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A review of topical corticosteroid sprays for the treatment of inflammatory dermatoses

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Abstract

Background: Topical corticosteroids are available in many vehicles. However, patients' preference for vehicles are variable and could be tailored to maximize patient adherence. Spray vehicles may offer, convenience, and strong efficacy.

Methods: A literature review was conducted using keywords: clobetasol, desoximetasone, betamethasone, triamcinolone, corticosteroid, topical, spray, vehicles, treatment, and clinical trial.

Results: For moderate-to-severe plaque psoriasis, 87% of subjects achieved an Overall Disease Severity (ODS) Score ≤ 2 at week two and 78% achieved an ODS ≤ 1 after four weeks with clobetasol propionate (CP) 0.05% spray compared to 17% and 3% in the control group, respectively ($P < 0.001$). For desoximetasone 0.25% spray, 31%-53% with moderate-to-severe psoriasis achieve Physician's Global Assessment (PGA) score ≤ 1 at day 28 versus 5%-18% in the vehicle spray group ($P < 0.01$). For betamethasone dipropionate 0.05% spray, 19% with mild-to-moderate plaque psoriasis achieved an Investigator's Global Assessment (IGA) score ≤ 1 or a 2-grade reduction in IGA versus 2.3% in vehicle group ($P \leq 0.001$). For mild-to-severe steroid responsive inflammatory dermatoses, 64% using triamcinolone acetonide 0.2% spray achieved clear or almost clear skin at day 14 (no P value reported). Adverse events including burning, irritation, and dryness were similar across all corticosteroids.

Keywords: clobetasol, desoximetasone, triamcinolone, betamethasone, vehicle, psoriasis, atopic dermatitis, adherence

Introduction

Topical corticosteroids are ubiquitous in the treatment of various dermatoses [1]. Vehicles available for topical corticosteroids include creams, ointments, gels, lotions, solutions, and sprays. Although ointments, creams, and gels are often prescribed, an increasing use of nontraditional vehicles, including sprays and foams, are being prescribed for psoriasis and other inflammatory dermatoses. Since patients have specific priorities for topical vehicles, healthcare providers could explore patient preference for medication vehicles [2, 3].

Patients may find topical sprays appealing since they are less messy, easy to apply, and leave minimal residue. A study investigating the trending use of sunscreen vehicles reported an increased use of sunscreen sprays and a decreased use of sunscreen lotions because consumers felt that sunscreen sprays were quick and easy to apply [4]. Multiple factors may influence a patient's choice of vehicle but preference varies widely. Individualizing treatment may optimize adherence [1, 5].

Owing to an increasing popularity of nontraditional vehicles like sprays for topical therapy, this article will review available topical corticosteroid sprays and their efficacy and safety in treating certain inflammatory skin conditions [3, 4].

Clobetasol propionate 0.05% spray

Clobetasol propionate 0.05% spray is a class 1, super-potent topical corticosteroid used for the treatment of moderate-to-severe plaque psoriasis. Clobetasol propionate 0.05% spray is FDA-approved for a 4-

week, twice daily application in patients 18 years or older [6]. Total dose should not exceed 50g of product per week (59ml or two fluid ounces) to prevent HPA-axis suppression [6].

Efficacy

A multicenter, randomized, double-blind, vehicle-controlled, parallel-group, comparative study evaluated the efficacy of clobetasol propionate 0.05% spray in 120 adults with moderate-to-severe plaque psoriasis affecting at least 2% of their body surface area. A successful primary outcome was defined as Overall Disease Severity (ODS) score of ≤ 2 (mild, almost clear or clear) at week 2 and ODS score ≤ 1 (clear or almost clear) at week 4. Secondary outcomes included reduction in disease severity for psoriasis signs and symptoms (scaling, erythema, plaque elevation and pruritus) at weeks 1 and 8 and calculated treatment success (defined as clear or almost clear) at week 8. Disease severity for psoriasis signs and symptoms were scored on a 5-point scale (0=none, 1=almost clear, 2=mild, 3=moderate, 4=severe, 5=very severe). Subjects were randomized in a 1:1 ratio to receive clobetasol propionate 0.05% spray or vehicle. Subjects were instructed to apply the study medication twice daily for 4 weeks. Evaluations were conducted at baseline, weeks 1, 2, 4, and 8. Superior results were achieved with clobetasol propionate 0.05% spray for both primary and secondary outcomes ([Table 1](#)). A significant amount of subjects in the clobetasol group maintained treatment success 4 weeks post-treatment [7].

