

EFFECT OF FOREARM, HAND AND WRIST EXERCISES ON WRITING SPEED IN HEALTH SCIENCE STUDENTS OF NAGPUR

EFFECTUL EXERCIȚIILOR ANTEBRAȚULUI, PUMNULUI ȘI MĂINII ASUPRA VITEZEI DE SCRIS, LA STUDENȚII SĂNĂTOȘI DIN NAGPUR

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Key words: Pinch grip, handwriting speed, co-ordination, hand and wrist exercises, words per minute (wpm)

Cuvinte cheie: pensa bidigitală, viteza de scris, exerciții pentru mână și pumn, cuvinte pe minut

Abstract.

Background. Human beings are the most advanced living beings, and hence perform skilful activities. Handwriting is one of the skills required in medical education. **Aim.** To assess the effectiveness of forearm, hand and wrist on handwriting speed. **Materials and method.** Interventional pre-test and post-test design was carried out on 100 health science students, and handwriting speed, pinch grip strength and co-ordination was assessed pre and post exercise intervention, initially and after 4 weeks of structured exercise programme. **Result.** There was 2.91 % improvement in handwriting speed ($p=0.044$), 5.08 % improvement in pinch grip strength ($p=0.00$), and 8.45 % improvement in co-ordination test ($p=0.00$). The co relational study post-test handwriting vs. co-ordination 2-tailed was statistically significant (0.403). **Conclusion** 4 weeks of forearm, wrist and hand exercises improve handwriting speed.

Rezumat. Oamenii sunt cele mai avansate ființe în viață, reușind să execute activități complexe. Scrisul este una dintre abilitățile necesare în educația medicală. **Scop.** Lucrarea își propune să evalueze eficiența antebrațului, pumnului și mâinii în creșterea vitezei scrisului. **Material și metodă.** Studiul pre test - post test s-a realizat pe un număr de 100 studenți sănătoși. Viteza scrisului, forța pensei bidigitale și coordonarea au fost evaluate înainte și după efectuarea programului de exerciții de 4 săptămâni. **Rezultate.** S-a constatat o îmbunătățire de 2.91% în viteza scrisului ($p=0.044$), 5.08 % creștere de forță a pensei bidigitale ($p=0.00$), și 8.45 % îmbunătățirea coordonării ($p=0.00$). Studiul corelațional post-test pentru scris vs. coordonare 2-tailed a fost semnificativ statistic (0.403). **Concluzii.** Patru săptămâni de exerciții pentru mușchii antebrațului, ai pumnului și mâinii îmbunătățesc viteza scrisului.

Introduction

Human beings are the most advanced of all the living beings and therefore they are designed to perform more skillful activities because of a developed hand and one such skill is writing. Writing, the most unique feature continues to be an essential skill in daily life and it is not only helpful in communication but also helps in improving the knowledge and also creativity and hence forms an essential tool in education. So even in medical education writing continues to be a part of learning as well as evaluation.

Handwriting is a complex activity and hence requires blending of various components such as cognitive, kinesthetic, perceptual and motor components and all these components have to be fully functional in order to write effectively [1]. If any of these components is missing then

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writing is affected. Handwriting is influenced by factors such as anatomy of extremity, general health, writing surface and instrument [2].

Therefore hand writing is a skill and this skill has an impact on academic performance and in course of time this would impact learning abilities which may further have an impact on the competencies of student perceiving health science education. Not all age group can write with same speed, hence it is an age variant factor.

It is observed that normal range of writing is between 10 -20 wpm in 15 year old individual. Average rate of writing for girls is 14.7 wpm and for boys is 13.8 wpm [3]. It is also noticed that if no. of words written are between 5-8 wpm then it is labeled as handicapped in writing. Study on group of Australian school children showed writing speed to be 33,34, 38, 46 and 52 wpm for students of grade 3,4,5,6 and 7 respectively[4].

Methods

Interventional pre test- post test design was carried out at VSPM's college of physiotherapy during 23rd august 2012 – 20th January 2013.

The independent variables were exercises for forearm, hand and wrist muscle the dependent variables were handwriting speed, pinch grip strength and co- ordination.

Health science students of NKP salve medical institute and VSPM's college of physiotherapy within age group 20-27 years formed the sample for the study. Random sampling was employed. The size of the sample was calculated by the handwriting speed from the previous study by the formula $n=4(SD)^2 / L^2$ and was found to be 100 therefore 100 subjects were studied.

Inclusion criteria: Age group: 20 - 27 years, both genders, willing to participate, subjects writing 15 words or > /min, medical & paramedical students, ability to complete all 3 tasks, medically fit.

