"The Effectiveness of Art Therapy on Improving Aphasia in 16–20-Year-Old Boys: Evidence from the Rey Complex Figure Test"

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ABSTRACT

Primary progressive aphasia (PPA) is a subtype of frontotemporal dementia that affects the language networks of the brain. Individuals with PPA suffer from a general decline in communicative abilities. Recent studies have confirmed the potential value of naming therapy in reducing widespread language difficulties in this population. However, most interventions have focused on word-level naming, and few have addressed their effectiveness within discourse contexts, leaving limited information in this domain. Therefore, the aim of this study is to investigate the effectiveness of creative art therapy in individuals with aphasia. Sixteen boys aged 16 to 20 with diagnosed aphasia were selected from a psychology clinic affiliated with the Welfare Organization. Using the T-test, eight participants were assigned to the experimental group and eight to the control group. The experimental group underwent eight sessions of art therapy. Both groups were assessed before and after the intervention using the Rey Complex Figure Test, the Persian version of the Aphasia Test, and brain mapping. Based on the Rey Complex Figure Test results, the experimental group showed a 23% improvement, compared to a 6% improvement in the control group. These findings suggest that art therapy contributed to an approximate 17% increase in memory improvement, image recall, and visual retrieval. Furthermore, some individuals experienced up to a 65% enhancement in visual performance and memory retrieval following art therapy, and showed notable improvement in executive function, particularly in processing speed.

Keywords: *Aphasia, Language Impairment, Art Therapy Effectiveness, Rey Complex Figure Test*

1. *INTRODUCTION*

Individuals affected by aphasia experience dysfunction in the brain's language and motor regions [1]. This raises an important question: how can these individuals be helped? The areas impacted by aphasia, in addition to their roles in motor and verbal processing, also play a significant role in creativity [2]. When discussing creativity and physical rehabilitation, attention is often drawn to art and crafts. Art therapy has been examined in various studies and is increasingly proposed as a therapeutic method for treating both brain and psychological disorders [3]. This leads to a second question: can art therapy support improvements in verbal and motor functions among individuals with aphasia, and to what extent is it effective? In the present study, through a series of structured art therapy sessions and the use of the Rey Complex Figure Test, we aim to evaluate improvements in aphasic individuals aged 16 to 20.

2. Research Background

The theoretical background of this study is based on three core frameworks: research focused on the treatment and rehabilitation of aphasia, studies on art therapy, and research grounded in cognitive psychology and neuropsychology. The background begins with domestic studies and then proceeds to international literature. The theoretical framework specifically emphasizes approaches used in the treatment and improvement of speech impairments.

1.1 Iranian Research

Hekak Khadem and colleagues (2019) investigated the effectiveness of art therapy (visual arts) in improving the negative symptoms of patients with schizophrenia at the Ahva Day Center for Neurology and Psychiatry. The research method was descriptive, semi-experimental, with a pre-test and post-test design. The study population included all schizophrenia patients at the Ahva Day Center, from which 14 patients were selected using a convenience sampling method. The participants attended 10 sessions of 90 minutes each. Data were collected using the Person Picking an Apple from a Tree (PPAT) drawing test and the Formal Elements Art Therapy Scale (FEATS). The results indicated that art therapy was effective in reducing negative symptoms (such as anxiety, inattention, lack of self-confidence, and depression) in these patients ($p < 0.05$). This study suggests that art therapy can be an effective therapeutic approach for managing the negative symptoms of schizophrenia [4][5].

Karimyai and colleagues (2019) examined the effectiveness of art therapy (specifically drawing therapy) in reducing separation anxiety symptoms in preschool children. Their research used a semi-experimental pre-test and post-test design with a control group. 121 mothers of children at the preschool centers were selected using a convenience sampling method, and through them, the separation anxiety of their children was assessed. Based on inclusion and exclusion criteria, 26 children were selected and randomly assigned to either the experimental or control group. The experimental group received two 45-minute art therapy sessions per week for 10 weeks, while the control group was placed on a waiting list [6][7][8].