A 4-week open-label observational study investigated the efficacy of clobetasol propionate 0.05% spray in subjects with psoriasis affecting 3% to 20% of their body surface area. Effectiveness was measured using a 7-point Investigators' Global Assessment of Improvement (GAI) scale (0=completely clear, 6=worsened) and a 6-point Target Plaque Severity (TPS) scale (0=clear, 5= very severe). Treatment success was defined as a score of 0 or 1 on GAI or on TPS or an improvement of 2 grades or more on TPS. Subjects were randomized to a monotherapy arm (N=1254) or add-on therapy arm (N=731) with another antipsoriatic agent in addition to clobetasol propionate 0.05% spray [8, 9]. Subjects

in the add-on therapy arm had to have at least one target plaque with TPS score of moderate to severe. When clobetasol propionate spray was used as topical monotherapy, significant improvement from baseline was achieved in target plaque severity and overall severity after 2 weeks of treatment. After 4 weeks of treatment, 80% of subjects achieved treatment success using topical monotherapy with clobetasol propionate 0.05% spray. Only 2% of subjects did not report grade improvement [8]. Clobetasol propionate 0.05% spray was also effective as additional topical therapy for patients already receiving topical or systemic antipsoriatic agent [9]. About 80% of subjects with a moderate-to-severe plaque achieved complete or almost complete clearing at 4 weeks when clobetasol propionate 0.05% spray was used as adjunctive therapy [9].

A multicenter, randomized, clinical trial of 122 subjects with moderate-to-severe plaque psoriasis affecting 3 to 20% of body surface area compared efficacy and safety of clobetasol propionate 0.05% spray to calcipotriene 0.005% mixed with betamethasone dipropionate 0.064% (C-BD) ointment. Subjects were instructed to apply medication twice daily and assessed at week 1, 2, 4 and 8 (4 weeks post-treatment). A successful primary outcome was defined as an ODS score of ≤ 1 and IGA scale. Clobetasol propionate 0.05% spray efficacy was greater than C-BD ointment with 75% of subjects achieving clear or almost clear skin (ODS ≤ 1) after 4 weeks of treatment compared with 45% using C-BD ointment. Both clobetasol propionate 0.05% spray and C-BD ointment improved patient quality of life without any significant differences between both groups. Compared with C-BD ointment, subjects found clobetasol propionate 0.05% spray easier to apply and were more satisfied with their results [10].

A multicenter, double-blind clinical study randomized 81 subjects with moderate-to-severe scalp psoriasis to a clobetasol propionate 0.05% spray or vehicle spray applied twice daily. The primary efficacy outcome was measured using the Global Severity Score (GSS) for scalp psoriasis at week 4. Subjects who achieved a score of 0 at week 2 were considered a treatment success and prematurely completed the study. End of treatment was therefore

either at week 2 or 4, depending on GSS score. Secondary end points included GSS at week 2, psoriasis individual sign scores, extent of scalp involvement index, and pruritus at weeks 2 and 4. Additional assessment included Scalpdex (a validated scalp dermatitis-specific quality of life instrument) score. Psoriasis individual sign scores rated scaling, erythema, and plaque elevation on a 4-point scale. Extent of scalp involvement index was rated on a 5-point scale (0=none, 1= <20%, 2=20-39%, 3=40-59%, 4=60-79% and 5=80-100%). Pruritus was evaluated on a 3-point scale (0=no itching, 1=some itching, not bothersome, 2=definite itch, bothersome and 3=intense itching). At week 2, 12% of subjects achieved treatment success (GSS=0) in the clobetasol group compared with 0% in the placebo group whereas 68% of subjects in the intent-to-treat (ITT) group were almost clear compared with 8% in the placebo group. At the end of the study, 85% achieved treatment success (GSS 0 [clear] or 1 [almost clear] at week 4 or GSS=0 at week 2) in the clobetasol group compared with 13% in the placebo group ($P<0.001$), [11]. Over 90% of subjects experienced significant reductions in scaling, erythema, and plaque elevation in the ITT group compared with 31% to 48% in the vehicle spray group. For extent of scalp involvement index, 51% of subject in the clobetasol group reported 0% involvement versus 3% in the vehicle spray group at the end of the study ($P<0.001$). About 28% of subjects in the vehicle spray group had $\geq 40\%$ involvement compared with 0% in the ITT group. Pruritus severity scores were significantly improved for subjects in the ITT group at end of treatment with 97% of subjects rated as mild or no pruritus. Scalpdex scores improved by 25 points at end of treatment in the ITT group ($P<0.001$ versus baseline and vehicle spray). Both groups agreed or strongly agreed that a topical spray pump made scalp application easier (85% in clobetasol group; 86% in placebo group), [11].

