

## Research Article

# A study of efficacy of subcision, micro-needling and carbon dioxide fractional laser for treatment of acne scars

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### ABSTRACT

**Background:** Acne vulgaris is one of the most common skin problem encountered in adolescents. Complication of acne may lead to scar formation. Types of acne scars are atrophic scars (ice pick, rolling scars and box scar), hypertrophic scar and keloidal scar. Multiple modalities for treating acne scars are chemical peeling, derma roller, subcision, punch excision, cryoroller, CROSS (chemical reconstruction of skin scars), fractional lasers, etc. This study is to study the efficacy of derma roller, subcision and CO<sub>2</sub> fractional laser in acne scar and complications associated with them.

**Methods:** Total 45 patients with grade 2, 3 and 4 atrophic acne scar (Goodman and Baron grading system) were enrolled in the study and randomly assigned in three groups of 15 patients each. Group A: Derma roller, Group B: Subcision, Group C: CO<sub>2</sub> fractional laser. 3 sittings at 28 days interval were done in each group. Evaluation was done by standardized digital photography pre-procedure and at each sitting. Physician's evaluation was done in terms of excellent, good, fair, poor improvement or worsening. Patient's self-evaluates as excellent, good, fair, poor improvement or worsening.

**Results:** According to physicians evaluation at the end of 3 sittings excellent response was seen in 20% (n=3), 13.33% (n=2), 6.67% (n=1) in group B, group C, group A respectively. According to self-evaluation by patient at the end of 3 sittings, overall, 44.44% (n=20) patients showed an excellent response (score of 8-10).

**Conclusions:** Time tested procedures; like subcision if done adequately and properly have excellent response and is comparable to newer and costly treatment like CO<sub>2</sub> fractional laser.

**Keywords:** Acne scars, Microneedling, Dermalroller, Subcision, CO<sub>2</sub> fractional laser, Acne, CROSS

### INTRODUCTION

Acne is a chronic inflammatory disease of the pilosebaceous unit, commonly affecting adolescents and young adults.<sup>1</sup>

Various factors like androgen induced increased sebum production, alteration in quality of sebum lipids; inflammation, altered keratinization and colonisation of hair follicles by bacteria like *Propioni bacterium* acne are contributory to it. Series of events like infra infundibular inflammatory process, follicular rupture and perifollicular abscess leads to injury of the skin. This in turn

initiates the cascade of wound healing through soluble chemical mediators and various inflammatory cells leading to enzymatic degradation of collagen fibres and subcutaneous fat. The end result of which is formation of scar tissue.<sup>2,3</sup>

Acne scarring is an unfortunate, permanent complication seen in about 95% patients of acne vulgaris up to some degree.<sup>4,5</sup> Given the psychological, social and emotional impact of disfigurement caused due to acne scars, dermatologists are frequently presented with the challenge of evaluating and providing treatment for the same.<sup>6-8</sup> The variation seen in development of scars is not

completely understood as degree of acne does not always correlate with the number or severity of scarring. Acne scars are classified as atrophic and hypertrophic. The most common type of acne scar is atrophic, which includes ice pick, rolling scars, and box scars.<sup>9</sup>

As such, there are multiple modalities of treatment for acne scars. But there are no common rules or standard set of treatment which can be applied to every patient. So, treatment should be individualised in each patient based on the type and characteristic of the scars. Various therapeutic options have been described with variable clinical outcomes and complications, such as subcision, micro needling, chemical peels, Trichloro acetic acid CROSS technique, punch graft, punch excision, dermabrasion, ablative laser treatment, non-ablative laser treatment, autologous fat transfer, and injection of dermal fillers etc.<sup>10-14</sup> Recently, better understanding of the scar pathology has led to development of many new procedures with shorter downtime and improved response. The objective of this study is to study the efficacy of subcision, micro needling with derma roller and CO<sub>2</sub> fractional laser in the treatment of atrophic acne scar and the complications associated with these procedures. In microneedling with dermaroller, there are

fine needles which puncture the skin and cause increased elastin and collagen content in the dermis, collagen remodeling and increase in thickness of epidermis and dermis.<sup>15</sup>

