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Original Article

Effect of intervention guided by Montessori Method on improving feeding capacity of patients with dementia

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Abstract: Objective: This study was designed to analyze the effects of intervention guided by Montessori Method on patients with dementia. Methods: 85 patients diagnosed with Alzheimer's disease (AD) in our hospital were included for retrospective analysis and were divided into 2 groups by double-blind randomized method. The control group (n=42) received routine guides on dieting, and the observation group (n=43) was intervened under the guides of Montessori Method. The 2 groups were compared for cognitive function, feeding capacity score, feeding difficulty, voluntary feeding time, and nutriture. Results: (1) After intervention, the observation group yielded a higher MMSE score for cognitive function than the control group (P<0.001); (2) The scores of feeding capacity in both groups achieved increase, which in the observation group was higher than that in the control group 1 month after intervention (P<0.001); (3) The scores of feeding difficulty in both groups achieved decrease, which in the observation group was lower than that in the control group after intervention (P<0.001); (4) For voluntary feeding time as intervention completed, 1 month and 3 months after intervention, the observation group reported prominent extension (P<0.001) while the control group achieved shortening gradually (P<0.001), and the voluntary feeding time in the observation group was longer than that in the control group (P<0.001). Conclusion: Intervention guided by Montessori Method helps patients with dementia by reducing their feeding difficulty and improving their cognitive function, feeding capacity, and nutriture. It is a method deserving popularization.

Keywords: Dementia, Montessori, intervention, feeding capacity, improvement

Introduction

Dementia is a status in which the patient has continuous obstacles in intelligence though he/she is clearly conscious, and the disease is mainly characterized by progressive compromised cognitive function concurrent with behavior disorder and progressive decline in capacity [1] in most cases. The senior group is vulnerable to dementia, especially vascular dementia and Alzheimer's disease (AD) with higher incidences [2]. As for the pathological process of dementia, most studies agree that the evaluation can be carried out by Mini-Mental State Examination (MMSE) scale, in which patients who score above 25 points are generally considered as normal, 21-25 points as mild dementia, 14-21 points as moderate dementia, less than 14 points as severe dementia [3]. In addition, the activities of daily living (ADL) scale and Cornell scale for depression in dementia (CSDD) are also used in the evaluation of dementia severity [4]. Clinical intervention for patients with dementia should focus on the control of complications, improvements of cognitive function, living capacity and quality of life. The decline in cognitive function results in disorders of most patients with dementia in feeding to various degrees, which specially includes compromised awareness of stopping eating, impaired concentration during dinner, inability to correctly locate food or use utensils, etc. Watson R et al. [5] found in the study that those with continuous feeding difficulties may be malnourished and have a higher risk of complications. Moreover, they may be confronted with quick degradation in abilities of living independence and increased fatality rate. Moreover, Hong HH et al. [6] believed that patients with dementia may heavily depend on their caregivers if they have difficulties in feeding, increasing the caregivers' physical and mental pressure and affecting their quality of

life and psychological status. Chang CC et al. [7] reported in their study that active intervention slows down the degradation of feeding capacity of patients with dementia, and reduces their difficulties in feeding. Liu MF et al. [8] revealed in their study that through continuous intervention, patients with dementia can regain their feeding functions. However, the methods used in the previous interventions were all relatively routine, and the interventions paid more attention to the direct guidance of nursing staff, and lacked integration with life. Therefore, even if some patients received guidance, they could not successfully apply it correctly in life. Montessori Method is developed by an Italian scholar for intervention in patients with dementia by designing daily life activities with programmatic features into structured and orderly activities to exercise patients, by tools in daily life to stimulate their senses and by repeated training to gradually reestablish their living independence [9].

The study specifically analyzes the effects of intervention guided by Montessori Method in patients with dementia, in order to find more feasible means to improve their feeding capacity.

Materials and methods

Materials

85 patients diagnosed with AD in our hospital from January 2018 to February 2019 were included for retrospective analysis and were divided into 2 groups by double-blind randomized method. In the control group (n=42) with age range between 60 and 81, 2 were illiterate, 5 graduated from primary schools, 18 from junior middle schools and 17 from junior high schools and above; for dementia type, 19 patients were with AD, and 23 with vascular dementia; the severity of dementia was 4 for mild, 23 for moderate, and 15 for severe. In the observation group (n=43) with age range between 62 and 83, 3 were illiterate, 6 graduated from primary schools, 17 from junior middle schools and 17 from junior high schools and above; for dementia type, 21 patients were with AD, and 22 with vascular dementia; the severity of dementia was 6 for mild, 20 for moderate, and 17 for severe.