1.2 International Research

Brightstein and colleagues (2022) consider successful therapy to be the result of aphasia rehabilitation. In their psychological article titled "Operational Success in Aphasia Rehabilitation," they discuss how success in therapy is defined and measured. They provide methods for calculating the average statistically significant changes across several group studies (such as standardized mean differences, raw unstandardized mean differences) for a specific OMI. Such metrics are useful for summarizing the overall impact of the intervention, especially in meta-analyses. As a result, operationalizing individual treatment success based on clinically meaningful and statistically significant criteria (as reported by patients) is considered a key priority in aphasia rehabilitation. The availability of such measures (a) facilitates the estimation of therapeutic response in intervention studies and thus optimizes treatment decisions, and (b) provides stakeholders (e.g., the community, stroke teams, individuals with aphasia, families, physicians, healthcare professionals) with objective, reliable, and meaningful feedback regarding individual therapeutic responses in clinical settings *[9].*

Wallace and colleagues (2020) aimed to identify all existing standardized measurement tools developed or tested with individuals with aphasia and to describe the constructs measured, reporting methods, structure (components and scoring systems), and the availability of cultural/language adaptations of the identified tools. Their research was conducted as a scoping review aligned with selected items for systematic reviews and meta-analysis extensions (PRISMA-ScR) to examine the range of available tools. Studies were identified through searches in databases such as PUBMED, EMBASE, and CINAHL. Secondary searches on individual measurement tools and manual searches were also performed. Two reviewers independently assessed titles, abstracts, and full-text articles. A total of 334 articles were evaluated, and secondary searches identified 99 additional publications. In total, 284 references for 143 measurement tools were included in this review. The tools were categorized based on the ICF component. It was reported that most of them measured body function criteria (n = 94), followed by activity/participation (n = 23), environmental factors (n = 5), and quality of life/other constructs not included in the ICF (n = 16). Five multiple ICF components were measured. This review identified 143 measurement tools developed or tested with individuals with aphasia. According to the ICF classification, these tools primarily measure body functions (n = 94). Some tools have undergone extensive cultural and linguistic translation or adaptation, while most have not. The resulting set of tools provides a foundation for selecting measurement tools in clinical and research settings *[10].*

Tippett and colleagues (2014) examined current concepts of aphasia both theoretically and practically. They found that aphasia is viewed as a disorder in the cognitive processes underlying language. Aphasia rehabilitation includes evidence-based and person-centered approaches. New methods, such as cortical brain stimulation approaches to modulate cortical excitability, like repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS), have only recently begun to be explored. In this review, we discuss the historical background of the neuroscience approaches to language. We sample emerging theoretical models of the neural substrates of language and cognitive processes underlying aphasia, which help in the development of more precise and refined language concepts. Current aphasia rehabilitation concepts, including the promising role of cortical brain stimulation as a complement to behavioral therapy and changes in therapeutic approaches based on neuroplasticity principles and evidence-based or person-centered training to optimize functional outcomes, are reviewed *[11]*.

3. Research Method

The present study is applied in nature, as it can assist therapists in the treatment of aphasia. Regarding the method, the study employs a quasi-experimental design with pre-test and post-test, including a control group. In this method, participants are assessed before and after art therapy using standardized questionnaires and tests, and the results are then compared with the control group.

The sampling method used is convenience sampling, as the participants are selected from a specific counseling center. Since the participants are divided into control and experimental groups, random sampling is used within each group.

Statistical Population, Sampling Method, and Sample Size:

To calculate the sample size for pre- and post-test studies with control and experimental groups, the T-test and Z-test are used for populations of fewer than 20 individuals. The calculation process for sample size is as follows:

The T-statistic (using the noncentral parameter) is first applied, and then the Z-statistic is used to measure the sample size in a small population. This method is commonly used in medical and psychological intervention studies with small sample sizes [12].

