JARQ 50 (1), 39 – 44 (2016) http://www.jircas.affrc.go.jp

REVIEW
Structured Floral Arrangement Program Developed for Cognitive Rehabilitation and Mental Health Care

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Abstract
The structured floral arrangement (SFA) program was developed for cognitive rehabilitation and mental health care. This program required participants to create symmetrical floral arrangements as per predetermined procedures and with instructions given on the sequence of placing each natural material. Attentional deficit, particularly unilateral spatial neglect, nearly disappeared after SFA intervention for a patient with traumatic brain damage. This positive effect was maintained for five months. In schizophrenic patients, visuospatial working memory was improved after SFA intervention. Motivational rehabilitation also increased through the SFA program. This program for mental health care was implemented for participants suffering traumatic stress from the Great East Japan Earthquake of 2011. The number of participants who showed mild physical symptoms (e.g., headache) decreased from seven to just one after SFA intervention. These findings suggest that the SFA program has the potential to improve brain function and/or mental health.

Discipline: Horticulture
Additional key words: Great East Japan Earthquake, motivation, visuospatial ability, visuospatial working memory

Introduction

Just viewing flowers or greenery appears to affect the mental and physical states in humans. Patients staying in rooms with windows facing a green garden have shorter postoperative hospital stays than those in rooms with windows facing a building wall (Ulrich 1984). Whether hospitalized patients or healthy employees, natural flowers and trees decrease anxiety and fatigue, and increase positive feelings for work and coworkers (Dravigne et al. 2008, Park & Mattson 2009). It has also been reported that psychological stress-related high blood pressure and heart rate were effectively reduced to baseline levels by exposure to a natural environment as compared with exposure to an urban environment (Hartig et al. 2003, Ulrich et al. 1991).

As long ago as 1699, the therapeutic benefits of horticulture were reported in a horticultural periodical (Sullivan 1979). While many hospitals and institutions have utilized gardening activities, it was not until 1917 when the first recorded gardening instructor joined the therapy department of Bloomingdale Hospital in New York (Sullivan 1979). In Sao Paulo, Brazil, Pereira and Pereira (2009) reported that floral arrangement led to increased activity of a schizophrenic patient who usually experienced severe difficulty in socializing. In Japan, horticultural activities have been introduced in psychiatric treatment since the 1920s. However, the development of psychotropic drugs since the 1950s has resulted in a lower executing rate of horticultural activities at psychiatric facilities (Yamakawa et al. 2008). Recently, horticultural activities have been introduced to geriatric nursing homes to facilitate communication among residents. After three months of horticultural therapy, both the quality of life and depressive states among geriatric residents improved (Sugihara et al. 2005).

Cognitive rehabilitation with flowers

The structured floral arrangement (SFA) program was developed as a new method of cognitive rehabilitation

This paper reports the results obtained in collaboration with Ibaraki Prefectural University of Health Sciences and the Graduate School of Comprehensive Human Sciences, University of Tsukuba.
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Received 29 January 2015; accepted 23 April 2015.

for patients with brain damage (Mochizuki-Kawai et al. 2010). In the SFA program, participants are asked to arrange natural flowers and foliage as per predetermined procedures. Mochizuki-Kawai et al. (2010) developed program-specific tools (Fig. 1) that allow systematic and symmetrical floral arrangements to be easily created (Fig. 1 (a)). A polygonal absorbent sponge (Fig. 1 (b)), cut flowers, and small branches with leaves (Fig. 1 (d)) were provided. The absorbent sponge was marked with the impressions of various shapes (Fig. 1 (c), left)). These shapes served as a guide for the placement of natural materials (e.g., four green carnations each placed where marked by a triangle on the sponge) (Fig. 1 (c)). Participants were instructed to place each natural material in the correct impression on the sponge based on an instruction sheet describing the procedure for creating a particular floral arrangement. The procedure was divided into four or five stages, with each stage involving the arrangement of a different kind of flower or leaf. Based on the instruction sheet, participants had to identify the placement order and position of each item, temporarily memorize these instructions, and then place the items correctly on the absorbent sponge.

