Dermatology Practical & Conceptual

Biologic and Non-Biologic Therapies for Scalp Psoriasis: A Network Meta-analysis of Randomized Controlled Trials

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ABSTRACT

Introduction: Scalp psoriasis affects up to 80% of patients with plaque-type psoriasis and is often resistant to topical and conventional systemic agents. There is a lack of consensus on a "gold standard" treatment.

Objective: This comprehensive review and network meta-analysis aimed to compare the efficacy and safety of studied interventions.

Methods: The Ovid MEDLINE(R), Embase, and Cochrane databases were searched from 01 January 2000 to 05 October 2022. All English-language randomized controlled trials evaluating an intervention for scalp psoriasis were included if they reported one of the following clinical outcomes: Psoriasis Scalp Severity Index (PSSI), scalp Physician Global Assessment (ScPGA), scalp-specific Investigator or Physician Global Assessment (IGA/PGA), and Total Sign Score (TSS), and adverse events. A random effects network meta-analysis was performed where possible, and network plots were generated.

Results: Of 1,046 studies identified, 35 met the inclusion criteria, with seven in the PSSI analysis and 16 in the IGA analysis. All interventions led to an improvement in all outcomes when compared to placebo in the PSSI and PGA/IGA. For the PSSI response, secukinumab 300 mg every four weeks (Q4W) was the most effective (SUCRA 0.991). For the PGA/IGA response, bimekizumab 320 mg Q4W was the most effective (SUCRA 0.975).

Conclusions: Several systemic therapies are superior to placebo in improving clinical outcomes, with secukinumab 300 mg Q4W and bimekizumab 320 mg Q4W deemed the most effective among biologic agents analyzed. Efforts to enhance research standardization, including head-to-head trials with standardized outcome measures, diverse patient recruitment, and long-term follow-up, are crucial next steps in assessing treatment efficacy and adverse events.

Introduction

Up to 80% of patients with plaque-type psoriasis have scalp involvement [1]. Scalp psoriasis can cause significant physical and social distress, with up to 97% reporting that the condition interferes in their daily life [2]. Many individuals experience intense pruritus and pain associated with their disease, and the shedding of scale as dandruff can cause significant social embarrassment for affected individuals [3]. Notably, patients have reported significant psychosocial distress and withdrawal from social activities as a result of embarrassment from not being able to hide their lesions [1, 4-6]. Scalp psoriasis is also often refractory to topical agents [1, 7, 8]. Overall, scalp psoriasis continues to pose a significant challenge for dermatologists due to the lack of effective therapies and the severe physical and psychosocial impact on affected patients.

Additionally, outcome measures to quantify the severity of scalp psoriasis are heterogeneous and have varied across various clinical studies. Commonly-used scalp psoriasis tools include the Psoriasis Scalp Severity Index (PSSI), scalp Physician Global Assessment (ScPGA), scalp-specific Investigator or Physician Global Assessment (IGA/PGA), and Total Sign Score (TSS). The PSSI score is calculated by assessing erythema, scaliness, induration, and extent of scalp psoriasis involvement [5]. ScPGA is a seven-point scale assessing plaque elevation, scaling, and erythema [9]. The TSS has been used differently in the studies, with some including only erythema, scaling, and thickness, and others also including pruritus [8]. Instruments that measure patient-reported outcomes such as quality of life and symptom burden also exist but are less often used. These include the Dermatology Life Quality Index (DLQI) and Scalpdex [5].

Previous reviews and meta-analyses on scalp psoriasis found a therapeutic benefit among biologics and small molecule agent (SMAs) treatments compared to placebo [4, 7]. There is a lack of consensus on the optimal or most effective treatment for scalp psoriasis mostly due to the limited number of head-to-head trials comparing biologics and SMAs. We conducted a systematic review and network meta-analysis on systemic therapies for scalp psoriasis.

Objectives

The objective of this study was to compare the efficacy of various therapies for the treatment of scalp psoriasis.

