

STUDYING THE EFFECT OF PARKINSONISM ON HANDWRITING

BY

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ABSTRACT

Handwriting is an acquired skill. It is one of the most important parameters of the personal identification. It involves muscular actions and reflexes. There must be constant coordination between the wrist and the arm muscles. Diseases of the CNS such as Parkinsonism can exhibit some interventions, which interfere with the process of writing. This work aimed at studying the effect of Parkinsonism on the handwriting via comparing the handwriting of the same person both before and after the disease from different technical points of view. The statistical results were found to be highly significant, also there was found to assume that the severer the disease, the more marked is the effect on the handwriting and the more the statistical significance. This is due to the effect of Parkinsonism on CNS, and on the musculoskeletal system involved in the process of handwriting.

INTRODUCTION

Handwriting can be described as the formation of letters, characters, or symbols, using a writing implement, according to a recognizable pattern, which is designed to communicate with another person. Writing is a form model system. The act is continuously repeating a written character fixes the form of that character in mind of the writer, normally during childhood, until this form becomes automatic (Cantu, 1996). From the moment people start learning to write, they introduce deviations from the model writing system taught. The extent of these devia-

tion increases as the writing style becomes more personalized, resulting in a style which is the product of many factors including the model system, artistic ability, muscular control, nature of employment, frequency of writing and exposure to the writings of the others. This results in an individual writing style, the development of which occurs throughout the childhood and adolescent years, and often beyond (Haber and Headrick, 1959).

Many factors can affect a person's handwriting and no one person writes so consistently that each letterform is exactly the same. However, the relative method of

construction, letter proportions, etc. remain consistent within a small range of variation even if the writing is completed on an uneven surface, at speed, or under some other stress (Ellen, 1997). More significant variations in writing style are caused by such factors as age, injuries, illness, (mental or physical) with handwriting showing a reduced speed, tremor in the form of erratic impulse movements, and there may also be misplaced or poorly joined strokes. Attempted imitation of this type of writing sometimes shows a high-frequency tremor which may not be consistent with the tremor of the genuine writer, inconsistent letter construction, or careful retouchings of strokes which exceeds the skill of the genuine writer. At times the use of medication can improve a person's handwriting for a limited period of time, and this is to be considered by a document examiner (Harrison, 1966). The only scientific method of determining whether a piece of handwriting or a signature has been written by a particular person whose handwriting may have been affected by such factors as described above, is to obtain as much comparable writing as possible, written when the factors applied. This normally means obtaining handwriting or signature specimens written as close as possible to the date of the questioned material (Siegel, 2000).

During the second half of the 20th century, the increase of the average life span

has led to "graying of the society"; some people remain relatively healthy into old age exhibiting only a general weakening and slowdown of their physical functions. Many elderly people fall prone to neurological diseases. One of these diseases is Alzheimer disease, and the effect may be seen in the individual writing as the disease progresses (Walton, 1997). On the other hand, diseases have an effect on the person's handwriting; this fact has been established since the principles of handwriting identification were first recognized. One of these diseases is Parkinson's disease which affects about 10% of the elderly population with consequent alteration of the writing ability. It should be mentioned here that few or little studies had concerning this subject especially as regards the Arabian handwritings of the diseased (Van-Vugt et al., 1996).

In document examination studies, it is mandatory to carry on the handwriting analysis to the original paper documents - and not their photocopies- as the latter cannot give an adequate idea about the indentation marks exerted by the pen pressure and which could be felt on the paper surface, also copies fail to evaluate the effects of environmental changes on papers and inks in the purposes of studying aging of documents (Morgan, 1992). Among the most important points of assessment of the handwriting are the following points:

- 1- Mean Speed of Handwriting.
- 2- Word Size.
- 3- Pen Pressure.
- 4- Inter-letter Connection and Inter-word Spacing.
- 5- Alignment.
- 6- Writing Skill Level.
- 7- Initial and terminal strokes.
- 8- Angle of Slope.
- 9- Direction of Handwriting.
- 10- Writing Errors.

(Basalah, 2001; Behrendt, 1984; Howard, 1986; Moon, 1997; Nevo, 1986; Osborn, 1964; Quirke, 1930; Ruenes, 1967).

This work aimed at evaluating and monitoring the effects of Parkinsonism on outcomes of the examination of the handwriting to demonstrate how could age and age-related neurological disorders such as Parkinsonism, affect one's handwriting.

SUBJECTS AND METHODS

In this study, 29 elderly right-handed Parkinsonism-patients were included by their handwritings, all of them were selected from the patients presenting to Kasr el Aini hospital, in the outpatient clinic. All cases were examined to exclude any other general or local disorders, which may be suspected to affect the writing process; all of them were proved to be free. Every subject was asked to present an old document having been handwritten be-

fore encountering the disease, and a part of this document (about 4-5 lines) with its exact verbal contents was asked to be written by the same person under the current circumstances, before starting therapy. In all cases, the writing position was tried to be as standardized as possible regarding the posture of the writer and his position in front of the desk. The pen used was the same in all cases to facilitate the fine changes in the handwriting features. Statistics were overtaken using SPSS program to settle the P value and consequently the statistical significance.

