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RESEARCH ARTICLE OPEN ACCESS

The Effects of the Floral Arrangement in a Designated Space on the Visual Perception Motor Coordination Ability and Hand Function of the Elderly with Dementia

Yeon Hee Kim, Suk Young Yun*, and Byung Jin Choi

Department of Horticulture, Daegu Catholic University, Gyeongsan 38430, South Korea

ABSTRACT

The purpose of this study is to look into the influence of the floral arrangement in a designated space on the visual perception motor coordination ability and hand function of the elderly with dementia. To this end, this study conducted a program consisting of 20 sessions (twice a week) in total targeting 25 senior citizens with dementia who were using a welfare center. The sessions consisted of the following activities in order - creating sections by drawing lines on the floral foam blocks, labeling each section with numbers, placing colored straws in sections, inserting different colored flowers for every session based on the Munsell 10-hue circle in a designated space (the hole at the top of straw) by instruction. It was found that in the pre, mid, and posttest change within a group, the control group did not show any significance, while in the pre, mid, and posttest change of the experimental group, visual perception motor coordination ability showed a significant difference (28.5 pieces in the pretest, 31.5 pieces in the midtest, and 32.5 pieces in the posttest) as the program was advanced (p=.006). However, manual ability of the right hand did not show a significant difference with 12.0lb-12.5lb-12.5lb in the pre, mid, and posttest, respectively (p=.606), and also no significant difference for the left hand with 11.3lb-11.8lb-11.3lb in the pre, mid, and posttest, respectively (p=.338). As a result of doing a multiple comparison by response of the visual perception coordination motor ability, which showed significant difference as sessions progressed, the difference value between the pre and posttest showed a significant change (p=.012). Floral arrangement in designated spaces is effective for improving visual perception motor coordination ability for the elderly with dementia.

Keywords: line-drawing, Munsell 10-hue circle, straw-putting

Introduction

Most elders face various problems such as loss of health due to weakened physical functions, economic poverty and deprivation of social participation, change in position and role, as well as loss of meaning of life and fear about death, and despondency about retirement from psychological view. In particular, dementia is a typical health problem that threatens the quality of elderly life, and the ratio of dementia patients is constantly increasing along with the elderly population (Kim, 2001). Most cases of dementia are chronic and progressive diseases that cannot make a full recovery, making it difficult for patients to effectively interact due to decreased cognitive functions and inability to function in daily life. In addition, the loss of physical, cognitive, emotional and social functions decrease life satisfaction (Lee, 2011).

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First author: Yeon Hee Kim, E-mail: kyh1021707@naver.com, ORCID: 0000-0002-8649-8852
***Corresponding author:** Suk Young Yun, E-mail: yune1004@cu.ac.kr, ORCID: 0000-0002-5862-0021

The characteristics of physical functions caused by aging include disorders of sensory organs such as hearing and vision, lack of kidney functions, decrease in muscles and balance. Visual perceptual disabilities due to aging or damage of the central nervous system hinder the ability to learn new behaviors such as standing straight, perception of space, and object control, and functional recovery is difficult for severe visual perceptual disabilities. Visual perception is defined as the general process of accepting and perceiving visual stimulation (Lieberman, 1984), requiring even the cerebration to recognize, identity and interpret visual stimulation in association with previous experience. Motor coordination is the functioning of the motor system shown through constant interaction between body and nerves, and central nerves and peripheral nerves. Hand-eye coordination is generally classified as fine motor skill. Motor coordination of fine motor skill requires accuracy of hand movements through coordination with eyes, which is the ability to efficiently adjust and move vision and hands in performing reflective behaviors (Hong, 2001).

Horticultural therapy is a plant-mediated therapy that stimulates the five senses and is effective for persons with mental disorders (Cho et al., 2003). It has been reported that using floral decorations in a horticultural program increased sense of security and relieved stress of the participants (Tak, 2004). Floral decorations gave emotional security by trimming, cutting, bending, arranging, tying and winding while also helped relieve stress and increase concentration (Jeong and Han, 2008). Floral arrangement is creating a stereoscopic work by beautifully combining a few stems or flowers into one vase or bowl (Ha, 1991). The typical methods are fixing stems into a pin holder with 1cm pins stuck densely into the lead foundation, and putting flowers from any direction in 360° using a floral form with excellent absorption and water retentivity that is a sponge-shaped chemical product (H.S. Kim, 2003). Moreover, horticultural therapy using a repeated floral decoration program showed effect in work performance, hand function and grip increase (Kim, 2010).

