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Original Article

Recent Advances in Pharmacotherapeutic Approaches for *Alopecia areata*: A Systematic Review of Clinical Trials from the Last Decade

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ABSTRACT

Background: *Alopecia areata* (AA) is an autoimmune disorder with diverse clinical presentations and limited universally effective therapeutic options. Over the past decade, numerous treatment strategies have emerged, including Janus Kinase (JAK) inhibitors, corticosteroids, laser therapies, PRP (Platelet-Rich Plasma), and novel alternative agents. **Objectives:** To systematically review and synthesize clinical trial evidence from the last ten years evaluating treatment modalities for AA with a focus on efficacy, safety, route of administration, and innovation. **Materials and Methods:** A comprehensive literature search was conducted across databases, including PubMed, Scopus, and Web of Science, for clinical trials published between 2015 and 2025. Studies were selected based on the predefined PRISMA criteria. Data on the study design, interventions, control treatments, sample size, and outcomes were extracted and analyzed descriptively. Among the retrieved articles, 108 met the inclusion criteria. **Results:** Treatments included oral and topical JAK inhibitors (e.g., baricitinib and ritlecitinib), intralesional corticosteroids, minoxidil, PRP, biologics, and alternative therapies. Oral JAK inhibitors showed the most consistent efficacy, particularly in patients with extensive AA, but they required continuous administration. Intralesional corticosteroids remained an effective option, while PRP and alternative treatments showed variable but promising outcomes. Laser and light therapies are effective adjuncts to certain regimens. **Conclusion:** There is an increasing therapeutic diversity for AA, with oral JAK inhibitors emerging as a key option for severe cases. However, the treatment response varies according to the patient profile, formulation, and delivery route. More high-quality long-term studies are needed to guide personalized treatment plans.

Keywords: *Alopecia areata*, Janus Kinase Inhibitors, Systematic Review, Hair Regrowth, Treatment Modalities.

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INTRODUCTION

Alopecia areata (AA) is an autoimmune inflammatory condition characterized by non-scarring alopecia that results in abrupt patchy or scattered hair loss.[1] This chronic disorder affects hair follicles, nails, and in certain instances, the retinal pigment epithelium.[2] It affects people across all ages, sexes, and ethnicities, with an estimated incidence of 20.9 per 100,000 person-years and a cumulative lifetime incidence of 2% (0.57-3.8%) worldwide.[3] Children account for approximately 20% of cases, but 60% of adults experience initial patches of hair loss before the age of 30 years.[4] AA presents with several manifestations, including distinct bald patches, numerous patches, entire scalp hair loss known as Alopecia Totalis (AT), and whole-body hair loss, referred to as Alopecia Universalis (AU). It may occasionally manifest as a band-like loss of hair at the perimeter of the scalp (ophiasis), affecting only the crown (ophiasis inversus), resembling male-pattern alopecia, abrupt greying, or AA incognita.[5] Patients frequently notice hair loss on the scalp, beards, eyebrows, and eyelashes. Furthermore, 10-40% of patients exhibit nail involvement with the progression of the illness, characterized by nail ridging and pitting that correspond to the degree of AA.[6]

Alopecia areata (AA) has been linked to autoimmune disorders and other ailments, including asthma, allergic rhinitis, atopic dermatitis, diabetes, hypertension, thyroiditis, Systemic Lupus Erythematosus (SLE), and vitiligo in several investigations.[7-9] Additionally, AA may be linked to chromosomal abnormalities, such as Down syndrome and Polyglandular autoimmune syndrome type 1.[10,11] The precise mechanism behind the formation of AA remains to be completely clarified, although the prevailing idea suggests that it involves the breakdown of the immune privilege of the hair follicle due to immunological

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processes. This condition generally arises when the body assaults on its own hair follicles via CD8+ T cells.[12] Psychological and environmental variables, including smoking, alcohol intake, sleep patterns, obesity, fatty acids, and gluten ingestion, can precipitate AA.[13] Currently, there are no conclusive therapies for AA. Treatments for AA include different intralesional, topical, or oral corticosteroids; minoxidil; and certain light-based treatments. Nevertheless, these therapies may have adverse side effects such as discomfort or unintended hair growth in other regions of the body.[14,15] Moreover, there is no guarantee that newly regenerated hair will persist beyond the conclusion of therapy.[16,17] Innovative therapeutic modalities include Janus Kinase (JAK) inhibitors, biologics, other small molecular medicines, antihistamines, Platelet-Rich Plasma (PRP) injections, and further treatments. These individuals are more susceptible to mental health disorders that can be emotionally traumatic, resulting in diminished self-esteem, social isolation, and depression. Therefore, it is essential to treat both physiological symptoms and psychological factors when managing AA.[18]

Several treatment modalities are available for AA, including JAK inhibitors,[19] corticosteroids (intralesional and topical),[20] minoxidil,[21] platelet-rich plasma,[14] cryotherapy,[22] topical immunotherapy,[23] vitamin D analogues,[24] prostaglandin analogues,[25] methotrexate,[26] calcineurin inhibitors,[27] laser therapies,[28] biological therapies,[29] PDE4 (phosphodiesterase-4) inhibitors,[30,31] alternative products,[32,33] procedural approaches,[3,34] and novel therapies.[35,36] However, a comprehensive systematic review summarizing clinical trials conducted in the last decade is lacking. This study bridges the research gap by providing an updated synthesis that highlights efficacy and safety. Its novelty lies in systematically mapping recent therapeutic advances with significance for guiding future clinical practice. The objective of this study was to critically appraise these recent clinical trials.

MATERIALS AND METHODS

Search Strategy

The search strategy involved systematically retrieving data from PubMed, Scopus, and Web of Science databases using the Medical Subject Headings (MeSH)[37] term "*Alopecia areata*" (MeSH Unique ID: D000506), along with its synonym "Alopecia Circumscripta," combined with the Boolean operator "OR." This query was specifically applied to the Title and Abstract fields ([Title/Abstract]). Filters were activated to limit the results to Clinical Trials published within the last ten years (2015-2025). The MeSH term "*Alopecia areata*" has a tree number of C17.800.329.937.122.147, and according to MeSH definitions, it refers to "Loss of scalp and body hair involving microscopically inflammatory patchy areas".[38] This structured approach ensured the comprehensive identification of relevant clinical trials focused on *Alopecia areata* (AA) conducted within the specified timeframe. The data were downloaded on 31 January 2025, which served as the final cutoff date for the inclusion of eligible clinical trials in this review.

This systematic review followed the PRISMA guidelines to ensure transparency, rigor, and methodological consistency.[39] A systematic search, screening, and selection process were conducted using predefined inclusion and exclusion criteria to minimize bias. The PRISMA flow diagram details each stage of the study-selection process. Data extraction adhered to PRISMA standards, ensuring systematic collection of the study design, sample size, interventions, outcomes, and key findings (Figure 1). This approach enhances methodological quality and strengthens the reliability of conclusions on novel AA treatments.

Inclusion and Exclusion Criteria

This systematic review included clinical trials (randomized controlled trials, controlled clinical trials, open-label trials, pilot trials, or comparative clinical studies) involving human participants diagnosed with AA (Figure 1). Eligible studies evaluated any therapeutic intervention aimed at treating AA, including pharmacological treatment, biological therapies, procedural or combined interventions, and alternative approaches. All included articles were published in English between 2015 and 2025 and indexed in PubMed using the MeSH terms "*Alopecia areata*" or "Alopecia Circumscripta." The exclusion criteria were case reports, case series, observational studies, reviews, editorials, conference abstracts, letters, animal studies, diagnostic trials, purely mechanistic or genetic studies without therapeutic intervention, studies not related explicitly to AA, non-English articles, and trials lacking sufficient data on clinical efficacy or safety outcomes.

RESULTS

Routes of administration

This review revealed various routes of administration (Figure 2) used for AA, including topical applications (e.g., corticosteroids or minoxidil), intralesional injections (direct scalp injections, often corticosteroids), oral supplementation, pulse therapy (intermittent dose corticosteroids for autoimmune modulation), and laser/light therapies (e.g., low-level laser therapy to stimulate hair growth). Together, these options address the localized and systemic causes of hair loss (Tables 1-10).

Risk of Bias Assessment

A descriptive assessment of the internal validity of the included randomized controlled trials was performed using the Cochrane Risk of Bias 2 (RoB 2) tool, evaluating domains such as the randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting. Most trials demonstrated low risk in randomization, though several lacked detailed reporting on allocation concealment and blinding, leading to some concerns in intervention and

measurement domains. Studies with small sample sizes or pilot designs often showed higher risk due to incomplete data or vague outcome definitions. Larger, well-conducted trials like those by King *et al*., (2022) and Ghafoor *et al*., (2024) showed lower risk, while earlier exploratory studies presented more methodological limitations. This variability in study quality highlights the need for cautious interpretation of findings in the absence of a formal meta-analysis.

Janus Kinase Inhibitors

A wide range of Janus Kinase (JAK) inhibitors have been studied for the treatment of AA (AA), with oral and topical formulations showing varying degrees of efficacy (Table 1). Among the oral JAK inhibitors, tofacitinib and ruxolitinib have demonstrated significant hair regrowth. An open-label study by Almutairi *et al*., (2019) found that both drugs were effective, with ruxolitinib inducing a faster initial regrowth. [2] Similarly, Jabbari *et al*., (2018) observed that 8 of 12 patients treated with tofacitinib achieved ≥50% regrowth with minimal adverse effects.[40] However, topical formulations have shown mixed results, with Bokhari and Sinclair (2018), who reported partial regrowth in a small sample, and Mikhaylov *et al*., (2023), who found that topical delgocitinib had no significant benefit over placebo.[41,42]

The BRAVE-AA1 and BRAVE-AA2 trials by King *et al*., (2022) assessed baricitinib, demonstrating that 38.8% of patients on a 4 mg dose achieved an SALT (Severity of Alopecia Tool) score ≤20 at week 36. A later study reported that most patients relapsed after discontinuing baricitinib, although retreatment restored efficacy.[8,43,44] The THRIVE-AA1 trial by King *et al*. (2024) on deuruxolitinib showed significant hair regrowth in 41.5% of the patients.[8] Comparatively, ritlecitinib and brepocitinib (ALLEGRO trials) were found to improve scalp biomarkers,[45] with ritlecitinib outperforming brepocitinib in terms of sustained efficacy.[7]

Several studies have highlighted the need for continuous treatment. Hordinsky *et al*., (2023) found that only 17-28% of adolescent patients on ritlecitinib achieved SALT ≤20 at week 24, but this increased to 25-50% at week 48.[15] Similarly, Piliang *et al*., (2025) confirmed sustained regrowth in responders at week 48.[46] Withdrawal studies have shown that stopping ritlecitinib and brepocitinib led to relapse, although retreatment was effective.[47] Studies assessing alternative treatment strategies have yielded promising results. Paracha *et al*., compared tofacitinib and azathioprine, and concluded that tofacitinib was significantly superior.[48] Joly *et al*., examined methotrexate plus prednisone and reported 31% complete regrowth in severe cases.[26] Additionally, a sublingual tofacitinib formulation showed prolonged half-life, indicating its potential for once-daily dosing.[49]

The safety profiles of JAK inhibitors have been extensively analyzed. Taylor *et al*., conducted a safety analysis of baricitinib in 14,744+ patients and showed a low incidence of major adverse events.[50] However, some studies reported that baricitinib was effective in Systemic Lupus Erythematosus (SLE), but did not meet all secondary endpoints, indicating the need for further evaluation.[51] Olsen *et al*., found that topical ruxolitinib cream had no significant regrowth compared with placebo, suggesting that oral formulations remain superior.[52]

Patient-reported satisfaction has been a key measure in recent clinical trials. Sinclair *et al*., found high satisfaction rates among patients receiving ritlecitinib, aligning with clinician-reported efficacy.[53,54] Additionally, Winnette *et al*., noted a moderate correlation between patient-reported outcomes and clinician

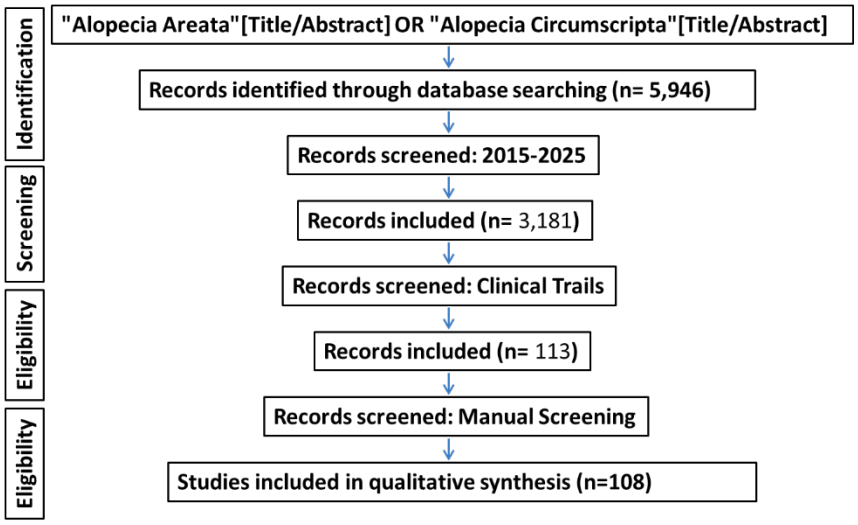

Figure 1: PRISMA 2020 flow diagram illustrating the selection process of clinical trials on *Alopecia areata*. The records were identified through database searching (PubMed, Scopus, and Web of Science). After removing duplicates and screening titles/abstracts, full-text articles were assessed for eligibility. A total of 108 studies met the inclusion criteria and were included in the final review. This systematic review adheres to PRISMA guidelines to ensure transparency and methodological rigor.

assessments, emphasizing the importance of subjective treatment experience.[55]

JAK inhibitors have emerged as a transformative treatment for AA, with oral formulations proving to be the most effective. Baricitinib, ritlecitinib, and deuruxolitinib have shown strong efficacy in clinical trials, particularly in patients with severe or refractory AA. However, continuous therapy is necessary to maintain the results, and withdrawal often leads to relapse. While topical formulations and alternative agents, such as methotrexate and azathioprine, show some promise, oral JAK inhibitors remain the leading therapeutic option. Future research should focus on long-term safety, dose optimization, and patient-centered outcomes to further refine treatment strategies.