Safety and Tolerability

About 23% of CP 0.05% spray subjects reported application-site stinging/burning within 15 minutes following the first application. However, the placebo group also reported application-site

stinging/burning suggesting the alcohol content may be attributed to the spray vehicle [7]. The most common adverse events reported were pruritus, moderate erythema, peeling/scaling, dryness, and stinging/burning. Telangiectasia, skin atrophy, and folliculitis were reported in 1% of subjects [7-9]. Scalp psoriasis subjects treated with CP 0.05% spray reported burning/stinging (26%) and telangiectasia (3%) [11].

Desoximetasone 0.25% spray

Desoximetasone 0.25% spray is a potent to super-potent topical corticosteroid [12]. Treatment indication includes adults with moderate-to-severe plaque psoriasis and atopic dermatitis. It can be used up to 4 weeks and should be applied directly to the affected site and rubbed in gently and completely [13]. It can provide rapid relief of scaling from psoriasis in up to 70% of patients in 1 week and 84% in 4 weeks [8]. Desoximetasone 0.25% spray has a low potential for irritation and sensitization and is less irritating than clobetasol spray [14].

Efficacy

Two phase III, double-blind, vehicle-controlled parallel studies randomized 120 adult subjects with moderate-to-severe plaque psoriasis to desoximetasone 0.25% spray (active group) or vehicle applied twice daily for 28 days. At baseline, subjects required PGA of 3 (moderate) or 4 (severe) and a target lesion with an area of at least 5cm² with a combined Target Lesion Severity Score (TLSS) of ≥ 7 , and a plaque elevation score of ≥ 3 . The primary endpoint included clinical success rate of PGA score 0 or 1 at day 28, and treatment success was defined as TLSS of 0 or 1 for each of three individual signs (erythema, scaling, and plaque elevation) at day 28. Secondary efficacy endpoint was the mean change from baseline to day 28 in PGA, TLSS, and mean change in percent of body surface area affected. Subjects were instructed to apply study medication twice-daily directly to affected areas, then evaluated at day 7, 14, and 28. Overall improvement of psoriasis (measured by PGA) in the active groups was noted in 31% to 53% of subjects compared with 5% to 18% in vehicle group (Study 1 $P=0.0003$; Study 2 $P<0.0001$). About 39% to 53% experienced complete or almost complete clearing of target plaques compared with

vehicle spray ($P < 0.0001$). Mean changes from baseline in TLSS, PGA and BSA were statistically significant and in favor of desoximetasone 0.25% spray after 28 days of treatment [15].

A multicenter, double-blind clinical trial randomized 120 adult subjects with moderate-to-severe plaque psoriasis to desoximetasone 0.25% spray or vehicle applied twice daily for 28 days. All participants had a baseline PGA of ≥ 3 and stable plaque psoriasis involving $\geq 10\%$ of body surface area. Target plaques required an area of $\geq 5\text{cm}^2$, TLSS of ≥ 7 and plaque elevation > 3 . Subjects were assessed at baseline, day 7, 14, and 28 using PGA score and TLSS. Primary outcome was the proportion of subjects that achieved clinical success, defined as PGA < 1 at day 28, and/or treatment success, defined as TLSS of ≤ 1 for erythema, scaling, and plaque elevation at day 28. More subjects achieved PGA ≤ 1 at day 28 with desoximetasone 0.25% spray than vehicle spray (31% versus 5%, $P = 0.0003$). More subjects achieved TLSS ≤ 1 at day 28 with desoximetasone 0.25% spray than vehicle spray (39% versus 7%, $P < 0.0001$), [16].