The SFA structure resembles pegboard and block-design training. Both the pegboard and block-design training are widely used in physical and cognitive rehabilitation for

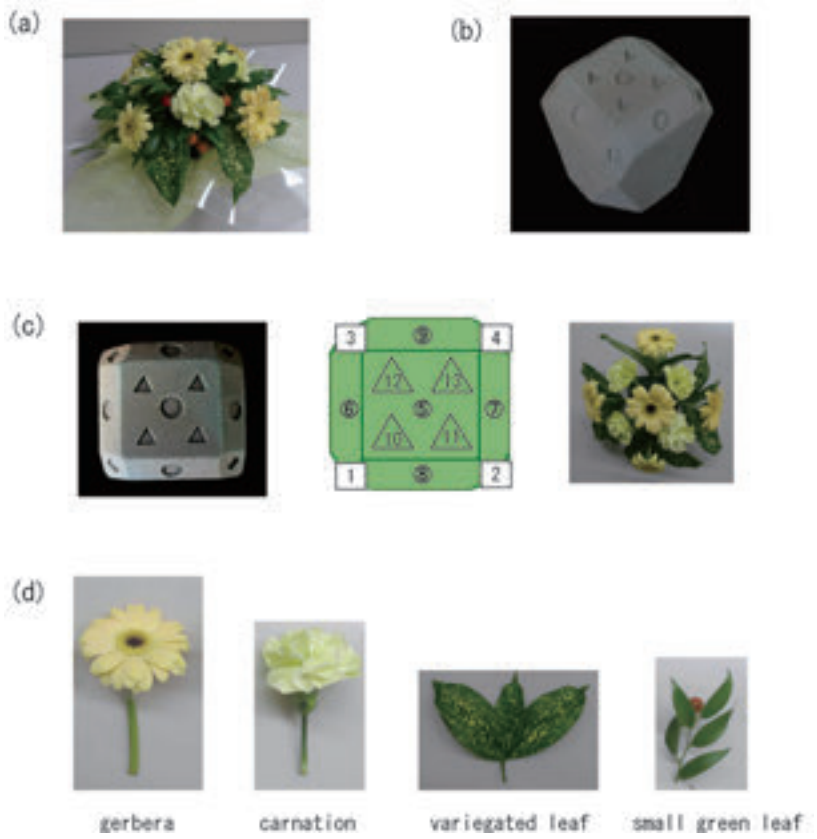

Fig. 1. Example of materials and procedures used in SFA (referenced and partially arranged from Mochizuki-Kawai et al. 2013)

(a) Example of a completed floral arrangement

(b) A polygonal-shaped absorbent sponge with impressions of various shapes (overall view)

(c) Overhead view of the absorbent sponge with impressions (left), diagram of the absorbent sponge (middle), and an example of a floral arrangement pattern (right). These were provided on the instruction sheet as the third stage of the floral arrangement task. The circles and triangles in the diagram (middle) correspond to impressions on the sponge (left). The shapes serve as a guide to where the materials should be placed; the materials were placed vertical to the plane of the shaped sponge (e.g., 4 lateral yellow gerberas placed on the 45° angled plane of the sponge where marked by circles). The numbers denote the sequence in which the items were to be placed (middle). Based on the diagrams shown on the instruction sheet, the participants were able to identify the placement position for each item, which they temporarily memorized and subsequently followed step-by-step.

(d) Example of materials used in SFA. After placing three of the four types of materials (i.e., gerberas, carnations, variegated leaves) as mentioned above, small green leaves were randomly arranged to fill up the remaining area on the absorbent sponge.

patients with brain damage (Ashman et al. 2008, Burdea, 2003, Young et al. 1983). Specifically, the patients set pegs into uniform slots on the pegboard. And similar to SFA, block-design training requires patients to arrange blocks according to a prescribed model. Patients with brain damage who received block-design training have shown improved reading and word-writing skills through their enhanced visual information scanning ability (Young et al. 1983). The SFA program showed improvements similar to those achieved through block-design training (Mochizuki-Kawai et al. 2010).

Compared to the pegboard and/or block-design training, there are two differences in the SFA procedure (Mochizuki-Kawai et al. 2010). First, the SFA procedure includes three-dimensional visual manipulations that require more complex visuospatial processes than pegboard work. Second, the memory load is apparently higher in the SFA program than that in the other two methods. The SFA program requires patients to memorize a predetermined order of placing materials and make a floral arrangement accordingly, while block-design (pegboard) training generally does not determine such an order of placement. The SFA program would be more useful as memory training comparing to traditional training methods.