Methods

Search Strategy and Selection Criteria

A systematic review of the literature was conducted of the Ovid MEDLINE(R), Embase, and Cochrane Central Register of Controlled Trials databases from 01 January 2000 to 05 October 2022. All full-text works published in English were included in the analysis if they answered the research question outlined using the Population, Intervention, Comparison, and Outcome (PICO) method: P) patients with any severity of scalp psoriasis; I and C) any therapy type (topical agents, SMAs, biologics, phototherapy, and other); and O) change in scalp psoriasis as determined by improvement and changes in PSSI score, IGA score, ScPGA, modified Psoriasis Area and Severity Index (mPASI) score, or TSS [10]. Works were excluded for the following reasons: only reporting outcomes beyond 24 weeks from baseline (denoted as "remission therapy"), non-randomized studies, abstract-only studies, non-English language, pediatric populations, or non-human models. In accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, two authors (TB and RPL) screened all titles and abstracts independently for eligibility and discussed any discrepancies [11]. All full texts of studies were then for eligibility, and all extracted data were cross-referenced by two reviewers (TB and RPL) to ensure accuracy. For each outcome, data were only extracted between baseline and the 24-week time point, which was denoted as "induction therapy."

Data Collection

Across studies included, data were extracted on demographics, sample size, publication year, treatment characteristics (dosing, frequency), comparison group, timing of outcome assessment, key findings, and others. PSSI, IGA/PGA, ScPGA, mPASI, TSS, and adverse event outcome data were also

extracted. Outcomes assessed at 12 weeks were included in the analysis. For studies that did not report 12-week data, the time point closest to 12 weeks was included for analysis purposes (ranging from four to sixteen weeks). The risk of bias of each trial was also assessed in accordance with the Cochrane Risk of Bias Tool for Randomized Controlled Trials (RoB 2) [12].

Statistical Analysis

A random-effects network meta-analysis was performed using R statistical software (Netmeta package). Within the outcome domain, standardized mean differences (SMD) were employed to combine different scales to allow for the consideration of all the studies reporting a given outcome. Studies of four to sixteen weeks of treatment were pooled, and the analysis was conducted using intention-to-treat (ITT) data. In these analyses, dosing schedules were treated as their own network nodes (i.e., results of different administration schedules of medications were not pooled). Network plots were generated for the analysis. Summary results are presented as SMDs with a 95% confidence interval (CI). Effect estimates for all pairwise comparisons in the network were also calculated.

Results

Characteristics of Included Studies

Through an initial search of the databases, 1,046 studies were identified, of which 702 remained after duplicates were removed (Figure 1); 184 studies were assessed for eligibility, and a total of 35 RCTs were selected for inclusion in the systematic review, of which 19 were included in the network meta-analysis [9, 13-46]. The study characteristics for all included RCTs are summarized in Table S1. Across included studies, there was only sufficient evidence available on systemic agents to include PSSI and scalp or scalp-specific IGA outcomes in a network meta-analysis. Twenty-two studies included a biologic as part of the treatment arm (62.3%), with guselkumab being the most commonly used (N=4, 11.4%). A similar number of studies had nonsteroidal topical therapy as part of at least one treatment arm (N=25, 71.4%). Fifteen studies included a topical corticosteroid as part of the treatment arms (42.9%), with betamethasone dipropionate used in almost half of these trials (N=7, 20%). Placebo was used as the control arm in the majority of the studies (N=23, 65.7%). Of the studies for which the blinding status was known, the majority of the studies were double-blinded (N=23, 65.7%). Detailed baseline demographic characteristics for each included study are included in Table 1. Of note, studies that reported on topical therapies only were not included in the network meta-analysis. In total, 11 studies examined only these agents, which included betamethasone valerate, betamethasone dipropionate, calcipotriol, calcipotriene, and combinations of these therapies [9, 23-25, 27-32, 40].

Network Meta-Analysis Results

PSSI Response

From all studies measuring PSSI response as an outcome, seven studies were included in the analysis [13-19]. One study was excluded due to a lack of information on the standard deviation of the mean PSSI [20], and two additional studies were excluded for including three treatments that formed a separate subnetwork which was not connected to the other treatments in the network [21, 22]. The treatments included in the analysis were: etanercept 50 mg twice weekly, secukinumab 300 mg every four weeks (Q4W), brodalumab 210 mg every two weeks (Q2W), ixekizumab 150 mg Q2W, ixekizumab 160 mg followed by 80 mg Q2W, and ixekizumab 160 mg followed by 80 mg Q4W. The treatment network formed by the included studies is depicted in Figure 2A. All interventions led to a statistically significant improvement in PSSI response compared to placebo, indicating a potentially beneficial effect in reducing the extent and severity of psoriasis involvement (Figure 2B and Table S1). When compared to each other, secukinumab 300 mg Q4W was found to be the safest and most effective (SUCRA 0.991) followed by ixekizumab 160 mg Q2W, (SUCRA 0.701), ixekizumab 150 mg Q2W, (SUCRA 0.671), ixekizumab 160 mg Q4W (SUCRA 0.605), brodalumab 210 mg Q2W, (SUCRA 0.302), and etanercept 50 mg twice weekly (SUCRA 0.230).

