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(12) **United States Patent**
Nakamura et al.(10) **Patent No.:** **US 9,815,827 B2**
(45) **Date of Patent:** ***Nov. 14, 2017**(54) **AGENT FOR TREATMENT OF SCHIZOPHRENIA**

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This patent is subject to a terminal disclaimer.

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- (60) Provisional application No. 60/404,927, filed on Aug. 22, 2002.
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- (52) **U.S. Cl.**
CPC **C07D 417/12** (2013.01); **A61K 31/496** (2013.01)
- (58) **Field of Classification Search**
CPC **A61K 31/496**; **C07D 417/12**
See application file for complete search history.

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Primary Examiner — Snigdha Maewall(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.(57) **ABSTRACT**

The present invention provides a novel method for treatment of schizophrenia which can improve wide-ranging symptoms of schizophrenia, especially positive symptoms and negative symptoms without being accompanied by extrapyramidal symptoms, which comprises orally administering as an active compound (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzisothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboxyimide or a pharmaceutically acceptable salt thereof (e.g., hydrochloride) at a daily dose of 5 mg to 120 mg once a day to a patient with schizophrenia, and a therapeutic agent to be used in said method.

75 Claims, 1 Drawing Sheet

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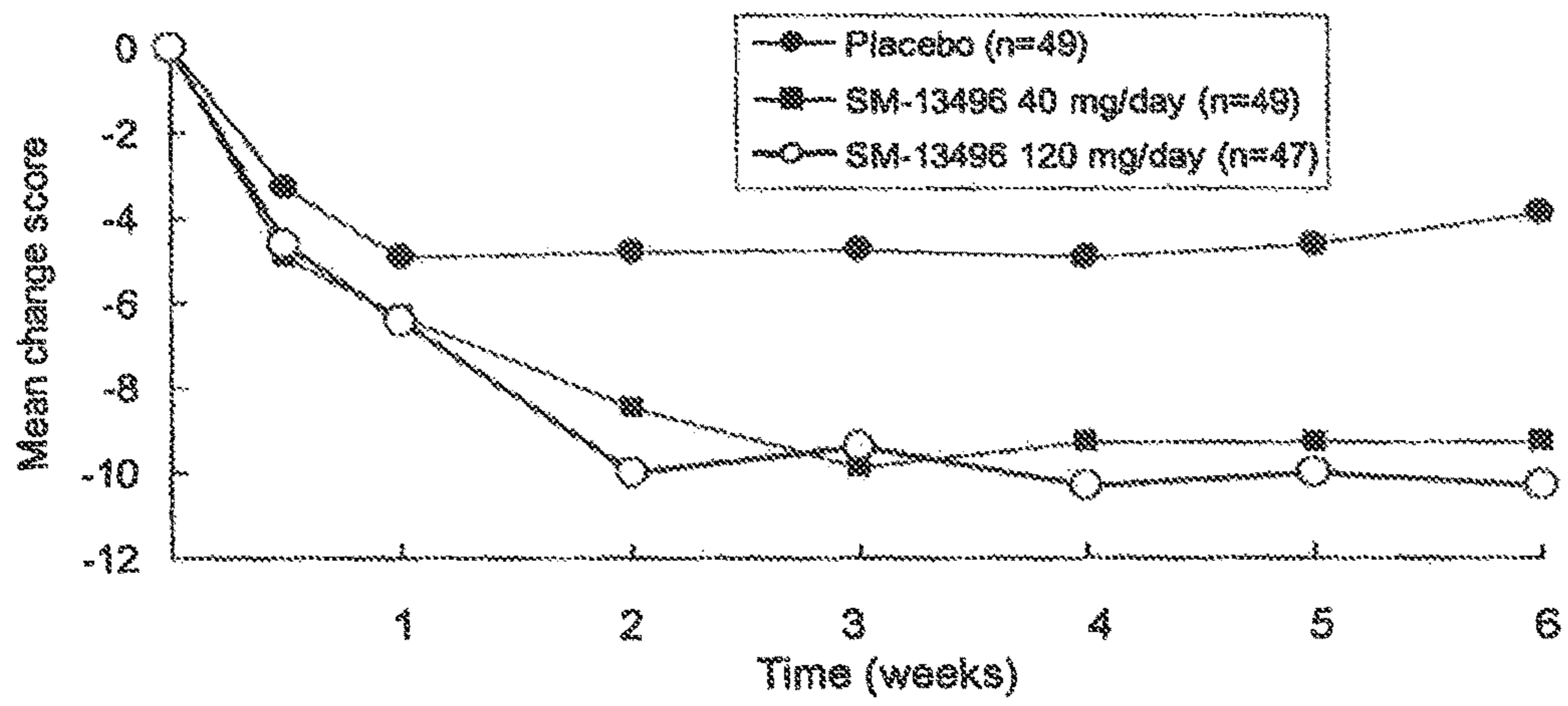
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AGENT FOR TREATMENT OF
SCHIZOPHRENIA

This is a continuation application of application Ser. No. 10/525,021, filed Feb. 18, 2005, which is a national stage application of PCT/JP2003/010490, filed Aug. 20, 2003, and claims priority to U.S. Provisional Application 60/404,927, filed Aug. 22, 2002, the contents of which are incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to a novel method for treatment of schizophrenia and a novel therapeutic agent used therein. More particularly, the present invention relates to a method for improving schizophrenia without being accompanied by extrapyramidal symptoms by orally administering a prescribed dose of a specific bicycloheptane dicarboximide derivative once a day, and a therapeutic agent used in said method.

BACKGROUND ART

Schizophrenia (split personality) is a kind of endogenous psychosis, and it is developed mainly during adolescence, and after a chronic course, the personality of patient is progressively decayed, and some of patients may culminate in a mental decay. The symptoms of this disease are, for example, positive symptoms often observed during the early stage of the disease such as hallucination, delusion, etc., or negative symptoms such as apathy and withdrawal, or cognitive dysfunction such as impairments of concentration and learning abilities, etc. Moreover, there are other symptoms such as depression, anxiety, etc. as related symptoms thereof.