Clinical research

As a case study, Mochizuki-Kawai et al. (2013) provided the SFA program for a male in his forties who had suffered a severe traumatic brain injury with bilateral frontal and temporal lesions (Mochizuki-Kawai et al.2013). The damage was more severe on the right side of the brain (Fig. 2), with serious symptoms of unilateral spatial neglect (USN). The patient tended to ignore stimuli affecting his left side field, a situation that continued for three years after onset. The presence of USN is a pivotal factor in delaying the recovery of activities of daily living (ADL) levels among hemiplegic patients (Denes, et al. 1982).

The patient participated in the SFA program three times during eight days. His USN symptoms were assessed at four times: just before, immediately after, about two weeks after, and five months after SFA intervention. These assessments employed the line cancellation test of the Behavioral Inattention Test (BIT) and the Rey-Osterrieth Complex Figure (ROCF) test. In the line cancellation test, the patient was instructed to cross all the straight lines drawn on a sheet of paper (Fig. 3, upper left, under **[sample]**). Before intervention, the patient had neglected two vertical rows of stimuli on the left side in the line cancellation test (Fig. 3 (a), within the dotted lines); however, after SFA intervention, he was able to recognize and cross all the lines, including the left-side stimuli (Fig. 3 (b), within the dotted lines). In the ROCF test, the patient was instructed to copy a complex figure (Fig. 3, upper right under **[sample]**), where the accuracy of his drawing was evaluated on a scale of 0 to 36 points. The sample figure was divided into 18 parts, with 2 points being scored for each part. The patient's score improved from 10 before SFA intervention (Fig. 3 (c)) to 22 immediately after intervention (Fig. 3 (d)). Furthermore, the patient was able to make a much more accurate copy of the complex figure in the center of the paper after SFA (Fig. 3 (d)). These effects were maintained for five months after intervention. Our results showed that, in chronic case, the SFA program could positively stimulate visuospatial ability while improving unilateral spatial neglect for a long time. The natural materials presented to the patient were arranged in a bilaterally symmetrical design, so as to draw his attention to both the left and right sides during SFA (Mochizuki-Kawai et al. 2013).

Fig. 2. CT image of a patient with traumatic brain damage recorded two months after the injury, with a low-density area found near the right temporal lobe (referenced and partially arranged from Mochizuki-Kawai et al. 2013)

In a pilot study with a stroke patient (male, age 59), the accuracy of the patient's figure drawing improved after SFA intervention (Fig. 4). The patient could copy a more accurate outline (the large rectangle) and details (e.g., five lines at the lower right) of the sample figure (Fig. 4 (b)). The SFA program may provide a positive effect on visuospatial dysfunction as well as attentional deficit. The SFA program's impact on brain damaged patients must therefore be clarified through further investigation.

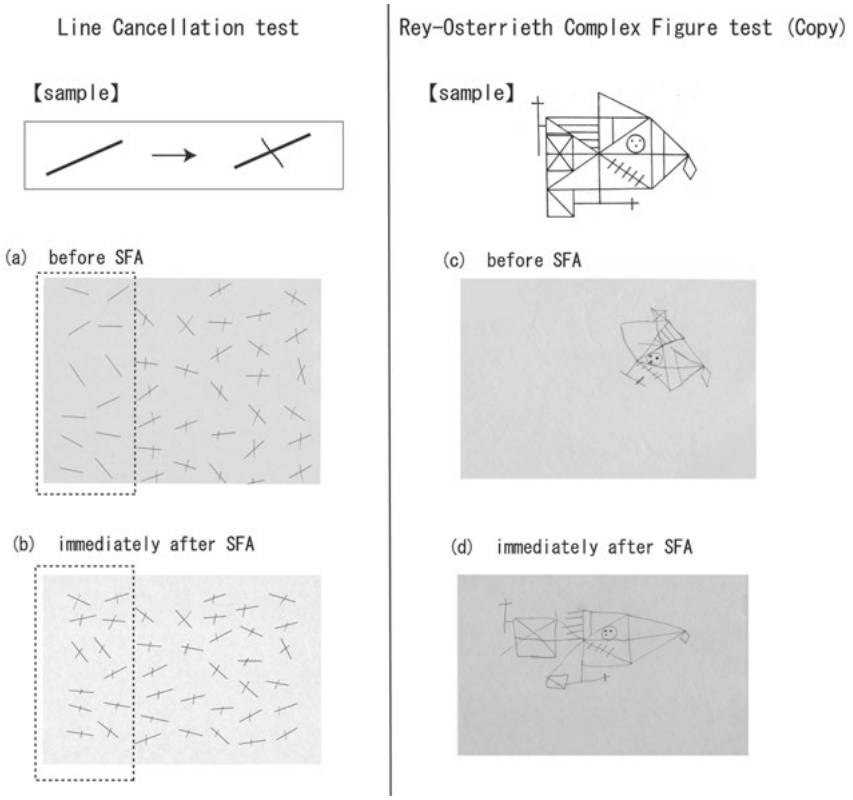

Fig. 3. Results of the line cancellation test of the BIT and ROCF test (copy version) before and after the SFA program (referenced from Mochizuki-Kawai et al. 2013)