Scalp or Scalp-Specific PGA/IGA Response

Seven studies were included in the analysis for the outcome of the IGA response [9, 13, 16 23-39]. Guselkumab 50 mg every eight weeks (Q8W), guselkumab 100 mg Q8W, adalimumab 80 mg Q2W, apremilast 30 mg twice daily, secukinumab 300 mg Q4W, bimekizumab 320 mg Q4W, and ustekinumab 90 mg Q12W were the treatments included in the analysis (Figure 3A).

In comparison to the placebo, all interventions led to a reduction in IGA, indicating a potentially beneficial effect in improving symptoms (Figure 3B and Table S1). Aside from guselkumab 50 mg Q8W, all interventions had a statistically significant benefit when compared to placebo. According to the SUCRA analysis, bimekizumab 320 mg Q4W had the highest likelihood of improving IGA scores (SUCRA 0.975), followed by ustekinumab 90 mg Q12W (SUCRA 0.7050), secukinumab 300 mg Q4W (SUCRA 0.6374), guselkumab 100 mg Q8W (SUCRA 0.5194), apremilast 30 mg twice daily (SUCRA 0.5071), adalimumab 80 mg Q2W, (SUCRA 0.4384), and guselkumab 50 mg Q8W (SUCRA 0.2023).

Risk of Bias Assessment

The risk of bias assessment for the included studies in the network meta-analysis revealed varying degrees of methodological quality across different trials. Overall, most studies exhibited a low risk of bias in random sequence generation, blinding of participants and personnel, blinding of outcome

