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The Application of 3+1 Holistic Rehabilitation Nursing in Patients with Alzheimer's Disease

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Abstract: *Objective:* The objective of this study is to determine the effectiveness of the 3+1 holistic rehabilitation nursing in terms of self-care ability, cognition, language, and emotional regulation of AD patients. This study also summarizes the advantages and disadvantages of current studies to guide future studies. *Methods:* Literatures on 3+1 holistic rehabilitation nursing as an intervention for patients with Alzheimer's disease were searched from three Chinese databases in January 2021: CNKI, VIP, and Wang Fang Database. Two reviewers independently screened the identified studies by title and abstract. Thereafter, the full text of all 28 studies were reviewed. Finally, 24 studies were included after excluding duplicates, non-3+1 holistic rehabilitation nursing studies, non-experimental studies, studies with inconsistent sample size, wrong data analysis, and unclear outcomes, etc. *Results:* Upon reviewing the 24 literatures, all the included studies were clinical studies that made comparisons between 3+1 holistic rehabilitation nursing groups and traditional nursing groups. The age of the participants were between 60 and 80 years, and the total number of participates were 2,790. However, there were some studies that did not report the average age (5/24), average duration (14/24), and the ratio of male to female patients (3/24). Only a few studies reported the intervention time (7/24) and classified the disease by severity (4/24). The outcomes included activities of daily living (ADL), Mini-Mental State Examination (MMSE), and Chinese Rehabilitation Research Center Aphasia Examination (CRRCAE). A total of 19 studies showed that 3+1 holistic rehabilitation nursing is effective in improving patients' self-care ability; 14 studies showed that this rehabilitation nursing has a significant curative effect for the cognitive function of patients; 7 studies showed that this nursing model can promote the recovery of language function in AD patients; 5 studies showed the model can significantly reduce the incidence of adverse events and complications upon receiving treatment; 2 studies showed that the nursing model is helpful for depression and emotional indifference. *Conclusion:* Compared with the traditional nursing mode, 3+1 holistic rehabilitation nursing is more effective in improving self-care ability, cognitive function, language function, emotional state, and so on. In addition, this nursing model can significantly reduce the incidence of adverse events, falls, pressure sores, and other complications during hospitalization. However, the inclusion criteria and duration of intervention for the included studies need to be further standardized, and more experimental studies on the efficacy of 3+1 holistic rehabilitation nursing on severe AD patients as well as the complications caused by AD are required. The cost of 3+1 holistic rehabilitation nursing, which is specialized and personalized, is high. Therefore, the value of this nursing model still requires much research.

Keywords: 3+1 holistic rehabilitation nursing; Application; Alzheimer's disease

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1. Introduction

Alzheimer's disease (AD) is an age-related degenerative disease of the central nervous system, and the prevalence of AD is increasing year by year. AD has a great impact on individuals, families, society, and

the economy. About 5-7% of the world population aged 60 or older is affected by AD [1]. The World Alzheimer Report 2018 stated that 500,000 people are suffering from dementia worldwide and the number will triple to 152 million in 2050. In the United States, the number of AD patients aged 65 or older reached 4.7 million in 2010 and is estimated to reach 13.8 million in 2050 [2]. China has the largest aging population in the world and the proportion of people who is older than 60 years old is estimated to increase from 15% to 25% during the period between 2015 and 2030 [1,2]. This contributes to a rapid increase in the number of AD patients. The prevalence of AD in China from 1985 to 2018 was only 3.9%, but it increased to 6.6% from 2015 to 2018. It is estimated that the number of AD patients in 2050 will be 1.35 times more than that in 2015 [3]. AD may be one of the diseases with the highest social cost as the disability rate among the elderly is high. Direct and indirect costs, which include family care expenses and work-related costs, increase before and after the diagnosis of AD [4] . In 2015, the total economic burden caused by AD in China reached $167.74 billion and it is estimated that it will reach $507.49 billion and $1.89 trillion in 2030 and 2050, respectively, much higher than the estimated burden reported by the World Alzheimer Report 2015 [5]. Therefore, it can be appreciated that AD will bring a huge economic burden to the world, especially China.