An open-label study evaluated the efficacy of desoximetasone 0.25% spray in 15 subjects with atopic dermatitis. All subjects were instructed to apply the medication twice daily, followed by a treatment evaluation at week 1, 2, and 4 using the IGA score. Primary outcome was a reduction in IGA score, and pruritus from baseline and mean reduction on Visual Analogue Scale (VAS) of pruritus from baseline. At baseline all subjects had an IGA score of moderate. A significant reduction in IGA scores was noted at week 1, 2, and 4 with all subjects rated as clear or almost clear at week 4 ($P \leq 0.001$). For pruritus, all subjects enrolled with a baseline score of moderate and at week 2, 13% persisted with a score of moderate with the remaining subjects rated as mild (54%) and no pruritus (33%), ($P < 0.002$). At week 4, all subjects reported either mild (40%) or no pruritus (60%), ($P < 0.002$). Mean VAS percent change from baseline was -56%, -74% and -91% at week 1, 2, and 4, respectively ($P \leq 0.0007$), [17].

Safety and Tolerability

Desoximetasone is a class C corticosteroid, which has the lowest potential for causing cutaneous allergies [18]. In both phase III trials, 28.3% and 15% of

subjects reported adverse events in the active arms of Study 1 and 2, respectively [15]. A similar number of adverse events were reported in both vehicle control groups (35% Study 1; 20% Study 2), [15]. There was no difference between both study arms (no P value reported), [15]. Adverse events included application-site reactions such as dryness, irritation, pruritus, erythema, and rash [15]. No stinging or burning was reported by any subject [15]. Less than 1% of subjects reported psoriasis exacerbation, folliculitis, and skin ulcers. No serious adverse events were reported [15]. About 69 adverse events (34, placebo group; 35, treatment group [no P value reported]) were reported in the multicenter, double-blind trial [16]. No skin atrophy, specific, or serious adverse events were reported (no P value reported), [16]. Although sample size was small ($N = 15$), no adverse events were reported for subjects with atopic dermatitis [17].

Betamethasone dipropionate 0.05% spray

Betamethasone dipropionate 0.05% spray is a mid-potency topical corticosteroid [19]. Its spray formulation is used for the treatment of mild-to-moderate adult plaque psoriasis. Betamethasone dipropionate spray should be applied and rubbed gently to affected areas twice daily for 4 weeks [20]. Betamethasone dipropionate 0.05% spray has less systemic absorption than betamethasone dipropionate 0.05% lotion [19].

Efficacy

A phase III, double-blind, vehicle-controlled trial randomized 394 subjects with mild-to-moderate plaque psoriasis affecting 10 to 20% body surface area to either betamethasone dipropionate 0.05% spray ($N = 174$), betamethasone dipropionate 0.05% lotion ($N = 90$), vehicle spray ($N = 87$), or vehicle lotion ($N = 43$). Subjects required baseline IGA of 3 (moderate) and a diagnosis of stable plaque psoriasis not affecting the scalp, groin, axillae, or intertriginous region. Primary endpoint was defined as the proportion of subjects that achieve at least a two-grade reduction or rated clear or almost clear using the IGA scale at day 15 from baseline. Secondary outcomes were measured using the Total Sign Score (TSS, the sum of individual scored for erythema, scaling, and plaque elevation) for target

lesions. Subjects were evaluated at days 1, 4, 8, 15, and 29. More subjects achieved IGA ≤ 1 or a 2-grade reduction at day 15 with betamethasone dipropionate 0.05% spray than vehicle spray (19% versus 2.3%, $P \leq 0.001$). For betamethasone dipropionate lotion, 18.9% achieved an IGA ≤ 1 or a 2-grade reduction at day 15 compared with 9.3% in the vehicle lotion group. More subjects had a 50% reduction in TSS with betamethasone dipropionate 0.05% spray than vehicle spray at day 4 (12.1% versus 2.3%, $P = 0.004$). There was no TSS reduction difference between treatment groups at day 8, 15, and 29 (no P value reported), [19].

Safety and Tolerability

Application-site adverse events for topical betamethasone dipropionate 0.05% spray included pain (18%), pruritus (15%), and atrophy (2.3%). No severe adverse events were reported in the betamethasone dipropionate spray group. Hypothalamus-pituitary-adrenal axis suppression was assessed for augmented betamethasone dipropionate 0.05% lotion versus betamethasone dipropionate 0.05% spray. A total of 74 subjects were randomized to a 15-day treatment with betamethasone dipropionate 0.05% lotion, 15-day treatment with betamethasone dipropionate 0.05% spray, or 29-day treatment with betamethasone dipropionate 0.05% spray. At day 15, 22.7% of subjects in the 15-day betamethasone dipropionate lotion group and 20% in the 15-day betamethasone dipropionate spray group had abnormal ACTH stimulation tests (defined as plasma cortisol level of ≤ 18 $\mu\text{g}/\text{dl}$, 30 minutes after ACTH administration), suggesting HPA-axis suppression [19]. Plasma concentrations of betamethasone dipropionate were lower in subjects in the spray group compared with subjects in the lotion group despite greater amount of product used in the spray group, indicating less systemic absorption [19].