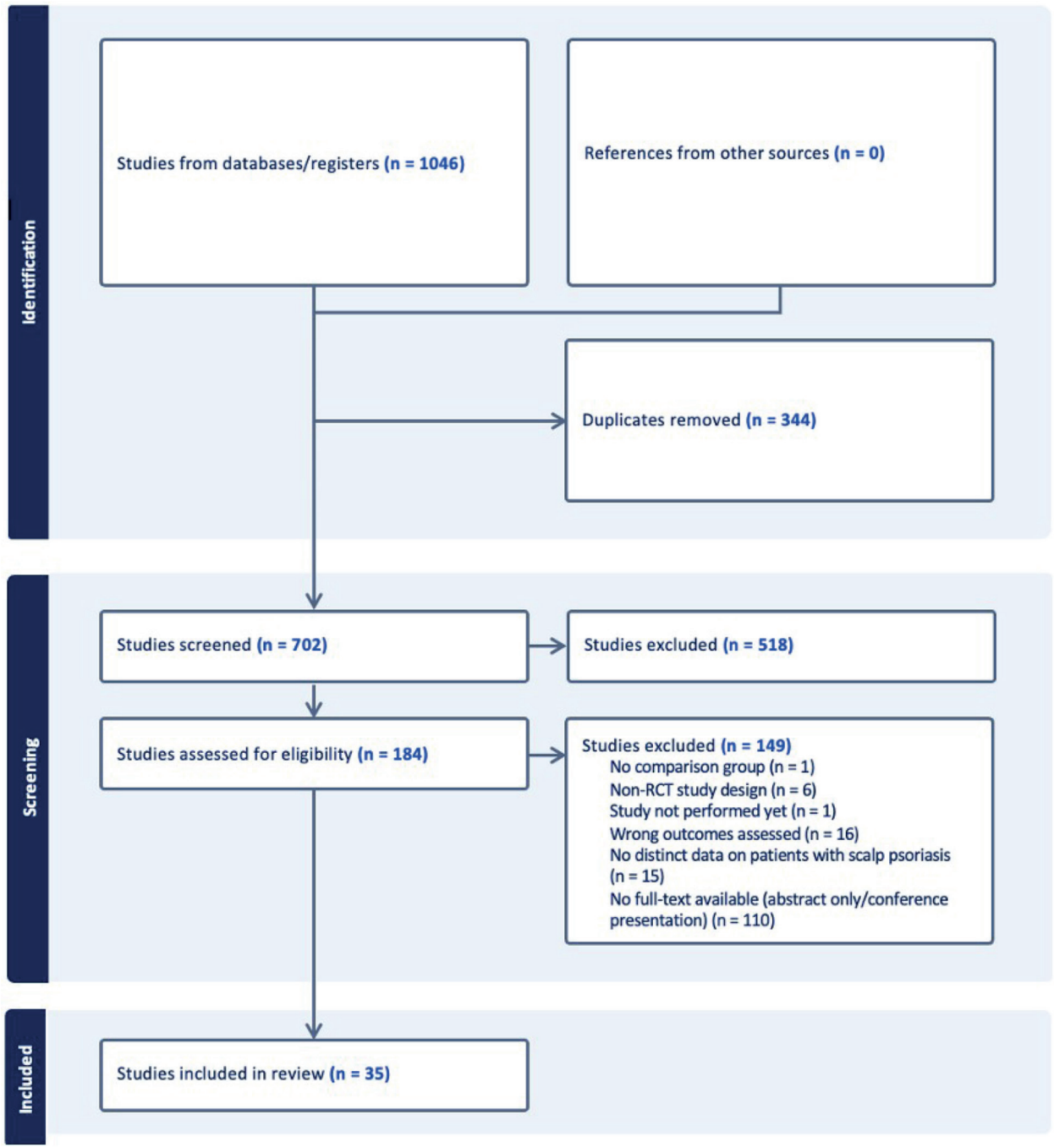

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.

assessment, and incomplete outcome data. However, there were instances of unclear or high risk of bias in certain domains, particularly in the allocation concealment, selective reporting, and other biases domains. In total, six out of 24 studies had a high risk of bias in at least one domain, while 20 studies had an unclear risk of bias in at least one domain.

Conclusions

Though corticosteroids are commonly used in the treatment of scalp psoriasis, they are suboptimal in severe or resistant cases, and long-term use is associated with adverse side effects, including skin lesions and atrophy, highlighting a need for newer, systemic therapeutic modalities [6, 47, 48]. In this analysis, all included therapies showed significant efficacy when compared to placebo through various measures, including PSSI response and IGA response. When all interventions were compared against each other, secukinumab 300 mg and bimekizumab 320 mg were found to be the most effective in improving the PSSI and PGA/IGA scores, respectively.

Among biologics compared in the PSSI and IGA response analyses, biologic agents outperformed other small molecules, aside from a 50-mg dosing of guselkumab, which is

Table 1. Baseline Characteristics of Included Studies.

Author	Arms	Caucasian (%)	Male (%)	Age [min-max] (years)	Mean BMI	Psoriasis Duration (Years)	Scalp involvement (%)	PSSI	TSS	IGA/PGA score of 3-5 (%)
Bagel J [13]	Secukinumab 300 mg	86.3	52.9	42.7*	31.2*	14.4*	61.6*	33.4*	NR	84.3, 70.6, NR
	Placebo	74.5	41.2	41.1*	31.9*	15.4*	59.3*	33*	NR	15.7, 29.4, NR
Buckley C [23]	Calcipotriol/ene+ Betamethasone Dipropionate	97.2	43.5	48.4*	NR	16*	NR	NR	6.79*	NR
	Betamethasone Dipropionate	98.2	46.4	48.4*	NR	13.2*	NR	NR	6.81*	NR
Elewski B [14]	Brodalumab 210 mg	NR	NR	NR	NR	20.4*	NR	16.7-	NR	NR
	Placebo	NR	NR	NR	NR	20.7*	NR	20*	NR	NR
Bagel J [15]	Etanercept 50 mg	69.5	53.2	39- [18-71]	30.2-	17.5-	72.5-	35-	NR	NR
	Placebo	75.8	58.1	42- [18-70]	30.1-	11.9-	60-	30-	NR	NR
Bahraini P [41]	Turmeric tonic	NR	40	29- [27-35]	NR	NR	NR	NR	NR	NR
	Placebo	NR	20	44- [29-50]	NR	NR	NR	NR	NR	NR
Feldman SR [9]	Betamethasone valerate BID	NR	45.57	50* [17-90]	NR	NR	NR	NR	7.7*	NR
	Betamethasone valerate QD	NR	45.57	50* [17-90]	NR	NR	NR	NR	8.1*	NR
Jemec GBE [24]	Calcipotriol/ene+ Betamethasone Dipropionate	95.7	47.9	47.9* [18-83]	NR	15.4*	NR	NR	6.7*	56.2, 28.2, 6.3
	Calcipotriene/ol	97.4	44.5	50.1* [17-91]	NR	16.7*	NR	NR	6.8*	57.4, 32, 4.8
	Betamethasone Dipropionate QD	96.8	41.9	49.5*[18-91]	NR	17.4*	NR	NR	6.9*	57, 32.9, 5.6
	Placebo	94.9	44.9	49.6* [18-97]	NR	16.3*	NR	NR	7*	50.7, 36, 5.9
Jury CS [42]	Itraconazole	NR	42.85	47-	NR	NR	NR	NR	NR	NR
	Placebo	NR	42.85	47-	NR	NR	NR	NR	NR	NR
Kragballe K [25]	Calcipotriol/ene+ Betamethasone Dipropionate	99	43.5	50.8* [18-91]	NR	18.4*	NR	NR	7.4*	54.6, 37.7, 7.7
	Calcipotriene/ol	99	41.9	51.4* [24-85]	NR	19.3*	NR	NR	7.1*	61, 32.4, 6.7
Liu L [26]	Calcipotriol/ene+ Betamethasone Dipropionate	0	67.6	40.9* [18-81]	24.05*	8.278*	NR	NR	NR	56.7, 27.1, 1.8
	Calcipotriene/ol	0	66.1	39.9* [18-76]	24.05*	7.517*	NR	NR	NR	56, 23.6, 1