Intralesional corticosteroids

Table 2 summarizes the clinical trials that have evaluated intralesional corticosteroids for AA treatment. Studies have varied in corticosteroid types, predominantly triamcinolone acetonide, administered via intralesional injections, laser-assisted methods, or microneedling. The sample sizes ranged from small pilot studies (12 participants) to larger randomized trials (226 participants). Triamcinolone acetonide consistently demonstrated higher efficacy than alternatives, such as cryotherapy, methotrexate,

Table 1: JAK inhibitors.

Study	Formulation/ Route of Administration	Name of the Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Almutairi *et al.*, 2019	Oral	Ruxolitinib vs. Tofacitinib	Open-label comparative	None	75	Both induced significant hair regrowth; ruxolitinib showed faster initial regrowth.[2]
Bokhari and Sinclair, 2018	Topical	Tofacitinib 2% vs. Ruxolitinib 1%	Double-blind, placebo-controlled	Placebo, Clobetasol	16	Partial regrowth observed; 100% regrowth in one patient but relapsed.[41]
Cheng *et al.*, 2018	Oral/Topical	Tofacitinib	Case series	None	11	Marked regrowth with oral; one patient responded to topical.[56]
Eisman and Sinclair, 2021	Oral	Ritlecitinib	Phase 2a trial	Placebo	24	Rapid onset, promising safety profile.[57]
Guttman-Yassky *et al.*, 2022	Oral	Ritlecitinib, Brepocitinib	Phase 2a trial	Placebo	46	Both improved scalp biomarkers; Ritlecitinib showed better improvement at week 24.[45]
Hordinsky *et al.*, 2023	Oral	Ritlecitinib	ALLEGRO Phase 2b/3	Placebo	105	17-28% achieved SALT ≤20 at week 24; increased to 25-50% at week 48.[15]
Jabbari *et al.*, 2018	Oral	Tofacitinib	Open-label pilot	None	12	8/12 had ≥50% regrowth; minimal adverse events.[40]
Joly *et al.*, 2023	Oral	Methotrexate ± Prednisone	Double-blind RCT	Placebo	89	Methotrexate+prednisone led to complete regrowth in up to 31%.[26]
King *et al.*, 2021	Oral	Ritlecitinib, Brepocitinib	Phase 2a RCT	Placebo	142	Significant improvement in SALT scores; brepocitinib showed stronger efficacy.[7]
King *et al.*, 2021	Oral	Baricitinib	Phase 2 RCT	Placebo	110	Baricitinib 4 mg superior to placebo at week 36.[58]
King *et al.*, 2022	Oral	CTP-543	Phase 2 dose-ranging	Placebo	120	Higher doses (8-12 mg) showed significant hair regrowth.[17]

Study	Formulation/ Route of Administration	Name of the Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
King *et al.*, 2022	Oral	Baricitinib	Phase 3 RCT (BRAVE-AA1 and AA2)	Placebo	1200+	38.8% achieved SALT ≤20 with 4 mg dose at week 36.[43]
King *et al.*, 2024	Oral	Baricitinib	BRAVE-AA1	Placebo (withdrawal)	654	Stopping treatment led to relapse in most cases; retreatment was effective.[59]
King *et al.*, 2024	Oral	Deuruxolitinib	THRIVE-AA1	Placebo	720	29.6%-41.5% achieved SALT ≤20 at week 24.[8]
King *et al.*, 2023	Oral	Ritlecitinib	Phase 2b-3	Placebo	718	31% of high-dose group achieved SALT ≤20 at week 24.[19]
Lai *et al.*, 2021	Sublingual	Tofacitinib	Pilot study	None	18	Prolonged half-life compared to oral; potential for once-daily dosing.[49]
Mesinkovska *et al.*, 2024	Oral	Ritlecitinib	ALLEGRO phase 2b/3	Placebo	718	7%-31% achieved SALT ≤20 at week 24; rates increased at week 48.[60]
Mikhaylov *et al.*, 2023	Topical	Delgocitinib	Phase 2a RCT	Placebo	31	No significant difference in efficacy.[42]
Morand *et al.*, 2023	Oral	Baricitinib	SLE-BRAVE-I	Placebo	760	Met primary endpoint for lupus but not secondary endpoints.[51]
Olsen *et al.*, 2020	Topical	Ruxolitinib cream	Phase 2 RCT	Vehicle	120	No significant regrowth difference from placebo.[52]
Paracha *et al.*, 2024	Oral	Tofacitinib vs. Azathioprine	RCT	None	104	Tofacitinib significantly superior in efficacy.[48]
Peeva *et al.*, 2022	Oral	Ritlecitinib, Brepocitinib	Maintenance study	None	100+	Withdrawal led to relapse; re-treatment was effective.[47]
Piliang *et al.*, 2025	Oral	Ritlecitinib	ALLEGRO phase 2b/3	Placebo	276	Hair regrowth sustained through 48 weeks in responders.[46]
Sinclair *et al.*, 2024	Oral	Ritlecitinib	ALLEGRO-2b/3	Placebo	718	High satisfaction among patients.[53]
Sinclair *et al.*, 2025	Oral	Ritlecitinib	ALLEGRO-2b/3	Placebo	718	Improved patient-reported hair growth impact.[54]
Taylor *et al.*, 2023	Oral	Baricitinib	Safety analysis	None	14,744+	Low incidence of major adverse events.[50]
Winnette *et al.*, 2022	Oral	Ritlecitinib, Brepocitinib	Phase 2a RCT	Placebo	142	Moderate correlation between clinician assessments and patient-reported outcomes.[55]
Zhou *et al.*, 2023	Oral	Ivarmacitinib	Phase 2 RCT	Placebo	94	Significant reduction in SALT score at week 24.[61]

PRP, and topical steroids. Comparative analyses showed that corticosteroids achieve substantial hair regrowth with manageable adverse effects, particularly at lower concentrations. Novel methods, such as microneedling or QR678 combinations, offered comparable results with added patient comfort or improved outcomes.[36] The most robust clinical trials identified in the table include Akram *et al*., demonstrating the superior efficacy of intralesional corticosteroids (83.05%) versus cryotherapy (50.85%) in a rigorous study of 118 patients.[62] Devi *et al*., using 226 participants, confirmed that intralesional triamcinolone (74.3%) significantly outperformed topical steroids (46.9%).[63] Rajan *et al*., (2021) determined the optimal triamcinolone dose (2.5 mg/ml) in a substantial randomized trial (105 patients).[20] Hamdino *et al*., highlighted the comparable effectiveness of triamcinolone and methotrexate over an extended follow-up.[64] Qiao *et al*., found that microneedle-delivered betamethasone-matched traditional intralesional injection efficacy, significantly reducing patient discomfort in 80 patients.[65]

Alternative and natural products

Table 3 summarizes the clinical trials exploring alternative and natural products for AA treatment, including topical and oral formulations. Sharquie *et al*., demonstrated that the effectiveness of squill extract was comparable to that of topical clobetasol, suggesting that it is a promising natural alternative. Bassino *et al*., reported significant hair regrowth benefits from oral supplements containing piperine, capsaicin, and curcumin. Sharquie *et al*., reported improved outcomes with antioxidant-rich, plant-based topical lotions. Tirant *et al*., found notable clinical improvement using Dr. Michaels® herbal treatments, whereas Rossi *et al*., identified hair density enhancement through amino acids, iron, selenium, and marine collagen supplements. Sharquie (2022) and

Table 2: Clinical Trials Evaluating Intralesional Corticosteroids for the Treatment of *Alopecia areata* (2015-2025).

Study	Formulation/ Route of Administration	Name of Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Akram *et al*., 2025	Intralesional Injection	Triamcinolone acetate	Randomized Controlled Trial	Cryotherapy	118	Intralesional steroids showed significantly superior efficacy (83.05%) compared to cryotherapy (50.85%).[62]
Chu *et al*., 2015	Intralesional Injection	Triamcinolone acetonide (various concentrations)	Pilot Study	Within-subject comparison	Not specified	Triamcinolone acetonide demonstrated clear efficacy with concentration-dependent results, highlighting early hair regrowth.[66]
de Sousa *et al*., 2022	Intralesional Injection	Triamcinolone acetonide vs. Betamethasone	Randomized Controlled Trial	Saline placebo	12	Triamcinolone acetonide provided earlier and better visual regrowth compared to lower-dose betamethasone, with similar efficacy at higher doses after 12 weeks.[67]
Devi *et al*., 2015	Intralesional Injection	Triamcinolone acetonide	Randomized Trial	Topical Betamethasone valerate	226	Intralesional triamcinolone acetonide (74.3% efficacy) was significantly more effective than topical betamethasone (46.9% efficacy).[63]
Hamdino *et al*., 2022	Intralesional Injection	Triamcinolone acetonide vs. Methotrexate	Randomized Controlled Trial	Within-study comparison	40	Triamcinolone acetonide initially showed higher regrowth efficacy, although methotrexate demonstrated comparable results over longer follow-up.[64]

Study	Formulation/ Route of Administration	Name of Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Khan *et al.*, 2022	Intralesional Injection	Triamcinolone acetonide vs. PRP	Randomized Controlled Trial	PRP injection	60	Triamcinolone acetonide had significantly greater efficacy compared to PRP injections.[68]
Omar *et al.*, 2022	Topical after fractional CO2 Laser vs. Microneedling	Triamcinolone acetonide	Comparative Randomized Study	Microneedling	30	Fractional CO2 laser-assisted triamcinolone showed similar efficacy to microneedling, with higher initial regrowth rates noted in the laser group.[13]
Qiao *et al.*, 2025	Microneedle Transdermal Delivery vs. Intralesional Injection	Betamethasone	Randomized Controlled Trial	Traditional Intralesional injection	80	Microneedle transdermal delivery of betamethasone showed comparable efficacy to traditional intralesional injection but significantly lower pain scores.[65]
Rajan *et al.*, 2021	Intralesional Injection (varied concentrations)	Triamcinolone acetonide	Double-Blind Randomized Controlled Trial	Saline placebo	105 patients (168 patches)	Triamcinolone acetonide at 2.5 mg/ml demonstrated optimal balance between efficacy and minimized adverse effects compared to higher concentrations.[20]
Shome *et al.*, 2022	Intralesional Injection	Corticosteroid alone vs. Corticosteroid + QR678 Neo®	Randomized Controlled Trial	Placebo with corticosteroid	20	Combination of intralesional corticosteroids and QR678 Neo® significantly improved regrowth outcomes compared to corticosteroid alone.[36]
Ustuner *et al.*, 2017	Intralesional Injection (varied dilutions)	Triamcinolone acetonide vs. Betamethasone dipropionate	Randomized Controlled Trial	Saline placebo	83 patients (231 patches)	Similar efficacy between triamcinolone and betamethasone with fewer adverse effects observed with betamethasone dipropionate.[69]
Yoshimasu *et al.*, 2016	Pulse Systemic Therapy	Methylprednisolone	Clinical Trial	Not specified	Not specified	Multiple courses of pulse methylprednisolone therapy effective, particularly beneficial in patients with <50% hair loss; limited adverse reactions observed.[70]

Table 3: Clinical Trials Evaluating Alternative and Natural Products for *Alopecia areata* Treatment (2020-2022).