In subcision a small needle is inserted beneath the scar to loosen the fibrotic adhesions. Along with loosening of tissue there is also some bleeding at the site which creates a potential space where collagen can be deposited during the wound healing phase CO<sub>2</sub> lasers have a selectivity for water and it has a double effect that is, they promote the wound healing process and arouse an amplified production of myo-fibroblasts and matrix proteins such as hyaluronic acid.<sup>16</sup>

**METHODS**

45 patients with atrophic acne scar presenting to the outpatient department of dermatology were enrolled for the study based on inclusion and exclusion criteria. The patients were elaborately explained about the procedure and written informed consent was obtained. Detailed history and clinical examination was done for all the patients. Grading of the acne scars was done using Goodman and Baron grading system.<sup>17</sup>

**Table 1: Goodman and Baron grading system for acne scars.**

Grade	Level of disease	Characteristics	Examples
1	Macular	Erythematous, hyper or hypopigmented flat marks visible to patient or observer irrespective of distance	Erythematous, hyper or hypopigmented flat marks
2	Mild	Mild atrophy or hypertrophy that may not be obvious at social distances of 50cm or greater and maybe covered adequately by makeup or the normal shadow of shaved beard hair in males or normal body hair if extra-facial	Mild rolling, small soft papular
3	Moderate	Moderate atrophic or hypertrophic scarring that is obvious at social distances of 50 cm or greater and is not covered easily by makeup or the normal shadow of shaved beard hair but is still able to be flattened by manual stretching of the skin	More significant rolling, shallow 'box scar', mild to moderate hypertrophic or opular scars
4	Severe	Severe atrophic or hypertrophic scarring that is obvious at social distances of 50 cm or greater and is not covered easily by makeup or shadow of shaved beard hair in males or body hair if extra-facial and is not able to be flattened by manual stretching of skin	Punched out atrophic (deep 'box scar'), ice pick, bridges and tunnels, gross atrophy, dystrophic scars, significant hypertrophy or keloid

**Inclusion criteria**

- Grade 2, 3 or 4 atrophic acne scar ( Goodman and Baron Grading system)
- No active acne
- Not on any other scar treatment
- Patients in the age group of 18-40 years.
- Patient willing to give consent for the treatment.

**Exclusion criteria**

- Pregnancy
- Use of oral isotretinoin in last 6 months
- h/o major surgery in last 6 months
- Herpetic infections or warts or any other active infection of adjacent skin
- Coagulopathies
- Presence of active acne
- H/o thyroid, diabetes, hypertension, asthma

- H/o keloid formation
- Use of drugs that may induce hyper pigmentation such as amiodarone, clofazimine, minocycline.
- Patient not giving consent

The patients were randomly divided into three groups of 15 patients each.

**Table 2: Groups of patients undergoing different modalities for acne scar.**

Group	Treatment
Group A	Patients treated with derma roller
Group B	Patients treated with subcision
Group C	Patients treated with CO <sub>2</sub> fractional laser

Patients were explained in detail about the benefits, duration of the treatment, possible side effects and the prognosis of the treatment. Standardised Digital photographs of face were taken pre procedure and each subsequent sitting. Priming was done in all patients with kojic acid cream 1% for 15 days before procedure. Before procedure, face was gently cleansed and a topical anaesthetic cream EMLA (a eutectic mixture of lidocaine 2.5% and prilocaine 2.5%) was applied for 1 hour. In Group A patients- a sterile derma roller with needles of length 1.5 mm was rolled across the skin with pressure in multiple directions (criss cross pattern) until the area demonstrates uniform pinpoint bleeding.<sup>18</sup>

Patients were advised topical antibiotic application for two to three days and sun protection for at least one week along with use of sunscreens (with a minimum sun protection factor of 30 and UVA 3+). The procedure was repeated at 28 days interval for 3 sittings. In Group B patients – individual scars were marked using a sterile marker pen. 23 gauge needle is inserted adjacent to the scar with the bevel upwards parallel to the skin surface, into the deep dermis under the scar to release fibrous bands at dermal or deep dermal subcutaneous plane (3-5) by moving needle in horizontal plane using the sharp edge of needle. Post procedure topical antibiotics were given for 5 days along with use of sunscreens (with a minimum sun protection factor of 30 and UVA 3+). The procedure was repeated at 28 days interval for 3 sittings.