Exclusion criteria: Congenital structural impairment of upper limb, congenital functional impairment of upper limb, acquired structural impairment of upper limb, acquired functional impairment of upper limb, absenteeism on initial and final day of assessment, irregularities in attending the exercise program.

Materials for study:

The materials used for the study were Dumbbell, soft ball, finger table exerciser, hand grip resistance trainer, peg board, pinch grip dynamometer, head phones, laptop& stopwatch.

Exercise intervention

The exercise intervention was carried out for 3 components namely strength, co ordination and endurance exercises which was structured exercise program and for strengthening

Type of intervention: exercise program

Nature of program: structured

Type of exercise: strengthening

Muscles exercised were: Biceps brachii, Flexor carpi ulnaris, Brachioradialis, Flexor carpi radialis, Flexor pollicis brevis, Interossei, Extensor carpi ulnaris, Extensor radialis longus, Flexor digitorum superficialis, Flexor pollicis longus.

2. Coordination training:

Type of intervention: exercise program

Nature of program: structured

Type of exercise: co-ordination

Duration:

Number of sessions: 1 session per day

Number of days: 5 days per week

Number of weeks: 4 weeks

Mode of exercise:

Clapping and reciprocal movements to finger

Number of repetitions: 10 repetitions per exercise

3. Endurance training

Intervention:

Type of intervention: exercise program

Nature of program: structured

Type of exercise: endurance

Duration:

Number of sessions: 1 session per day

Number of days: 5 days per week

Number of weeks: 4 weeks

Mode of exercise: Praying exercise and straight finger flexion

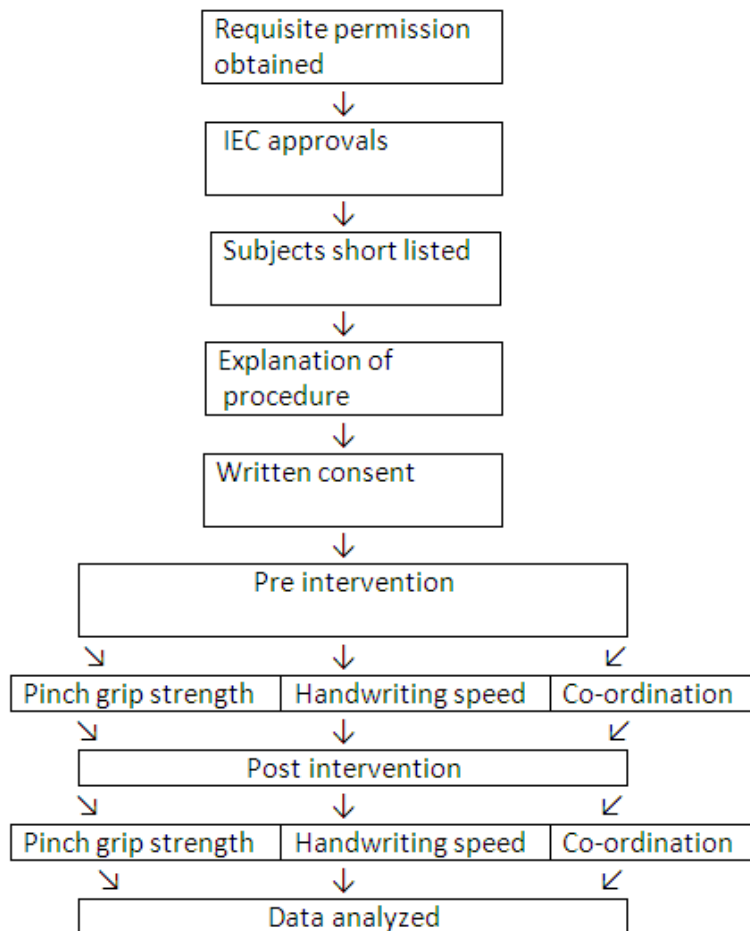
Number of repetitions: 10 repetitions per exercise.

Measures

The measures were writing speed (words/minute), Co-ordination (no. of pegs/ 15 seconds), grip strength (kg) and were calibrated initially on day 1 of pre test and post test after 4 weeks.