Despite the increasing understanding of the pathophysiology of AD and the improvement of diagnostic methods, the diagnostic rate is still relatively low in China. Hence, clinicians in China are looking for solutions to improve the current situation. The 3+1 holistic rehabilitation nursing, a comprehensive rehabilitation and nursing model, aims to delay the progression of cognitive function and improve daily function [1]. "3+1" refers to staged assessment, health education, cognitive training, and predictive nursing [6]. This model aims to train the brain, help improve memory effectively, and prevent complications [7,8]. This nursing model has some clinical value in chronic obstructive pulmonary disease (COPD), senile stroke, and Alzheimer's disease based on research. Clinical studies have shown promising and significant results with this model in terms of daily living ability, cognitive function, and language ability of AD patients.

In order to determine its clinical efficacy on the cognitive function, emotional state, and self-care ability of AD patients, this paper summarized the content of related studies, which can help guide clinical work in the future.

2. Materials and methods

In consideration of the lack of English articles on 3+1 holistic rehabilitation nursing, three Chinese databases, namely CNKI, Wan Fang, and VIP, were searched for relevant literatures in January 2021. The keywords and Boolean operators used were "3+1 holistic rehabilitation" AND "Alzheimer's disease." A total of 508 articles published between 2011 and 2021 were found. After excluding 25 duplicates by using Endnote X9, two reviewers independently screened the identified studies by title and abstract, using a similar standard. Irrelevant, reduplicative, non-3+1 holistic rehabilitation nursing, and non-experimental studies were excluded, with a remainder of 29 studies for full-text review. Five studies were then excluded in view of inconsistent sample size, no full-text, wrong data analysis, and unclear outcomes. Finally, 24 studies were included. The search process is shown in **Figure 1.**

