ORIGINAL ARTICLE

Quality of life and patient-perceived symptoms in patients with psoriasis undergoing proactive or reactive management with the fixed-dose combination Cal/BD foam: A *post-hoc* analysis of PSO-LONG

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Abstract

Background Psoriasis has important physical and psychosocial effects that extend beyond the skin. Understanding the impact of treatment on health-related quality of life (HRQoL) and patient-perceived symptom severity in psoriasis is key to clinical decision-making.

Objectives This *post hoc* analysis of the PSO-LONG trial data assessed the impact of long-term proactive or reactive management with fixed-dose combination calcipotriene 50 μg/g and betamethasone dipropionate 0.5 mg/g (Cal/BD) foam on patient-reported outcomes (PROs) in patients with *psoriasis vulgaris*.

Methods Five hundred and twenty-one patients from the Phase 3, randomized, double-blind PSO-LONG trial were included. An initial 4-week, open-label phase of fixed-dose combination Cal/BD foam once daily (QD) was followed by a 52-week maintenance phase, at the start of which patients were randomized to a proactive management arm (Cal/BD foam twice weekly) or reactive management arm (vehicle foam twice weekly). Patient-perceived symptom severity and HRQoL were assessed using the Psoriasis Symptom Inventory (PSI), the Dermatology Life Quality Index (DLQI) and the EuroQol-5D for psoriasis (EQ-5D-5L-PSO).

Results Statistically and clinically significant improvements were observed across all PRO measures. The mean difference (standard deviation) from baseline to Week 4 was −8.97 (6.18) for PSI, −6.02 (5.46) for DLQI and 0.11 (0.15) for EQ-5D-5L-PSO scores. During maintenance, patients receiving reactive management had significantly higher DLQI (15% [$p = 0.007$]) and PSI (15% [$p = 0.0128$]) and a numerically lower EQ-5D-5L-PSO mean area under the curve score than patients receiving proactive management (1% [$p = 0.0842$]).

Conclusions Cal/BD foam significantly improved DLQI, EQ-5D-5L-PSO and PSI scores during the open-label and maintenance phases. Patients assigned to proactive management had significantly better DLQI and PSI scores and numerically better EQ-5D-5L-PSO versus reactive management. Additionally, baseline flare was associated with worse PROs than the start of a relapse, and patients starting a relapse also had worse PROs than patients in remission.

Keywords: betamethasone dipropionate, calcipotriol, psoriasis, topical administration.
Received: 25 June 2021; Accepted: 13 August 2021

Clinical trial registration: NCT02899962

Conflict of interest

Ahmad Jalili has been a consultant and advisor and/or received speaking fees and/or grants and/or served as an investigator in clinical trials for the following companies: AbbVie, Almirall, Amgen, Boehringer Ingelheim, BMS, Celgene, Eli Lilly, Galderma, GSK, LEO Pharma, Janssen, MSD, Novartis, Sanofi and UCB. Piergiacomo Calzavara-Pinton has served as an advisory board member or lectured for Galderma, Almirall, LEO Pharma, Sanofi, Meda and AbbVie. Leon Kircik has been a consultant and advisor and/or received speaking fees and/or grants and/or served as an investigator in clinical trials for the following companies: Abbott Laboratories, Abbvie, Allergan, Almirall, Amgen, Arcutis, Biogen-Idec, BMS, Boehringer-Ingleheim, Breckinridge Pharma, Celgene, Centocor, Cellceutix, Cipher, Combinatrix, Connetics Corporation, Coria, Dermavant, Dermira, Dow Pharmaceutical Sciences, Dr. Reddy's Lab, Eli Lilly, Galderma, Genentech, GlaxoSmithKline PLC, Idera, Johnson & Johnson, LEO Pharma, Maruho, Merck, Medicis Pharmaceutical Corp., Novartis AG, Noven Pharmaceuticals, Nucryst Pharmaceuticals Corp, Obagi, Onset, OrthoNeutrogena, Promius, PharmaDerm, Pfizer, Serono (Merck Serono International SA), Stiefel Laboratories Inc, Sun Pharma, Taro, UCB Valeant Pharmaceuticals Intl and XenoPort. Dominique Lons-Danic has been a consultant for and/or received speaking fees or grants from: Novartis, Lilly, AbbVie, LEO Pharma, Janssen and Sanofi. Andrew Pink has served as an advisor, steering group member and/or lectured for: AbbVie, Almirall, LEO Pharma, Eli Lilly, Sanofi, Novartis and La Roche Posay. Stephen Tyring has served as an investigator for LEO Pharma. Pablo de la Cueva has been a consultant and advisor and/or received speaking fees and/or grants and/or served as an investigator in clinical trials for the following companies: AbbVie, Almirall, Astellas, Biogen, Boehringer Ingelheim, Celgene, Janssen, LEO Pharma, Eli Lilly, MSD, Novartis, Pfizer, Roche, Sanofi and UCB. Melinda Gooderham has been an investigator, speaker and/or advisor for AbbVie, Amgen, Akros, Arcutis, Boehringer Ingelheim, BMS, Celgene, Dermira, Eli Lilly, Galderma, GSK, Incyte, Janssen, Kyowa Kirin, LEO Pharma, MedImmune, Novartis, Pfizer, Regeneron, Roche, Sanofi Genzyme, Sun Pharma, UCB and Valeant. Siegfried Segaert has been a paid speaker or consultant for AbbVie, Almirall, Amgen, Biogen, Boehringer Ingelheim, Celgene, Galderma, Glenmark, Janssen, LEO Pharma, Eli Lilly, Merck Serono, MSD, Novartis, Pierre Fabre, Pfizer, Roche, Sun Pharma and UCB. Nanna Nyholm Jensen, Henrik Thoning and Bibi Petersen are employees at LEO Pharma. Diamant Thaçi has been a consultant and advisor and/or received speaking fees and/or grants and/or served as an investigator in clinical trials for the following companies: AbbVie, Almirall, Amgen, Bioskin, Boehringer Ingelheim, BMS, Celgene, Dermira, Dignity, Eli Lilly, Galapagos, Galderma, GSK, LEO Pharma, Janssen, MSD, Morphosis, Novartis, Pfizer, Regeneron, Roche, Sandoz, Sanofi and UCB.