RESULTS

Assessment of the writing skill level in cases of Parkinsonism is displayed in tables 1&2. It consists of analyzing the writing properties from different points of comparison, showing the results of the comparative analysis of physiologic features both before and after the onset of the disease. The results of comparative analysis according to the findings demonstrated in table 1 are as follows: there was a highly significant lighter pen pressure as a result of the disease, as well as a highly significant increase in the mean speed of handwriting as an effect of the disease, also a highly significant disturbed alignment after onset of the disease in comparison to samples written before the illness. Examination of the word size revealed insignificant -yet well-noticed- decrease and

inconsistency in the word size as a result of the disease, which results in also a highly significant disturbed word shape. Also secondary of the disease the inter-word spacing became narrow, but this change was insignificant. As compared to the handwritings before the onset of the disease, all patients showed highly significant tremor; either mild, moderate, or severe. The results of noticing the angle of slanting revealed the occurrence of insignificant slanting towards the right side after the disease. On the other hand, as regards the writing errors, there were highly significant retouchings as a result of the disease as well as highly significant omissions.

DISCUSSION

In the present study, Parkinsonian patients handwriting examination revealed lighter pen pressure ($P=0.00$), and disturbed alignment ($P=0.00$). this could be explained by lack of force which could be applied to create letters with a subsequent decrease of pen pressure and increased mean speed of writing. This is because Parkinson's disease is known to result in difficulty in performing fine movements due to the tremor, where the small muscles suffer most and characteristically in opposition of the thumb and the other fingers (Mortimer et al., 1985). This was in agreement with what had been mentioned in writing changes of the diseased (Basa-

lah, 2001) and in contrast with Teulings and Stelmach (1991) who reported slower speed of handwriting of Parkinsonism patients, and also unlike what was found in the research performed by Walton (1997) who described insignificant pen pressure changes or may be heavier pen pressure and slower speed of handwritings, but Walton's study illustrated the change in handwritings over the 5 years interval. In the present study, Parkinsonian patients did not reduce their word size in general, but there was insignificant smaller and inconsistent word size. This could be explained by the accompanying dementia which could be the reason for the resulting macrographia. (Fahn et al, 1991) reported that 10 to 15% of Parkinsonism patients have a high incidence of developing dementia, and that it increases with age. Also it could be attributed to the visual deterioration (presbyopia) which may lead to increase the word size. This was in agreement with Van-Gemmert et al. (1999) who described 3 types of word size in handwriting of Parkinsonian patients, slightly larger, slightly smaller, and words of the same size. Agreed with what was mentioned in the section "writing changes of the diseased", (Basalah, 2001) described inconsistent word size in handwriting of Parkinsonism patients. In contrast to Contreras et al. (1995) who described micrographia in the writing of Parkinsonian patients, also on the contrary of what came in the research done by Hilton (1977) who

mentioned smaller word size as a result of the occurrence of Parkinsonism, but not to the extent of micrographia. The current study revealed significant irregularity of inter-word spacings ($P=0.00$), this could be attributed to the high speed of handwriting. Also significant retouchings ($P=0.00$) were found as proved as well with Basalah (2001). The inter-word spacing showed narrowing, which is explained by the difficulty in moving the writing instrument as a result of muscle rigidity, this is in accordance with Walton (1997). Concerning word shapes, they showed highly significant disturbance ($P=0.00$), and also appearance of mild, moderate, and severe regular tremor ($P=0.00$), this is explained by ranging of the severity of the disease from mild to severe. This is agreed with Basalah (2001) and disagreed with Walton (1997) who described moderate and severe or widespread tremor only within a limited scale of comparison points, but he did not depend on a comparison with their original hand writings before the onset of the disease. Moreover, he classified his Parkinsonian patients according to the date of onset of the disease and not to the severity of the disease. It is to mention also that the handwriting of Parkinsonian patients showed disturbance

of the angle of slanting with a tendency to be right-slanted, together with a significant handwriting on the opposite direction of the normal writing ($P=0.02$). This is to be attributed to the physical difficulty in moving the writing instrument in the intended direction i.e. to coincide with the handwriting pattern stored in the brain, and this was in accordance with what had been mentioned in the writing changes of the diseased (Basalah, 2001).

CONCLUSION

From this work, it is concluded that forensic document examiners should consider the effect of Parkinsonism on the handwriting while examining a document, not to be misled by the changes occurring after the onset of the Parkinsonism, especially at the beginning of its onset or in mild forms; where these changes are not very obvious, and judge the document as not written by the same person due to the fact that both documents could have been written one before and the other after having encountered the disease, and subsequently after having the CNS actions including the basic characteristics of handwriting affected.

