Original Article

Efficacy of 100% TCA (Trichloroacetic Acid) in the Treatment of Atrophic Facial Post Varicella Scars

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Abstract

Background: Atrophic facial scars from varicella can affect confidence and quality of life. Among treatments, 100% TCA peels show encouraging results in improving skin texture and scar appearance. Although international evidence supports their effectiveness, local data are limited. This study aims to evaluate TCA peel outcomes in our population.

Objective: Assessment of therapeutic outcomes of 100% TCA CROSS application in treatment of atrophic facial post-varicella scars.

Methods: After approval of synopsis and permission from ethical review committee, one hundred (100) patients form both the genders with age between 10-40 years presenting with post-varicella atrophic facial scars falling under Goodman Grade III or IV were included. All participants provided informed consent in written form. These patients were treated by CROSS using 100% TCA every fortnight for 4 sessions. Study variable was outcome of treatment which was assessed 3 months after the last session and was graded as excellent (3 grades decline from baseline), good (2 grades decline from baseline) and fair (1 grade decline from baseline) depending upon final Goodman Grade.

Results: The patients had a mean age of 25.4±7.7 years, mean scar duration of 3.5±1.5 years and 10.2±4.5 scars. Overall, 45% were married. Excellent outcomes were observed in 71% and good in 29%, with no significant differences across subgroups based on age, gender, marital status, scar duration, or number.

Conclusion: The use of 100% TCA for CROSS was found safe and effective approach for managing atrophic facial scars following varicella. Most patients demonstrated excellent improvement after four treatment sessions, confirming TCA CROSS as a practical, well-tolerated option in routine dermatological practice.

Keywords: 100% TCA, Trichloroacetic Acid, Atrophic Scars, Post-varicella Scars, Facial Scar Treatment, CROSS Technique, Scar Remodeling.

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Introduction

Varicella, also known as chickenpox, is a common viral infection that has a significant global impact. According to WHO, there are about 140 million cases of varicella annually worldwide, resulting in 4.2 million severe complications necessitating hospitalization and 4,200 deaths.[1] Importance to understand and management complications related with varicella including developing of scars is trigged by its widespread prevalence.[2,3]

After injury, scars are outcome of skin's intrinsic repair mechanism. Scars can be categories as hypertrophic, keloid, and atrophic scars on the basis of histological patterns and distinct clinical features.[4] Among these categories, prevalence of

atrophic scars is high.[5] They are subclassified into ice-pick, rolling, and boxcar variants. Ice-pick scars are the predominant form, comprising approximately 60–70% of cases, followed by rolling scars at 15–25% and boxcar scars at 20–30%.[6] The defining feature of atrophic scars is surface depression caused by dermal collagen depletion during wound healing.[7]

Especially in adults, varicella usually results in post-inflammatory scarring, where persistent facial scars develop in approximately 7-18% of cases.[8] These scars are typically atrophic and may present additional complications such as hyperpigmentation or hypopigmentation. Facial scars, especially those resulting from varicella, can cause significant psychological and emotional distress, social impairment, and a reduced quality of life. Treating atrophic scars, including those from varicella, poses a significant challenge, particularly for cosmetic dermatologists working with patients who have darker skin tones, as these individuals are at a higher risk for pigmentary complications.[7,9]

Multiple therapeutic modalities have been developed to improve scar texture and appearance. These include surgical interventions such as punch grafting, punch excision, and subcision; resurfacing procedures like dermabrasion, chemical peeling, and ablative laser therapy; non-ablative laser techniques; autologous fat grafting; and dermal filler injections.[9] Among these approaches, TCA is widely used in dermatological practice for the management of atrophic scars.[9,10]

TCA is employed using CROSS technique, in which 95-100% high str4ength TCA is focally applied. This method promotes dermal collagen remodeling, resulting in a measurable decrease in scar depth.[11] This technique has shown its effectiveness across different types of atrophic scars, including post-varicella scars.[12,13]

