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Long-term efficacy and safety of certolizumab pegol in Japanese rheumatoid arthritis patients with an inadequate response to methotrexate: 52-week results from an open-label extension of the J-RAPID study

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Abstract
Objectives. To evaluate the long-term efficacy and safety of certolizumab pegol (CZP) plus methotrexate treatment and to assess the efficacy of two CZP maintenance dosing schedules in Japanese rheumatoid arthritis (RA) patients with an inadequate response to methotrexate.
Methods. J-RAPID double-blind patients were entered into an open-label extension (OLE) study. Patients withdrawn due to lack of efficacy at 16 weeks and double-blind completers without a week-24 American College of Rheumatology (ACR) 20 response received CZP 200 mg every other week (Q2W) plus methotrexate. Double-blind completers with week-24 ACR20 responses were randomized to CZP 200 mg Q2W plus methotrexate or CZP 400 mg every 4 weeks plus methotrexate.
Results. The ACR20/ACR50/ACR70 response rates of double-blind completers (n = 204) were 89.7%/67.2%/36.3% at OLE entry and 95.6%/84.8%/58.3% at 52 weeks, respectively. Other clinical, functional and radiographic outcomes were sustained with long-term CZP plus methotrexate. Long-term treatment with CZP was well-tolerated with no new unexpected adverse events observed. The efficacy and safety of CZP treatment were similar between the two dosing schedules.
Conclusions. Continued CZP administration with methotrexate maintained efficacy over 52 weeks and was well-tolerated for Japanese RA patients. No obvious differences in clinical efficacy and safety were observed between the two dosing schedules, giving flexibility in maintenance administration schedules.

Introduction
TNFα plays a central role in the pathogenesis of rheumatoid arthritis (RA). After the introduction of TNF inhibitors in clinical practice, the management of RA has dramatically changed [1,2]. Early initiation of TNF inhibitors is beneficial not only because they improve the signs and symptoms of RA, but also because they improve physical function and inhibit structural damage, particularly when used in combination with methotrexate (MTX) [3–5]. TNF inhibitors control RA symptoms and suppress functional and structural damages in the long-term, resulting in improved overall outcomes for RA patients [6,7].

In Japan, four TNF inhibitors (infliximab, adalimumab, etanercept and golimumab) have been introduced in clinical practice over the last 10 years [8]. As a relatively new member of the TNFα inhibitor family, certolizumab pegol (CZP) was developed as a novel polyethylene glycolylated (PEG) Fc-free anti-TNFα agent [9,10] and is approved for the treatment of adults suffering from RA not responding to conventional therapy. The efficacy and safety of CZP has been demonstrated in patients with active RA in pivotal international clinical studies [11,12]. In addition, CZP has been shown to improve the signs and symptoms of RA, and decrease disease activity in J-RAPID (concomitant use with MTX) [13] and HIKARI (without MTX) studies performed in Japan [14].

Long-term administration of CZP plus MTX has been previously reported [15], where sustained improvement in RA
clinical signs and symptoms including radiographic progression and safety was shown. The aim of the current study was to determine whether the beneficial effects of CZP are sustained during long-term treatment in Japanese RA patients who showed an inadequate response to MTX treatment. To evaluate the long-term efficacy and safety of CZP treatment, we conducted an open-label extension (OLE) study of the J-RAPID study. As a subsidiary objective, we also compared the efficacy of two separate maintenance dosing schedules, CZP 200 mg given every 2 weeks (Q2W) and CZP 400 mg given every 4 weeks (Q4W). We hereby report the 52-week interim results and post-hoc analysis from the ongoing J-RAPID OLE study.