Medication is mainly employed in the treatment of schizophrenia, but the treatment of schizophrenia should be continued for a long time, and even though schizophrenia is once healed, there is a large risk of reoccurring of schizophrenia after drug withdrawal so that it is necessary to continue the medication forever. Therefore, any side effects of medication may always be serious problems, and based on this perspective, it has been desired to develop a medicine being suitable for prolonged medication.

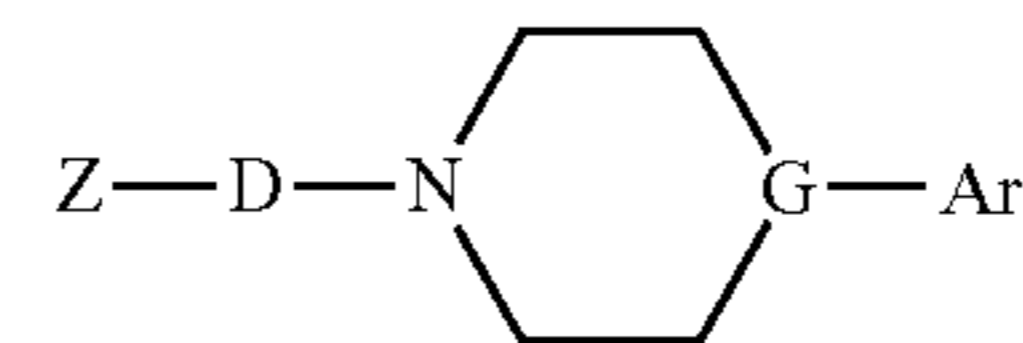
The agents for treatment of schizophrenia are various medicaments such as ones classified in the category of antipsychotic, for example, phenothiazine derivatives (e.g., chlorpromazine, methoxy-promazine, etc.), thioxanthin derivatives having a similar structure to phenothiazine (e.g., chlorprothixene, flupentixol, etc.); benzamide derivatives (e.g., sulpiride, sultopride, etc.), thienodiazepine derivatives (e.g., clotiazepam, etizolam, etc.), and further butyrophenone derivatives (e.g., haloperidol, triperidol, etc.), diphenylbutylamine derivatives (e.g., pimozone, etc.), etc.

However, phenothiazine derivatives, phenothiazine analogues, and butyrophenone derivatives may cause serious side effects of extrapyramidal symptoms showing parkinsonism such as the stiff gait of skeletal muscles, tremor of muscles, lack of facial expression, salivation, etc. Further, diphenylbutylamine derivatives may cause extrapyramidal symptoms in addition to insomnia. In addition, these conventional antipsychotics may be effective on only some of symptoms among positive symptoms, negative symptoms, cognitive dysfunctions of schizophrenia, and there has been no drug being effective on all of these symptoms.

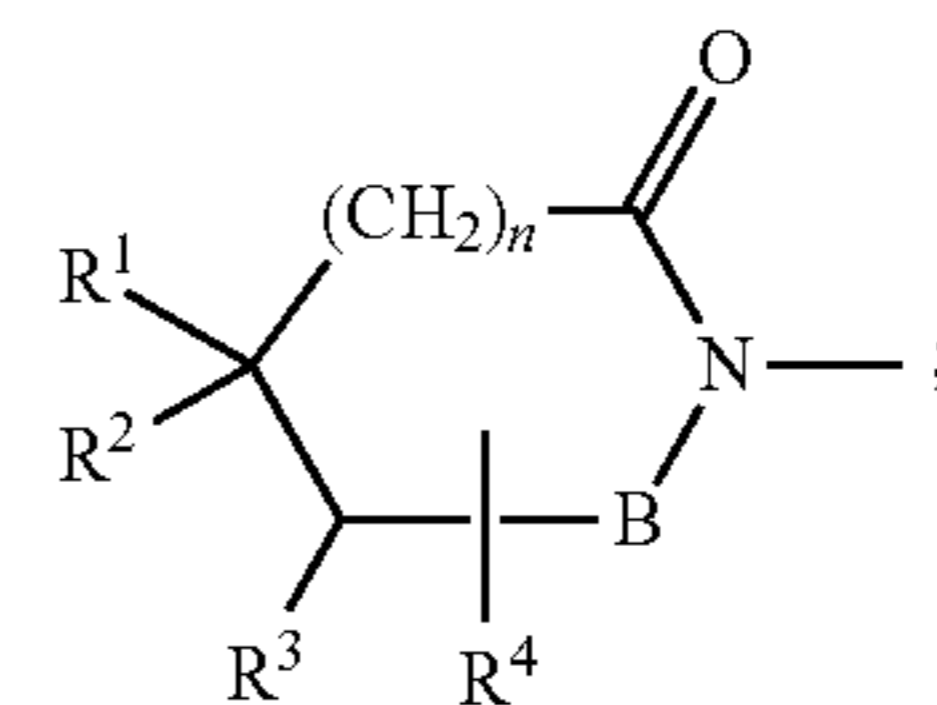
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Therefore, it has been desired to develop a safe medication which exhibits an excellent effect on various schizophrenia as an antipsychotic without causing side effects such as extrapyramidal symptoms.

