

Adalimumab Plus Narrowband Ultraviolet B Light Phototherapy for the Treatment of Moderate to Severe Psoriasis

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ABSTRACT

Background: Combining systemic agents with phototherapy is becoming a standard of care for patients with moderate to severe psoriasis. The combination of adalimumab and phototherapy has not been previously explored.

Methods: In this 24-week single-arm open-label study, adults with moderate to severe psoriasis received adalimumab 40 mg every other week and narrowband (NB)-UVB phototherapy three times a week for 12 weeks and then were followed for 12 weeks without treatment. Response to therapy was determined using the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA) affected and Physician's Global Assessment (PGA) of psoriasis.

Results: Twenty patients were enrolled with mean baseline scores of 17.0 for PASI, 21.2 for BSA and 3.5 for PGA. Half (10/20) of the patients achieved PASI 75 response by week 4. At the end of treatment at week 12, 19 (95%) patients achieved PASI-75, 15 (75%) patients achieved PASI-90 and 11 (55%) patients achieved PASI-100. Seventeen (85%) patients were clear or almost clear (PGA score ≤ 1). Mean baseline PASI, BSA and PGA scores improved by 95 percent, 93 percent and 80 percent, respectively. Disease improvement was observed through the end of follow up period at week 24. No serious adverse events were noted.

Conclusion: Concurrent use of adalimumab and NB-UVB phototherapy was clinically effective and well tolerated in patients with moderate to severe psoriasis. This combination regimen represents a new treatment option for clinical practice and warrants further investigation in controlled clinical trials.

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INTRODUCTION

Psoriasis is a chronic immunologically driven inflammatory disease characterized by infiltration of the skin with activated T cells and by abnormal keratinocyte proliferation and differentiation, resulting in marked inflammation and thickening of the epidermis. Psoriasis affects 1-3 percent of the world population, making it one of the most prevalent inflammatory immunological diseases.^{1,2} There are several clinical subtypes of psoriasis: plaque, guttate, erythrodermic, inverse and pustular. Plaque psoriasis is the most common type of psoriasis affecting up to 90 percent of psoriasis sufferers.^{1,2} It presents as raised silvery scale, which can cover large areas, with underlying erythema, itching and discomfort. A significant proportion of patients with plaque psoriasis also have psoriatic arthritis.^{3,4}

Currently incurable, psoriasis is treated with a plethora of topical and systemic agents and photo(chemo)therapy. Traditional therapies for moderate to severe psoriasis include phototherapy, methotrexate, oral retinoids and cyclosporin. Patients whose skin lesions and concurrent symptoms cannot be adequately controlled with one therapeutic modality may receive combination therapy with systemic agents and phototherapy.⁵

Combination regimens that utilize a systemic agent with light therapy and/or a topical agent are becoming the standard of care in the United States⁶ and Europe,⁷ confirming the observation of Lebwohl et al.⁸ in 2004 that the use of two or more therapies to treat patients with moderate to severe psoriasis seems to be the rule rather than the exception.

Injectable immunomodulatory agents, the so-called "biologics," such as alefacept, etanercept, efalizumab and adalimumab have also become candidates for use in combination psoriasis regimens. Alefacept interferes with leukocyte function antigen (LFA)-3/CD2 interaction by suppressing the activation of T-lymphocytes,⁹ etanercept interferes with the natural activity of tumor necrosis factor (TNF)- α in the body by mimicking the p75 TNF receptor¹⁰ and efalizumab interferes with the binding of LFA-1 to intercellular adhesion molecule-1 (ICAM-1),¹¹ thereby inhibiting the adhesion of leukocytes to other cell types. Adalimumab is a recombinant human immunoglobulin (IgG1) monoclonal antibody specific for tumor necrosis factor (TNF). Adalimumab binds with high affinity and specificity to soluble TNF- α and neutralizes the biological function of TNF- α by blocking its interaction with the p55 and p75 cell surface TNF

receptors. TNF- α is a naturally occurring cytokine involved in normal inflammatory and immune responses. As a result of over-production by monocytes/macrophages, dendritic cells, T-cells and keratinocytes, TNF- α levels are increased in psoriatic lesions compared to levels in uninvolved skin in psoriasis patients and in normal individuals. Serum and lesional TNF- α levels decrease after effective psoriasis therapy, correlating with clinical improvement in the disease.¹² Adalimumab has received marketing approval in the United States (US) and the European Union (EU) based on successful results from three pivotal clinical trials and is currently available for the treatment of moderate to severe psoriasis in adults.