Materials and methods

J-RAPID and J-RAPID OLE study design

The J-RAPID OLE study (NCT00851318) is an OLE study of the J-RAPID study (NCT00791999) [13]. In brief, the J-RAPID study [hereinafter referred to as “double-blind (DB) phase”] was a 24-week, Phase II/III, DB study conducted in 66 centers across Japan. Eligible patients were aged from 20 to 74 years and had a diagnosis of RA by the ACR (1987) criteria [16] with at least nine tender and nine swollen joints at screening and baseline. Moreover, the patients must have met at least one of the following criteria at screening: erythrocyte sedimentation rate (ESR) of ≥ 30 mm/hour or C-reactive protein (CRP) of ≥ 1.5 mg/dL. Patients must have received treatment with MTX (with or without folic acid) for ≥ 6 months before study drug administration, with the MTX dose fixed for ≥ 2 months beforehand and within the range of 6–8 mg/week. Patients with extensive comorbidities were excluded from the study. Refer to [13] for detailed inclusion and exclusion criteria of the J-RAPID study. Japanese patients with active RA and an inadequate response to MTX received CZP 200 mg Q2W plus MTX thereafter. Patients who exhibited an ACR20 response at both weeks 12 and 14 were withdrawn from the DB phase at week 16, assigned to Group I (n = 81) and treated with CZP 200 mg Q2W plus MTX thereafter. Patients who achieved an ACR20 response at week 12 or 14 but failed to achieve an ACR20 response at week 24 were assigned to Group II (n = 19) and also received CZP 200 mg Q2W plus MTX. Patients who achieved an ACR20 response at week 12 or 14 as well as at week 24 were randomized 1:1 to either CZP 200 mg Q2W plus MTX (Group III, n = 93) or CZP 400 mg Q4W plus MTX (Group IV, n = 92) (Figure 1). Of importance, we established this dosing schedule so that the total dose received by patients in Groups III and IV over a 1-month period was the same.

Week 0 of the OLE phase of Groups II, III and IV (J-RAPID DB phase completers: hereinafter referred to as DB completers) corresponds to week 28 of the DB phase and week 0 of the OLE phase of Group I (early escape) corresponds to week 16 of the DB phase. Patients assigned to the placebo group during the DB phase were also included in this OLE study. Discontinuation of concomitant MTX was not permitted during the OLE phase up to week 52. A change in MTX dosage was permitted after week 24 of the OLE phase, if it was not greater than the original dose (6–8 mg/week).

Figure 1. J-RAPID OLE study design. The diagram depicts the breakdown of J-RAPID DB study patients into four groups for the OLE phase of the study. *Regardless of their initial DB phase group assignment, patients who achieved an ACR20 response at weeks 12 or 14 as well as at week 24 were randomized (1:1) to either CZP 200 mg Q2W (Group III, n = 93) or CZP 400 mg Q4W (Group IV, n = 92).
Post-hoc analyses

Since the OLE study included patients who received placebo during the J-RAPID DB phase, an additional post-hoc analysis of clinical efficacy was performed on patients who received CZP in the DB phase, to observe the effects of continuous CZP treatment during the combined DB and OLE phases of the study. This data set includes patients who were originally assigned to CZP 100, 200 and 400 mg treatment groups in the DB phase and completed the DB phase (CZP-DB completers). We focused on ACR20/ACR50/ACR70 response rates, DAS28-ESR scores, HAQ-DI scores and the disease activity state (high: DAS28-ESR > 3.2, functional remission (HAQ-DI ≤ 0.5) and radiographic non-progression (yearly ΔmTSS ≤ 0.5). Similarly, comprehensive disease remission (CDR) was defined by simultaneously achieving the following: clinical remission (DAS28-ESR < 2.6), functional remission (HAQ-DI ≤ 0.5) and radiographic non-progression (yearly ΔmTSS ≤ 0.5). To calculate CDC and CDR for overall DB completers (n = 204), yearly ΔmTSS from J-RAPID pre-study baseline (linear extrapolation, non-responder imputation for patients with no data) was used. Safety outcomes were reported for all patients who received at least one dose of CZP in the OLE study (n = 285).

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and with the Pharmaceutical Affairs Law Standards for the Conduct of Clinical Trials on Drugs (Ministry of Health, Labour and Welfare Ordinance no. 28, 27 March 1997) and related notifications. Institutional review board approval was obtained at all centers and all patients provided written informed consent.

Statistical analyses

The efficacy analysis was performed on the full-analysis set (FAS) using the last observation carried forward (LOCF) to impute missing data. We used J-RAPID pre-study parameters as baseline values. Safety analyses were performed on all subjects who received at least one dose of CZP during the OLE study. Because the objective of the study was to evaluate the long-term efficacy and safety of CZP treatment, inferential analyses were not performed.

Results

Patient characteristics and disposition of the J-RAPID OLE study

We obtained informed consent from 286 J-RAPID DB phase patients to enter the OLE study. Because one patient withdrew from the OLE study before receiving CZP treatment, a total of 285 patients were included in the efficacy and safety analyses. During the 52-week treatment, an additional 33 patients withdrew from the study resulting in a total of 252 patients (88.4%) completing the 52-week interim period of the OLE study. A few patients (2.5%) withdrew from the study due to an inadequate response (Table 1). All reasons for study withdrawal are listed in Table 1.

