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Original Article

Effect of Hand Grip Strength and Endurance on Writing Speed Among Students of DPT in AMNC

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ABSTRACT

Hand grip strength is a measure and indicator of general strength of upper limb as well as general body strength. The grip strength varies in different populations and regions due to difference in genetic makeup, nutritional habits, body type and level of activity. ADLs of upper limb depend on strength and endurance of hand as greater the strength and endurance greater the performance. **Objectives:** To find the effect of handgrip strength and endurance on handwriting speed. **Methods:** Associational study included 113 healthy young adult students. Convenience sampling technique was used. Dynamometer was used to measure the hand grip strength and endurance in a standardized manner. Letters per Minute test was used to assess the handwriting speed. Dynamometer is an instrument with excellent validity, consistency and reliability. **Results:** The hand grip strength and writing speed was moderately correlated as (r 0.559) and the hand endurance and writing speed was moderately correlated as (r 0.57). **Conclusions:** We concluded that hand grip strength and hand endurance have positive moderate effect on writing speed. Exercises that increase hand strength and endurance can increase the writing speed and ultimately academic performance of students.

INTRODUCTION

Handwriting is a well-designed activity that requires the synchronization of a number of person's skills. On the other hand, it is a complex skill. Handwriting depends on the development and integration of Visual Perceptual, cognitive and fine motor system ability. Smooth writing is created by combined and synchronized movements of individual for sensory motor feedback and visual monitoring simultaneously [1]. In everyone's daily life, ADLs upper limbs play an important role to perform task effectively. There are some important sensory motor parameters that include grip strength and endurance which are essential for their satisfactory actions. In clinical practice practitioner assume the strength of grip as a sign of many diseases which can lead patient toward disability [2]. The wrist is a sophisticated biological structure with 27 bones, 15 joints, and around 30° of freedom in rotation and translation. It is used to grasp and exert force on objects of all sizes and shapes as well as to carry out a variety of complicated, highly coordinated actions [3]. Grip strength is being used worldwide due to portability and practicality

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of the dynamometer [4]. Grip strength is evaluated as a module of hand function (American Society of Hand Therapists), hand grip strength just not only used to demonstrate the importance of the hand but also to signify as entire upper extremity strength. ASHT has suggested the grip strength to be measured by using the Jamar dynamometer [5]. Since handwriting speed and the capacity to communicate knowledge are closely related, both have a significant impact in academic performance [6]. Grip strength of hand shows overall muscle strength that is measured by using a hand dynamometer. To measure the grip strength and endurance, dynamometer is declared as a gold standard test. Both strength and endurance of the hand was checked in students by using the hand dynamometer and writing speed assessment. Grip strength basically tests the isometric contraction of the hand. Additionally, it was discovered that there are variances based on gender, with males having stronger dominant hand grips [7]. Writing speed is calculated by using the number of letters written with in one minute [8]. Letters per minute test (LPM) is being used instead of words per minute test (WPM) because of the high unpredictability of words. For the training purpose of working adults and amputees this test is very useful for the vocational evaluators and as well as hand therapists. It is also very useful for assessing a patient's ability to return to specific work situations that require written communication [9]. Many professional and job related responsibilities requires handling of tools, equipment and fine movements of hands. Avery simple instance is the inability of older persons to open food jars due to diminish strength of grip. The overall performance of upper extremity functions and ability to perform specific tasks is due to weak grip strength [10]. The Jamar is very reliable and also valid for measuring hand grip strength. Its reliability is (ICC [3, 1] = 0.98) and its validity is (ICC (2, K) = 0.99) [11]. The writing speed is evaluated through letters per minute test. According to Dave Bledsoe. for an adult population (age ranges 18-64) the average speed of copying letters is 68 in a minute, with range from a minimum letters of 26 to maximum letters of 113 in a minute [12]. Another study recommend the task based training procedure that can advance the performance and reduce handwriting difficulties in children. The results of this research show that the comprehensive and competence of motor skill improve handwriting in children [13]. The study considered inspecting the handgrip endurance and strength which is considered a significant tool for the measurement the status of nutrition and as an indicator of the muscle quality in underweight individuals with overweight individuals. They discover that the overweight and underweight subjects had a lower grip endurance and strengths compare to the normal weight group in males, but not in females [14]. The values of handgrip strength in subjects of normal healthy adult using a hand Dynamometer. They find that the normal suggested values of strength handgrip should be recognized and graded according to gender or age. Variation in height does not require changes to be made in order to get and illustrate the average scores for handwriting speed in healthy persons [15]. They recommended that norms of the handwriting speed should be reorganized regularly. The obtained findings will update the therapists about the cause that affect the adult's handwriting speed [16]. Dynamometers to conclude their co-existing reliability and validity for assessing the strength of hand grip in clinical settings. They discovered that there is no major difference between dynamometers' validity and reliability [17]. Because no studies have been conducted to determine the impact of hand grip strength and endurance on handwriting speed, this study is distinctive in that regard. This study will raise students' understanding of how improving hand grip strength and endurance can increase handwriting speed, enabling them to effectively manage their time and writing speed throughout tests.

