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Patterns of Writing in Cognitive Communicative Disorders: A Diagnostic Study

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ABSTRACT

The aging population is gaining attention in nations due to higher living standards and better health care and serene life. This trend may cause a threat to society in the long run with physical and many psychological issues. This budding Group needs to be taken care of by all the professionals to diagnose and manage multifunctional issues. One of them is the cognitive issue, found in Aging, replicating a few symptoms of the neurological impaired population. This study is a part of my Ph.D. work, attaining the difference in WRITING SKILLS in the elderly and impaired populations. This subtest is a part of the BDAE-R short form test. The population included 3 Groups i.e. 60-70 years, 70-80years and cognitively impaired Group. The raw scores were subjected to the non-parametric test, for the total variance in the scores of WRITING subtests on BDAE-R.

Summary: Result significantly represented a difference in a few subtests, however, the variance in WRITING was more prominent in terms of letter choice and motor facility.

Keywords: BDAE-R, Boston Diagnostic Aphasia Examination- Revised Form

INTRODUCTION

Cognitive and communicative impairments are the sole features found in ample of neurodegenerative diseases like Alzheimer's and Parkinson's, along with the normal aging population. Out of many impairments, the present concern is the impairment of cognitive-motor abilities of the general aging and cognitively impaired population. The most impaired cognitive motor ability is WRTIIN which brought attention due to an immense effect on the livelihood of the aging population. To the researcher's beliefs, the WRITING issues were due to impaired processing followed by memory loss and confusion. As writing involves the brain's functioning and motor control, many researchers found an alteration in handwriting as the prime sign of cognitive impairment. As documented in neuroscience and neurophysiology, writing is a most complex and coordinated task of planning, programming and executing motor movements; any impairment in nervous systems represents the effect on WRITING. Writing involves a complex process coordinated by many parts of the brain, and on the skill of developing more writing, more neural connections get activated. Cognitively impaired populations represent various writing issues, including shaky writing patterns, which were believed to be due to loss of muscle control, confusion, and forgetfulness. The symptoms over the period get worsen and become illegible phonologically. The inevitable WRITING issue is commonly spelling mistake, which is clinically presented in many cases. This

study is a part of a Ph.D. research and this aimed to extract features of WRITING concerning various clinical conditions of neuro pathology along with a representation of WRITING in the Aging process to clinically differentiate normal and pathological Aging. This can be to be utilized as a parameter for diagnosis in clinical studies. This study also aimed at successfully extracting the Writing features in the handwritten samples, which can be used as a differential diagnostic tool for the early detection of pathological aging.

Research shows the more you use your brain by practicing skills, the tinier connections multiply and become stronger to improve the communication abilities, and this applies to writing skills too.

As mentioned earlier, writing includes - wording, style, phrasal expressions, syntax and pragmatic skills etc. Writing is a stimulating and strenuous brain activity engaging all parts of your brain, which can grow and change over time representing plasticity and progression of aging.

The part of the brain associated with speaking and writing is the frontal lobe, which is also responsible for movement, reasoning, judgment, planning and problem-solving. The parietal lobe is also important in writing. Patients with damage to this part of their brain often have trouble spelling and writing issues, sometimes termed as EMPTY WRITING. Few research in the area of writing represented Improved memory in writing, and it is due to stimulation of the neural network system even it is found that the physical act of writing brings the information to the forefront and triggers your brain to pay close attention. As so far working on writing is not yet a domine for the diagnosis and rehabilitation of any aging as well as in cognitively impaired population, this research aimed to identify the core issues in writing in terms of aging and cognitively impaired population to establish a norm for the differential diagnosis.

LITERATURE REVIEW

Handwriting involves a complex task of neuromuscular coordination. As documented by many researchers, old age and neurological illness affect the neurological processing and muscular coordination of the body. This produces significant effects on the handwriting of an individual (Huber & Headrick, 1999), ranging from minor variations to a marked decline in writing skill, muscular coordination, speed, deterioration of letter formations, and so on. Few changes in handwriting, due to old age and illness resemble a few characteristics of forgery, which can be considered as nongenuine if overlooked and may lead to misdiagnosis of serious pathology. Looking into this, the present study aimed at finding the Writing skills of individuals with normal aging and cognitive communicative impairment. Following is few documented research supporting our present study

The study by Saini et al. (2019), in "Forensic study on the effect of age and illness (Parkinsonism) on handwriting characteristics" with 50 normal ages and 25 with Parkinson disease, found that old age affects the handwriting of individuals in a considerable manner with deterioration in the quality of handwriting/signatures, and in individuals with Parkinsonism have markedly writing, different altogether as compared to their corresponding normal aging writing. However, the retouching and alignments in writing were the least affected in the Parkinson's Group.

