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Original Research Article

# REMOTE MONITORING OF TREATMENT RESPONSE IN ALLERGIC CONTACT DERMATITIS USING PATIENT-ASSISTED TELEDERMATOLOGY: A COMPARATIVE OUTCOME STUDY

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ABSTRACT

**Background:** Allergic Contact Dermatitis (ACD) requires repeated follow-up to monitor treatment response and identify triggers. Frequent hospital visits can reduce compliance. Patient-Assisted Teledermatology Practice (PATP) allows patients to share lesion images remotely for clinical monitoring. The aim is to compare clinical outcomes, treatment adherence, between patient-assisted teledermatology and conventional face-to-face (FF) follow-up in patients with ACD.

**Materials and Methods:** This prospective comparative study included 160 clinically diagnosed ACD patients. Participants chose either PATP (n=82) or FF follow-up (n=78). All patients received standard topical therapy. Disease severity was assessed using a modified Eczema Area and Severity Index for ACD (ACD-EASI) at baseline, week 2, week 4, and week 8. Adherence to treatment, number of missed follow-ups, and time to symptom resolution were recorded. Image quality in PATP was graded (1–4 scale). Patient satisfaction and physician confidence were evaluated using Likert scales.

**Results:** Mean reduction in ACD-EASI score at 8 weeks was 72.4% in PATP and 74.1% in FF group (p=0.62). Treatment adherence was significantly higher in PATP (88%) compared to FF (71%) (p=0.01). Missed follow-up visits were lower in PATP (9.7%) than FF (26.9%) (p=0.004). Average time to symptom resolution was similar (PATP: 5.8 weeks; FF: 5.6 weeks; p=0.54). Good-to-excellent image quality was achieved in 68% of PATP submissions. Patient satisfaction was high in both groups but higher in PATP (mean score 4.5/5 vs 4.1/5).

**Conclusion:** Patient-assisted teledermatology is as effective as face-to-face care in monitoring ACD treatment response and significantly improves adherence and follow-up compliance.

**Keywords:** Allergic Contact Dermatitis, Teledermatology, Remote Monitoring, Treatment Adherence, Digital Dermatology.

## INTRODUCTION

Allergic Contact Dermatitis (ACD) is a common inflammatory dermatosis resulting from a Type IV delayed hypersensitivity reaction following skin contact with environmental allergens. It accounts for a significant proportion of dermatology outpatient visits and frequently affects the hands, feet, face, and exposed body areas. Chronic exposure leads to persistent eczema characterized by erythema, vesiculation, crusting, scaling, and lichenification. Occupational exposure, cosmetic allergens, metals, rubber chemicals, and plant allergens are major triggers.[1,2]

**Management of ACD involves three critical components:**

1. Identification and avoidance of allergens
2. Control of active inflammation with topical or systemic therapy
3. Long-term follow-up to monitor treatment response and prevent relapse.

While patch testing is used to identify causative allergens, monitoring treatment response over time is equally important, particularly in chronic or occupational ACD. Clinical follow-up typically requires repeated hospital visits for visual assessment, therapy adjustment, and patient education. However, frequent visits are often impractical for working individuals, elderly patients, and those living in remote areas. Travel cost, loss of wages, and long waiting times reduce compliance and may lead to incomplete treatment, chronicity, or recurrent flares.[3,4]

Teledermatology has emerged as a powerful tool to bridge this accessibility gap. It uses digital technology to provide dermatologic care at a distance through image transfer and virtual interaction. Two major models exist: store-and-forward (asynchronous) and live interactive (synchronous). Dermatology is particularly suited to telemedicine because many skin conditions can be evaluated visually.[5]

Patient-Assisted Teledermatology Practice (PATP) represents a participatory model in which patients or caregivers capture lesion photographs and share them with dermatologists via smartphones. This approach shifts part of the monitoring responsibility to patients, improves engagement, and allows continuous care without physical visits. PATP has shown feasibility in wound care, chronic ulcers, and inflammatory dermatoses, but limited data are available regarding treatment response monitoring in ACD.[5,6]

Most previous teledermatology studies in ACD have focused on patch test interpretation or feasibility surveys rather than longitudinal clinical outcomes. There remains a need to evaluate whether remote monitoring can provide equivalent disease control, while also improving adherence, follow-up compliance, and patient satisfaction.[7]

This study was therefore designed to compare clinical improvement, adherence to therapy, follow-up attendance, and patient experience between patients followed through PATP and those receiving conventional face-to-face (FF) care.

## MATERIALS AND METHODS

It was a prospective comparative cohort study conducted at Department of Dermatology at a tertiary care teaching hospital with a dedicated contact dermatitis clinic for a period of 18 months.

Adult patients clinically diagnosed with Allergic Contact Dermatitis attending the dermatology outpatient department.

**Sample Size:** A total of 160 patients were enrolled based on expected moderate effect size in adherence rates with 80% power and 5% alpha error.