Triamcinolone acetonide 0.2% spray

Triamcinolone acetonide 0.2% spray is a mid-potency topical corticosteroid indicated for the inflammatory and pruritic relief of steroid-responsive dermatoses including eczema, psoriasis, atopic dermatitis, seborrheic dermatitis, and contact dermatitis [21, 22]. It can be applied to any area of the

body, 3 to 4 times a day, but special care must be taken to avoid inhalation and eye contact [21].

Efficacy

An open-label, single-center study evaluated the efficacy of triamcinolone acetonide 0.2% spray in 42 adult subjects with mild-to-severe, steroid-responsive inflammatory dermatoses. Most patients were instructed to apply medication 1 to 2 times a day but some were allowed to use the medication as needed up to 4 times a day. Clinical outcome was assessed using an Investigator and Patient Global Assessment Score (0=clear, 1=almost clear, 2=mild, 3=moderate, 4=severe, 5=very severe), a Physician Assessment Improvement Score (0=complete clearing, 1=marked improvement [$\geq 75\%$ overall improvement], 2=moderate improvement [25-75% overall improvement], 3=mild improvement [$\leq 25\%$ overall improvement], 4=no response), and patient satisfaction was measured with a survey. GAS was measured at baseline and day 7, 14, 21, and 28, whereas patient satisfaction was assessed at day 28. At baseline, 83% of subjects had moderate-to-severe dermatoses whereas 17% had mild dermatoses. At day 14, 32% of subjects were completely clear or almost clear and no subject had severe dermatoses (no P value reported). After day 2, 64% of subjects were completely clear or almost clear. No subject reported severe dermatoses at day 14 (no P value reported). At day 28, 89% of subjects assessed their dermatoses as clear, almost clear, or mild on the patient global assessment scale (no P value reported). Mean scores for erythema, papules/vesicles, excoriations, pruritus, burning/stinging steadily decreased from baseline to day 28. Moderate improvement (25-75%) or complete clearing was observed using the physician's assessment improvement scale after 7 days of treatment in 32% of subjects (no P value reported). This increased to 64% of subjects after day 28 of treatment (no P value reported). About 95% of subjects prefer triamcinolone spray over creams and ointments owing to descriptions of "no residue," "easier to apply," "not greasy," "fast drying," and "not sticky," and 92.3% stated they would use triamcinolone spray again [22].

Safety and Tolerability

Adverse reactions reported in decreasing order of occurrence include burning, irritation, dryness,

folliculitis, hypertrichosis, acneiform eruptions, hypopigmentation, perioral dermatitis, allergic contact dermatitis, maceration of the skin, secondary infection, skin atrophy, striae, and miliaria. Such adverse reactions were infrequent and may increase with the use of occlusive dressing [21].

Discussion

An increasing trend in prescribing nontraditional topical corticosteroid vehicles exists due to poor patient adherence and patients' preferences for other vehicles [3]. Adherence to treatment is an important determinant of treatment success and overall clinical outcome [23]. Time consumption and poor cosmetic appearance associated with use of topical vehicles, including lotions and ointments, may contribute to poor adherence and treatment failure [24]. Spray vehicles may provide better clinical outcome for patients who prioritize factors such as ease of application and decreased messiness [23, 25]. Since patients' preferences for topical vehicles are highly variable, healthcare providers could tailor treatment according to patients' preferred vehicle of choice in order to attain good adherence [5].

Clobetasol propionate 0.05% spray formulation is an efficacious treatment for moderate-to-severe scalp and/or plaque psoriasis compared to placebo. Although there are a few comparative studies between different topical clobetasol propionate vehicles, topical sprays and other recent topical vehicle formulations have similar efficacy [23]. In a clinical setting, best outcomes may be achieved by selecting a vehicle based on patient preference [23].