In Group C patients- Fractional CO<sub>2</sub> laser was delivered to each atrophic acne scar present. Fluence ranging from 10-15 Joules/cm<sup>2</sup> was used at densities of about 100- 150 Micro Thermal Zones/cm<sup>2</sup>, thus providing about 40-45 mili Joules energy and an ablation depth of 1.0-1.2 millimetre at each spot. Post procedure patient was advised skin cooling with ice packs for 10 mins for post procedure erythema, oedema and burning sensation. Topical antibiotic formulation was given and sun exposure was prevented for 5 days. Patients were advised to use sunscreens (with a minimum sun protection factor of 30 and UVA 3+).The procedure was repeated at 28 days interval for 3 sittings.

**Evaluation procedure**

All the patients were clinically and photographically evaluated at each subsequent sitting.

*Physician’s assessment*

The response was assessed by a single observer by using the quartile grading scale. A score of 0, 1, 2, 3 was thus given if the response was <25%, 25-50%, 51-75% and >75% respectively. The response was termed as excellent if the score was 3, good if the score was 2, fair if the score was 1 while patients getting a score of <1 were termed as poor responders.

*Patient’s assessment*

The patients were given a preformed questionnaire at the end of the follow up period where in they were asked to rate the improvement in their scars on a 10 point scale. Rating above 6 was graded as ‘excellent response’, rating between 4 and 6 means ‘good response’ and rating below 4 served as poor response. Adverse effects, if any, were also monitored at each follow up visit.

**RESULTS**

A total of 45 patients were included in the study and were randomly divided into three groups of 15 patients each. Group A: derma roller, group B: subcision, group C: CO<sub>2</sub> fractional laser. Over-all maximum number of patients in this study, 51.1% (n=23), were in age group of 21-30 year (Table 3).

**Table 3: Age distribution of patients.**

Age group	Group A		Group B		Group C		Total	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
11-20	5	33.33%	4	26.67%	2	13.33%	11	24.44%
21-30	9	60.00%	8	53.33%	6	40.00%	23	51.11%
31-40	1	6.67%	3	20%	7	46.67%	11	24.44%
Total	15	100	15	100	15	100	45	100

**Table 4: Sex distribution of patients.**

Sex	Group A		Group B		Group C		Total	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Male	10	66.67%	8	53.33%	6	40%	24	53.33%
Female	5	33.33%	7	46.67%	9	60%	21	46.67%
Total	15	100	15	100	15	100	45	100

**Table 5: Distribution of grade of acne scar.**

Grade	Group A		Group B		Group C		Total	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
2	4	26.67%	5	33.33%	6	40%	15	33.33%
3	7	46.67%	8	53.33%	6	40%	21	46.67%
4	4	26.67%	2	13.33%	3	20%	9	20%
Total	15	100	15	100	15	100	45	100

Out of 45 patients, 24 (53.33%) were males and 21 (46.67%) were females (Table 4). There were 7 (46.67%) patients with grade 3 acne scar in group A, 8 (53.33%) patients with grade 3 acne scar in group B and 6 patients (40%) each of grade 2 and grade 3 acne scar in group C (Table 5).

According to physician's assessment of the response as noted by a single observer at the end of 1 sitting excellent response that is >75% improvement was seen in overall 8.89% patients (n=4) only with 1 patient each in group A and B and 2 patients in group C. No worsening was seen

(Table 6). According to physician's assessment of the response as noted by a single observer at the end of 3 sittings, overall 13.33% patients (n=6) had an excellent response showing >75% improvement.

20% (n=3) patients of group B, 13.33% (n=2) patients of group C, 6.67% (n=1) patients of group A showed excellent response. No worsening was seen (Table 7).

