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Laser Skin Resurfacing Treatment Outcome of Facial Scars and Wrinkles in Asians with Skin Type III/IV with the Unipulse® CO_2 Laser System

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ABSTRACT

Objective: To study the efficacy and complications from Unipulse® CO_2 laser resurfacing system (Nidek, California) for the treatment of scars and wrinkles in patients with Type III and IV skin type.

Methodology: This is a prospective study of patients with skin type III and IV who received laser-resurfacing treatment for facial scars and wrinkles.

All patients received topical tretinoin 0.025% cream at least two weeks prior to laser resurfacing. Laser resurfacing was carried out under lidocaine 1% nerve blocks with the Unipulse® CO_2 laser scanning system. The power at tissue was set at 15 watts (fluence = 6.12 J/cm^2; spot size = 1.02mm, frequency = 300 Hz), with a 20% overlap. Lesions around the eyes were resurfaced with one pass. Those on other parts of the face with two to three passes. Patients were assessed up to 12 months.

Treatment response (assessed by patient and dermatologist) was graded as "no change" = no improvement, "minimal improvement" = <25% clearance, "moderate improvement" = 25 - 50% clearance, "good improvement" = 50 - 75% clearance and "excellent improvement" = >75% clearance. Complications (assessed by dermatologist only) including erythema, hypopigmentation and hyperpigmentation were scored subjectively as none, minimal, mild, moderate and severe.

Results: 16 (nine females, seven males) patients were studied. Thirteen patients were treated for acne scars, two patients for wrinkles and one patient for chicken pox scar. Their mean age was 30.7 years (SD = 9.5 years). Fifteen patients had skin type IV and 1 had skin type III.

Treatment response: Thirteen patients were assessed at six weeks post laser treatment. One (8%) patient had "minimal improvement" (<25%) improvement, 10 (77%) patients had "moderate improvement" (25 - 50%) and 2 (15%) patients had "moderate improvement" (50 - 75%) improvement. At six months, 37% had "minimal improvement", 37% had "moderate improvement" and two had "good improvement and one patient with fine wrinkles had "excellent improvement".

Complications: All patients experienced severe erythema at Day 1. Erythema faded over six months. By three months only 22% had minimal erythema and by six months none had erythema. Moderate pigmentation developed in 15% at six weeks. At three months 33% had varying degree of pigmentation. At six months one (12%) patient had residual pigmentation. Only one patient developed mild minimal hypopigmentation at six month, which cleared at 12 months. Another patient developed hypopigmentation at 12 months.

Conclusion: CO_2 laser resurfacing provides minimal to moderate improvements for scars and wrinkles among Asians with darker skin type. Erythema fades over six months after resurfacing. Post-inflammatory pigmentation is common but tends to clear over six months.

Keywords: Acne scars, wrinkles, cosmetic laser-surgery

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INTRODUCTION

The carbon dioxide laser at 10.6 um is recognised as being an effective method for skin resurfacing for wrinkles and scars. It is efficient and provides good control of bleeding during the resurfacing procedure. The laser resurfacing procedure is often associated with prolonged period of erythema and secondary post inflammatory hyperpigmentation caused by the associated tissue damage[1-3]. There are few reports of the efficacy and complications with the carbon dioxide laser resurfacing on type III and IV skin among the Asian type skin. Our prospective study was carried out to study the efficacy and complications of a carbon dioxide laser (Unipulse® CO_2 laser, Nidek, California) resurfacing system for the treatment of scars and wrinkles among Asian skin type III and IV.

METHODOLOGY

This is a prospective study of patients with skin type III and IV who presented to the NSC for laser treatment of facial scars and wrinkles.

All suitable patients who requested laser treatment of acne scars, chicken-pox scars or traumatic scars or wrinkles were recruited into the study.

All patients were assessed for suitability to enter the study. Only patients who were >21 years old, with skin type III or IV were included in the study. Patients with skin type V and VI were excluded.

Patients who were pregnant or suffered from any serious medical conditions including diabetes, bleeding diathesis or immunosuppressed were excluded. Patients with active acne vulgaris and those who took oral retinoids in the preceding year were also excluded from the study.

All patients received topical tretinoin 0.025% cream at least two weeks prior to laser resurfacing.

