# Systematic Review of the Effectiveness of Phototherapy Treatments with Seborrheic Dermatits

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## Abstract

The management of seborrheic dermatitis is based on the severity of the symptoms. Phototherapy is one of the treatment options. However, the effectiveness of phototherapy treatment has not yet been clarified. Thus, a systematic study can investigate the effectiveness of the phototherapy in order to select the treatment based on the symptoms. This study uses the PRISMA checklist 2020 to screen the number of studies relating to the research question. The GRADE approach as well as the Cochrane Public Health Group Data Extraction and Assessment were used to clarify and grade the data. The search for the studies was conducted both online and offline. Selection criteria was having a sample diagnosed with seborrheic dermatitis and the use of phototherapy treatment.

After conducting a thorough search, 65 records were found initially. The next steps included deleting redundant records, and then, carefully filtering and evaluating full-text articles. Three papers in total—two prospective single-arm trials and one randomized trial with three arms—were eventually incorporated into this systematic review. Notably, each study used different types of light therapy, offering variants such as green diode light therapy, narrower band UVB, and strong pulse therapy. Nonetheless, the inhomogeneity of these interventions and research designs makes it impractical to carry out an additional meta-analysis. Based on the findings of this study, phototherapy methods such as photodynamic laser, intense pulsed light (IPL) in conjunction with 30% supramolecular salicylic acid, and narrow-band ultraviolet B (TL-01) phototherapy have been shown to offer successful treatment.

Phototherapy treatments are particularly helpful with seborrheic dermatitis. However, the existing evidence is limited in both quantity and quality. Therefore, a large-scale randomized controlled trial is warranted to establish the efficacy of phototherapy in treating seborrheic dermatitis.

***Keywords:*** *Seborrheic Dermatitis, Phototherapy, Dermatitis, Ultraviolet*

## 1. Introduction

Seborrheic dermatitis is one of the most common chronic inflammatory skin diseases, found across all ethnicities and particularly prevalent among individuals with HIV infection and AIDS. The pathogenesis of seborrheic dermatitis remains debated, with the role of Malassezia spp. being unclear. Clinical evidence indicates that reducing Malassezia with antifungal treatment improves symptoms, while yeast populations increase during exacerbations, suggesting a possible, yet unresolved, link in the disease's pathophysiology (Crespo, & Delgado, 2002). Phototherapy is a light treatment for inflammatory skin conditions. There are different types of phototherapies, including broad band UVB, narrow band UVB, PUVA (psoralen UVA), laser, and IPL (intense pulse light) treatments.

Occasionally, patients diagnosed with seborrheic dermatitis encounter issues with oral medications or find that topical medications do not sufficiently alleviate their symptoms, necessitating alternative treatment options. Phototherapy is used as one of these alternative treatments (Pirkhammer et al., 2000). Combination therapies, integrating topical treatments with phototherapy, have proven to be very effective (Borda et al., 2019). Seborrheic dermatitis exhibits variable treatment responses, which are influenced by factors specific to each patient, such as the condition's severity and the patient's underlying health status, including immune function. Traditional treatment modalities primarily rely on topical applications and, in some instances, systemic medications (Kastarinen et al., 2014).

Currently, advancements in evidence-based medicine have refined our understanding of seborrheic dermatitis, enhancing our ability to select optimal treatments. Despite the availability of various treatment options, the effectiveness of phototherapy remains insufficiently characterized, underscoring the need for further research to elucidate its therapeutic potential in managing this condition.

## 2. Objectives

1) To elucidate the efficacy of phototherapy in the treatment of seborrheic dermatitis, an area where knowledge regarding its risks and benefits remains inconclusive.

2) To evaluate the available evidence on the effectiveness and safety profile of phototherapy in treating seborrheic dermatitis, thereby identifying gaps in current knowledge, and suggesting directions for future research.

3) Phototherapy has been used for inflammatory skin diseases, which has proven very useful. However, we do not yet know about the standard guidelines of treatment. Therefore, this study aims to standardize the phototherapy treatment.

