Journal of Clinical & Experimental Dermatology Research

Molin et al., J Clin Exp Dermatol Res 2013, 4:3
DOI: 10.4172/2155-9554.1000184

Review Article Open Access

Mometasone Furoate: A Well-Established Topical Corticosteroid now with Improved Galenic Formulations

Molin S[1], Abeck D[2], Guilabert A[3]* and Bellosta M[4]

[1]Department of Dermatology and Allergy, Ludwig Maximilian University, München, Bavaria, Germany
[2]Private Dermatology Munich-Nymphenburg, Germany
[3]Dermatology Department, Hospital de Granollers, Spain
[4]Dermatology Practice, Pavia, Italy

Abstract

Mometasone furoate is an established topical corticosteroid that is frequently used for the treatment of inflammatory skin diseases because it offers a balanced efficacy and safety profile. The type of vehicle of a topical corticosteroid has impact not only on its efficacy but also on the patients' adherence to treatment. Traditional formulations of mometasone furoate might have not properly fulfilled all the ideal features required for its use in topical treatment. Extensive research has recently been performed and new formulations have been developed that will be available shortly. The aim of this review is to give a thorough overview on the substance mometasone furoate and the available clinical data with a special focus on the newly developed galenic formulations.

Keywords: Mometasone furoate; Vehicle; Cream; Emulsion; Scalp psoriasis; Psoriasis; Atopic eczema

Introduction

Topical corticosteroids are widely used to treat inflammatory skin diseases. For instance, they are the recommended first-line therapy in Atopic Dermatitis (AD) according to the European Task Force on AD [1]. Inappropriate use may be related to adverse effects such as skin atrophy or suppression of the Hypothalamic Pituitary Axis (HPA) [2]. Corticosteroid derivatives and formulations have been developed in the last decades with the aim of increasing efficacy and decreasing the incidence of adverse effects. More recently, however, the interest is more focused on improving the vehicles to fulfil patients' preference in order to improve adherence. Adherence to topical therapy is an important issue, particularly in chronic skin diseases, where it is reported to be low (30-50%) [3].

According to the ATC/DDD Index (Anatomical Therapeutic Chemical classification system and Defined Daily Dose), Mometasone Furoate (MF) 0.1% is a high potency corticosteroid. Authorized and marketed in Europe since the early 90´s, it has been widely used by dermatologists due to its potent efficacy and favourable safety profile for the treatment of inflammatory skin disorders [4]. MF is also licensed for the treatment of other clinical conditions such as rhinitis, rhino-sinusitis or nasal polyps.

Beyond designing new active corticosteroid congeners and focusing on the improvement of the benefit/risk ratio, the development of new formulations is also an important challenge. The use of vehicles more adapted to the patients' needs (i.e. less messy and easy to apply) is considered one of the main strategies to tackle the general lack of adherence to topical corticosteroids. Therefore, corticosteroid formulations need to have appropriate cosmetic properties, which not only adequately fit the current state of the patients' skin, but also fulfil their expectations and ameliorate their quality of life. Since traditional vehicles of MF might not have fully matched patients' preferences, new topical formulations have recently been developed to optimize treatment modalities for every patient, skin and clinical situation in order to ensure adherence and improve 'real life' efficacy.

With the present article we want to give an overview of the current state of MF as a valuable and established topical medication, as well as review the data from its new formulations.

Topical Corticosteroids

Topical corticosteroids are a great family of hydrocortisone-derivative compounds with variable anti-inflammatory potency and side-effects profile. Their relative potency should be carefully considered when choosing the formulation for treating individual patients. While the least potent corticosteroids may be sufficient in certain conditions, clinical settings, and for long-term maintenance therapy, the same medication may be ineffective in other conditions (e.g. where hyperkeratosis is present such as in psoriasis, or when treating palms or soles). Due to the vasoconstrictive properties of topical corticosteroids, their relative potencies are measured with the vasoconstrictor assay (VCA) [5]. Based on pharmacodynamic measures, this assay provides objective and quantifiable data reflecting the delivery of the active agent through the skin barrier, its intrinsic activity at the receptor, and the rate of clearance from the site of application [6]. While the VCA is useful in clinical trials, its predictive value on outcomes is reduced in daily clinical practice, where patient adherence also plays a very important role.

Corticosteroid potency is not only influencing therapeutic effectiveness, but also the likelihood of adverse events. All topical corticosteroids theoretically possess the ability of systemic absorption and production of adrenal suppression [7]. The degree of suppression is directly related to potency and penetration, which increases with several factors: application to large surface areas, occlusion, inflamed skin, and higher concentrations.

In the early years following their introduction, topical corticosteroids

***Corresponding author:** Dr. Antonio Guilabert, Unidad de Dermatologia. Hospital de Granollers, Av Francesc Ribas s/n 08402, Granollers, Spain, Tel: 0034 625621527; Email: tonovidal@gmail.com

Received June 05, 2013; **Accepted** September 21, 2013; **Published** September 28, 2013

Citation: Molin S, Abeck D, Guilabert A, Bellosta M (2013) Mometasone Furoate: A Well-Established Topical Corticosteroid now with Improved Galenic Formulations. J Clin Exp Dermatol Res 4: 184. doi:10.4172/2155-9554.1000184

were widely misused, often prescribed for the wrong conditions or in the wrong potencies fostering the so-called corticophobia (fear of corticosteroids) among patients and dermatologists. Nevertheless, specific guidelines can help to implement the safe and effective use of these topical medications [8]. Under appropriate medical supervision, unwanted side effects of topical corticosteroids should not be an issue.

Factors affecting clinical efficacy in topical corticosteroids: potency and adherence to treatment

The relative potency of a corticosteroid molecule can be greatly modified by different factors such as chemical modifications, vehicles, use of bandages, etc. When analyzing relative vasoconstriction, it is relevant to verify whether the experiment refers to the use of occlusion, to a simple solvent vehicle rather than the definitive formulation, or to an open testing procedure.