Forbes-McKay et al. (2014), in the study "Charting the decline in spontaneous writing in Alzheimer's disease" reported that minimal–moderate AD patients produced more semantic paraphasias, phonological paraphasias, and empty and indefinite phrases, whilst producing fewer pictorial themes, repairing fewer errors, and producing shorter and less complex sentences than controls.

Considering the above literature, following objectives were taken into consideration.

Objectives-

To find the writing issues in aging and disordered population.

To find the difference of writing with respect to gender if any with aging and disordered population.

Forbes-McKay et al. (2005), in the study "The age of acquisition of words produced in a semantic fluency task can reliably differentiate normal from pathological age-related cognitive decline" obtained Length, frequency, typicality and age of acquisition (AoA), values for each word generated and reported that AD patients generated fewer items, and their items were higher in frequency, shorter in length, more typical and earlier in AOA.

MATERIALS & METHODS

This present study is a part ongoing research on "Cognitive communication in aging and disordered population" for the fulfillment of Ph.D Program. The population included 3 Groups of elderly and cognitively impaired population. i.e., Group I, 60-70 years Group II,70-80 years and cognitively impaired population with controlled gender distribution. A questionnaire was used for inclusion and exclusion criteria for the selection of the population. The population selection was a purposive sample selection. Selective tests for mental status (MMSE-Mini mental status examination), cognitive-communication (BDAE-R-Boston diagnostic aphasic examination) and communication (DAP-Discourse ability profile) were used. In this present study, the scores for subtest -Writing from BDAE-R were taken into consideration due to multiple errors and common issues for all the Groups. All the subjects for this study were with their essential qualification as 12^{th} grade and functionally perform communication in American English. Prior to proceeding with the research, the selected participants had a consent signed.

Procedure:

While assessment of writing in the test of BDAE (R), all the Groups were screened out for MMSE score and for elderly Groups I and II, the inclusion criteria was 27score. Proceeding with MMSE, the selected population underwent BDAE-R short form test then the Discourse ability Profile was (DAP) done. On the sub-test BDAE-R i.e., WRITING, the clients were assessed on form, letter choice, motor facility, prime words, regular phonics, common irregular words, written picture naming and narrative writing. The scores were marked as a raw data sheet and converted into percentile form. On the test of writing a Group comparison between and within was done and gender difference was marked for the same. All the participants were tested individually in a quiet room and the test took around 40-50 minutes with two session per participant.

Statistical Analysis

Appropriate statistics version SPSS 21 was used for nonparametric analysis to identify the significance within and between Groups and for the difference in gender within and between Groups. The nonparametric tests used as the Friedman test used to find the Kruskal value. The data were compared with a P-value, less than 0.05 represented a level of significance.

RESULT

The Boston diagnostic aphasia examination III (R) short form test for administering to proficiency in communication. It was observed from the raw score that the elderly, i.e., both Group I and Group II performed better than Group III on the cognitive screening tool. Based on the scores, it was found that elderly subjects were towards the higher scale range whereas those in Group III were towards the value of scale limit, i.e., lower range.

TABLE 1: Group comparison

Components	Groups	N	Minimum	Maximum	Mean	SD	Median	Mean Rank	X^2 (2)	p-value
Form	60-70	60	14	14	14.00	0.00	14.00	96.00	134.05	0.000**
	70-80	60	8	14	13.90	0.77	14.00	94.43		
	Disorder	36	8	14	11.44	1.18	12.00	22.78		
Letter choice	60-70	60	21	21	21.00	0.00	21.00	99.50	129.15	0.000**
	70-80	60	14	21	20.80	0.94	21.00	92.44		
	Disorder	36	15	20	18.86	1.05	19.00	20.26		
Motor facility	60-70	60	14	14	14.00	0.00	14.00	95.00	128.41	0.000**
	70-80	60	13	14	13.98	0.13	14.00	93.94		
	Disorder	36	7	14	10.17	1.99	9.00	25.26		
Primer words	60-70	60	4	4	4.00	0.00	4.00	95.00	136.65	0.000**
	70-80	60	4	4	4.00	0.00	4.00	95.00		
	Disorder	36	0	4	2.50	0.77	2.00	23.50		
Regular phonics	60-70	60	2	2	2.00	0.00	2.00	95.50	142.10	0.000**
	70-80	60	2	2	2.00	0.00	2.00	95.50		
	Disorder	36	0	2	0.75	0.55	1.00	21.83		
Common irregular words	60-70	60	3	3	3.00	0.00	3.00	96.00	147.00	0.000**
	70-80	60	3	3	3.00	0.00	3.00	96.00		
	Disorder	36	0	3	1.47	0.61	1.00	20.17		
Written pic naming	60-70	60	4	4	4.00	0.00	4.00	96.50	151.85	0.000**
	70-80	60	4	4	4.00	0.00	4.00	96.50		
	Disorder	36	0	3	1.06	0.89	1.00	18.50		
Narrative writing	60-70	60	11	11	11.00	0.00	11.00	114.00	120.27	0.000**
	70-80	60	9	11	10.20	0.78	10.00	78.89		
	Disorder	36	0	9	1.53	2.57	1.00	18.68		

