Infliximab maintains a high degree of clinical response in patients with active psoriatic arthritis through one year of treatment: results from the IMPACT 2 trial

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ABSTRACT

Objective: To evaluate the efficacy and safety of infliximab through one year in patients with psoriatic arthritis (PsA) enrolled in the IMPACT 2 trial.

Methods: In this double-blind, placebo-controlled, phase III study, 200 patients with active PsA were randomized to receive infusions of infliximab 5 mg/kg or placebo at Weeks 0, 2, and 6 and every 8 weeks thereafter through one year. Patients with persistent disease activity could enter early escape at Week 16, and all remaining placebo patients crossed over to infliximab at Week 24. Infliximab-randomized patients who had no response or who lost response could escalate their dose to 10 mg/kg starting at Week 38. Clinical efficacy was assessed based on the proportion of patients achieving ACR 20 and PASI 75 responses. Major clinical response (i.e., maintenance of ACR 70 response for 24 continuous weeks) was assessed for the first time in PsA.

Results: Through one year of treatment, 58.9% and 61.4% of patients in the randomized infliximab and placebo/infliximab groups, respectively, achieved ACR 20; corresponding figures for PASI 75 were 50.0% and 60.3%. At Week 54, major clinical response was achieved by 12.1% of patients in the infliximab group. The safety profile of infliximab through Week 54 was consistent with that observed through Week 24. Two malignancies occurred: basal cell skin cancer (placebo) and stage 1 Hodgkin’s lymphoma (infliximab).

Conclusion: Infliximab maintains a high degree of clinical efficacy and continues to be well tolerated in patients with PsA through one year of treatment.

Key Indexing Terms: Infliximab, psoriatic arthritis, tumour necrosis factor - \( \alpha \), ACR 20, PASI 75
INTRODUCTION
Psoriatic arthritis (PsA), an inflammatory arthropathy occurring in 6 to 39% of patients with psoriasis (1-3), can result in substantial morbidity (4,5), increased mortality (6,7), and impaired physical function and quality of life (8-10). The proinflammatory cytokine, tumor necrosis factor alpha (TNFα), plays a key role in the pathogenesis of this disease (11-18), and the efficacy of biologic agents that neutralize TNFα has been demonstrated in several studies of patients with PsA (19-24).

IMPACT 2 was a 54-week, multicenter study of infliximab 5 mg/kg in patients with active PsA. The 1-year efficacy and safety findings from IMPACT 2 in this report expand upon the published clinical response data from the initial, 24-week, double-blind, placebo-controlled period (21). The study design allowed for evaluation of changes in skin and joint efficacy parameters in patients initially randomized to placebo and then switched to infliximab relative to those receiving one year of infliximab therapy. This report evaluates the effect of concomitant methotrexate (MTX) use on the efficacy and safety profile in patients with PsA and, further, it assesses the effect of infliximab dose escalation from 5 to 10 mg/kg on arthritis and skin response. This report also presents the effect of long-term infliximab treatment on PsA-specific features of joint disease, such as dactylitis and enthesopathy, and on quality of life and physical function. It also generates the first report of major clinical response in PsA based on a definition used to evaluate the RA population (i.e., maintenance of ACR 70 response for at least 6 consecutive months).
PATIENTS AND METHODS

Patients
Details of patient eligibility criteria for the IMPACT 2 study were published previously (21). Briefly, 200 adult patients with active PsA were enrolled. Active disease was defined as five or more swollen joints and five or more tender joints and either C-reactive protein levels of at least 15 mg/L and/or morning stiffness lasting 45 minutes or longer. All patients had active psoriasis, with at least one plaque of 2 cm or greater in diameter. A negative rheumatoid factor result and an inadequate response to current or previous disease-modifying antirheumatic drugs (DMARDs) or nonsteroidal anti-inflammatory drugs (NSAIDs) were also required. Concomitant MTX treatment (up to 25 mg/wk) was allowed but not mandatory.