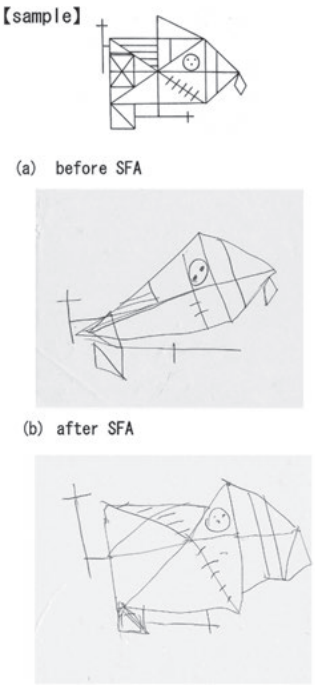

Fig. 4. Results of the ROCF test (copy version) before and after the SFA program for a patient with stroke

Mochizuki-Kawai et al. (2010) found that visuospatial working memory improved after SFA intervention in schizophrenic patients. Schizophrenic patients sometimes show cognitive deficits as well as psychiatric symptoms, which may restrict their social participation (e.g., Bowie et al. 2008, Green 1996). Mochizuki-Kawai et al. (2010) tried to improve these patients' cognitive dysfunction, particularly visuospatial working memory. Twenty patients were recruited for the present study. The patients were diagnosed with schizophrenia or schizoaffective disorder under criteria described in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (American Psychiatric Association, 2004), and assigned to either of two groups: the SFA-intervention group (10 patients; 6 males, 4 females) and the non-intervention group (10 patients; 4 males, 6 females). No marked differences were observed between the patients in the SFA-intervention and non-intervention groups in terms of their characteristics (i.e., mean age, years of education, age of onset, total chlorpromazine-equivalent neuroleptic dose, levels of cognitive deficits, severity of psychiatric symptoms). Patients in the SFA-intervention group participated in SFA four times during a two-week period. During that period, their visuospatial

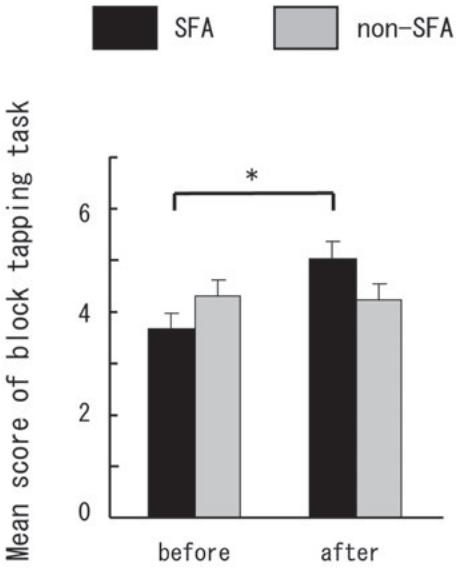

Fig. 5. Change in mean scores of visuospatial working memory task before and after the SFA program (* $p < 0.05$ (Mann-Whitney *U* test) (referenced and partially arranged from the NARO homepage: http://www.naro.affrc.go.jp/project/results/laboratory/flower/2010/flower10-04.html)

working memory was tested twice—just before and immediately after SFA intervention—in the block tapping task. Patients in the non-intervention group were also tested twice, at two-week intervals, to assess their visuospatial working memory. The results showed that only the SFA-intervention group significantly increased their visuospatial working memory scores (Fig. 5), thus suggesting that SFA may be useful in stimulating and enhancing visuospatial working memory in schizophrenic patients.

The attendance rate for the SFA program was 62.5%. Although not particularly high, this rate was higher than that of a previous study (30%-40%) involving a horticultural therapy program conducted at the same facility (Yamakawa et al. 2008). And the attendance rate in the present study was also nearly double that of a typical daily non-floral horticultural program (Mochizuki-Kawai et al. 2010). Natural material may reduce anxiety and improve motivation during the cognitive approach, and subsequently increase the attendance rate. These findings agree with previous studies involving horticultural therapy (Sullivan 1979).