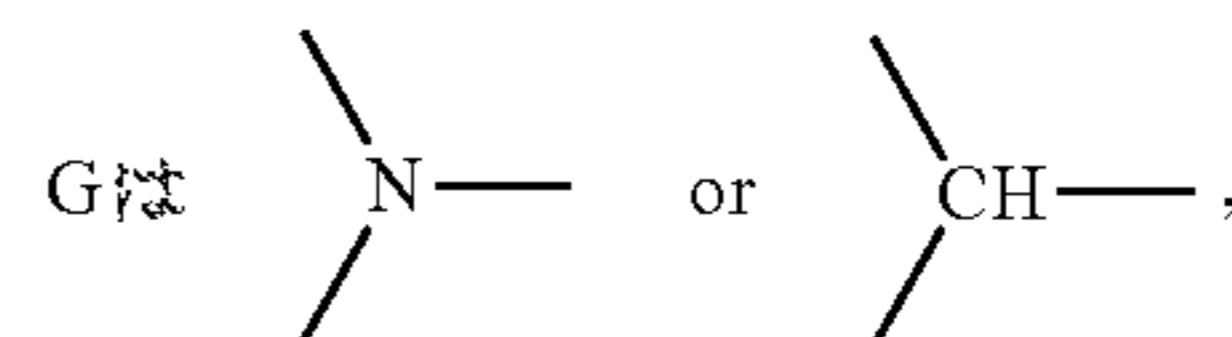
On the other hand, it has been known that the imide derivative of the following formula, which was found by the co-workers of the present inventors, may be useful as an antipsychotic (c.f., neuroleptic agent, anti-anxiety, etc.), especially as an agent for treatment of schizophrenia, senile insanity, manic depressive psychoses, and nervous breakdown (U.S. Pat. No. 5,532,372).



wherein Z is



D is a group of the formula: $-(CH_2)_p-A-(CH_2)_q-$,



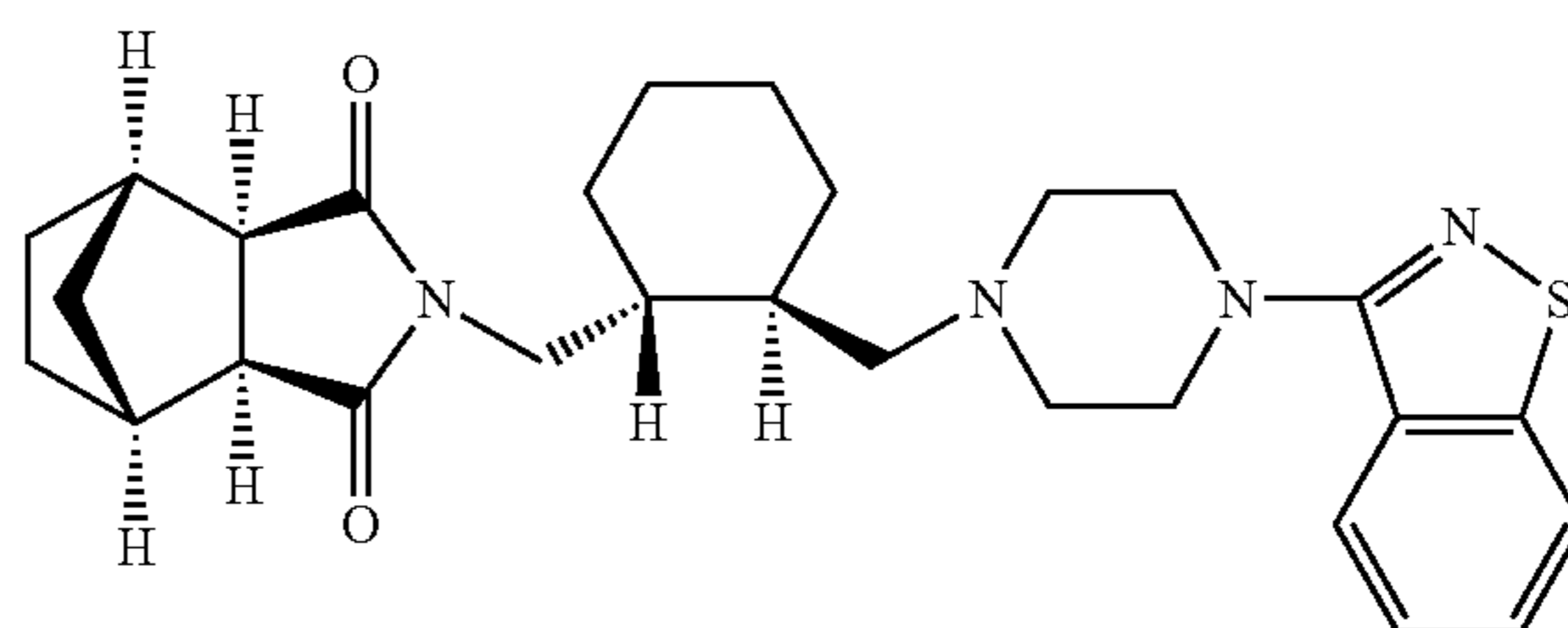
etc., and

Ar is an aromatic group, or an aromatic heterocyclic group, etc.

DISCLOSURE OF INVENTION

The present inventor has intensively studied on a series of imide derivatives with respect to many aspects including a use and a dose thereof in order to find a novel agent for treatment of schizophrenia, which may exhibit an excellent effect in the treatment of schizophrenia and have no side effect such as extrapyramidal symptoms, which are often observed in many conventional antipsychotics, and can safely be administered for a long time. As a result, the present inventors have found that (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzisothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptane-dicarboximide of the following formula:

(1)



or a pharmaceutically acceptable salt thereof such as a hydrochloride thereof is effective for relieving the wide-ranging symptoms of schizophrenia, and may treat schizop-
hrensia quite safely without being accompanied by extrapy-
ramidal symptoms by orally administering a prescribed dose
thereof once a day.

Namely, the present invention provides a method for
treatment of schizophrenia without being accompanied by
extrapyramidal symptoms by orally administration of a
prescribed amount of (1R,2S,3R,4S) -N-[(1R,2R)-2-[4-(1,2-
benzothiazol-3-yl)-1-piperazinyl-methyl]-1-cyclohexyl-
methyl]-2,3-bicyclo[2.2.1]heptanedicarboximide of the
above formula (1) or a pharmaceutically acceptable salt
thereof once a day, and further provides an agent for
treatment of schizophrenia which is used in said method.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a graph showing the change with time in scores
of Brief Psychiatric Rating Scale: BPRS, which are indexes
for the effects on schizophrenia, of the active compound of
the present invention, (1R,2 S,3R,4 S) -N-[(1R,2R)-2-[4-(1,
2-benzothiazol-3 -yl)-1-piperazinyl-methyl]-1-cyclohex-
ylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydro-
chloride and placebo in the double blind clinical trial.