Efficacy and safety of CROSS technique was evaluated by Khunger et al, in treatment of ice-pick scars in skin types IV and V. They found that the majority of patients (73.3%) experienced excellent improvements (over 70%), 20% had good improvements (50-70%), and 6.7% had fair results (30-49%) after four sessions. The study didn't report any adverse effects like pigmentary changes or scarring. The study concluded that CROSS technique, utilizing 100% TCA, is a safe, minimally invasive, effective, and cost-efficient method for treating ice-pick scars in individuals with darker skin types.[14]

Another study by Agarwal and associates in 2013 assessed efficacy of CROSS technique with 100% TCA for treating atrophic facial post-varicella scars. In this study, 69% patients had excellent response (>75%) whereas remaining 31% reported good improvements (51-75%). The authors reported this technique as effective, inexpensive and safe especially in the back drop of non-observance of any complication in any patient.[15]

The CROSS technique with 100% TCA has been established as an effective and safe intervention for ice-pick and post-acne scars, as demonstrated by Khunger et al, who reported excellent outcomes without significant adverse effects in darker skin types.[14] Similarly, Agarwal et al, documented favorable results in atrophic post-varicella scars.[15] However, evidence remains limited,[14,15] particularly in local populations, and variations in patient demographics and scar characteristics restrict generalizability. This study aims to bridge the existing evidence gap by assessing the safety and therapeutic effectiveness of 100% TCA CROSS in the management of post-varicella scars.

Methods

This descriptive case series was conducted over a period of six months, from 20/10/2020 to 19/04/2021, at Dermatology Department, Sir Ganga Ram Hospital, Lahore. A sample size of 100 patients was calculated with a 95% confidence level and a 5% margin of error, taking the expected frequency of fair outcome as 6.7%.[14]

Patients of both the genders with age between 10–40 years suffering from atrophic facial post-varicella scars of grade III or IV as per Goodman and Baron Qualitative method for more than 3 months duration were included. Atrophic acne scars were excluded on the basis of detailed his-

tory and clinical examination. Patients with active viral, bacterial and fungal infections over the treatment site, having history of keloid / hypertrophic scar formation, using oral isotretinoin in the last six months, with known photosensitivity and pregnant and lactating females were excluded. At the initial visit, patient demographics including age, gender, marital status, and occupation were recorded. Scars were systematically documented, noting their number, duration, and any associated hypopigmentation or hyperpigmentation, as well as the patient's previous and current medications. Scars were graded, and pre-treatment photographs were taken. To address potential effect modifiers, data were stratified by age, gender, marital status, and the duration and number of scars. Post-stratification chi-square tests was used for establishing statistical significance, a p-value of ≤0.05 considered as statistically significant.

While keeping their eyes closed, patients were asked to wash the face and further cleaned with alcohol swabs and soap before start of treatment. To manage any incidental spill of TCA, a 10 ml syringe filled with normal saline was kept available. A 100% TCA solution was prepared by diluting 100 g of TCA crystals with distilled water to a final volume of 100 ml. TCA was applied to the scars using a toothpick dipped in the solution, carefully avoiding surrounding normal skin. Surrounding normal skin was protected by precise focal application and immediate neutralization with saline in case of spillage. No local anesthetics were used. A mild burning sensation of 2–3 minutes was felt by the patients. Treatment area was monitored till achievement of frosted appearance. The face was then washed with plain water. Patients were advised not to remove the crusts that formed within 24 hours, allowing them to naturally fall over the next 5–7 days. They were advised to use sunscreens and avoid direct sunlight. They were further instructed to start applying 2% hydroquinone cream over the treated area after shedding of crust every night. Focal TCA applications were performed every two weeks for a total of four sessions. Final results were evaluated and documented with photographs three months after the last treatment. For three dropped out patients, similar number was added again as per inclusion criteria.

Outcome was assessed. Grading of atrophic facial post-varicella scars was done. Clinical response was assessed by finding the difference between the initial and final grade. Data collected were analyzed using SPSS version 22.0. Numerical variables, such as age and the duration and number of scars, were summarized using mean ± SD. Categorical variables, including gender, marital status, and treatment outcomes (excellent, good, and fair), were reported as frequencies and percentages.

