

Efficacy of Trichloroacetic Acid (100%) in the Management of Plantar Fissures: A Pilot Study**Sharanya Lavu¹, Ramya B.G.², Abhishek Rao T.³**^{1,2,3}Department of Dermatology, Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka, India

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Conflict of interest: Nil

Abstract**Objective:** To evaluate the efficacy and safety of 100% trichloroacetic acid (TCA) in the management of plantar fissures.**Methods:** this prospective interventional pilot study included 20 patients aged above 15 years presenting with plantar fissures to the department of dermatology, Navodaya medical college hospital and research centre, Raichur, from June 2025 to February 2026. After cleaning the soles with sterile saline, 100% TCA was applied to the fissure margins until fine white frosting was achieved. Superficial fissures were treated with a cotton swab, while deep fissures were treated using a pointed applicator. Applications were repeated at 3-week intervals for a maximum of four sittings or until complete resolution. All patients used a plain non-urea-based moisturizer twice daily. Physician-graded improvement, patient self-assessment, adverse effects and relapse at 10-week follow-up were recorded.**Results:** of 20 patients, 15 (75%) were female and 5 (25%) were male, with a mean age of 38.1 +/- 12.7 years. Twelve patients had superficial fissures and eight had deep fissures. Excellent improvement was achieved in 13 patients (65%), and marked-to-excellent improvement in 16 patients (80%). Excellent improvement was more frequent in superficial fissures than deep fissures (75.0% versus 50.0%), although the difference in overall response distribution was not statistically significant ($p = 0.602$). Transient exfoliation occurred in 5 patients (25%). No infection, dyspigmentation, scarring or relapse was observed during follow-up.**Conclusion:** TCA 100% is a simple, affordable and well-tolerated office-based treatment for plantar fissures, especially superficial fissures. Larger controlled studies with longer follow-up are required to confirm long-term efficacy and recurrence rates.**Keywords:** Chemical Peeling; Heel Fissures; Plantar Fissures; Trichloroacetic Acid; Wound Healing.**DOI:** 10.25258/ijcpr.18.7.66

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Introduction

Plantar fissures are a common dermatological problem characterized by linear cracks or splits in the thick plantar epidermis, most frequently over the heel. They may remain superficial or extend deeper into the dermis, causing pain, bleeding, and difficulty in walking and reduced quality of life. [1] Xerosis, repeated friction, barefoot ambulation, open-back footwear, poor foot hygiene and systemic conditions such as diabetes mellitus and hypothyroidism are recognized contributors.

The condition has particular relevance in tropical and rural settings, where barefoot walking and occupational exposure increase repeated mechanical trauma. Sivakumar et al. reported fissure foot in nearly half of a rural Tamil Nadu population, with a higher burden among females and occupational groups such as housewives and farmers. [2] In

diabetic patients, plantar fissures may have additional clinical importance because autonomic neuropathy, vascular impairment and reduced skin hydration can impair healing and increase the risk of deeper fissuring and secondary complications. [3,4]

Conventional management includes emollients, keratolytic agents such as urea and salicylic acid, topical steroids when inflammatory dermatoses coexist, mechanical debridement and fissure-sealing agents. These approaches can provide symptomatic relief, but often require prolonged and regular application and may be insufficient for deep or recalcitrant fissures. [5,6] Therefore, an affordable office-based intervention that can promote rapid fissure closure with acceptable safety would be clinically useful. Trichloroacetic acid (TCA) is a well-established chemical cauterizing and peeling

agent used in dermatology. At higher concentrations, TCA produces controlled coagulation necrosis followed by re-epithelialization, tissue remodeling and collagen reorganization. [7-9] Because TCA is self-neutralizing and has minimal systemic absorption when used focally, it can be applied to small localized lesions with careful technique. Kapoor et al. described the use of 100% TCA for deep heel fissures and later reported favorable results in a small case series of plantar fissures, with good clinical response and no major adverse effects. [10,11] In view of the limited published evidence, the present pilot study was conducted to evaluate the efficacy and safety of 100% TCA in patients with plantar fissures.

