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Burn Scars Treatment Using Ablative Fractional Carbon Dioxide Laser in Sudanese

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Abstract

Skin scars develop following different causes, mainly burns, trauma, surgery or pathological condition. The objective of present work is to evaluate the efficacy and safety of ablative fractional CO2 laser resurfacing in burn scars in the skin of color represented by Sudanese patients. Six patients (4 males and 2 females, aged 12-50 years) with skin phototype V and V1 with burn scars were treated with three sessions of CO_2 laser, on an average of 4-week interval. The laser equipment used in the study was (Dreampulse CO_2 laser system, manufactured by Daeshin Enterprise CO. LTD, Seoul, Korea). A single pass was performed using following parameters; 12.5-20 mJ/cm^2, with density setting of 5% to 15%. Objective and subjective assessments were obtained at baseline and at 6 months after the final treatment. All patients showed clinical improvement in their scars. After the treatments, pain, itch, erythema and hyperpigmentation was improved. Surface smoothness and skin tension significantly improved. The adverse effects were those of immediate pain and discomfort in the first week of laser sessions. Ablative Fractional CO_2 laser was effective and safe for the treatment of burn scars appearance, including measures such as pigmentation, vascularity, pliability, and thickness, in the skin of color, represented by Sudanese.

Keywords: Burn Scar, Treament, Laser.

Introduction

Skin scars develop following different causes, mainly burns; trauma, surgery or pathological causes. Scars resulting from different causes are estimated to exceed 100 million/year; considerable number of these scars is unaesthetic and can have profound physical, aesthetic, psychological and social consequences (McGoldrick 2016). The severity of the burn will determine whether these scars will fade or remain permanently visible. First degree and some second degree burns usually heal by nonscarring while severe, infected second degree and third degree burns are more likely to scar. These types of scars are categorized according to their features and effects on the skin into; hypertrophic, keloidal and contracture scars (Cadman 2018).

Burn scars are associated with significant morbidity ranging from painful contractures, pruritus, and disfigurement to psychosocial impairment (Cadman 2018, Willows 2017). Conventional methods of scar management include: dermabrasion, silicone gel, steroid injection, chemical peels, pressure therapy, autologous

fibroblast therapy, surgical scar revision, and recently under trial RXI-109, a self-delivering RNAi compound (to reduce dermal scarring), and many other methods with inconvenient result outcomes (McGoldrick 2016, Cadman 2018, Willows 2017, Alqurishy 2016 , Inglefield 2008, Libertine 2015 , and Goldberg 20156). The carbon dioxide laser uses results in selective collagen remodelling of burn scar texture by targeting the abnormal collagen to improve scar color, pain, pruritus, thickness, pliability, and tightness (McGoldrick 2016, Greenba 1999, and Suh 2012). Fractionated delivery of CO2 laser treatment leaved columns of undamaged skin to quickly re-epithelialize and has reduced the previously higher risk profile of unfractionated ablative laser delivery in terms of permanent pigmentation changes, higher rates of infection and scarring (Wood 2018). The histological effects of lasers, with their ability to act directly on dermal collagen as well as the epidermis, are quite remarkable (McGoldrick 2016, Hantash 2007).

Many complications were reported to arise from burn scars: calcinosis cutis (Coskey 1984), malignant melanoma (Jayasekera 2016, Goldberg 1985), lichen sclerosus et atrophicus (Meffert 1994), basal cell carcinoma (Bagazgoitia 2009, Imbernón 2015), porokeratosis (Nova 1991), keratoacanthoma (Tamir 1999), and primary cutaneous anaplastic large cell lymphoma (Morihara 2007). In this study we investigated the efficacy and safety of using ablative fractional CO2 Laser in the treatment of burn scars in ethnic (color) skin in a group of Sudanese patients.

Materials and methods

The study is a case series in which patients presented to the "Dermatology Consultancy Center" (Khartoum) with burn scars were selected for treatment with ablative fractional CO2 Laser. The study was conducted in the period from January 2016-Decemeber 2016. The numbers of patients included in the study were six, four males (M) and two females (F). Four were children (3 M, 1 F) and two adults (1 M, 1F). The age ranged between 12-50 years (mean 23.3 years). All patients were dark skinned (Fitzpatrick type V & V1). The duration of burn was between 1 – 2 years. All patients had multiple scars with atrophic, hypertrophic and keloidal features. Sites of the scars were on the face, ear, neck, chest and upper limbs, mostly on one side. All patients had symptoms of pain and pruritus, the scar color was erythematous in one patient, red in one and dark in 4 patients. Other scar features include: thickness, moderate to poor pliability and moderate to severe tightness. (Table 1). Scars assessment was done initially at presentation using the modified Vancouver scar scale (VSS), and the Patient and Observer Scar Assessment Scale (POSAS) (Tables 2, and 3 respectively).