A summary of patient demographics and J-RAPID pre-study baseline characteristics is shown in Table 2. Patients were divided into four groups in the OLE phase based on their response during the DB phase. It was important to distinguish patients with an ACR20 response at week 24 of the DB phase (DB responders: Groups III and IV) and DB non-responders (Groups I and II) to evaluate the sustained efficacy of continued long-term CZP treatment. As shown in Table 2, all of these groups included patients who were on placebo during the DB phase. The fraction of patients that received placebo during the DB phase was 55.6% (45 patients), 31.6% (6 patients), 10.8% (10 patients) and 9.8% (9 patients) in Groups I, II, III and IV, respectively. DB responders were further divided into two groups to evaluate the efficacy of two different dosing regimens. DB responder patients (n = 185) were randomized to either CZP 200 mg Q2W (Group III, n = 93: 83 CZP patients, 10 placebo patients) or CZP 400 mg Q4W (Group IV, n = 92: 83 CZP patients, 9 placebo patients) as shown in Table 2. At OLE study entry (OLE week-0), the mean DAS28-ESR scores of Groups I, II, III and IV were 6.08, 5.12, 3.22 and 3.20, respectively.

Clinical efficacy is sustained by long-term CZP plus MTX treatment

The J-RAPID OLE study was designed to evaluate whether the benefits obtained after short-term CZP plus MTX treatment could be sustained by prolonged treatment. To this end, we analyzed the outcomes of Groups I, II, III, IV and overall DB completers (Groups II + III + IV) after up to 52 weeks of long-term CZP treatment in the OLE phase. ACR20/ACR50/ACR70 response rates, calculated from the J-RAPID pre-study baseline, were increased or sustained for up to 52 weeks in the OLE phase. At OLE study entry and at 52 weeks of the OLE phase, the ACR20 response rates were 7.5% and 76.5% for Group I, 36.8% and 84.2% for Group II, 95.7% and 98.9% for Group III, and 94.6% and 94.6% for Group IV, respectively (Figure 2a). The ACR50 response rates were 0% and 48.1% for Group I, 0% and 57.9% for Group II, 77.4% and 87.1% for Group III, and 70.7% and 88% for Group IV, respectively (Figure 2b). The ACR70 response rates were 0% and 30.9% for Group I, 0% and 31.6% for Group II, 39.8% and 64.5% for Group III, and 40.2% and 57.6% for Group IV, respectively (Figure 2c). For overall DB completers...
Table 2. Patient demographics and disease status at J-RAPID pre-study baseline (FAS population).

