, dyschromia, actinic damage, superficial rhytides.
2. Comedonal acne (non-inflammatory).
3. Superficial scar-acne, chicken pox, traumatic.
4. Hyperpigmentation.
5. Enlarged pores.
6. Striae.
7. Melasma.

Contraindications[17,21-23]

1. Inflammatory acne-pustular, nodulocystic.
2. Active bacterial or viral infections.
3. Keloidal tendency.
4. History of use of isotretinoin within last 1 year.
5. Side-effects and complications[17,21-23,25-28]:

6. Erythema.
7. Edema.
8. Increased skin sensitivity.
9. Drying.
10. Infection.
11. Gouging and Grooving.
12. Abrasion.

To reduce the side-effects proper post-operative precautions and care should be explained e.g. application of moisturizer and sunscreen should be advised.

Advantages

1. No anesthesia is required.
2. Safe during pregnancy and lactation.
3. Less down time.
4. Easy to perform, less time consuming and requiring no special surgical skills.
5. Even patients with Fitzpatrick skin types IV to VI, who may be at more risk of complications with other resurfacing techniques (carbon di oxide laser), may be treated with relative safety.

Disadvantages

1. Results not sustainable on long term basis.
2. Repeated number of sittings are required.
3. Not useful in deep acne scars.

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