As mentioned in TABLE 1, Group comparison, Group I, Group II and Group III were compared and results were found to be significant for all the components with a P-value, Form-0.000, letter choice-0.000, Motor facility- 0.000, Primer words- 0.000, Regular phonics- 0.000, Common irregular words- 0.000, Written pie naming-0.000, Narrative writing- 0.000. However, results were highly significant for Letter choice and Motor facility.

Table 2: Comparison between pairs

Components	Groups	N	Minimum	Maximum	Mean	SD	Median	Mean Rank	|Z|	p-value
Form	60-70	60	14	14	14.00	0.00	14.00	61.00	1.000	0.317
	70-80	60	8	14	13.90	0.77	14.00	60.00		
	60-70	60	14	14	14.00	0.00	14.00	65.50	9.084	0.000**
	Disorder	36	8	14	11.44	1.18	12.00	20.17		
	70-80	60	8	14	13.90	0.77	14.00	64.93	8.704	0.000**
	Disorder	36	8	14	11.44	1.18	12.00	21.11		
Letter choice	60-70	60	21	21	21.00	0.00	21.00	63.50	2.502	0.012*
	70-80	60	14	21	20.80	0.94	21.00	57.50		
	60-70	60	21	21	21.00	0.00	21.00	66.50	9.434	0.000**
	Disorder	36	15	20	18.86	1.05	19.00	18.50		
	70-80	60	14	21	20.80	0.94	21.00	65.44	8.529	0.000**
	Disorder	36	15	20	18.86	1.05	19.00	20.26		
Motor facility	60-70	60	14	14	14.00	0.00	14.00	61.00	1.000	0.317
	70-80	60	13	14	13.98	0.13	14.00	60.00		
	60-70	60	14	14	14.00	0.00	14.00	64.50	8.759	0.000**
	Disorder	36	7	14	10.17	1.99	9.00	21.83		
	70-80	60	13	14	13.98	0.13	14.00	64.44	8.642	0.000**
	Disorder	36	7	14	10.17	1.99	9.00	21.93		
Primer words	60-70	60	4	4	4.00	0.00	4.00	60.50	0.000	1.000
	70-80	60	4	4	4.00	0.00	4.00	60.50		
	60-70	60	4	4	4.00	0.00	4.00	65.00	8.906	0.000**
	Disorder	36	0	4	2.50	0.77	2.00	21.00		
	70-80	60	4	4	4.00	0.00	4.00	65.00	8.906	0.000**
	Disorder	36	0	4	2.50	0.77	2.00	21.00		
Regular phonics	60-70	60	2	2	2.00	0.00	2.00	60.50	0.000	1.000
	70-80	60	2	2	2.00	0.00	2.00	60.50		
	60-70	60	2	2	2.00	0.00	2.00	65.50	9.126	0.000**
	Disorder	36	0	2	0.75	0.55	1.00	20.17		
	70-80	60	2	2	2.00	0.00	2.00	65.50	9.126	0.000**
	Disorder	36	0	2	0.75	0.55	1.00	20.17		