Study Design
The details of study design were reported previously (21). Patients in this phase III, multicenter, double-blind, placebo-controlled study were randomized (1:1) to infliximab 5 mg/kg (Remicade®, Centocor, Inc., Malvern, PA, USA) or placebo as induction therapy at Weeks 0, 2, and 6 followed by infusions at Weeks 14 and 22 through Week 24, at which time placebo patients crossed over to active treatment; all patients received infliximab for the remainder of the 54-week study. Based on predefined criteria (i.e., less than 10% improvement from baseline in both swollen and tender joint counts), placebo patients could enter early escape to infliximab at Week 16. To maintain the blind, patients in the infliximab group meeting the same definition of lack of response also entered early escape by receiving additional placebo infusions but continued to receive infliximab on the original dosing schedule. Patients randomized to infliximab with less than 20% improvement from baseline in the combined number of swollen and tender joints at Week 38 could also escalate their dose from 5 to 10 mg/kg at Weeks 38 and 46.

Study Procedures and Evaluations
Clinical Efficacy
Clinical efficacy was assessed by the ACR core set (25), the Psoriatic Arthritis Response Criteria (PsARC) (26), and duration of morning stiffness. Major clinical response was defined as maintenance of ACR 70 response for a 24-week continuous period (27). The presence and severity of dactylitis (on a scale of 0-3) were assessed in the hands and feet, and the presence of active enthesopathy was evaluated in the feet (21). In patients with at least 3% body surface area (BSA) psoriasis at baseline, psoriasis activity was assessed using the Psoriasis Area and Severity Index (PASI) (28). Regardless of baseline BSA, the target skin lesion was assessed for scaling, erythema, and plaque induration on a scale of 0 to 4. Functional status was evaluated using the Disability Index of the Health Assessment Questionnaire (HAQ) (29); a decrease of at least 0.3 in HAQ was considered clinically significant (30). Health-related quality of life was evaluated using the SF-36 (31).

Safety Evaluations
Adverse events (AEs) and routine hematology and chemistry parameters were evaluated at every visit through Week 54. Blood samples were drawn to determine the presence of antibodies to infliximab through Week 66 (20 weeks after the last infusion) and
antinuclear antibodies (ANAs; antibody titer of 1/160 or more was considered positive) through Week 54. Samples positive for ANAs were tested for the presence of antibodies to double stranded DNA (anti-dsDNA).

**Statistical Methods**

A sample size of 200 patients was chosen to ensure an adequate safety evaluation. With 100 patients in each group, the study had at least 90% power to detect a significant treatment difference in the proportion of ACR 20 responders at Week 24. At randomization, patients were stratified by baseline MTX use and investigational site. The primary analysis was based on all randomized patients according to the treatment assigned. Patients with missing ACR data and those who entered early escape at Week 16 were considered nonresponders at Week 24. For the PASI analyses at Week 24, the last observation prior to Week 16 was carried forward. Analyses at Week-54 were based on the subset of patients who completed study evaluations and included patients with imputed data based on treatment failure rules. Patients were considered treatment failures if infusions were discontinued for lack of efficacy, if they lost response, if prohibited treatment was started or the concomitant medication dose was increased, or if they underwent more than 2 surgical joint procedures for PsA. For these patients, percent change for ACR response was imputed to 0. Patients with missing data for other reasons were excluded. All efficacy analyses presented were pre-specified, unless otherwise noted.

Data were summarized using descriptive summary statistics for continuous variables and counts and percentages for discrete variables. The Cochran-Mantel-Haenszel (CMH) chi-square test stratified by baseline MTX usage was used to analyze the co-primary endpoint of ACR 20 response at Week 14 and other secondary endpoints with categorical data. A two-sided F-test using an ANOVA method with baseline MTX usage as a factor on the van der Waerden normal scores was employed to analyze endpoints with continuous data.

Safety analyses were performed using data from patients who received at least one infusion of infliximab, regardless of treatment assignment. Safety data through Week 54 are presented for the placebo group (i.e., only data reported prior to first dose of infliximab) and the combined infliximab group (i.e., data for infliximab-randomized patients and data from Week 16 onward for placebo-randomized patients who entered early escape at Week 16, from Week 24 onward for those who crossed over to infliximab at Week 24, and from the first dose of infliximab onward for those who received a dose of infliximab in error).
RESULTS
Baseline Characteristics and Patient Disposition
Patient disposition through Week 54 is summarized in Figure 1. With the exception of the gender distribution, demographics and baseline disease characteristics were similar between treatment groups (Table 1).

