

HANDWRITING IN THE EARLY DETECTION OF DIS-EASE

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Abstract – The purpose of this study was to identify and establish the movements in writing samples of patients attending cardiology clinics, in support of the hypothesis that early detection of heart related problems is possible by identifying the common traits. 61 patients attending the cardiac clinics and 41 people, known to not have any form of diagnosed cardiac disease were used as subject and control group. Writing samples were taken, and a letter by letter detailed analysis carried out using an Eschenbach ELG01 reader viewed on 2 separate monitors giving magnification factors from 6x to 11x. Various writing traits were analysed including pressure on the paper, shape and malformation of the letter 'o', breaks in the letter formation and resting dots, the placing, number and on which letters they appeared. A chi-squared test showed no significant differences between the patients and the control group in the number of breaks, malformed 'o's and pressure. A t-test showed that the mean ratio of resting dots to letters in the handwriting of patients was significantly higher than in the controls. The results suggest that the handwriting of patients attending the cardiac clinic show more resting dots, particularly in the letters a, e and o.

1. Introduction

There is huge potential for medical research in handwriting, as Arie Naftali so aptly phrased in his book *Graphology and Medicine* (2000) "Every disease causes a disturbance in the functions of the systems and distortion of their basic rhythm. This is how such disturbances become apparent in handwriting, not only after the disease has set in but already in the intermediate state prior to its development." Almost every book written on handwriting analysis incorporates at least a paragraph and often chapters on clinical graphology. However, very few scientific papers seem to have been published by the authors to validate the claims, although some studies on neurological and psychological issues have been published (Jancar, J. et al, 1984; Mottis-Planet H.,1965; Broeren W.,1971; Privat S., 1965; Hojer-Pedersen W., 1950; Breil M A., 1964; Naftali A L., 1959-1978).

Assuming that whatever conditions exist within a body (psychological, physical or pathological) the brain is aware of the dysfunction and transmits it through the writing. Studies on Parkinson's Disease, Huntingdon's Disease, Alzheimers are all well documented, to a lesser degree stress, alcoholism, drug abuse have also been researched; but no recordable scientific studies have been found to show Cardiac Disease in its many forms (Beck J., 1985; Eliasberg W G et al., 1961; Contreras-Vidal JL et al., 2002; Phillips J G et al., 1994).

2. Hypotheses

Prior to data collection the hypothesis quoted four types of handwriting error:-

- Resting Dots, the placing, number and on which letters they appeared (O'Hara-Keeton M., 2000)
- Breaks in the letter formation (Eliasberg W G et al., 1961; Sainte Colombe P de., 1966).
- Shape and Malformation of the letter 'o' (Sainte Colombe P de., 1966).
- Pressure on the paper – light, medium, heavy and variable (O'Hara-Keeton M., 2000; Santoy C., 1992)

Assuming 50% of the cardiac patients present an error and 20% of the normal group do, and the ratio of normal subjects to cardiac patients (n_2/n) = 0.60, with a significant level of .05, a two sided significance test and power 80%. 61 patients would be required in the cardiac group and 37 in the normal group.

All of the above handwriting errors have historically been cited by different graphologists as means of identifying heart disease in people.

3. Participants

Handwriting samples were requested from 76 patients attending the outpatient cardiac clinics and Nuclear Medicine Department for stress testing, of which 61 were used. Reasons for non-selection of 6 of the patients included:- Educated in another country, samples written in script form, sample copied from other works, samples written on wrong paper, sample written with the wrong pen. There were a further 8 samples of writing which were put aside for later analyses. Participants were asked to state their age, gender, country of education and handedness.

The breakdown of Patient to Control Participants was 22 Male Patients with one being in his teens, the others ranged from 30's to 70's, with the highest number being in their 70's; and 13 Male Control Group Participants, with the youngest being in his 40's and the majority being in their 60's. The females numbered 39 Patient Participants with the youngest being in their 30's and the eldest in their 70's with the majority being in

their 60's; and the Control Group female participants were aged from 50's to 80's with the majority being in their 50's, 2 female control group participants did not state their age. The mean age of patients being 61 and controls being 62.

The control group was taken from a diverse range of people including:- Residential homes, Teachers, Volunteers from all sectors of society, Sheltered housing, and Business people, with all of the older control group participants coming from residential homes, and the female (50+) control group participants mainly being Adult Education teachers.