Study	Formulation/ Route of Administration	Name of Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Moosavi *et al.*, 2020	Topical Application	Squill extract vs. Clobetasol propionate lotion	Randomized, Double-Blind Clinical Trial	Topical Clobetasol propionate	Not specified	Squill extract exhibited therapeutic potential with comparable efficacy to topical clobetasol, showing promise as a natural alternative for *Alopecia areata* treatment.[11]
Mao *et al.*, 2022	Oral Supplementation	Mixed preparation (Piperine, Capsaicin, Curcumin)	Randomized Controlled Trial	Placebo	Not specified	Oral supplementation with piperine, capsaicin, and curcumin showed positive effects in hair regrowth, suggesting effectiveness as an adjunctive or alternative treatment for *Alopecia areata*.[71]
Anzai *et al.*, 2020	Topical Application	Plant-based lotion containing antioxidants and anti-inflammatory agents	Randomized Controlled Trial	Placebo lotion	Not specified	The plant-based topical formulation significantly reduced hair loss and improved hair regrowth, demonstrating beneficial effects due to antioxidant and anti-inflammatory properties.[32]
Wollina *et al.*, 2016	Topical Application	Dr. Michaels® (Alopinex) herbal product family	Clinical Trial	Not specified	Not specified	Herbal products from the Dr. Michaels® range achieved notable clinical improvement in patients with *Alopecia areata*, indicating substantial therapeutic potential as natural treatments Wollina.
Rossi *et al.*, 2021	Oral Supplementation	Amino acids, Iron, Selenium, Marine collagen supplement	Randomized Controlled, Assessor-Blinded Study	Placebo	Not specified	Oral supplementation resulted in improved hair density and decreased hair shedding, indicating efficacy for conditions such as *Alopecia areata*.[33]

Bassino (2021) represent the most robust studies, owing to their rigorous randomized controlled designs.[10,11,32,33,71,72]

Laser and light therapies

Laser and light therapies for AA evaluated include fractional CO_2 lasers, erbium-glass lasers, UVA phototherapy, excimer lasers, and combined approaches with topical agents such as minoxidil or corticosteroids (Table 4). Fractional CO_2 laser combined with minoxidil significantly improved hair regrowth compared with minoxidil alone, showing excellent efficacy and minimal side effects. [73] Excimer laser therapy, particularly when combined with topical steroids, has also demonstrated substantial hair regrowth and reduced disease activity.[74] The effectiveness of UVA phototherapy regimens was comparable to that of standard corticosteroids, highlighting their utility in extensive cases. The largest and most robust studies involved fractional CO_2 laser plus minoxidil, and excimer laser combined with topical corticosteroids.[73,74]

Biological and Immunotherapy Modalities

Biological and immunotherapy modalities evaluated for AA include topical immunotherapy (diphenylcyclopropenone [DPCP]), anthralin, IL-17A antagonist (secukinumab), IL-4Rα inhibitor (dupilumab), low-dose IL-2, abatacept, tildrakizumab, and oral corticosteroids (dexamethasone oral mini-pulse) (Table 5). DPCP showed superior effectiveness in multi-concentration patch testing, offering faster and more significant hair regrowth. The combination of DPCP with anthralin did not enhance the results of DPCP alone. Dupilumab resulted in modest hair regrowth, particularly in patients with elevated baseline IgE levels. Secukinumab and tildrakizumab yielded minimal clinical response. Dexamethasone oral mini-pulse significantly outperformed DPCP in patients with severe

pediatric AA. The most robust clinical trials,[82-84] on biological and immunotherapy modalities identified multi-concentration Diphenylcyclopropenone (DPCP) as superior, demonstrating faster onset and greater effectiveness than standard DPCP therapy. Additionally, dupilumab (anti-IL-4Rα) showed modest efficacy, particularly in patients with elevated baseline IgE levels, supporting the role of the Th2 pathway in AA. Dexamethasone oral mini-pulse therapy significantly outperformed DPCP, providing quicker and more substantial hair regrowth in pediatric patients with severe AA, highlighting its potential as an effective and practical therapeutic option.

Topical corticosteroids

Key clinical trials of topical corticosteroids for AA are presented in Table 6. Among the most robust trials, Akram *et al.*, (2025) demonstrated the superior efficacy of intralesional triamcinolone acetate over cryotherapy, with an 83.05% improvement rate (p=0.0001). Bhat *et al.*, (2021) showed that betamethasone dipropionate had a significantly higher response rate (56%) than latanoprost (24%).[91] Qiao *et al.*, (2025) compared microneedle transdermal delivery of betamethasone with traditional injections and found comparable efficacy, but significantly reduced pain (p=0.0047).[65] Ustuner *et al.*, (2017) identified optimal betamethasone dipropionate dilution with fewer side effects, enhancing treatment precision.[69]

Calcineurin Inhibitors, Methotrexate (Immunosuppressants), PDE4 Inhibitors, Prostaglandin Analogues, and Vitamin D Analogues

Table 7 presents various treatment modalities for AA, including Calcineurin Inhibitors, Methotrexate (Immunosuppressants), PDE4 Inhibitors, Prostaglandin Analogues, and Vitamin D Analogues. Among the most robust trials, Joly *et al.*, demonstrated that methotrexate combined with low-dose prednisone led to complete hair regrowth in up to 31% of cases.[26] Ghassemi *et al.*, found that betamethasone-latanoprost provided the highest

Table 4: Laser and Light Therapies Clinical Trials.

Study	Formulation/ Route of Administration	Name of Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Abd ElKawy *et al.*, 2022	Fractional CO_2 Laser vs. Microneedling (Transepidermal)	Triamcinolone acetonide	Comparative Clinical Trial	Within-study comparison	30	Microneedling showed significantly greater improvement compared to fractional CO_2 laser, though both modalities effectively reduced SALT scores.[75]
Al-Dhalimi *et al.*, 2019	Fractional Erbium-Glass Laser	Erbium-Glass Laser with Topical Minoxidil	Randomized Controlled Trial	Topical Minoxidil alone	Not specified	Erbium-Glass Laser combined with minoxidil showed superior hair regrowth (60%) compared to minoxidil alone (16%), indicating significant synergistic efficacy.[76]
El-Mofty *et al.*, 2019	UVA Phototoxic regimen (PUVA)	Psoralen UVA	Randomized Controlled Trial	Intralesional corticosteroids	40	Phototoxic regimen demonstrated comparable effectiveness (45% success rate) to intralesional corticosteroids, supporting PUVA as an alternative, especially for extensive alopecia.[77]
Elhawary *et al.*, 2025	Fractional CO_2 Laser with Minoxidil	CO_2 Laser + Minoxidil	Comparative Clinical Trial	Topical Minoxidil alone, placebo	150	Combination therapy resulted in significant hair regrowth (80% excellent improvement), notably better than minoxidil alone (53% excellent improvement), with minimal side effects.[73]

Study	Formulation/ Route of Administration	Name of Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Herz-Ruelas *et al.*, 2017	UVA-1 Phototherapy	UVA-1 escalating doses	Clinical Trial	Within-study comparison	22	Escalating UVA-1 dosimetry showed significant regrowth at higher doses (60 J/cm^2), effectively increasing anagen phase hairs and reducing inflammation.[78]
Kianfar *et al.*, 2022	Excimer Laser (308-nm)	Excimer Laser vs. Intralesional corticosteroids	Randomized Controlled Trial	Intralesional corticosteroids	16	Excimer laser was effective and safer than intralesional steroids, although hair regrowth onset was delayed compared to corticosteroids.[28]
Meymandi *et al.*, 2024	Fractional CO_2 Laser with Bimatoprost	CO_2 Laser + Bimatoprost solution	Randomized Comparative Clinical Trial	Topical Bimatoprost alone	20	Fractional laser-assisted bimatoprost significantly outperformed topical bimatoprost alone, substantially improving SALT scores and patient satisfaction.[79]
Omar *et al.*, 2022	Fractional CO_2 Laser vs. Microneedling (Transepidermal)	Triamcinolone acetonide	Comparative Randomized Study	Microneedling	30	Fractional CO_2 laser had higher initial terminal hair regrowth compared to microneedling, though overall differences were not statistically significant.[13]
Ragab *et al.*, 2020	Fractional CO_2 Laser vs. Microneedling vs. Intradermal PRP	Platelet-rich plasma (PRP)	Randomized Controlled Trial	Within-study comparison	60	Fractional CO_2 laser and microneedling demonstrated effective, less painful transepidermal PRP delivery, achieving comparable results to intradermal PRP injections.[80]
Tawfik *et al.*, 2025	308-nm Excimer Light + Betamethasone valerate	Excimer Light + Topical Steroids	Randomized Controlled Trial	Excimer light alone, steroids alone	30	Combination therapy of excimer light and topical steroids provided significantly better hair regrowth (60% improvement), reducing disease activity signs more effectively.[74]
Yalici-Armagan and Elcin, 2016	Fractional CO_2 Laser, Nd:YAG Laser	Fractional CO_2, Nd:YAG Laser	Controlled Clinical Trial	Within-study comparison	32	Neither fractional CO_2 nor Nd:YAG lasers significantly improved hair regrowth compared to the control, though spontaneous remission occurred in 22% of participants.[81]

regrowth among prostaglandin analogues.[5] Rashad *et al.*, highlighted significant regrowth using intralesional vitamin D3, and El Taieb *et al.*, confirmed enhanced efficacy of calcipotriol combined with narrowband UVB phototherapy.[93,94]

Cryotherapy and procedural/combination therapies

Trials on cryotherapy and procedural/combination therapies have explored diverse approaches to treat AA (Table 8). Cryotherapy trials have assessed different freezing times,[1] compared cryotherapy with microneedling,[22] and evaluated its effectiveness against intralesional corticosteroids, which proved superior.[62] Procedural therapies include carboxytherapy, which improves hair regrowth,[3] stem cell educator therapy, which enhances the immune response and hair regrowth,[99] behavioral health integration, improving quality of life,[35] and combination therapy of carboxytherapy and intralesional corticosteroids, which was the most effective.[34] The most robust trials include Akram *et al.*, for their large sample size and strong statistical significance, Li *et al.*, for their novel stem cell approach, and Metwally *et al.*, to show the superiority of combination therapy over individual treatments.[34,62,99]

Platelet-Rich Plasma (PRP)

Table 9 presents an overview of clinical trials investigating Platelet-Rich Plasma (PRP) therapy for AA. Various formulations and administration routes were analyzed, including intralesional injections, topical applications, and PRP-like biomimetic peptides. Several studies have compared PRP to standard

Table 5: Biological and immunotherapy modalities.

Study	Formulation/ Route of Administration	Name of Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Al Bazzal *et al.*, 2021	Topical Immunotherapy	DPCP Multi-concentration	Randomized Controlled Trial	Standard DPCP	30	Multi-concentration DPCP demonstrated higher effectiveness and faster hair regrowth compared to standard DPCP.[83]
Ghandi *et al.*, 2021	Topical Immunotherapy	DPCP + Anthralin	Randomized Controlled Trial	DPCP alone	50	Combination of DPCP with anthralin showed no additional benefit compared to DPCP alone.[85]
Guttman-Yassky *et al.*, 2018	Subcutaneous Injection	Secukinumab (IL-17A antagonist)	Randomized Controlled Pilot Trial	Placebo	11	Secukinumab failed to show meaningful hair regrowth, suggesting limited involvement of IL-17 pathway.[86]
Guttman-Yassky *et al.*, 2022	Subcutaneous Injection	Dupilumab (anti-IL-4Rα)	Phase 2a Randomized Clinical Trial	Placebo	60	Dupilumab demonstrated modest effectiveness, notably higher in patients with elevated baseline IgE.[82]
Kerkemeyer and Sinclair, 2020	Subcutaneous Injection	Tildrakizumab	Open-label Pilot Study	None	Not specified	Minimal clinical response, limited efficacy reported.[29]
Law *et al.*, 2025	Various	JAK inhibitor (Analysis of PROs)	Post hoc Analysis of Randomized Trial	Placebo comparison	650	Clinically meaningful hair regrowth significantly improved patient-reported outcomes (PROs), including psychosocial health.[87]
Le Duff *et al.*, 2021	Subcutaneous Injection	Low-Dose IL-2	Randomized Controlled Trial	Placebo	Not specified	Evaluated regulatory T-cell modulation; limited clinical data provided.
Mackay-Wiggan *et al.*, 2021	Subcutaneous Injection	Abatacept	Open-label Study	None	Not specified	Abatacept showed limited efficacy; modest results in hair regrowth reported.[88]
Mahajan *et al.*, 2022	Oral Administration	Dexamethasone Oral Mini-Pulse	Randomized Controlled Trial	DPCP sensitization	30	Dexamethasone oral mini-pulse significantly outperformed DPCP, providing faster and more substantial hair regrowth in pediatric alopecia.[84]

Study	Formulation/ Route of Administration	Name of Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Özdemir and Balevi, 2017	Topical Application	Anthralin 1%	Bilateral Controlled Trial	Untreated control	30	Anthralin demonstrated effective regrowth over 9-12 months in children with chronic *Alopecia areata*.[23]
Rocha *et al*., 2021	Topical Application	DPCP vs. Anthralin	Randomized Controlled Trial	Within-study comparison	Not specified	Compared efficacy of DPCP and anthralin; both effective, no significant superiority of one treatment over the other.[89]
Thuangtong *et al*., 2017	Topical Immunotherapy	Patch Test Guided DPCP	Randomized Controlled Trial	Conventional DPCP	20	Patch test-guided DPCP reduced treatment duration without compromising efficacy, showing comparable results with standard DPCP.[90]

Table 6: Topical Corticosteroids Clinical Trials.