Funding sources

This work was sponsored by LEO Pharma.

Introduction

Psoriasis is a chronic, immune-mediated disease, with primarily skin and joint symptoms.[1,2] The morphology, localization and severity of lesions in psoriasis can be highly variable.[3] Various genetic, environmental and immunological factors have been proposed as potential contributors to the pathophysiology of this disease.[3] Individuals with psoriasis have also been shown to have an elevated risk of cardiovascular disease, metabolic syndrome and diabetes, compared with the general population.[4]

Globally, the prevalence of psoriasis has been reported to vary between 0.09% and 11.43%, which corresponds to approximately 125 million affected people.[5,6] Despite ongoing efforts to improve the management of this condition, the burden of disease has been increasing steadily over the past decades.[7] Collectively, this renders psoriasis a significant health issue worldwide.

Psoriasis can significantly influence a person's quality of life (QoL) and cause social stigmatization, physical disability and emotional distress.[8] Moreover, the impact of psoriasis on QoL is similar to that in patients with other chronic conditions such as cardiovascular disease, diabetes, end-stage renal disease, liver disease and cancer.[9] Skin symptoms of psoriasis including scaling, itch and pain can significantly affect physical well-being and limit daily activities, social contacts and (skin-exposing) activities, and work.[10] Psoriasis has a greater psychological burden than any other dermatological condition and has been associated with impaired emotional functioning, a negative body and self-image, depression, anxiety and suicide risk more than any other skin condition.[10,11] Other factors may also be attributable to the low QoL in psoriasis patients, including the chronic and recurring nature of the disease, lack of control and fear of unexpected breakout, and feeling of hopelessness in terms of cure.[12] Furthermore, duration and severity of psoriasis significantly decrease the QoL.[13,14]

For mild to moderate psoriasis, current treatment strategies commonly involve topical agents. For moderate to severe psoriasis, topical agents are often added to phototherapy and systemic or biologic agents.[15–17] Current management strategies mainly aim to clear active disease sites and prolong symptom-free

periods.[18] However, long-term disease control is challenging, and patient satisfaction with available therapies remains low.[19] Moreover, psoriasis is often undertreated such that patients do not achieve substantial skin clearance, symptom relief or improvements in QoL.[20,21]

Although skin clearance may be achievable for most patients in the short term, long-term strategies are important to optimize adherence and long-term outcomes including health-related quality of life (HRQoL).[22,23] However, the majority of clinical data and guidance available for topical management of psoriasis is focused on short-term use, with limited data on long-term use.[23]

Therefore, understanding the impact of treatment on HRQoL and patient-perceived symptom severity in psoriasis is key to informing clinical decision-making, improving clinical outcomes and quality of care. Patient-reported outcomes measures (PROs) are invaluable tools to evaluate these effects and support clinical management.[22,24]