These findings compare favorably with historical data, including the results from the pivotal phase III trial of adalimumab (REVEAL)²⁷ and the open-label study of NB-UVB phototherapy plus etanercept (UNITE),¹⁶ which inspired the design of this study. In fact, the results suggest that NB-UVB light plus adalimumab has the potential to outperform adalimumab alone, light therapy alone, or light therapy with other biologic agents in treating psoriasis, but this will need to be confirmed in controlled, large-scale, head-to-head clinical trials.

The concurrent use of biologic agents and narrowband-ultraviolet B (NB-UVB) phototherapy for the treatment of moderate to severe psoriasis has been investigated in three studies with alefacept,^{13, 14, 15} two studies with etanercept^{16, 17} and one study with efalizumab.¹⁸ This is the first open-label study to explore the benefit and the tolerability of adalimumab in combination with NB-UVB phototherapy.

METHODS

Study Design

This was a single-center, single-arm, open-label, prospective pilot study to evaluate the efficacy and tolerability of adalimumab in combination with NB-UVB phototherapy for the treatment of psoriasis. The study was conducted at the Psoriasis Treatment Center of Central New Jersey, East Windsor, NJ, USA. The protocol was approved by the Western Institutional

Review Board and all participating patients provided written informed consent.

Patient Selection

Eligible patients included men and women, 18 years of age or older, with moderate to severe chronic plaque psoriasis defined by 10% or greater body surface area (BSA) involvement and a score of 10 or greater on the Psoriasis Area and Severity Index (PASI). Patients were excluded for the following reasons: non-plaque psoriasis or eczema; prior phototherapy; current or prior treatment with a TNF antagonist (including etanercept, infliximab, and adalimumab) or cyclophosphamide; current or recent treatment with an investigational drug; photosensitivity disorder; observable pre-cancerous conditions or a history of skin cancer; nursing, pregnant, or planning a pregnancy; current or latent tuberculosis; untreated infections; and any other medical conditions that would make adalimumab treatment contraindicated according to the HUMIRA® Package Insert.¹⁹

Study Treatment and Evaluations

All enrolled patients received 12 weeks of combination therapy with adalimumab (HUMIRA, Abbott Laboratories, North Chicago, IL, USA) and NB-UVB phototherapy. Patients self-administered adalimumab subcutaneously starting with 80 mg at week zero, 40 mg at week one, and then 40 mg every other week and received NB-UVB phototherapy three times per week at the Psoriasis Treatment Center. After the week 12 visit, patients were followed without treatment for another 12 weeks (until the week 24 visit). Initial NB-UVB light doses were selected based on Fitzpatrick skin type²⁰ and were 130, 220, 260, 330, 350 and 400 mJ/cm² for skin types 1 through 6, respectively. Doses were escalated 10 percent to 15 percent at later visits based on previous response and were reduced or withheld if patients experienced erythema or burning or missed treatment sessions. Patients were evaluated at weeks zero (baseline), four, eight, 12 (end of treatment), 16, 20 and 24 (end of post-treatment follow up). During evaluations, the study investigator collected adverse events and assessed psoriasis using BSA involvement scale (0% to 100%), PASI, [0 (no psoriasis) to 72 (worst possible psoriasis)], and Physician's Global Assessment (PGA) of psoriasis scale [Clear (0) to Severe (4)].