One way of optimizing penetration is by altering the formulation vehicle. Vehicles designed specifically for certain corticosteroids (taking into consideration their solubility and the rate of release from the vehicle) are more likely to be successful in clinical application [7]. Some vehicles also enhance the penetration and biological activity of the active compound [7]. Important factors are:

- Solubility and rate of release of the therapeutic agent in/from the vehicle
- Ability of the vehicle to hydrate the stratum corneum
- Stability of the active agent in the vehicle
- Chemical and physical interactions of the vehicle and the outermost layer of the epidermis
- The mode of action of the substance itself

Corticosteroids are formulated in different vehicles such an ointments, creams, emulsions, gels, lotions and solutions. In general, the more occlusive and hydrating the vehicle (i.e. ointment), the more penetrating and potent the corticosteroid, but also a larger likelihood of local and systemic side-effects.

In addition to the drug's intrinsic potency and its optimal penetration, treatment adherence is a critical factor influencing the therapeutic effectiveness of topical corticosteroids. Treatment adherence has multiple dimensions, including patients' acceptance, continuation and discontinuation of treatment [9]. The cosmetic properties of the vehicle influence convenience and patient acceptance, therefore determining treatment adherence. If the correct agent but the wrong vehicle is used, the response to therapy may be delayed, inadequate, or in some cases absent [10]. This might be the case in alcoholic solutions, which should be avoided in clinical conditions where drying effects are unwanted. Hence, it is important to consider the clinical condition and the patient's preferences in order to find the most appropriate vehicle for any individual patient [11].

Mometasone Furoate

Chemical structure

Mometasone furoate is the 17-ester of the 16α-methyl of beclometasone with chlorine substituents in the 9α- and 21- position (Figure 1). The development of MF has been the result of scientific efforts aimed to separate the wanted from the unwanted effects of topical corticosteroids [12]. Halogenation of the 9α-position, substitution of the 21-OH by Cl (chlorine) and esterification of the 17-OH with

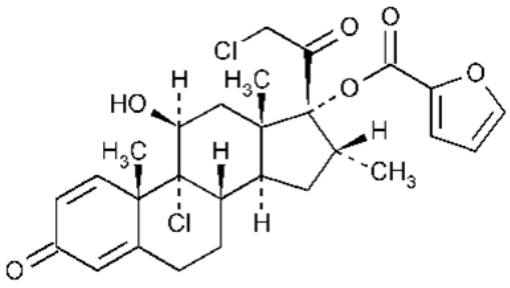

Figure 1: Chemical structure of mometasone furoate.

furoate, considerably increase the binding affinities of mometasone to the corticosteroid receptor. The ester hydrolysis biotransformation reduces the receptor binding during the passage through the skin, therefore mometasone has a lower affinity to dermal than to epidermal cells [13]. All these chemical characteristics lead to improved efficacy but lower incidence of undesirable effects.

Ideally, a topical corticoid should permeate the *stratum corneum* and reach a therapeutic concentration in the skin, but without passing on to the systemic circulation in order to avoid further toxicity [7]. Topical steroids' lipophilicity is closely related to this ability, and can be increased by several ways, including the esterification at the 17 or chlorination at the 21 positions, as it was done in MF [7].

MF has antipruritic, anti-inflammatory and vasoconstrictive properties [14]. Alike the other corticosteroids, the anti-inflammatory efficacy of the complex MF-corticosteroid receptor is mediated by the repression of inflammatory gene transcription either directly (via transrepression) or by activating transcription of anti-inflammatory/repressive factors (transactivation) [15]. According to the ATC/DDD Index, MF 0.1% belongs to the potent (group III) of topical corticosteroids (high potency) [4]. Nevertheless, it is characterized by low atrophogenicity as well as low systemic availability and, consequently, less risk of local adverse events and HPA suppression. The molecule MF is currently well established for the treatment of a variety of inflammatory corticosteroid-responsive dermatoses, such as chronic hand eczema, atopic dermatitis (AD), seborrhoeic dermatitis, and psoriasis [16-19].

Pharmacokinetics and safety profile

The specifically low and well-known rate of systemic side effects of MF is explained by the minimal degree of systemic absorption as was measured in pharmacokinetic studies with different formulations:

Cream [20]: The percutaneous absorption of MF cream 0.1% was evaluated in subjects receiving a single dose of radio-labelled ^{3}H-cream which remained on intact skin for eight hours. Based on the amount of radioactivity excreted in the urine and faeces during the five-day study period, it was demonstrated that only approximately 0.4% of the applied dose was absorbed systemically. The radioactive amount found in plasma and red blood cells remained a few counts above background levels throughout the study.

Ointment [21]: A similar study with radio-labelled ^{3}H-ointment was conducted in volunteers with intact skin. Based on the amounts of radioactivity excreted after an eight-hour application, approximately 0.7% of the applied dose was absorbed systemically without occlusion.

Solution [22]: The occlusive nature of the ointment base leads to a

greater percutaneous absorption of a corticosteroid ointment compared to topical corticosteroids in a cream or solution formulation. Thus, the absorption following application of MF solution 0.1% is expected to be no greater than that of the ointment formulation.

Due to the low percutaneous absorption and rapid hepatic biotransformation, topically applied MF does not show a significant effect on the HPA [23]. The atrophogenic potential and risk of sensitisation of MF are considered to be low [19,24,25]. Not all the available corticosteroids have the same potential to induce skin atrophy. Wach F et al. [26] showed that MF has a lower effect on human keratinocytes and fibloblasts than other corticosteroids in vitro. It has been shown that MF, like tacrolimus, does not affect the expression of collagen mRNAs in human fibroblasts [27].