This *post hoc* analysis of the PSO-LONG trial captured the effect on HRQoL and patient-perceived symptom severity of treating psoriasis with fixed-dose calcipotriene 50 μg/g and betamethasone dipropionate 0.5 mg/g (Cal/BD) foam topical treatment through a 52-week period. Three PRO measures were used: EuroQoL 5-Dimensional Questionnaire for Psoriasis (EQ-5D-5L-PSO), the Dermatology Life Quality Index (DLQI) and the Psoriasis Symptom Inventory (PSI). The analysis aimed to evaluate the value of Cal/BD foam for flare treatment and long-term management (proactive vs reactive) on PROs as well as compare results at baseline flare, start of a relapse and during remission.

Materials and methods

Study design

This *post hoc* analysis included the full analysis set (n = 521) from the Phase 3, randomized, double-blind PSO-LONG trial (NCT02899962). The PSO-LONG trial assessed long-term efficacy and safety of proactive management with twice-weekly fixed-dose combination Cal/BD foam versus reactive management with twice-weekly vehicle in patients with psoriasis vulgaris. Eligible patients were aged ≥18 years and had a clinical diagnosis of truncal and/or limb psoriasis for at least 6 months involving 2–30% of the body surface area (BSA), a modified Psoriasis Area and Severity Index (mPASI) score of ≥2 and a physician's global assessment of disease severity (PGA) score of at least 'mild' (PGA ≥ 2).

The trial included an initial 4-week, open-label phase of fixed-dose combination Cal/BD foam once daily, followed by a 52-week maintenance phase for patients who achieved a PGA score of 0 or 1 and an at least 2-grade improvement after the initial 4 weeks. At the start of the maintenance phase, patients were randomized to either proactive management (Cal/BD foam twice weekly) or reactive management (vehicle foam twice weekly). Relapses (defined as at least 'mild', PGA ≥ 2) were treated with fixed-dose combination Cal/BD foam once daily (QD) for 4 weeks. Remission was defined as 'clear' or 'almost clear', PGA 0/1. The full details of the PSO-LONG trial study design[25] and the efficacy and safety results[26] are published elsewhere.

Patient-reported outcomes

Patients completed the EQ-5D-5L-PSO, DLQI and PSI assessments. The EQ-5D-5L-PSO questionnaire measures health status over five general dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) and two psoriasis-related dimensions (skin irritation and self-confidence).[27] Each dimension has five response levels, and a visual analogue scale allows patients to assess their health status with a score ranging from 0 (worst health) to 100 (best health). Responses to the questions can be converted into an index score ranging from 0.00 to 1.00, where a score of 0.00 indicates the worst health and 1.00 indicates full health.

The DLQI is a ten-item questionnaire used to measure the impact of dermatological disorders on a patient's HRQoL in the following six areas: symptoms and feelings; daily activities; leisure activities; work and school; personal relationships and treatment-related distress.[12,28] Total scores range from 0–1 ('no effect at all') to 21–30 ('extremely large effect').

The PSI is an assessment of the severity of eight psoriasis-related symptoms including itch, redness, scaling, burning, stinging, cracking, flaking and pain.[29,30] Scoring for each symptom ranges from 'not at all severe' (0) to 'very severe' (4), giving a total score range from 0 (no symptoms) to 32 (more severe symptoms).

Patient-reported outcomes were assessed across treatment arms at baseline (Visit 1), at the start of a relapse and during remission at all monthly scheduled and unscheduled visits. The DLQI and EQ-5D-5L-PSO were completed at the trial site on an electronic slate/tablet. To ensure unbiased answers for questionnaires that were completed onsite, the PROs were collected prior to any other assessments. The PSI was completed on an eDiary device, provided for the participants for use at home. The participants were asked to complete the PSI daily during the open-label treatment phase (starting at Visit 1), then weekly during the first 28 weeks of the maintenance phase (Weeks 4–28) and the last 2 weeks of the maintenance phase (Weeks 54–56 – only applicable for those who completed the PSI).