DETAILED DESCRIPTION OF INVENTION

As shown in Examples as described hereinafter, when
orally administering a prescribed dose of (1R,2S,3R,4S)-N-
[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylm-
ethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicar-
boximide hydrochloride once a day for 6 weeks to the
patients with schizophrenia in the acute exacerbation, the
present inventors have found that the excellent effects on the
wide-ranging symptoms were obtained, and surprisingly,
any extrapyramidal symptoms as observed in the conven-
tional antipsychotics were hardly observed, especially,
abnormal electrocardiogram which progresses to sudden
death is not recognized, and hence, that this compound may
be quite safely used in the treatment of schizophrenia.

Namely, the present invention provides a novel method
for treatment of schizophrenia improving a wide-ranging
schizophrenia including positive symptoms, negative symp-
toms, and cognitive dysfunction, especially positive symp-
toms and negative symptoms, without being accompanied
by extrapyramidal symptoms which comprises orally
administering a prescribed dose of (1R,2S,3R,4S)-N-[(1R,
2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-
1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboxi-
mide of the above formula (1) or a pharmaceutically
acceptable salt thereof, especially a hydrochloride thereof, to
a patient with schizophrenia once a day.

The present invention also provides a novel agent for
treatment of such schizophrenia.

According to the present invention, excellent improving
effects on the wide-ranging symptoms of schizophrenia may
be obtained by orally administering (1R,2S3R,4S)-N-[(1R,
2R)-2-[4-(1,2-benzothiazol-3-yl) -1-piperazinylmethyl]-
1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]-heptanedicarboxi-
mide or a pharmaceutically acceptable salt thereof, for
example, a hydrochloride, at a daily dose of 5 mg to 120 mg,
preferably at a daily dose of 10 mg to 100 mg, more
preferably at a daily dose of 20 mg to 80 mg, once a day.
Further, in the therapeutic method of the present invention,
side effects such as extrapyramidal symptoms such as par-
kinsonism, dyskinesia, akathisia, etc., abnormal electro-

cardiogram, hepatic dysfunction are hardly observed, and
hence, the present method may be quite safely used and
suitable for a prolonged medication.

Besides, when the present method is applied to a patient
with schizophrenia in chronic phase, the above active com-
pound should preferably be administered to said patient for
a long time at a dose as low as possible, and in such a case,
the daily dose of the active compound is in the range of 5 mg
to 80 mg, preferably in the range of 5 mg to 60 mg, more
preferably in the range of 10 mg to 40 mg, and it is orally
administered once a day.

The therapeutic agent used in the method for treatment of
schizophrenia of the present invention is in the form of an
oral preparation, which contains the compound of the above
formula (1) or a pharmaceutically acceptable salt thereof,
especially (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothi-
azol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,
3-bicyclo[2.2.1]heptanedicarboximide hydrochloride in an
amount of 5 mg to 120 mg, preferably in an amount of 10
mg to 100 mg, more preferably in an amount of 20 mg to 80
mg per a single dosage unit. The oral preparation includes,
for example, tablets, granules, fine granules, powders, cap-
sules, syrups, etc. These preparations should be in the form
of a preparation for administration once a day.

The above preparations may be prepared by a conven-
tional method by using a conventional pharmaceutically
acceptable carrier which is usually used in the preparation of
a conventional pharmaceutical formulation, for example,
excipients such as lactose, white sugar, glucose, starch,
calcium carbonate, kaolin, talc, crystalline cellulose, silicic
acid, etc, binders such as water, ethanol, gelatin, carboxym-
ethylcellulose, shellac, methylcellulose, gum arabic, traga-
canth powder, polyvinylpyrrolidone, etc., disintegrating
agents such as sodium arginate, agar powder, laminaran
powder, sodium hydrogen carbonate, polyoxyethylenesorbi-
tan fatty acid esters, sodium laurylsulfate, stearic acid mono-
glyceride, etc., lubricants such as purified talc, stearate, boric
acid powder, polyethyleneglycol, etc.

EXPERIMENTS

The method for treatment of the present invention and the
effects thereof are illustrated in more detail by Experiments
as described hereinafter.

The active compound SM-13496 used in Experiments
means (1R,2S,3R,4S)-N-1[(1R,2R)-2-[4-(1,2-benzothi-
azol-3-yl)-1-piperazinyl-methyl]-1-cyclohexylmethyl]-2,3-
bicyclo[2.2.1]heptanedicarboximide hydrochloride, and the
meanings of the abbreviations used in Experiments are as
follows.

DSM-IV: Diagnostic and Statistical Manual of Mental Dis-
orders, 4th ed.

CGI-S; Clinical Global Impressions scale-Severity of Illness

CGI-I: Clinical Global Impressions scale-Improvement

AIMS: Abnormal Involuntary Movement Scale

EPS: Extrapyramidal symptoms

LOCF: Last Observation Carried Forward (LOCF Analysis:
a method of using last not-missing data in cases of
dropouts)

BAS: Barnes Akathisia Scale

SAS: Simpson-Angust Rating Scale (Rating Scale For
Extrapyramidal Reactions)

PANSS: Positive and Negative Syndrome Scale (Rating
Scale For Positive Negative symptoms)

Experiment 1

First Stage Phase II Clinical Trial

(1) Test Method

According to the procedures as shown in Table 1 as described below, the placebo-controlled double blind experiment was done on 149 patients with schizophrenia in the acute exacerbation phase at 15 facilities in USA. The efficacy and safeness were studied when SM-13495 at a dose of 40 mg or 120 mg, or a placebo was orally administered once a day for 6 weeks after placebo washout.