<table>
<thead>
<tr>
<th>Group</th>
<th>CRP 200 mg</th>
<th>Group II</th>
<th>CRP 200 mg</th>
<th>Group III</th>
<th>CRP 200 mg</th>
<th>Group IV</th>
<th>CRP 400 mg</th>
<th>Total (Groups I + II + III + IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2W</td>
<td>(n = 81)</td>
<td>Q2W</td>
<td>(n = 19)</td>
<td>Q2W</td>
<td>(n = 93)</td>
<td>Q4W</td>
<td>(n = 92)</td>
<td>(n = 285)</td>
</tr>
<tr>
<td>Prior treatment in the double-blind phase, n (%)*</td>
<td></td>
<td></td>
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<tr>
<td>Placebo</td>
<td>45 (55.6)</td>
<td>6 (31.6)</td>
<td>10 (10.8)</td>
<td>9 (9.8)</td>
<td>70 (24.6)</td>
<td></td>
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<tr>
<td>CZP 100 mg</td>
<td>14 (17.3)</td>
<td>5 (26.3)</td>
<td>22 (23.7)</td>
<td>24 (26.1)</td>
<td>65 (22.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CZP 200 mg</td>
<td>11 (13.6)</td>
<td>5 (26.3)</td>
<td>29 (31.2)</td>
<td>29 (31.5)</td>
<td>74 (26.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CZP 400 mg</td>
<td>11 (13.6)</td>
<td>3 (15.8)</td>
<td>32 (34.4)</td>
<td>30 (32.6)</td>
<td>76 (26.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age (SD), years</td>
<td>51.8 (10.7)</td>
<td>51.3 (13.7)</td>
<td>52.9 (11.0)</td>
<td>54.1 (11.0)</td>
<td>52.8 (11.1)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Female, n (%)</td>
<td>67 (82.7)</td>
<td>16 (84.2)</td>
<td>76 (81.7)</td>
<td>77 (83.7)</td>
<td>236 (82.8)</td>
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<td></td>
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<tr>
<td>Mean body weight (SD), kg</td>
<td>56.30 (12.00)</td>
<td>54.27 (9.57)</td>
<td>55.81 (11.34)</td>
<td>54.92 (9.47)</td>
<td>55.56 (10.83)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean total mTSS (SD)</td>
<td>46.73 (52.61)</td>
<td>60.41 (46.53)</td>
<td>53.52 (52.20)</td>
<td>53.10 (55.35)</td>
<td>25.10 (55.35)</td>
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<tr>
<td>Mean ESR (SD), mm/h</td>
<td>53.6 (24.1)</td>
<td>58.0 (21.3)</td>
<td>49.8 (23.2)</td>
<td>51.5 (21.8)</td>
<td>52.0 (22.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean CRP (SD), mg/dL</td>
<td>2.68 (2.40)</td>
<td>2.03 (1.87)</td>
<td>1.23 (0.66)</td>
<td>1.04 (0.60)</td>
<td>1.11 (0.63)</td>
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<tr>
<td>Mean no. (SD) of swollen joints (0 – 66)</td>
<td>18.2 (9.2)</td>
<td>17.2 (10.9)</td>
<td>18.4 (11.6)</td>
<td>18.6 (8.8)</td>
<td>19.8 (10.4)</td>
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<tr>
<td>Mean MTX dose (SD), mg/week</td>
<td>7.50 (0.9)</td>
<td>7.5 (0.8)</td>
<td>7.5 (0.9)</td>
<td>7.5 (0.8)</td>
<td>7.5 (0.8)</td>
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<tr>
<td>Mean RF-positive (%)</td>
<td>3.2 – 5.1, n (%)</td>
<td>0.0 (0.0)</td>
<td>4 (4.3)</td>
<td>10 (10.9)</td>
<td>15 (5.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean body weight (SD), kg</td>
<td>81 (100.0)</td>
<td>89 (95.7)</td>
<td>89 (94.7)</td>
<td>89 (94.7)</td>
<td>89 (94.7)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean age (SD), years</td>
<td>54.0 (11.8)</td>
<td>55.8 (11.2)</td>
<td>54.0 (11.2)</td>
<td>54.0 (11.2)</td>
<td>54.0 (11.2)</td>
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<td>49.8 (23.2)</td>
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<td>53.52 (52.20)</td>
<td>53.10 (55.35)</td>
<td>25.10 (55.35)</td>
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</table>

*Number of patients (%).

At OLE study entry and at 52 weeks of the OLE phase, the ACR20 response rates were 89.7% and 95.6%, the ACR50 response rates were 67.2% and 84.8%, and the ACR70 response rates were 36.3% and 58.3%, respectively (Figure 2). A marked improvement in DAS28-ESR was also sustained for up to 52 weeks of the OLE phase for overall DB completers (Figure 3a). DAS28-ESR remission rates (defined as DAS28-ESR ≤ 3.2) for overall DB completers were 28.4% and 42.6% at OLE study entry and 52 weeks of the OLE phase, respectively.

Improvements in quality of life indicators including HAQ-DI were maintained for the duration of the OLE phase. The HAQ-DI remission rates (defined as HAQ-DI ≤ 0.5) for overall DB completers were 66.7% and 77.5% at OLE study entry and at 52 weeks of the OLE phase, respectively, indicating that most patients achieved functional remission. The mean ± SD changes of SF-36 scores from J-RAPID pre-study baseline at OLE study entry and at week 52 were 11.93 ± 10.03 and 13.60 ± 10.54 in physical component summary scores and 5.56 ± 11.07 and 5.21 ± 11.17 in mental component summary scores, respectively. In addition to clinical parameters, the ΔmTSS from OLE study entry to OLE study entry were 95.7% and 98.9% for Groups III and IV, respectively (Figure 3a). In addition to clinical parameters, the ΔmTSS from OLE study entry to OLE study entry were 95.7% and 98.9% for Groups III and IV, respectively (Figure 3a). In addition to clinical parameters, the ΔmTSS from OLE study entry to OLE study entry were 95.7% and 98.9% for Groups III and IV, respectively (Figure 3a).