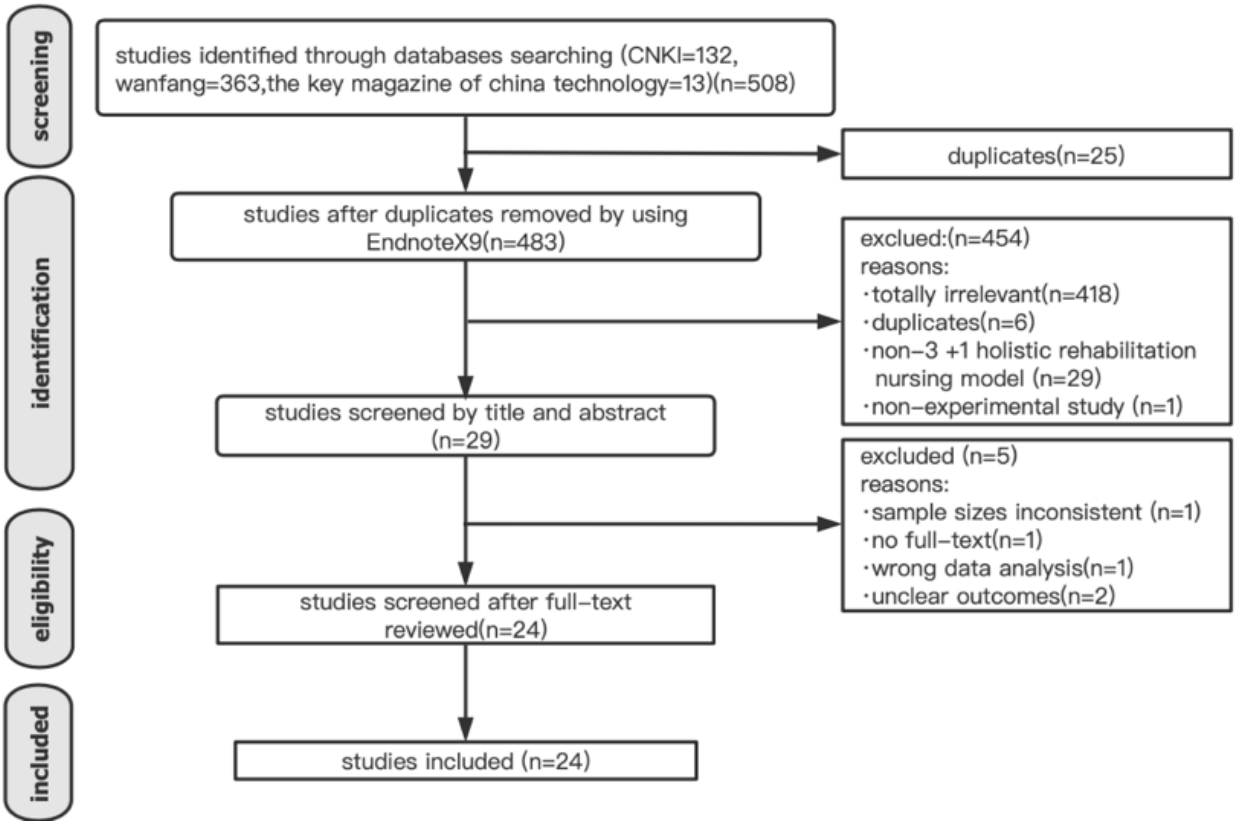

Figure 1. Flowchart of data search

3. Results

After reviewing 24 studies, it was found that all the included studies were clinical studies that made comparisons between 3+1 holistic rehabilitation nursing groups and traditional nursing groups. The basic information included is shown in **Table 1**. The reported results between groups and within groups of all the included articles are shown in **Table 2** and **Table 3**, respectively.

Table 1. Comparisons of the included studies

First author, year	Study design	IG				CG			
		TN	F:M	MA	MCD	TN	F:M	MA	MCD
Chen L, 2020 [13]	BG	30	-	-	-	30	-	-	-
Wan Y, 2020 [22]	BWG	88	1:1.67	68.5	4.1	88	1:1.44	68.1	4.3
Ling Y, 2020 [26]	BG	40	1:1.67	68.97	3.53	40	1:1.86	69.51	3.54
Zhang Y, 2019 [14]	BG	51	1:2.4	68.3	-	49	1:2.5	68.5	-
Ma Z, 2019 [15]	BG	30	1:0.67	73.35	-	30	1:0.76	73.83	-
Wang S, 2019 [16]	BG	75	1:1.88	65.48	-	75	1:1.68	65.59	-
Liu L, 2019 [27]	BG	60	1:2.16	59.15	3.9	60	1:1.86	59.85	4.2
Yuan X, 2019 [9]	BG	54	-	-	-	54	1:1.5	-	-
Wang X, 2019 [28]	BG	60	1:1.14	73.21	4.1	60	1:1.31	74.54	4.7
Zhang S, 2019 [17]	BG	25	1:1.27	73.26	-	25	1:0.92	70.25	-
Jiang L, 2018 [18]	BWG	68	1:0.74	73.85	-	68	1:0.84	72.93	-
Wang L, 2018 [23]	BG	50	1:1.94	63.24	0.67	50	1:2.13	63.72	0.68

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First author, year	Study design	IG				CG			
		TN	F:M	MA	MCD	TN	F:M	MA	MCD
Luo X, 2018 [29]	BG	64	1:1.29	66.52	2.7	64	1:1.13	66.02	2.1
Yu J, 2017 [19]	BG	29	1:0.81	59.5	-	29	1:42	62.5	-
Wang W, 2017 [10]	BG	100	-	-	-	100	-	-	-
Cao J, 2017 [24]	BG	30	1:1.31	70.93	3.89	30	1:1	70.16	3.78
Sun H, 2017 [21]	BG	41	1:1.05	68.7	-	41	1:0.95	69.1	-
Lu P, 2016 [25]	BG	39	1:1.29	76.54	23.11	39	1:0.95	78.39	22.91
Wang Y, 2016 [30]	BG	31	1:0.94	65.36	2.21	31	1:0.82	70.21	2.58
Yin B, 2015 [31]	BG	45	1:1.5	66.1	2.2	45	1:1.37	66.3	2.3
Xu L, 2014 [20]	BG	65	1:1.24	75.3	-	65	1:1.24	78.27	-
Zhong Y, 2014 [11]	BG	100	1:1.56	-	-	-	1:1.5	-	-
Zhong Y, 2011 [32]	BG	100	1:1.56	-	-	100	1:1.5	-	-
Zhong Y, 2011 [7]	BG	120	-	-	-	120	-	-	-

Note: IG: intervention group; CG: control group; TN: total numbers; F:M: female:male; MA: mean age (years); MCD: mean course of disease (year); -: none reported; BG: between groups; BWG: between and within groups.

As can be seen from **Table 1**, the total number of participants were 2,790. The age of the participants was from 50 to 90, focusing between 60 and 80 years. However, there were several studies that did not report the average age (5/24) [7, 9-13], average duration (14/24) [7, 9-21], and the ratio of male to female patients (3/24) [7,9,13].