Table1 continues

Table 1. Baseline Characteristics of Included Studies. *(continued)*

Author	Arms	Caucasian (%)	Male (%)	Age [min-max] (years)	Mean BMI	Psoriasis Duration (Years)	Scalp involvement (%)	PSSI	TSS	IGA/PGA score of 3-5 (%)
Ma L [27]	Calcipotriol/ene+ Betamethasone Dipropionate	NR	60.8	39.9*	NR	7.4*	54.1*	NR	6.8*	69.2, 24.4, 6.7
	Calcipotriene/ol	NR	55.6	38.7*	NR	7.5*	48.6*	NR	6.9*	70.2, 25.8, 4
Okubo Y [40]	Betamethasone butyrate propionate + maxacalcitol (8 weeks)	NR	87.5	49.6* [24-78]	NR	14.1*	NR	NR	5.6*	NR
	Betamethasone butyrate propionate + maxacalcitol (4 weeks)	NR	80	46.1* [26-76]	NR	7.3*	NR	NR	5.4*	NR
van de Kerkhof PC [28]	Calcipotriol/ene+ Betamethasone Dipropionate	98.4	41.9	48.5* [18-92]	NR	15.7*	NR	NR	6.8*	54.8, 29.9, 5.5
	Betamethasone Dipropionate QD	96.8	46.2	47.9* [18-85]	NR	16.1*	NR	NR	6.9*	53.6, 33.6, 4.8
	Calcipotriene/ol	95.8	47.9	48.7* [18-88]	NR	15.8*	NR	NR	6.8*	51.4, 32.9, 3.5
Patel DS [29]	Calcipotriol/ene+ Betamethasone Dipropionate	93	53	47.4* [20-81]	NR	14.6*	NR	NR	NR	65, 17, NR
	Calcipotriene/ol	91.1	60.4	50.7* [21-85]	NR	18.4*	NR	NR	NR	62.4, 14.9, NR
	Betamethasone Dipropionate QD	82.2	55.4	49* [20-85]	NR	16.2*	NR	NR	NR	71.3, 9.9, NR
Rattanakaemakorn P [21]	Excimer lamp + 10% LCD cream	NR	46.7	35.53*	27.15*	NR	NR	12^{-}	NR	NR
	Excimer lamp	NR	40	47*	29.1*	NR	NR	18^{-}	NR	NR
Reich K [16]	Etanercept 50 mg	92.4	68.7	45.4*	NR	18.6*	NR	19.9*	NR	NR
	Ixekizumab Q2W	93.2	65.3	44.8*	NR	18.7*	NR	20.3*	NR	NR
	Ixekizumab Q4W	92.2	67.9	45.2*	NR	18.7*	NR	20.1*	NR	NR
	Placebo	91.4	71.2	46*	NR	18.8*	NR	20.8*	NR	NR
Reygagne P [30]	Clobetasol propionate shampoo	NR	49	44.9*	NR	NR	46*	NR	4.86*	NR
	Calcipotriene/ol	NR	45	45.7*	NR	NR	44*	NR	4.95*	NR