(1) Inclusion criteria: patients with age at or above 60, satisfying the diagnosis criteria of dementia [10], and orally fed patients were included based on their provision of complete medical records and informed consent (or by their guardians). The study was approved by the ethic committee, and informed consent was signed by patients or their guardians.

(2) Exclusion criteria: some patients were excluded as they aged below 60, or failed to provide complete clinical medical records, or had severe dysphagia and masticatory dysfunction or activity disorder with the dominant extremities or severe visual or hearing disorder or other mental disease affecting cognition concurrently.

Methods

The controls were guided for routine diets, and attended by interveners when they were feeding to observe the process and point out any defect for timely correction based on guidance and hands-on teaching. Patients who were less cooperative and unwilling to study were not forced but directly fed by the interveners.

The observation group adopted intervention guided by Montessori Method from 3 aspects of sensory stimulation and feeding training as summarized below:

Sensory stimulation: food or music was selected for this purpose to accelerate the process of cognitive internalization by playing the same music patients were fond of or touching their lips with the food they preferred at each dinner time.

Feeding training: (1) re-identification of food and utensils: patients started practice from the stages of naming, identification and pronunciation until they can identify utensils and food, select the correct utensils and judge if the food is directly edible. In the process of naming, interveners introduced the objects to patients with their names to establish a relationship between objects and names. Utensils introduced were those patients were familiar with and frequently used. Identification required patients to find the objects based on the names given in order to reinforce their memory about the relationship of objects and names. Pronunciation, specifically, helped patients deepen their understanding of objects by memorizing their names. (2) Take utensils: interveners gave examples by taking the spoons, bowls or

chopsticks in standard manner, and patients followed and practiced by themselves, during which, interveners may point out their incorrect behaviors. (3) Use utensils: patients were trained for refined movements and techniques with foods in various shapes and textures in the sequence of grasping, pouring, lading out and clamping based on their difficulty. (4) Transfer food: specific training included food location and transfer. During food location, patients used chopsticks. If they failed, the interveners would hold their hands to guide the movement toward the targets for repeated practice. During transfer, patients were guided to transfer food to the designated position of the interveners with utensils.

Training summary: after interventions, patients were rewarded with foods or music they were fond of. The interveners notified the next training time after commending their performance, and encouraged caregivers to train patients accordingly.

The observation group and the control group received 1-month intervention guided by Montessori Method and routine diets, respectively.

Observation indices

(1) Cognitive function: before and 1 month after intervention, patients were assessed through Mini-mental State Examination (MMSE) [11]. The examination covered 4 items of attention, time and place orientation, computational power, and language skills (repeat, name, understand commands, read and express), etc., and contained 30 questions with a full score of 30. Patients with a point at or above 27 were normal in cognitive function, or otherwise, they had cognitive dysfunction, which were further graded as severe between 0 and 10, moderate between 11 and 20, and mild between 21 and 26.

(2) Feeding capacity: before and 1 month after intervention, patients were assessed with Eating Behavior Scale (EBS) [12] in simplified Chinese, which consisted of "start eating", "stay focused", "locate food", "use utensils properly", "bite food", "eat safely" and "terminate eating". Each item was scored between 1 to 3 points based on patients' dependence (dependence, body contact prompt, language prompt, and independence). The total score was 18 and positively associated with patients' feeding capacity.

(3) Feeding capacity: before and 1 month after intervention, patients were assessed with the Edinburgh Feeding Evaluation in Dementia Scale (Ed FED) [13] in simplified Chinese, which contained 3 factors of indication of feeding difficulty, feeding behavior and nursing intervention, and 11 items with a total score of 22 positively associated with the feeding difficulty.

(4) Voluntary feeding time: the time required for patients to finish a dinner voluntarily was measured with a stopwatch before, 1 month and 3 months after intervention from the moment they took the utensils to when they were put down.

(5) Nutriture: both groups were assessed for nutriture before and 1 month after intervention, including albumin and prealbumin levels.