After counselling, patient's facial skin was cleansed with normal saline thoroughly. Facial nerve blocks with 1% lidocaine were administered on the infraorbital nerves and the mental nerves on both sides of the face. Local infiltrate were also delivered on the sides and temples of the face. When the nose is resurfaced, the nasal nerves were also infiltrated. The supra-orbital nerves were anaesthetised for forehead resurfacing.

A Unipulse 1040 carbon dioxide laser system (Nidek Incorporated, Fremont, California) with a computerised scanner with FastScan™ computer pattern generator which scans the laser beam over a large areas was used for resurfacing. The power at tissue was set at 15 watts (fluence = 6.12 J/cm^2; spot size = 1.02 mm, frequency = 300 Hz, laser off time = 0.4 sec.), using the circular pattern, with 20% overlap. The shape (circle, square, hexagon, rectangle, triangle, parallelogram and line) and size (1.8 x 1.6 mm to 14.4 x 14.4 mm) of the scanner was adjusted according to the area of the face to be resurfaced.

Lesions around the eyes were resurfaced with one pass. Those on other parts of the face with two to three passes.

Post-operatively, all patients received a thin colloid dressing on the first and second day post operatively. All patients were prescribed prophylactic oral erythromycin 500 mg tid post-operatively. Because of cost concern, oral acyclovir 200 mg 5x/day or oral valacyclovir 500 mg tid x five days was prescribed for all patients whose lips were resurfaced and for those who gave a history of herpes labials when the cheeks/forehead were resurfaced. Patients were prescribed mefenamic acid 500 mg tid prn for relief of postoperative pain. Thereafter they were advised to self-dress their wound with normal saline wash and aqueous cream. When the resurfaced skin stopped oozing, the patients were advised to use sunscreen regularly and topical hydroquinone 2% cream every night post operatively.

The post-operative resurfaced skin was assessed at Day 1 and Day 7 post operatively, for complications. Patients were also assessed at six weeks, three months, six months and twelve months for treatment response and complications.

Treatment response was graded as "no change" = no improvement, "minimal improvement" = <25% clearance, "moderate improvement" = 25 - 50% clearance, "good improvement"= 50 - 75% clearance and "excellent improvement" = >75% clearance.

Complications including erythema, hypopigmentation, hyperpigmentation and pain were scored as "none" = normal skin colour, "minimal" = slight tone change from surrounding skin colour, "moderate" = obvious tone difference and "severe" = marked contrasting difference from surrounding untreated skin colour.

The severity score and treatment response was carried out by the patient and treating dermatologist. The complication scores were carried out by the treating dermatologist.

RESULTS

Sixteen patients (nine females and seven males) were included in the study. Thirteen patients were treated for acne scars, two patients for wrinkles and one patient for chicken pox scar.

The mean age of the patients was 30.7 years (SD = 9.5 years). The mean age of female patients was 36 years (11.7 years), and for male patients was 27 years (SD = 3.7 years).

Fifteen patients had skin type IV and one patient with skin type III.

Treatment response

Thirteen patients were assessed at six weeks post laser treatment. In all assessment, both patient and dermatologist assessment were concordance on all occasions.

1/13(8%) patients had "minimal improvement" (<25% clearance), 10/13 (77%) patients had "moderate improvement" (25 - 50% clearance) and 2/13(15%) patients had "good improvement" (50 - 75% clearance). Both patients who experienced "good improvement had rhytides. At six months, 3/8 (37%) had minimal improvement (<25% clearance); 3/8 (37%) had moderate improvement (25 - 50% clearance) and 2/8 (25%) had good improvement (50 - 75% clearance). At 12 month 5/6 (83%) had "moderate" improvement (50 - 75% clearance) and one patient had "good improvement". All patients with "good improvement"

Table I. Treatment response according to duration of follow-up.

	no change	Minimal (<25% clearance)	Moderate (25 - 50% clearance)	Good (50 - 75% clearance)	Excellent (>75% clearance)
Three months (n=9)	0	1 (11%)	6 (67%)	2 (22%)*	0
Six months (n=9)	0	3 (33%)	3 (33%)	2 (23%)	1 (11%)*
12 months (n=6)	0	0	5 (83%)	1 (17%)*	0

No change = no improvement, Minimal = <25% improvement, Moderate = 25 - 50% improvement, Good = 50 - 75% improvement, Excellent = >75% improvement.

* were patients resurfaced for rhytides.

Table II. Showing the severity and frequency of postoperative erythema.