Statistical analyses

The statistical analyses were performed on the full analysis set (N = 521). Patient-reported outcome results were collected within treatment arms at each visit. The integrated area under the curve (AUC) in proactive and reactive management arms during the maintenance phase was calculated for each PRO using the trapezoidal rule and subsequently normalized by the

Table 1 Demographic and baseline characteristics of randomized patients (full analysis set; N = 521)

Demographic and baseline characteristics (maintenance full analysis set; N = 521)	
Gender, *n* (%)	
Female	170 (32.6)
Male	351(67.4)
Race, *n* (%)	
White	470 (90.2)
Asian	33 (6.3)
Black or African American	7 (1.3)
Native Hawaiian or other Pacific	3 (1.5)
Missing	8 (1.5)
Age	
Mean (standard deviation)	52.3 (14.4)
PGA, *n* (%)	
2 – mild	43 (8.3)
3 – moderate	444 (85.2)
4 – severe	34 (6.5)
mPASI	
Mean (SD)	7.8 (3.8)
BSA	
Mean (SD)	8.2 (6.2)

number of days in study for each patient. Additionally, PROs were assessed across treatment arms at baseline, at the start of a relapse and during remission at unscheduled and scheduled visits. Missing assessment of PRO scores in-between non-missing assessments in the maintenance phase was not imputed. The *P*-value for treatment changes were assessed by using the Wilcoxon signed rank sum test. Differences across treatment arms were considered significant at $P < 0.05$.

Results

Patient demographics

A total of 521 patients were included in the full analysis set used in this *post hoc* analysis. Patients were predominantly male (67.4%) and white (90.2%). The mean age was approximately 52.3 years. The majority of patients had moderate baseline PGA scores (85.2%). Patient characteristics are summarized in Table 1.

Open-label phase

Initial flare treatment with Cal/BD foam QD during the open-label phase led to statistically and clinically significant improvements across all PRO measures (Table 2). The mean difference from baseline to Week 4 was −8.97 (standard deviation [SD] = 6.18; $P < 0.0001$) for PSI scores, −6.02 (SD = 5.46; $P < 0.0001$) for DLQI scores and 0.11 (SD = 0.15; $P < 0.0001$) for EQ-5D-5L-PSO scores.

Maintenance phase

The PRO improvements were maintained over the next 52 weeks for both proactive and reactive management arms, across the three PRO assessment tools. Patients receiving proactive management showed significantly greater improvements in patient-perceived symptom severity than patients receiving reactive management: the mean PSI AUC score was 15% higher for reactive management (5.74) than for proactive management (4.99) during the maintenance phase (difference −0.75; $P = 0.0128$) (Table 3). It is worth noting that the levels of participant engagement with the PSI questionnaire were low in the last 2 weeks of the maintenance phase. The analysis of the PSI total score was therefore based on the first 28 weeks of the maintenance phase.

Proactive management also corresponded with significantly greater improvements in DLQI AUC scores; the mean DLQI score was 15% higher for reactive management (3.40) than proactive management (2.95) (difference −0.45; $P = 0.007$). Although the difference between proactive and reactive management did not result in significantly greater improvement in EQ-5D-5L-PSO scores, the numerical difference favoured the proactive management arm; the mean EQ-5D-5L-PSO AUC score was

Table 3 Mean PSI, DLQI and EQ-5D-5L-PSO AUC scores in proactive and reactive management arms and differences during maintenance phase (full analysis set; N = 521)

	Proactive management	Reactive management	Difference	Statistical significance
PSI	4.99	5.74	–0.75	$P = 0.0128$
DLQI	2.95	3.40	–0.45	$P = 0.007$
EQ-5D-5L-PSO	0.89	0.88	0.01	$P = 0.0842$

Table 2 Changes in PSI, DLQI and EQ-5D-5L-PSO scores in flare treatment from baseline to Week 4 (full analysis set; N = 521)

	Baseline		Week 4		Difference*		Statistical significance
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	*P*-value
PSI	471	12.5 (6.15)	360	3.36 (3.66)	330	–8.97 (6.18)	<0.0001
DLQI	519	8.63 (6.19)	516	2.64 (3.31)	515	–6.02 (5.46)	<0.0001
EQ-5D-5L-PSO	518	0.80 (0.17)	515	0.90 (0.14)	513	0.11 (0.15)	<0.0001

*Difference calculated from participants with both baseline and Week 4 scores.