Therefore, this study is conducted to determine the effects of the horticultural activity of arranging flowers in a designated space on the improvement of visual perception motor coordination ability and hand function of dementia patients as well as on the alleviation of symptoms of dementia.

Method

Subjects

This study was conducted on the elderly with dementia in the care of a senior welfare center located in D City. Among 25 elders with dementia, 12 elders (3 males, 9 females) who did not wish to participate were put in the control group, and 13 elders who wished to participate were put in the experimental group. The mean age was 86.7±6.7 in the control group and 81.9±5.8 in the experimental group. The cognitive functions (MMSE-K) regularly measured for management of the subjects at the center were 16.8±5.3 points on average in the control group and 14.5±6.2 points on average in the experimental group as of March 2017, with the scores lower than 24 in both groups and thus belonging to the category of cognitive dysfunction (Korean Association for Geriatric Psychiatry, 2007).

Tools

Program design

Demarcation and decoration of the floral form are effective for memory registration and recollection training of the elderly with dementia (Kim and Yun, 2003), and arranging flowers in a designated space is effective for improving visual perception motor coordination and attention (Yun et al., 2005). Moreover, the act of arranging flowers reinforces the power to hold with fingers (Yun, 2007). Therefore, this study created designated spaces for the elderly with dementia who

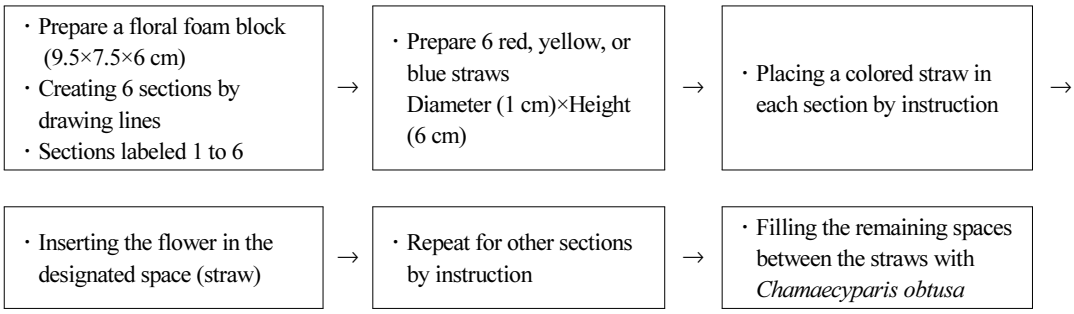

Figure 1. Design of program.

mostly spend time indoor to arrange flowers in order to improve their visual perception motor coordination ability and hand function. To create designated spaces, lines were drawn on the floral foam (9.5×7.5×6 cm) to demarcate it, and numbered each section. Then, straws in different colors are put into the designated spaces for the participants to put the flowers inside the spaces (straws) (Fig. 1).

The colors of cut flowers put into designated spaces are based on the Munsell 10-hue circle that is one of the color order systems most widely used worldwide (Yun, 2006) and the achromatic color of white, choosing the materials for each session. Munsell colors are based on the five primary colors of R, Y, G, B, P (Red, Yellow, Green, Blue, Purple) and total 10 colors by adding YR, GY, BG, PB, RP (Yellow Red, Green Yellow, Blue Green, Purple Blue, Red Purple) in between (Yun, 2006). In general, elders lack the ability to adapt to contrast and identify colors due to decreased physical functions, and thus prefer vivid colors like red or yellow (H.Y. Kim, 2003). Moreover, visual stimulation by contrast is effective for capturing attention (Yun, 2006). Therefore, the cut flower used in each session of the floral arrangement program by color was green (G) using *Chamaecyparis obtuse* with an even distribution of warm colors and cold colors each session. The cut flowers used as warm colors were *Rosa hybrida, Camellia japonica, Alstroemeria aurantiaca, Anemone coronaria, Gerbera jamesonii, Freesia hybrida, Limonium sinuatum, Chrysanthemum morifolium, Eustoma grandiflorum, Dianthus caryophyllus, Gypsophila elegans*, and those used as cold colors were *Rosa hybrida, Freesia hybrida, Mathiola incana, Limonium sinuatum, Dianthus sinensis, Dianthus caryophyllus, Antirrhinum majus, Delphinium ajacis, Ageratum houstonianum, Tagetes patula, Hydrangea paniculata, Chrysanthemum morifolium, Alstroemeria aurantiaca*.