After the initial Consent was taken by the Researcher, the participants' papers were given reference numbers for confidentiality purposes and throughout the analyses it is the reference numbers which are referred to.

4. Method

Approval for the research was granted by Dorset Research Ethics Committee, and by Poole Hospital Research Governance Department.

The participants were asked to write approximately 100 words on any subject they chose, with the patient group completing the form on their laps in the waiting rooms, whilst the control group were also requested to write on their laps. Both the patient and the control groups used the same 4 pads and the same 4 pens supplied by Amersham Health.

The last 30 words (numbers were not included) of each sample of writing was selected and a letter by letter detailed analysis carried out using a Reader (ELG 01 Eschenbach Optik of America Inc), the output of which was viewed on 2 separate screens giving a magnification factor from 6x to 11x. Every mark on the script or unusual movement in the trace was noted during the on screen analysis and recorded individually on hard copy spreadsheets for each participant; further the frequency of every letter written was totalled and analysed alongside the main data.

The Cats (2) as usual were around me feet, fed them, then moved to the lounge to uncover my African Grey bird Binky, fed him, then left the house to come to the hospital.

Please continue on separate sheet if necessary

Figure 1. Example of writing taken from CD2005/09008. Man, aged 59. This particular example shows many variations in writing movements - The circles highlight Resting Dots, Breaks, Malformed and Unfinished Letters. This patient had 40 Resting Dots in total, Malformed o's and some Breaks. The pressure was heavy.

High water springs would cost less/have much lower maintenance costs and cause no traffic or boat caps. Remove the old bridge and have a ferry service for pedestrians and bikes. Why doesn't common sense prevail?

Figure 2. Example of writing taken from CD2005/09011, Male, aged 62. This patient had 56 Resting Dots, no Breaks, some Malformed o's, and Pressure was heavy. Of the 56 Resting Dots, 38 were in the Upper Middle Zone, with 9 on the letter 'a', 9 on the letter 'e' and 6 on the letter 'o'.

The information from the hardcopy spreadsheets was individually totalled and transferred to Excel spreadsheets forming an initial analysis based on every participant. Further secondary analyses were undertaken

to break the Resting Dots down into zones with the ascenders and descenders of letters being split into 3 horizontal zones, and the central section split into a further 3, thereby giving 9 separate horizontal zonal areas, this was cast onto Excel Spreadsheets on a letter by letter basis. Following extensive analysis the focus concentrated on the upper middle zone area (tops of a's, c's, e's etc).

Other notes for possible on-going research was also made on: a) Slant of the writing b) Form of Connection made in the writing stroke c) Dark patches which were found to be amalgamated Resting Dots d) Letters which were unfinished in the formation of stroke e) Black lines inside of curves f) Thinning of the stroke which is determinant as loss of Pressure and/or a motor control issue dependent on position in the letter formation g) Baseline of writing. Noted but not included in the analysis were small black specks that appeared in many letters and were thought to be an early development of Resting Dots. At no time were the patients' pathologies known to the researcher at this stage of the research project which was conducted blind.

5. Results

The chi-squared test for association was used to compare the proportion of participants with Breaks, Malformed o's and Pressure between patient and controls. The independent samples t-test was used to compare the mean ratio of Resting Dots to letters between patients and controls; since the data were normally distributed. The distribution of the ratio of Resting Dots to letters for 'a', 'e', and 'o' were skewed, these have been described using Median and Interquartile Range and compared using a Mann Whitney U-Test. The data were analysed using SPSS for Windows with a 5% significance level.

Table 1.
Data Analysis

| Trait | Patients | Control | p-value |
|---|-------------|-------------|---------------------|
| Ratio of Resting Dots Mean(SD) | 0.31 (0.14) | 0.17 (0.09) | <0.001 ^a |
| Breaks n(%) | | | =0.71 ^b |
| 0 | 18 (30%) | 15 (37%) | |
| 1 | 21 (34%) | 11 (27%) | |
| 2 | 7 (11%) | 7 (17%) | |
| 3 | 6 (10%) | 2 (5%) | |
| 4+ | 9 (15%) | 6 (15%) | |
| ^a Malformation of letter 'o' n(%) | 24 (39.3%) | 13 (31.7%) | =0.43 ^b |
| Pressure n(%) | | | =0.61 ^b |
| Light | 22 (36.1%) | 18 (43.9%) | |
| Medium | 11 (18.0%) | 9 (22.0%) | |
| Heavy | 17 (27.9%) | 7 (17.1%) | |
| Variable | 11 (18.0%) | 7 (17.1%) | |

