

Correlative study between handgrasp power with handwriting speed and legibility among medical students

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Abstract

Background: Medical students must possess four skills namely reading, writing, speaking and listening as potential doctors. Writing as a skill is particularly important as it helps them to perform well academically as well as prevent drawbacks of bad handwriting later like illegible prescriptions. The deterioration of handwriting starts in medical school due to time bound subjective assessment pattern in medical schools.

Objectives: To assess if there was any association between grasp power with handwriting speed and legibility. This will help therapists deal with writing issues by improving handgrip strength which is a function of intrinsic muscles of hand. **Material and methods:** Grasp power (in Kgs), handwriting speed (Letters per minute) and handwriting legibility score (1-4) were measured for 100 (M=30, F=70) undergraduate medical students. Descriptive statistics was used to expressed quantitative variable as mean±S.D. Independent t test was used to compare mean grasp power left and right hand between male and female. Pearson correlation coefficient was used to find correlation between grasp power with letters per minute and legibility score. **Results and conclusions:** Mean Grasp power of right hand for female subjects was found to be 13.5±6.3 kgs while for males it was 33.23± 12.6 kgs. Grasp power on right and left side showed a statistically significant difference between the two genders. Handwriting speed for females was 117±9.25 letters per minute as compared to 124.13±14.46 letters per minute for males. It was observed there is positive correlation between RGP (Right hand Grip power) and HWS (Letters per minute) ($r=0.24$). There was no correlation between grasp power and handwriting legibility. The present study establishes a positive correlation between grasp power and handwriting speed. This will help in addressing calligraphic issues amongst medical students.

Keywords: Grasp power, Handwriting Speed, Legibility.

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Introduction

Handwriting of an individual depends on many factors such as anatomy of extremity, general health, mental acuity, instrument used and surface evenness. During the process, most of the movements come from the forearm while shoulder provides the power with minimum movement occurring at fingers and wrist. [1] Role of fast and legible handwriting plays a significant role in an undergraduate student's life as it helps in improving their academic performance. It will also help them in future as doctor's poor handwriting harmfully affects patients, leads to bad functioning the support staff, dispensing of improper drugs and doses, inappropriate treatment regimens. [2] Handgrip strength or grasp power is the maximum force of voluntary flexion of all fingers under normal conditions. [3] It is measure of power of intrinsic muscles of hand. Stronger handgrip strength indicates a firmer grasp or grip. Handgrip strength is affected by multiple factors such as age, gender, muscle mass, body mass index and hand dimensions [4] Previously, studies have focussed correlating grasp power and handwriting speed and legibility amongst children, but such studies are very few worldwide in adult population. [5,6] The objective of this study was to find out if there was any association between handgrasp power and handwriting speed and legibility among medical students in India as there is paucity of knowledge in this area. This which will help therapists to address writing issues followed by weak musculature of hand.

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Improving handwriting speed and legibility by strengthening power of handgrip among medical students will be helpful in improving their academic performance. In addition, as doctors it will be beneficial in avoiding side effects of bad handwriting in the future.

Material and methods

Subject: The study was conducted in Heritage Institute of Medical sciences, Varanasi. 100 undergraduate medical students in age group 18-22 years (M= 30, F= 70) were recruited for the study. After obtaining institutional ethical clearance informed consent was taken from all participants.

Study design: Cross sectional observational type of study.

Inclusion criteria: First year medical students in age group of 18-22.

Exclusion criteria: Subjects having acute trauma or wrist pain were excluded from the study.

Measurement of grasp power: Hand grip dynamometer, ranging from 0-120 kg, was used for the measurement of handgrip strength. Subjects were made to stand in right posture in front of the investigator with shoulders abducted, elbow rotated to 90° and the wrist and forearm kept in neutral. A single dynamometer was used throughout the study. The observation was taken in triplicate and average grasp power was utilised for the study. For handwriting Speed Test (HST), standardized instructions were provided. Subjects were asked to write the sentence 'The quick brown fox jumps over the lazy dog' as 'quickly' and as 'neatly' as they could for a 3-minute period, they were then asked to put down their pencils/pens. Following a short break of about 30 seconds, further instructions were given, requesting them to skip two lines and commence writing the sentence again. The second period lasted for 9 minutes. This meant the subjects would be writing for 12 minutes in total. [7]

Assessment of handwriting legibility: The following legibility score table was used to assess legibility. [8]

1: Illegible (most or all words were unidentifiable)

2: Most words were illegible; meaning of sentence was not clear
 3: Some words were illegible but meaning of sentence was understood.
 4: Legible (all words were clear)

Statistical analysis: Data was tabulated using excel sheet.Descriptive statistics was used to calculate the mean and standard deviation

RESULTS AND OBSERVATION

Table 1: Comparison of variables RGP=Right grasp power, LGP=Left grasp power and HWS=Letters per minute between two genders. S=Significant, NS=Not significant

Variable	Gender	n	Mean	Median	Range	p-value
RGP (Kgs)	F	70	13.50±6.3	14	0-30	<0.001(S)
	M	30	33.23±12.6	34	9-58	
LGP (Kgs)	F	70	12.43±6.93	13	0-30	<0.001(S)
	M	30	34.73±11.01	34	19-56	
HWS (Lpm)	F	70	117.00±9.25	114	96-137	0.004(NS)
	M	30	124.13±14.46	120	99-150	

. S=Significant, NS=Not significant

Mean Grasp power of right hand for female subjects was found to be 13.5±6.3 kgs while for males it was 33.23± 12.6 kgs .When grasp power of male and female subjects on right side were compared there was a statistically significant difference which was found between two genders.(p<0.001)(Table 1) (Figure 2)