Statistical analysis

Statistical analysis was performed with SPSS-22.0. In case of numerical data expressed as Mean ± Standard Deviation, intergroup and intragroup comparison studies were carried out through independent-samples T test; in case of nominal data expressed as [n (%)], intergroup and intragroup comparison studies were carried out through X^2 test. ANVOA was used to analyze the multipoint comparison in the groups. $P<0.05$ was considered as statistically significant difference.

Results

Comparison between the observation group and the control group in general materials

No statistical difference was found between the observation group and the control group in terms of proportions of males and females, average age, proportions of patients with different educational background, proportions of dementia types and severity of dementia (P= 0.751, 0.445, 0.929, 0.740, 0.716) (**Table 1**).

Comparison between the observation group and the control group in cognitive function

For MMSE score of cognitive function, there was no significant difference before intervention (P=0.712). Both groups attained an intra-

Table 1. Comparison between the observation group and the control group ($\bar{x}$ ± sd)/[n (%)]

Material		Observation Group (n=43)	Control Group (n=42)	t/X^2	*P*
Gender	Male	24 (55.81)	22 (52.38)	0.1008	0.751
	Female	19 (44.19)	20 (47.62)		
Age (y)		70.15±8.62	71.62±9.03	0.768	0.445
Educational Level	Illiterate	3 (6.98)	2 (4.76)	0.008	0.929
	Primary school	6 (13.95)	5 (11.90)		
	Junior middle school	17 (39.53)	18 (42.86)		
	Junior high school and above	17 (39.53)	17 (40.48)		
Dementia type	AD	21 (48.84)	19 (45.24)	0.111	0.740
	Vascular dementia	22 (51.16)	23 (54.76)		
Dementia severity	Mild	6 (13.95)	4 (9.52)	0.132	0.716
	Moderate	20 (46.51)	23 (54.76)		
	Severe	17 (39.53)	15 (35.71)		

Table 2. Comparison between the 2 groups for MMSE scores of cognitive function before and after intervention ($\bar{x}$ ± sd, score)

Group	n	Before intervention	After intervention	*t*	*P*
Observation Group	43	15.24±4.49	24.18±3.81	9.955	0.000
Control Group	42	15.61±4.72	20.37±4.15	4.908	0.000
t		0.370	4.411		
P		0.712	0.000		

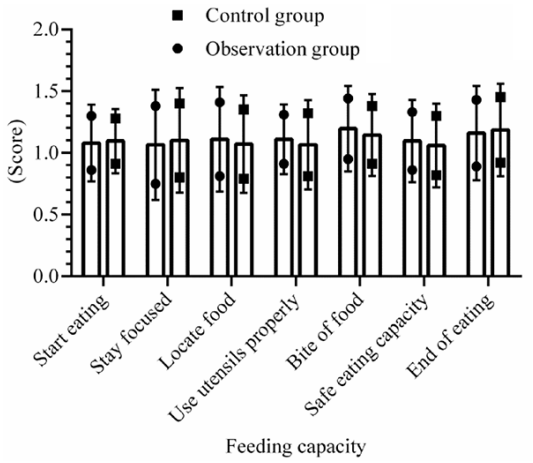

Figure 1. Comparison between the observation group and the control group in feeding capacity before intervention. The 2 groups had no statistical difference in scores in "start eating", "stay focused", "locate food", "use utensils properly", "bite food", "eat safely" and "terminate eating" before intervention (*P*>0.05).

group elevation after intervention (P<0.001), and the MMSE score in the observation group was higher than that in the control group (*P*<0.001, **Table 2**).

Comparison between the observation group and the control group in feeding capacity

For scores of all indexes, there was no significant difference before intervention (*P*=0.173), while both groups attained an intragroup elevation after intervention (*P*<0.001), and the scores in the observation group were higher than those in the control group 1 month after intervention (*P*<0.001, **Figures 1** and **2**).

Comparison between observation group and the control group in feeding difficulty

For feeding difficulty score, there was no significant difference before intervention (*P*=0.525), while both groups attained an intragroup decrease after intervention (*P*<0.001), and the feeding difficulty score in the observation group was lower than that in the control group (*P*< 0.001, **Table 3**).