METHODS

The study type is associational study and the study data collection center was Azra Naheed Medical College (ANMC) Lahore. This research was completed in three months and convenience sampling technique was used. A Sample of 113 Students of DPT was taken from total population of 600 DPT students in ANMC. Inclusion criteria: Students of DPT in ANMC who were willing to participate in this study, both male and female students were included. Exclusion criteria: Students with fracture or any deformity of upper extremity, any skin lesion or pathology in dominant hand. With permission of HOD and Supervisor researcher gave consent form to students and conducted data. After teaching the whole procedure the researcher first task was to measure maximal grip strength in three trails. The subject was asked to squeeze the dynamometer and the readings of three maximal contractions were noted down in three trials e.g. T1, T2, and T3 with a rest period of 5 seconds between each trial to prevent muscle fatigue. For each subject the dynamometer was reset to zero before the reading of next grip strength. The second task was of muscle endurance (sustained grip strength). This task consisted of a sustained maximal isometric contraction over a period of 10 seconds. After every 10th second the reading for endurance in kilograms was noted down. Using the stop watch, the task was initiated on a start signal and end on a stop signal given by the researcher. For writing speed measurement, Letters per Minute Test (LPM) was used. A paper with a paragraph of 57 words printed on it was

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provided to each subject. The subjects were verbally instructed to write down their names on the paper and go through the short paragraph. After the subjects understood the procedure and were ready for the test they were asked to copy the paragraph of 57 words in 1 minute. After one minute, the papers were collected and the number of letters written in one minute by each subject were counted and noted down. The writing speed was calculated as the number of letter. Dynamometer was used for assessment of both Strength and Endurance of hand [5, 7]. Letter per minute test was used to assess the writing speed [8]. Study conducted after an informed consent was signed. The subject was fully informed about the research and the reason for conducting it. The confidentiality of the subject was ensured and not shared with any outside source for public display. Subject was free to withdraw at any stage. Collected data were entered in SPSS version 16.0 and analyzed through correlation test. Result revealed that the hand strength and writing speed was moderately correlated as (r 0.559). The hand endurance and wiring speed was moderately correlated as (r 0.57). Statically results approved the alternative hypothesis.

RESULTS

Table 1 shows the descriptive characteristics n=113 of the study participants. The gender distribution was out of 113 students, 59 were male while 54 were females. The mean values for the age was 26 ± 21.70. All 113 study participants were right hand dominant.

Gender	113 (59 M/54 F)
Age	26 ±21.70
Hand Dominance	113 (RHD)

M= Male, F= Female, R=Right Hand Dominant

Table 1: Descriptive statistical analysis (N=113)

Table 2 represents the relationship between hand strength and endurance. The mean score of hand strength was score as 34.16 ± 26.24 and mean score of hand endurance was 34.74 ± 24.48. The (r) of 0.95 is showing strong positive correlation between hand power and hand endurance.

Variables	Mean ± SD	Pearson correlation coefficient®
Hand Strength (Dynamometer)	34.16 ± 26.244	0.95
Hand Endurance (Dynamometer)	34.74 ± 24.486	

Table 2: Relationship b/w Hand strength & Endurance

Table 3 depicts the effect of hand strength on writing speed. The mean value of hand strength score was 34.16 ± 26.244 and mean score of wiring speed was 100.12 ± 28.589. The (r) of 0.559 is showing effective relationship between hand power and writing speed.

Variables	Mean ± SD	Pearson correlation coefficient®
Hand Strength (Dynamometer)	34.16 ± 26.244	0.559
Writing Speed (Letters per minute)	100.12 ± 28.589	

Table 3: Effect of hand grip strength on writing speed

Table 4 shows the effect of hand endurance on writing speed. The mean score of hand endurance was 34.74 ± 24.48 and mean score of wiring speed was 100.12 ± 28.589. The (r) of 0.57 is showing moderate positive correlation between hand power and writing speed.