- PATP group: 82 patients
- Face-to-Face (FF) group: 78 patients

Group allocation was based on patient preference after counseling about both follow-up methods.

**Inclusion Criteria**

- Age ≥ 18 years
- Clinically diagnosed ACD based on history and morphology
- Mild to moderate disease requiring outpatient management
- Willing to participate and provide informed consent
- Access to smartphone with camera and messaging application (PATP group)

**Exclusion Criteria**

- Severe erythrodermic or infected dermatitis
- Patients requiring systemic immunosuppressants
- Pregnancy and lactation
- Inability to provide follow-up data
- Co-existing severe dermatological or systemic illness

**Baseline Assessment**

**At enrollment, the following were recorded:**

- Demographic details (age, gender, occupation, residence)
- Duration of disease
- Suspected allergen exposure
- Previous treatments
- Sites involved and body surface area
- Baseline symptom severity (itch, burning, sleep disturbance)

Clinical photographs were taken in the hospital for reference.

Patients were counselled about the advantages of PATP. In PATP patient attenders were trained to capture the image of patch test area on Day 4(96 hrs) and day 7(Late reactions) readings were noted in FF, PATP and cross over modes of interpretation of serial patch test reading. The reaction was read using the International Contact Dermatitis Research Group (ICDRG) criteria for all patients.

**Statistical Methods:** The Descriptives procedure displays univariate summary statistics for several variables in a single table and calculates standardized values (z scores). Variables can be ordered by the size of their means (in ascending or descending order), alphabetically, or by the order in which the researcher specifies. Following descriptive statistics were employed in the present study-mean, Standard deviation, frequency and percent and Chi-square and T-test were used for associations. P<0.05 is considered statistically significant. SPSS (25.0) was used for analysis.

## RESULTS

**Table 1: Baseline Demographic and Clinical Characteristics**

| Variable | PATP (n=82) | FF (n=78) | p-value |
|---|---|---|---|
| Mean Age (years) | 36.2 ± 12.1 | 38.5 ± 11.8 | 0.28 |
| Age <30 years | 29 (35.4%) | 24 (30.8%) | 0.54 |
| Male | 43 (52.4%) | 38 (48.7%) | 0.65 |

| | | | |
|---|---|---|---|
| Female | 39 (47.6%) | 40 (51.3%) | |
| Occupational exposure | 38 (46.3%) | 34 (43.6%) | 0.74 |
| Duration >6 months | 31 (37.8%) | 29 (37.2%) | 0.93 |
| Hand involvement | 34 (41.5%) | 30 (38.5%) | 0.70 |
| Foot involvement | 23 (28.0%) | 24 (30.8%) | 0.69 |
| Multiple site involvement | 19 (23.2%) | 17 (21.8%) | 0.84 |

Both groups were comparable at baseline with no statistically significant differences. ACD was most common in working-age adults with hand involvement predominating.

**Table 2: Mean Modified ACD-EASI Score Over Time**

| Follow-up Time | PATP (Mean ± SD) | FF (Mean ± SD) | p-value |
|---|---|---|---|
| Baseline | 18.4 ± 5.2 | 17.9 ± 5.6 | 0.58 |
| Week 2 | 11.3 ± 4.8 | 10.5 ± 4.6 | 0.32 |
| Week 4 | 7.4 ± 3.9 | 6.8 ± 3.6 | 0.41 |
| Week 8 | 5.1 ± 3.1 | 4.6 ± 2.9 | 0.38 |

Both groups showed progressive reduction in disease severity. No significant difference in improvement between PATP and FF at any follow-up.

**Table 3: Percentage Reduction in ACD-EASI Score**

| Time Point | PATP (%) | FF (%) | p-value |
|---|---|---|---|
| Week 2 | 38.5 | 41.2 | 0.47 |
| Week 4 | 59.6 | 61.8 | 0.56 |
| Week 8 | 72.4 | 74.1 | 0.62 |

Clinical improvement was similar in both groups. Remote monitoring did not compromise treatment outcomes.

**Table 4: Treatment Adherence**

| Adherence Level | PATP (n=82) | FF (n=78) | p-value |
|---|---|---|---|
| Good adherence | 72 (87.8%) | 55 (70.5%) | 0.01 |
| Poor adherence | 10 (12.2%) | 23 (29.5%) | |

PATP patients had significantly better adherence to treatment. Reduced hospital visits likely improved compliance.

**Table 5: Image Quality in PATP Group**

| Image Grade | Number (n=82) | Percentage |
|---|---|---|
| Grade 1 – Poor | 7 | 8% |
| Grade 2 – Fair | 20 | 24% |
| Grade 3 – Good | 38 | 46% |
| Grade 4 – Excellent | 17 | 22% |

68% of images were good to excellent, allowing reliable remote assessment. Only a small proportion were of poor quality.