Study	Formulation/ Route of Administration	Name of the Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Akram *et al*., 2025	Intralesional	Triamcinolone acetate	Randomized controlled	Cryotherapy	118	Superior efficacy compared to cryotherapy (83.05% vs. 50.85% improvement; p=0.0001).[62]
Bhat *et al*., 2021	Topical lotion	Betamethasone dipropionate 0.05%	Randomized controlled	Latanoprost 0.005% ophthalmic solution	50	Higher efficacy compared to latanoprost; complete response 56% vs. 24%; significant faster hair regrowth.[91]
de Sousa *et al*., 2022	Intralesional	Betamethasone 1.75 mg/ml and Triamcinolone acetonide 2.5 mg/ml	Within-patient randomized controlled	Saline placebo	12	Comparable efficacy; betamethasone similar to triamcinolone at 12 weeks, both significantly superior to placebo.[67]
El-Ashmawy *et al*., 2018	Topical solution	Betamethasone valerate 0.1%	Randomized controlled	Vehicle lotion	100	Statistically significant improvement in hair regrowth compared to vehicle control, efficacy further enhanced when combined with latanoprost.[92]
Qiao *et al*., 2025	Microneedle transdermal vs. intralesional	Compound betamethasone	Randomized controlled	Traditional intralesional injection	80	Comparable efficacy with intralesional injection; microneedle group significantly lower pain (p=0.0047).[65]
Ustuner *et al*., 2017	Intralesional	Betamethasone dipropionate (BD) and Triamcinolone acetonide (TA)	Randomized controlled	Saline placebo	83	Similar efficacy between BD and TA, fewer side effects in BD group; optimal BD dilution identified as 1.25 mg/dL.[69]
Yoshimasu *et al*., 2016	Systemic pulse therapy	Methylprednisolone	Observational study	None	N/A	Effective, particularly in cases with <50% hair loss, high response rate (100%), limited adverse reactions.[70]

treatments such as minoxidil and triamcinolone, revealing mixed efficacy. While some trials,[4,100] demonstrated significant hair regrowth and an excellent safety profile, others[6,68] suggest that PRP is less effective than corticosteroids. Additionally, Ragab *et al*., highlighted the potential of PRP combined with CO2 laser or microneedling, offering reduced pain and enhanced delivery.[80] Rinaldi *et al*., introduced a PRP-like topical biomimetic peptide formulation that showed significant hair growth improvement, suggesting an alternative to traditional PRP injections.[101] Overall, PRP appears to be a promising but variable treatment, with its efficacy influenced by the administration method, combination therapies, and patient-specific factors.

The most robust PRP trials were those with larger sample sizes, rigorous randomized controlled designs, and statistically significant results. Ghafoor *et al.*, is the largest study with 376 participants, directly comparing PRP to minoxidil 5%, but found no significant difference between the two treatments.[14] El Taieb *et al.*, (90 participants) demonstrated a faster response and greater regrowth with PRP than minoxidil.[4] El-Dawla *et al.*, while smaller (30 participants), showed a significant increase in hair density and thickness with an excellent safety profile.[100] Ragab *et al.*, compared PRP administration methods and demonstrated that CO_2 laser/microneedling delivery reduced pain while maintaining efficacy.[80] These studies provide strong evidence for PRP's potential role of PRP in AA treatment, although the results vary in terms of comparative efficacy against standard treatments such as corticosteroids and minoxidil.

Minoxidil and Miscellaneous/Novel Therapies

Table 10 summarizes studies investigating the efficacy of Minoxidil and Miscellaneous/Novel Therapies for treating AA. The Minoxidil section includes studies comparing its efficacy with Platelet-Rich Plasma (PRP) and other treatments. El Taieb *et al.*, and Ghafoor *et al.*, found no significant difference in efficacy between minoxidil and PRP, whereas Abdallah *et al.*, reported that minoxidil monotherapy had limited effectiveness but accelerated recovery.[4,14,21] The Miscellaneous/Novel Therapies section covers a diverse range of treatments, including the Dr. Michaels® herbal product family,[103] which showed promising hair regrowth in an observational study. El-Taweel and Akl demonstrated that combining Pentoxifylline with Triamcinolone is the most effective therapy.[104] Carvalho *et al.*, explored a vibratory anesthetic device that significantly reduced pain during scalp injections.[105] Gorbatenko-Roth *et al.*, found that behavioral health integration improved the quality of life for patients with AA Mahgoub *et al.*, conducted two studies on Trichloroacetic Acid (TCA) 35%, comparing it to phenol 88% and Intralesional Corticosteroids, showing that TCA 35% was safer but had a slower response. Finding comparable efficacy but recommend further studies.[106] Finally, Shome *et al.*, (2022) reported that QR678 Neo® combined with triamcinolone led to significantly improved hair regrowth compared with triamcinolone alone.[36]

DISCUSSION

The treatment landscape for *Alopecia areata* (AA) reveals remarkable variability in modalities, routes of administration, and dosage forms, each of which offers distinct therapeutic outcomes. Among the most prominent treatment classes are Janus Kinase (JAK) inhibitors, intralesional corticosteroids, minoxidil, biological therapies, laser/light procedures, Platelet-Rich Plasma

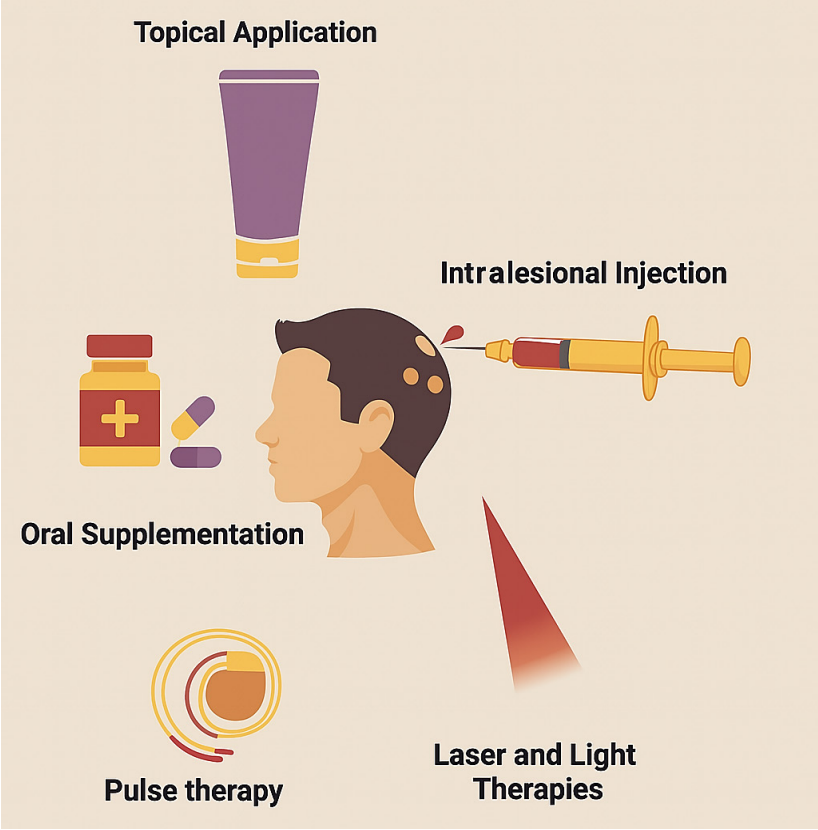

Figure 2: Schematic representation of treatment modalities for *Alopecia areata*, including topical applications, intralesional injections, oral supplementation, pulse therapy, and laser/light therapies. Created by the authors.

Table 7: Overview of Calcineurin Inhibitors, Methotrexate, PDE4 Inhibitors, Prostaglandin Analogues, and Vitamin D Analogues for *Alopecia areata* Treatment.

Study	Formulation/ Route of Administration	Name of the Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Calcineurin Inhibitors						
Lai *et al.*, 2019	Oral	Cyclosporine	Randomized controlled	Placebo	32	Cyclosporine showed trends toward improvement in hair regrowth and eyelash/brow scores but did not reach statistical significance.[27]
Lai *et al.*, 2021	Oral	Cyclosporine	Randomized controlled	Placebo	32	Showed trends of improvement in quality of life (QoL) measures related to *Alopecia areata*.[95]
Nassar *et al.*, 2023	Topical ointment	Tacrolimus 0.03%, Calcipotriol 0.005% + Betamethasone dipropionate	Randomized controlled	Clobetasol 0.05%	60	Combined vitamin D analogues with potent steroid showed comparable efficacy to superpotent steroids with fewer side effects.[96]
Methotrexate (Immunosuppressant)						
Hamdino *et al.*, 2022	Intralesional	Methotrexate vs. Triamcinolone Acetonide	Randomized controlled	Triamcinolone	40	Initially, triamcinolone had better regrowth, but after three months, methotrexate was comparable in efficacy.[64]
Toma *et al.*, 2022	Topical gel	Methotrexate 1% gel vs. Minoxidil 5% gel	Randomized controlled	Minoxidil 5% gel	50	Minoxidil showed higher improvement at six weeks, but both treatments had similar efficacy at 12 weeks.[97]
Joly *et al.*, 2023	Oral	Methotrexate + Low-Dose Prednisone	Randomized controlled	Methotrexate alone	89	Methotrexate alone allowed partial regrowth, but combination with prednisone enabled complete hair regrowth in up to 31% of cases.[26]
PDE4 Inhibitor						
Mikhaylov *et al.*, 2019	Oral	Apremilast	Randomized controlled	Placebo	30	No significant difference in hair regrowth vs. placebo, low response rate.[31]
Awasthi *et al.*, 2024	Oral + Intralesional	Apremilast + Intralesional corticosteroids	Randomized controlled	Apremilast alone, corticosteroids alone	60	Intralesional corticosteroids were superior to apremilast; combination therapy showed no additional benefit.[30]
Prostaglandin Analogues						
El-Ashmawy *et al.*, 2018	Topical solution	Latanoprost 0.1%, Minoxidil 5%, Betamethasone valerate 0.1%	Randomized controlled	Vehicle lotion	100	Statistically significant improvement in all treatment groups; latanoprost enhanced efficacy when combined with betamethasone.[92]
Ghassemi *et al.*, 2022	Topical solutions	Latanoprost, Minoxidil, Betamethasone	Randomized controlled	Betamethasone alone	108	Highest regrowth observed in betamethasone-latanoprost combination; latanoprost was superior to minoxidil.[5]
Rafati *et al.*, 2022	Topical solution	Latanoprost 0.005%	Randomized controlled	Placebo	30	Increased hair density and regrowth (p=0.02), acceptable safety profile.[25]
Vitamin D Analogues						
Çerman *et al.*, 2015	Topical cream	Calcipotriol	Retrospective study	None	48	Significant reduction in SALT score, 69.2% total response, 75% achieved ≥50% hair regrowth.[24]
El Taieb *et al.*, 2019	Topical cream and phototherapy	Calcipotriol vs. Narrowband UVB	Randomized controlled	Placebo	60	Significant improvement in SALT score and Vitamin D levels, combined therapy showed better response.[93]

Study	Formulation/ Route of Administration	Name of the Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Rashad *et al*., 2022	Intralesional injection	Vitamin D3	Randomized controlled	Saline placebo	60	Significant regrowth, improved dermoscopic findings, no major side effects.[94]
Ali *et al*., 2023	Topical + Microneedling	Vitamin D3 + Bimatoprost	Randomized controlled	Microneedling alone	75	Higher regrowth with Vitamin D3 and bimatoprost compared to microneedling alone, no difference at three-month follow-up.[98]
Nassar *et al*., 2023	Topical ointment	Tacrolimus 0.03%, Calcipotriol 0.005% + Betamethasone dipropionate	Randomized controlled	Clobetasol 0.05%	60	Comparable efficacy of calcipotriol + betamethasone to clobetasol, fewer side effects.[96]

(PRP), and a range of alternative and novel interventions. These approaches reflect the complex autoimmune pathogenesis of AA, and the need for personalized multimodal treatment strategies.

JAK inhibitors have emerged as the most transformative option, particularly for patients with severe or refractory AA. Oral formulations, such as tofacitinib, ruxolitinib, baricitinib, ritlecitinib, and deuruxolitinib, have demonstrated robust efficacy in clinical trials, often outperforming traditional immunosuppressants and topical therapies. [2] The BRAVE-AA1 and AA2 trials reported that nearly 39% of patients receiving four mg baricitinib achieved significant regrowth at week 36.[16,59] Similarly, ritlecitinib showed sustained efficacy at week 48 and beyond in the ALLEGRO studies.[15,44,46,53-55,60,87,109] However, these agents require continuous administration because treatment withdrawal frequently results in relapse. Topical formulations of JAK inhibitors, including ruxolitinib cream[52] and delgocitinib,[42] have shown limited penetration and inconsistent outcomes, suggesting that oral delivery remains superior. Given the growing use of systemic immunomodulators like JAK inhibitors, there is a critical need for long-term safety monitoring. Current evidence lacks robust data on rare but serious adverse events and sustained safety in pediatric populations, highlighting an important gap that future longitudinal studies must address.