The two dosing schedules (CZP at 200 mg Q2W vs. 400 mg Q4W) combined with MTX similarly sustain the clinical efficacy of CZP.

In both randomized arms (Groups III and IV), the high ACR20/ACR50/ACR70 rates and the high changes from J-RAPID pre-study baseline in DAS28-ESR and HAQ-DI scores were sustained through 52 weeks of the OLE phase (Figures 2 and 3). For example, the ACR20 response rates at OLE study entry and at 52 weeks of the OLE phase were 95.7% and 98.9% for Group III and 94.6% and 94.6% for Group IV, respectively (Figure 2a). In addition to clinical parameters, the ΔmTSS from OLE study entry to OLE study entry were 95.7% and 98.9% for Groups III and IV, respectively, suggesting that both arms were similarly effective at inhibiting radiographic progression. Thus, both CZP maintenance regimens similarly sustained clinical efficacy of CZP during the OLE study phase.

Assessment of sustained clinical efficacy of combined long-term CZP plus MTX treatment by a post-hoc analysis through the DB and OLE phase.

Since all arms of the OLE protocol (Groups I, II, III and IV) included patients who were originally randomized to the placebo group during the DB phase (Table 2), a post-hoc analysis was performed only on data from patients who were originally assigned to one of the CZP treatment groups in the DB phase and completed the DB phase with an ACR20 response at week 12 or 14 (CZP-DB completers). This was an important analysis to observe the effects...
of continuous CZP treatment during the DB and OLE phases of the study. In this post-hoc analysis, we focused on ACR20/ACR50/ACR70 response rates, DAS28-ESR scores, HAQ-DI scores and the disease activity state (LDA and remission). The efficacy results are summarized in Figures 5–7 for the patients who were originally randomized to either CZP 100, 200 or 400 mg in the DB phase and received either CZP 200 mg Q2W + MTX (Groups II and III) or CZP 400 mg Q4W + MTX (Group IV) in the OLE phase.

The ACR20/ACR50/ACR70 response rates in CZP-DB completers were sustained with long-term CZP treatment up to week 52 compared with OLE study entry (Figure 5). For example, 87.3% (55/63) of CZP-DB completers receiving 200 mg CZP during the DB phase continued treatment with CZP to 52 weeks of the OLE phase, with the ACR20/ACR50/ACR70 response rates of 96.8%/88.9%/49.2% at week 52, respectively (Figure 5).
DB phase, respectively (Figure 7). The remission rates (DAS28-ESR < 2.6) were 31.4%, 25.4% and 38.5% at OLE entry, and 47.1%, 34.9% and 49.2% at week 52, in CZP-DB completers receiving 100, 200 and 400 mg CZP during the DB phase, respectively (Figure 7). Therefore, this post-hoc analysis demonstrates that the efficacy of CZP can be sustained in long-term CZP treatment, even when the analysis set is restricted to patients who have achieved an ACR20 clinical response after 12–14 weeks of CZP treatment.

Adverse events (AE)s reported during long-term CZP plus MTX treatment

During the 52 weeks of the OLE phase, 253 patients (88.8%) experienced AEs and 31 patients (10.9%) experienced serious AEs (Table 3). Among SAEs, two patients (0.7%) exhibited abnormal hepatic function, two patients (0.7%) developed bronchitis, three patients (1.1%) displayed RA exacerbations and two patients (0.7%) developed subarachnoid hemorrhage. Two patients (0.7%) developed a malignancy (breast cancer, colon cancer). The most common AEs were nasopharyngitis, pharyngitis and upper respiratory tract infections. Most AEs were mild to moderate (84.6%). The rate, severity and distribution of AEs were similar among all groups (Groups I–IV), suggesting that no obvious differences in AEs are observed based on the CZP treatment schedule. No tuberculosis infections or deaths were reported. No unanticipated AEs occurred in any of the groups. Thus, over 52 weeks of the OLE phase, CZP coadministered with MTX was well tolerated, with no new safety precautions when compared with the DB phase (Table 3).