## 3. Materials and Methods

Our systematic literature search was meticulously conducted across several renowned databases to ensure a comprehensive review of the available evidence. We specifically targeted the Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library, MEDLINE, PubMed, and the Web of Science databases and tracked the references covering an extensive period from the year 2000 up to 2023. We started our search in March 2022 and concluded in October 2023.

In this study, we employed the PICO strategy to articulate our research question concerning the treatment of seborrheic dermatitis, specifically examining the effectiveness of phototherapy (I) in patients with seborrheic dermatitis (P) as compared to those who have not been treated with ultraviolet therapy (C), with the aim of assessing treatment outcomes (O). We used the search terms (((phototherapy) OR (ultraviolet)) AND (seborrheic dermatitis). Our selection criteria were focused on studies that investigate the use of phototherapy in treating individuals diagnosed with seborrheic dermatitis. Any study not directly assessing the role of phototherapy in the management of seborrheic dermatitis was excluded.

Regarding the selection criteria, if the researchers had differing opinions, a third person including the researchers themselves found a consensus together. To analyze the studies, we used the Cochrane Collaboration's tool for assessing the risk of bias. Also, the PRISMA checklist 2020 was used in order to clarify the details of the studies as well as the Cochrane Public Health Group Data Extraction and Assessment. Risk of Bias assessments provide awareness. Thus, grading the risks of bias applies three levels – Good quality, Fair quality, and Poor quality. In terms of cohort study/case control study, the New Castle-Ottawa scale endorsed by the Cochrane Collaboration was used to adjust the data.

## 4. Results and Discussion

Following the extensive search process, 65 records were initially retrieved. Subsequent stages involved the removal of duplicate records, meticulous screening, and a thorough assessment of full-text articles, in which we found 35 records from the PubMed, 27 records from Medline and three records from the Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library based on the keywords. Furthermore, among the screened studies, two were represented solely by abstracts without accessible full texts (Kircik, 2009), and one had an abstract in English with the full text available only in Korean (Liu et al., 2022). The PRISMA flow is demonstrated in Figure 1.

In total, three studies were included in this systematic review, encompassing two prospective single-arm trials and one randomized trial featuring three arms. The focus of these studies was primarily on adults, with a median age of 32 years, ranging from 6 months to 61 years old. The interventions across these studies exhibited a median duration of 12 weeks, with exposure periods ranging from 6 to 47 weeks. Additional details regarding the characteristics of the included studies are comprehensively outlined in Table 1. It is noteworthy that each study employed distinct forms of light therapy, introducing variations including intense pulse therapy, narrowed band UVB, and green diode light therapy. However, the lack of homogeneity among these interventions and study designs precludes the feasibility of conducting a further meta-analysis. As such, a narrative synthesis will be employed to effectively present the diverse findings and outcomes within the constraints of this systematic review.