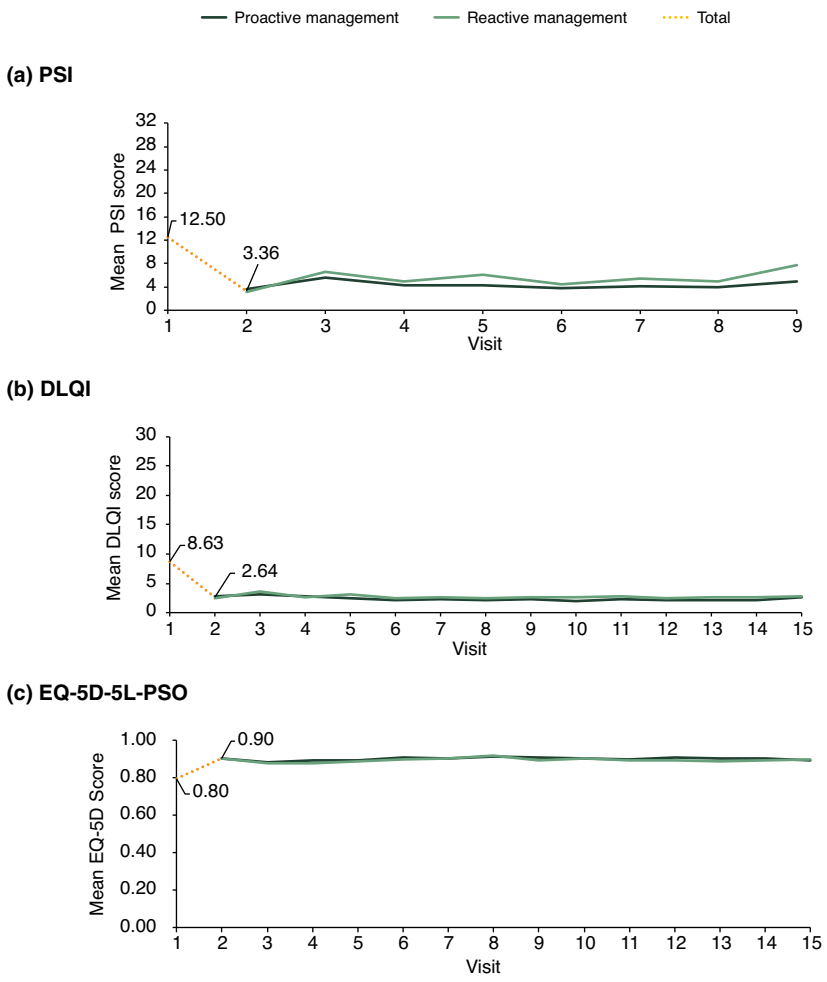

Figure 1 Mean scores in proactive and reactive management arms for (a) PSI, (b) DLQI, and (c) EQ-5D across study visits (Full Analysis Set; N = 521).

1% higher for proactive management (0.89) than for reactive management (0.88) (difference 0.01, $P = 0.0842$). The mean scores in proactive and reactive management arms for PSI, DLQI and EQ-5D-5L-PSO across each visit are shown in Fig. 1.

Across both treatment arms, patients had improvements in symptoms and HRQoL during remission compared with the baseline flare and the start of a relapse (Table 4). Additionally, the mean change (95% confidence interval [CI]; p-value) between the start of a relapse and remission was −2.28 (95% CI: −2.64 to −1.92; <0.0001) for PSI scores, −1.32 (95% CI: −1.60 to −1.04; <0.0001) for DLQI and 0.03 (95% CI: 0.02 to 0.04; <0.0001) for EQ-5D-5L-PSO (Fig. 2).

Table 4 PSI, DLQI and EQ-5D-5L-PSO scores for baseline, remission and start of relapse (full analysis set; N = 521)

	Baseline		Remission		Start of a relapse	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)
PSI	471	12.5 (6.2)	507	5.2 (4.2)	280	7.4 (5.1)
DLQI	519	8.6 (6.2)	520	2.7 (3.2)	446	4.0 (4.2)
EQ-5D-5L-PSO	518	0.80 (0.17)	520	0.90 (0.13)	445	0.86 (0.16)

Discussion

The PSO-LONG was the first randomized, double-blind, 52-week clinical trial to evaluate long-term safety and efficacy outcomes of a proactive management strategy.[25] This *post hoc* analysis evaluated the value of Cal/BD foam for flare treatment and long-term management (proactive vs. reactive) on PROs as well as comparing results at baseline flare, start of a relapse and during remission. To our knowledge, it is the first analysis to capture the effect on HRQoL of treating psoriasis with Cal/BD foam throughout a 52-week period.