Results

Patients had a mean of 25.4±7.7 years. Majority (n=39, 39.0%) of the patients were in age group of 21-30 years followed by 34 (34.0%) patients aged between 10-20 years and 27 (27.0%) patients aged between 31-40 years. There were 38 (38.0%) males and 62 (62.0%) females. The duration of scars ranged from 1 to 6 years with a mean of 3.5±1.5 years while the number of scars ranged from 3 to 18 with a mean of 10.2±4.5. 45 (45.0%) patients were married while 55 (55.0%) were single as shown in Table 1.

Excellent treatment outcome was observed in 71 (71.0%) patients while 29 (29.0%) patients had good outcome as per operational definition as shown in Table 2. The high proportion of excellent responses indicates that 100% TCA CROSS is highly effective for post-varicella atrophic scars, comparable to results reported in previous studies for ice-pick and post-acne scars. The frequency of excellent and good outcome across various subgroups of patients based on age (p= 0.990), gender (p=0.993), marital status (p=0.982) and duration (p=0.926) and number (p=0.813) of scars had insignificant difference as shown in Table 3. This suggests that the efficacy of TCA CROSS is consistent across different demographic and clinical characteristics, highlighting its broad applicability and reproducibility in diverse patient populations.

Table 1: *Baseline Profile of Enrolled Subjects.*

Characteristics	Study Sample n=100
Age (years)	25.4±7.7
• **10-20 years**	34 (34.0%)
• **21-30 years**	39 (39.0%)
• **31-40 years**	27 (27.0%)
Gender	
• **Female**	62 (62.0%)
• **Male**	38 (38.0%)
Marital Status	
• **Married**	45 (45.0%)
• **Single**	55 (55.0%)
Duration of Scars (years)	3.5±1.5
• **1-3 years**	49 (49.0%)
• **4-6 years**	51 (51.0%)
Number of Scars	10.2±4.5
• **3-10**	57 (57.0%)
• **11-18**	43 (43.0%)

Table 2: *Frequency of Various Grades of Outcome in Patients with Post-Varicella Facial Scars treated with TCA CROSS.*

Outcome	Frequency (n)	Percent (%)
Fair	0	0.0 %
Good	29	29.0%
Excellent	71	71.0%
Total	100	100.0%

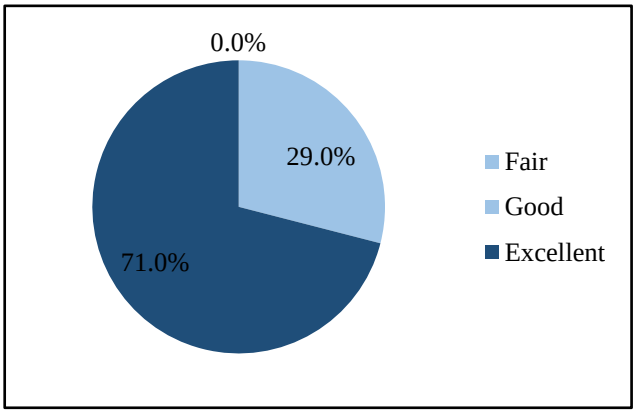

Figure 1: *Distribution of Outcome Grades Following TCA CROSS Treatment in Post-Varicella Facial Scars.*

Table 3: *Stratification of Excellent and Good Outcome across various Subgroups of Patients with Post-Varicella Facial Scars treated with TCA CROSS.*

Subgroups	n	Outcome		P-value
		Excellent (n=71)	Good (n=29)	
Age				
• **10-20 years**	34	24 (70.6%)	10 (29.4%)	
• **21-30 years**	39	28 (71.8%)	11 (28.2%)	0.990
• **31-40 years**	27	19 (70.4%)	8 (29.6%)	
Gender				
• **Male**	38	27 (71.1%)	11 (28.9%)	0.993
• **Female**	62	44 (71.0%)	18 (29.0%)	
Marital Status				
• **Single**	55	39 (70.9%)	16 (29.1%)	0.982
• **Married**	45	32 (71.1%)	13 (28.9%)	
Duration of Scars				
• **1-3 years**	49	35 (71.4%)	14 (28.6%)	0.926
• **4-6 years**	51	36 (70.6%)	15 (29.4%)	
Number of Scars				
• **3-10**	57	41 (71.9%)	16 (28.1%)	0.813
• **11-18**	43	30 (69.8%)	13 (30.2%)	