<table>
<thead>
<tr>
<th>TABLE 1. BASELINE CHARACTERISTICS OF THE PATIENTS</th>
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<tbody>
<tr>
<td>Placebo</td>
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<tr>
<td>Patients randomized</td>
</tr>
<tr>
<td>Female sex (%)</td>
</tr>
<tr>
<td>Age (yrs)</td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td>PsA subtype (%)</td>
</tr>
<tr>
<td>Arthritis involving DIPs</td>
</tr>
<tr>
<td>Arthritis mutilans</td>
</tr>
<tr>
<td>Asymmetric peripheral arthritis</td>
</tr>
<tr>
<td>Polyarticular arthritis</td>
</tr>
<tr>
<td>Spondylitis with peripheral arthritis</td>
</tr>
<tr>
<td>PsA duration (yrs)</td>
</tr>
<tr>
<td>ACR component</td>
</tr>
<tr>
<td>Number of swollen joints (0-66)</td>
</tr>
<tr>
<td>Number of tender joints (0-68)</td>
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<tr>
<td>CRP (mg/dL)</td>
</tr>
<tr>
<td>Physician's global assessment of disease activity (VAS; 0-10 cm)</td>
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<tr>
<td>Patient's global assessment of disease activity (VAS; 0-10 cm)</td>
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<tr>
<td>Patient's assessment of pain (VAS; 0-10 cm)</td>
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<tr>
<td>HAQ disability index (0-3)</td>
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<tr>
<td>Duration of morning stiffness (0-1440 min)</td>
</tr>
<tr>
<td>Patients with 1 or more dactylitis digits (%)</td>
</tr>
<tr>
<td>Patients with enthesopathy (%)</td>
</tr>
<tr>
<td>Psoriasis duration (yrs)</td>
</tr>
<tr>
<td>Psoriasis evaluation</td>
</tr>
<tr>
<td>Patients with ≥ 3% BSA with psoriasis (%)</td>
</tr>
<tr>
<td>PASI score (0-72)</td>
</tr>
</tbody>
</table>
Patients with PASI ≥ 10
Target lesion score (0–12)  
31  
30
Target lesion score (0–12)  
6.2 ± 1.9  
5.9 ± 2.2
SF-36 score
Physical component (0-100)  
31.0 ± 9.0  
33.0 ± 9.4
Mental component (0-100)  
47.0 ± 11.9  
45.5 ± 11.9
Baseline medication
Patients taking MTX (%)  
45.0  
47.0
MTX dose (mg/week)  
14.8 ± 5.4  
16.2 ± 5.2
Patients taking oral corticosteroids (%)  
10.0  
15.0
Patients taking NSAIDs (%)  
73.0  
71.0

Values are means ± SD
ACR = American College of Rheumatology; BSA = body surface area; CRP = C-reactive protein; DIP = distal interphalangeal; HAQ = health assessment questionnaire; MTX = methotrexate; NSAIDs = nonsteroidal anti-inflammatory drugs; PASI = Psoriasis Area and Severity Index; PsA = psoriatic arthritis; SF-36 = Short Form 36; VAS = visual analogue scale.

Post hoc analyses suggested that the demographic characteristics of placebo-randomized patients who entered early escape at Week 16 did not differ from those of patients who crossed over to infliximab at Week 24 (data not shown). However, the demographics of the small number of infliximab-randomized patients who required dose escalation from 5 to 10 mg/kg at Week 38 were different from those in patients who did not. Patients who escalated their infliximab dose were older (mean age, 55.0 versus 45.9 years) and higher proportions were taking MTX (66.7% versus 44.1%) or NSAIDs (86.7% versus 67.7%) or had arthritis involving distal interphalangeal joints (46.7% versus 23.5%).

Efficacy
As previously reported, patients receiving infliximab 5 mg/kg had significantly better outcomes compared with those receiving placebo, with regard to joint response (ACR criteria, enthesopathy, and dactylitis), skin response (PASI), physical function (HAQ), and quality of life (SF-36) at Week 24 (Table 2) (21).
**TABLE 2. CLINICAL RESPONSES AT WEEK 24 AND WEEK 54**