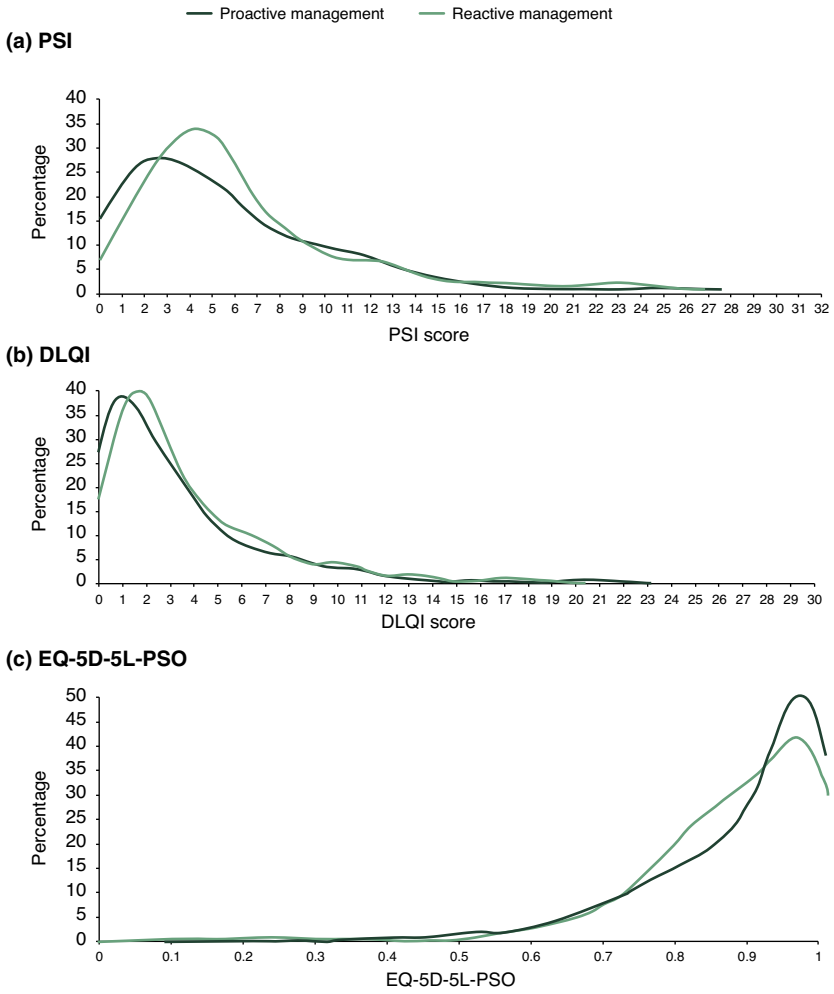

Figure 2 Distribution of AUC scores in proactive and reactive management arms for (a) PSI, (b) DLQI, and (c) EQ-5D (Full Analysis Set; N = 521).

In this *post hoc* analysis, the patient's HRQoL considerably improved with the Cal/BD foam QD flare treatment as demonstrated by significant changes in the DLQI, EQ-5D-5L-PSO and PSI scores at randomization (end of flare) versus the baseline (start of flare). It is worth noting, however, that patients who did not achieve treatment success at the end of the open-label phase were discontinued from the study. Therefore, those included in the maintenance phase were already shown to respond to Cal/BD foam treatment.

Following resolution of the initial flare, the impact of the initial treatment on DLQI, EQ-5D-5L-PSO and PSI on these patients was maintained through the 52 weeks for both proactive and reactive management. Patients assigned to proactive management had significantly better DLQI and PSI scores and numerically better EQ-5D-5L-PSO scores versus reactive management. This could be attributed to dermatology-specific and psoriasis-specific questionnaires having a greater capacity for differentiation and sensitivity to changes on HRQoL than generic measures such as EuroQol-5D.[31]

The baseline flare was associated with worse PROs than the start of a relapse. This could be due to the baseline flare representing an untreated flare, whereas the start of relapse represents flares occurring during the course of proactive or reactive management. Patients in relapse also had a poorer HRQoL and patient-perceived symptom severity than patients in remission, which indicated that relapses had a substantial impact on the patients' HRQoL. In the PSO-LONG trial, the rate ratio of relapses for proactive versus reactive management was 0.54 (95% CI: 0.46–0.63; $P < 0.001$), and the predicted number of relapses per year of exposure was 3.1 (proactive management)

versus 4.8 (reactive management), with proactive management giving 41 extra days in remission in a year.[26] Therefore, a reduction in the number of relapses and increased time in remission over a year of exposure in patients receiving proactive management versus reactive management can be attributed to the observed improvements in HRQoL and patient-perceived symptom severity.