Assumptions:

- The threshold probability for rejecting the null hypothesis is set at the Type I error rate:
  α=0.05\alpha = 0.05
- The probability of failing to reject the null hypothesis under the alternative hypothesis is the Type II error rate:
  β=0.02\beta = 0.02
- The proportion of subjects in the experimental group (exposed):
  q1=0.5q_1 = 0.5
- The proportion of subjects in the control group (not exposed):
  q0=0.5q_0 = 0.5
- Effect size (if μ1\mu_1 is the mean in group 1 and μ0\mu_0 is the mean in group 0, then:
  E=μ1−μ0E = \mu_1 - \mu_0):
  E=0.5E = 0.5
- The standard deviation of the outcome in the population:
  S=1S = 1

3-1Calculation

For the calculation, the sample size calculator for clinical research design provided by the National Institute of Health (NIH) and the National Center for Advancing Science (2023) was used.

- **Standard Normal Deviation for α\alphaα:**
  Zα=2.1701Z_{\alpha} = 2.1701Zα=2.1701
- **Standard Normal Deviation for β\betaβ:**
  Zβ=−1.2816Z_{\beta} = -1.2816Zβ=−1.2816
- **Standard Effect Size** (ES)=0.500\left(\frac{E}{S} \right) = 0.500(SE)=0.500

1. Calculation using T-statistic and non-central parameter:

- N1=8N_1 = 8N1=8 (experimental group size)
- N0=8N_0 = 8N0=8 (control group size)

- NT=16N_T = 16NT=16 (total sample size)

2. Normal Approximation using Z-statistic instead of T-statistic:

- A=(1q1+1q0)=4.0000A = \left(\frac{1}{q_1} + \frac{1}{q_0} \right) = 4.0000A=(q11+q01)=4.0000
- B=(Zα+Zβ)2=0.7895B = (Z_{\alpha} + Z_{\beta})^2 = 0.7895B=(Zα+Zβ)2=0.7895

The total group size is calculated as:

N=AB(ES)2=12.632N = \frac{AB}{\left(\frac{E}{S} \right)^2} = 12.632N=(SE)2AB=12.632

For N1=7N_1 = 7N1=7, N0=6N_0 = 6N0=6, and NT=13N_T = 13NT=13, the Z-statistic approximation gives a slightly lower sample size. This is done to account for unforeseen events during the research process. Therefore, based on the T-statistic sample size, the study is conducted, and if participants drop out during the study, the research will still maintain its validity with up to 7 participants in the experimental group and 6 participants in the control group.

Summary of Data Collection Tools and Procedure

The table below summarizes the tools and data collection methods used for this research, specifying the pre-test and post-test. The proposed protocols for aphasia art therapy and the process are outlined. The reliability and validity of all research tools are detailed in the following sections.

Table 3.1: Pre-Test and Post-Test Procedure

Action	Estimated Time	Data	Research Goal	Question
Initial Interview (Pre-Test)	10-15 minutes	Validation of content; Strengths and weaknesses analysis; Introduction and development of therapeutic relationship. Observational data on language and behavior of the participant.	General data collection: psychological data before and after therapy program; commitment to participation; behavioral data collection and assessment of the relationship.	Were appropriate participants selected for the study?
Stroke Burden Questionnaire (Pre-Test)	15-25 minutes	Structured interview (questionnaire) on psychological, cognitive, and physical experiences resulting from the pre-treatment stroke program. Qualitative narrative feedback and post-treatment evaluation.	Generating comparative data to assess social, occupational, and psychological outcomes to address the research goal.	What level of aphasia do the participants have?
Complex Shape Test (Pre-Test)	10-15 minutes	Quantitative measurement of visual-spatial domains, psychomotor skills, executive functioning, and memory; qualitative observations on psychological, motor, attention, and executive functioning.	Generating quantitative and qualitative comparative data to evaluate cognitive domains of interest in the research.	What problems do the participants have in the visual-spatial, psychomotor, executive functioning, and memory domains?
Art Therapy Session (Next Table's Description)	8 sessions, 70 minutes each	Video creation. Clinical qualitative observation of behaviors in psychological domains, including behavioral expressions, gestures, and discourse. Continuous monitoring of outcomes and therapeutic goals for each session.	Providing continuous evaluation data related to cognitive and psychological domains of interest, including quantity and quality of discourse, creativity process, and therapeutic goals.	How does participation in creative art therapy influence cognitive and psychological outcomes at the session level?
Session Evaluation Questionnaire (Post-Test)	5 minutes	Verbal assessment of session quality and social interaction between therapist and participant. Behavioral observation. "How do you feel about today's art	Providing comparative data during the session to evaluate the participant's experience with the process and content of therapy,	How does participation in creative art therapy affect rehabilitation and cognitive