Variables	Mean ± SD	Pearson correlation coefficient®
Hand Endurance (Dynamometer)	34.74 ± 24.486	0.570
Writing Speed (Letters per minute)	100.12 ± 28.589	

Table 4: Effect of hand endurance on writing speed

DISCUSSION

The relation of hand grip strength and endurance on handwriting speed was evaluated in this study. To determine the relation between 3 parameters a standardized tool, Dynamometer was used for the measurement of strength and endurance. For the assessment of hand writing speed, Letters per minute Test was used. The report of this study showed the high correlation of strength and endurance (r 0.95), and moderate positive correlation of handwriting speed and strength (r 0.559) and moderate positive correlation of handwriting and endurance (r 0.570). Forceful contraction of muscles required for picking and pulling of object but sustain isometric contraction required for holding any object as in writing both strength and endurance required for movement of pen and holding pen vertically so both characteristics of muscle of hand strength and endurance required for better efficacy and speed of handwriting. As shown in result that strength and endurance are highly correlated so weakness in one of these characteristic will affect the performance of second. A study conducted in 2011 by Bledsoe et al., on hand writing speed in an adult population included 300 individuals. Letters per minute test was selected to assess the handwriting speed. He concluded that the Letters per minute test was very useful for the hand therapists to establish the handwriting speed among young adults by improving their hand grip strength. In the present study, the maximal strength and endurance of the right hand showed a positive relation on handwriting speed which is similar to above mentioned study [12]. According to Massy-Westroop et al., hand grip strength can be calculated by measuring the amount of static force that the hand can squeeze around a dynamometer. Hand grip strength is a reliable measurement when standardized methods and adjusted equipment are used, even when there are different assessors or different brands of dynamometers. The Published normative data for hand

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grip strength are available from many countries, and in most cases, data are divided into age and gender subgroups. Analysis of grip strength by gender shows higher grip by males and lower grip by females at all ages. This trend is always present even though some studies divide participants by age, gender, and then by right and left hand, while a small number of studies divide participants by age gender and then dominant and non-dominant hand. These trends can be seen in the current study also. Thus going through all the literatures that showed a positive relation between strength, endurance and writing speed students can improve their academic performance through exercises that increase hand strength and endurance can increase their writing speed [18]. Padmavathi et al., reported a study based on gender difference in muscle strength and endurance on young adults and shows positive relation between strength and endurance. The results of the study showed that males had close to twice the hand grip strength of females in absolute terms ($P < 0.01$). In contrast, the rate of decline of muscle strength during sustained isometric contraction was lower in females as compared to males ($P < 0.05$), suggestive of greater muscle endurance in females. Our study shows similar results as above mention study that there is a positive relation between these two variables (hand strength and endurance) but the only difference is our study is not based on gender difference [19]. In the medical context, handgrip strength (HGS) is frequently employed as a bedside test of muscular function. The purpose of this study was to determine the relationship between HGS, endurance, and work (force during endurance 3 times), as determined by mobility and physical activity (PA), and physical function in young, healthy volunteers. Additionally, the connections between HGS, mobility, PA, and patient quality of life (QoL) were looked at. A total of 45 patients (56 percent men, mean age 55 y) and 92 healthy volunteers (45 percent men, mean age 30 y) had their mobility (timed up-and-go test) and PA examined (Baecke questionnaire or Bouchard activity diary) [20].

CONCLUSIONS

This study concludes that hand grip strength and hand endurance had positive moderate effect on writing speed. It was found that majority of the students were unaware about the fact that if they had a better hand grip strength and endurance, their writing speed can be greatly influenced. Exercises that increases hand strength and endurance can increase the writing speed and ultimately academic performance of students.

REFERENCES

[1] Tseng MH and Chow SM. Perceptual-motor function of school-age children with slow handwriting speed. The American Journal of Occupational Therapy. 2000 Feb; 54(1):83-8. doi: 10.5014/ajot.54.1.83

[2] Desrosiers J, Bravo G, Hébert R, Dutil E. Normative data for grip strength of elderly men and women. The American Journal of Occupational Therapy. 1995 Aug; 49(7):637-44. doi: 10.5014/ajot.49.7.637

[3] Cronin J, Lawton T, Harris N, Kilding A, McMaster DT. A Brief Review of Handgrip Strength and Sport Performance. The Journal of Strength and Conditioning Research. 2017 Nov; 31(11):3187-3217. doi: 10.1519/JSC.0000000000002149