TABLE 1

Name of Clinical Trial	A double-blind, randomized, fixed dose, placebo-controlled, parallel-group, 6-week, efficacy, safety, and tolerability study of two dose levels of SM-13496 in patients with schizophrenia by DSM-IV criteria who are experiencing an acute exacerbation of symptoms
Purpose	The efficacy and safety on patients with schizophrenia in the acute exacerbation phase (DSM-IV criteria) were studied in the placebo-controlled, parallel-group, double-blind test.
Subjects	Selection criteria: 1) Patients with schizophrenia determined according to DSM-IV criteria who are experiencing an acute exacerbation of symptoms 2) Patients having 42 or more of Extracted-BPRS Score as well as 4 or more of CGI-S Score 3) Patients having less than 2 of Simpson-Angus Score as well as less than 3 of AIMS Score 4) Patients suffering from schizophrenia for more than 1 year 5) Males and females aged 18-64 years Factors for patient exclusion: 1) Patients with treatment-resistant schizophrenia 2) Patients being taking depot injections before finishing the therapy cycle 3) Patients having a strong suicidal ideation 4) Patients with Parkinson's disease, Alzheimer disease, drug addiction, convulsive disorders, epilepsy 5) Pregnant women and any women having a possibility of pregnancy, and lactating women 6) Patients having drug hypersensitivity 7) Any patients who are examined not to be suitable as subjects by principal investigator
Design of Clinical Trial	Placebo-controlled, randomized, comparison with parallel-group, double-blind
Dosage and Administration route	Oral administration of the test compound at a dose of 40 mg/day, 120 mg/day or a placebo once a day for 6 weeks Washout with placebo for one week (at least for 3 day) Hospitalization during the washout period and two weeks after medication
Combined Drug and Combination Therapy	1) Another antipsychotic is not administered. When another antipsychotic is taken, then it is necessary to set up a washout period before the trial at least 3 days for oral drug or for one therapy cycle for depot injection. 2) In case of onset of extrapyramidal symptoms, then the administration of an antiparkinson agent is allowed. 3) In case of onset of insomnia, lorazepam is used.
Number of subjects	In the planning stages: 132 subjects (each 44 subjects for the placebo-treated group, the 40 mg-treated group and the 120 mg-treated group) After the completion of the trial: 149 subjects (50 subjects for the placebo-treated group, 50 subjects for the 40 mg-treated group, and 49 subjects for the 120 mg-treated group)
Evaluation Items	Efficacy: PANSS, Extracted-BPRS, CGI-S/I Safety: EPS Rating scale (Simpson-Angus, Barnes, AIMS), vital signs (body temperature, blood pressure, pulse), 12-lead electrocardiogram, laboratory test [hematologic test, biochemical test of blood, prolactin, urine test] psychosomatic conditions, eyeground-slit-lamp microscopy, adverse event

(2) Test Results:

1) Evaluation of Efficacy:

(i) The data by BPRS and PANSS (LOCF), and CGI-S and CGI-I at the end of the trial are shown in Table 2 and Table 3, respectively. As is shown in Table 2 and Table 3, the reductions in the scores at the end of the trial (6 weeks after the administration) from those prior to the administration in the groups treated by SM-13496 40 mg or 120 mg are statistically significant as compared to that in the placebo-treated group with respect to BPRS, CGI-I and CGI-S evaluations. With respect to PANSS evaluation, the reduction in the score at the end of the experiment in the SM-13496 120 mg-treated group is statistically significant as compared to that in the placebo-treated group, which means the psychotic manifestations are improved by SM-13496.

TABLE 2

Rating scale	Dose (No. of Subjects)				
	Placebo (45)	SM-13496 40 mg (47)	p value [#]	SM-13496 120 mg (44)	p value [#]
BPRS Total Score	Average (SD) -4.0 (8.45)	Average (SD) -10.0 (12.79)	0.014	Average (SD) -11.3 (8.89)	0.003
PANSS Total Score	Average (SD) -5.8 (14.06)	Average (SD) -14.1 (23.10)	0.063	Average (SD) -17.4 (15.70)	0.010

[#]Two-sided Dunnett's t-test (comparison between the groups treated by each dose and the placebo-treated group)
Covariance analysis using faculty and Groups as factors and the values before administration as covariate

TABLE 3

Rating Scale	Dose				
	Placebo	SM-13496 40 mg	p value [#]	SM-13496 120 mg	p value [#]
CGI-S	Average (SD) (n = 41) 0.0 (0.77)	Average (SD) (n = 41) -0.7 (1.12)	0.004	Average (SD) (n = 40) -0.8 (1.03)	0.002
CGI-I	Average (SD) (n = 45) 4.0 (1.41)	Average (SD) (n = 47) 3.2 (1.56)	0.013	Average (SD) (n = 42) 3.0 (1.29)	0.005

[#]Two-sided Dunnett's t-test (comparison between the groups treated by each dose and the placebo-treated group)
Covariance analysis using faculty and Groups as factors and the values before administration as covariate

(ii) Further, the appended FIG. 1 shows the changes in BPRS total score (LOCF). As is shown in FIG. 1, the BPRS scores in the SM-13496-treated groups are statistically significantly reduced from those of prior to the administration as compared to that in the placebo-treated group at the 2 weeks or later ($p < 0.05$).

(iii) The ratio of the patients of which the BPRS reduction at the end of the experiment is 20% or more, or the patients who showed 1 or 2 of CGI-I, those patients are considered as responder, is shown in Table 4. As is apparent from Table 4, there was a statistically significant difference between the SM-13496 40 mg- or 120 mg-treated group and the placebo-treated group.

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TABLE 4

	Dose (No. of Subjects)				
	Placebo (45)	SM-13496 40 mg (47)		SM-13496 120 mg (44)	
	Number	Number	p value [#]	Number	p value [#]
Responder	10	26	0.002	22	0.007

[#]Cochran-Mantel-Haenszel test adjusting the faculties (comparison between the groups treated by each dose and the placebo-treated group)

2) Evaluation of Safety:

(i) Adverse events observed in 10% or more of the patients are shown in Table 5.