Clinical studies on mometasone furoate (atopic dermatitis, psoriasis)

MF has been extensively evaluated in several clinical trials (Table 1). They include studies evaluating MF 0.1% (cream, ointment and solution) to assess its efficacy and safety in the treatment of corticosteroid responsive dermatoses (mainly AD and psoriasis) in comparison to vehicle (non-active control) and other corticosteroids (active comparators) in a number of skin conditions. Globally, MF 0.1% was significantly more effective than the vehicle in all the indications studied and, when compared to active drugs, it showed comparable or even significantly better efficacy in the different settings. One proven advantage of MF over other corticoids is that only once daily application is needed to achieve the clinical effect.

Atopic dermatitis: AD (or atopic eczema) is an extremely common disease that has a strong negative impact on the quality of life in affected patients [28]. Topical corticosteroids remain the mainstay of AD treatment [29]. Several clinical trials have been conducted to evaluate MF, both as cream and ointment formulation, in comparison to vehicle and other standard treatments. MF cream and ointment showed significantly superior efficacy than their vehicles, both administered once daily [30,31]. MF cream once daily, compared to other cream corticosteroids administered twice daily, was either significantly more effective in adults and children or comparable in efficacy [32-35]. MF ointment once daily showed comparable efficacy as other ointment comparators administered twice daily [36-38].

Psoriasis: Psoriasis is a chronic inflammatory skin disease with a relapsing and remitting course [39]. The occurrence of psoriasis varies according to age (lower prevalence in children) and geographic region (more frequent in countries more distant from the Equator) [40]. Since their introduction, topical corticosteroids have become a standard treatment of psoriasis [41]. Several clinical trials have evaluated MF in this indication comparing cream and ointment formulations with vehicle and active drugs. MF cream and ointment showed significantly superior efficacy than their vehicles, both administered once daily [42,43]. The efficacy of ointment and cream MF formulations administered once daily, as compared to cream and ointment comparators administered once, twice or three times per day showed comparable or significantly superior results [44-50].

Scalp Psoriasis: About 25% of patients suffering from psoriasis have scalp involvement [51]. Topical treatment options for this skin

Study product	Indication	Comparator	Treatment duration (weeks)	Results vs comparator
MF 0.1 % Cream QD	AD	Vehicle QD	3	Significantly superior [30]
		Hydrocortisone butyrate 0.05 % BID	3	Significantly superior [32]
		Betamethasone valerate0.1 % BID	3	Comparable [35]
	AD pediatrics*	Hydrocortisone valerate0.2 % BID	3	Significantly superior [33]
	AD pediatrics	Hydrocortisone 1.0 % BID	6	Significantly superior [34]
	Psoriasis	Vehicle QD	3	Significantly superior [42]
	Psoriasis	Betamethasone valerate 0.1 % BID	2	Comparable [44]
	Corticosteroid-responsive dermatoses	Betamethasone dipropionate 0.05 % BID		No significant differences [66]
	Chronic eczema	Clobetasol propionate 0.05 % BID	3	Inferior patient satisfaction [67]
MF 0.1 % Ointment QD	AD	Vehicle QD	3	More effective [31]
		Betamethasone valerate 0.1 % BID	3	Comparable [36]
		Hydrocortisone Butyrate 0.1 % BID	3	comparable [37]
	AD pediatrics**	Fluticasone propionate 0.005 % QD	4	Comparable [38]
	Psoriasis	Vehicle QD	3	Significantly superior [43]
		TriamcinoloneacetonideBID	3	Significantly superior [47]
		Fluocinolone Acetonide TID	3	Significantly superior [48]
		Betamethasone dipropionate 0.05 % QD	3	Comparable [45]
		Betamethasone valerate 0.1 % BID	3	Significantly superior [49]
		Hydrocortisone QD	6	Significantly superior [50]
MF 0.1 % Cream and Ointment QD	Psoriasis	Fluocinolone acetonide 0.025 % Cream and Ointment TID	3	Significantly superior (both cream and ointment) [46]
		Triamcinolone acetonide 0.1 % Cream and Ointment BID	3	Significantly superior (ointment) and comparable (cream) [46]
MF 0.1 % Solution QD	Scalp psoriasis	Vehicle QD		Significantly superior [53]
		Betamethasone valerate 0.1 % BID		Slightly superior [54]
		Betamethasone dipropionate 0.05 % QD		Slightly superior [55]
		Triamcinolone acetonide 0.1 % BID	7	Significantly superior [56]

*Patients who failed to previous topical hydrocortisone
**Comparing open and wet wrap dressing (better long-term improvement when using wet wrap dressing)
MF: Mometasone furoate. AD: Atopic dermatitis. QD: Once daily; BID: twice a day; TID: three times per day

Table 1: Study profile of the current mometasone furoate formulations in different skin diseases.

condition need a vehicle easy to administer and to remove from the hairy region. In fact, scalp psoriasis is a critical area for understanding patients' vehicle preference [52]. MF was evaluated in a solution vehicle for the treatment of patients with scalp psoriasis in several clinical studies, showing the superiority of the MF 0.1% solution once daily as compared with its vehicle and active drugs administered once or twice per day [53-56].

Mometasone Furoate in other Skin Diseases

Apart from these main indications, MF has also been evaluated for use in other skin diseases:

Genital lichen sclerosus

Lichen sclerosus (LS) is an inflammatory skin disease characterized by a lymphocytic response that predominantly affects the genital region and can be associated with several other autoimmune diseases [57]. Its pathogenesis is not yet fully understood, but there is increasing evidence suggesting underlying autoimmune mechanisms [57]. Topical steroids have become the mainstay of treatment for this condition where MF has shown effectiveness [57]. Cattaneo et al. [58] evaluated the efficacy and safety of MF in the treatment of vulvar LS. All 31 female patients showed a significant improvement and a decrease in symptoms, with nearly all subjects reaching complete symptomatic remission. Adherence was excellent, and no side effects were present. Clinical evidence in males is limited. A systematic review by Chi et al. [59] showed a significant improvement in the investigator-rated change in clinical grade of phimosis with MF 0.05% compared to placebo.