Rich P [43]	Apremilast 30 mg	NR	65.2	44.9*	NR	19.14*	NR	NR	NR	64.7, 35.3, NR
	Placebo	NR	65.1	45.1*	NR	17.41*	NR	NR	NR	62.4, 37.6, NR
	Apremilast 30 mg	NR	58.5	44.7*	NR	17.78*	NR	NR	NR	68.8, 31.3, NR
	Placebo	NR	75.3	44.1*	NR	17.52*	NR	NR	NR	58.1, 41.9, NR
Saraceno R [31]	Calcipotriol/ene+ Betamethasone Dipropionate	NR	51	44.1* [18-85]	NR	NR	37.3*	NR	6.9*	NR
	Calcipotriol/ene+ Betamethasone Dipropionate	NR	59.2	45.7* [18-84]	NR	NR	36.8*	NR	6.8*	NR
Tyring S [32]	Calcipotriol/ene+ Betamethasone Dipropionate	0	62.2	44.4* [18-75]	NR	10.5*	NR	NR	6.3*	81.5, NR, NR
	Placebo	0	66.7	45.8* [22-76]	NR	11.8*	NR	NR	6.2*	76.2, NR, NR
Van Voorhees S [33]	Apremilast 30 mg	76.6	62.2	47*	30.7*	15.7*	61.9*	NR	NR	76.1, 23.9, NR
	Placebo	73.5	60.8	46.7*	31.7*	14.8*	58.2*	NR	NR	74.5, 25.5, NR
Zhou J [22]	UVA1 phototherapy	NR	61.76	32.7* [21-53]	NR	3.02*	NR	15.28*	NR	NR
	Narrow band UVB phototherapy	NR	61.76	32.7* [21-53]	NR	3.02*	NR	15.5*	NR	NR
Thaçi D [20]	Risankizumab 150 mg	NR	NR	42* [18-73]	NR	NR	NR	23.1*	NR	NR
	Fumaric acid esters	NR	NR	42.5* [19-69]	NR	NR	NR	20.2*	NR	NR
Blauvelt A [44]	Placebo	NR	NR	NR	NR	NR	NR	NR	NR	59.3, 16.7, NR
	Guselkumab 100 mg	NR	NR	NR	NR	NR	NR	NR	NR	58.8, 19.6, NR
	Adalimumab 80 mg	NR	NR	NR	NR	NR	NR	NR	NR	59.3, 19.3, NR
Reich K [34]	Placebo	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Guselkumab 100 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Adalimumab 80 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ohtsuki M [35]	Placebo	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Guselkumab 50 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Guselkumab 100 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
Thaçi D [36]	Guselkumab 100 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Fumaric acid esters	NR	NR	NR	NR	NR	NR	NR	NR	NR
Seo SJ [17]	Placebo	NR	NR	NR	NR	NR	NR	28*	NR	NR
	Brodalumab 210 mg	NR	NR	NR	NR	NR	NR	24.6*	NR	NR

Table1 continues

Table 1. Baseline Characteristics of Included Studies. *(continued)*

Author	Arms	Caucasian (%)	Male (%)	Age [min-max] (years)	Mean BMI	Psoriasis Duration (Years)	Scalp involvement (%)	PSSI	TSS	IGA/PGA score of 3-5 (%)
Nakagawa H [18]	Placebo	NR	NR	NR	NR	NR	NR	26.2*	NR	NR
	Brodalumab 70 mg	NR	NR	NR	NR	NR	NR	25.8*	NR	NR
	Brodalumab 140 mg	NR	NR	NR	NR	NR	NR	26.5*	NR	NR
	Brodalumab 210 mg	NR	NR	NR	NR	NR	NR	24.3*	NR	NR
Reich K [37]	Bimekizumab	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Ustekinumab 45 or 90 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Placebo	NR	NR	NR	NR	NR	NR	NR	NR	NR
Gordon KB [38]	Bimekizumab 320 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Placebo	NR	NR	NR	NR	NR	NR	NR	NR	NR
Langley RG [19]	Ixekizumab 10 mg	NR	NR	NR	NR	NR	NR	19.5*	NR	NR
	Ixekizumab 25 mg	NR	NR	NR	NR	NR	NR	20.5*	NR	NR
	Ixekizumab 75 mg	NR	NR	NR	NR	NR	NR	13.8*	NR	NR
	Ixekizumab 150 mg	NR	NR	NR	NR	NR	NR	20.1*	NR	NR
	Placebo	NR	NR	NR	NR	NR	NR	18.8*	NR	NR
Lebwohl MG [39]	Calcipotriol/ene+ Betamethasone Dipropionate	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Calcipotriene/ol	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Betamethasone Dipropionate QD	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bergstrom KB [45]	Clobetasol propionate foam	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Clobetasol propionate solution	NR	NR	NR	NR	NR	NR	NR	NR	NR
Stein Gold L [46]	Apremilast 30 mg	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Placebo	NR	NR	NR	NR	NR	NR	NR	NR	NR