Study Outcome Measures

The primary efficacy outcome measure was the proportion of patients achieving at least a 75 percent improvement in the baseline PASI score (PASI-75 response) at the end of treatment (week 12). Secondary efficacy outcome measures included a) PASI response rates defined as proportions of patients achieving 75 percent, 90 percent and 100 percent improvement in the baseline PASI score (PASI-75, PASI-90 and PASI-100 responses), b) PGA response rates defined as proportion of patients achieving clear or almost clear status (PGA score=0 or 1) and c) mean percent improvements in baseline PASI, BSA and PGA scores.

TABLE 1.

Patient Demographics	
Patients, n = 20	
Sex (n)	
Male	15
Female	5
Age (years)	
Mean (range)	39 (19 – 62)
Duration of Psoriasis (years)	
Mean (range)	13.5 (<1 – 36)
Race/Ethnicity (n)	
Caucasian	12
Latino	7
African American	1
Fitzpatrick Skin Type (n)	
Type 1	0
Type 2	7
Type 3	7
Type 4	1
Type 5	4
Type 6	1

Safety outcome measures included adverse events, serious adverse events and events of medical interest.

Statistics

This was an uncontrolled and unpowered single arm pilot study. Enrollment was limited to 20 patients, and all patients receiving at least one dose of both adalimumab and NB-UVB light were included in the analyses. Patient demographics, disease characteristics and safety outcome measures were summarized using descriptive statistics. To determine response rates at each post-baseline visit, patients were sorted into responders, non-responders and patients with an unknown response due to a missing score. Proportions of patients with each response were tabulated. To determine mean improvement from baseline for PASI, BSA and PGA at each post-baseline visit, every patient's percent improvement from baseline was first calculated using the formula $\frac{((\text{post-baseline score} - \text{baseline score}) / \text{baseline score}) \times 100\%}{}$, and then individual percent improvement values were averaged for the group. Missing scores were replaced by last observation carried forward method. Changes at weeks 16, 20 and 24 (end of follow up) were calculated only for patients who attended the week 24 visit.

RESULTS

Patient Disposition

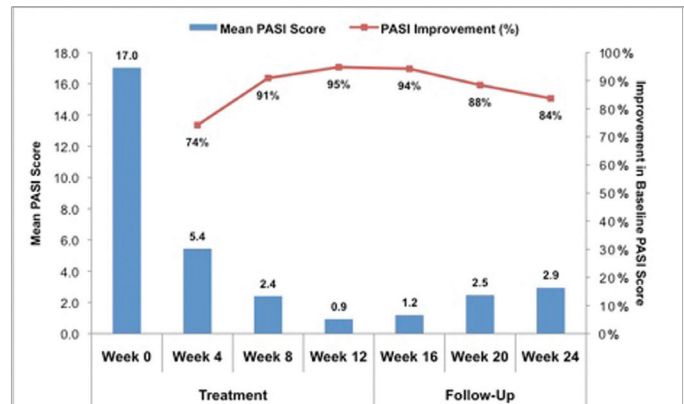
Twenty patients were enrolled, 19 completed 12 weeks of therapy and 15 completed the additional 12 weeks of follow up. Patient demographics are summarized in Table 1.

Efficacy

At the end of treatment at week 12, there were 19 (95%) patients with PASI-75, 15 (75%) patients with PASI-90 and 11 (55%) patients with PASI-100 response. One patient withdrew from the study at week eight after achieving PASI-90. Based on PGA scores, 11 (55%) patients were clear (PGA score=0), and 6 (30%) patients were almost clear (PGA score=1) at week 12. Mean baseline scores improved by 95 percent for PASI, 93 percent for BSA and 80 percent for PGA at week 12 (Table 2).

At the end of the study (week 24), 13 (65%) patients retained PASI-75, two (10%) patients lost PASI-75 and five (25%) patients had unknown PASI responses as they did not attend the week 24 visit (Table 2). Mean percent improvements in the baseline scores for the 15 patients who completed the study were 84 percent for PASI, 79 percent for BSA, and 56 percent for PGA (Figure 1).

FIGURE 1. Changes in Psoriasis Area and Severity Index scores in 15 study completers.