	Severe	Moderate	Mild	Minimal	None
Day seven (n=16)	4 (25%)	8 (50%)	2 (13%)	2 (13%)	0
Six weeks (n=13)	0	1 (8%)	2 (15%)	6 (46%)	4 (31%)
Three months (n=9)	0	0	0	2 (22%)	7 (78%)
Six months (n=8)	0	0	0	0	8 (100%)
12 months (n=8)	0	0	0	0	6 (100%)

Table III. Showing the severity and frequency of post-inflammatory pigmentation.

	Severe	Moderate	Mild	Minimal	None
Day one (n=15)	0	0	0	0	15 (100%)
Day seven (n=16)	0	0	0	0	16 (100%)
Six weeks (n=13)	0	2 (15%)	1 (8%)	0	10 (77%)
Three months (n=9)	0	1 (11%)	0	2 (22%)	6 (67%)
Six months (n=8)	0	0	1 (12%)	0	7 (88%)
12 months (n=6)	0	0	1 (17%)	0	5 (87%)

were patients resurfaced for rhytides. Table I shows the breakdown of treatment response according to duration of follow-up.

Complications

Erythema:

All patients experienced servere erythema at Day 1. Erythema faded over six months post-operatively. By three months only 22% had minimal erythema and by six months none of our patients had erythema. Table II shows the severity and frequency of erythema post-operatively.

Hyperpigmentation:

Moderate pigmentation developed in 15% of patients at six weeks post-operatively. At three months, 33% had varying degree of pigmentation. Pigmentation cleared slowly subsequently and by the 6th month only one patient had residual pigmentation. Table III shows the severity and frequency of post-inflammatory pigmentation after resurfacing.

Pain:

Pain did not seem to be a problem post-operatively. Forty-seven percent of our patients experienced mild pain the next day and by one week only 12% experienced minimal pain.

Hypopigmentation:

One patient developed mild minimal hypopigmentation at six months. The hypopigmentation cleared at 12 months, but another patient developed hypopigmentation at 12-month follow-up.

DISCUSSION

Cutaneous laser resurfacing with the new generation of carbon dioxide and erbium: YAG and combined Er: YAG/CO_2 lasers have recently been put to good use in the treatment of facial scars and wrinkles[1-5]. The treatment response and complications vary, depending on the type of skin pathology which resurfaces. Acne scars appear to be the commonest indication for laser resurfacing in Singapore. Rhytides are a less common indication in Singapore. This is probably because photoageing is less commonly seen in Singapore compared to western countries. The pigmented skin of Asians probably confers some protection against sunlight. In addition, culturally, Asians tends to shun the sun and they prefer to maintain fair complexions.

In our experience the superficial rhytides generally respond better than the deeper ones but patients with deep rhytides tend to have more obvious improvement subjectively. Acne scars generally do not respond as well as rhytides[2]. Our findings confirmed that carbon dioxide laser resurfacing outcome is variable and usually does not result in complete clearance of the rhytides and scars. Patient expectations should be assessed carefully before beginning surgery. Acne scars do not respond well and most patients experience mild to moderate improvements only. This is probably due to the presence of deeper scars and fibrosis underlying most acne scars. Scar revision surgery, and excision of fibrotic scars preceding laser resurfacing may help improve the outcome of

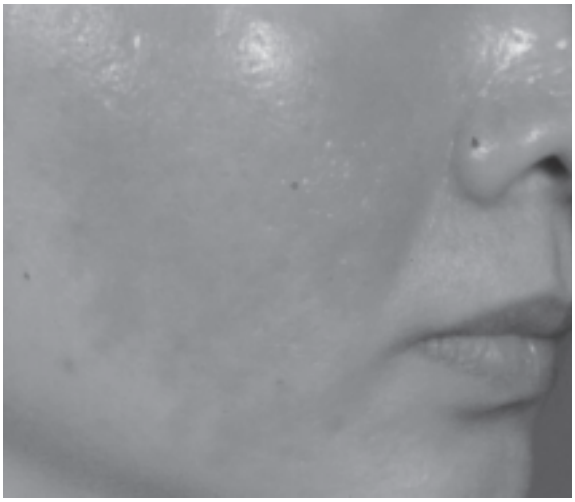

Fig.1 Post-inflammatory pigmentation (seen in 25% of patients) three months' post-operation.