Discussion

Varicella zoster virus (VZV) is one of the eight herpesviruses that infect humans. Initial exposure results in varicella (chickenpox), after which the virus remains dormant within the host.[7] The long-term sequelae after infection are recurrent infection, neuralgia and atrophic scars.[6] Although not life-threatening, the post-varicella atrophic facial scars are of serious cosmetic concern and adversely affect the quality of life. These are also a common reason for dermatology clinic visit among such patients.[8]

In this study, the patients had a mean age of 25.4 ± 7.7 years, with 38 (38.0%) males and 62 (62.0%) females. The mean duration of scars was 3.5±1.5 years while the mean number of scars was 10.2 ± 4.5. Excellent treatment outcome was observed in 71 (71.0%) patients while 29 (29.0%) patients had good outcome.

Our observation is similar to results of an Indian study where Agarwal et al,[15] studied 16 patients with post-varicella facial scars. They too observed a similar female predominance with male to female ratio of 1:1.6. The duration of scar ranged from 3 months to 6 years while the number of scars ranged from 2 to 25 in their series. They also reported similar frequency of excellent (69.2%) and good (30.8%) outcome of treatment after TA CROSS in line with the present study.

In another Indian study, Khunger et al,[14] studied 30 patients with post-varicella atrophic facial scars with a mean age of 25 years and male to female ratio of 1:2. The duration of scars ranged from 1 to 10 years with a mean of 2.3 years in their study. They also reported comparable treatment outcome among such patients after TA CROSS with excellent outcome in 73.3% and good outcome in 20.0% patients. 6.7% patients had fair outcome in their series.

This study is the first in the local population, expanding limited existing international evidence. The strengths of the present study were its large sample size of 100 cases compared to only 16 and 30 patients in previous studies by Agarwal et al,[5] and Khunger et al,[14] respectively. In the present study, we observed that post-varicella scars were of serious cosmetic concern as majority of our sampled patients were un-married, females, aged between 21-30 years. We also noted that CROSS using 100% TA resulted in excellent treatment outcome in 71.0% of such patients. It can be thus advocated that chemical reconstruction of skin scars using 100% TA acid should be used in the management of such patients in future dermatological practice. An added advantage of TCA is that it has long been used as a peeling agent and has a well-established safety profile. Moreover, TCA CROSS is an outdoor procedure which doesn't need any kind of anesthesia or specialized hardware.

Strengths of the study include relatively large sample size, strict inclusion and exclusion criteria, standardized assessment using Goodman and Baron grading system, and objective photographic documentation, which enhance the reliability of the findings. Stratification was performed to address potential effect modifiers. However, the study is limited by its descriptive design, lack of a control or comparison group, short follow-up period, and absence of patient-reported outcome measures, which restrict generalizability and long-term outcome assessment.

Conclusion

In the present study, we observed that CROSS using 100% TA resulted in excellent treatment outcome in 71.0% of patients presenting with post-varicella atrophic facial scars which along with its low cost, safety and ease of administration advocates its preferred use in the management of such patients.

Ethical Approval: The Research Evaluation Unit, College of Physicians and Surgeons of Pakistan approved this study vide Ref No: CPSP/REU/DER-2018-059-924.

Conflict of Interest: There was no conflict of interest to be declared by any author.

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Authors' Contribution

AS: Substantial contributions to concept, study design, acquisition of data, analysis and interpretation of data, manuscript writing

SM: Substantial contributions to concept, study design, acquisition of data, analysis and interpretation of data, manuscript writing.

AM: Analysis and interpretation of data, manuscript writing.

MS: Substantial contributions to concept, study design, acquisition of data, analysis and interpretation of data, manuscript writing.

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