PASI=Psoriasis Area and Severity Index

This figure presents mean PASI scores and mean changes in baseline PASI scores in 15 patients with moderate to severe psoriasis who received 12 weeks of adalimumab injections (40 mg every other week) and NB-UVB phototherapy three times a week and then completed 12 weeks of post-treatment follow up.

Tolerability

The combination regimen of adalimumab and NB-UVB phototherapy was well tolerated. The most frequent adverse reaction was mild to moderate photosensitivity after a phototherapy session (Table 3). No unusual reactions or unexpected increases in photosensitivity were observed with combination treatment. No serious adverse events were recorded.

TABLE 2.

Efficacy Outcome Measures During the Study

Outcome Measure	Baseline	Week 4	Week 8	Week 12	Week 24
PASI-75 responders, n (%)	--	10 (50%)	17 (85%)	19 (95%)	13 (65%)
PASI-90 responders, n (%)	--	4 (20%)	15 (75%)	15 (75%)	7 (35%)
PASI-100 responders, n (%)	--	1 (5%)	9 (45%)	11 (55%)	5 (25%)
Patients with PGA score ≤ 1 , n (%)	--	9 (45%)	13 (65%)	16 (80%)	7 (35%)
Mean PASI score \pm SD	17.0 \pm 9.5	4.6 \pm 5.6	1.4 \pm 5.1	0.9 \pm 1.3	2.9 \pm 3.4 ^a
Mean affected BSA \pm SD	21.2 \pm 14.7 ^b	9.1 \pm 8.1 ^b	1.9 \pm 5.9 ^b	1.6 \pm 2.3 ^b	3.0 \pm 4.2 ^a
Mean PGA score \pm SD	3.5 \pm 0.5	1.8 \pm 1.0	1.2 \pm 1.3	0.7 \pm 1.0	1.5 \pm 1.2 ^a

PASI=Psoriasis Area and Severity Index; PASI-75, PASI-90 and PASI-100 = 75 percent, 90 percent and 100 percent improvement in the baseline PASI score, respectively; PGA=Physician's Global Assessment of psoriasis; BSA=Body Surface Area affected by psoriasis; SD=standard deviation. ^aValues are based on scores from 15 patients who completed the study; ^bValues are based on scores from 19 patients—one patient was excluded due to a missing BSA score at baseline.

TABLE 3.

Adverse Events Observed During Treatment

Event	Patients, n (%)
Photosensitivity reaction	5 (25%)
UVB-induced erythema	3 (15%)
Cold	2 (10%)
Heat reaction*	1 (5%)
Hematuria	1 (5%)
Psoriatic arthritis	1 (5%)
Rosacea	1 (5%)
Syncope	1 (5%)
Upper respiratory infection	1 (5%)
Urinary tract infection	1 (5%)

*Patient reported becoming overheated and dizzy inside the phototherapy box.

DISCUSSION

Moderate to severe psoriasis is increasingly treated with a combination of a systemic agent and light therapy to optimize response, minimize toxicity and offer more options to patients with resistant disease. Injectable biologic agents are the latest of drugs tested in conjunction with UVB light. This study explored a 12 week combination treatment with adalimumab 40 mg every other week and NB-UVB phototherapy three times a week in 20 adults with moderate to severe psoriasis and found it to be beneficial and well tolerated.

Each individual treatment modality has been clinically effective in improving psoriasis symptoms in controlled randomized clinical trials. The effectiveness of NB-UVB phototherapy in the treatment of psoriasis is well documented with typical

rates of clearance/minimal residual activity of 65 percent to 80 percent.^{21, 22, 23, 24} Three large randomized clinical trials^{25, 26, 27} that investigated the safety and efficacy of adalimumab 40 mg every other week in patients with moderate to severe psoriasis have demonstrated that adalimumab is more effective than placebo and can result in PASI 75 response rates between 53 percent and 77 percent after the first 12 weeks of treatment.