Vitiligo

Vitiligo is a skin disease characterized by depigmentation of the skin corresponding to a substantial loss of functioning epidermal and hair follicle melanocytes [60]. This skin condition often leads to substantial cosmetic disfigurement, particularly in patients with dark skin-types. According to the European guidelines for the management of this skin condition, topical corticosteroids lead to the best results on sun-exposed areas, dark skin and in new lesions [60]. MF is considered effective and largely devoid of the well-known local side-effects of potent and very potent corticosteroids. Recent studies have also shown that MF is effective and safe in the treatment of childhood vitiligo [61,62].

Contact dermatitis

Contact dermatitis or contact eczema describes a reaction pattern of the skin in response to external stimuli (i.e. irritant substances or allergens) [63]. Its clinical presentation very often includes a location of the skin lesions on the hands, especially in certain occupational groups [64]. Irritant contact dermatitis is a non-specific inflammatory disease, which involves in its pathogenesis the activation of innate immunity, whereas allergic contact dermatitis predominantly is a T-cell-mediated disease [65,66]. Topical corticosteroids are widely used for the treatment of contact dermatitis, as mentioned in the guidelines for the management of the disease entity from the British Association of Dermatologists [17]. The effectiveness of long-term intermittent use of MF in chronic hand eczema was demonstrated in an open prospective randomized trial [16].

Currently Available Formulations of Mometasone Furoate

MF currently is formulated in vehicles such as ointments, cream and solutions. Cosmetic properties of the vehicles and their ease of use are also important issues in the use of topical medications. The available mometasone cream (original product and generics) is a fatty cream with less than 5% of water, whereas the available solutions are alcoholic formulations with the risk of drying and stinging as potential side effects when applied to the scalp. In the current context of generally low adherence to topical corticosteroids, vehicles of topical drugs should be convenient in order to fulfil the patients' expectations of coMFort in order to improve their treatment adherence. A regularity of application is crucial for patients suffering from chronic skin conditions. The patients' adherence to treatment is improved if convenient and user-friendly topical formulations are provided. A medicinal product that is not accepted for cosmetic properties significantly impairs the success of treatment.

Despite the proven efficacy and safety of the available MF, there still seem to be some unmet needs regarding to its formulations. For this reason new, more patient preference-oriented vehicles have recently been developed.

New formulations of mometasone furoate

Considering all the aforementioned, new pharmaceutical formulations have been developed and studied in order to broaden the clinical spectrum of MF use and ensure adherence. This new range of MF formulations includes a 33% water content o/w (oil in water) cream and a 36% water content emulsion. Both formulations will be shortly available commercially.

In the clinical trials, VCA was used for assessing in vivo bioavailability, and the psoriasis plaque test (PPT) was used for the assessment of the antipsoriatic action of the new MF formulations.

Cream (33% Water Content)

The new cream formulation is a white, semi-solid topical product on the base of an oil in water emulsion (33% water) which has shown a similar efficacy and tolerability compared to the previous mometasone cream formulation, but with the cosmetic properties of a lighter cream [12]. it has been evaluated in clinical phase I and II studies conducted to assess bioavailability, efficacy, tolerability as well as quality of life (Qol) and patient satisfaction in intact skin, psoriasis and AD [12,67] (Table 2).

The bioavailability, as measured by VCA, was studied in a single-center, randomized, observer-blind phase I study comparing the new formulation with its vehicle alone, the previous mometasone formulation (mometasone comparator, less than 5% water content) and class II & IV corticosteroid comparators with lower or higher potency [12]. Each preparation was used in a single application for 6 hours. The chromametric measurements demonstrated similar mean area under curve (AUC) values for the new MF cream, the mometasone comparator and clobetasol cream (higher-strength comparator), whereas a lower mean AUC value was noted for triamcinolone cream (lower-strength comparator). The clinical assessment reproduced the chromametric results: the vasoconstriction achieved with mometasone cream with 33% water content was comparable to the effect seen for the mometasone comparator and clobetasol cream and superior to the effect seen for triamcinolone cream. In the test fields treated with the vehicle cream, the majority of the subjects showed no vasoconstriction.

The tolerability of the new MF cream was evaluated in one single-centre, randomized, double-blind phase I study in healthy skin, compared to its vehicle alone and two controls: negative (purified water)

Study product	Indication	Objective	N	Admin. frequency	Comparator	Results vs comparator
MF 0.1 % O/W 33 % water content Cream	**Healthy Skin** [12]	Bioavailability (VCA)	31	Single application	Vehicle	Superiority
					Class II lower strength	Non-inferiority
					Mometasone comparator	Non-inferiority
					Class IV higher strength	Non-inferiority (not confirmed)
		Tolerability	33	QD 21 days	Vehicle	
					Purified water (negative control)	Higher irritation score
					SDS (positive control)	Lower irritation score
	Plaque Psoriasis [12]	Efficacy	22	QD 12 days	Vehicle	Superiority
					Mometasone comparator	Comparable
	Atopic Dermatitis [67]	Efficacy QoL Patient satisfaction	20	QD 2 weeks	Mometasone comparator	Comparable efficacy Better cosmetic traits and patient satisfaction
MF 0.1 % 36 % water content Emulsion	**Plaque Psoriasis** [68]	Efficacy and Tolerability	24	QD 12 days	Placebo emulsion	Superiority
					Reference product cream	Comparable
	Chronic Scalp Psoriasis [69]	Efficacy	70	QD 3 weeks	Reference product solution	Non-inferiority

QD: Once daily; Mometasone comparator: the originator mometasone furoate 0.1 % cream formulation (water content <5 %); Class II: 1 mg/g of triamcinolone acetonide (water content 72.2 %); Class IV: 0.5 mg/ml of clobetasol-17-propionate (water content 30.8 %); SDS: 0.3 % sodium dodecyl sulfate in water

Table 2: Summary of clinical trials evaluating the new mometasone formulations O/W cream (33 % water content) and emulsion (36 % water content).

and positive (sodium dodecyl sulfate in water, SDS) [12]. The results showed a mild to moderate irritative potential. A higher irritation score was measured comparing the active compound and the vehicle with the negative control but a lower irritation score was seen compared to the positive control (SDS).