<table>
<thead>
<tr>
<th></th>
<th>Week 24</th>
<th>Infliximab 5 mg/kg</th>
<th>P-value</th>
<th>Week 54</th>
<th>Placebo/Infliximab&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Randomized Infliximab&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>100</td>
<td>100</td>
<td></td>
<td>84</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>ACR response&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% improvement (%)</td>
<td>16.0</td>
<td>54.0</td>
<td>&lt;0.001</td>
<td>61.4</td>
<td>58.9</td>
<td></td>
</tr>
<tr>
<td>50% improvement (%)</td>
<td>4.0</td>
<td>41.0</td>
<td>&lt;0.001</td>
<td>43.4</td>
<td>36.7</td>
<td></td>
</tr>
<tr>
<td>70% improvement (%)</td>
<td>2.0</td>
<td>27.0</td>
<td>&lt;0.001</td>
<td>25.3</td>
<td>22.2</td>
<td></td>
</tr>
<tr>
<td>Achieving PsARC (%)</td>
<td>32.0</td>
<td>70.0</td>
<td>&lt;0.001</td>
<td>81.9</td>
<td>74.4</td>
<td></td>
</tr>
<tr>
<td>Percentage improvement in individual ACR components&lt;sup&gt;3,4&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of swollen joints</td>
<td>23.5 ± 39.8</td>
<td>58.0 ± 45.3</td>
<td>&lt;0.001</td>
<td>57.5 ± 62.5</td>
<td>59.6 ± 54.9</td>
<td></td>
</tr>
<tr>
<td>Number of tender joints</td>
<td>14.9 ± 36.5</td>
<td>54.1 ± 45.2</td>
<td>&lt;0.001</td>
<td>54.8 ± 53.0</td>
<td>52.0 ± 46.8</td>
<td></td>
</tr>
<tr>
<td>CRP</td>
<td>-7.0 ± 55.0</td>
<td>34.7 ± 67.5</td>
<td>&lt;0.001</td>
<td>16.6 ± 108.2</td>
<td>8.3 ± 136.4</td>
<td></td>
</tr>
<tr>
<td>Physician's global assessment of disease activity (VAS)</td>
<td>18.0 ± 55.9</td>
<td>57.3 ± 46.8</td>
<td>&lt;0.001</td>
<td>66.5 ± 46.1</td>
<td>62.6 ± 39.7</td>
<td></td>
</tr>
<tr>
<td>Patient's global assessment of disease activity (VAS)</td>
<td>7.2 ± 45.4</td>
<td>35.1 ± 74.4</td>
<td>&lt;0.001</td>
<td>45.9 ± 56.8</td>
<td>31.3 ± 78.6</td>
<td></td>
</tr>
<tr>
<td>Patient's assessment of pain (VAS)</td>
<td>-10.0 ± 114.2</td>
<td>37.4 ± 54.2</td>
<td>&lt;0.001</td>
<td>48.9 ± 53.3</td>
<td>38.9 ± 63.6</td>
<td></td>
</tr>
<tr>
<td>HAQ disability index</td>
<td>-19.4 ± 102.8</td>
<td>46.0 ± 42.5</td>
<td>&lt;0.001</td>
<td>35.5 ± 103.7</td>
<td>41.2 ± 89.4</td>
<td></td>
</tr>
<tr>
<td>Absolute values for individual ACR components&lt;sup&gt;4&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of swollen joints (0-66)</td>
<td>11.7 ± 9.7</td>
<td>5.6 ± 6.9</td>
<td>&lt;0.001</td>
<td>6.7 ± 9.5</td>
<td>5.1 ± 7.3</td>
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</tr>
<tr>
<td>Number of tender joints (0-68)</td>
<td>21.1 ± 13.4</td>
<td>12.5 ± 15.1</td>
<td>&lt;0.001</td>
<td>11.9 ± 15.0</td>