Although JAK inhibitors, particularly baricitinib[16,43,58,59] and ritlecitinib,[15,45,57] show promising efficacy, their high cost and limited accessibility may restrict use in low-resource settings, underscoring the need for cost-effectiveness analyses and equitable treatment frameworks. Moreover, while some studies briefly addressed behavioral health interventions, the psychosocial impact of *Alopecia areata* remains underexplored. Future clinical trials should incorporate validated quality-of-life instruments such as the Dermatology Life Quality Index (DLQI) to comprehensively assess patient-reported outcomes. Additionally, although most included studies declared no conflicts of interest, the potential influence of industry sponsorship, especially for novel agents, warrants careful interpretation.[110] Transparent disclosure and independent funding are essential to mitigate bias and maintain trust in clinical research.

Intralesional corticosteroids, particularly triamcinolone acetonide, remain the gold standard treatment for localized AA.[20,63] Numerous trials have confirmed their high efficacy and manageable side effects when used at optimal concentrations. Studies have also demonstrated that combining triamcinolone with newer agents or delivery techniques, such as microneedling or peptide-based solutions, such as QR678 Neo®, can enhance outcomes and reduce injection-related discomfort.[13,36] The consistency of results across trials further solidifies the role of corticosteroids in the first-line management of patchy AA.

Minoxidil, primarily used as a topical agent, has demonstrated variable efficacy. While it showed benefits in mild AA, its effectiveness increased significantly when combined with procedural therapies such as fractional CO_2 laser or PRP. Nevertheless, when used as monotherapy, especially for severe AA, its impact appears modest. Novel formulations, such as intradermal and sublingual delivery, have been explored to improve drug bioavailability and efficacy.[4,14,21]

Biological and immunotherapeutic agents, including dupilumab, secukinumab, abatacept, and DPCP, represent innovative frontiers in AA treatment. DPCP has shown promising outcomes, particularly in patients with extensive AA, while dupilumab demonstrated mild-to-moderate regrowth, especially in individuals with elevated baseline IgE, supporting a role for Th2-mediated inflammation in AA pathophysiology. However, responses to agents targeting IL-17A and IL-23 have been inconsistent, warranting further investigation.[83-85,90]

Alternative and natural products, such as squill extract, piperine, curcumin, and herbal preparations (e.g., Dr. Michaels®), have demonstrated beneficial effects in small-to moderate-sized trials. Although their mechanisms are less well defined, many appear to exert antioxidant or anti-inflammatory effects. These options may serve as adjuncts or alternatives for patients seeking nonpharmaceutical treatments.[32,103]

PRP therapy has also been widely studied, with outcomes varying depending on the administration technique, frequency, and whether PRP is used alone or in combination. Studies involving

Table 8: Cryotherapy and procedural/combination therapies.

Study	Therapy Type	Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Cryotherapy						
Abdel Motaleb and Sayed, 2020	Cryotherapy	Superficial liquid nitrogen cryotherapy	Randomized Controlled Trial	None	75	Liquid nitrogen cryotherapy effective, optimal time is 8-10 sec dual freeze-thaw cycles.[1]
Aboeldahab *et al*., 2021	Cryotherapy	Superficial cryotherapy using DMEP mixture	Randomized Controlled Trial	Microneedling	80	Cryotherapy and microneedling effective, microneedling showed higher efficacy.[22]
Akram *et al*., 2025	Cryotherapy	Intralesional steroid injections vs Cryotherapy	Randomized Controlled Trial	Intralesional corticosteroids	118	Intralesional steroids superior to cryotherapy for hair regrowth.[62]
Procedural/combination therapies						
Doghaim *et al*., 2018	Procedural and Combination	Carboxytherapy	Randomized Controlled Trial	Placebo	80	Carboxytherapy improved SALT score and dermoscopic parameters.[3]
Li *et al*., 2015	Procedural and Combination	Stem Cell Educator Therapy	Open-Label Phase 1/2 Study	None	9	Significant hair regrowth in severe AA, improved immune response.[99]
Gorbatenko-Roth *et al*., 2021	Procedural and Combination	Behavioral health integration	Randomized Controlled Trial	Standard dermatology care	32	Behavioral health integration improved quality of life in AA patients.[35]
Metwally *et al*., 2022	Procedural and Combination	Carboxytherapy + Intralesional Corticosteroids	Comparative Study	Intralesional corticosteroids alone	30	Combination therapy superior to carboxytherapy or intralesional corticosteroids alone.[34]

Table 9: Platelet-Rich Plasma (PRP).

Study	Therapy Type	Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
El-Dawla *et al*., 2023	Intralesional	Platelet-Rich Plasma	Randomized controlled	Normal saline placebo	30	Significant increase in hair density and thickness, excellent safety profile.[100]
El Taieb *et al*., 2017	Intralesional	Platelet-Rich Plasma vs. Minoxidil 5%	Randomized controlled	Placebo	90	PRP showed faster response and greater regrowth than minoxidil.[4]
Ghafoor *et al*., 2024	Intralesional	Platelet-Rich Plasma vs. Minoxidil 5%	Randomized controlled	Minoxidil 5%	376	No significant difference between PRP and minoxidil.[14]
Gupta *et al*., 2021	Intralesional	Platelet-Rich Plasma	Randomized controlled	Placebo	27	Limited efficacy, but modulated immune response in alopecic patches.[6]
Hegde *et al*., 2020	Intralesional	Platelet-Rich Plasma	Randomized controlled	Placebo	50	PRP showed improvement in regrowth, but steroids were superior.[102]
Khan *et al*., 2022	Intralesional	Platelet-Rich Plasma vs. Triamcinolone	Randomized controlled	Triamcinolone	60	Triamcinolone superior to PRP in complete response rate.[68]
Ragab *et al*., 2020	Intralesional vs. Topical	PRP intradermal vs. topical PRP with CO2 laser or microneedling	Randomized controlled	None	60	All methods effective, but CO2 laser/ microneedling delivery reduced pain associated with PRP injections.[80]
Rinaldi *et al*., 2019	Topical cosmetic	PRP-like biomimetic peptides	Randomized controlled	Placebo	N/A	PRP-like topical product significantly improved hair growth.[101]

Table 10: Minoxidil and Miscellaneous/Novel Therapies.

Study	Formulation/ Route of Administration	Name of the Treatment	Study Type	Control Drug/ Placebo	Sample Size	Key Findings
Minoxidil						
El Taieb *et al.*, 2017	Topical solution	Minoxidil 5% vs. PRP	Randomized controlled	Placebo	90	PRP showed faster response and greater regrowth than minoxidil.[4]
Abdallah *et al.*, 2022	Intradermal injection	Minoxidil 5%	Randomized controlled	Triamcinolone, Micro-needling	20	Minoxidil monotherapy had limited efficacy but accelerated recovery.[21]
Ghafoor *et al.*, 2024	Topical solution	Minoxidil 5% vs. PRP	Randomized controlled	PRP	376	No significant difference between PRP and minoxidil.[14]
Miscellaneous/Novel Therapies						
Wollina *et al.*, 2016	Topical and Oral	Dr. Michaels® (Alopinex) product family	Observational	None	40	Significant hair regrowth in most patients using topical oils, lotion, and oral herbal supplement.[103]
El-Taweel and Akl, 2019	Intralesional injection	Pentoxifylline vs. Triamcinolone	Randomized controlled	Triamcinolone	75	Combined Pentoxifylline and Triamcinolone was most effective.[104]
Carvalho *et al.*, 2021	Mesotherapy	Vibration anesthetic device	Randomized split-scalp	None	30	Vibration anesthesia significantly reduced pain during scalp injections.[105]
Gorbatenko-Roth *et al.*, 2021	Psychological intervention	Behavioral health integration	Randomized controlled	Standard dermatology care	32	Improved quality of life in AA patients.[35]
Mahgoub *et al.*, 2021	Topical chemical peel	Trichloroacetic acid 35% vs. Phenol 88%	Randomized controlled	None	20	TCA 35% was superior in hair regrowth and tolerability.[106]
Mahgoub *et al.*, 2021	Topical chemical peel	Trichloroacetic acid 35% vs. Intralesional steroids	Randomized controlled	Intralesional corticosteroids	22	Both treatments effective, TCA 35% was safer but had a slower response.[107]
Mogawer *et al.*, 2024	Topical	Sodium Valproate-loaded nanospanlastics vs. Topical steroids	Randomized controlled	Topical steroids	66	Both treatments comparable; further studies needed on sodium valproate.[108]
Shome *et al.*, 2022	Intralesional injection	QR678 Neo® + Triamcinolone vs. Triamcinolone alone	Randomized controlled	Triamcinolone	20	QR678 Neo® + Triamcinolone significantly improved hair regrowth.[36]

CO_2 laser-assisted delivery or microneedling often showed improved patient tolerance and better outcomes compared to standard PRP injections. However, in head-to-head comparisons with corticosteroids, PRP is generally underperformed, emphasizing its role as a supplementary rather than a primary therapy.[4,14,80]

Laser- and light-based therapies, including fractional CO_2, excimer, and UVA phototherapy, offer encouraging results, especially when used adjunctively. Fractional CO_2 laser combined with minoxidil and excimer laser paired with corticosteroids produced significant regrowth and symptom relief. These therapies represent valuable additions to multimodal treatment plans, particularly for patients who are unresponsive to monotherapy.[73-75]

The route of administration plays a critical role in determining the treatment efficacy. Oral therapies dominate moderate-to-severe cases because of their systemic immunomodulatory effects. Intralesional routes offer targeted efficacy with fewer systemic risks, making them ideal for localized presentations. Topical treatments, which are convenient and noninvasive, often suffer from poor penetration, limiting their utility in advanced AA. Emerging formulations, such as sublingual and nanocarrier-based delivery systems, show promise for enhancing drug absorption and patient adherence.

In terms of dosage forms, traditional solutions, creams, injections, and oral tablets dominate current practice. However, newer technologies, such as nanospanlastics, peptide complexes, and sublingual tablets, are being evaluated for their potential to

improve pharmacokinetics and therapeutic outcomes. Dosage optimization has been emphasized in trials, particularly for corticosteroids and JAK inhibitors, to balance efficacy with safety.

This systematic review has several limitations that may affect the confidence in its conclusions. Publication bias is possible, as only English-language, peer-reviewed studies were included, potentially excluding relevant data. Significant heterogeneity in study designs, outcome measures, treatment durations, and patient populations precluded meta-analysis, limiting comparative conclusions. Moreover, subgroup-specific outcomes based on AA severity or demographics were inconsistently reported, and safety data-especially for novel agents like JAK inhibitors-were summarized narratively without pooled analysis. A future study is planned to address safety outcomes systematically. The review also did not include grey literature or protocol registration, which may limit transparency and comprehensiveness. To enhance reliability, future reviews should apply quality appraisal tools, include broader literature searches, register protocols, and consider living systematic review models to remain current.

CONCLUSION

The treatment landscape of *Alopecia areata* (AA) continues to evolve with the emergence of novel immunomodulators and precision-based strategies. Oral JAK inhibitors such as baricitinib, ritlecitinib, and deuruxolitinib have demonstrated 30-40% response rates in moderate-to-severe cases but typically require sustained use. Intralesional corticosteroids remain the first-line option for localized disease due to their favorable efficacy-safety profile. Adjunctive therapies-including PRP, laser interventions, and select natural products-may benefit select patients, though robust evidence is still needed. Personalized, multimodal treatment strategies that consider disease severity, tolerability, and patient preferences are essential. Future research should focus on head-to-head trials, long-term safety, standardized outcome measures, and the integration of quality-of-life endpoints to optimize care.