Although skin clearance may be achievable for most patients in the short term, long-term strategies are important to optimize adherence and long-term outcomes, including HRQoL.[22,23] However, the majority of clinical data and guidance available for topical agents is focused on short-term use, with limited guidance or clinical data on long-term use.[23] Currently, long-term management with topical treatment in psoriasis follows a reactive approach in response to disease relapses as opposed to a proactive approach to maintain remission. In the PSO-LONG trial, the incidence of adverse events in the maintenance phase was similar between treatment groups and similar to the incidence reported following treatment with Cal/BD foam QD for 12 weeks, providing support for the long-term safety and tolerability of proactive management with topical agents.[26] Although this analysis has inherent limitations related to its *post hoc* nature, the results of the PSO-LONG trial warrant further research into the use of proactive topical treatments in the long-term management of psoriasis, including in the real-world clinical setting.

Conclusion

In this analysis, Cal/BD foam QD flare treatment was associated with significant improvements in PROs from baseline that were maintained with a twice-weekly application through 52 weeks. In patients undergoing proactive management, DLQI and PSI scores were significantly improved vs. patients receiving reactive management, potentially due to the reduction in the number of relapses and increased time in remission over a year of exposure.

Overall, the results of this analysis add to the original PSO-LONG findings, suggesting that proactive management with fixed-dose Cal/BD foam could offer not only improved long-term control of psoriasis but also improved HRQoL and patient-perceived symptom severity over conventional reactive treatment with Cal/BD foam.

Acknowledgements

The authors would like to acknowledge Laura Alvarez Lorenzana, of Lucid Group, for medical writing support that was funded by LEO Pharma in accordance with Good Publications 435 Practice (GPP3) guidelines (http://www.ismpp.org/gpp3).

References

1 Rachakonda TD, Schupp CW, Armstrong AW. Psoriasis prevalence among adults in the United States. *J Am Acad Dermatol* 2014; **70**: 512–516.
2 Langley RGB, Krueger GG, Griffiths CEM. Psoriasis: epidemiology, clinical features, and quality of life. *Ann Rheum Dis* 2005; **64**(suppl_2): ii18–ii23.
3 Reich K. The concept of psoriasis as a systemic inflammation: implications for disease management. *J Eur Acad Dermatol Venereol* 2012; **26** (Suppl. 2): 3–11.
4 Davidovici BB, Sattar N, Prinz J *et al*. Psoriasis and systemic inflammatory diseases: potential mechanistic links between skin disease and co-morbid conditions. *J Invest Dermatol* 2010; **130**: 1785–1796.
5 World Health Organisation. Global Report on Psoriasis Available from: https://apps.who.int/iris/handle/10665/204417 (last accessed 23 February).
6 Griffiths CEM, van der Walt JM, Ashcroft DM *et al*. The global state of psoriasis disease epidemiology: a workshop report. *Br J Dermatol* 2017; **177**: e4–e7.
7 AlQassimi S, AlBrashdi S, Galadari H, Hashim MJ. Global burden of psoriasis – comparison of regional and global epidemiology, 1990 to 2017. *Int J Dermatol* 2020; **59**(5): 566–571.
8 Raho G, Koleva DM, Garattini L, Naldi L. The burden of moderate to severe psoriasis: an overview. *Pharmacoeconomics* 2012; **30**: 1005–1013.
9 Moller AH, Erntoft S, Vinding GR, Jemec GB. A systematic literature review to compare quality of life in psoriasis with other chronic diseases using EQ-5D-derived utility values. *Patient Relat Outcome Meas* 2015; **6**: 167–177.
10 de Korte J, Sprangers MA, Mombers FM, Bos JD. Quality of life in patients with psoriasis: a systematic literature review. *J Investig Dermatol Symp Proc* 2004; **9**: 140–147.
11 Gooderham M, Gavino-Velasco J, Clifford C, MacPherson A, Krasnoshtein F, Papp K. A review of psoriasis, therapies, and suicide. *J Cutan Med Surg* 2016; **20**: 293–303.
12 Basra MK, Hussain S. Application of the dermatology life quality index in clinical trials of biologics for psoriasis. *Chin J Integr Med* 2012; **18**: 179–185.
13 Kowalewska B, Cybulski M, Jankowiak B, Krajewska-Kulak E. Acceptance of illness, satisfaction with life, sense of stigmatization, and quality of life among people with psoriasis: a cross-sectional study. *Dermatol Ther (Heidelb)* 2020; **10**: 413–430.
14 Armstrong AW, Schupp C, Wu J, Bebo B. Quality of life and work productivity impairment among psoriasis patients: findings from the National Psoriasis Foundation survey data 2003–2011. *PLoS One* 2012; **7**: e52935.
15 Feldman SR, Goffe B, Rice G *et al*. The challenge of managing psoriasis: unmet medical needs and stakeholder perspectives. *Am Health Drug Benefits* 2016; **9**: 504–513.
16 Hsu S, Papp KA, Lebwohl MG *et al*. Consensus guidelines for the management of plaque psoriasis. *Arch Dermatol* 2012; **148**: 95–102.
17 Menter A, Gottlieb A, Feldman SR *et al*. Guidelines of care for the management of psoriasis and psoriatic arthritis: Section 1. Overview of psoriasis and guidelines of care for the treatment of psoriasis with biologics. *J Am Acad Dermatol* 2008; **58**: 826–850.
18 Bagel J, Gold LS. Combining topical psoriasis treatment to enhance systemic and phototherapy: a review of the literature. *J Drugs Dermatol* 2017; **16**: 1209–1222.
19 Lebwohl MG, Bachelez H, Barker J *et al*. Patient perspectives in the management of psoriasis: results from the population-based Multinational Assessment of Psoriasis and Psoriatic Arthritis Survey. *J Am Acad Dermatol* 2014; **70**: 871–881. e1–30.
20 Armstrong AW, Robertson AD, Wu J, Schupp C, Lebwohl MG. Undertreatment, treatment trends, and treatment dissatisfaction among patients with psoriasis and psoriatic arthritis in the United States: findings from the National Psoriasis Foundation surveys, 2003–2011. *JAMA Dermatol* 2013; **149**: 1180–1185.
21 van de Kerkhof PC, Reich K, Kavanaugh A *et al*. Physician perspectives in the management of psoriasis and psoriatic arthritis: results from the population-based Multinational Assessment of Psoriasis and Psoriatic Arthritis survey. *J Eur Acad Dermatol Venereol* 2015; **29**: 2002–2010.