Patients were treated with ablative fractional CO2 Laser using the scanner mode in all treatment sessions. The parameters used differ according to the site, thickness and pliability of the scar. Each treatment site of the scar received three standardized CO2 laser treatments using the (Dreampulse CO_2 laser system, manufactured by Daeshin Enterprise CO. LTD, Seoul, Korea**).** The laser treatment was performed under local anesthetic at 4-6 week intervals. All treatments consisted of a single pass performed using following parameters;) 12.5-20 mJ/cm^2, with density setting of 5% to 15% (according to site and features of the scar with minimal overlapping. Post-operatively laser treatment areas had emollient applied and dressings which were removed at 48 hours. Further emollient was applied twice daily for 7-10 days to the treated areas. Standard care scar management was continued till full recovery of the scar. Scar assessment at 6 months post-laser was made, using VSS and the POSAS (Tables 4 and 5 respectively). Patient photographs at all follow-up visits were used.

Table: 1 Burn patient's characteristics at presentation

Age	Sex	Duration	Type	Symptoms	color	Thickness	Pliability	Tightness	Site
50	F	1 Y	Hypertrophic Keloid	Pain, pruritus	red	thick	Poor	severe	Face, neck, chest
12	M	1 y	Hypertrophic, keloid	Pain, pruritus	dark	thick	Poor	severe	Face, chest
14	M	> 1 Y	Hypertrophic, keloid	Pain, pruritus	Dark	thick	poor	Severe contractures	Face, neck, chest
16	F	> I Y	Hypertrophic	Pruritus	dark	thick	moderate	moderate	face
35	M	>2 Y	Hypertrophic, Keloid	Pain, pruritus	erythema	thick	Poor	Severe,	Right hand
13	M	> 1 Y	Hypertrophic Keloid	Pain, contracture	Dark	thick	poor	severe	Face, ear, right hand

Results

Six patients were included in this case series study; had severe burn scars (VSS >6 and the POSAS >30). Improvement of scars at specific anatomical locations is shown in Table 4 and 5 for each subject at 6 months. The reduction in VSS & POSAS scores was statistically significant at 6 months post-laser (Table 6 & 7). Pain and pruritus improved shortly after laser treatment. Two patients who had vacularization improved markedly. The pigmentation improved in all patients. The thickness was better in all patients with different score rates. The surface of the scar improved very well in 4 patients and moderately in two others who had extensive (very bad) scars.

Patient satisfaction was evaluated at the end of the study. Overall, 66.7% percent of patients rated the treatment, very good, and two patients (33.3%) reported moderate satisfaction after six months of treatment (Table 8).

Table 2 Basic Vancouver Scar Scale (VSS)

Patient/item	Pliability 0-4	Height 0-4	Vascularity 0-3	Pigmentation 0-3	Total score 0-14
1	4	3	3	1	11
2	4	4	0	3	11
3	4	4	0	3	11
4	3	2	0	3	8
5	3	3	2	0	8
6	4	4	0	3	11

Table 3 Basic Patient Observer Scar Assessment Scale (POSAS).

Patient/item	Pain 1-10	Itch 1-10	Color 1-10	Surface 1-10	Thickness 1-10	Overall 1-10	Score 7-70
1	8	7	5	9	9	9	45
2	6	6	6	9	9	9	44
3	9	8	7	10	10	10	54
4	5	6	5	6	6	7	35
5	6	6	6	5	6	7	36
6	10	8	7	10	10	10	55

Table 4 Change in modified Vancouver Scar Scale from baseline after 6 months of final treatment

Item/patient	Pliability 0-4	Height 0-4	Vascularity 0-3	Pigmentation 0-3	Score 0-14
1	1	1	0	1	3
2	1	2	0	1	4
3	1	1	0	1	3
4	1	1	0	1	3
5	1	1	1	0	3
6	2	2	0	1	5

Table 5 Change in Patient Observer Scar Assessment Scale (POSAS) from baseline after 6 months of final treatment

Patient/item	Pain 1-10	Itch 1-10	Color 1-10	Surface 1-10	Thickness 1-10	Overall 1-10	Score 7-70
1	3	2	3	2	1	4	15
2	1	1	2	2	2	3	11
3	2	2	2	3	4	4	17
4	1	1	1	1	1	2	7
5	2	2	3	2	2	3	14
6	2	2	2	3	3	5	19

Table 6 Improvement of total VSS Score (as %age difference from baseline) at scar location.