Abbreviations: BID: twice a day; Calcipotriol/ene: combination therapy of calcipotriol and calcipotriene; Calcipotriene/ol: combination therapy of calcipotriene and calcipotriol; QD; once daily, * indicates this value is a mean, ˆ indicates this value is a median

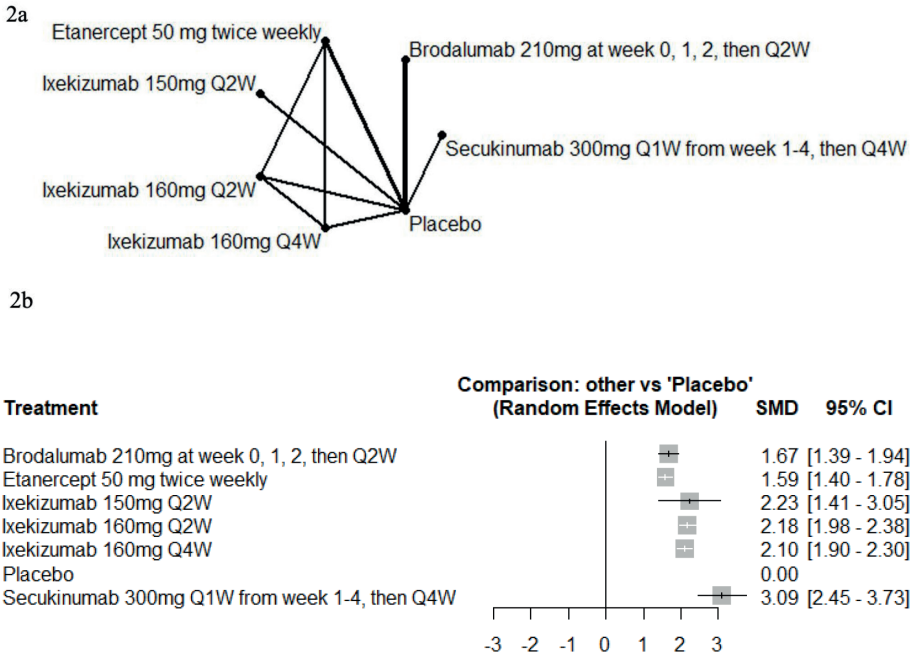

Figure 2. (A) Network plot of studies reporting the PSSI response. (B) Forest plot of network meta-analysis results for studies reporting the PSSI response. (PSSI = Psoriasis Scalp Severity Index.)

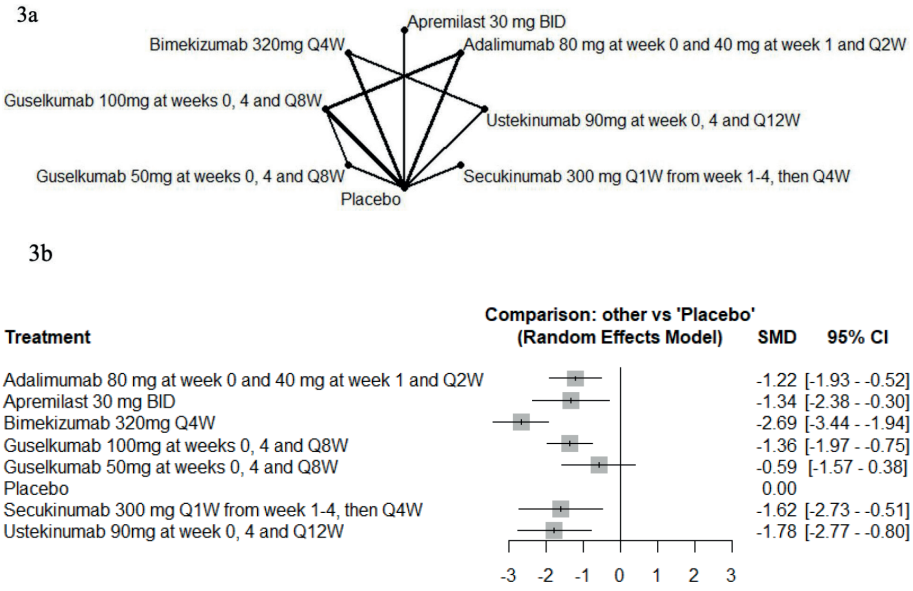

Figure 3. (A) Network plot of studies reporting the IGA response. (B) Forest plot of network meta-analysis results for studies reporting the IGA response. (IGA = scalp-specific Investigator Global Assessment).