Program implementation

The program was implemented in total 20 sessions twice a week from March 9 to May 25, 2017 for 60 minutes each from 2 p.m. to 3 p.m. on Tuesdays and Thursdays at a 33 m^2 program room in the senior welfare center. The program was carried out by a Level 2 welfare horticultural therapist (Korea Horticultural Therapy Association) and assisted by 1 social worker and 4 care workers.

Evaluation tools

(1) Minnesota Manual Dexterity Test (MMDT)

The MMDT (Minnesota Manual Dexterity Test; SH-7502, Prestone, USA) was developed by Jurgensen in 1943 to assess the hand-eye coordination and dexterity of the upper limbs, and it tests the ability to move small objects in various distances. The patient moves and turns 60 discs on one aluminum testing board. The turning test is done either on one hand or both hands. This study used the testing method for both hands which require more hand-eye coordination. Moreover, to determine whether the hand-eye coordination is properly done considering the subjects as the elderly with dementia, we

used the method of moving the objects to the board within 1 minute. The scores were given according to the number of objects (ea) moved within 1 minute, and those placed incorrectly or in an incorrect position were excluded from the scores. This was measured repeatedly 3 times before, during and after the program.

(2) Pinch gauge

The pinch gauge (JAMAR Serial Number 60504224, SAMMONS PRESTON, INC, UK) was measured before, during and after the program to test the pinch. The unit is in pounds (lb), with higher scores indicating stronger pinch.

Data analysis

The measurements taken before, during and after the program were analyzed with IBM SPSS Statistics 19 Program using the following method. The normality of the sample data was analyzed with Kolmogorov-Smirnov test (K-S test), homogeneity between the control group and experimental group was analyzed with an independent samples t-test, and the MMDT and pinch gauge changes before-during-after the program were analyzed with a repeated measures ANOVA.

Results and Discussions

Normality test of samples

The one sample Kolmogorov-Smirnov test was conducted to investigate whether the measured sample data follows normal distribution. The MMDT measurement to determine the visual perception motor coordination ability of the subjects was p=.069 to the test statistic 1.297 and thus followed normal distribution. The pinch gauge measurement to determine the hand function was p=.375 to the test statistic .913 on both hands, thereby following normal distribution (Table 1).

Homogeneity test between groups

To determine the homogeneity between the control group and experimental group before the program, an independent samples t-test was conducted on the measurements of visual perception coordination and hand function. Visual perception coordination ability showed no significant difference with 24.1 in the control group and 28.5 in the experimental group (p=.318), and thus the two groups can be regarded as homogeneous. Hand function also showed no significance for the right hand with 9.5lb in the control group and 12.0lb in the experimental group (p=.108), as well as the for left hand with 9.3lb in the control group and 11.3lb in the experimental group (p=.236), thereby indicating that the two groups are homogenous for both hands (Table 2).

Table 1. Normality test of sample

Item		(Unit)	N	M	SD	z	p
Visual perception motor coordination		(ea)	25	26.4	10.7	1.297	$.069^{NS}$
Pinch	Right	(lb)	25	10.8	3.9	.913	$.375^{NS}$
	Left	(lb)	25	10.4	4.1	.913	$.375^{NS}$

^{NS}Non significant by Kolmogorov-Smirnov test.

Table 2. Prior homogeneity test of the control group and experimental group before conducting the program

Item		(Unit)	Control		Experiment		t	*p*
			M	SD	M	SD		
Visual perception motor coordination		(ea)	24.1	7.8	28.5	12.9	-1.020	.318^{NS}
Pinch	Right	(lb)	9.5	3.5	12.0	4.0	-1.672	.108^{NS}
	Left	(lb)	9.3	3.7	11.3	4.3	-1.217	.236^{NS}

^{NS}Non significant by independent t-test.

Pretest-midtest-posttest changes within the group

Pretest-midtest-posttest changes within the control group

Measurements were taken repeatedly for three times on the control group at the same time as the experimental group to examine the change in the control group without any treatment. A repeated measures ANOVA was used to determine how the visual perception motor coordination ability and hand function of the subjects changed according to the point of measurement. First, visual perception motor coordination ability did not show a significant difference from 24.1, 24.8 to 21.5, and F=1.212, *p*=.317. Hand function also did not show a significant difference from 9.5lb, 9.7lb, to 11.0lb for the right hand and F=2.486, *p*=.106, and then from 9.3lb, 10.2lb, to 10.4lb for the left hand and F=.955, *p*=.400 (Table 3).