Table 2. Comparisons of the included studies

First author, year	D	Primary outcomes	Between groups							
			Baseline				Post			
			IG	CG	*t*	*p*	IG	CG	*t*	*p*
Chen L, 2020 [13]	-	ADL	41.59	42.44	-	-	59.23	49.14	-	*
Wan Y, 2020 [22]	2	ADL	56.73	56.16	0.522	#	40.17	51.52	12.942	**
Ling Y, 2020 [26]	-	MMSE	16.75	16.71	0.046	#	21.98	18.04	5.992	**
Zhang Y, 2019 [14]	6	MMSE	18.5	18.6	0.149	#	25.6	21.4	4.941	*
Ma Z, 2019 [15]	6	MMSE	17.87	18.06	0.334	#	21.73	19.27	3.755	**
Wang S, 2019 [16]	-	ADL	23.85	23.81	-	-	39.54	30.15	-	*
		MMSE	17.86	17.67	-	-	31.16	21.78	-	*
		CRRCAE-R	-	-	-	-	73.52	55.29	-	*
		CRRCAE-L	-	-	-	-	58.56	49.85	-	*
		CRRCAE-N	-	-	-	-	41.36	29.64	-	*
Liu L, 2019 [27]	-	ADL	-	-	-	-	40.24	35.67	4.144	**
Yuan X, 2019 [9]	-	ADL[@]	-	-	-	-	29.65	24.10	-	*
		ADL[%]	-	-	-	-	42.01	34.80	-	*
		MMSE	-	-	-	-	19.68	22.87	-	*
Wang X, 2019 [28]	-	ADL	23.54	22.98	2.473	#	37.56	30.45	5.673	*
		CRRCA-E	-	-	-	-	72.65	57.56	-	*

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First author, year	D	Primary outcomes	Between groups							
			Baseline				Post			
			IG	CG	*t*	*p*	IG	CG	*t*	*p*
Zhang S, 2019 [17]	-	MMSE	17.73	17.94	0.371	#	21.26	18.36	2.368	*
Jiang L, 2018 [18]	6	ADL	42.68	42.14	0.747	#	35.09	37.65	-3.005	**
Wang L, 2018 [23]	6	MMSE	17.91	17.73	0.287	#	25.12	18.98	9.849	**
Luo X, 2018 [29]	-	ADL	25.45	25.48	0.031	#	38.61	30.12	11.719	**
		MMSE	18.02	18.11	0.168	#	25.22	22.42	4.728	**
Yu J, 2017 [19]	-	ADL	25.59	25.13	-	-	39.43	30.28	8.571	**
Wang W, 2017 [10]	-	MMSE	18.12	18.14	-	#	30.21	22.44	7.893	**
		ADL	24.98	24.96	-	#	38.60	31.02	6.716	**
Cao J, 2017 [24]	1	MMSE	17.73	17.96	0.371	#	21.63	18.83	2.662	*
	2	ADL	33.36	32.96	0.607	#	28.67	31.16	2.521	*
Sun H, 2017 [21]	-	ADL	34.1	33.9	-	-	23.1	30.1	-	*
		CRRCAE-C	45.1	47.3	-	-	59.6	48.1	-	*
		CRRCAE-R	47.1	46.4	-	-	75.1	54.2	-	*
Lu P, 2016 [25]	-	MMSE	18.12	18.14	-	#	30.21	22.44	-	*
		ADL	24.98	24.96	-	#	38.60	31.02	-	*
		CRRCAE-N	25.61	23.69	-	#	40.97	30.12	-	*
		CRRCAE-L	43.84	43.42	-	#	57.69	50.96	-	*
		CRRCAE-R	43.21	45.58	-	#	72.49	56.31	-	*
Wang Y, 2016 [30]	-	MMSE	17.98	17.61	0.666	#	27.61	20.39	12.912	*
		ADL	26.54	26.58	0.083	#	39.61	31.24	12.162	*
Yin B, 2015 [31]	-	ADL	25.59	25.57		#	38.57	30.09	-	*
		MMSE	18.04	18.08	-	#	25.17	22.38	-	*
		CRRCAE-L	44.31	43.39	-	#	58.24	51.24	-	*
		CRRCAE-N	26.51	24.86	-	#	41.24	38.56	-	*
		CRRCAE-R	42.53	45.62	-	#	72.52	55.53	-	*
Xu L, 2014 [20]	-	ADL	41.27	42.07	-	-	59.82	49.29	-	*
Zhong Y, 2014 [11]	-	ADL@	25.36	26.43	1.39	#	29.38	23.98	5.44	*
		ADL%	38.54	37.56	1.09	#	42.48	35.83	7.28	**
Zhong Y, 2011 [32]	-	ADL@	26.43	25.36	1.39	#	23.98	29.38	5.40	*
		ADL%	37.56	38.54	1.23	#	35.83	42.48	6.21	**
		CRRCEA-L	44.30	43.38	-	-	58.23	51.23	-	**
		CRRCEA-N	26.50	24.85	-	-	41.23	38.53	-	**
		CRRCEA-R	42.51	45.61	-	-	72.51	55.52	-	**
Zhong Y, 2011 [7]	6	ADL@	28.52	28.63	0.088	#	24.98	29.38	4.850	**
		ADL%	38.32	38.34	1.660	#	35.98	41.48	5.710	**
		MMSE	18.93	19.13	1.65	#	22.63	20.25	3.72	**