A phase II study (single-centre, randomized and observer-blind) evaluated the efficacy of the new MF formulation (in terms of non-inferiority) compared to its vehicle and reference mometasone cream in psoriatic patients [12]. The PPT showed a strong positive effect of the new mometasone cream. The antipsoriatic effect was comparable to the effect seen with the reference MF cream and, as expected, no relevant effect was noted for the vehicle.

Another single-centre, randomized, double-blind phase II study evaluated the efficacy, cosmetic properties and patients' acceptance of the new mometasone cream compared with the traditional more fatty cream in patients with mild to moderate AD [67]. Patients' satisfaction was assessed by a questionnaire on cosmetic properties and contentment, and health-related Qol was recorded using the dermatology life quality index (DLQI). The overall assessment of the preparations was based on the clinical tool scoring atopic dermatitis (Scorad), the stratum corneum hydration, the patients' statements on skin penetration, and the answers in the questionnaires on cosmetic properties and on quality of life. The results confirmed the bioequivalence and the comparable clinical efficacy of both preparations. However, the patient-reported preference showed a better acceptance of the new MF cream since 75% of patients stated that they preferred the new developed cream over the classical mometasone. In addition, the new formulation was found to be more convenient for daily application by patients (70% vs 40%) and to permeate more quickly than the reference mometasone (50% vs 10%). These characteristics may lead to an improved treatment adherence and better clinical results in real life clinical scenario[6].

Emulsion (36% Water Content)

This new MF formulation is a unique, fluid, 36% water content emulsion with no similar vehicle currently available in the market. Generally speaking the main differences between an emulsion and a solution is that the emulsion is more emollient in nature (in fact it is an o/w vehicle) and does not have alcohol in its formulation. Due to its very fluid properties, this product can e.g. be easily applied in hairy sites like the scalp. It does not have alcoholic content like the available mometasone solution, which implies the capability of being used where alcohol-based formulations are stinging or irritant. Two phase II studies have been carried out to evaluate its efficacy and tolerability in plaque and scalp psoriasis (Table 2).

In plaque psoriasis, the new formulation was compared with its vehicle and the reference product cream (water content <5%) in a single-centre, randomized, double-blind phase II study to assess efficacy and tolerability [68]. The effect of the treatments on the PPT was evaluated both clinically (visually and by palpating the respective test area) by the investigator and by 22 mhz ultrasound on days 1 (baseline), 5 and 12. Assessed clinically, the emulsion was superior to placebo on study days 5 and 12. Both the emulsion and the reference cream produced similar reductions in plaque thickness by study day 5, which was even more pronounced on day 12. This new, very fluid emulsion was therefore found to be as effective as a fatty cream in the treatment of body psoriasis.

A multi-centre, randomized, observer-blind phase IIb study assessed the efficacy of the new formulation compared to the reference mometasone solution in scalp psoriasis [69]. The non-inferiority of the new formulation was proved compared to the reference product based on clinical total sign score (TSS) assessments. The new mometasone emulsion was effective, well-tolerated and accepted by patients in the treatment of scalp psoriasis. It was shown to be non-inferior to the alcoholic reference MF solution in the primary outcomes of the study. These results make the new formulation a promising option for the treatment of scalp psoriasis.

The results of the clinical trials demonstrate the efficacy and safety of the new MF formulations compared to those currently available. Appropriate efficacy *plus* adequate safety and tolerability profile *plus* improved cosmetic properties and patients' acceptance will foster treatment success [6].

Conclusions

A careful choice of the proper formulation is crucial for the success of the treatment in topical corticosteroids. MF is a well-studied corticosteroid with high potency but low rate of adverse effects.

Traditionally available formulations for MF might not be suitable for all clinical skin conditions and patients' needs. Therefore, new formulations have been developed:

New cream with improved cosmetic properties

Due to its increased patients' preference, this cream seems ideal for the treatment of any inflammatory skin condition that requires the potency of MF. Due to the evanescent and fluid nature of this cream, patients with large areas affected by inflammation and dry skin are good candidates for this product**.**

Emulsion

Due to its efficacy in body and scalp psoriasis, together with its good cosmetic acceptance and tolerability, this product can be used, among other indications, as a solely once daily application for psoriasis affecting both the body and scalp. Treating all sites with just one daily application may be extremely useful for adherence purposes.

It has been shown that the new range of MF products is equivalent to the original products, as no clinical differences were found in the complete set of clinical trials designed for the new improved formulations. Nevertheless, the daily clinical practice is not a controlled environment. The better cosmetic acceptability and patients´ preference of the new range compared to the original formulations might lead to greater treatment adherence rates and treatment success in chronic inflammatory conditions (ad and psoriasis) in a daily clinical setting. It is important to highlight that available classical generics of mometasone do not produce cosmetic improvement as they are copies and based in the original range of products. Conversely, improved formulations, like new range of mometasone, offer added value to patients.

To sum up, MF fulfils all demands to be classified as a topical corticosteroid with a high benefit/risk ratio. The newly expanded range of 0.1% MF formulations enables to choose the optimal vehicle for a successful treatment of the individual patient, leading to increased treatment adherence and good clinical results.

Conflict of Interest

SM has received honoraria as speaker and consultant and received a travel grant from almirall.