Pretest-midtest-posttest changes within the experimental group

Measurements were taken repeatedly for three times before, during and after the program to examine the changes in the experimental group that were to arrange flowers in designated places. A repeated measures ANOVA was used to determine how the visual perception motor coordination ability and hand function of the subjects changed according to the point of measurement. First, visual perception motor coordination ability showed a significant difference from 28.5 before

Table 3. Changes in the control group's pre, mid, and posttest visual perception motor coordination ability and pinch

Item		(Unit)	Pretest		Midtest		Posttest		F	*p*
			M	SD	M	SD	M	SD		
Visual perception motor coordination		(ea)	24.1	7.8	24.8	7.0	21.5	7.6	1.212	.317^{NS}
Pinch	Right	(lb)	9.5	3.5	9.7	3.7	11.0	4.0	2.486	.106^{NS}
	Left	(lb)	9.3	3.7	10.2	4.0	10.4	4.3	.955	.400^{NS}

^{NS}Non significant by repeated measures design ANOVA.

Table 4. Changes in the experimental group's pre, mid, and posttest visual perception motor coordination ability and pinch

Item		(Unit)	Pretest		Midtest		Posttest		F	*p*
			M	SD	M	SD	M	SD		
Visual perception motor coordination		(ea)	28.5	12.9	31.5	15.1	32.5	13.4	6.500	.006**
Pinch	Right	(lb)	12.0	4.0	12.5	4.6	12.5	4.5	.511	.606^{NS}
	Left	(lb)	11.3	4.3	11.8	4.0	11.3	3.9	1.071	.338^{NS}

^{NS}Non significant, **Significant at $p < .01$ by repeated measures design ANOVA.

to 31.5 in the middle and then to 32.5, with F=6.500, p=.006. Session by session, the visual perception motor coordination ability of the subjects improved significantly. Hand function did not show a significant difference from 12.0lb before to 12.5lb in the middle and then to 12.5lb for the right hand with F=.511, p=.606, and then from 11.3lb before to 11.8lb in the middle and then to 11.3lb for the left hand with F=1.071, p=.338 (Table 4).

Multiple comparison of the visual perception motor coordination ability of the experimental group

To compare the visual perception motor coordination ability that showed a significant difference in the experimental group that were to arrange flowers in designated spaces, the Bonferroni test was used for post-hoc analysis. The result showed that there was no significant difference between the pretest and midtest evaluation (p=.104), but there was a significant difference between the pretest and posttest evaluation (p=.012). There was also no significant difference between the midtest and posttest evaluation (p=1.000)(Table 5).

The results of this study are in line with the results of Kang (2002) and You (2001) proving that floral arrangement is effective for hand function and finger recovery due to elaborate hand movements, and the making of works using floral arrangements helps improve hand-eye coordination. Moreover, the results are also similar to the study by Relf (1981) claiming that horticultural activities induce development of physical functions through gross and fine motor skills, as well as to the study (Lee and Kim, 2004) that horticultural therapy programs increased grip of dementia patients. Yun et al. (2010) claimed that various horticultural therapy programs focusing on sensory stimulations are effective therapeutic programs to improve the quality of elderly life in the aging society. Kim (2000) stated that horticultural activities focused on sensory stimulations are effective for cognitive functions such as place orientation, time orientation, attention, calculation and judgment.

To improve the visual perception motor coordination of the elderly with dementia, this study created designated spaces for them to arrange various flowers in each session. Cut flowers were selected based on the Munsell 10-hue circle and white. To determine which color the subjects most prefer, they were to hold the flower they like the most when handing out the materials before the program. The most preferred flowers in each session were classified by color and compared in percentage. They most preferred red (R) at 31.9%, followed by yellow red (YR) at 29.9%, yellow (Y) at 16.9%, red purple (RP) at 6.8%, green (G) and white (W) at 4.3%, purple (P) at 3.5%, and blue (B) and purple blue (PB) at 1.2%. This result is similar to the study (Yun et al., 2002) showing materials before each session of the program for the elderly with dementia and having them choose the flowers they like, which proved that the elderly most preferred red, followed by yellow (Yun et al., 2002). However, while Yun et al. (2002) claimed that there were no subjects choosing yellow red and white, the subjects of this study preferred yellow red after red. This is in line with the study (H.Y. Kim, 2003) that the elderly generally lack the ability to adapt to light and shade or identify color due to the decrease of physical functions, and thus prefer vivid colors like red or yellow.