<td>13.0 ± 15.7</td>
<td></td>
</tr>
<tr>
<td>CRP (mg/dL)</td>
<td>2.2 ± 3.2</td>
<td>0.7 ± 0.8</td>
<td>&lt;0.001</td>
<td>1.0 ± 1.6</td>
<td>1.0 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>Physician's global assessment of disease activity (VAS)</td>
<td>4.5 ± 2.4</td>
<td>2.2 ± 2.2</td>
<td>&lt;0.001</td>
<td>1.9 ± 2.2</td>
<td>2.0 ± 2.3</td>
<td></td>
</tr>
<tr>
<td>Patient's global assessment of disease activity (VAS; 0-10 cm)</td>
<td>5.0 ± 2.5</td>
<td>3.0 ± 2.5</td>
<td>&lt;0.001</td>
<td>2.8 ± 2.7</td>
<td>3.0 ± 2.6</td>
<td></td>
</tr>
<tr>
<td>Patient's assessment of pain (VAS; 0-10 cm)</td>
<td>5.2 ± 2.6</td>
<td>3.1 ± 2.6</td>
<td>&lt;0.001</td>
<td>2.7 ± 2.7</td>
<td>3.1 ± 2.7</td>
<td></td>
</tr>
<tr>
<td>HAQ disability index (0-3)</td>
<td>1.1 ± 0.7</td>
<td>0.7 ± 0.7</td>
<td>&lt;0.001</td>
<td>0.7 ± 0.8</td>
<td>0.6 ± 0.7</td>
<td></td>
</tr>
<tr>
<td>Percentage improvement in duration of morning stiffness⁴</td>
<td>-152.0 ± 882.6</td>
<td>43.1 ± 103.9</td>
<td>&lt;0.001</td>
<td>29.0 ± 330.7</td>
<td>12.4 ± 281.5</td>
<td></td>
</tr>
<tr>
<td>Patients with at least one dactylitis digits (%)</td>
<td>34.0</td>
<td>11.8</td>
<td>&lt;0.001</td>
<td>14.8</td>
<td>12.2</td>
<td></td>
</tr>
<tr>
<td>Patients with enthesopathy (%)</td>
<td>37.2</td>
<td>20.4</td>
<td>0.002</td>
<td>19.8</td>
<td>18.9</td>
<td></td>
</tr>
<tr>
<td>PASI response³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients with ≥ 3% BSA affected with psoriasis (baseline), n</td>
<td>87</td>
<td>83</td>
<td>73</td>
<td>72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥50% improvement (%)</td>
<td>8.0</td>
<td>74.7</td>
<td>&lt;0.001</td>
<td>79.5</td>
<td>69.4</td>
<td></td>
</tr>
<tr>
<td>≥75% improvement (%)</td>
<td>1.1</td>
<td>60.2</td>
<td>&lt;0.001</td>
<td>60.3</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>≥90% improvement (%)</td>
<td>0.0</td>
<td>38.6</td>
<td>&lt;0.001</td>
<td>42.5</td>
<td>41.7</td>
<td></td>
</tr>
<tr>
<td>Percentage improvement in target lesion score³⁴</td>
<td>-1.0 ± 40.1</td>
<td>64.2 ± 43.9</td>
<td>&lt;0.001</td>
<td>70.3 ± 38.1</td>
<td>53.6 ± 50.4</td>
<td></td>
</tr>
<tr>
<td>Change in SF-36, n³⁴</td>
<td>92</td>
<td>93</td>
<td>82</td>
<td>84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical component</td>
<td>1.3 ± 8.2</td>
<td>7.7 ± 9.8</td>
<td>0.001</td>
<td>10.7 ± 10.4</td>
<td>8.8 ± 10.6</td>
<td></td>
</tr>
<tr>
<td>Mental component</td>
<td>0.4 ± 11.6</td>
<td>3.9 ± 11.9</td>
<td>0.047</td>
<td>2.8 ± 10.3</td>
<td>3.7 ± 9.5</td>
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</tr>
</tbody>
</table>