Subject no.	Scar site	Baseline	At 6 month after laser	% Difference
1	Face, neck, chest	11	3	72.7%
2	Face, neck, chest	11	4	63.6%
3	Face, neck, chest	11	3	72.7%
4	Face	8	3	62.5%
5	Right hand	8	3	62.5%
6	Face, ear, right hand	11	5	54.5%

Table 7 Improvement I POSAS after 6 month post-laser therapy (as %age difference from baseline) at scar location

Subject no.	Scar sites	Baseline scale	At 6 month after laser	%age difference
1	Face, neck, chest	45	15	66.7%
2	Face, neck ,chest	44	11	75%
3	Face, neck, chest	54	17	68.5%
4	Face	35	7	80%
5	Right hand	36	14	61.1%
6	Face, ear, right hand	55	19	67.3%

Table 8 Degree of satisfaction among the studied patients

Patient/degree of satisfaction	1	2	3	4	5	6	7	8	9	10
1								8		
2							7			
3					5					
4					7					
5					7					
6					5					

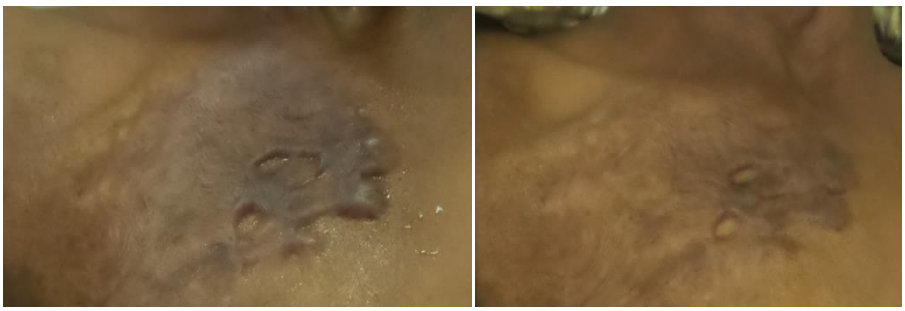

Figure 1 A hypertrophic and partially atrophic scar on the right chest of a 14-year-old boy at presentation and 6 months post-laser therapy. The scar was improved in color, thickness and surface texture.

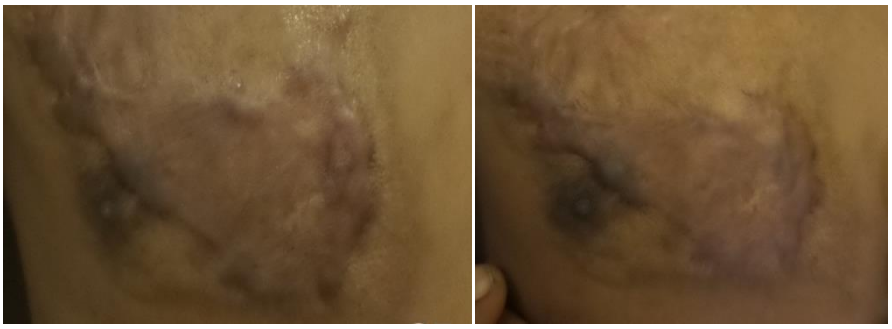

Figure 2 A partially atrophic and hypertrophic scar on the right side of the chest of a 14-year-old boy at presentation and 6 months post-laser therapy. the scar improved in color and surface texture.

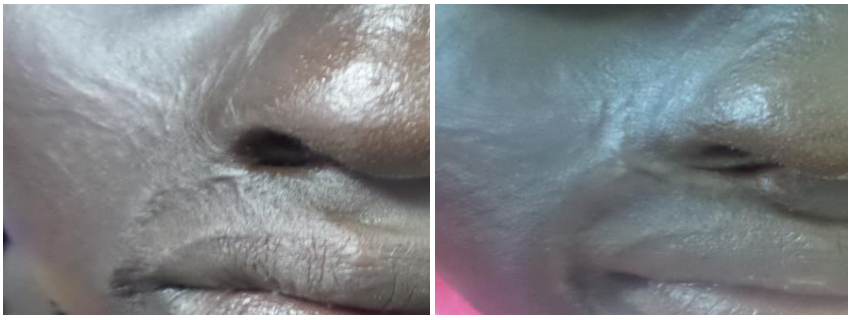

Figure 3 a linear scar on the upper lip of a 16-year-od girl at presentation and after 6 months post-laser therapy. The scar was improved.