Table 5. Multiple comparison by response of the experimental group's visual perception motor coordination ability

(I)Test	(J)Test	MD^{z} (I-J)	SE^{y}	p
Pre	Middle	-3.000	1.261	.104^{NS}
Pre	Post	-4.000	1.127	.012*
Middle	Post	-1.000	1.068	1.000^{NS}

^{z}Mean difference, ^{y}Standard error.
^{NS}Non significant, *Significant at $p < .05$ by Bonferroni multiple comparison.

Session by session, confidence about repeated program activities was expressed in various stories recalled from the past, helping others, cleaning up afterwards and presenting satisfied reviews. Programs for the elderly with dementia that lack cognitive function will be more effective for treatment if the participants are given confidence and satisfaction by repeatedly applying simple horticultural activities rather than applying various activities (H.Y. Kim, 2003). This study also improved visual perception motor coordination ability and maintained hand function of the elderly with dementia by having the participants arrange flowers repeatedly in designated spaces. Sustaining various floral arrangement activities will further improve hand function.

The elderly with dementia looked bright and enthusiastic during the activities, but there are limitations in generalizing the evaluation data because the chronic diseases of the subjects aside from dementia were not controlled in this study. However, this study has value in applying the results to therapeutic purposes by conducting additional research on improving visual perception motor coordination ability of the elderly with dementia using various plant-mediated horticultural activities using designated spaces aside from planting in designated spaces. Moreover, by developing various differentiated and selective programs, there would be much more remarkable effects on the elderly with dementia than the current horticultural therapy programs.

Conclusion

This study conducted total 20 sessions of the program twice a week from March 9 to May 25, 2017 to determine the effects of floral arrangement in designated spaces on visual perception motor coordination ability and hand function of the elderly with dementia. The subjects were 25 elders with dementia using a senior welfare center in D City, classified into 12 subjects in the control group (3 males, 9 females) and 13 in the experimental group (3 males, 10 females) for the pretest-posttest nonequivalent control group design. The program consisted of putting flowers into designated spaces in each session, which were created in the order of demarcation of the floral form, line drawing, numbering and straw putting. The participants were to put flowers in various colors based on the Munsell 10-hue circle in each session. The MMDT to measure visual perception motor ability and pinch gauge to measure the pinch of fingers were used repeatedly 3 times before, during and after the program. The IBM SPSS Statistics 19 Program was used for analysis, and the Kolmogorov - Smimov test (K-S test) was used for normality test of the sample data, independent samples t-test was used for homogeneity test between the control group and the experimental group, and a repeated measures ANOVA was used to determine the pretest-midtest-posttest changes in each group.

The result of normality test showed that visual perception motor coordination ability (p=.069), right hand function (p=.375), and left hand function (p=.375) all had the same distribution. The homogeneity showed that the groups were homogeneous in all evaluation items such as visual perception motor coordination ability (p=.318), right hand function (p=.108), and left hand function (p=.236). As for the pretest, midtest and posttest changes in the group, the control group showed no significance whereas the experimental group showed a significant change as the program went on in visual perception motor coordination ability, from 28.5 before the program to 31.5 in the middle, and then to 32.5 after the program (p=.006). However, the right hand function did not show a difference with 12.0lb before, 12.5lb in the middle and 12.5lb after (p=.606) as well as the left hand function with 11.3lb before, 11.8lb in the middle and 11.3lb after (p=.338). As a result of multiple comparison of visual perception motor coordination ability that showed a more significant difference as the participants arranged flowers in designated spaces, there was no significant difference between before and during (p=.104), or during and after (p=1.000), but there was a significant change between before and after (p=.012).

As a result, floral arrangement in designated spaces is effective for improving visual perception motor coordination

ability for the elderly with dementia. If programs suitable for therapeutic purposes are well applied step-by-step, it will maximize the effects of rehabilitation and treatment. Furthermore, it is necessary to apply the programs continuously instead of in the short run in order to alleviate the symptoms.

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