Comparison between the observation group and the control group in voluntary feeding time

Before, upon completion, 1 month and 3 months after intervention, the voluntary feeding times were 16.75±6.29 min, 21.46±7.18 min, 20.15±7.19 min and 18.96±7.30 min in the observation group, and those were 17.02±6.06 min, 14.29±6.07 min, 13.51±6.20 min and 12.38±5.18 min in the control group,

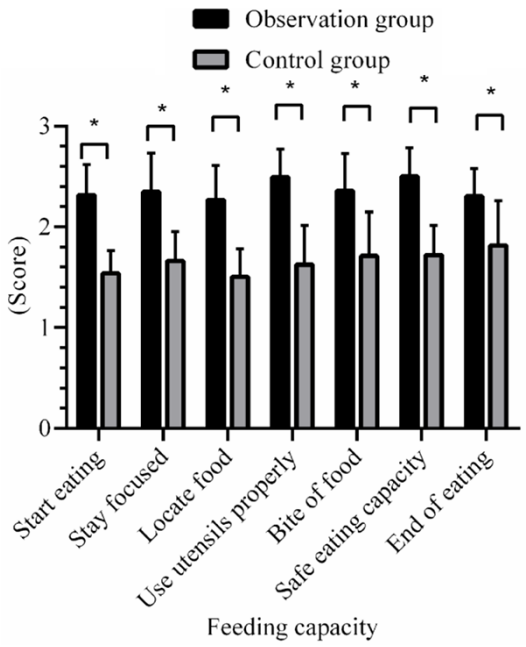

Figure 2. Comparison between the observation group and the control group in feeding capacity after iIntervention. The observation group reported higher scores in "start eating", "stay focused", "locate food", "use utensils properly", "bite food", "eat safely" and "terminate eating" as compared with the control group after intervention (P<0.05).

respectively. For voluntary feeding time of intervention completed, 1 month and 3 months after intervention, the observation group reported prominent intragroup extension (P< 0.001) while the control group achieved shortening gradually (P<0.001), and the voluntary feeding time in the observation group was longer than that in the control group (P<0.001) though the 2 groups had no statistical difference in this regard before intervention (P=0.518, **Figure 3**).

Comparison between the observation group and the control group in nutriture

For levels of albumin and prealbumin, the 2 groups had no statistical difference before intervention (P=0.978). After intervention, the observation group reported an intragroup elevation in albumin level (P<0.001) but had no statistical intragroup difference in prealbumin level (P=0.716), and in the control group, it was the opposite. After intervention, the levels of albumin and prealbumin in the observation group were higher than those in the control group (P<0.001, **Table 4**).

Discussion

At present, treatments and interventions given to patients with dementia aim at delaying the disease progression and improving patients' cognitive function, living capacity and quality of life. In addition to medication, many scholars have tried non-medicine-based intervention methods, such as stories, music and games in clinical application [14], while Montessori Method has been more frequently applied for this purpose. The intervention guided by Montessori Method is based on patients' cognitive function and multiple measures after assessing their existing capacities, habits and interests to achieve accelerated improvements in capacity and behaviors, so as to slow down degradation of functions, and to realize higher quality of life [15]. So far, Montessori Method is extensively adopted in many developed countries, and Taiwan of China [16, 17]. The present study, by referring to literature and previous experience, is trying to find more new methods to improve the feeding capacity of patients with dementia by intervention with the Montessori Method.

Meier CA et al. [18] believed that a comprehensive intervention should be carried out to improve the safe feeding capacity of patients with cognition-related dementia from the aspects of quiet dinning environment, proper dinning methods and postures, and refined management of utensils. Results of the present study revealed that, after intervention, the MMSE score of cognitive function and scores of feeding capacities in the observation group was higher than those in the control group, while the score of feeding difficulty was lower in the observation as compared to that in the control group. Compared with the control group, the observation group reported a longer voluntary feeding time as intervention ended, 1 month and 3 months after intervention, and higher levels of albumin and prealbumin after intervention (P<0.05), indicating that the application of Montessori Method in the intervention of patients with dementia can effectively improve their cognitive function and feeding capacity, reduce the degree of cognitive dysfunction and feeding difficulty, extend voluntary feeding time and finally realize effective improvements in patients' nutriture. It also resulted in marked elevation in terms of feeding initiative, maintenance of feeding focus, correct location of food, proper use of utensils and liv-

Table 3. Comparison between the observation group and control group in feeding difficulty ($\bar{x}$ ± sd, score)