TABLE 5

	Placebo	40 mg	120 mg
Number of Subjects	50	50	49
Number of subjects showing adverse events (%)	36 (72)	40 (80)	38 (78)
Number of subjects showing serious adverse events (%)	3 (6)	3 (6)	3 (6)
Number of subjects who drop out from the trial due to adverse events (%)	2 (4)	6 (12)	6 (12)
Occurrence of Adverse events (%)			
Digestive disturbance	6 (12)	4 (8)	2 (4)
Nausea	2 (4)	5 (10)	11 (22)
Headache	5 (10)	8 (16)	3 (6)
Akathisia	0 (0)	4 (8)	7 (14)
Free-floating vertigo (excluding rotatory vertigo)	3 (6)	6 (12)	5 (10)
Suppression	5 (10)	9 (18)	7 (14)
Drowsiness	2 (4)	4 (8)	5 (10)
Exacerbation of schizophrenia	5 (10)	2 (4)	1 (2)

Subject having multiple adverse events was accounted as 1.

As is shown in Table 5, 114 subjects among 149 subjects (77%) showed adverse events, but most of them were mild or moderate ones. The number of subjects who dropped out from the trial due to the adverse events was higher in both of the groups treated by two doses of SM-13496 than in the placebo-treated group.

The main adverse events are suppression, nausea, headache, akathisia, and free-floating vertigo (excluding rotatory vertigo). The ratio of the subjects showing suppression was 10%, 18%, 14% in the placebo-treated group, the SM-13496 40 mg-treated group, and the SM-13496 120 mg-treated group, respectively. In the SM-13496 120 mg-treated group, nausea was more observed as compared to the other groups, but digestive disturbance was less observed than in the placebo-treated group. Exacerbation of schizophrenia was less observed in the SM-13496 40 mg- and 120 mg-treated groups (4% and 2%, respectively) than in the placebo-treated group (10%). Akathisia was observed only in the SM-13496 treated groups, i.e., 8% and 14% in the 40 mg-treated group and in the 120 mg-treated group, respectively. The occurrence of the adverse events in the groups treated by SM 13496 were the same as that in the placebo-treated group. Either body weight gain, bulimia, impotence, erectile dysfunction or convulsion was not observed.

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(ii) The serious adverse events observed in the above phase II clinical trial are shown in Table 6 as described below.

TABLE 6

	Placebo	40 mg	120 mg
Number of Subjects	50	50	49
Total (%)	4 (8)	3 (6)	2 (4)
Occurrence of Serious Adverse Events (%)			
Exacerbation of paranoia	0 (0)	1 (2)	0 (0)
Psychosis aggravated	0 (0)	1 (2)	0 (0)
Exacerbation of schizophrenia	4 (8)	1 (2)	1 (2)
Paranoid schizophrenia	0 (0)	0 (0)	1 (2)

As is shown in Table 6 the serious adverse events were observed in 4 cases of the placebo-treated group, 3 cases of the SM-13496 40 mg-treated group and 2 cases of the SM 13496 120 mg-treated group, but the relationship to the tested medicament was denied.

(iii) Further, the side effects observed in this clinical trial are listed in the following Table 7.

TABLE 7

	Placebo	40 mg	120 mg
Number of Subjects	50	50	49
Occurrence of side effects (%)	22 (44)	33 (66)	35 (71)
Mental disturbance			
Restlessness	0 (0)	1 (2)	1 (2)
Psychosis aggravated	0 (0)	0 (0)	2 (4)
Agitation	0 (0)	0 (0)	1 (2)
Agitation aggravated	0 (0)	0 (0)	2 (4)
Anxiety aggravated	0 (0)	1 (2)	0 (0)
Insomnia	0 (0)	1 (2)	1 (2)
Exacerbation of insomnia	0 (0)	0 (0)	1 (2)
Nightmare	0 (0)	0 (0)	1 (2)
Metabolic disturbances and nutritional disturbance			
Anorexia	1 (2)	1 (2)	0 (0)
Decrease in appetite	1 (2)	1 (2)	1 (2)
Disturbance in Skin and Hypodermis			
Pruritus	1 (2)	0 (0)	0 (0)
Infection and parasitosis			
Tinea pedis	0 (0)	0 (0)	1 (2)
External otitis	0 (0)	1 (2)	0 (0)
Parotiditis	1 (2)	0 (0)	0 (0)
Urinary tract infection	0 (0)	1 (2)	0 (0)
Vascular diseases			
Flushing	1 (2)	0 (0)	0 (0)
Hot flashes	0 (0)	0 (0)	1 (2)
Disturbance in respiratory organ, chest and mediastinum			
Laryngopharynx pain	0 (0)	1 (2)	0 (0)
Breathing difficulty	0 (0)	0 (0)	1 (2)
Heart problems			
Sinus tachycardia	0 (0)	0 (0)	1 (2)
Palpitation	0 (0)	0 (0)	1 (2)
Gastroenteric disturbance			
Nausea	2 (4)	4 (8)	9 (18)
Vomiting	0 (0)	2 (4)	3 (6)
Constipation	1 (2)	2 (4)	0 (0)
Diarrhea	3 (6)	3 (6)	0 (0)
Loose stools	0 (0)	0 (0)	1 (2)