DA received consulting fees and / or honoraria from almirall, German Academy for Development Promotion and Health of the Child and Adolescent ev, GlaxoSmithKline GmbH, Govi publisher, Infectopharm Gmbh, l'Oreal Germany GmbH, MSDS sharp & dohme, nestlé germany, pierre fabre Germany, Taurus pharma Gmbh

AG received honoraria for medical advisory tasks from Almirall

MB received honoraria for medical advisory tasks from Almirall

References

1. Darsow U, Lubbe J, Taieb A, Seidenari S, Wollenberg A, et al. (2005) Position paper on diagnosis and treatment of atopic dermatitis. J Eur Acad Dermatol Venereol 19: 286-295.
2. Castela E, Archier E, Devaux S, Gallini A, Aractingi S, et al. (2012) Topical corticosteroids in plaque psoriasis: a systematic review of risk of adrenal axis suppression and skin atrophy. J Eur Acad Dermatol Venereol 26 Suppl 3: 47-51.
3. Tan X, Feldman SR, Chang J, Balkrishnan R (2012) Topical drug delivery systems in dermatology: a review of patient adherence issues. Expert Opin Drug Deliv 9: 1263-1271.
4. ATC/WHO classification. [updated Dec 20, 2012]; Available from: http://www.whocc.no/atc_ddd_index/?code=D07AC13.
5. Stoughton RB (1972) Bioassay system for formulations of topically applied glucocorticosteroids. Arch Dermatol 106: 825-827.
6. Kirkland R, Pearce DJ, Balkrishnan R, Feldman SR (2006) Critical factors determining the potency of topical corticosteroids. J Dermatolog Treat 17: 133-135.
7. Anigbogu AN, Maibach HI (2005) Topical Corticosteroid Therapy. In: Millikan LE, editor. Drug Therapy in dermatology. New Orleans, Louisiana: Marcel Dekker, Inc.; 2005.
8. Drake LA, Dinehart SM, Farmer ER, Goltz RW, Graham GF, et al. (1996) Guidelines of care for the use of topical glucocorticosteroids. American Academy of Dermatology. J Am Acad Dermatol 35: 615-619.
9. Feldman SR (2009) Expert Column: Topical Corticosteroids in the Treatment of Psoriasis.
10. Goldstein BG, Goldstein AO. General principles of dermatologic therapy and topical corticosteroid use.
11. Carroll CL, Feldman SR, Camacho FT, Manuel JC, Balkrishnan R (2004) Adherence to topical therapy decreases during the course of an 8-week psoriasis clinical trial: commonly used methods of measuring adherence to topical therapy overestimate actual use. J Am Acad Dermatol 51: 212-216.
12. Korting HC, Schöllmann C, Willers C, Wigger-Alberti W (2012) Bioavailability, antipsoriatic efficacy and tolerability of a new light cream with mometasone furoate 0.1%. Skin Pharmacol Physiol 25: 133-141.
13. Schäfer-Korting M, Gysler A (1992) Topical Glucocorticoids with Improved Benefit/Risk Ratio: do they exist? J Am Acad Dermatol 27: 87-92.
14. Shaikh S, Muneera MS, Thusleem OA, Tahir M, Kondaguli AV (2009) A simple RP-HPLC method for the simultaneous quantitation of chlorocresol, mometasone furoate, and fusidic acid in creams. J Chromatogr Sci 47: 178-183.
15. King EM, Chivers JE, Rider CF, Minnich A, Giembycz MA, et al. (2013) Glucocorticoid repression of inflammatory gene expression shows differential responsiveness by transactivation- and transrepression-dependent mechanisms. PLoS One 8: e53936.
16. Veien NK, Olholm Larsen P, Thestrup-Pedersen K, Schou G (1999) Long-term, intermittent treatment of chronic hand eczema with mometasone furoate. Br J Dermatol 140: 882-886.
17. Bourke J, Coulson I, English J; British Association of Dermatologists Therapy Guidelines and Audit Subcommittee (2009) Guidelines for the management of contact dermatitis: an update. Br J Dermatol 160: 946-954.
18. Faergemann J, Christensen O, Sjövall P, Johnsson A, Hersle K, et al. (2000) An open study of efficacy and safety of long-term treatment with mometasone furoate fatty cream in the treatment of adult patients with atopic dermatitis. J Eur Acad Dermatol Venereol 14: 393-396.
19. Prakash A, Benfield P (1998) Topical mometasone. A review of its pharmacological properties and therapeutic use in the treatment of dermatological disorders. Drugs 55: 145-163.
20. Cohn A (1988) Percutaneous Absorption of 3H-mometasone Furoate (3H-SCH 32088) in Male Volunteers Following Topical Application of a 0.1% Cream Formulation (C87-065-01). Mometasone Furoate Cream 01% Health Registration Dossier: Schering International 1988.
21. Nagabhushan N (1988) Percutaneous Absorption of 3H-SCH 32088 in Male Volunteers, (C84-103). Mometasone Furoate Ointment 0.1% Health Registration Dossier: Schering International 1988.
22. Elocom® (2011) (Mometasone Furoate 0.1 % Cream, Ointment and Lotion) Product Monograph.
23. Hughes J, Rustin M (1997) Corticosteroids. Clin Dermatol 15: 715-721.
24. Kerscher MJ, Hart H, Korting HC, Stalleicken D (1995) In vivo assessment of the atrophogenic potency of mometasone furoate, a newly developed chlorinated potent topical glucocorticoid as compared to other topical glucocorticoids old and new. Int J Clin Pharmacol Ther 33: 187-189.
25. Hoffmann K, Auer T, Stücker M, Hoffmann A, Altmeyer P (1998) Comparison of skin atrophy and vasoconstriction due to mometasone furoate, methylprednisolone and hydrocortisone. J Eur Acad Dermatol Venereol 10: 137-142.
26. Wach F, Bosserhoff A, Kurzidym U, Nowok K, Landthaler M, et al. (1998)

Effects of mometasone furoate on human keratinocytes and fibroblasts in vitro. Skin Pharmacol Appl Skin Physiol 11: 43-51.