Adalimumab therapy was also shown to be beneficial in small open-label studies that focused on patients with resistant disease. Pitarch et al.²⁸ treated nine patients who failed other treatment for their moderate to severe psoriasis with adalimumab every other week and achieved PASI 75 response in 55.5 percent (5/9) of patients after 12 weeks. Papoutsaki et al.²⁹ treated 30 patients with psoriasis unresponsive to other biological agents with adalimumab 40 mg weekly and achieved a PASI 75 response in 87 percent (26/30) of patients after 12 weeks. Lecluse et al.³⁰ studied a cohort of 29 psoriasis patients who did not respond sufficiently to other therapies and were receiving adalimumab 80 mg at week zero, 40 mg at week one, and then 40 mg eow (end of the week) and observed a PASI 75 response in 32 percent (9/29) of patients after 12 weeks. Martyn-Simmons et al.³¹ treated five patients with severe psoriasis who did not respond to high-dose etanercept with adalimumab 40 mg weekly and observed a PASI 75 response in 40 percent (2/5) of patients. Bongiorno et al.³² also treated 15 patients with severe plaque psoriasis refractory to other treatments with adalimumab and obtained a decisive regression of skin involvement.

The concurrent use of biologic agents and NB-UVB phototherapy for the treatment of moderate to severe psoriasis has been investigated in three studies with alefacept, two studies with etanercept and one study with efalizumab. Alefacept has been studied the most in combination with light therapy. Overall, alefacept studies have revealed greater disease improve-

ment with alefacept plus NB-UVB light than with alefacept alone over the same period of time.¹³⁻¹⁵ In the one controlled clinical trial, among fourteen patients treated with alefacept 7.5 mg intravenously once a week plus NB-UVB phototherapy on one randomly selected body half three times a week for 12 weeks, significantly more patients reached a PASI 75 response with alefacept and light therapy (86% (12/14)) than with alefacept alone (43% (6/14)) and baseline PASI scores also improved more with combination therapy (81%) than with alefacept alone (62%).¹⁵ Efalizumab 1 mg/kg/wk plus NB-UVB phototherapy three times a week for 12 weeks achieved a PASI 75 response in 65 percent (13/20) of patients and improved baseline PASI, BSA and PGA scores by 75 percent, 74 percent, and 60 percent, respectively.¹⁸ When five patients who received etanercept 50 mg twice weekly for six weeks without success added NB-UVB phototherapy three times weekly to a randomly selected body half for another six weeks, they significantly accelerated and bolstered therapeutic response on the side treated with combination therapy (89% improvement in baseline PASI) compared to the side treated with etanercept alone (68% improvement in baseline PASI).¹⁷ Etanercept 50 mg twice a week plus NB-UVB phototherapy three times a week for 12 weeks achieved a PASI 75 response in 85 percent (73/86) of patients and improved baseline PASI, BSA and PGA scores by 89 percent, 84 percent, and 73 percent, respectively.¹⁶

The present study explored the tolerability and effectiveness of a new combination regimen with adalimumab 40 mg every other week plus NB-UVB phototherapy three times a week for 12 weeks in 20 patients with moderate to severe plaque psoriasis. The treatment achieved a PASI 75 response in 95 percent (19/20) of patients, and improved mean baseline PASI, BSA and PGA scores by 95 percent, 93 percent and 80 percent, respectively. These findings compare favorably with historical data, including the results from the pivotal phase III trial of adalimumab (REVEAL)²⁷ and the open-label study of NB-UVB phototherapy plus etanercept (UNITE),¹⁶ which inspired the design of this study. In fact, the results suggest that NB-UVB light plus adalimumab has the potential to outperform adalimumab alone, light therapy alone, or light therapy with other biologic agents in treating psoriasis, but this will need to be confirmed in controlled, large-scale, head-to-head clinical trials. Also since adalimumab has generally been found to be more cost-effective than other biologic agents,^{33,34} it may turn out to be a more cost-conscious choice when treatment with a biologic agent and light therapy is considered.

The study could have been strengthened by including control arms (light-placebo adalimumab and placebo light-adalimumab), but the results still demonstrate that the combination therapy was feasible, well tolerated, with the most frequent adverse reactions related to the dose escalation of UVB light and benefited the patients in the study. Thus the study has limita-

tions that make it difficult to generalize the findings to clinical practice, but does provide important information. Based on the findings from this exploratory open-label study, the adalimumab and NB-UVB light combination regimen has the potential to become an exciting new treatment option for clinical practice and warrants further investigation in controlled clinical trials.