Action	Estimated Time	Data	Research Goal	Question
		activity?" (pre) / "What did you feel after doing art today?" (post)	including satisfaction and feasibility of tools for therapy session.	outcomes at the session level?
Complex Shape Test (Post-Treatment)	10-15 minutes	Quantitative measurement of visual-spatial domains, psychomotor skills, executive functioning, and memory; qualitative observations on psychological, motor, attention, and executive functioning.	Summarizing the process and content of creative art therapy interventions for these participants in relation to the research question and program design.	How does participation in creative art therapy influence clinical and cognitive outcomes at the program level (multiple sessions)?

4. Findings

Initially, the preliminary interviews were conducted with all 16 participants, and the results are summarized below. To maintain ethical standards and respect participants' privacy, their last names are omitted. Additionally, images taken during the therapy sessions were recorded from behind the participants to ensure their faces are not identifiable.

4-1Complex Shape Test (Pre-Test and Post-Test)

All 16 participants were administered the Complex Shape Test as a pre-test before the art therapy sessions and a post-test after the therapy sessions. The purpose was to assess the level of aphasia in the participants. The results from these tests are summarized in **Table 4.5** and the questionnaire sample is attached in the appendix. This test aims to investigate the following cognitive areas: visual-spatial, psychomotor, executive function, and memory.

Table 4.5: Raw Scores of the Complex Shape Test (Pre-Test)

Participant	Copying (Score based on correct placement of elements)	Relative to Normal Table	Copy Time (Score for speed)	Relative to Normal Table	Recall (Score based on correct placement of elements from memory)	Relative to Normal Table	Drawing Time from Memory	Relative to Normal Table
1	21	11%	10	<10%	23	55%	6	10%
2	22	12%	12	<10%	24	60%	8	<10%
3	21	11%	9	<10%	18	25%	5	25%
4	24	14%	11	<10%	22	50%	6	10%
5	16	6%	5	25%	20	35%	4	50%
6	20	10%	10	<10%	21	40%	6	10%
7	23	13%	8	<10%	25	65%	5	25%
8	21	11%	10	<10%	24	60%	6	10%
1 (Control)	18	8%	6	10%	22	50%	4	50%
2 (Control)	20	10%	10	<10%	22	50%	6	10%
3 (Control)	24	14%	10	<10%	21	40%	6	10%
4 (Control)	22	12%	8	<10%	22	50%	5	25%
5 (Control)	22	12%	11	<10%	24	60%	8	<10%
6 (Control)	20	10%	8	<10%	25	65%	5	25%
7 (Control)	22	12%	10	<10%	24	60%	6	10%
8 (Control)	23	13%	10	<10%	20	35%	4	50%

Table 4.6: Raw Scores of the Complex Shape Test (Post-Test)

Participant	Copying (Score based on correct placement of elements)	Relative to Normal Table	Copy Time (Score for speed)	Relative to Normal Table	Recall (Score based on correct placement of elements from memory)	Relative to Normal Table	Drawing Time from Memory	Relative to Normal Table
1	26	16%	6	10%	27	75%	3	75%
2	32	40%	8	<10%	25	65%	4	50%
3	27	17%	9	<10%	22	50%	4	50%
4	29	19%	9	<10%	26	70%	5	25%
5	31	25%	5	10%	28	80%	3	75%
6	34	75%	10	<10%	25	65%	4	50%
7	28	18%	6	10%	29	90%	5	25%
8	28	18%	6	10%	28	80%	4	50%
1 (Control)	18	8%	6	10%	22	50%	4	50%
2 (Control)	22	12%	9	<10%	23	55%	5	25%
3 (Control)	24	14%	10	<10%	20	35%	6	10%
4 (Control)	25	15%	7	<10%	22	50%	4	50%
5 (Control)	20	10%	7	<10%	27	75%	7	<10%
6 (Control)	21	11%	8	<10%	25	65%	5	25%
7 (Control)	25	15%	10	<10%	22	50%	5	25%
8 (Control)	28	18%	8	<10%	20	35%	4	50%