27. Averbeck M, Gebhardt C, Anderegg U, Simon JC (2010) Suppression of hyaluronan synthase 2 expression reflects the atrophogenic potential of glucocorticoids. Exp Dermatol 19: 757-759.

28. Callen J, Chamlin S, Eichenfield LF, Ellis C, Girardi M, et al. (2007) A systematic review of the safety of topical therapies for atopic dermatitis. Br J Dermatol 156: 203-221.

29. Ring J, Alomar A, Bieber T, Deleuran M, Fink-Wagner A, et al. (2012) Guidelines for treatment of atopic eczema (atopic dermatitis) part I. J Eur Acad Dermatol Venereol 26: 1045-1060.

30. McCormick GE (1987) Double-blind Parallel-group, Cooperative Efficacy and Safety Study in Atopic Dermatitis Comparing Once Daily Applications of SCH 32088 Cream 0.1% and Its Vehicle, (C84-076). Mometasone Furoate Cream 01% Health Registration Dossier: Schering International.

31. Rex I (1987). Double-blind Cooperative Efficacy and Safety Study of SCH 32088 Ointment in Psoriasis Comparing 0.1% and Its Vehicle QD in Atopic Dermatitis, (C84-065). Mometasone Furoate Ointment 01%, Health Registration Dossier: Schering International.

32. Gip L (1988) Single-blind Efficacy and Safety Study in Atopic and Seborrheic Dermatitis Patients Comparing Once Daily Applications of Mometasone Furoate Cream 0.1% and Twice Daily Applications of LOCOID® Cream 0.1% (I86-313). Mometasone Furoate Cream 01%, Health Registration Dossier: Schering International.

33. Lebwohl M (1999) A comparison of once-daily application of mometasone furoate 0.1% cream compared with twice-daily hydrocortisone valerate 0.2% cream in pediatric atopic dermatitis patients who failed to respond to hydrocortisone: mometasone furoate study group. Int J Dermatol 38: 604-606.

34. Vernon HJ, Lane AT, Weston W (1991) Comparison of mometasone furoate 0.1% cream and hydrocortisone 1.0% cream in the treatment of childhood atopic dermatitis. J Am Acad Dermatol 24: 603-607.

35. Dvorkin D (1988) Single-blind Efficacy and Safety Study in Atopic Dermatitis Comparing Once Daily Applications of Mometasone (SCH 32088) Cream 0.1% and Twice Daily Applications of Betamethasone Valerate Cream 0.1% (C84-084). Mometasone Furoate Cream 01% Health Registration Dossier: Schering International 1988.

36. Hanifin J (1987) Bilateral Paired Comparison Study of SCH 32088 Ointment 0.1% and Valisone Ointment 0.1% in Atopic Dermatitis, (C84-020). Mometasone Furoate Ointment 01% Health Registration Dossier: Schering International 1987.

37. Cerio R (1988) MacDonald DM. Single-blind Efficacy and Safety Study in Atopic Dermatitis Patients Comparing Once Daily Applications of Mometasone Furoate Ointment 0.1% and Twice Daily Applications of LOCOID® Ointment 0.1%, (I86-309-01,02). Mometasone Furoate Ointment 01% Health Registration Dossier: Schering International 1988.

38. Pei AY, Chan HH, Ho KM (2001) The effectiveness of wet wrap dressings using 0.1% mometasone furoate and 0.005% fluticasone proprionate ointments in the treatment of moderate to severe atopic dermatitis in children. Pediatr Dermatol 18: 343-348.

39. Pathirana D, Ormerod AD, Saiag P, Smith C, Spuls PI, et al. (2009) European S3-guidelines on the systemic treatment of psoriasis vulgaris. J Eur Acad Dermatol Venereol 23 Suppl 2:1-70.

40. Parisi R, Symmons DP, Griffiths CE, Ashcroft DM; Identification and Management of Psoriasis and Associated ComorbidiTy (IMPACT) project team (2013) Global epidemiology of psoriasis: a systematic review of incidence and prevalence. J Invest Dermatol 133: 377-385.

41. Uva L, Miguel D, Pinheiro C, Antunes J, Cruz D, et al. (2012) Mechanisms of action of topical corticosteroids in psoriasis. Int J Endocrinol 2012: 561018.

42. Katz HI (1987) Double-blind, Parallel-group, Cooperative Efficacy and Safety Study in Psoriasis Comparing Once Daily Applications of SCH 32088 Cream 0.1% and Its Vehicle, (C84-075). Mometasone Furoate Cream 01% Health Registration Dossier: Schering International 1987.

43. Kanof N (1987) Double-blind Cooperative Efficacy and Safety Study of SCH 32088 Ointment 0.1% QD and Its Vehicle QD in Psoriasis, (C84-055). Mometasone Furoate Ointment 01% Health Registration Dossier: Schering International 1987.

44. Cornell RC (1987) Bilateral Comparison Study of SCH 32088 Creams 0.1% and Valisone Cream 0.1% in Psoriasis, (C85-008). Mometasone Furoate Cream 01% Health Registration Dossier: Schering International 1987.

45. Daniel J (1988). Single-blind Efficacy and Safety Study in Psoriasis Patients Comparing Once Daily Applications of Mometasone Furoate Ointment 0.1 and Diprosone Ointment 0.05%, (I86-211-01, 02). Mometasone Furoate Ointment 01% Health Registration Dossier: Schering International 1988.