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Dr. Bagel has served as investigator and on the Speaker's Bureau for Abbot, Amgen and Centacor.

REFERENCES

1. Griffiths CE, Barker JN. Pathogenesis and clinical features of psoriasis. *Lancet*. 2007;370:263-271.
2. Greaves MW, Weinstein GD. Treatment of psoriasis. *New Engl J Med*. 1995;332(9):581-588.
3. Gladman DD, Antoni C, Mease P, et al. Psoriatic arthritis: Epidemiology, clinical features, course, and outcome. *Ann Rheum Dis*. 2005;64(suppl 2):14-17.
4. Mrowietz U, Reich K. Psoriasis—New insights into pathogenesis and treatment. *Dtsch Arztebl Int*. 2009;106(1-2):11-19.
5. Menter A, Griffiths CE. Current and future management of psoriasis. *Lancet*. 2007;370:272-284.
6. Menter A, Korman NJ, Elmets CA, Feldman SR, Gelfand JM et al. Guidelines of care for the management of psoriasis and psoriatic arthritis: Section 5. Guidelines of care for the treatment of psoriasis with phototherapy and photochemotherapy. *J Am Acad Dermatol*. 2010;62(1):114-135.
7. Jensen P, Skov L, Zachariae C. Systemic combination treatment for psoriasis: A review. *Acta Derm Venereol*. 2010;90:341-349.
8. Lebwohl M, Menter A, Koo J, Feldman SR. Combination therapy to treat moderate to severe psoriasis. *J Am Acad Dermatol*. 2004;50(3):416-430.
9. Full prescribing information for Amevive® (alefacept). Available at: <http://www.astellas.us/docs/amevive.pdf>. Accessed July 16, 2010.
10. Full prescribing information for Enbrel® (etanercept). Available at: <http://www.enbrel.com/documents/ENBREL-Prescribing-Information.pdf>. Accessed July 16, 2010.
11. Full prescribing information for Raptiva® (efalizumab). Available at: <http://www.flakehq.com/archives/raptiva-prescribing.pdf>. Accessed July 16, 2010.
12. Bonifati C, Ameglio F. Cytokines in psoriasis. *Int J Dermatol*. 1999;38(4):241-251.
13. Ortonne JP, Khemis A, Koo JY, Choi J. An open-label study of alefacept plus ultraviolet B light as combination therapy for chronic plaque psoriasis. *J Eur Acad Dermatol Venereol*. 2005;19(5):556-563.
14. Koo JY, Bagel J, Sweetser MT, Ticho BS. Alefacept in combination with ultraviolet B phototherapy for the treatment of chronic plaque psoriasis: Results from an open-label, multicenter study. *J Drugs*