not used in real life. In the PSSI analysis, the biologic agents (secukinumab 300 mg Q4W, brodalumab 210 mg Q2W, and ixekizumab 150/160 mg Q2-4W) had a higher likelihood of being more effective than etanercept 50 twice weekly, which is consistent with previous studies [7, 16]. In the IGA response analysis, bimekizumab 320 mg Q4W, ustekinumab, secukinumab 300 mg Q4W, and the 100 mg dosing of guselkumab Q8W were deemed to be more effective than other biologic and small molecule therapies, including apremilast 30 mg twice daily and adalimumab 80 mg Q2W. This is consistent with previous head-to-head comparative studies [49]. These results, consistent with previous research, indicate that the use of newer biologics may be linked to better clinical performance and control of scalp psoriasis symptoms, thus improving quality of life [47].

Scalp psoriasis treatment is greatly expanding, including over 10 different biologic drugs and one small molecule. Scalp psoriatic plaques are particularly refractory to topical

and phototherapeutic treatments due to the presence of hair, and patients often struggle with adherence due to poor cosmetic results [1, 7, 8]. However, current clinical decision-making tools still endorse topical corticosteroids as the first-line treatment for patients, and agents such as ciclosporin, methotrexate, fumaric esters, and acitretin as second-line agents for moderate-severe or treatment-resistant psoriasis [50]. Despite their clear advantages, the widespread adoption of biologics in psoriasis treatment is constrained by cost, administration challenges, and uncertainties surrounding long-term efficacy and safety. Foremost among these is the substantial cost associated with biologics, far exceeding that of traditional medications. Despite efforts such as patient assistance programs and savings coupons, cost-related barriers persist, leading to discontinuation of treatment and hindering cost-effective care. Moreover, the need for injections or infusions adds another layer of inconvenience, impacting adherence and posing logistical challenges particularly for travelers who must navigate storage and transportation requirements. Additionally, while biologics offer promise for long-term maintenance due to their lower toxicity compared to alternatives, uncertainties remain regarding their efficacy and safety over extended periods. Limited long-term clinical data and the potential for patients to develop anti-drug antibodies raise concerns about treatment durability and effectiveness [51].

Limitations

The strengths of this review include its comprehensive nature, encompassing a wide range of treatments and outcome measures for scalp psoriasis, the use of a network meta-analysis methodology to compare these simultaneously, and a systematic approach enhancing the reliability and validity of the findings. However, this study was not without limitations. Due to the heterogeneity in the timing of outcome reporting, trials with durations between 8 and 12 weeks were pooled, and trials beyond 12 weeks were included, which may have favored treatments with longer trial durations and thus increased time to improve psoriasis. Combining different dosing regimens of treatments to incorporate more information may also have introduced limitations due to heterogeneity and comparability issues across the different treatment groups. This analysis was further limited by differences in trial design and heterogeneity in the populations involved. For example, though most studies that reported race-/ethnicity-based data had a majority of Caucasian populations, there were some studies with only racial minorities and significant heterogeneity in the country of study completion. The generalizability of these results is also limited in populations underrepresented in the included clinical trials, such as racial minorities and older patients.

In summary, this systematic review and network meta-analysis offer new insights into the range of treatments for scalp psoriasis. There is a critical need for effective therapies for scalp psoriasis given its significant impact on patients' quality of life. The findings of this study highlight the efficacy of various treatments in improving symptoms, with secukinumab 300 mg Q4W and bimekizumab 320 mg Q4W deemed most effective in improving PSSI and IGA, respectively. These interventions were deemed most effective among biologic agents analyzed, indicating that they may be helpful among patients with moderate-to-severe scalp psoriasis that is refractory to traditional first-line treatments. To address these limitations, future studies should conduct head-to-head trials comparing various treatments directly, using standardized outcome measures and consistent timing of assessments. In this study, certain studies found in the systematic review could not be included as they did not use an outcome that was being assessed for the network meta-analysis. Thus, standardization is not only crucial for the generalizability of the results but also to facilitate evidence synthesis. Furthermore, there should be efforts to recruit a more diverse patient population for clinical trials to increase the generalizability of findings to underrepresented groups. Lastly, studies with long-term follow-up are needed to assess adverse events associated with prolonged therapy and the durability of treatment responses over time.

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