TABLE 7-continued

	Placebo	40 mg	120 mg
Tongue disturbance	0 (0)	1 (2)	0 (0)
Dyspepsia	2 (4)	3 (6)	2 (4)
Flatulence	0 (0)	1 (2)	0 (0)
Dry mouth	1 (2)	0 (0)	0 (0)
Salivary hypersecretion	1 (2)	0 (0)	0 (0)
Abdominal pain	2 (4)	0 (0)	0 (0)
Total disability and local condition			
Fatigue	3 (6)	3 (6)	1 (2)
Fatigue aggravated	0 (0)	1 (2)	0 (0)
Hot sensation	1 (2)	0 (0)	0 (0)
Sleepiness	1 (2)	1 (2)	2 (4)
Nervous system disorder			
Suppression	3 (6)	9 (18)	7 (14)
Akathisia	0 (0)	4 (8)	7 (14)
Free-floating vertigo (excluding rotatory vertigo)	0 (0)	5 (10)	5 (10)
Drowsiness	2 (4)	4 (8)	5 (10)
Headache	3 (6)	6 (12)	1 (2)
Extrapyramidal disease	0 (0)	1 (2)	3 (6)
Tremor	0 (0)	3 (6)	3 (6)
Akathisia aggravated	0 (0)	1 (2)	0 (0)
Dystonic reaction	0 (0)	1 (2)	0 (0)
Anarthria	0 (0)	0 (0)	1 (2)
Glossoplegia	1 (2)	0 (0)	0 (0)
Cogwheel rigidity	0 (0)	0 (0)	1 (2)
Trismus	0 (0)	0 (0)	1 (2)
Musculoskeletal system and connective tissue disorder			
Muscle stiffness	1 (2)	2 (4)	1 (2)
Myalgic pain	0 (0)	0 (0)	1 (2)
Cervical rigidity	0 (0)	1 (2)	0 (0)
Articular rigidity	0 (0)	1 (2)	0 (0)
Melalgia	0 (0)	0 (0)	1 (2)
Heavy feeling	0 (0)	1 (2)	0 (0)
Laboratory assay			
Increase in prolactin level in the blood	0 (0)	1 (2)	1 (2)
Increase in creatine phosphokinase level in the blood	0 (0)	1 (2)	0 (0)
Abnormal electrocardiogram	1 (2)	0 (0)	0 (0)
Weight loss	1 (2)	1 (2)	2 (4)
Increase in total protein	0 (0)	1 (2)	0 (0)
Abnormal liver function tests	0 (0)	0 (0)	1 (2)
Renal Injury and urinary disorder			
Polyuria	1 (2)	0 (0)	0 (0)
Frequent urination	1 (2)	0 (0)	0 (0)
Ocular disturbance			
Blurred vision	0 (0)	1 (2)	1 (2)
Dry eye	1 (2)	0 (0)	0 (0)

As is shown in Table 7, among the adverse events, the main side effects, a relationship of which to the SM-13496 cannot be denied, was suppression, nausea, akathisia, free-floating vertigo (excluding rotatory vertigo), sleepiness, headache. The occurrence of dystonic reaction was low (less than 4%) in the SM-13496-treated groups. There was no clinically significant change in 12-lead electrocardiogram. There was no significant difference in the ratio of the patients having an abnormal change in laboratory values among the groups. In the SM-13496-treated groups, the moderate increase in the prolactin level in the blood was observed, but there was no clinically significant change in the body temperature, respiration rate, fundoscopic examination and slit-lamp microscopy.

(iv) Further, the results of the evaluation for dyskinesia (by AIMS), akathisia (by BAS), parkinsonism (by SAS), those symptoms being extrapyramidal symptoms, are shown in Table 8.

TABLE 8

	Placebo*	SM-13496 40 mg*		SM-13496 120 mg*	
Rating Scale	Average (SD)	Average (SD)	p value [#]	Average (SD)	p value [#]
AIMS	0.7 (2.63)	0.7 (2.88)	0.978	0.2 (2.21)	0.467
BAS**	0.0 (0.97)	0.1 (1.04)	0.687	0.4 (0.94)	0.352
SAS	-0.1 (0.96)	0.1 (1.08)	0.588	0.1 (1.11)	0.808

[#]Two-sided Dunnett's t-test (comparison between the groups treated by each dose and the placebo-treated group)
Covariance analysis using faculty and Groups as factors and the values before administration as covariate
*n = 44-47 for each rating score
**BAS Global score

As is apparent from the results in Table 8, there was no significant difference in the changes in the score prior to the treatment or in the total score between the treated groups. The ratio of the patients requiring benztropine was 24% in the SM-13496-treated groups and 18% in the placebo-treated group.

INDUSTRIAL APPLICABILITY

The method for treatment of schizophrenia and the agent intended to be used therein of the present invention exhibit an excellent effect on the improvement of wide-ranging schizophrenia including positive symptoms, negative symptoms, cognitive dysfunctions, especially positive symptoms and negative symptoms, without accompanied by extrapyramidal symptoms by orally administering a prescribed amount of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo-2.2.1]heptanedicarboximide or a pharmaceutically acceptable salt thereof, especially a hydrochloride thereof once a day to a patient with schizophrenia. Besides, since the present method and the agent used therein do not cause an abnormal electrocardiogram which may progress to sudden death, or do not show excessive suppression effects, they may be quite safely employed and may be suitable even to a prolonged medication, and further they may be applied safely to even elder patients, and hence, the present method and the agent used therein are extremely excellent.

The invention claimed is:

1. A method for treating schizophrenia in a patient without a clinically significant weight gain, comprising:

administering orally to the patient (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide or a pharmaceutically acceptable salt thereof at a dose of from 20 to 120 mg/day such that the patient does not experience a clinically significant weight gain.

2. The method of claim 1, wherein (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride is administered.

3. The method of claim 2, wherein the administering is conducted such that the patient does not experience a clinically significant weight gain after six weeks of administration.

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4. The method of claim 3, wherein the administering is conducted without concurrently administering another antipsychotic medication.

5. The method of claim 2, further comprising:

detecting a weight gain after six weeks of administration.

6. The method of claim 1, wherein said patient has a BPRS score of at least 42 and wherein the patient's BPRS score is significantly reduced from a baseline measurement prior to the administering.

7. The method of claim 3, wherein the dose is from 40 to 120 mg once daily.

8. A method for treating manic depressive psychosis in a patient without a clinically significant weight gain, comprising:

administering orally to the patient (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide or a pharmaceutically acceptable salt thereof at a dose of from 20 to 120 mg/day such that the patient does not experience a clinically significant weight gain.

9. The method of claim 8, wherein (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride is administered.

10. The method of claim 9, wherein the administering is conducted such that the patient does not experience a clinically significant weight gain after six weeks of administration.

11. The method of claim 9, further comprising:

detecting a weight gain after six weeks of administration.

12. The method of claim 10, wherein the administering is conducted without concurrently administering another antipsychotic medication.