4-2 Results from the Pre-Test and Post-Test of the Complex Shape Test

The results from the pre-test and post-test of the Complex Shape Test for both the experimental group (8 participants) and the control group (8 participants) are summarized in the table below. As observed:

- **Change in Copying (Score based on correct placement of elements):**
  - The experimental group showed progress ranging from 5% to 65%, indicating improvement in their ability to copy the shape correctly.
  - In contrast, the control group showed progress between 5% and a decrease of -2%.
- **Change in Copy Time (Improvement in time):**
  - Both groups showed improvement in copy time, ranging from 0 to 4 minutes.
  - The experimental group improved by a total of 15 minutes (sum of the time improved for all 8 participants).
  - The control group improved by a total of 8 minutes (sum of the time improved for all 8 participants), showing that art therapy had a more significant effect on the experimental group.
- **Change in Recall (Score based on correct placement of elements from memory):**
  - The experimental group showed an improvement in recall of 5% to 45%, with an average improvement of approximately 23%.
  - The control group showed changes in recall ranging from a decrease of -10% to 15%, with an average improvement of only around 6%.
- **Change in Drawing Time from Memory:**
  - In the experimental group, the change in drawing time ranged from 15% to 65%, with an average of about 33%.
  - For the control group, the change ranged from -5% to 25%, with an average of approximately 6%.

Table 4-7: Complex Shape Test Analysis (Pre-Test and Post-Test)

Participant	Percentage of Change in Copying (Score based on correct placement of elements)	Copying Time Change (Improvement in time)	Percentage of Change in Recall (Score based on correct placement of elements from memory)	Percentage of Change in Time to Draw from Memory
1	5.00%	4	20.00%	65.00%
2	28.00%	4	5.00%	45.00%
3	6.00%	0	25.00%	25.00%
4	5.00%	2	20.00%	15.00%
5	19.00%	0	45.00%	25.00%
6	65.00%	0	25.00%	40.00%
7	5.00%	2	25.00%	15.00%
8	7.00%	1	20.00%	40.00%
9 (Control)	0.00%	0	0.00%	0.00%
10 (Control)	2.00%	1	5.00%	15.00%
11 (Control)	0.00%	0	-5.00%	0.00%
12 (Control)	3.00%	1	0.00%	25.00%
13 (Control)	-2.00%	4	15.00%	-5.00%
14 (Control)	0.00%	0	0.00%	0.00%
15 (Control)	3.00%	0	-10.00%	15.00%
16 (Control)	5.00%	2	0.00%	0.00%

5. Discussion and Conclusion

This thesis began with the aim of rehabilitation for aphasic patients using creative art therapy. It then examined the theoretical and practical foundations of aphasia and, in the subsequent stages, explored the research findings in the context of a control and experimental group. The results obtained were positive.

In response to the two sub-questions of the research, including: *What impact does creative art therapy have on patients with speech apraxia disorders?* and *What impact does creative art therapy have on patients with mild unilateral paralysis or other motor disorders?* the findings were also positive.

Using the Complex Shape Test (pre-test and post-test with the control group), participants were reassessed after art therapy. The reason for assessing learning with this test was that the control group also underwent the pre- and post-test. The effect of administering the test again was 6%, which was based on the control group, where no treatment had been applied. The experimental group, however, experienced a 23% improvement. Considering the 6% improvement in the control group's test results, it can be concluded that the effectiveness of art therapy in improving memory, image recall, and enhancing image retrieval is approximately 17%. In fact, some participants experienced up to a 65% improvement in visual performance and memory retrieval after art therapy. Executive function, specifically in speed of action, also showed improvement in the individuals. Therefore, the second hypothesis, "Creative art therapy has a direct impact on the treatment of patients with mild unilateral paralysis," is confirmed.

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