Group	n	Before intervention	After intervention	*t*	*P*
Observation Group	43	15.26±3.29	7.84±1.42	13.578	0.000
Control Group	42	15.72±3.36	10.75±1.91	8.334	0.000
t		0.638	7.984		
P		0.525	0.000		

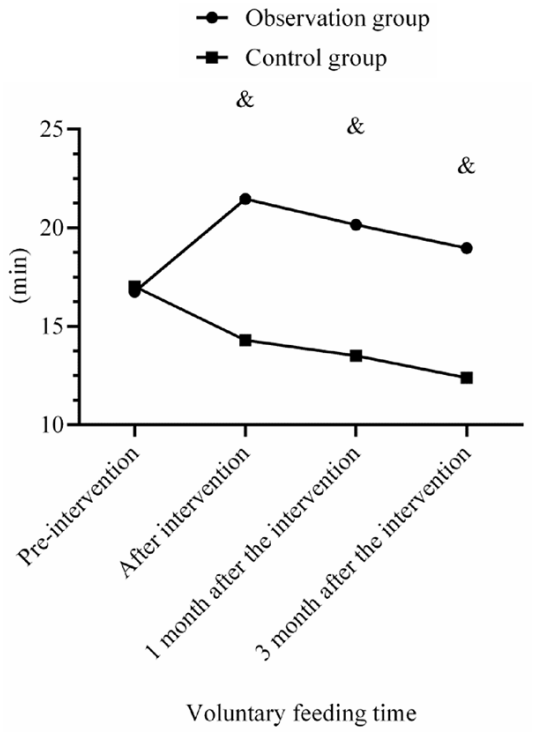

Figure 3. Comparison between the observation group and the control group in voluntary feeding time at different time points. For voluntary feeding time as intervention completed, 1 month and 3 months after intervention, the observation group was longer as compared with the control group ($P<0.05$) though the 2 groups had no statistical difference in this regard before intervention ($P>0.05$). & represents $P<0.05$ for comparison between the 2 groups at the same time points.

ing independence, and reduction in dependence on caregivers. A similar study by Douglas N et al. [19] revealed that active intervention can extend the voluntary feeding time of patients with dementia from 12.97±13.65 min to 23.20±16.92 min, consistent with the finding in the present study. Hitzig SL et al. [20] showed in their study that the experimental group reported lower feeding difficulty and nutritional risk, longer feeding time and elevated BMI than the control group after intervention guided by Montessori Method, indicating that intervention guided by Montessori Method can effectively improve the voluntary feeding capacity of patients with dementia, which was consistent with the conclusions drawn in the present study.

Roberts G [21] et al. thought that proper activity materials can reinforce the intervention effects, while Wu HS [22] chose Mozart's music to stimulate patients and van der Ploeg ES [23] used light music as an accessory material. In the present study, music was selected from songs with a historical background or some local operas as they were more popular in the aged people, and it was believed that only music taking full consideration of patients' living environment, living background and personal habits can maximally plays its value. In addition to music, the present study also selected food for stimulation, so did Lin LC et al. [24]. Huang YJ et al. [25] found in their study that some patients were more responsive to food than music and they were motivated maximally by senses of touching, sight and taste.

Intervention guided by Montessori Method helps patients with dementia by reducing their feeding difficulty and improving their cognitive function, feeding capacity, and nutriture. It is a method deserving popularization. However, with a retrospective nature, the study has deficiencies in advanced selection of study objects, enlargement of sample size, acquisition of representative results and comprehensive analysis. The future studies shall depend on larger sample size and more aspects, and be more in-depth and forward-looking to obtain more scientific and representative study results, and to provide more guidance in the intervention of patients with dementia.

Disclosure of conflict of interest

None.

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Table 4. Comparison between the observation group and the control group for nutriture before and after intervention ($\bar{x}$ ± sd, g/L)

Group	Albumin		Prealbumin	
	Before intervention	After intervention	Before intervention	After intervention
Observation Group (n=43)	30.36±6.38	37.15±7.15*	177.42±24.19	172.30±20.28*
Control Group (n=42)	30.32±6.82	31.05±7.10*	175.46±25.21	145.34±20.19*
t	0.028	3.946	0.366	6.141
P	0.978	0.000	0.716	0.000

Note: *P<0.05 for intragroup comparison before intervention.

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