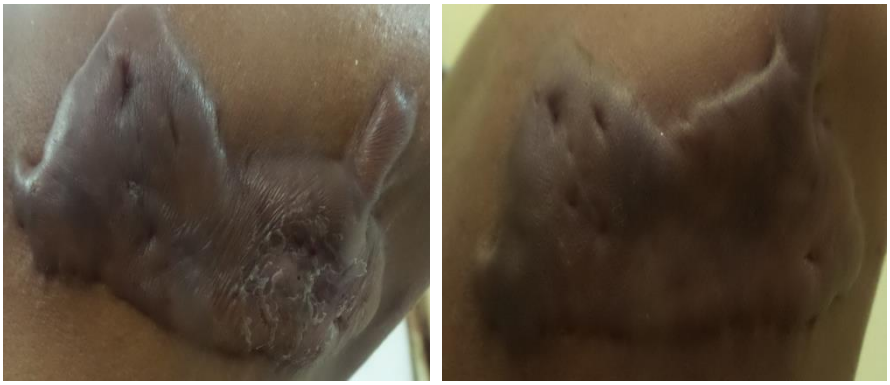

Figure 4 A keloidal scar of a 12-year-old boy on the submental region at presentation and after 6 months post- laser therapy. the scar improved in color, thickness and surface texure.

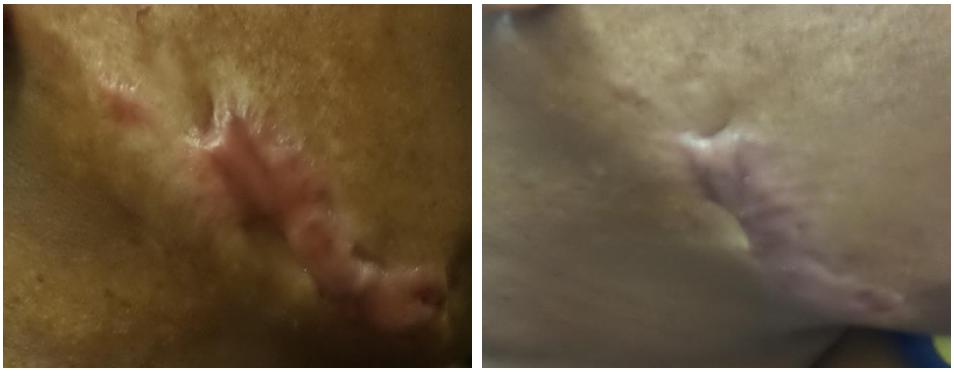

Figure 5 A keloidal scar on the right cheek of a 50-year-old femae at presentation and 6 month post-laser resurfacing. The scar improved in color, thickness and surface texure.

Discussions

In this study most scars were present on the face, an anatomical area which is considered to be of significant aesthetic and functional importance. All the scars were large ones, scar area of 10x10cm; Vancouver Scar Scale (VSS) score of > 5;

POSAS >30 and of > 1 year following injury. A variety of measurement tools have been applied to grade scars on the basis of parameters such as pigmentation, vascularity, thickness, pliability, height or depression, patient acceptability, and comfort. Scar grading systems are used to quantify changes in scar appearance during treatment including VSS, SCAR and POSAS (Mustoe 2002, Gold 2014). Most of the scars (in 4 out of six) of patients in our study had widespread hypertrophic and major keloidal scars; they had major symptoms of pain, itch, and signs of pigmentation, thickness, rough surface and poor pliability. The features of these scars are an indication of using fractional laser according to the guidelines recommendations in this category of scar classes (Gold 2014). Scars never disappear and in many cases only partial response is possible. This limitation must be kept in mind in evaluating any of the therapies applied for scar management (Mustoe 2002). In this study marked improvement in different scars parameters (pain, itch, pigmentation, vascularity, thickness and general scar appearance) was evident as shown by changes in VSS and OSAS scores, respectively, at six months compared to baseline (Tables 6, and 7). Scar color and thickness were the most important criteria and of much concern to patients, their improvement is a major indicator for treatment results and patient satisfaction (Alqurishy 2016). Patients 3 & 6 who had extensive widespread hypertrophic scars with multiple keloids showed good improvement in symptoms of pain, itch and tightness, but moderate improvement in the scar height and surface textures. These patients also showed less tolerance to the laser and the use of general anesthesia may be indicated in young patients with widespread scars. The laser treatment was well tolerated with minimum pain and discomfort in the other patients. Patient`s satisfaction with the treatment was generally very good and no adverse events were observed in the study. The majority (4 patients) showed >7 degree satisfaction, considered very well. Two patients, who showed 5 degrees, are considered to have moderate satisfaction. The safety endpoint in this study was indicated by the low or absence of adverse events.

Conclusions

Ablative Fractional CO_2 laser was effective and safe for the treatment of burn scars of different characters in the skin of color, represented by Sudanese patients.

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