Discussion

The 24-week treatment of CZP has been shown to be efficacious in improving RA disease activity [11–14]. This was also true in patients who showed an inadequate response to MTX. In the DB placebo-controlled J-RAPID study, the combination of CZP plus MTX for 24 weeks improved disease outcome in RA patients who showed an inadequate response to MTX [13]. Although several data on short-term CZP plus MTX treatment have been available [17–19], the clinical efficacy and safety of long-term CZP plus MTX treatment is unknown in Japanese RA patients. Thus, we conducted an OLE study of the J-RAPID study to evaluate the safety of combined long-term CZP plus MTX treatment and to investigate whether the clinical benefit obtained from the 24-week DB phase of the J-RAPID study could be sustained by extending the treatment for another 52 weeks. In addition, we used the OLE herein to assess the efficacy of two different maintenance dosing schedules, the standard dosing (CZP 200 mg Q2W) and an alternative regimen (CZP 400 mg Q4W), both with concomitant MTX.

Our data demonstrate that long-term CZP treatment sustains the clinical efficacy obtained in overall DB completers. This was
true for ACR response rates, DAS28-ESR, SF-36 scores and the pain VAS. In addition, clinical remission was observed in 42.6% of patients with long-term treatment at 52 weeks of the OLE study. Functional remission was also observed in 77.5% at 52 weeks of the OLE. Moreover, an analysis of mTSS scores showed that radiographic non-progression ($\Delta mTSS < 0.5$) was achieved in 68.3% of the patients. In terms of the radiographic scores, as described in the Materials and Methods, all patients received CZP in this OLE, and the changes in mTSS scores were within the 52 weeks of the OLE. Therefore, there are no significant differences seen in radiographic progression between groups. On a separate note, the disconnect between the improvements in signs and symptoms and changes in radiographic manifestations of disease has been previously reported in patients treated with TNF antagonists [20].

Together, these results suggest that long-term CZP treatment is effective at controlling RA disease progression, even with the relatively low dose of concomitant MTX (6–8 mg/week). The low withdrawal rate (2.5%) of patients from the study due to lack of efficacy further supports this notion. This was true even for patients that were initially treated with the lower dose of CZP true for ACR response rates, DAS28-ESR, SF-36 scores and the pain VAS. In addition, clinical remission was observed in 42.6% of patients with long-term treatment at 52 weeks of the OLE study. Functional remission was also observed in 77.5% at 52 weeks of the OLE. Moreover, an analysis of mTSS scores showed that radiographic non-progression ($\Delta mTSS < 0.5$) was achieved in 68.3% of the patients. In terms of the radiographic scores, as described in the Materials and Methods, all patients received CZP in this OLE, and the changes in mTSS scores were within the 52 weeks of the OLE. Therefore, there are no significant differences seen in radiographic progression between groups. On a separate note, the disconnect between the improvements in signs and symptoms and changes in radiographic manifestations of disease has been previously reported in patients treated with TNF antagonists [20].

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(100 mg) during the DB phase. Although the rate of LDA was approximately 7% lower in patients treated with 100 mg CZP during the DB phase compared with patients treated with 200 mg CZP at 52 weeks of the OLE phase, there were no overall significant differences in disease activity state regardless of the dose received during the DB phase (Figure 7).

This is the first study that demonstrates the benefits of continued long-term treatment of CZP administration in Japanese RA patients. Similar studies have been conducted internationally. In the RAPID1 trial, sustained benefit in clinical signs and symptoms and radiographic progression was observed after 2 years of continuous CZP treatment [15]. More recently, the 5-year OLE study from the RAPID1 trial showed continued efficacy up to 256 weeks with no new safety signals identified [21]. Our data presented here suggest that Japanese patients continue to receive relief from RA symptoms after long-term TNFα inhibition by CZP. Importantly, long-term CZP plus MTX treatment was well-tolerated as no unexpected new AEs were detected in patients compared with those observed in previous clinical studies involving short-term CZP plus MTX treatment.

CZP is a novel anti-TNFα monoclonal antibody consisting of a humanized Fab’ fragment fused to a 40-kD PEG moiety [22,23]. One drawback of Fab’ fragments is that the clearance of Fab’ fragments is accelerated in the absence of the Fc region, leading to shorter in vivo half-lives compared with full antibodies. However, by attachment of the PEG moiety to the Fab’ fragment, the plasma half-life of CZP was extended to about 2 weeks. Because of the extended half-life, a more spaced out CZP maintenance dosing schedule is possible. Our current study provides evidence that extending the interval to Q4W for CZP maintenance therapy is as effective as the Q2W regimen. No obvious differences in clinical efficacy and safety were observed between patients treated with CZP 200 mg Q2W and CZP 400 mg Q4W (Group III vs. Group IV). Thus, patients and physicians have the flexibility of choosing either of two maintenance dosing schedules based on their needs. For example, a Q4W dosing schedule might decrease the number of doctor visits and thus, might be an attractive option for some patients.