22 Strober BE, van der Walt JM, Armstrong AW *et al*. Clinical goals and barriers to effective psoriasis care. *Dermatol Ther (Heidelb)* 2019; **9**: 5–18.
23 Segaert S, Calzavara-Pinton P, de la Cueva P *et al*. Long-term topical management of psoriasis: the road ahead. *J Dermatolog Treat* 2020; 1–10.
24 Svoboda SA, Ghamrawi RI, Owusu DA, Feldman SR. Treatment goals in psoriasis: which outcomes matter most? *Am J Clin Dermatol* 2020; **21**: 505–511.
25 Stein Gold L, Alonso-Llamazares J, Lacour JP *et al*. PSO-LONG: Design of a Novel, 12-Month Clinical Trial of Topical, Proactive Maintenance with Twice-Weekly Cal/BD Foam in Psoriasis. *Adv Ther* 2020; **37**: 4730–4753.
26 Lebwohl M, Kircik L, Lacour JP *et al*. Twice-weekly topical calcipotriene/betamethasone dipropionate foam as proactive management of plaque psoriasis increases time in remission and is well tolerated over 52 weeks (PSO-LONG trial). *J Am Acad Dermatol* 2021; **84**: 1269–1277.
27 Swinburn P, Lloyd A, Boye KS, Edson-Heredia E, Bowman L, Janssen B. Development of a disease-specific version of the EQ-5D-5L for use in patients suffering from psoriasis: lessons learned from a feasibility study in the UK. *Value Health* 2013; **16**: 1156–1162.
28 Strober B, Papp KA, Lebwohl M *et al*. Clinical meaningfulness of complete skin clearance in psoriasis. *J Am Acad Dermatol* 2016; **75**: 77–82 e7.
29 Bushnell DM, Martin ML, McCarrier K *et al*. Validation of the Psoriasis Symptom Inventory (PSI), a patient-reported outcome measure to assess psoriasis symptom severity. *J Dermatolog Treat* 2013; **24**: 356–360.
30 Bushnell DM, Martin ML, Scanlon M, Chen T, Chau D, Viswanathan HN. Equivalence and measurement properties of an electronic version of the Psoriasis Symptom Inventory. *Qual Life Res* 2014; **23**: 897–906.
31 Chernyshov PV, Tomas-Aragones L, Manolache L *et al*. Quality of life measurement in atopic dermatitis. Position paper of the European Academy of Dermatology and Venereology (EADV) Task Force on quality of life. *J Eur Acad Dermatol Venereol* 2017; **31**: 576–593.