Materials and Methods

Study design and setting: This prospective interventional pilot study was conducted in the Department of Dermatology, Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka, India, from June 2025 to February 2026. The study was initiated after Institutional Ethics Committee approval.

Study population: Patients aged above 15 years presenting to the dermatology outpatient department with plantar fissures were screened. Patients willing to participate and provide written informed consent were included. Patients below 15 years of age, those with concurrent infective conditions such as tinea pedis or bacterial infection, and those unwilling to participate were excluded.

Sample size: A total of 20 patients were enrolled. As this was a pilot study intended to assess feasibility, efficacy and safety of 100% TCA in plantar fissures, no formal sample size calculation was performed.

Treatment protocol: A detailed clinical history was obtained and the plantar lesions were examined. Baseline fissure severity was documented. Before each application, the affected sole was cleaned with sterile saline. In superficial fissures, 100% TCA was applied using a cotton swab in evenly distributed strokes over the fissured area.

In deep fissures, a sharp-tipped applicator was used to apply TCA precisely along opposing fissure margins until fine white frosting was observed. Care was taken to avoid unnecessary application over surrounding normal skin. Applications were repeated at 3-week intervals for a maximum of four sittings or until complete clinical resolution, whichever occurred earlier. All patients were advised to use a plain non-urea-based moisturizer twice daily.

Assessment parameters: Fissures were graded clinically as Grade 0: no fissure, Grade I: minimal

superficial fissure, Grade II: intermediate fissuring, and Grade III: deep fissure. Physician assessment of improvement was graded as Grade 0: no improvement, Grade I: mild improvement up to 25%, Grade II: moderate improvement 26-50%, Grade III: marked improvement 51-75%, and Grade IV: excellent improvement 76-100%. Patient self-assessment was recorded as very dissatisfied, dissatisfied, satisfied or very satisfied. The primary outcome was the proportion of patients achieving Grade IV improvement. Secondary outcomes included marked-to-excellent response, patient satisfaction, adverse effects and relapse at 10-week post-treatment follow-up.

Statistical analysis: Data were recorded in a structured case proforma and entered into Microsoft Excel. Categorical variables were summarized as frequency and percentage. Continuous variables were summarized as mean with standard deviation or median with interquartile range, as appropriate. The Fisher-Freeman-Halton exact test was used to compare the distribution of physician-graded improvement between superficial and deep fissures. The Wilcoxon rank-sum test was used to compare the number of TCA applications required between groups. A P value less than 0.05 was considered statistically significant.

Results

A total of 20 patients were included. The mean age was 38.1 $\pm$ 12.7 years, with an age range of 19-65 years. There were 15 females (75%) and 5 males (25%). Disease duration ranged from 6 months to 4 years. Twelve patients (60%) had superficial fissures corresponding to Grades I-II, while 8 patients (40%) had deep fissures corresponding to Grade III. Predisposing factors included dry skin in 8 patients (40%), barefoot ambulation in 6 patients (30%), backless footwear in 6 patients (30%) and diabetes mellitus in 5 patients (25%). Multiple predisposing factors were present in some patients.

Overall, 13 of 20 patients (65%) achieved Grade IV excellent improvement after treatment with 100% TCA. Marked improvement was observed in 3 patients (15%), moderate improvement in 3 patients (15%) and mild improvement in 1 patient (5%). Thus, 16 patients (80%) achieved marked-to-excellent improvement.

Excellent improvement was observed in 9 of 12 patients (75.0%) with superficial fissures and 4 of 8 patients (50.0%) with deep fissures. Although superficial fissures showed a higher proportion of excellent response, the overall distribution of physician-graded response between superficial and deep fissures was not statistically significant (Fisher-Freeman-Halton exact test, $P = 0.602$). The median number of TCA applications was 2.5 (interquartile range, 1.75-3.25) for superficial

fissures and 2.5 (interquartile range, 1.00-3.25) for deep fissures. The difference was not statistically significant on Wilcoxon rank-sum testing ($P = 0.842$). On patient self-assessment, 13 patients (65%) were very satisfied, 3 (15%) were satisfied, 3 (15%) were dissatisfied and 1 (5%) was very dissatisfied. Transient exfoliation of plantar skin

occurred in 5 patients (25%) and resolved without active intervention. No patient developed wound infection, dyspigmentation, scarring or worsening of fissures. No relapse was observed among patients who achieved marked or excellent response during the 10-week follow-up period.