^a T-Test ^b chi-squared test for association

The chi-squared test showed no significant differences between the patients and the control group in the number of Breaks, Malformed o's and Pressure. However the t-test showed that the mean ratio of Resting Dots to letters in the handwriting of Patients was significantly higher than in the Controls. The Mean Resting Dots ratio in patients was 0.31 (SD 0.14), and in controls was 0.17 (SD 0.09), this difference is statistically significant ($p < 0.001$), Cohen's $d = 1.2$, and led to the further breakdown of the Resting Dots.

The t-test compared the mean ratio of Resting Dots in the upper middle zone area to letters - patients 0.14 (SD 0.08), and controls 0.08 (SD 0.05) $p < 0.001$ again showing a significant difference.

Table 2.
Secondary Outcomes

| Trait | Patients | Controls | p-value ^c | z |
|--|-------------|-------------|----------------------|------|
| Ratio of Resting Dots to Letters Median (IQR) | | | | |
| Letter 'a' | 0.20 (0.25) | 0.08 (0.18) | <0.001 | 3.60 |
| Letter 'e' | 0.32 (0.32) | 0.18 (0.26) | =0.001 | 3.19 |
| Letter 'o' | 0.20 (0.30) | 0.07 (0.13) | <0.001 | 4.60 |

6. Conclusion & Discussion

This research was initially set up to investigate movements and traits in writing that had been identified by graphologists as signifying cardiac disease in its many guises. Of the patients attending the clinics some had already been diagnosed as having cardiac related disease, and were attending the clinic for assessment, follow up and staging; whilst others had been referred by their GP for chest pains, palpitations and associated disorders. In effect many of the patients are likely to have been referred on to other clinics such as Gastro-Enterology, Pulmonary function or Chest Pain Clinics for further diagnosis having had normal test results in Cardiology and/or Nuclear Medicine. Whilst the Control Group, at the time of writing, had not been diagnosed with any form of Cardiac illness, some may well have since been referred for tests. One of the participants in the Control Group has since undergone surgery for malignancy. With the Researcher being blind to the results of the tests and ailments of the Patients, the initial phase of the research project was to record the writing traits in the Patient group participants attending the Cardiac Clinics and Nuclear Medicine Department, and the Control Group participants. On completion of the first phase of data analysis it was agreed that the researcher would be given access to individual patient clinical data, which would permit a further analysis of the non-significant findings and the possible implications associated with patient medication and other illnesses.

The results confirm that there is a significant difference in Resting Dots between the Patient Group and the Control Group this is where the pen rests momentarily causing a dot on the stroke. In many instances multiple Resting Dots were observed on an individual letter, and often these had amalgamated causing a Dark Patch within the stroke. Further findings confirmed that the letters 'a', 'e' and 'o' carried significantly more Resting Dots than other letters in the Patient Group. Some replication of Multiple Resting Dots was found in a few of the Control Group participants, however at this stage it is not known if this is signs of early stages of cardiac disease, and if so at what stage. Further research is needed to turn the statistical findings into practical research by accessing the patients' results and then correlating the data against the findings; and to expand the research hypothesis to include other movements in the writing; however the significant differences in the writing do prove that patients attending the cardiac clinic have a higher number of Resting Dots in their writing than the Control Group. The result of the "Malformation of letter 'o'" is based on a positive or negative analysis, not based numerically; therefore there is a possibility that the malformed letter 'o' could still be found to be of interest if all the malformations are counted individually, or even correlated against details of particular factors in heart disease eg high cholesterol.

Additional study is also warranted to see if deeper analysis could uncover distinct handwriting movements for specific heart related issues, how and at what stage heart disease can be seen in the writing, whether it is pre physical symptoms becoming apparent and if there is a mean ratio of resting dots associated with stages of diagnosed cardiac disease. Some of these studies would in necessity become longitudinal covering at least a 20 year span.

No special arrangements were made to cater for the stress of waiting for a clinical intervention in the patient group and stress may have had an effect on the writing. The researcher was not blind to participants, however as participation was determined by the patients and not the researcher this did not have influence on the research; in effect the study was blind. In order to minimise variability in the data collection standardised pens, papers and writing surfaces were provided for each of the subjects.

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