46. Medansky RS, Bressinck R, Cole GW, Deeken JH, Ellis CN, et al. (1988) Mometasone furoate ointment and cream 0.1 percent in treatment of psoriasis: comparison with ointment and cream formulations of fluocinolone acetonide 0.025 percent and triamcinolone acetonide 0.1 percent. Cutis 42: 480-485.

47. Liebsohn E (1987). Single-blind Cooperative Efficacy and Safety Study of SCH 32088 Ointment 0.1% QD and Kenalog Ointment 0.1% BID in Psoriasis, (C84-043). Mometasone Furoate Ointment 01% Health Registration Dossier: Schering International 1987.

48. Lasser A (1987) Single-blind Cooperative Efficacy and Safety Study of SCH 32088 Ointment 0.1% QD and SYNALAR Ointment 0.025% TID in Psoriasis, (C84-047). Mometasone Furoate Ointment 01% Health Registration Dossier: Schering International 1987.

49. Rosenthal D (1988) Single-blind Efficacy and Safety Study in Psoriasis Patients Comparing Once Daily Applications of Mometasone Furoate Ointment 0.1% and Twice Daily Applications of Betnovate® Ointment 0.1%, (I86-308-01, 02). Mometasone Furoate Ointment 01% Health Registration Dossier: Schering International 1988.

50. Katz HI, Prawer SE, Watson MJ, Scull TA, Peets EA (1989) Mometasone furoate ointment 0.1% vs. hydrocortisone ointment 1.0% in psoriasis. Atrophogenic potential. Int J Dermatol 28: 342-344.

51. Rossi A, Pranteda G, Iorio A, Mari E, Milani M (2012) Efficacy of Iralfaris shampoo in the treatment of scalp psoriasis: a videodermoscopy evaluation prospective study in 70 patients. G Ital Dermatol Venereol 147: 625-630.

52. Feldman SR, Housman TS (2003) Patient's vehicle preference for corticosteroid treatments of scalp psoriasis. Am J Clin Dermatol 4: 221-224.

53. Menter MA (1988) Double-blind Efficacy and Safety Study in Scalp Psoriasis Comparing Once Daily Applications of Mometasone Furoate Lotion 0.1% and Its Vehicle, (C86-018-01, 02, 03, 04, 05). Mometasone Furoate Lotion 01% Health Registration Dossier: Schering International 1988.

54. Wong E (1988) Single-blind Efficacy and Safety Study in Scalp Psoriasis Patients Comparing Once Daily Applications of Mometasone Furoate Lotion 0.1% and Twice Daily Applications of BETNOVATE Lotion 0.1%, (I86-312-01, 02, I87-200-01,02). Mometasone Furoate Lotion 01% Health Registration Dossier: Schering International 1988.

55. Chevrant-Breton J (1988) Double-blind Efficacy and Safety Study in Scalp Psoriasis Patients Comparing Once Daily Applications of Mometasone Furoate Lotion 0.1% and DIPROSONE Lotion 0.05%, (I86-217-01, 02). Mometasone Furoate Lotion 01% Health Registration Dossier: Schering International 1988.

56. Swinehart JM, Barkoff JR, Dvorkin D, Fisher G, Peets E (1989) Mometasone furoate lotion once daily versus triamcinolone acetonide lotion twice daily in psoriasis. Int J Dermatol 28: 680-681.

57. Neill SM, Lewis FM, Tatnall FM, Cox NH; British Association of Dermatologists (2010) British Association of Dermatologists' guidelines for the management of lichen sclerosus 2010. Br J Dermatol 163: 672-682.

58. Cattaneo A, De Magnis A, Botti E, Sonni L, Carli P, et al. (2003) Topical mometasone furoate for vulvar lichen sclerosus. J Reprod Med 48: 444-448.

59. Chi CC, Kirtschig G, Baldo M, Brackenbury F, Lewis F, et al. (2011) Topical interventions for genital lichen sclerosus. Cochrane Database Syst Rev : CD008240.

60. Taieb A, Alomar A, Böhm M, Dell'anna ML, De Pase A, et al. (2013) Guidelines for the management of vitiligo: the European Dermatology Forum consensus. Br J Dermatol 168: 5-19.

61. Masuria BL, Batra A, Kothiwala RK, Khuller R, Singhi MK (1999) Topical mometasone furoate for the treatment of childhood vltiligo. Indian J Dermatol Venereol Leprol 65: 219-221.

62. Köse O, Arca E, Kurumlu Z (2010) Mometasone cream versus pimecrolimus cream for the treatment of childhood localized vitiligo. J Dermatolog Treat 21: 133-139.

63. Statescu L, Branisteanu D, Dobre C, Solovastru LG, Vasilca A, et al. (2011) Contact dermatitis - epidemiological study. Maedica (Buchar) 6: 277-281.

64. Goh CL (1989) An epidemiological comparison between occupational and non-occupational hand eczema. Br J Dermatol 120: 77-82.

65. Cavani A, De Pità O, Girolomoni G (2007) New aspects of the molecular basis of contact allergy. Curr Opin Allergy Clin Immunol 7: 404-408.

66. Nosbaum A, Vocanson M, Rozieres A, Hennino A, Nicolas JF (2009) Allergic and irritant contact dermatitis. Eur J Dermatol 19: 325-332.

67. Ruzicka T, Willers C, Wigger-Alberti W (2012) Efficacy and patient-reported outcomes of a new mometasone cream treating atopic eczema. Skin Pharmacol Physiol 25: 305-312.

68. Wilhelm D (2010) A 12 day placebo and reference-controlled, double-blind, single center, randomized, phase II clinical study with an intraindividual comparison, investigating the anti-psoriatic efficacy and the tolerability of LAS41002 lotion in a psoriasis plaque test. Clinical Study Report.

69. (2010) Randomized, observer-blind, multi-center, reference-controlled phase IIb study to evaluate the efficacy of topically applied LAS41002 lotion in the treatment of scalp psoriasis. Clinical Study Report.