Note: D: duration of the clinical trial (month); IG: intervention group; CG: control group; MMSE: Mini-Mental State Examination; ADL: activities of daily living; CRRCAE: Chinese Rehabilitation Research Center Aphasia Examination; -: none reported; *: < 0.05; **: < 0.01; #: > 0.05; ##: > 0.01; @: mild group; %: moderate group; L: listening; N: naming; R: reading; C: comprehension

From **Table 2**, it can be seen that only a few studies reported the intervention time (7/23) [7,14,15,18, 22-24] and classified the disease by severity (4/23) [7,9,11,12]. The intervention time of most studies was 6 months, and those with severe AD were not studied. The primary outcomes included activities of daily living (ADL), Mini-Mental State Examination (MMSE), and Chinese Rehabilitation Research Center Aphasia Examination (CRRCAE). A total of 19 studies showed that 3+1 holistic rehabilitation nursing effectively improves patients' self-care ability; 14 studies showed that the nursing mode has a significant curative effect on patients' cognitive function; 7 studies showed that this nursing model can promote the recovery of language function in AD patients; 5 studies showed the nursing model can significantly reduce the incidence of adverse events and complications while receiving treatment; 2 studies showed that this model is helpful for depression and emotional indifference.

Table 3. Comparisons of the included studies

First author, year	Primary outcomes	Within groups			
		IG		CG	
		t	*p*	*t*	*P*
Wan Y, 2020 [22]	ADL	17.740	**	4.440	**
Jiang L, 2018 [18]	ADL	9.277	**	5.903	**
Lu P, 2016 [25]	MMSE	-	*	-	*
	ADL	-	*	-	*
	CRRCAE-N	-	*	-	*
	CRRCAE-L	-	*	-	*
	CRRCAE-R	-	*	-	*

Note: IG: intervention group; CG: control group; -: none reported; *: < 0.05; **: < 0.01; ADL: activities of daily living; MMSE: Mini-Mental State Examination; CRRCAE: Chinese Rehabilitation Research Center Aphasia Examination; L: listening; N: naming; R: reading

From **Table 3**, only 3 studies made comparisons within groups [18,22,25]. Both, the intervention groups and the control groups showed significant improvement in ADL after trials.

4. Discussion

4.1. Subjects

Patients with AD in all 24 articles were selected as subjects. The research area covered a large part of China, including eight provinces (Jiangsu, Henan, Shandong, Sichuan, Guangdong, Jilin, Jiangxi, and Hebei), 12 district cities (Nantong, Guangzhou, Ordos, Tianjin, Kaifeng, Weihai, Nanchong, Jiangmen, Changchun, Jiujiang, Huanghua, Zigong, and Binzhou), 2 autonomous regions (Xinjiang Uygur Autonomous Region and Inner Mongolia Autonomous Region), and 2 municipalities (Chongqing City and Tianjin City).

4.2. Evaluation tools

All 24 articles used the activities of daily living (ADL) scale as the primary outcome; two other common scales used included MMSE (Simple Mental Status Examination) and CRRCAE (China Rehabilitation Research Center Aphasia Examination).

The ADL scale was developed by Lawton and contains 14 items of the most basic aspects of daily life, such as clothing, food, housing, transportation, self-care, and social behavior. Specifically, it can be divided into two subscales: physical daily living ability (PADL) and instrumental daily living ability (IADL), with 7 items each and four grades in total. The total score is 56, and the minimum score is 14. This scale is

simple in operation and has been widely used in the evaluation of AD patients' daily life function. The ADL scale has good reliability, validity, and stability. It can be widely used in the screening of AD [33].