ABBREVIATIONS

AA: *Alopecia areata*; **AT:** Alopecia Totalis; **AU:** Alopecia Universalis; **CO2:** Carbon Dioxide; DMEP: Dimethyl Ether and Propane; **DPCP:** Diphenylcyclopropenone; **IL:** Interleukin; **JAK:** Janus Kinase; **MeSH:** Medical Subject Headings; **ND:YAG:** Neodymium-doped Yttrium Aluminum Garnet; **PDE4:** Phosphodiesterase-4; **PRISMA:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses; **PROs:** Patient-Reported Outcomes; PRP: Platelet-Rich Plasma; **PUVA:** Psoralen plus Ultraviolet A; **QoL:** Quality of Life; **RCT:** Randomized Controlled Trial; **SALT:** Severity of Alopecia Tool; **SLE:** Systemic Lupus Erythematosus; **TCA:** Trichloroacetic Acid; **UVA:** Ultraviolet A.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

SUMMARY

This systematic review synthesizes clinical trial evidence from 2015 to 2025 on pharmacotherapeutic advances for *Alopecia areata*, an autoimmune condition causing non-scarring hair loss. Analyzing 108 studies identified through PubMed, Scopus, and Web of Science using PRISMA guidelines, the review evaluates treatments including oral and topical Janus Kinase (JAK) inhibitors (e.g., baricitinib, ritlecitinib), intralesional corticosteroids, minoxidil, Platelet-Rich Plasma (PRP), biologics, laser therapies, and alternative agents. Oral JAK inhibitors demonstrated consistent efficacy for severe AA but require continuous use to prevent relapse, while intralesional corticosteroids remain effective for localized cases. PRP and laser therapies showed variable but promising results, often as adjuncts. The review highlights increasing therapeutic diversity, emphasizing the need for personalized treatment plans based on patient profiles and long-term studies to optimize efficacy, safety, and patient-centered outcomes.

REFERENCES

1. Abdel Motaleb AA, Sayed DS. Different freezing time of superficial liquid nitrogen cryotherapy in treatment of recalcitrant alopecia areata: randomized clinical trial. Dermatol Ther. 2020; 33(4): e13640. doi: 10.1111/dth.13640, PMID 32441386.
2. Almutairi N, Nour TM, Hussain NH. Janus kinase Inhibitors for the Treatment of Severe alopecia areata: an Open-Label Comparative Study. Dermatology. 2019; 235(2): 130-6. doi: 10.1159/000494613, PMID 30566941.
3. Doghaim NN, El-Tatawy RA, Neinaa YM, Abd El-Samd MM. Study of the efficacy of carboxytherapy in alopecia. J Cosmet Dermatol. 2018; 17(6): 1275-85. doi: 10.1111/jocd.12501, PMID 29460509.
4. El Taieb MA, Ibrahim H, Nada EA, Seif Al-Din M. Platelets rich plasma versus minoxidil 5% in treatment of alopecia areata: A trichoscopic evaluation. Dermatol Ther. 2017; 30(1). doi: 10.1111/dth.12437, PMID 27791311.
5. Ghassemi M, Yazdanian N, Behrangi E, Jafari M, Goodarzi A. Comparison of efficacy, safety and satisfaction of latanoprost versus minoxidil, betamethasone and in combination in patients with alopecia areata: A blinded multiple group randomized controlled trial. Dermatol Ther. 2022; 35(12): e15943. doi: 10.1111/dth.15943, PMID 36257912.
6. Gupta V, Parihar AS, Sharma VK, Jain S, Singh V, Khanna N. Evaluation of platelet-rich plasma on hair regrowth and lesional T-cell cytokine expression in alopecia areata: A randomized observer-blinded, placebo-controlled, split-head pilot study. J Am Acad Dermatol. 2021; 84(5): 1321-8. doi: 10.1016/j.jaad.2020.12.039, PMID 33359595.
7. King B, Guttman-Yassky E, Peeva E, Banerjee A, Sinclair R, Pavel AB, *et al.* A phase 2a randomized, placebo-controlled study to evaluate the efficacy and safety of the oral Janus kinase inhibitors ritlecitinib and brepocitinib in alopecia areata: 24-week results. J Am Acad Dermatol. 2021; 85(2): 379-87. doi: 10.1016/j.jaad.2021.03.050, PMID 33757798.
8. King B, Senna MM, Mesinkovska NA, Lynde C, Zirwas M, Maari C, *et al.* Efficacy and safety of deuruxolitinib, an oral selective Janus kinase inhibitor, in adults with alopecia areata: results from the Phase 3 randomized, controlled trial (THRIVE-AA1). J Am Acad Dermatol. 2024; 91(5): 880-8. doi: 10.1016/j.jaad.2024.06.097, PMID 39053611.
9. Kwon O, Senna MM, Sinclair R, Ito T, Dutronc Y, Lin CY, *et al.* Efficacy and Safety of Baricitinib in Patients with Severe alopecia areata over 52 weeks of Continuous Therapy in Two Phase III Trials (BRAVE-AA1 and BRAVE-AA2). Am J Clin Dermatol. May 2023; 24(3): 443-51. doi: 10.1007/s40257-023-00764-w, PMID 36855020.
10. Milani M, Colombo F, GFM-O-Trial Investigators Group: Chiara Baraldo (Padova), Mauro Barbareschi (Milano), Paolo Chieco (Ruvo di Puglia), Laura Colonna (Roma), Mandel Victor Desmond (Modena), Maria Cristina Fiorucci (Genova). Efficacy and tolerability of an oral supplement containing amino acids, iron, selenium, and marine hydrolyzed collagen in subjects with hair loss (androgenetic alopecia, AGA or FAGA or telogen effluvium). A prospective, randomized, 3-month, controlled, assessor-blinded study. Skin Res Technol. 2023; 29(6): e13381. doi: 10.1111/srt.13381, PMID 37357646.

11. Moosavi ZB, Aliabdi M, Golfakhrabadi F, Namjoyan F. The comparison of therapeutic effect of clobetasol propionate lotion and squill extract in alopecia areata: a randomized, double-blind clinical trial. Arch Dermatol Res. 2020; 312(3): 173-8. doi: 10.1007/s00403-019-02004-w, PMID 31707498.
12. Takahashi R, Kinoshita-Ise M, Yamazaki Y, Fukuyama M, Ohyama M. Increase in CD8(+) Effector Memory T cells Re-Expressing CD45RA Correlates with Intractability of Severe alopecia areata. J Invest Dermatol. 2024; 144(7): 1654-1657.e7. doi: 10.1016/j.jid.2024.01.006, PMID 38280481.
13. Omar MM, Obaid ZM, Sayedahmed OM. Comparative study between topical application of triamcinolone acetonide after fractional carbon dioxide laser versus microneedling in the treatment of resistant alopecia areata. Dermatol Ther. Dec 2022; 35(12): e15913. doi: 10.1111/dth.15913, PMID 36209381.
14. Ghafoor R, Saher N, Ali SM. The Role of 5% minoxidil versus Platelet-Rich Plasma in Treatment of alopecia areata. J Coll Physicians Surg Pak. 2024; 34(6): 650-3. doi: 10.29271/jcpsp.2024.06.650, PMID 38840345.
15. Hordinsky M, Hebert AA, Gooderham M, Kwon O, Murashkin N, Fang H, *et al.* Efficacy and safety of ritlecitinib in adolescents with alopecia areata: results from the Allegro phase 2b/3 randomized, double-blind, placebo-controlled trial. Pediatr Dermatol. 2023; 40(6): 1003-9. doi: 10.1111/pde.15378, PMID 37455588.
16. King B, Ko J, Kwon O, Vañó-Galván S, Piraccini BM, Dutronc Y, *et al.* Baricitinib Withdrawal and retreatment in Patients with Severe alopecia areata: the BRAVE-AA1 Randomized Clinical Trial. JAMA Dermatol. 2024; 160(10): 1075-81. doi: 10.1001/jamadermatol.2024.2734, PMID 39141364.
17. King B, Mesinkovska N, Mirmirani P, Bruce S, Kempers S, Guttman-Yassky E, *et al.* Phase 2 randomized, dose-ranging trial of CTP-543, a selective Janus Kinase inhibitor, in moderate-to-severe alopecia areata. J Am Acad Dermatol. 2022; 87(2): 306-13. doi: 10.1016/j.jaad.2022.03.045, PMID 35364216.
18. Lepe K, Syed HA, Zito PM. Alopecia areata. StatPearls. StatPearls Publishing LLC; 2025.
19. King B, Zhang X, Harcha WG, Szepietowski JC, Shapiro J, Lynde C, *et al.* Efficacy and safety of ritlecitinib in adults and adolescents with alopecia areata: a randomised, double-blind, multicentre, phase 2b-3 trial. Lancet. 2023; 401(10387): 1518-29. doi: 10.1016/S0140-6736(23)00222-2, PMID 37062298.
20. Rajan M B, Bhardwaj A, Singh S, Budania A, Bains A, Thirunavukkarasu P, *et al.* Identification of novel step-up regimen of intralesional triamcinolone acetonide in scalp alopecia areata based on a double-blind randomized controlled trial. Dermatol Ther. 2021; 34(1): e14555. doi: 10.1111/dth.14555, PMID 33210434.
21. Abdallah MA, Shareef R, Soltan MY. Efficacy of intradermal minoxidil 5% injections for treatment of patchy non-severe alopecia areata. J Dermatolog Treat. 2022; 33(2): 1126-9. doi: 10.1080/09546634.2020.1793893, PMID 32643454.
22. Aboeldahab S, Nada EE, Assaf HA, Gouda ZA, Abu El-Hamd M. Superficial cryotherapy using dimethyl ether and propane mixture versus microneedling in the treatment of alopecia areata: A prospective single-blinded randomized clinical trial. Dermatol Ther. 2021; 34(5): e15044. doi: 10.1111/dth.15044, PMID 34176196.
23. Özdemir M, Balevi A. Bilateral Half-Head Comparison of 1% anthralin Ointment in Children with alopecia areata. Pediatr Dermatol. 2017; 34(2): 128-32. doi: 10.1111/pde.13049, PMID 28044367.
24. Çerman AA, Solak SS, Altunay İ, Küçükünal NA. Topical calcipotriol Therapy for Mild-to-Moderate alopecia areata: A Retrospective Study. J Drugs Dermatol. 2015; 14(6): 616-20. PMID 26091388.
25. Rafati M, Mahmoudian R, Golpour M, Kazeminejad A, Saeedi M, Nekoukar Z. The effect of latanoprost 0.005% solution in the management of scalp alopecia areata, a randomized double-blind placebo-controlled trial. Dermatol Ther. 2022; 35(6): e15450. doi: 10.1111/dth.15450, PMID 35289043.
26. Joly P, Lafon A, Houivet E, Donnadieu N, Richard MA, Dupuy A, *et al.* Efficacy of methotrexate Alone vs methotrexate Plus Low-Dose prednisone in Patients with alopecia areata Totalis or universalis: A 2-Step Double-Blind Randomized Clinical Trial. JAMA Dermatol. 2023; 159(4): 403-10. doi: 10.1001/jamadermatol.2022.6687, PMID 36884234.
27. Lai VW, Chen G, Gin D, Sinclair R. Cyclosporine for moderate-to-severe alopecia areata: A double-blind, randomized, placebo-controlled clinical trial of efficacy and safety. J Am Acad Dermatol. Sep 2019; 81(3): 694-701. doi: 10.1016/j.jaad.2019.04.053, PMID 31048013.
28. Kianfar N, Dasdar S, Mahmoudi H, Abedini R, Fahim S, Hosseini SA, *et al.* Comparison of the efficacy and safety of 308-nm excimer laser with intralesional corticosteroids for the treatment of alopecia areata: A randomized controlled study. Lasers Surg Med. 2022; 54(4): 502-10. doi: 10.1002/lsm.23501, PMID 34859460.
29. Kerkemeyer KL, Sinclair R. Treatment of chronic alopecia areata with tildrakizumab: an open-label pilot study. Int J Dermatol. 2020; 59(5): e136-7. doi: 10.1111/ijd.14826, PMID 32124974.
30. Awasthi S, Nijhawan M, Mishra A, Gupta A. Comparing the efficacy of oral apremilast, intralesional corticosteroids, and their combination in patients with patchy alopecia areata: a randomized clinical controlled trial. Arch Dermatol Res. 2024; 317(1): 129. doi: 10.1007/s00403-024-03642-5, PMID 39673617.
31. Mikhaylov D, Pavel A, Yao C, Kimmel G, Nia J, Hashim P, *et al.* A randomized placebo-controlled single-center pilot study of the safety and efficacy of apremilast in subjects with moderate-to-severe alopecia areata. Arch Dermatol Res. 2019; 311(1): 29-36. doi: 10.1007/s00403-018-1876-y, PMID 30417279.
32. Anzai A, Pereira AF, Malaquias KR, Guerra LO, Mercuri M. Efficacy and safety of a new formulation kit (shampoo + lotion) containing anti-inflammatory and antioxidant agents to treat hair loss. Dermatol Ther. 2020; 33(3): e13293. doi: 10.1111/dth.13293, PMID 32134172.
33. Rossi A, Magri F, DI Fraia M, Caro G, Fortuna MC, Piacentini M, *et al.* A new combination of molecules for the treatment of androgenetic alopecia and telogen effluvium: a double-blind randomized, monocentric, placebo-controlled study. Ital J Dermatol Venerol. Feb 2022; 157(1): 78-83. doi: 10.23736/S2784-8671.21.06915-7, PMID 33878855.
34. Metwally D, Abdel-Fattah R, Hilal RF. Comparative study for treatment of alopecia areata using carboxy therapy, intralesional corticosteroids, and a combination of both. Arch Dermatol Res. 2022; 314(2): 167-82. doi: 10.1007/s00403-021-02201-6, PMID 33742252.
35. Gorbatenko-Roth K, Hodges JS, Lifson D, Golm M, Kranz D, Windenburg D, *et al.* Integrating colocated behavioral health care into a dermatology clinic: A prospective randomized controlled treatment pilot study in patients with alopecia areata. J Am Acad Dermatol. 2021; 84(5): 1487-9. doi: 10.1016/j.jaad.2020.07.070, PMID 32707246.
36. Shome D, Kapoor R, Doshi K, Patel G, Vadera S, Kumar V. Effectiveness of QR678 and QR678 Neo(®) with intralesional corticosteroid vs. intralesional corticosteroid alone in the treatment of alopecia areata -A randomized, comparative, prospective study. J Cosmet Dermatol. 2022; 21(1): 358-67. doi: 10.1111/jocd.14630, PMID 34825770.
37. Wang S, Scells H, Koopman B, Zuccon G. Automated MeSH term suggestion for effective query formulation in systematic reviews literature search. Intell Syst Appl. 2022; 16: 200141. doi: 10.1016/j.iswa.2022.200141.
38. Rudnicka L, Arenbergerova M, Grimalt R, Ioannides D, Katoulis AC, Lazaridou E, *et al.* European expert consensus statement on the systemic treatment of alopecia areata. J Eur Acad Dermatol Venereol. 2024; 38(4): 687-94. doi: 10.1111/jdv.19768, PMID 38169088.
39. Sarkis-Onofre R, Catalá-López F, Aromataris E, Lockwood C. How to properly use the PRISMA Statement. Syst Rev. 2021; 10(1): 117. doi: 10.1186/s13643-021-01671-z, PMID 33875004.
40. Jabbari A, Sansaricq F, Cerise J, Chen JC, Bitterman A, Ulerio G, *et al.* An Open-Label Pilot Study to Evaluate the Efficacy of tofacitinib in Moderate to Severe Patch-Type alopecia areata, Totalis, and universalis. J Invest Dermatol. 2018; 138(7): 1539-45. doi: 10.1016/j.jid.2018.01.032, PMID 29452121.
41. Bokhari L, Sinclair R. Treatment of alopecia universalis with topical Janus kinase inhibitors – a double blind, placebo, and active controlled pilot study. Int J Dermatol. 2018; 57(12): 1464-70. doi: 10.1111/ijd.14192, PMID 30160787.
42. Mikhaylov D, Glickman JW, Del Duca E, Nia J, Hashim P, Singer GK, *et al.* A phase 2a randomized vehicle-controlled multi-center study of the safety and efficacy of delgocitinib in subjects with moderate-to-severe alopecia areata. Arch Dermatol Res. 2023; 315(2): 181-9. doi: 10.1007/s00403-022-02336-0, PMID 35230488.
43. King B, Ohyama M, Kwon O, Zlotogorski A, Ko J, Mesinkovska NA, *et al.* Two Phase 3 Trials of Baricitinib for alopecia areata. N Engl J Med. 2022; 386(18): 1687-99. doi: 10.1056/NEJMoa2110343, PMID 35334197.
44. King B, Soung J, Tziotzios C, Rudnicka L, Joly P, Gooderham M, *et al.* Integrated Safety Analysis of Ritlecitinib, an Oral JAK3/TEC Family kinase Inhibitor, for the Treatment of alopecia areata from the ALLEGRO Clinical Trial Program. Am J Clin Dermatol. 2024; 25(2): 299-314. doi: 10.1007/s40257-024-00846-3, PMID 38263353.
45. Guttman-Yassky E, Pavel AB, Diaz A, Zhang N, Del Duca E, Estrada Y, *et al.* Ritlecitinib and brepocitinib demonstrate significant improvement in scalp alopecia areata biomarkers. J Allergy Clin Immunol. 2022; 149(4): 1318-28. doi: 10.1016/j.jaci.2021.10.036, PMID 34863853.
46. Piliang M, Lynde C, King B, Mirmirani P, Sinclair R, Senna M, *et al.* Sustained hair regrowth with continued ritlecitinib treatment through week 48 in patients with alopecia areata with or without early target responses: *post hoc* analysis of the Allegro phase 2b/3 trial. J Am Acad Dermatol. 2025; 92(2): 276-84. doi: 10.1016/j.jaad.2024.09.064, PMID 39423930.
47. Peeva E, Guttman-Yassky E, Banerjee A, Sinclair R, Cox LA, Zhu L, *et al.* Maintenance, withdrawal, and re-treatment with ritlecitinib and brepocitinib in patients with alopecia areata in a single-blind extension of a phase 2a randomized clinical trial. J Am Acad Dermatol. 2022; 87(2): 390-3. doi: 10.1016/j.jaad.2021.12.008, PMID 34915057.
48. Paracha M, Wasim M, Noor SM, Khan AQ, Sagheer F, Ahmad I. Comparison of efficacy and safety of tofacitinib and azathioprine in patients with alopecia areata and variants: a double-blind, randomized controlled trial. Arch Dermatol Res. 2024; 316(7): 458. doi: 10.1007/s00403-024-03203-w, PMID 38967866.
49. Lai VW, Bokhari L, Sinclair R. Sublingual tofacitinib for alopecia areata: a roll-over pilot clinical trial and analysis of pharmacokinetics. Int J Dermatol. 2021; 60(9): 1135-9. doi: 10.1111/ijd.15657, PMID 34008179.
50. Taylor PC, Bieber T, Alten R, Witte T, Galloway J, Deberdt W, *et al.* Baricitinib safety for events of special interest in populations at risk: analysis from randomised trial data across rheumatologic and dermatologic indications. Adv Ther. 2023; 40(4): 1867-83. doi: 10.1007/s12325-023-02445-w, PMID 36802049.
51. Morand EF, Vital EM, Petri M, Van Vollenhoven R, Wallace DJ, Mosca M, *et al.* Baricitinib for systemic lupus erythematosus: a double-blind, randomised, placebo-controlled, phase 3 trial (SLE-BRAVE-I). Lancet. 2023; 401(10381): 1001-10. doi: 10.1016/S0140-6736(22)02607-1, PMID 36848918.
52. Olsen EA, Kornacki D, Sun K, Hordinsky MK. Ruxolitinib cream for the treatment of patients with alopecia areata: A 2-part, double-blind, randomized, vehicle-controlled phase 2 study. J Am Acad Dermatol. 2020; 82(2): 412-9. doi: 10.1016/j.jaad.2019.10.016, PMID 31622643.