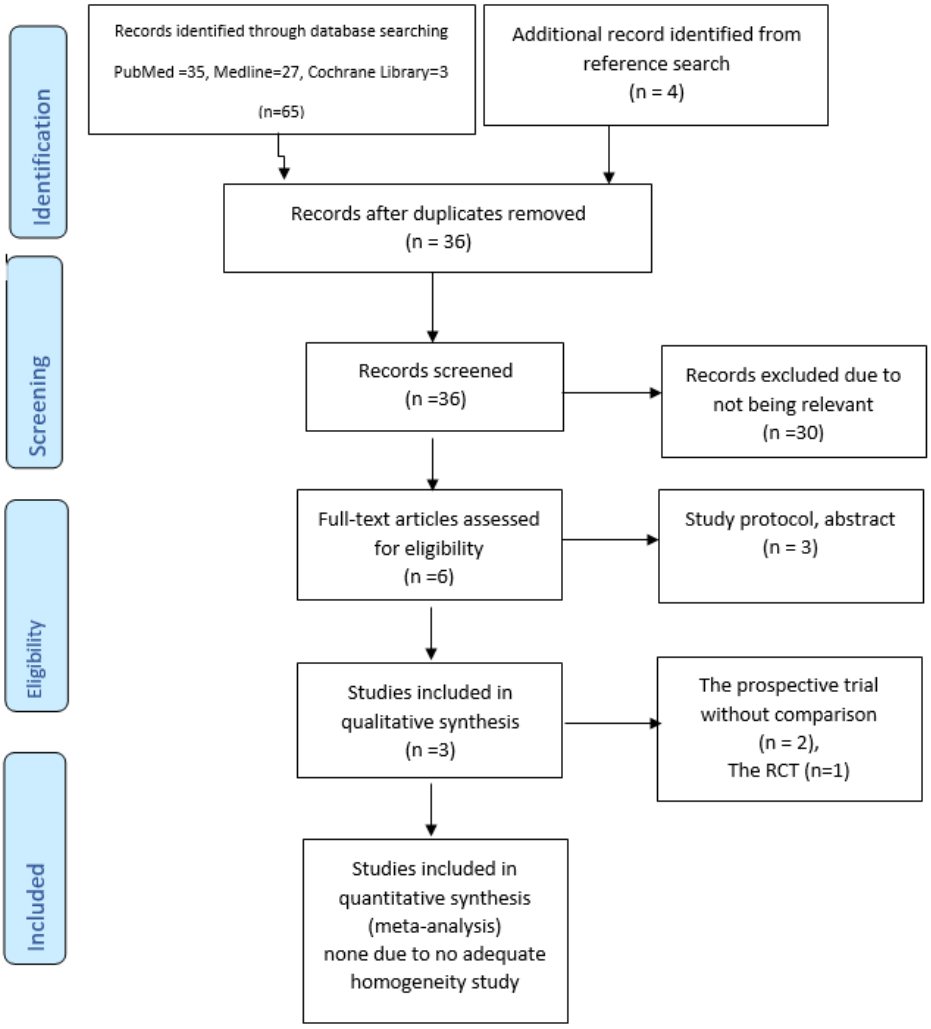


**Figure 1** Algorithm of study selection following PRISMA guidelines

**Table 1** Characteristics of the included studies

| Paper | Population characteristics | Intervention | Outcome measured | Study design and duration | Main findings |
|---|---|---|---|---|---|
| Clinical study on treatment of facial seborrheic dermatitis with intense pulsed light combined with 30% supramolecular salicylic acid (Gu & Wang, 2020). | Patients with mild or moderate facial seborrheic dermatitis, with a higher proportion of female patients, aged 20-41 years, and specific exclusion criteria related to allergies, recent medication use, and other health conditions. Total: 45 (15:15:15) | Combination of IPL and 30% supramolecular salicylic acid treatment compared with IPL treatment alone and 30% supramolecular salicylic acid treatment alone. | Improvement in symptoms of seborrheic dermatitis after the treatments. | Randomized nonblinded trial<br><br>The duration of the intervention in this study was approximately 46-47 weeks (11-12 months), based on the treatment occurring once every 4 weeks in three consecutive rounds and the average treatment course of 15.3-15.4 months. | - The combination of IPL and 30% supramolecular salicylic acid showed significant improvement in symptoms of seborrheic dermatitis 4 weeks after the first treatment, with quicker and more effective results compared to individual treatments.<br>- After three rounds of treatments, the combination group had significantly higher efficacy in decreasing seborrheic dermatitis compared to the IPL group and the 30% supramolecular salicylic acid group.<br>- The combination of IPL and 30% supramolecular salicylic acid was effective in treating facial seborrheic dermatitis and provided quicker results with no adverse reactions. |
| Narrow-band ultraviolet B (TL-01) phototherapy is an effective and safe treatment option for patients with severe seborrheic dermatitis (Pirkhammer et al., 2000). | Patients with severe seborrheic dermatitis, with an age range from 6 months to 24 years had treatments performed during different seasons. Some patients underwent HIV testing and had negative results. Total: 18 | Narrow-band ultraviolet (UV) B (TL-01) phototherapy was administered three times weekly for up to a maximum of 8 weeks. The dose of the intervention started at 70% of the minimal erythema dose (MED) and was adjusted based on the erythemal reaction to the previous exposure. The median cumulative narrow-band UVB dose applied to the | Clinical scores assessing erythema, scaling, infiltration, and pruritus at baseline and every 2 weeks, with median clinical score decreased from baseline to after 8 weeks of treatment, intensity of pruritus was measured on a visual analogue scale, median pruritus score decreased from baseline to week 8, the time of relapse after treatment. | Perspective nonblinded trial<br><br>The duration of the intervention in the study was 7.4 weeks (range 2.6–8 weeks). | Narrow-band UVB phototherapy is highly effective and safe for treating severe seborrheic dermatitis, with all patients showing favorable responses, including complete clearance and marked improvement. The median clinical score and pruritus score significantly decreased after 8 weeks of treatment, indicating the effectiveness of narrow-band UVB phototherapy in reducing the symptoms of seborrheic dermatitis. Despite the positive response to treatment, relapses occurred in all patients after a median of 21 days, suggesting the need for a maintenance |