¹This group includes patients who were randomized to placebo and received infliximab, starting at either Week 16 or 24.
²This group includes patients who were randomized to infliximab 5 mg/kg and either received infliximab 5 mg/kg throughout the study or escalated the dose to 10 mg/kg at Week 38 or 46.
³Values are change or improvement from baseline.
⁴Values are means ± standard deviation.

ACR = American College of Rheumatology; BSA = body surface area; CRP = C-reactive protein; HAQ = Health Assessment Questionnaire; PASI = Psoriasis Area and Severity Index; PsARC = Psoriatic Arthritis Response Criteria; SF-36 = Short Form 36; VAS = visual analogue scale.

Joint response
Through Week 54, ACR 20, ACR 50, and ACR 70 responses were maintained with continued infliximab treatment in the randomized infliximab group and were substantial following crossover to infliximab in the placebo/infliximab group (Table 2; Figure 2). The ACR response at Week 54 was consistent, regardless of baseline MTX use (e.g., 56.8% of infliximab plus MTX patients and 60.9% of infliximab only patients achieved...
ACR 20 response). Major clinical response was achieved by 12.1% of patients in the infliximab group at Week 54.

By Week 54, there was a marked decrease from baseline in the numbers of patients with active enthesopathy and with at least one dactylitis digit in both treatment groups (Table 2). Other efficacy results, including the proportion of patients achieving PsARC, percent improvement in individual ACR components, and duration of morning stiffness, confirmed the maintenance of efficacy of infliximab through Week 54. Furthermore, by Week 54, all efficacy parameters improved in the placebo/infliximab group to an extent similar to that in the combined infliximab group.

Skin response
Through Week 54, the PASI 75 and PASI 90 responses seen at Week 24 were generally maintained in the randomized infliximab group (Table 2; Figure 3). By Week 54, similar proportions of patients achieved both PASI 75 and PASI 90 across treatment groups (Table 2; Figure 3). Compared with patients not receiving MTX at baseline, those receiving MTX in combination with infliximab had similar PASI 75 responses at Week 54 (i.e., 47.5% and 53.1%, respectively).

Effect of dose escalation
Among the 15 patients who were randomized to infliximab 5 mg/kg but whose dose was escalated to 10 mg/kg at Week 38 (i.e., by definition did not achieve ACR 20 response), 9 had previously achieved an ACR 20 response and 6 had not. Among these 9 patients, 5 also achieved an ACR 20 response at Week 54. None of the 6 patients who failed to respond through Week 38 achieved an ACR 20 response after dose escalation to 10 mg/kg. Only 12 of 15 dose-escalated patients had baseline BSA of at least 3% and were included in the PASI analyses. Of these 12 patients, 5 achieved PASI 75 at Week 38, and all 5 maintained PASI 75 response at Week 54. Conversely, the 7 patients who did not achieve PASI at Week 38 were unable to achieve the response following dose escalation. Post hoc analyses showed that body mass index did not affect PASI response to dose escalation (data not shown).
Physical function and quality of life
By Week 54, the percent improvement in HAQ was markedly better compared with baseline in both treatment groups (Table 2). At Week 54, 58.9% in the combined infliximab group and 53.0% in the placebo/infliximab group had achieved a clinically significant change (≥ 0.3 units decrease) in HAQ. Through Week 54, the mean improvement in SF-36 achieved at Week 24 was maintained in the combined infliximab group and was similar between treatment groups for both the Physical Component Summary (PCS) score and the Mental Component Summary (MCS) score (Table 2).

Safety
The safety profile of infliximab through Week 54 was consistent with that observed through Week 24. Approximately 85% of patients experienced an AE in the combined infliximab group at Week 54 and 67% at Week 24. The incidence of AEs in the combined infliximab group was generally similar between patients receiving MTX (87.5%) and those not receiving MTX (82.5%) at baseline. Twenty-two patients (11.5%) in the combined infliximab group experienced a serious adverse event (SAE) through Week 54; one dose-escalated patient experienced worsening of pre-existing carotid arterial stenosis that required surgery approximately 4 months after the last infusion.

Sixteen patients (8.4%) in the combined infliximab group had infusions stopped due to an AE, 7 of whom had elevated liver function tests. Two patients in the placebo group (cellulitis, bronchitis) and 3 in the infliximab group (infectious hepatitis, cellulitis, and pneumonia) experienced serious infections. Two patients had malignancies: 1 placebo patient had basal cell carcinoma and 1 infliximab patient, who had been treated with MTX and alefacept before the study, had stage I Hodgkin’s lymphoma. There were no reports of tuberculosis or opportunistic infection, autoimmune disorders, central demyelinating events, or congestive heart failure (CHF).

Infusion reactions were reported with 2.1% of infusions in the combined infliximab group and 1.6% of infusions in patients receiving placebo only. In the combined infliximab group, the infusion reaction rate was lower in patients receiving MTX at baseline (0.9% versus 3.2% without MTX). Most infusion reactions were mild to moderate, and none were considered serious. There were no anaphylactic reactions or delayed hypersensitivity reactions.