13. The method of claim 10, wherein the dose is 20 mg once daily.

14. The method of claim 10, wherein the dose is 40 mg once daily.

15. The method of claim 10, wherein the dose is 60 mg once daily.

16. The method of claim 10, wherein the dose is 80 mg once daily.

17. The method of claim 10, wherein the dose is 120 mg once daily.

18. The method of claim 9, wherein the dose is 20 mg, 40 mg, 60 mg, 80 mg or 120 mg once daily.

19. The method of claim 3, wherein the dose is 20 mg once daily.

20. The method of claim 3, wherein the dose is 40 mg once daily.

21. The method of claim 3, wherein the dose is 60 mg once daily.

22. The method of claim 3, wherein the dose is 80 mg once daily.

23. The method of claim 3, wherein the dose is 120 mg once daily.

24. The method of claim 2, wherein the dose is 20 mg, 40 mg, 60 mg, 80 mg or 120 mg once daily.

25. A method of treating a patient with an antipsychotic without a clinically significant weight gain in the patient, comprising:

orally administering the antipsychotic to the patient once daily at a dose of from 20 to 120 mg such that the patient does not experience a clinically significant weight gain,

wherein the antipsychotic is (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-

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1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide or a pharmaceutically acceptable salt thereof.

26. The method of claim 25, wherein the antipsychotic is (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

27. The method of claim 26, wherein the administering is conducted such that the patient does not experience a clinically significant weight gain after six weeks of administration.

28. The method of claim 26, further comprising:

detecting a weight gain after six weeks of administration.

29. The method of claim 27, wherein the method treats schizophrenia in the patient.

30. The method of claim 27, wherein the method treats manic depressive psychosis in the patient.

31. The method of claim 25, wherein the method treats the patient without the patient experiencing a weight gain.

32. The method of claim 29, wherein the administering is conducted without concurrently administering another antipsychotic medication.

33. The method of claim 30, wherein the administering is conducted without concurrently administering another antipsychotic medication.

34. The method of claim 27, wherein the dose is 20 mg.

35. The method of claim 27, wherein the dose is 40 mg.

36. The method of claim 27, wherein the dose is 60 mg.

37. The method of claim 27, wherein the dose is 80 mg.

38. The method of claim 27, wherein the dose is 120 mg.

39. The method of claim 26, wherein the dose is 20 mg, 40 mg, 60 mg, 80 mg or 120 mg.

40. A method of treating a patient with an antipsychotic without a clinically significant weight gain, comprising:

orally administering once daily to the patient a pharmaceutical composition comprising 20 to 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide or a pharmaceutically acceptable salt thereof as a sole active ingredient such that the patient does not experience a clinically significant weight gain.

41. The method of claim 40, wherein the sole active ingredient is (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

42. The method of claim 41, wherein the pharmaceutical composition is a tablet.

43. The method of claim 41, wherein the administering is conducted such that the patient does not experience a clinically significant weight gain after six weeks of administration.

44. The method of claim 41, further comprising:

detecting a weight gain after six weeks of administration.

45. The method of claim 43, wherein the method treats schizophrenia in the patient.

46. The method of claim 43, wherein the method treats manic depressive psychosis in the patient.

47. The method of claim 45, wherein the administering is conducted without concurrently administering another antipsychotic medication.

48. The method of claim 46, wherein the administering is conducted without concurrently administering another antipsychotic medication.

49. The method of claim 41, wherein the pharmaceutical composition includes 40 to 120 mg of (1R,2S,3R,4S)-N-

[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

50. The method of claim **41**, wherein the pharmaceutical composition includes 20 mg, 40 mg, 60 mg, 80 mg or 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

51. The method of claim **41**, wherein the pharmaceutical composition includes 20 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

52. The method of claim **41**, wherein the pharmaceutical composition includes 40 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

53. The method of claim **41**, wherein the pharmaceutical composition includes 60 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

54. The method of claim **41**, wherein the pharmaceutical composition includes 80 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

55. The method of claim **41**, wherein the pharmaceutical composition includes 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

56. A method of treating a patient with an antipsychotic without a weight gain, comprising:

orally administering once daily to the patient a pharmaceutical composition comprising 20 to 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide or a pharmaceutically acceptable salt thereof as a sole active ingredient such that the patient does not experience a weight gain.

57. The method of claim **56**, wherein the sole active ingredient is (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

58. The method of claim **57**, wherein the pharmaceutical composition is a tablet.

59. The method of claim **57**, wherein the administering is conducted such that the patient does not experience a weight gain after six weeks of administration.

60. The method of claim **57**, further comprising:
detecting a weight gain after six weeks of administration.

61. The method of claim **57**, wherein the method treats schizophrenia in the patient.

62. The method of claim **57**, wherein the method treats manic depressive psychosis in the patient.

63. The method of claim **61**, wherein the administering is conducted without concurrently administering another antipsychotic medication.

64. The method of claim **62**, wherein the administering is conducted without concurrently administering another antipsychotic medication.

65. The method of claim **61**, wherein the pharmaceutical composition includes 40 to 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

66. The method of claim **57**, wherein the pharmaceutical composition includes 20 mg, 40 mg, 60 mg, 80 mg or 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

67. The method of claim **62**, wherein the pharmaceutical composition includes 20 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

68. The method of claim **61**, wherein the pharmaceutical composition includes 40 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

69. The method of claim **62**, wherein the pharmaceutical composition includes 40 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

70. The method of claim **61** wherein the pharmaceutical composition includes 60 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

71. The method of claim **62** wherein the pharmaceutical composition includes 60 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

72. The method of claim **61**, wherein the pharmaceutical composition includes 80 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

73. The method of claim **62**, wherein the pharmaceutical composition includes 80 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

74. The method of claim **61**, wherein the pharmaceutical composition includes 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.

75. The method of claim **62**, wherein the pharmaceutical composition includes 120 mg of (1R,2S,3R,4S)-N-[(1R,2R)-2-[4-(1,2-benzothiazol-3-yl)-1-piperazinylmethyl]-1-cyclohexylmethyl]-2,3-bicyclo[2.2.1]heptanedicarboximide hydrochloride.