| Paper | Population characteristics | Intervention | Outcome measured | Study design and duration | Main findings |
|---|---|---|---|---|---|
| | | patients was 9'8 J cm 22 (range 2'9 ± 22′2), and the median number of exposures was 23 (range 9 ± 24) with a median duration of treatment of 7.4 weeks (range 2′6 ± 8). | | | schedule to prevent or delay remission. |
| A new therapeutic option for facial seborrheic dermatitis: indole-3-acetic acid photodynamic therapy SH (Kwon et al., 2014). | Population characteristics: - Age range: 26 to 51 years - Gender: all female - Fitzpatrick skin type: III or IV Total: 23 | The intervention(s) that the study participants received were: - 0.015% IAA (AC gel Ò; Wellskin, Seoul, Korea) applied for 15 minutes under occlusion - 520-nm green diode light (Nouvo-GB Ò; M.I. Tech, Daejeon, Korea) with an intensity of 9 J/cm 2 illuminated for 15 minutes - The treatment protocol was repeated three times with 1-week intervals. | Seborrheic dermatitis Area and Severity Index (SASI), patients' assessment of the symptoms (itchiness, burning, erythema, scale, and tightness), sebum secretion rate, Erythema Index (EI), and physician's photographic assessment. | Perspective single-blinded, trial<br><br>The duration of the intervention in the study was 6 weeks, consisting of three treatment sessions with 1-week intervals, and the therapeutic effects were observed to be maintained for 4 weeks after the last treatment session. | IAA-PDT is a safe and effective therapeutic option for trials on facial seborrheic dermatitis. |

**Quality of included studies**

In our analysis of the research by Gu, and Wang (2020), it was observed that the study demonstrated a low risk of bias in random sequence generation and other bias sources. However, there was not enough information to determine if the allocation to treatment groups was hidden, which creates some uncertainty. Both the participants and those administering treatments likely knew which treatment was being given, raising concerns about potential biases in how the outcomes were perceived and reported. Similarly, the people assessing the results were probably aware of who received which treatment, which could skew their evaluations. On a positive note, the study did a good job of reporting all of the outcomes they set out to measure, and there were no additional biases found, suggesting a generally reliable approach in these areas. Overall, considering these strengths and weaknesses, the study's quality is deemed medium.

The study by Pirkhammer et al. (2000) reveals certain limitations in its risk reporting, with many domains showing unclear or high risks, raising concerns about the study's reliability. The lack of explicit mention of random sequence generation or allocation concealment raises questions about the study's

effectiveness in preventing selection bias. Furthermore, the absence of detailed blinding procedures suggests potential risks of performance and detection bias.