A total of 15 patients experienced complications out of 45, the most common of which was prolonged erythema, seen in 6 patients (Table 8).

**Table 6: Physician's evaluation of treatment response at the end of 1 sitting.**

Response	Score	Group A		Group B		Group C		Total	
		No.	%	No.	%	No.	%	No.	%
Excellent	3	1	6.67%	1	6.67%	2	13.33%	4	8.89%
Good	2	0	0	2	13.33%	2	13.33%	4	8.89%
Fair	1	7	46.67%	6	40%	7	46.67%	20	44.44%
Poor	0	7	46.67%	6	40%	4	26.67%	17	37.78%
Total		15	100	15	100	15	100	45	100

**Table 7: Physician's evaluation of response at end of 3 sittings.**

Response	Score	Group A		Group B		Group C		Total	
		No.	%	No.	%	No.	%	No.	%
Excellent	3	1	6.67%	3	20%	2	13.33%	6	13.33%
Good	2	3	20%	5	33.33%	5	33.33%	13	28.89%
Fair	1	7	46.67%	5	33.33%	5	33.33%	17	37.78%
Poor	0	4	26.67%	2	13.33%	3	20%	9	20%
Total		15	100	15	100	15	100	45	100

According to self-evaluation by patient at the end of 1 sitting, overall, 37.78% (n=17) patients showed good

response, that is a score of 5-8. No worsening was seen (Table 9).

According to self-evaluation by patient at the end of 3 sittings, overall, 44.44% (n=20) patients showed an

excellent response, that is a score of 8-10. No worsening was seen (Table 10).

**Table 8: Complications to treatment in different groups.**

Complications	Group A		Group B		Group C		Total	
	No.	%	No.	%	No.	%	No.	%
Hyperpigmentation	1	6.67%	0	0%	1	26.67%	2	4.44%
Hypopigmentation	0	0%	0	0%	1	26.67%	1	2.22%
Prolonged erythema	1	6.67%	2	13.33%	3	75%	6	13.33%
Hematoma	0	0%	2	13.33%	0	0%	2	4.44%
Hypertrophic scarring	1	6.67%	0	0%	0	0%	1	2.22%
Allergic reaction	0	0%	1	6.67%	0	0%	1	2.22%
Photosensitivity	0	0%	0	0%	2	50%	2	4.44%
<b>Total</b>	<b>3</b>	<b>20%</b>	<b>5</b>	<b>33.33%</b>	<b>7</b>	<b>175%</b>	<b>15</b>	<b>33.33%</b>

**Table 9: Self-evaluation by patient at the end of 1<sup>st</sup> sitting.**

Response	Score	Group A		Group B		Group C		Total	
		No.	%	No.	%	No.	%	No.	%
<b>Excellent</b>	8-10	1	6.67%	3	20%	4	26.67%	8	17.78%
<b>Good</b>	5-8	3	20%	6	40%	8	53.33%	17	37.78%
<b>Fair</b>	2-5	8	53.33%	5	33.33%	2	13.33%	15	33.33%
<b>Poor</b>	<2	3	20%	1	6.67%	1	6.67%	5	11.11%
<b>TOTAL</b>	<b>TOTAL</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>	<b>45</b>	<b>100</b>

**Table 10: Self-evaluation by patient at end of 3 sittings**

Response	Score	Group A		Group B		Group C		Total	
		No.	%	No.	%	No.	%	No.	%
Excellent	8-10	4	26.67%	8	53.33%	8	53.33%	20	44.44%
Good	5-8	5	33.33%	5	33.33%	6	40%	16	35.55%
Fair	2-5	5	33.33%	2	13.33%	1	6.67%	8	17.78%
Poor	<2	1	6.67%	0	0%	0	0%	1	2.22%
<b>Total</b>		<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>	<b>45</b>	<b>100</b>