Score ↑ Time →	Pen Pressure							Mean speed							Alignment							Word Size							Word Shape			Inter-word Spacing						
	1	2	3	4	5	p	1	2	3	4	5	p	1	2	3	4	5	p	1	2	3	4	5	p	1	2	3	4	5	p	1	2	3	4	5	p		
Before onset of the disease	0/29	5/29	9/29	17/29	0/29	0.01	1	3/29	6/29	16/29	4/29	0/29	0.00	1	15/29	12/29	0/29	2/29	0/29	0.00	1	0/29	4/29	3/20	0.21	1	1/29	28/29	0.00	1	9/29	18/29	2	3	0.62			
After the onset of the disease	0	1	16	7	5	-	1	1	0	6	18	4	-	26	3	0	0	0	-	3	10	8	8	-	18	11	11	-	9	16	4	-	-	-	-	-	-	-

(Table 1)

Score	Tremor					Angle of Slanting					Retouchings												
	1	2	3	4	P	1	2	3	P	0	1	2	3	4	5	6	7	8	9	14	25	P	
Timing																							
Before the onset of the disease	0	0	0	29	0.00	6	18	5	0.36	24	4	7	4	1	0	0	0	0	0	0	0	0	-
After the onset of the disease	4	10	15	0	-	9	6	14	-	10	4	7	4	1	2	0	0	0	1	0	0	0	-

(Table 2)

- The total number of subjects is 29
- P value is compared in all cases with the handwriting before and after the onset of Parkinsonism.
- P < or = 0.05 is significant
- P > 0.05 is insignificant
- Pen Pressure:
 - 1: very heavy
 - 2: Word Alignment
 - 3: Medium
 - 4: The whole line Alignment
 - 5: The whole lines Alignment
- Mean Speed:
 - 1: Absent or Letter Alignment
 - 2: Heavy
 - 3: Sentence Alignment
 - 4: Light
 - 5: Very light
- Retouchings: The number written on the top of Word Size:
 - 1: Left Slanting
 - 2: Vertical
 - 3: Medium
 - 4: Large
 - 5: Very rapid
- Angle of Slanting: this section is the number of retouchings
 - 1: Consistent
 - 2: Small
 - 3: Right Slanting
- Word Shape:
 - 1: Disturbed
 - 2: Undisturbed
- Tremor:
 - 1: Severe
 - 2: Moderate
 - 3: Large
 - 4: Absent
- Iner-word Spacing:
 - 1: Narrow
 - 2: Inbetween
 - 3: Absent

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دراسة تأثير مرض الشلل الرعاش على خطوط الكتابة اليدوية

المشركون في البحث

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تم فى هذه الدراسة تجميع عينات خطية عديدة لبعض المرضى الذين يعانون من مرض الشلل الرعاش، ويجمع بينهم أنهم جاءوا لمستشفى النيل الجامعى لتلقى العلاج، وقد أجريت دراسة تحليلية مقارنة لخطوط هؤلاء المرضى قبل حدوث المرض من أوراق قديمة بخطوطهم قبل حدوث المرض وبعد الإصابة عن طريق كتابة بعض الجمل المتكررة فى الأوراق القديمة ولكن بعد حدوث المرض وقبل تلقي العلاج، وقد اعتمدت الدراسة التحليلية على دراسة ضغط الأداة الكاتبة، السرعة الكتابية، حجم وشكل الحروف، الاصطفاف، المسافات البينية بين الكلمات وبين الحروف، زاوية الميل، المسحات القلمية، إجهاد الكتابة أو الارتداد، بداية ونهاية الجرات، والأخطاء الكتابية فى صورة إهمال بعض الحروف أو محاولات التصحيح، وقد أثبتت هذه الدراسة أن مرض الشلل الرعاش قد أحدث تدهوراً عصبياً واختلافات جسيمة فى الموصفات الخطية للشخص بعد حدوث المرض، وقد ظهرت هذه التغيرات فى صورة إحداث صغراً وتقلباً ملحوظاً فى حجم الكلمات مع وجود إرتعاشات ملحوظة فى اليد أثناء الكتابة ثبتت بالفحص التحليلي.

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QUESTION 1

Read the following passage and answer the questions that follow.

QUESTION 2

Read the following passage and answer the questions that follow.

The first part of the passage describes the physical appearance of the man. He is tall and thin, with a long, straight nose and a thin mustache. His eyes are a deep, dark color, and he has a serious expression on his face. The second part of the passage describes his manner of speech. He speaks in a slow, deliberate manner, with a slight accent. He is very polite and courteous, and he always uses the title 'Sir' when addressing someone. The third part of the passage describes his actions. He is a very careful and organized man, and he always has everything in its proper place. He is also a very hardworking man, and he always goes to work on time.