53. Sinclair R, Law EH, Zhang X, Zhang F, Napatalung L, Zwillich SH, *et al.* Patient-Reported Satisfaction with Hair Regrowth in a Study of Ritlecitinib in alopecia areata: results from ALLEGRO-2b/3. Dermatology. 2024; 240(5-6): 767-77. doi: 10.1159/000539536 , PMID 38934147.
54. Sinclair R, Mesinkovska N, Mitra D, Wajsbrot D, Law EH, Wolk R, *et al.* Patient-Reported Hair Loss and Its Impacts as Measured by the alopecia areata Patient Priority Outcomes Instrument in Patients Treated with Ritlecitinib: the Allegro Phase 2b/3 Randomized Clinical Trial. Am J Clin Dermatol. 2025; 26(1): 109-19. doi: 10.1007/s40257-024-00899-4, PMID 39441519.
55. Winnette R, Banerjee A, Sikirica V, Peeva E, Wyrwich K. Characterizing the relationships between patient-reported outcomes and clinician assessments of alopecia areata in a phase 2a randomized trial of ritlecitinib and brepocitinib. J Eur Acad Dermatol Venereol. 2022; 36(4): 602-9. doi: 10.1111/jdv.17909, PMID 35000236.
56. Cheng MW, Kehl A, Worswick S, Goh C. Successful Treatment of Severe alopecia areata with Oral or Topical tofacitinib. J Drugs Dermatol. 2018; 17(7): 800-3. PMID 30005104.
57. Eisman S, Sinclair R. Ritlecitinib: an investigational drug for the treatment of moderate to severe alopecia areata. Expert Opin Investig Drugs. 2021; 30(12): 1169-74. doi: 10.1080/13543784.2021.2012149, PMID 34826225.
58. King B, Ko J, Forman S, Ohyama M, Mesinkovska N, Yu G, *et al.* Efficacy and safety of the oral Janus kinase inhibitor baricitinib in the treatment of adults with alopecia areata: Phase 2 results from a randomized controlled study. J Am Acad Dermatol. 2021; 85(4): 847-53. doi: 10.1016/j.jaad.2021.05.050, PMID 34090959.
59. King B, Ohyama M, Senna M, Shapiro J, Dutronc Y, Durand F, *et al.* Outcomes of down-titration in patients with severe scalp alopecia areata initially treated with baricitinib 4-mg: Week 152 data from BRAVE-AA2. J Am Acad Dermatol. 2025; 92(2): 299-306. doi: 10.1016/j.jaad.2024.09.072, PMID 39447758.
60. Mesinkovska N, King B, Zhang X, Guttman-Yassky E, Magnolo N, Sinclair R, *et al.* Efficacy and safety of ritlecitinib, an oral JAK3/TEC family kinase inhibitor, in adolescent and adult patients with alopecia totalis and alopecia universalis. J Dermatol. 2024; 51(11): 1414-24. doi: 10.1111/1346-8138.17442, PMID 39328096.
61. Zhou C, Yang X, Yang B, Yan G, Dong X, Ding Y, *et al.* A randomized, double-blind, placebo-controlled phase II study to evaluate the efficacy and safety of ivarmacitinib (SHR0302) in adult patients with moderate-to-severe alopecia areata. J Am Acad Dermatol. 2023; 89(5): 911-9. doi: 10.1016/j.jaad.2023.02.063, PMID 37019385.
62. Akram S, J Tan I, R Shah R, Tariq Z, Javaid H, Rao B. Comparative efficacy of intralesional steroid injections vs cryotherapy for the treatment of alopecia areata. J Drugs Dermatol. 2025; 24(3): 294-7. doi: 10.36849/JDD.8499, PMID 40043263.
63. Devi M, Rashid A, Ghafoor R. Intralesional triamcinolone acetonide versus Topical betamethasone Valearate in the Management of Localized alopecia areata. J Coll Physicians Surg Pak. 2015; 25(12): 860-2. PMID 26691357.
64. Hamdino M, El-Barbary RA, Darwish HM. Intralesional methotrexate versus triamcinolone acetonide for localized alopecia areata treatment: A randomized clinical trial. J Cosmet Dermatol. 2022; 21(2): 707-15. doi: 10.1111/jocd.14090, PMID 33749975.
65. Qiao R, Zhu J, Fang J, Shi H, Zhang Z, Nie J, *et al.* Microneedle transdermal delivery of compound betamethasone in alopecia areata-A randomized controlled trial. J Am Acad Dermatol. 2025; 92(2): 269-75. doi: 10.1016/j.jaad.2024.09.059, PMID 39393548.
66. Chu TW, AlJasser M, Alharbi A, Abahussein O, McElwee K, Shapiro J. Benefit of different concentrations of intralesional triamcinolone acetonide in alopecia areata: an intrasubject pilot study. J Am Acad Dermatol. 2015; 73(2): 338-40. doi: 10.1016/j.jaad.2015.04.049, PMID 26183987.
67. de Sousa VB, Arcanjo FP, Aguiar F, Vasconcelos J, Oliveira AF, Honório A, *et al.* Intralesional betamethasone versus triamcinolone acetonide in the treatment of localized alopecia areata: a within-patient randomized controlled trial. J Dermatolog Treat. 2022; 33(2): 875-7. doi: 10.1080/09546634.2020.1788703, PMID 32594786.
68. Khan FA, Hussain M, Khan BM, Afsar S, Shafique M, Haq SU, *et al.* Comparative Study between intralesional Injection of Platelet Rich Plasma and intra lesional triamcinolone for the Treatment of alopecia areata. J Ayub Med Coll Abbottabad. 2022; 34(4): 762-5. doi: 10.55519/JAMC-04-10933, PMID 36566395.
69. Ustuner P, Balevi A, Özdemir M. Best dilution of the best corticosteroid for intralesional injection in the treatment of localized alopecia areata in adults. J Dermatolog Treat. 2017; 28(8): 753-61. doi: 10.1080/09546634.2017.1329497, PMID 28489468.
70. Yoshimasu T, Kanazawa N, Yamamoto Y, Furukawa F. Multiple courses of pulse corticosteroid therapy for alopecia areata. J Dermatol. 2016; 43(9): 1075-7. doi: 10.1111/1346-8138.13388, PMID 27095016.
71. Mao Y, Xu Z, Song J, Xie Y, Mei X, Shi W. Efficacy of a mixed preparation containing piperine, capsaicin and curcumin in the treatment of alopecia areata. J Cosmet Dermatol. 2022; 21(10): 4510-4. doi: 10.1111/jocd.14931, PMID 35318791.
72. Mou KH, Han D, Liu WL, Li P. Combination therapy of orally administered glycyrrhizin and UVB improved active-stage generalized vitiligo. Braz J Med Biol Res [Braz J Med Biol Res]. 2016; 49(8): e5354. doi: 10.1590/1414-431X20165354, PMID 27464024.
73. Elhawary EE, Abdelnaby NM, Rezk GF. Qandil AM. Fractional CO(2) Laser and minoxidil in the Treatment of alopecia areata, A Comparative Study. Lasers Surg Med. 2025; 57(2): 154-62. doi: 10.1002/lsm.23876.
74. Tawfik YM, Hofny ER, Zidan FM, Ghazally A. 308 nm-Excimer light together with topical betamethasone valerate in treating alopecia areata. Arch Dermatol Res. 2025; 317(1): 342. doi: 10.1007/s00403-025-03833-8, PMID 39912941.
75. ElKawy A FAE, Aly SHM, Ibrahim SMA. Fractional CO(2) laser versus microneedling as a transepidermal drug delivery system for the treatment of alopecia areata: A clinical dermoscopic evaluation. Dermatol Ther. 2022; 35(7): e15553. doi: 10.1111/dth.15553.
76. Al-Dhalimi MA, Al-Janabi MH, Abd Al Hussein RA. The Use of a 1,540 nm Fractional Erbium-Glass Laser in Treatment of alopecia areata. Lasers Surg Med. 2019; 51(10): 859-65. doi: 10.1002/lsm.23133, PMID 31321800.
77. El-Mofty M, Rasheed H, El-Eishy N, Hegazy RA, Hafez V, Shaker O, *et al.* A clinical and immunological study of phototoxic regimen of ultraviolet A for treatment of alopecia areata: a randomized controlled clinical trial. J Dermatolog Treat. Sep 2019; 30(6): 582-7. doi: 10.1080/09546634.2018.1543847, PMID 30411986.
78. Herz-Ruelas ME, Gomez-Flores M, Miranda-Maldonado I, Welsh E, Ocampo-Candiani J, Welsh O. Escalating dosimetry of UVA-1 in the treatment of alopecia areata. Int J Dermatol. 2017; 56(6): 653-9. doi: 10.1111/ijd.13572, PMID 28233311.
79. Meymandi SS, Safari A, Meymandi MS, Aflatoonian M. The role of fractional laser-assisted drug delivery in enhancing the efficacy of topical bimatoprost solution in the treatment of alopecia areata: an intra-patient comparative randomized clinical trial. J Cosmet Dermatol. 2024; 23(5): 1663-8. doi: 10.1111/jocd.16209, PMID 38321929.
80. Ragab SE, Nassar SO, Morad HA, Hegab DS. Platelet-rich plasma in alopecia areata: intradermal injection versus topical application with transepidermal delivery via either fractional carbon dioxide laser or microneedling. Acta Dermatovenerol Alp Pannonica Adriat. 2020; 29(4): 169-73. doi: 10.15570/actaapa.2020.35, PMID 33348935.
81. Yalici-Armagan B, Elcin G. The Effect of neodymium: Yttrium Aluminum Garnet and Fractional Carbon Dioxide Lasers on alopecia areata: A Prospective Controlled Clinical Trial. Dermatol Surg. 2016; 42(4): 500-6. doi: 10.1097/DSS.0000000000000649, PMID 26963147.
82. Guttman-Yassky E, Renert-Yuval Y, Bares J, Chima M, Hawkes JE, Gilleaudeau P, *et al.* Phase 2a randomized clinical trial of dupilumab (anti-IL-4Rα) for alopecia areata patients. Allergy. 2022; 77(3): 897-906. doi: 10.1111/all.15071, PMID 34460948.
83. Al Bazzal A, Hatami P, Abedini R, Etesami I, Ayanian Z, Ghandi N. A prospective comparative study of two regimens of diphenylcyclopropenone (DPCP) in the treatment of alopecia areata. Int Immunopharmacol. 2021; 101(B):108186. doi: 10.1016/j.intimp.2021.108186, PMID 34710658.
84. Mahajan R, Daroach M, Handa S, De D. Randomized controlled trial to compare the effectiveness and safety of low dose dexamethasone oral mini-pulse versus diphenylcyclopropenone contact sensitisation in severe pediatric alopecia areata. Dermatol Ther. 2022; 35(11): e15810. doi: 10.1111/dth.15810, PMID 36086930.
85. Ghandi N, Daneshmand R, Hatami P, Abedini R, Nasimi M, Aryanian Z, *et al.* A randomized trial of diphenylcyclopropenone (DPCP) combined with anthralin versus DPCP alone for treating moderate to severe alopecia areata. Int Immunopharmacol. 2021; 99: 107971. doi: 10.1016/j.intimp.2021.107971, PMID 34298402.
86. Guttman-Yassky E, Nia JK, Hashim PW, Mansouri Y, Alia E, Taliercio M, *et al.* Efficacy and safety of secukinumab treatment in adults with extensive alopecia areata. Arch Dermatol Res. 2018; 310(8): 607-14. doi: 10.1007/s00403-018-1853-5, PMID 30121698.
87. Law EH, Hanson KA, Harries M, Korver D, Sherif B, Chirila C. Patient-reported outcome improvements following scalp hair regrowth among patients with alopecia areata: analysis of the ALLEGRO-2b/3 trial. J Dermatolog Treat. 2025; 36(1): 2460577. doi: 10.1080/09546634.2025.2460577, PMID 39900352.
88. Mackay-Wiggan J, Sallee BN, Wang EH, Sansaricq F, Nguyen N, Kim C, *et al.* An open-label study evaluating the efficacy of abatacept in alopecia areata. J Am Acad Dermatol. 2021; 84(3): 841-4. doi: 10.1016/j.jaad.2020.09.091, PMID 33045294.
89. Rocha VB, Kakizaki P, Donati A, Machado CJ, Pires MC, Contin LA. Randomized controlled study comparing the use of diphencyprone and anthralin in the treatment of extensive chronic alopecia areata. An Bras Dermatol. 2021; 96(3): 372-6. doi: 10.1016/j.abd.2020.06.018, PMID 33849753.
90. Thuangtong R, Varothai S, Triwongwaranat D, Rujitharanawong C. Multi-concentration level patch test guided diphenyl cyclopropenone (DPCP) treatment in alopecia totalis or alopecia universalis. J Med Assoc Thai Chotmaihet Thangphaet. 2017; 100(1): 86-92. PMID 29911776.
91. Bhat S, Handa S, De D. A randomized comparative study of the efficacy of topical latanoprost versus topical betamethasone diproprionate lotion in the treatment of localized alopecia areata. Indian J Dermatol Venereol Leprol. 2021; 87(1): 42-8. doi: 10.25259/IJDVL_787_19, PMID 33580923.
92. El-Ashmawy AA, El-Maadawy IH, El-Maghraby GM. Efficacy of topical latanoprost versus minoxidil and betamethasone valerate on the treatment of alopecia areata. J Dermatolog Treat. 2018; 29(1): 55-64. doi: 10.1080/09546634.2017.1330527, PMID 28521549.
93. El Taieb MA, Hegazy EM, Ibrahim HM, Osman AB, Abualhamd M. Topical calcipotriol vs narrowband ultraviolet B in treatment of alopecia areata: a randomized-controlled trial. Arch Dermatol Res. 2019; 311(8): 629-36. doi: 10.1007/s00403-019-01943-8, PMID 31236672.
94. Rashad AF, Elgamal E, Fouda I. Intralesional vitamin D3 in treatment of alopecia areata: A randomized controlled clinical trial. J Cosmet Dermatol. 2022; 21(10): 4617-22. doi: 10.1111/jocd.14844, PMID 35152536.
95. Lai VW, Chen G, Sinclair R. Impact of cyclosporin treatment on health-related quality of life of patients with alopecia areata. J Dermatolog Treat. 2021; 32(2): 250-7. doi: 10.1080/09546634.2019.1654068, PMID 31389731.