Mean grasp power of left hand for female subjects was 12.43±6.9 while for males it was 34.73±11.01 . Like the right hand a statistically significant difference in left hand grip strength was found between the two genders.(p<0.001).Mean grasp power for right and left hands for all subjects was 19.52±12.5 and 19.12±13.1Kgs respectively.(Table 1, Figure 2)

Handwriting speed for females was 117±9.25 letters per minute as compared to 124.13±14.46 letters per minute for males.When handwriting speed was compared between two genders , no statistically significant difference was found .(Table 1)

Pearson correlation coefficient was used to find the correlation ofhandwriting speed (LPM) and right hand grasp power (Kgs).Correlation was assessed with right hand grasp power since all our subjects wrote with their right hand. It was observed there is positive correlation between RGP(Right Grasp power) and HWS(Handwriting speed)(r=0.24) which means when grasp power increases on right side, handwriting speed also increases. Handgrip strength of right hand does not show any statistically significant correlation(p=0.012) with handwriting speed, however it shows a good trend towards positive direction as indicated by a positive correlation coefficient.(Figure 1)

Table 2: Comparison between Right hand grasp power (RGP) and Handwriting speed(HWS) with legibility.S=Significant, NS=Not significant. P<0.05 set as significant

Variable	Illegible(n=0)	Moderately Legible(n=60)	Legible(n=40)	p-value
RGP(Kgs)	0	23.25±15.05	16.82±9.86	0.0805(NS)
HWS(Lpm)	0	121.32±13.46	117.68±9.75	0.1206(NS)

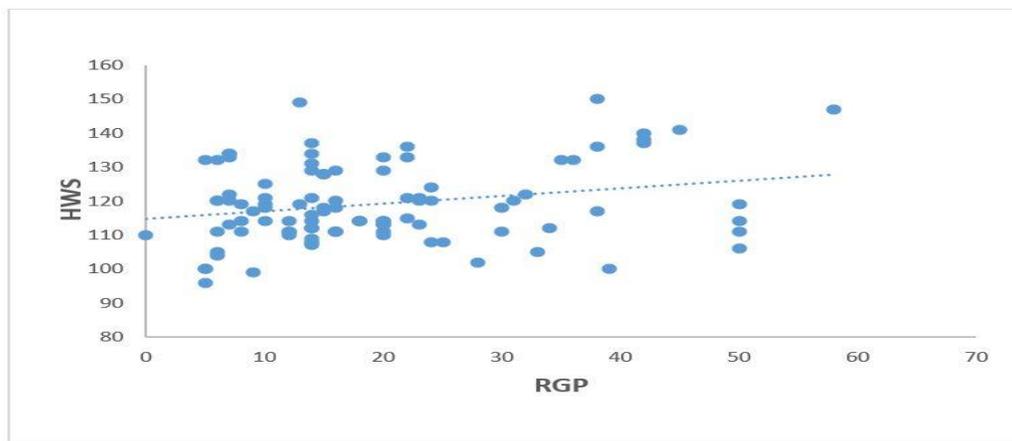


Fig 1: Pearson correlation coefficient showing positive correlation between RGP=Right grasp power and HWS=Handwriting speed.(r=0.24). p=0.012 indicates statistically insignificant difference.



Fig 2:Plot showing comparison between R=Right hand grasp power, L=Left hand grasp power, LPM=Letters per minute between male and female subjects

Illegible handwriting group consisted of subjects who had legibility score of 1 meaning all words were illegible, no subjects were found in this category. Moderately legible group had subjects with legibility score 2 and 3 combined, meaning some or most words were illegible, 40 subjects were found in this category. Legible group consisted of 60 subjects. (Table 2)

Mean right grasp power of subjects in moderately legible was 23.25 ± 15.05 Kgs and those in group 3 was 16.82 ± 9.86 Kgs. When right hand grasp power was compared between these two groups, no statistical significant difference was found ($p=0.0805$). (Table 2)

Discussion

Handwriting speed is a composite process which needs synergism between nervous and musculoskeletal systems.[9] Ability to talk, write, read and listen are four attributes every medical student must possess as potential doctors. Writing in an effective manner helps in delivering scientific views and important clinical information.[10] Handwriting issues has always been a topic of concern in medical fraternity. The beginning of deterioration starts mostly from medical school where the pressure of finishing tasks and answers within a limited period leads to compromised handwriting skills. This negatively impacts their academic performance. In addition, this might prove detrimental in future while they execute their medical practice and write prescriptions or instructions for patient treatment. Handgrip strength is a function of intrinsic muscles primarily interossei and thenar muscles, partially contributed by lumbricals.[11] This study was an attempt to find if there was any association between handgrip strength (grasp power) with handwriting speed and legibility. This will help medical students in giving better academic performance during undergraduate years, also prevent the pitfalls for budding doctors due to handwriting issues in future.

This study shows better grasp power for males as compared to females in both hands. This finding is in agreement with other researchers.[12,13]

No correlation was found between handwriting legibility and grip strength in the present study. Our findings are dissimilar to findings

of another study where grip strength correlated with legibility in normal children but not in the autism spectrum group.[14]

The present study showed that there was positive correlation between grasp power and handwriting speed. However, no satisfactory correlation could be found with legibility. A similar finding was reported by Taiyab et al who showed a positive correlation between handgrip strength and handwriting speed. The results of this study is similar to another study conducted by Dana and Valey et al on 300 subjects which also showed a positive correlation between handgrip strength and speed.[15]

Conclusion

This study affirms that improving the handgrip strength will improve the handwriting speed. However, as far as legibility of handwriting is concerned, no correlation was found. Improving the handwriting by strengthening exercises of intrinsic muscles will improve handgrip strength thus improving writing speed. The findings of this study will help devise methods to improve performance of undergraduate medical student since there is a positive correlation between handgrip strength and speed.

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