Of the 15 patients in whom the dose of infliximab was escalated to 10 mg/kg, 4 (26.7%) experienced at least one SAE from baseline through week 54. These SAEs included arthralgia, bone fracture, extracardiac aneurysm, abdominal hernia, and carotid arterial stenosis, the last of which was the only SAE that occurred after dose escalation. Twelve of these 15 patients experienced an AE of infection from baseline through week 54, although none were considered SAEs and only 3 patients had an infection (including one case of pneumonia) after dose escalation. Through week 54, one dose-escalated patient each experienced an infusion reaction and markedly abnormal ALT. One patient discontinued infliximab after dose escalation at week 38 due to hives, which were also experienced during previous treatment with the 5-mg/kg dose.
As reported previously, markedly abnormal ALT and AST values (i.e., predefined as >150 IU/L and ≥100% increase from baseline for ALT and AST) occurred in 5 patients in the infliximab group through Week 24 (21). Through Week 54, markedly abnormal ALT and AST values were reported in 8 (4.2%) and 4 (2.1%) patients, respectively, in the combined infliximab group. These elevations occurred in the same patients in whom elevations were reported at week 24 and in 3 additional patients, and they resolved in all but one patient who was lost to follow-up. Of the 191 patients in the combined infliximab group, ALT and AST values increased from normal at baseline to high (i.e., any value above normal) through Week 54 in 81 patients (42.4%) and 51 patients (26.7%), respectively. Slightly more infliximab-treated patients not receiving MTX had an ALT value that shifted from normal to high compared with those receiving MTX (46.6% vs 39.5%); similar findings were observed for AST (31.1% vs. 21.6%). Post hoc analyses showed that slightly more male patients had shifts from normal to high, especially for ALT values (data not shown). Other baseline factors, including body mass index, prior PsA or psoriasis medications, and pain medications, did not affect the proportion of patients with a shift in ALT/AST values from normal to high (data not shown). There were no cases of liver failure or clinically significant liver dysfunction through Week 54.

Through Week 66, 15.4% of patients in the combined infliximab group were positive for antibodies to infliximab; most had low antibody titers. As only 5 patients had a titer above 1:80, the correlation between antibody status and patient outcome could not be evaluated. While only 3.6% of patients receiving MTX at baseline were positive for antibodies to infliximab, 26.1% of those not receiving MTX at baseline tested positive. Among the 14 dose-escalated patients with available samples, 2 (14.3%) were positive for antibodies. Through Week 66, 41.3% of the patients in the combined infliximab group were newly positive for ANA, and 8.6% were newly positive for anti-dsDNA antibodies; however, no patient developed drug-induced lupus. No patients in the placebo-only group were newly positive for anti-dsDNA antibodies. In the combined infliximab group, the median percentage ACR improvement at Week 54 for patients who were positive for antibodies to infliximab (21.7%) was lower than that for the antibody-negative (33.3%) and inconclusive (44.8%) patients. Among antibody-positive patients, an approximately 3.5-fold increase in the incidence of mild to moderate infusion reactions occurred compared with antibody negative subjects; however, no severe or serious infusion reactions or possible delayed type hypersensitivity or possible anaphylactic reactions were experienced by antibody-positive patients.
DISCUSSION
Several studies have demonstrated the safety and efficacy of anti-TNFα agents in the treatment of PsA (19-24). This report demonstrates improvement in the signs and symptoms of arthritis and associated psoriasis, quality of life, and physical function in PsA patients through one-year of infliximab therapy, thereby broadening the knowledge of the benefits and risks of long-term infliximab treatment, both with and without MTX. One year of treatment with infliximab resulted in a high degree of sustained ACR and PASI response, regardless of concomitant MTX use, in addition to continued benefit with regard to dactylitis and enthesopathy.

While it was our intent to evaluate infliximab dose escalation in this study, only 15 patients met the predefined criteria for escalation. This suggests that 5 mg/kg is the appropriate dose for the majority of patients. Interestingly, in the subgroup requiring dose escalation, patients who had not achieved ACR 20 before dose escalation were unable to achieve this response despite doubling the dose of infliximab from 5 to 10 mg/kg. In contrast, patients who demonstrated ACR 20 improvement at some point before dose escalation were able to regain ACR 20 responses by doubling the dose. Dose escalation did not appear to improve PASI responses; however, the protocol requirement for increasing the dose was not contingent upon PASI response. The fact that the percentage of antibody-positive patients was similar between dose-escalated patients (14.3%) and the combined infliximab group (15.4%) suggests that a positive antibody-to-infliximab status was not necessarily a factor in the need for dose escalation. However, the small number of patients whose dose was increased from 5 to 10 mg/kg precludes drawing definitive inferences regarding the efficacy and safety of higher doses in patients with PsA.