Great East Japan Earthquake and mental health care with flowers

On March 11, 2011, at 2:46 p.m., the Great East Japan Earthquake (Higashi-Nihon Earthquake) struck prefectures on the Pacific side of northeastern Japan. The resulting tsunami left more than 20,000 people dead or missing, with over 240,000 homes damaged or destroyed (Kotozaki & Kawashima 2012). The earthquake also caused severe damage to the Fukushima Daiichi Nuclear Power Plant. After the earthquake event, many people have led an uncomfortable life and suffered damage to both their physical and mental functions (Kotozaki & Kawashima 2012). Therefore, a special health care system is required for those affected.

From October to December 2012, Mochizuki-Kawai et al. (2014) examined the effects of mental health care with flowers on the people affected in Fukushima. Twenty-four women (ages 39 to 71; mean age of 57.5) participated in the investigation. They were asked to meet together at a community center and participate in making floral arrangements once a month. The meetings were conducted three times during a three-month period. At each meeting, the participants arranged flowers and foliage as per predetermined SFA procedures (Mochizuki-Kawai et al. 2010), which allowed all participants (even beginners) to easily and properly create floral arrangements (Fig. 6 (a)). The participants were also allowed to take their completed work home. Moreover, bouquets were sent to each participant's home twice between the floral arrangement meetings to maintain a connection with natural materials (Fig. 6 (b)). The mental health status of each participant was assessed twice, both before and after the three-month intervention, by using General Health Questionnaire-28 (GHQ-28). GHQ-28 includes 28 question items about mental health (e.g., anxiety, insomnia, depressive symptoms) (Goldberg 1978). When a participant answered yes to an item, one point was added to the total score. For scores above 6 points, GHQ-28 allowed for the identification of people with mental health disorders. Mochizuki-Kawai et al. (2014) reported that the mean GHQ scores were higher than 6.0 points, and did not decrease significantly from before and after the intervention (7.84 (SD ±1.13) before and 6.11 (SD ±0.96) after)). In contrast, the percentage of participants with mental health disorders decreased from 63.2% to 47.4% after the floral intervention (Mochizuki-Kawai et al. 2014). The number of participants who showed mild physical symptoms in response to GHQ-28 (e.g., headache) decreased from seven to only one, whereas the number of participants with moderate or severe physical symptoms increased from six to eight persons. Our results therefore suggest that floral health care may improve the mild symptoms of mental health disorders, but may not result in a successful response to moderate or severe symptoms (Mochizuki-Kawai et al. 2014).

Conclusions

Mochizuki-Kawai et al. (2010) developed the SFA program and examined its effects in cognitive rehabilitation training and/or mental health care. It was found that the ability to analyze visuospatial information, maintain

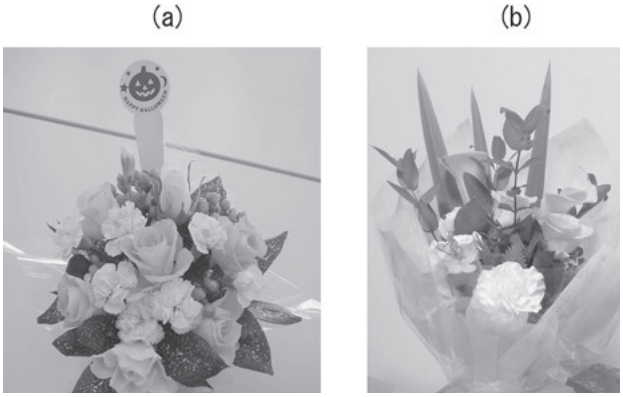

Fig. 6. Examples of a completed floral arrangement and a flower bouquet
(a) An example of a completed floral arrangement work created by a participant
(b) An example of a bouquet that was sent to each participant's home

memory function and attention span were positively stimulated through the SFA program in patients with brain damage and schizophrenia. Our findings also suggest that SFA program is useful intervention for improving mental health care. Specifically, SFA intervention resulted in higher motivation and a decrease in the mild symptoms of mental disorders. These positive outcomes indicate the potential application of SFA as a useful modality in the development of both cognitive rehabilitation training and mental health care systems in the future.

Acknowledgements

I wish to extend my grateful appreciation to Dr. Yamakawa, Dr. Mochizuki and Mr. Mogi for their valuable cooperation in clinical research.

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