The study indicates that every participant showed improvement following the treatment, and it tracked their progress until any recurrence or notable worsening of the condition. However, there were six patients who did not complete the study but were still counted in the final analysis using an intention-to-treat approach. This method helps reduce the impact of missing data but does not completely eliminate concerns, especially if these patients stopped participating due to issues related to the treatment itself. This situation raises some questions about the completeness and reliability of the study's outcome data.

The lack of explicit information on whether all pre-specified outcomes were reported introduces uncertainty regarding selective reporting. Additionally, the absence of detailed descriptions of other study design elements makes it challenging to fully evaluate the potential for other biases.

In summary, while Pirkhammer et al.'s study provides valuable insights into the efficacy of narrow-band UVB phototherapy for seborrheic dermatitis, the absence of comprehensive methodological details necessitates a cautious interpretation of the findings. A more thorough methodological disclosure is essential to fully assess the risks of various biases and validate the study's conclusions.

The investigation conducted by Kwon et al. (2014) lacks explicit methodological disclosures regarding random sequence generation and allocation concealment. This omission introduces ambiguity concerning the unbiased nature of treatment allocation, raising potential concerns about the influence of selection bias on the study's outcomes.

Furthermore, the absence of detailed reporting on blinding protocols for participants and personnel is noteworthy, given its critical role in mitigating performance bias—a form of bias that arises when the knowledge of treatment allocation influences behaviors or outcome assessments. The clarity is similarly deficient regarding the blinding of outcome assessors, an essential aspect to prevent detection bias, where foreknowledge of treatment assignments could affect outcome evaluations.

The study does not thoroughly articulate how it managed instances of incomplete outcome data, an issue pivotal for ensuring the integrity of the research findings. Incomplete data, if not properly addressed, can distort the study's conclusions, particularly concerning the efficacy of the treatment under investigation.

Concerning selective reporting, the study falls short of confirming whether all predetermined outcomes and analyses were comprehensively reported. The absence of such confirmation may lead to suspicions of selective reporting bias, where only selected outcomes—potentially those that are favorable—are disclosed, while others are neglected.

Lastly, the paper does not delve into potential additional biases, leaving readers to speculate about other unaddressed factors that might skew the results. The failure to acknowledge or control these potential biases further complicates the interpretation of the study's validity.

In conclusion, the paucity of methodological transparency and the unaddressed risk of various biases in the study by Kwon et al. (2014) suggest a poor level of quality. While the research provides insights into the treatment of facial seborrheic dermatitis, the identified methodological shortcomings necessitate a prudent approach to interpreting its findings, underscoring the imperative for rigorous methodological rigor in clinical research.

To summarize, the quality assessment (Table 2) of the included studies revealed varied bias risk levels. Gu, and Wang (2020) was assessed as having medium quality, with some low and unclear bias risks. In contrast, Pirkhammer et al. (2000) and Kwon et al. (2014) were rated as poor, displaying unclear and high bias risks across several domains.

**Table 2** Results of the risk of bias assessment

| Domain | Gu and Wang (2020) | Pirkhammer et al. (2000) | Kwon et al. (2014) |
|---|---|---|---|
| Random sequence generation | + | - | - |
| Allocation concealment | 0 | - | - |
| Blinding of participants and personnel | - | - | - |
| Blinding of outcome assessment | - | - | - |
| Incomplete outcome data | + | 0 | 0 |
| Selective reporting | 0 | 0 | 0 |
| Other sources of bias | + | 0 | 0 |
| Summary quality | medium | poor | poor |

+ = yes, or low risk of bias

0 = unclear or unknown risk of bias

- = no or high risk of bias

## 5. Conclusion

Phototherapy techniques, including narrow-band ultraviolet B (TL-01) phototherapy, intense pulsed light (IPL) combined with 30% supramolecular salicylic acid, and photodynamic laser, have shown effectiveness in managing seborrheic dermatitis. These interventions have demonstrated significant alleviation of symptoms and a reduction in the severity of the condition. However, it is crucial to recognize that the underlying pathological mechanisms of seborrheic dermatitis primarily involve Malassezia proliferation and inflammation. The prevailing conventional treatment involves the application of topical antifungal and anti-inflammatory agents, as emphasized by Borda et al. (2019).