Both calcipotriene 0.05% and betamethasone dipropionate 0.064% ointment with clobetasol propionate 0.05% spray were well tolerated and an efficacious therapy for moderate-to-severe plaque psoriasis. Clobetasol propionate 0.05% spray had greater improvement in efficacy compared to calcipotriene/betamethasone dipropionate ointment. Compared with clobetasol propionate 0.05% spray, desoximetasone 0.25% spray has low allergenicity and low potential for adrenal suppression [16].

Although all topical corticosteroid sprays displayed similar clinical efficacy, superiority between each

topical corticosteroid spray is difficult to compare since each clinical trial used different clinical outcome measurements. Therefore, whether to recommend one topical corticosteroid spray over another corticosteroid spray is difficult to determine. To help avoid such limitation, the International Dermatology Outcome Measure outlined standard clinical outcome measurements that may be implemented in all psoriasis clinical trials. Such measurements include the Physician Global Assessment, Body Surface Area, Psoriasis Area and Severity Index, Visual Analog Scale, Psoriasis Symptom Inventory, and Dermatology Life Quality Index [26-28]. The Harmonizing Outcome Measure for Eczema implemented similar standards in atopic dermatitis clinical trials [29]. Implementing all these clinical outcome measurements as a standard requirement in future studies can help compare results between all clinical trials in psoriasis and atopic dermatitis [26-29].

Adrenal suppression may be physiologic or pathologic. Physiologic adrenal suppression is the adrenal gland's inability to release cortisol followed by quick normalization of hormone levels. Pathologic adrenal suppression is the prolonged or irreversible recovery of adrenal glands to produce cortisol [30]. Although betamethasone dipropionate 0.05% spray caused adrenal suppression in 22.7% of subjects, a systematic review and risk analysis of topical corticosteroids found little evidence for pathologic or clinically significant physiologic adrenal suppression [19, 30]. Of 16 clinical trials, only one clinical trial reported pathologic adrenal suppression. Furthermore, of all subjects treated with class I to IV topical corticosteroids diagnosed with physiologic adrenal suppression, about 50% of those subjects reported normalized adrenal laboratory values within weeks of continued topical corticosteroid therapy. Topical corticosteroids appear to rarely cause symptomatic adrenal suppression [30].

Area of disease involvement may also help narrow a healthcare provider's decision on choosing a vehicle of choice. For example, patients with scalp psoriasis may use a topical corticosteroid spray as it may be easier to use and less time-consuming. Subjects

strongly agreed that a spray pump applicator made it easier to apply the topical medication into their scalp [11]. However, newer topical corticosteroid vehicles including sprays and foams may be difficult to acquire owing to poor insurance coverage. Therefore, cost and availability act as barriers to patient adherence. Reducing copayments may improve patient adherence to topical therapy [31, 32].

Clobetasol propionate 0.05% spray, desoximetasone 0.25% spray, betamethasone dipropionate 0.05% spray and triamcinolone acetonide 0.02% spray are all effective treatments for psoriasis, atopic dermatitis, and other corticosteroid-sensitive dermatoses. Tailoring an appropriate vehicle to patient preference, severity, and area of disease involvement may improve patient adherence and overall clinical outcome [23].

Conclusion

Topical corticosteroid sprays are effective and well-tolerated treatments for steroid-responsive

inflammatory dermatoses. Their ease of application make topical corticosteroid sprays an effective treatment alternative for patients that are not adherent to their prescribed medication.

Potential conflicts of interest

Dr. Steven Feldman has received research, speaking and/or consulting support from a variety of companies including Galderma, GSK/Stiefel, Almirall, Leo Pharma, Baxter, Boehringer Ingelheim, Mylan, Celgene, Pfizer, Valeant, Taro, Abbvie, Cosmederm, Anacor, Astellas, Janssen, Lilly, Merck, Merz, Novartis, Regeneron, Sanofi, Novan, Parion, Qurient, National Biological Corporation, Caremark, Advance Medical, Sun Pharma, Suncare Research, Informa, UpToDate and National Psoriasis Foundation. He is founder and majority owner of www.DrScore.com and founder and part owner of Causa Research, a company dedicated to enhancing patients' adherence to treatment. Dr. Adrian Pona, Sree S. Kolli, and Dr. Kyle Habet have nothing to disclose.