## DISCUSSION

There are numerous options available for the treatment of acne scars. Out of these the treatment has to be individualised in each patient based on the type of scar, his need and his expectations. In this study we chose three treatment modalities, namely, derma roller, subcision and CO<sub>2</sub> fractional laser. In derma roller or micro needling, there are fine needles which puncture the skin. In 15 patients of group A who underwent derma roller, on physicians evaluation at the end of 1 sitting, 6.67% (n=1), 0% (n=0), 46.67% (n=7), 46.67% (n=7) patients showed excellent (>75% improvement), good (50-75% improvement), fair (25-50% improvement) and poor response (<25% improvement) respectively. While at the end of 3 sittings 6.67% (n=1), 20% (n=3), 46.67% (n=7), 26.67% (n=4) patients showed excellent, good, fair and poor response respectively. According to a

study, this technique can reduce the depth of scars up to 25% after 2 sessions.<sup>19</sup>

In 15 patients of group B who underwent subcision, on physicians evaluation at the end of 1 sitting, 6.67% (n=1), 13.33% (n=2), 40% (n=6), 40% (n=6) patients showed excellent, good, fair and poor response respectively. While at the end of 3 sittings 20% (n=3), 33.33% (n=5), 33.33% (n=5), 13.33% (n=2) patients showed excellent, good, fair and poor response respectively. It has been reported that in treatment of rolling scars, subcision has improvement of about 50% to 60%.<sup>20</sup>

In 15 patients of group C who underwent CO<sub>2</sub>, on physicians evaluation at the end of 1 sitting, 13.33% (n=2), 13.33% (n=2), 46.67% (n=7), 26.67% (n=4) patients showed excellent, good, fair and poor response respectively. While at the end of 3 sittings 13.33% (n=2),

33.33% (n=5), 33.33% (n=5), 20% (n=3) patients showed excellent, good, fair and poor response respectively.



**Figure 1: Pre and post photographs of group A showing moderate improvement after 3 sittings and of group B and group C showing excellent improvement after 3 sittings.**

Thus at the end of 1<sup>st</sup> sitting excellent response was seen in 13.33% (n=2), 6.67% (n=1), 6.67% (n=1) in group C, group B, group A in that order while good response was seen in 13.33% (n=2), 13.33% (n=2), 0% (n=2) respectively.

At the end of 3 sittings sitting excellent response was seen in 20% (n=3), 13.33% (n=2), 6.67% (n=1) in group B, group C, group A in that order while good response was seen in 33.33% (n=5), 33.33% (n=5), 20% (n=3) respectively.

Post procedure complications were seen in a total of 15 patients out of 45. The most common of which was prolonged erythema which was noted in 3 patients of group C, 2 patients of group B and 1 patient of group A. However, erythema subsided in all these patients within 2-3 weeks. Hyperpigmentation was seen in 1 patients of group C and 1 patient of group A while hypopigmentation was observed in 1 patient of group C. Hematoma formation was seen in 2 patients of group B after subcision. Photosensitivity was increased in 2 patients in group C. Allergic reaction was seen in 1 patient of subcision which was possibly due to application of topical eutectic anaesthetic application. 1

patient of microneedling showed the formation of hypertrophic scars.

Post inflammatory pigmentation changes, prolonged erythema and post-operative purpura are sometimes seen after treatment with fractional CO<sub>2</sub> lasers.<sup>21,22</sup> Skin needling is expected to cause temporary erythema, pain, a burning sensation, edema, bleeding, or serous ooze resolving with crusting or scabbing.<sup>23</sup> Compared to other procedures the risk of post procedure complications is very less with microneedling.

According to self-evaluation by patient at the end of 1 sitting, excellent response was seen in 6.67% (n=1), 20% (n=3), 26.67% (n=4) patients in group A, group B, and group C respectively. According to self-evaluation by patient at the end of 3 sittings, excellent response was seen in 26.67% (n=4), 53.3% (n=8), 53.3% (n=8) patients in group A, group B, and group C respectively.

Lately there has been development of many advanced treatments for acne scars like fractional CO<sub>2</sub> lasers etc.

## CONCLUSION

This study shows that time tested procedures like subcision if done adequately and properly can not only give the same efficacy but at times even better. However, a larger study group and longer duration of follow up is required for better conclusion.

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