While the initial evidence suggests the effectiveness of phototherapy treatments, it is important to consider them as integral components within a comprehensive treatment strategy that may include these alternative agents. Nevertheless, the existing evidence is notably limited in both quantity and quality. Therefore, a large-scale randomized controlled trial is warranted to establish the efficacy of phototherapy in treating seborrheic dermatitis.

The use of phototherapy in the management of seborrheic dermatitis (SD) has been a subject of discussion and investigation. There are few studies that have reported positive outcomes with phototherapy in the treatment of seborrheic dermatitis. Patients have shown improvement when exposed to natural sunlight during the summer months (Akbulut et al., 2022), and specific phototherapy methods, such as narrow-band UVB, have demonstrated efficacy. The previous research across various skin conditions, including psoriasis, atopic dermatitis, mycosis fungoides, and vitiligo (Krenitsky et al., 2020), have suggested that narrow-band UVB is more effective than broadband UVB. This comparative effectiveness supports the consideration of narrow-band UVB in the treatment of seborrheic dermatitis.

The hypothetic mechanism of narrow-band UVB is believed to induce cellular and molecular changes in the skin. This leads to photochemical reactions that transform chromophores into photoproducts, resulting in cell cycle arrest and apoptosis. Reduced cell proliferation, immunosuppression, and T cell apoptosis are thought to contribute to the suppression of disease activity in inflammatory skin conditions such as seborrheic dermatitis (Borda et al., 2019). Phototherapy can therefore be considered as part of a comprehensive treatment plan for seborrheic dermatitis. Combining phototherapy with topical treatments or other therapeutic modalities may enhance the overall efficacy. Meanwhile, there was some evidence which claimed that PUVA (Tegner, 1983) and natural sunlight may worsen seborrheic dermatitis (Moehrle et al., 2020).

Phototherapy, when administered correctly, has generally demonstrated a favorable safety profile. Studies, including the one by Pirkhammer et al., have found narrow-band UVB to be both effective and safe for patients with severe seborrheic dermatitis (Patrizi et al., 2017). While adverse effects are generally minimal, occasional moderate erythema post-exposure has been reported in some cases. It is therefore crucial to carefully monitor patients for any adverse reactions and adjust the treatment plan accordingly. The success of phototherapy is contingent upon patient compliance. Factors such as the frequency and duration of sessions should be tailored to individual patient needs and preferences.

Regarding the recommendations for further research, despite the positive findings, there is a need for additional well-designed studies to further establish the efficacy, safety, and optimal protocols of phototherapy in seborrheic dermatitis. Future research should explore the long-term outcomes, patient subgroups, and potential synergies with other treatment modalities.

In conclusion, while phototherapy, particularly narrow-band UVB, has shown promise in the treatment of seborrheic dermatitis, ongoing research is essential to strengthen the evidence base, refine treatment protocols, and address individual patient variations in response. A multidisciplinary approach, involving dermatologists, researchers, and patients, is crucial for advancing our understanding and optimizing the use of phototherapy in the management of seborrheic dermatitis. It has been demonstrated that patients experience improvement when exposed to natural sunlight during the summer months. Additionally, two studies have indicated the positive effects of treatment involving selective ultraviolet (UV) phototherapy or oral photochemotherapy. Nevertheless, it is noteworthy that psoralen and ultraviolet A therapy may trigger seborrheic dermatitis.

This section reiterates the key findings and recommends additional research. Moreover, more randomized controlled trials (RCTs) of phototherapy are needed to gather more evidence for precise analysis. However, this study has determined that phototherapy is safe and yields positive results. Maintenance therapy through phototherapy is suggested.

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