Table 2 To Be Continued…										
Common irregular words	60-70	60	3	3	3.00	0.00	3.00	60.50	0.000	1.000
	70-80	60	3	3	3.00	0.00	3.00	60.50		
	60-70	60	3	3	3.00	0.00	3.00	66.00	9.286	0.000**
	Disorder	36	0	3	1.47	0.61	1.00	19.33		
	70-80	60	3	3	3.00	0.00	3.00	66.00	9.286	0.000**
	Disorder	36	0	3	1.47	0.61	1.00	19.33		
Written pic naming	60-70	60	4	4	4.00	0.00	4.00	60.50	0.000	1.000
	70-80	60	4	4	4.00	0.00	4.00	60.50		
	60-70	60	4	4	4.00	0.00	4.00	66.50	9.435	0.000**
	Disorder	36	0	3	1.06	0.89	1.00	18.50		
	70-80	60	4	4	4.00	0.00	4.00	66.50	9.435	0.000**
	Disorder	36	0	3	1.06	0.89	1.00	18.50		
Narrative writing	60-70	60	11	11	11.00	0.00	11.00	78.00	6.904	0.000**
	70-80	60	9	11	10.20	0.78	10.00	43.00		
	60-70	60	11	11	11.00	0.00	11.00	66.50	9.451	0.000**
	Disorder	36	0	9	1.53	2.57	1.00	18.50		
	70-80	60	9	11	10.20	0.78	10.00	66.39	8.295	0.000**
	Disorder	36	0	9	1.53	2.57	1.00	18.68		

*** Indicates significant at P< 0.05 ** Indicates significant at P<0.01**

TABLE 2 represented Comparison between the Groups. When Group I and Group II were compared, results were not significant for any of the components. On comparing Group I and Group II with Group III respectively, results were significant for all the components with a P-value of Form-0.000, 0.000, letter choice-0.000, 0.000, Motor facility- 0.000, 0.000, Primer words-0.000, 0.000, Regular phonics- 0.000, 0.000, Common irregular words- 0.000, 0.000, Written pie naming-0.000, 0.000, Narrative writing- 0.000, 0.000 for Group I with Group III and Group II with Group III respectively.

DISCUSSION

The presence of impaired writing as compared indicates the overall inability of subjects to execute writings in a smooth manner (Smits et al. 2014). It has been observed that adjoining letters and smooth strokes at some places are dominant in Group II (Brewester 1932). This may be an indication of low of control over the holding. Despite these peculiarities found in writings of the old age persons and individuals suffering from other neurological issues demonstrated perseveration in their Writings.

In both the Groups (Group I and II) impaired writings were observed, retouching, lack of effort to join the strokes, Pen lifts have been found with respect to their counter parts i.e. Group I, who did not attempt the same (Walton 1997). Some individuals suffering from Parkinsonism have been found to write all letters separately.

In the writings of aging population, the impairment ranged from the omission of diacritic marks and letters to the level of omission of even words and they did not make an attempt to complete the letters. However, the writers in both Group I and II, presented the tendency of persistency writing features which makes better Writing in Aging than the Impaired Population

All the Groups represented reduced writing speed which ranged from a slight change in the fluency of letter formations to marked deterioration (Smits et al. 2014). Cognitively Impaired Group were found to be using their second hand to hold the properly however the alignment errors were dominant in this Group and the same was not found to be significantly affected in both the Aging Groups. An increase size of writings was observed in a few writings of Aging population. It can be inferred that size of letter can be a sign of Aging. (Aligiuri et al. 2014). Thus, it is suggested that Aging and cognitive communicative impaired population affects most of the handwriting characteristics significantly this can be taken as a vital diagnostic consideration.

CONCLUSION

This present study demonstrates the disputed handwriting involving old age persons and individuals suffering any neurological disorders. A marked depreciation in the quality of writings through aging which affects writing still, an apparent difference was observed in cognitively impaired population altogether as compared to the corresponding normal writings.

Moreover, handwriting assessment is least considered during any process of Aging and neuro pathology and it may be due to overlaid health issues. Affected writings in Aging, executed during normal health condition is also represented paucity in care and there is adequate norms or contemporaneous standard samples available for these issues. Thus, it is a prerequisite for the rehabilitation to be aware of the Writing effects and its pattern during Aging and other cognitive disorders while assessment and management. This study was conducted keeping facts of writing issues in AGING in view of differentiating the other neuro-pathological conditions. Results of this study need to utilized by all rehabilitation Group for ruling out and establish the covert features of Writing for differential diagnosis. Further it can also be utilized to assist the other professionals for document Aging and Pathology experts

As this study is a part of PhD thesis, the detail test was not aimed to asses WRITING skills, and also lacks the suggestions from a hand writing expert for detail differences. The WRITING skills were only assessed in terms of communication basis i.e. done predominantly on the basis of frequency of words used, size of letter, prime words and motor ability. Further study can be done on differentiating WRITING pertaining to cognitively impaired population with sensory and motor impairments.

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