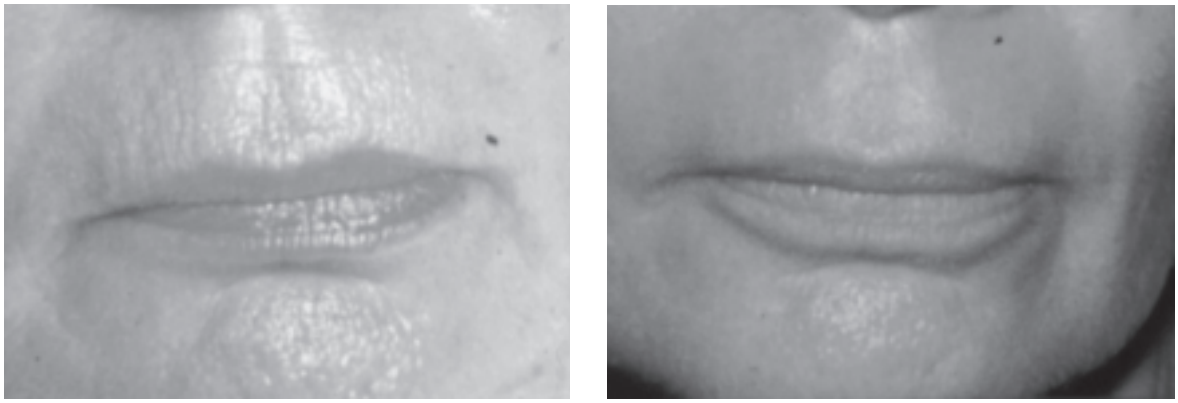

Fig.2 Rhytides on lips- pre- and post CO_2 laser resurfacing. (three months' post-operation). Type III skin. Good improvement.

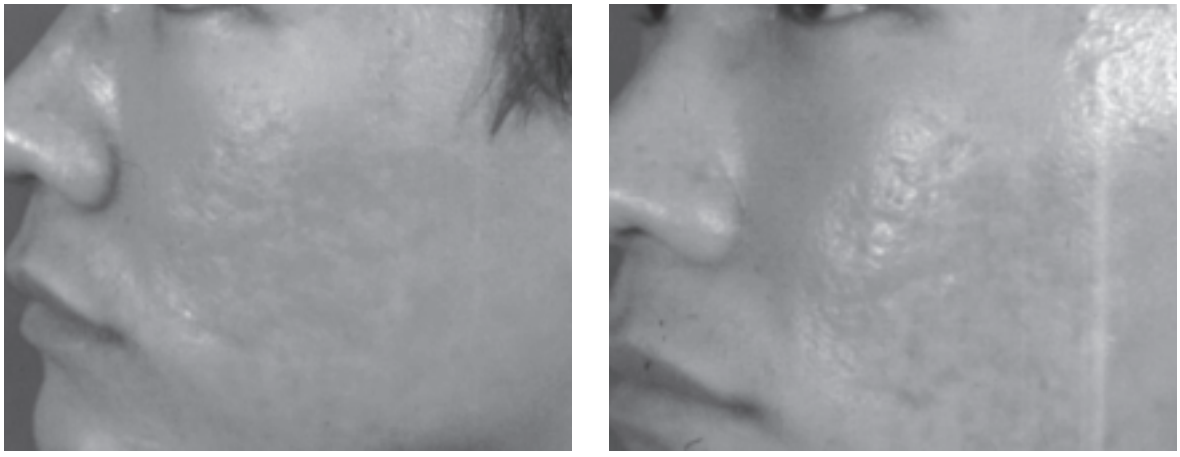

Fig.3 A one scar (severe scarring) pre- and post CO_2 laser resurfacing. Type IV skin (six months' post-operation). Minimal improvement.

laser resurfacing on acne scars. It is important that the dermatologist lower the patient's expectation before surgery. Patients with unrealistic expectations should not be encouraged to undergo surgery.

CO_2 laser resurfacing provides mild to moderate improvements for acne scars in our patients. It provides better outcome for rhytides. All our patients noticed some improvement in their scars and rhytides post operatively. At six months post operatively, 25% of the patients achieved minimal improvement (<25% clearance) of their acne scars, and 37% had moderate improvement (25 - 50% clearance) and 25% had "improvement", the latter was seen in two patients who had resurfacing done for rhytides. At 12 months,

83% of our patients had moderate improvement (25 - 50% clearance) and 17% had good improvement. It appears that patients with acne scars continued to show improvement over the 12-month period. Our findings should serve as an important reminder to laser surgeons to educate patients on the expectation of treatment outcome of laser resurfacing especially for acne scars.