- Dermatol.* 2006;5(7):623-628.
15. Legat FJ, Hofer A, Wackernagel A, Salmhofer W. Narrowband UV-B phototherapy, alefacept, and clearance of psoriasis. *Arch Dermatol.* 2007;143(8):1016-1022.
 16. Kircik L, Bagel J, Korman N, Menter A, et al. Utilization of narrow-band ultraviolet light B therapy and etanercept for the treatment of psoriasis (UNITE): Efficacy, safety, and patient-reported outcomes. *J Drugs Dermatol.* 2008;7(3):245-253.
 17. Wolf P, Hofer A, Legat FJ, Bretterkieber A, et al. Treatment with 311-nm ultraviolet B accelerates and improves the clearance of psoriatic lesions in patients treated with etanercept. *Br J Dermatol.* 2009;160(1):186-189.
 18. Kircik LH, Liu C, Goffe BS. Treatment of moderate to severe plaque psoriasis with concomitant efalizumab and narrow-band ultraviolet B phototherapy. *J Drugs Dermatol.* 2008;7(10):947-952.
 19. Full prescribing information for Humira (adalimumab). Available at: <http://www.rxabbott.com/pdf/humira.pdf>. Accessed July 16, 2010.
 20. Fitzpatrick T, Ortonne JP. *Fitzpatrick's Dermatology in General Medicine*. 6th ed. New York: McGraw-Hill; 2003.
 21. Cameron H, Dawe RS, Yule S, Murphy J, Ibbotson SH, Ferguson J. A randomized, observer-blinded trial of twice vs. three times weekly narrowband ultraviolet B phototherapy for chronic plaque psoriasis. *Br J Dermatol.* 2002;147:973-978.
 22. Yones SA, Palmer RA, Garibaldino TT, Hawk JLM. Randomized double-blind trial of the treatment of chronic plaque psoriasis. Efficacy of psoralen-UV-A therapy vs. narrowband UV-B therapy. *Arch Dermatol.* 2006;142:836-842.
 23. Hallaji Z, Barzegari M, Balighi K, Mansoori P, et al. A comparison of three times vs. five times weekly narrowband ultraviolet B phototherapy for the treatment of chronic plaque psoriasis. *Photodermatol Photoimmunol Photomed.* 2010;26:10-15.
 24. Dawe RS, Cameron H, Yule S, Man I, Wainwright NJ, et al. A randomized controlled trial of narrowband ultraviolet B vs. bath-psoralen plus ultraviolet A photochemotherapy for psoriasis. *Br J Dermatol.* 2003;148(6):1194-1204.
 25. Gordon KB, Langley RG, Leonardi C, Toth D, Menter MA, et al. Clinical response to adalimumab treatment in patients with moderate to severe psoriasis: Double-blind, randomized controlled trial and open-label extension study. *J Am Acad Dermatol.* 2006;55:598-606.
 26. Saurat JH, Stingl G, Dubertret L, Papp K, Langley RG, et al. Efficacy and safety results from the randomized controlled comparative study of adalimumab vs. methotrexate vs. placebo in patients with psoriasis (CHAMPION). *Br J Dermatol.* 2008;158:558-566.
 27. Menter A, Tying SK, Gordon K, Kimball AB, Leonardi L, et al. Adalimumab therapy for moderate to severe psoriasis: A randomized, controlled phase III trial. *J Am Acad Dermatol.* 2008;58:106-115.
 28. Pitarch G, Sanchez-Cararo JL, Mahiques L, Perez-Ferriols MA, Fortea JM. Treatment of psoriasis with adalimumab. *Clin Exp Dermatol.* 2006;32:18-22.
 29. Papoutsaki M, Chimenti MS, Costanzo A, Talamonti M, Zandrilli A, et al. Adalimumab for severe psoriasis and psoriatic arthritis: An open-label study in 30 patients previously treated with other biologics. *J Am Acad Dermatol.* 2007;57:269-275.
 30. Lecluse LLA, Driessen RJB, Spuls PI, de Jong EMGJ, Stapel SO, et al. Extent and clinical consequences of antibody formation against adalimumab in patients with plaque psoriasis. *Arch Dermatol.* 2010;146(2):127-132.
 31. Martyn-Simmons CL, Green L, Ash G, Groves RW, et al. Adalimumab for psoriasis patients who are non-responders to etanercept: Open-label prospective evaluation. *J Eur Acad Dermatol Venereol.* 2009;23(12):1394-1397.
 32. Bongiorno MR, Pistone G, Doukaki S, Arico M. Adalimumab for treatment of moderate to severe psoriasis and psoriatic arthritis. *Dermatol Ther.* 2008;21(suppl 2):15S-20S.
 33. Sizto S, Bansback N, Feldman SR, William MK, Anis AH. Economic evaluation of systemic therapies for moderate to severe psoriasis. *Br J Dermatol.* 2009;160:1264-1272.
 34. Anis AH, Bansback N, Sizto S, Gupta SR, William MK, Feldman SR. Economic evaluation of biologic therapies for the treatment of moderate to severe psoriasis in the United States. *J Dermatolog Treat.* 2011;22(2):65-74.

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