96. Nassar A, Elradi M, Radwan M, Albalat W. Comparative evaluation of the efficacy of topical tacrolimus 0.03% and topical calcipotriol 0.005% mixed with betamethasone dipropionate versus topical clobetasol 0.05% in treatment of alopecia areata: A clinical and trichoscopic study. J Cosmet Dermatol. 2023; 22(4): 1297-303. doi: 10.1111/jocd.15558, PMID 36575890.
97. Toma DM, Atallah RB, Eldahshan RM. Comparative study between topical methotrexate 1% gel and minoxidil 5% gel in the treatment of localized alopecia areata. Dermatol Ther. 2022; 35(9): e15696. doi: 10.1111/dth.15696, PMID 35796224.
98. Ali MS, Hafiz HS, Ahmed NA, Galal SA. Combined microneedling with topical vitamin D3 or bimatoprost versus microneedling alone in the treatment of alopecia areata: A comparative randomized trial. J Cosmet Dermatol. 2023; 22(4): 1286-96. doi: 10.1111/jocd.15569, PMID 36762396.
99. Li Y, Yan B, Wang H, Li H, Li Q, Zhao D, *et al.* Hair regrowth in alopecia areata patients following Stem Cell Educator therapy. BMC Med. 2015; 13: 87. doi: 10.1186/s12916-015-0331-6, PMID 25896390.
100. El-Dawla RE, Abdelhaleem M, Abdelhamed A. Evaluation of the safety and efficacy of platelet-rich plasma in the treatment of female patients with chronic telogen effluvium: A randomised, controlled, double-blind, pilot clinical trial. Indian J Dermatol Venereol Leprol. 2023; 89(2): 195-203. doi: 10.25259/IJDVL_1011_20, PMID 35593290.
101. Rinaldi F, Marzani B, Pinto D, Sorbellini E. Randomized controlled trial on a PRP-like cosmetic, biomimetic peptides based, for the treatment of alopecia areata. J Dermatolog Treat. 2019; 30(6): 588-93. doi: 10.1080/09546634.2018.1544405, PMID 30513014.
102. Hegde P, Relhan V, Sahoo B, Garg VK. A randomized, placebo and active controlled, split scalp study to evaluate the efficacy of platelet-rich plasma in patchy alopecia areata of the scalp. Dermatol Ther. 2020; 33(6): e14388. doi: 10.1111/dth.14388, PMID 33034942.
103. Wollina U, Hercogová J, Fioranelli M, Gianfaldoni S, Chokoeva AA, Tchernev G, *et al.* Successful treatment of alopecia areata with Dr. Michaels® (Alopinex) product family. J Biol Regul Homeost Agents. 2016; 30(2) Suppl 3: 83-7. PMID 27498663.
104. El-Taweel AI, Akl EM. Intralesional pentoxifylline injection in localized alopecia areata. J Cosmet Dermatol. 2019; 18(2): 602-7. doi: 10.1111/jocd.12796, PMID 30302901.
105. Carvalho RM, Barreto TM, Weffort F, Machado CJ, Melo DF. Use of vibrating anesthetic device reduces the pain of mesotherapy injections: A randomized split-scalp study. J Cosmet Dermatol. 2021; 20(2): 425-8. doi: 10.1111/jocd.13554, PMID 32640097.
106. Mahgoub D, Mohye Eldeen R, Saadi D, El-Samanoudy S, Ibrahim S. Clinical and trichoscopic evaluation of trichloroacetic acid 35% vs phenol 88% peels in treatment of alopecia areata. J Cosmet Dermatol. 2021; 20(1): 143-9. doi: 10.1111/jocd.13465, PMID 32436287.
107. Mahgoub DA, Dhannoon TI, El-Mesidy MS. Trichloroacetic acid 35% as a therapeutic line for localized patchy alopecia areata in comparison with intralesional steroids: clinical and trichoscopic evaluation. J Cosmet Dermatol. 2021; 20(6): 1743-9. doi: 10.1111/jocd.13749, PMID 33001537.
108. Mogawer RM, Fawzy MM, Mourad A, Ahmed H, Nasr M, Nour ZA, *et al.* Topical sodium valproate-loaded nanospanlastics versus conventional topical steroid therapy in alopecia areata: a randomized controlled study. Arch Dermatol Res. 2024; 316(2): 64. doi: 10.1007/s00403-023-02785-1, PMID 38170256.
109. Piliang M, Soung J, King B, Shapiro J, Rudnicka L, Farrant P, *et al.* Efficacy and safety of the oral Janus kinase 3/tyrosine kinase expressed in hepatocellular carcinoma family kinase inhibitor ritlecitinib over 24 months: integrated analysis of the Allegro phase IIb/III and long-term phase III clinical studies in alopecia areata. Br J Dermatol. 2025; 192(2): 215-27. doi: 10.1093/bjd/ljae365, PMID 39432738.
110. Finlay AY, Khan GK. Dermatology Life Quality Index (DLQI)- a simple practical measure for routine clinical use. Clin Exp Dermatol. 1994; 19(3): 210-6. doi: 10.1111/j.1365-2230.1994.tb01167.x, PMID 8033378.

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