Erythema is a common post-operative complication[6,7]. All our patients in the initial six weeks post treatment experience erythema. In all out patients, erythema cleared completely over six months after laser resurfacing.

Hyperpigmentation has been reported to occur in 5% to 83% of patients after carbon dioxide laser resurfacing and is principally related to patient skin type[8-10]. Post inflammatory pigmentation is a problem among the dark-skinned Asians post operatively. About 25% of our patients' experience post inflammatory pigmentation from six weeks post-operatively with about 15% having moderately severe pigmentation. From our study, it appears that post-inflammatory pigmentation following laser resurfacing among the dark-skinned Asian might not be as frequent as expected. But pigmentation may be severe in those affected. The pigmentation tends to clear slowly over the next six to 12 months. Asian patients should be warned of the potential of moderate post-inflammatory pigmentation following laser resurfacing. Vigilant sun protection and use of bleaching agents e.g. hydroquinone cream, may help to reduce the severity and frequency of pigmentation[10,11]. All our patients were told to be vigilant on the use of sunscreen indefinitely. Hydroquinone 4% creams bd, are routinely prescribed after laser resurfacing to be used for at least six months.

Pain was not a problem experienced by our patients. Almost all patients experienced minimal to mild pain the next day postoperatively. By seven days only two patients experienced minimal pain and the rest experienced no pain or discomfort at all.

Hypopigmentation appeared to be not uncommon in our patients. It has been reported to occur after carbon dioxide laser resurfacing in patients with skin type I to IV, most commonly in patients with extensive photo-damage skin[12]. One of our patients developed hypopigmentation at 12 month post-laser resurfacing. It is a late complication even among skin type IV patients.

From our studies, it appears that patients with skin type III or IV can be resurfaced with the carbon dioxide laser with improvement. However the treatment outcome and complications should be made known clearly to the patient. The treatment outcome may be lower than that expected by the patients. The complications including post-laser erythema, pigmentation and hypopigmentatoin that appear in all patients should be made known to the patients before resurfacing.

REFERENCES

1. Lask G, Keller G, Lowe N, Gormley D. Laser skin resurfacing with the silktouch flashscanner for facial rhytides. Dermatol Surg 1995; 21:1021-4.
2. Ratner D, Tse Y, Marchell N, et al. Cutaneous laser resurfacing. J Am Acad Dermatol 1999; 41:365-89
3. Fitzpatrick RE, Goldman MP. Resurfacing of photo-damage of the neck using the ultrapulse CO_2 laser. Lasers Surg Med 1997; 21:33.
4. McDaniel DH, Ash K, I Loar, Newman I. The erbium:YAG laser. A review and preliminary report on resurfacing the face, neck and hand. Aestht Plast Surg 1997; 17:157-64.
5. Trelles M, Garcia-Solana L, Calderhead RG. Skin resurfacing improved with a new dual wavelength Er:YAG/CO^2 laser system: A comparative study. J Clin Laser Med Surg 1999; 17:99-04.
6. Goodman GJ. Carbon dioxide laser resurfacing. Dermatol Surg 1998; 24:331-4.
7. Trelles Mam Mordon S, Svaasand LO, Mellow TK, Rigau J, Garcia L. The origin and role of erythema after carbon dioxide laser resurfacing: a clinical and histological study. Dermatol Surg 1998; 24:25-9.
8. Alster TS, Garg S. Treatment of facial rhytides with the ultrapulse high energy carbon dioxide laser. Plast Reconstru Surg 1996; 98:791-4.
9. Ross EV, Grossman MC, Duke D, Grevelink JM. Long term results after CO_2 laser resurfacing: a comparison of scanned and pulsed systems. J Am Acad Dermatol 1997; 37:709-18.
10. Weinstein C, Ramirez O, Pozner J. Postoperative care following carbon dioxide laser resurfacing: avoiding pitfalls. Dermatol Surg 1998; 24:51-6.
11. Ho C, Nguyen Q, Lowe NJ Griffin ME, Lask G. Laser resurfacing in pigmented skin. Dermatol Surg 1995; 21:1035-7.
12. Laws RA, Finley EM, McCollough ML, Grabski WJ. Alabaster skin after carbon dioxide laser resurfacing with histologic correlation. Dermatol Surg 1998; 24:633-8.