[4] Bohannon RW. Adequacy of simple measures for characterizing impairment in upper limb strength following stroke. Perceptual and Motor Skills. 2004 Dec; 99(3 Pt 1):813-7. doi: 10.2466/pms.99.3.813-817

[5] Bohannon RW, Peolsson A, Massy-Westropp N, Desrosiers J, Bear-Lehman J. Reference values for adult grip strength measured with a Jamar dynamometer: a descriptive meta-analysis. Physiotherapy. 2006 Mar; 92(1):11-5. doi: 10.1016/j.physio.2005.05.003

[6] Gokulakrishnan J and Franklin J. A Study on Upper Limb Strengthening Exercises on Hand Writing Speed for Undergraduates. Journal of Physiotherapy Research.2020;4(3):3.doi:10.36648/physiotherapy.4.3.3

[7] Shechtman O, Davenport R, Malcolm M, Nabavi D. Reliability and validity of the BTE-Primus grip tool. Journal of Hand Therapy. 2003 Mar; 16(1):36-42. doi: 10.1016/s0894-1130(03)80022-4

[8] Connelly V, Dockrell JE, Barnett J. The slow handwriting of undergraduate students constrains overall performance in exam essays. Educational Psychology.2005Feb;25(1):99107.doi:10.1080/01443410420000294912

[9] van Drempt N, McCluskey A, Lannin NA. A review of factors that influence adult handwriting performance. Australian Occupational Therapy Journal. 2011 Oct; 58(5):321-8. doi: 10.1111/j.1440-1630.2011.00960.x

[10] Tyler H, Adams J, Ellis B. What can handgrip strength tell the therapist about hand function?. The British Journal of Hand Therapy. 2005 Mar; 10(1):4-9. doi: 10.1177/175899830501000101

[11] Bellace JV, Healy D, Besser MP, Byron T, Hohman L. Validity of the Dexter Evaluation System's Jamar dynamometer attachment for assessment of hand grip strength in a normal population. Journal of Hand Therapy. 2000 Mar; 13(1):46-51. doi: 10.1016/s0894-1130(00)80052-6

[12] Bledsoe Jr D. Handwriting speed in an adult population. Advance for Occupational Therapy

DOI: https://doi.org/10.54393/pbmj.v5i8.718

Practitioners. 2011; 27(22):10.
[13] Baldi S, Nunzi M, Brina CD. Efficacy of a task-based training approach in the rehabilitation of three children with poor handwriting quality: a pilot study. Perceptual and Motor Skills. 2015 Feb; 120(1):323-35. doi: 10.2466/10.15.PMS.120v15x5
[14] Lad UP, Satyanarayana P, Shisode-Lad S, Siri ChC, Kumari NR. A Study on the Correlation Between the Body Mass Index (BMI), the Body Fat Percentage, the Handgrip Strength and the Handgrip Endurance in Underweight, Normal Weight and Overweight Adolescents. Journal of Clinical and Diagnostic Research.2013Jan;7(1):514.doi:10.7860/JCDR/2012/5026.2668
[15] Luna-Heredia E, Martín-Peña G, Ruiz-Galiana J. Handgrip dynamometry in healthy adults. Clinical Nutrition. 2005 Apr; 24(2):250-8. doi: 10.1016/j. clnu. 2004.10.007
[16] Burger DK and McCluskey A. Australian norms for handwriting speed in healthy adults aged 60-99 years. Australian Occupational Therapy Journal. 2011 Oct; 58(5):355-63. doi: 10.1111/j.1440-1630. 2011.00955.x
[17] Mathiowetz V. Comparison of Rolyan and Jamar dynamometers for measuring grip strength. Occupational Therapy International. 2002; 9(3):201-9. doi: 10.1002/oti.165
[18] Massy-Westropp NM, Gill TK, Taylor AW, Bohannon RW, Hill CL. Hand Grip Strength: age and gender stratified normative data in a population-based study. BMC Research Notes. 2011 Apr; 4:127. doi: 10.1186/1756-0500-4-127
[19] Padmavathi R, Bharathi AV, Vaz M. Gender differences in muscle strength & endurance in young Indian adults. Indian Journal of Medical Research. 1999 May; 109:188-94
[20] Jakobsen LH, Rask IK, Kondrup J. Validation of handgrip strength and endurance as a measure of physical function and quality of life in healthy subjects and patients. Nutrition. 2010 May; 26(5):542-50. doi: 10.1016/j.nut.2009.06.015