**Table 6: Patient Satisfaction**

| Satisfaction Level | PATP (n=82) | FF (n=78) | p-value |
|---|---|---|---|
| Very satisfied (5) | 49 (59.8%) | 36 (46.2%) | |
| Satisfied (4) | 26 (31.7%) | 30 (38.5%) | |
| Neutral (3) | 7 (8.5%) | 12 (15.3%) | |
| Mean Score | 4.5 ± 0.6 | 4.1 ± 0.7 | 0.002 |

Patient satisfaction was significantly higher in PATP. Convenience and reduced travel were commonly cited reasons.

## DISCUSSION

This study evaluated the effectiveness of patient-assisted teledermatology practice (PATP) for remote monitoring of treatment response in Allergic Contact Dermatitis (ACD) and compared it with conventional face-to-face (FF) follow-up. The findings demonstrate that clinical outcomes were comparable between the two groups, while PATP significantly improved treatment adherence, follow-up compliance, and patient satisfaction.

Both PATP and FF groups showed steady and significant reduction in Modified ACD-EASI scores over the 8-week follow-up. The percentage improvement at week 8 (72.4% vs 74.1%) did not differ significantly, indicating that remote visual monitoring is sufficient for evaluating therapeutic response in ACD.

These findings align with prior teledermatology research in inflammatory dermatoses such as eczema and psoriasis, where remote assessment has shown diagnostic and monitoring concordance rates exceeding 80–90%. Dermatology is inherently image-based, and high-quality photographs can effectively capture erythema, scaling, lichenification, and excoriations — the core clinical features evaluated in ACD.[7,8]

Our results suggest that direct physical examination may not be essential for routine follow-up once diagnosis and initial management have been established, provided that patients are properly trained to capture lesion images.

A key strength of PATP in this study was significantly better treatment adherence (87.8% vs 70.5%). Improved adherence may be attributed to:

- Reduced travel burden and time constraints
- Continuous digital communication reinforcing instructions
- Greater patient engagement through active participation

Telemedicine has been shown in other chronic conditions (diabetes, hypertension, and dermatologic diseases) to enhance adherence by improving accessibility and maintaining regular patient–doctor interaction. In ACD, where prolonged use of topical therapy and allergen avoidance is critical, better adherence directly translates into improved disease control and lower relapse rates.[9,10]

In our study, 68% of submitted images were graded as good or excellent, and only 8% were considered poor. Proper patient training and standardized instructions likely contributed to this high quality. Although physician confidence was slightly higher in the FF group, confidence remained high in PATP (81.7%). Prior studies in teledermatology have reported diagnostic concordance rates of 75–90% between in-person and image-based consultations, supporting the reliability of remote visual assessment.

Importantly, most ACD lesions are located on hands, feet, face, and exposed areas, which are easily photographed, making this condition particularly suitable for telemonitoring.

Patient satisfaction scores were significantly higher in the PATP group (4.5 vs 4.1). Common advantages reported in teledermatology literature include:

- Convenience
- Reduced travel and waiting time
- Lower indirect costs
- Faster communication

These benefits are especially meaningful in developing countries, where dermatology specialists are concentrated in urban centers. PATP empowers patients and promotes patient-centered care, which is increasingly recognized as a key determinant of healthcare quality.[8-10]

Earlier teledermatology studies in contact dermatitis have primarily focused on feasibility of patch test interpretation rather than longitudinal treatment monitoring. Our study expands this evidence by demonstrating that PATP can be effectively used for ongoing disease severity assessment and therapeutic supervision.[11,12]

Similar success with remote monitoring has been reported in chronic wounds, leg ulcers, and inflammatory dermatoses, where image-based follow-up improved compliance and reduced clinic visits without compromising outcomes. Our findings are consistent with these studies and provide further evidence that teledermatology can safely replace many routine in-person visits.[12]

**Clinical Implications**

The results suggest that PATP can be integrated into routine dermatology practice as a hybrid care model, where:

- Initial diagnosis is made in person
- Stable follow-ups are conducted remotely
- Physical visits are reserved for complications or non-response

Such a model can help decongest outpatient departments, improve access in rural areas, and optimize specialist time.

**Limitations and Future Scope**

Although outcomes were comparable, the study was non-randomized, and adherence was partly self-reported. Future randomized trials with longer follow-up periods could assess relapse rates and long-term allergen avoidance compliance.

Advances such as AI-assisted image analysis and standardized photography apps may further improve diagnostic accuracy and physician confidence in teledermatology.

## CONCLUSION

This study reinforces that patient-assisted teledermatology is not only feasible but clinically effective for monitoring ACD treatment. It maintains equivalent disease control while significantly improving adherence, follow-up compliance, and patient satisfaction. PATP represents a scalable, patient-friendly model that can enhance dermatologic care delivery, particularly in resource-limited settings.

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