Table 1: Baseline demographic and clinical characteristics of study patients

Characteristic	Value
Total patients	20
Age, mean +/- SD (range)	38.1 +/- 12.7 years (19-65 years)
Female sex	15 (75.0%)
Male sex	5 (25.0%)
Disease duration	6 months to 4 years
Superficial fissures (Grades I-II)	12 (60.0%)
Deep fissures (Grade III)	8 (40.0%)
Dry skin*	8 (40.0%)
Barefoot ambulation*	6 (30.0%)
Backless footwear*	6 (30.0%)
Diabetes mellitus*	5 (25.0%)

*Some patients had more than one predisposing factor.

Table 2: Treatment outcome by fissure type

Fissure type	No. of patients	Grade IV excellent improvement	Grade III marked improvement	Grade II moderate improvement	Grade I mild improvement
Superficial fissures	12	9 (75.0%)	2 (16.7%)	1 (8.3%)	0
Deep fissures	8	4 (50.0%)	1 (12.5%)	2 (25.0%)	1 (12.5%)
Total	20	13 (65.0%)	3 (15.0%)	3 (15.0%)	1 (5.0%)

Fisher-Freeman-Halton exact test comparing overall distribution of physician-graded improvement between superficial and deep fissures: $P = 0.602$.

Table 3: Number of TCA applications and patient self-assessment

Parameter	Overall result
One application	6 (30.0%)
Two applications	4 (20.0%)
Three applications	5 (25.0%)
Four applications	5 (25.0%)
Median applications in superficial fissures	2.5 (IQR 1.75-3.25)
Median applications in deep fissures	2.5 (IQR 1.00-3.25)
Wilcoxon rank-sum test	$P = 0.842$
Very satisfied	13 (65.0%)
Satisfied	3 (15.0%)
Dissatisfied	3 (15.0%)
Very dissatisfied	1 (5.0%)