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Table 1: Efficacy of Topical Corticosteroid Sprays

Authorship	Study Design	Intervention	Subject Size	Duration	Result
Jarrat et al. [7].	R, DB, PG, PC	Clobetasol propionate 0.05% spray vs vehicle spray applied twice daily	120	8 weeks	<p>ODS \leq 2 at Week 2 or \leq 1 at Week 4 87% vs 17% at Week 2 ($P < 0.001$) 78% vs 3% at Week 4 ($P < 0.001$)</p> <p>Clear/almost clear for psoriasis signs and symptoms at Week 4 Plaque elevation (80% vs 15%, $P \leq 0.001$) Erythema (70% vs 5%, $P \leq 0.001$) Scaling (80% vs 15%, $P \leq 0.001$) Pruritus (80% vs 35%, $P \leq 0.001$)</p> <p>ODS \leq 1 at Week 8 (4 weeks post-treatment) 44% vs 4% ($P \leq 0.001$)</p>
Menter A. [8].	OL, O	Clobetasol propionate 0.05% spray	1254	4 weeks	<p>TPS \leq 1 or 2-grade reduction 43.6% at Week 2 ($P < 0.001$) 80% at Week 4 ($P < 0.001$)</p> <p>GAI \leq 1 30.2% at Week 2 (No P-value reported) 69.3% at Week 4 ($P < 0.001$ vs Week 2)</p>
Feldman SR. [9].	OL, O	Clobetasol propionate 0.05% spray twice daily as add-on treatment with antipsoriatic agent	731	4 weeks	<p>TPS \leq 1 or 2-grade reduction 59% at Week 2 ($P < 0.001$) 80.3% at Week 4 ($P < 0.001$)</p> <p>GAI \leq 1 26.5% at Week 2 (No P-value reported) 62% at Week 4 ($P < 0.001$)</p>
Menter A. [10].	R	Clobetasol propionate 0.05% spray vs calcipotriene 0.005% + betamethasone dipropionate 0.064% ointment twice daily	122	8 weeks	<p>ODS \leq 1 7% vs 12% at Week 1 (No P-value reported) 41% vs 27% at Week 2 (No P-value reported) 75% vs 45% at Week 4 ($P = 0.003$)</p> <p>IGA \leq 1 20% vs 20% at Week 1 (No P-value reported) 52% vs 33% at Week 2 ($P = 0.054$) 73% vs 65% at Week 4 (Difference did not reach statistical significance; no P-value reported) 41% vs 24% at Week 8 (4 weeks post-treatment; no P-value reported)</p> <p>Mean change in PQLQ-12 from baseline -24.4 and 21.4 at Week 2 -36.1 and -30.8 at Week 4 -15.9 and -10.1 at Week 8 Scores were reported as not statistically significant between groups (although no P-values were reported)</p> <p>Patient satisfaction survey (10-point scale) Ease of application: Median 10 vs 9 ($P < 0.001$) Satisfaction: Median 9 vs 8 ($P = 0.03$)</p>
Sofen et al. [11].	R, DB, PC	Clobetasol propionate 0.05% spray vs vehicle	81	2 or 4 weeks	<p>GSS \leq 1 at Week 4 or GSS=0 at Week 2 85% vs 13% at end of treatment ($P < 0.001$)</p>