Attainment of “major clinical response” (i.e., ACR 70 improvement for 24 consecutive weeks) was also evaluated. Designed originally to measure response in RA patients, major clinical response is evaluated here for the first time in a PsA population. Although this definition confirms a high degree of sustained improvement in arthritis, it does not make provisions for improvement in the dermatologic component of the disease. Further research is needed to better identify a definition that is specific for major response in both skin and joint components of PsA and to evaluate the effect of infliximab on major clinical response over time.

Skin response, as measured by PASI, was impressive for both patients treated with infliximab from baseline and those who crossed over to active treatment at Week 16 or Week 24. At Week 54, more than half of all patients achieved a PASI 75 response and 42% achieved a PASI 90 response, which is consistent with a clear or almost clear status. Although patients were not randomized to receive MTX, randomization was stratified by baseline MTX use, and it is especially notable that skin response did not appear to be affected by concomitant MTX use. These results are particularly relevant because, as a dermatologic manifestation, psoriasis is a critical factor in decreased quality of life and physical function in patients with PsA (8-10). Accordingly, notable improvement was observed with infliximab in the physical and mental aspects of quality of life as well as
the ability to function in daily life, indicating that the substantial effects observed at 6 months (21) continued through one year.

Infliximab was generally well tolerated over the one-year treatment period. The incidence of predefined markedly abnormal transaminase levels, which were higher in the infliximab group than in the placebo group at Week 24, did not increase disproportionally with an additional 30 weeks of treatment. Methotrexate use at baseline appeared to result in fewer patients with elevations in transaminase levels compared with patients not using MTX. However, the effect of MTX on transaminase levels must be interpreted with caution, as patients receiving MTX prior to enrollment were required to have tolerated MTX for at least 3 months without significant toxicity, suggesting these patients may have been less prone to abnormal liver enzymes than the other patients. No cases of opportunistic infections, CHF, demyelination, or liver failure were reported. One infliximab-treated patient, who had received MTX and alefacept prior to study entry, was diagnosed with stage I Hodgkin’s lymphoma; one placebo patient developed basal skin carcinoma. Fewer infusion reactions occurred among patients receiving MTX at baseline than among those not receiving MTX. However, most infusion reactions were mild-to-moderate, and no patients developed a serious infusion reaction or anaphylaxis. Similarly, at the end of the study, the proportion of patients positive for antibodies to infliximab was lower among patients receiving MTX at baseline than among those not receiving MTX; however, ACR and PASI responses were consistent irrespective of MTX use.

Through one year of infliximab therapy, a high degree of clinical response, as measured by both ACR and PASI responses, was sustained with corresponding improvements in physical function and quality of life, as measured by HAQ and SF-36. Infliximab was generally well tolerated. These results indicate that the positive benefit/risk ratio of infliximab observed at 6 months remains favorable after one year of treatment in patients with PsA.
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APPENDIX

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FIGURE LEGENDS

Figure 1. Patient disposition chart, including patients who entered early escape, escalated the infliximab dose, or discontinued from the study or study agent.

Figure 2. Joint response over time through Week 54, as measured by various degrees of ACR response in patients treated with infliximab and/or placebo. Data are reported for 100 patients each at Weeks 0, 24, and 54 in the infliximab groups and for 100, 100, and 91 at Weeks 0, 24, and 54, respectively, in the placebo groups. ACR = American College of Rheumatology.

Figure 3. Skin response over time through Week 54, as measured by various degrees of PASI response in patients treated with infliximab and/or placebo. Data are reported at Weeks, 0, 24, and 54, respectively, for 100, 83, and 82 in the infliximab groups and for 100, 87, and 80 in the placebo groups. (PASI = Psoriasis Area and Severity Index).
A. ACR 20

Proportion of Patients (%)

0 2 6 14 22 24 30 38 46 54

B. ACR 50

Proportion of Patients (%)

0 2 6 14 22 24 30 38 46 54

C. ACR 70

Proportion of Patients (%)

0 2 6 14 22 24 30 38 46 54

Weeks

--- Placebo
--- Infliximab 5 mg/kg
--- Placebo Crossover to Infliximab 5 mg/kg (Week 24)