MMSE was compiled by Folstein and contains 19 items, including time and place orientation, language, attention and calculation, immediate and short-term memory, structural imitation, etc., with a full score of 30 points. Normal: MMSE ≥ 27 points; mild dementia: 21 ≤ MMSE ≤ 26 points; moderate dementia: 10 ≤ MMSE ≤ 20 points; severe dementia: MMSE < 10 points. The sensitivity and specificity of MMSE in screening and diagnosing dementia are 92.5% and 79.1%, respectively. The scale is one of the most influential dementia screening tools with simple assessment method and strong feasibility. It is widely used in the large-scale primary screening study of dementia patients. However, this scale is not sensitive to early dementia, and it does not apply to patients who have speech motor disturbance [34].

Derived from the Japanese Standard Language Test of Aphasia, CRRCAE had been revised based on the language habits and rules of the Chinese. The scale has good reliability and sensitivity in evaluating the training effect in patients. Consisting of several parts including understanding ability, expression ability, reading ability, and other abilities related to language, it is mainly used for the diagnosis and treatment of aphasia [35]. The scale consists of two parts: the first part is to understand the general situation of the patient's speech by answering 12 questions; the second part is composed of nine subtests (listening comprehension, retelling, speaking, reading aloud, reading, transcription, description, dictation, and calculation). In addition to column naming and calculation, the 6-grade evaluation is adopted. Among them, 5-6 reflects a positive answer, and 1-4 reflects the wrong answer. If the participant fails to reach level 4, he or she must be prompted. The accuracy rate should then be calculated, and the aphasia curve should be drawn in the form of percentage on the examination page [36].

ADL is mainly used to evaluate patients' self-care ability; MMSE is usually adopted to reflect patients' cognitive function; CRRCAE is a useful tool to understand patients' language function. To some extent, the three functional disorders mentioned above are the main obstacles faced by patients with AD, and the three scales can be effectively used to reflect the recovery of patients with AD.

4.3. Shortcomings

All 24 articles compared the gender, age, and course of disease between the intervention groups and the control groups before intervention. There were no significant differences between the groups. However, only a few studies compared the educational level, self-care ability, and language ability of the patients before intervention. Secondly, statistical analysis was conducted on the evaluation indicators of the disease, including self-care ability and language ability, between the observation groups and the control groups after intervention. However, only a number of studies carried out intragroup comparisons pertaining to the self-care ability and language ability of the patients before and after intervention. Finally, although the 3+1 holistic rehabilitation nursing is a personalized nursing model based on the patient's situation with multiple benefits, there are only a few trials currently. Therefore, there is a need for more good quality studies in the future.

As for disease diagnosis and evaluation, different hospitals and trials used different criteria to enroll patients. The relevant diagnostic criteria set by the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINDS-ADRDA), the Chinese Classification and Diagnostic Criteria of Mental Disorders (3rd Edition), and their exclusion criteria were used in these studies. Several studies used the comparative objective evidence of CT and MRI as the diagnostic criteria for AD. In view of that, the diagnostic criteria for Alzheimer's disease need to be standardized.

In terms of rehabilitation, most of the studies elaborated specific rehabilitation measures, but only a few studies focused on the duration and frequency of rehabilitation training per session. In addition, there

were no trials that studied the efficacy of different frequencies and durations. The manner to conduct 3+1 holistic rehabilitation nursing in the future remains a challenge. Furthermore, although several studies have pointed out that 3+1 holistic rehabilitation nursing can significantly improve the language function of patients, especially in the early months, the data provided could not fully reflect whether the language improvement was more significant than other aspects.

5. Conclusion

Compared with traditional nursing, 3+1 holistic rehabilitation nursing is more effective in improving self-care ability, cognitive function, language function, emotional state, and so on. In addition, this nursing model can significantly reduce the incidence of adverse events, falls, pressure sores, and other complications during hospitalization. However, the inclusion criteria and duration of intervention need to be further standardized in these studies; in addition, there is a need for more experimental studies on the efficacy of this nursing model on severe AD patients. The cost of 3+1 holistic rehabilitation nursing, which is specialized and personalized, is high. Therefore, much research is still required to determine the value of 3+1 holistic rehabilitation nursing.

Disclosure statement

The author declares no conflict of interest.

Author contributions

The author conceived the idea of the study, analyzed the data, and wrote the paper.

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