		spray applied twice daily			<p><u>Psoriasis individual sign scores at end of treatment ($P<0.001$ for differences in distribution between groups)</u> Scaling: 96% vs 31% none or mild Erythema: 93% vs 36% none or mild Plaque elevation: 95% vs 48% none or mild</p> <p><u>Extent of scalp involvement index at end of treatment ($P<0.001$ for differences in distribution between groups)</u> 51% vs 3%: None 39 vs 40%: <20% involvement 10% vs 30%: 20-39% involvement 0% vs 10%: 40-59% involvement 0% vs 13%: 60-79% involvement 0% vs 5%: 80-100% involvement</p> <p><u>Pruritus severity score at end of treatment ($P<0.001$ for differences in distribution)</u> 68% vs 20% None 29% vs 35% Mild 2% vs 35% Moderate 0% vs 10% Severe</p> <p><u>Scalpdex score ($P<0.001$ for differences between groups)</u> Vehicle: 57.9 ± 20.5 baseline vs 50.7 ± 22.8 end of treatment ($P=0.634$) ITT: 55.0 ± 21.0 baseline vs 30.0 ± 22.0 end of treatment ($P<0.001$)</p>
Kircik et al. [15].	DB, PC	Desoximetasone 0.25% spray vs vehicle spray applied twice daily	120 per study	28 days	<p><u>PGA ≤ 1 at Day 28</u> Study 1: 31% vs 5% ($P=0.003$) Study 2: 53% vs 18% ($P<0.0001$)</p> <p><u>TLSS ≤ 1 for erythema, scaling, and plaque elevation at Day 28</u> Study 1: 39% vs 7% ($P<0.0001$) Study 2: 53% vs 13% ($P<0.0001$)</p> <p><u>Mean change in TLSS from baseline</u> Study 1: 4.73 ± 3.08 vs 1.93 ± 1.96 ($P<0.0001$) Study 2: 6.18 ± 3.13 vs 3.02 ± 2.97 ($P<0.0001$)</p> <p><u>Mean change in PGA from baseline</u> Study 1: 1.14 ± 0.9 vs 0.50 ± 0.68 ($P<0.0001$) Study 2: 1.72 ± 1.06 vs 0.85 ± 0.94 ($P<0.0001$)</p> <p><u>Mean change in BSA from baseline</u> Study 1: 2.24 ± 3.79 vs 0.37 ± 2.05 ($P=0.0083$) Study 2: 3.47 ± 4.74 vs 1.27 ± 4.23 ($P=0.0083$)</p>
Saleem et al. [16].	R, DB, PC	Desoximetasone 0.25% spray vs vehicle spray applied twice daily	120	28 days	<p><u>PGA ≤ 1 at Day 28</u> 31% vs 5% ($P=0.0003$)</p>

					<p>TLSS \leq1 for erythema, scaling, and plaque elevation at Day 28 39% vs 7% ($P < 0.0001$)</p>
Hoffman and Kircik [17].	OL	Desoximetasone 0.25% spray applied twice daily	15	4 weeks	<p>IGA improvement from baseline of 3 (moderate) Week 1: 7% IGA=0; 13% IGA=1; 80% IGA=2 ($P \leq 0.001$) Week 2: 74% IGA \leq1; 27% IGA=2 ($P \leq 0.001$) Week 4: 100% IGA \leq1 ($P \leq 0.001$)</p> <p>Pruritus at Week 4 from baseline of moderate 40% mild, 60% none ($P < 0.002$)</p> <p>Mean VAS percent change from baseline -56%, -74%, -91% at week 1, 2, and 4, respectively ($P \leq 0.0007$)</p>
Sidgiddi et al. [19].	PIII, R, DB, PC	Betamethasone dipropionate 0.05% spray (n=174) vs betamethasone dipropionate 0.05% lotion (n=90) vs vehicle spray (n=87) applied twice daily	394	29 days	<p>IGA \leq1 or 2-grade reduction at Day 15 19% spray; 18.9% lotion 2.3% vehicle ($P \leq 0.001$ for spray vs vehicle)</p> <p>TSS reduction for erythema, scaling and plaque elevation 12.1% in betamethasone group vs 2.3% in vehicle spray group with $\geq 50\%$ reduction at 4 days ($P = 0.004$) No statistically significance differences at Days 15 and 29 (although no P-values was reported)</p>
Sidgiddi et al. [19].	R, OL, CC	Betamethasone dipropionate 0.05% spray vs betamethasone dipropionate 0.05% lotion twice daily	74	15 or 29 days	<p>Abnormal ACTH stimulation test 15-day group: 20% spray, 22.7% lotion 29-day spray group: 0%</p>
Fowler J [22].	OL	Triamcinolone acetonide 0.2% spray 1-4 times daily	42	28 days	<p>Investigator and Physician Global Assessment Score 32% clear or almost clear at Day 14 (no P-value reported) 89% clear or almost clear at Day 28 (no P-value reported)</p> <p>Physician Assessment of Improvement Score 32% with 25 to 75% improvement or complete clearing at Day 7 (no P-value reported) 64% with 25 to 75% improvement or complete clearing at Day 7 (no P-value reported)</p>

R-randomized; DB-double-blinded; PG-parallel-group; PC-placebo-controlled; ODS-Overall Disease Severity; OL-open-label; O-Observational; TLSS-Target Lesion Severity Scale; TPS-Target Plaque Severity; GAI-Global Assessment of Improvement; PQLQ-12- Patient Quality of Life Questionnaire; ITT-Intent-to-treat; GSS-Global Severity Score; PGA-Physician's Global Assessment; VAS-Visual Analogue Scale; TSS-Total sign score; CC-Comparator-controlled