The design of the J-RAPID OLE study included patients that were previously on placebo during the DB phase of the J-RAPID study. To observe the effects of continuous CZP treatment through the DB and OLE phases of the study (80 weeks), an additional post-hoc analysis was performed on CZP-DB completers (Groups II–IV) who received CZP during the DB phase. Restricting our analysis to these patients clearly showed that long-term CZP plus MTX treatment sustained the clinical, radiographic and functional efficacy against disease. Thus, we conclude that long-term CZP plus MTX treatment for up to 80 weeks results in a sustained positive response.

Administration of MTX remains the cornerstone for treatment of RA [24,25]. However, some patients do not achieve the desired response when MTX is used as monotherapy [25]. Thus, it is important to identify drugs that can be used in conjunction with MTX to more effectively treat the symptoms of RA. The J-RAPID study demonstrated that CZP is clinically effective in combination with MTX for treatment of patients who failed to achieve a satisfactory response with MTX alone. Our current study is the first to investigate the clinical efficacy of CZP with MTX treatment over an ~80-week period (28 weeks during the DB phase + 52 weeks during the OLE phase) in Japanese RA patients. Our data demonstrate that long-term CZP plus MTX treatment sustains the beneficial effect of CZP plus MTX afforded after 24 weeks of therapy. Moreover, no new unexpected AEs were discovered during the OLE phase, suggesting that additional risks are not incurred by long-term treatment with CZP plus MTX. Based on results from clinical trials and from post market surveys, the AEs observed with long-term CZP treatment are comparable to those seen with other TNF inhibitors such as infliximab, etanercept, adalimumab and golimumab. As an added benefit, the local skin reaction to subcutaneous injection of CZP tends to be lower than other subcutaneously administered TNF inhibitors. Together, these data suggest that if the patient obtains a positive response to CZP treatment after 12–14 weeks, clinicians can expect sustained efficacy without additional risks by continuing onto long-term use of CZP plus MTX.

In summary, our data suggest that continuous long-term CZP treatment is a beneficial option in patients with active RA and an inadequate response to MTX, by providing long-term clinical, functional and radiographic disease control. This was true for both the Q2W and Q4W maintenance dosing schedules of CZP. Moreover, long-term treatment was well-tolerated with no new unexpected adverse events observed. One limitation of our study was that this was an OLE study and therefore not blinded. However, we believe that our data still suggest that long-term CZP treatment is beneficial for continued suppression of RA. Thus, we propose that patients with active RA and an inadequate response to MTX should undergo continuous combined long-term treatment with either a CZP 200 mg Q2W or CZP 400 mg Q4W schedule with MTX to achieve long-lasting suppression of RA symptoms.

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Conflict of interest

The competing interests of all authors are provided below.

- Y. Tanaka has received research funding from BMS, MSD, Chugai, Mitsubishi-Tanabe, Astellas, Abbvie and Daichi-Sankyo and has served on speaker bureaus for UCB, Mitsubishi-Tanabe, Abbott, Abbvie, Eisai, Chugai, Janssen, Pfizer, Takeda, Astellas, Daichi-Sankyo, GSK, AstraZeneca, Eli Lilly, Quintiles, MSD and Asahi Kasei.
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- H. Yamanaka has served as a consultant for, and received research funding from, UCB, Abbott, Astellas, BMS, Chugai, Eisai, Janssen, Mitsubishi-Tanabe, Pfizer and Takeda.
- N. Ishiguro has received research funding from Takeda, Mitsubishi-Tanabe, Astellas, Chugai, Abbott, BMS, Eisai, Janssen, Kaken and Pfizer and has served on speaker bureaus for Takeda, Mitsubishi-Tanabe, Astellas, Chugai, Abbott, BMS, Eisai, Janssen, Kaken, Pfizer, Taisho-Toyama and Otsuka.
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- H. Origasa has served as a consultant for UCB and Astellas.
- T. Shoji is an employee of UCB.
- N. Miyasaka has received research support from Pfizer, Takeda, Mitsubishi-Tanabe, Chugai, Abbott, Eisai and Astellas.
- T. Koike has served on speaker bureaus for UCB, Pfizer, Chugai, Abbott, Mitsubishi-Tanabe, Takeda, Eisai, Santen, Astellas, Taisho-Toyama, BMS, Teijin and Daichi-Sankyo.

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