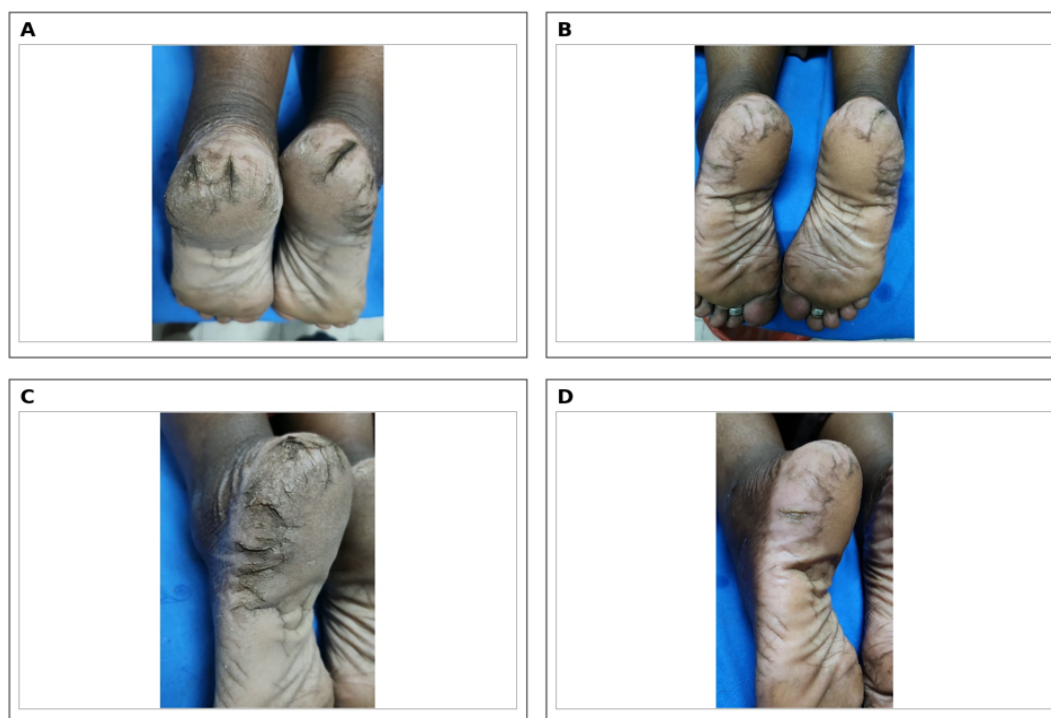


Figure 1: Representative clinical photographs documenting plantar fissures among study participants. Panels A-D show fissure morphology over the heel and plantar surface, showing improvement after 2 applications of TCA 100 %.

Discussion

The present pilot study suggests that 100% TCA is an effective and well-tolerated office-based therapeutic option for plantar fissures. In this cohort of 20 patients, 65% achieved excellent improvement and 80% achieved marked-to-excellent improvement. The response was clinically better in superficial fissures than in deep fissures, although the difference in response distribution did not reach statistical significance, likely because of the small sample size.

Plantar fissures are common but frequently undertreated because they may be perceived as a minor condition. However, painful heel fissures can restrict walking, interfere with daily activity and predispose to secondary infection, especially in patients with diabetes or impaired skin barrier function. [1,3,4] Standard therapies such as emollients and keratolytics are useful but depend heavily on patient adherence and may require prolonged use. [5]

The probable therapeutic effect of TCA in plantar fissures is related to controlled chemical cauterization and tissue remodeling. Focal application of high-concentration TCA produces localized coagulation necrosis, followed by re-epithelialization and collagen remodeling. [7-9] When applied along fissure margins, this effect may help controlled approximation of fissure edges and promote healing by secondary intention. The thick plantar stratum corneum may also limit excessive

penetration, contributing to the favorable tolerability observed in this study.

The findings are broadly comparable with the reports by Kapoor et al., who documented favorable response of recalcitrant deep heel fissures and later described excellent outcomes in a case series of plantar fissures treated with 100% TCA. [10,11] The excellent response rate in the present study was lower than that reported in the smaller case series, but the marked-to-excellent response rate was similar. This difference may be explained by inclusion of patients with deeper fissures, longer disease duration and diabetes mellitus.

Compared with several other modalities, TCA has practical advantages. It is inexpensive, readily available, does not require specialized equipment and can be applied by the clinician in an outpatient setting. Cyanoacrylate liquid skin protectants and topical timolol have also been reported for fissure management, but may require specific materials or repeated self-application over a period of time. [6,12] In contrast, TCA may reduce dependence on prolonged patient-applied therapy, although continued emollient use and foot-care measures remain essential to prevent recurrence.

The safety profile was acceptable. Transient exfoliation occurred in one-fourth of patients and resolved spontaneously. No infection, scarring, dyspigmentation or worsening was observed. Nevertheless, careful patient selection and precise application are essential, particularly in diabetic

patients, patients with poor peripheral circulation and those with active infection.

This study has limitations. It was a pilot study with a small sample size, lacked a control group and had a short 10-week follow-up period. Response grading, although clinically practical, may have an element of observer subjectivity.

Larger randomized controlled studies with longer follow-up are needed to compare 100% TCA with standard emollients, keratolytics, fissure sealants and other wound-healing modalities.

Conclusion

Trichloroacetic acid 100% appears to be an effective, affordable and safe therapeutic modality for plantar fissures. In this pilot study, excellent improvement was achieved in 65% of patients and marked-to-excellent improvement in 80%.

Superficial fissures showed better clinical response than deep fissures. The procedure was well tolerated, with transient exfoliation as the only observed adverse effect. TCA may be considered as a simple office-based treatment option for selected patients with plantar fissures, provided that infection is excluded and preventive foot-care measures are continued. Larger controlled studies with longer follow-up are required to confirm durability of response and recurrence rates.

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Declarations

Ethical approval: Obtained from the Institutional Ethics Committee, Navodaya Medical College Hospital and Research Centre, Raichur.

Informed consent: Written informed consent was obtained from all participants before enrollment.

Consent for clinical photographs: Consent for use of anonymized clinical photographs should be confirmed before journal submission.

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