GENERAL PROCEDURE

The procedure for the study is as depicted in the flow chart below:



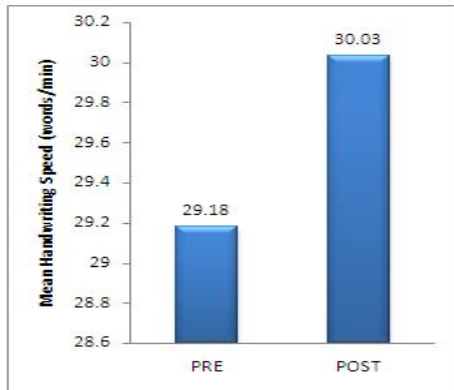
Results

The collected raw data was then spread in the Microsoft excel sheet 2007 and the data was later analyzed by using means, standard deviation and percentages with SPSS package, version 20.0 with paired t test and Pearson's correlation test and the level of significance was fixed at $p < 0.05$. The components analyzed were handwriting speed, strength of pinch grip and co ordination.

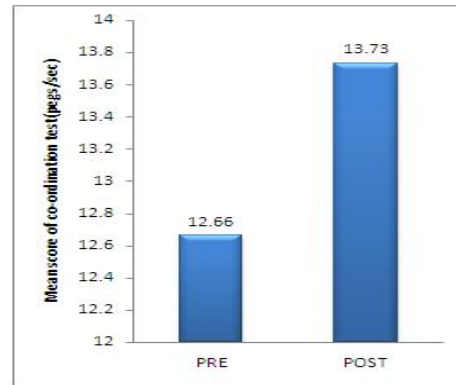
Table: 4 % improvement of parameters

Sr. no	Parameters	Pre test	Post test	%improvement
1	Writing speed	29.18	30.03	2.91%
2	Pinch grip strength	6.528	6.860	5.08%
3	Co ordination	12.66	13.73	8.45%

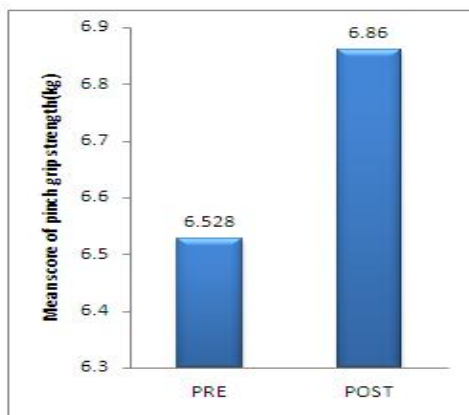
Study group showed 2.91% improvement in handwriting speed, 5.08 % in pinch grip strength and 8.45 % in co- ordination test.



Graph 1 Hand writing speed



Graph 2 co-ordination



Graph 3 pinch grip

Discussion

The speed of writing is the most important component even in health science institute.

Therefore this study was undertaken to estimate the writing speed for a period of 1 min and later these individuals were prescribed with exercises for a period of 4 weeks. 7 exercises were performed during the course of the study according to the protocol. The exercises were user friendly and it was a supervised program and hence no exercise related complications were found. The handwriting was legible and was contrary to the myth that health care professional have illegible handwriting. It was also observed that there were excessive use of abbreviations and incomplete sentences were prominent but these issues were not studied because it was beyond the scope of study.

From the results it was clear that there was improvement in all 3 parameters (handwriting speed by 2.91%, pinch grip strength by 5.08% and co- ordination by 8.45%) When the

improvements in parameters of current study were compared with shoemaker et al [6] study it was comparatively less in handwriting speed(11.8%) whereas Nilukshika KVK, Nanayakkarawasam PP, Wickramasinghe VP found 21.1% improvement, pinch grip strength comparison with Roger et al[5] had lower values (3.6% right, 2.9% left) whereas co-ordination improvement was higher in earlier studies [1](24.07%).The study confirms that exercises does impact the improvement in speed of writing and is also able to observe the lacunae of writing and can also provide motivation to individuals who tend to write slow. The exercise period was 4 week duration and the duration of writing was only for a minute. It would be interesting to find out the changes by increasing the duration of writing as well as exercise period and such exercises can be incorporated in individuals who write slow. So the competencies of writing could be improved. The limitation of the current study was that the length of the hand was not considered. Moreover gender analysis was not done for all 3 parameters and study was analyzed as a single group.

Conclusion

It can be concluded that forearm, hand and wrist exercises for a period of 4 weeks can improve the speed of writing. These studies can be further carried out in different samples in order to generalize the statement. Further studies could also be carried out in individuals who have got writing capabilities less than 8 words per minute.

Conflict of interest: There is no conflict of interest.

Finance: It was self-finance study.

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References

- [1] Nilukshika KVK, Nanayakkarawasam PP, Wickramasinghe VP. (2012), Effects of upper limb exercises on writing speed, *Indian Journal of Physiotherapy and Occupational Therapy*, April June 2012. Vol. 6, no.2
- [2] Koppenhaver KM (2007), *Factor that causes change in handwriting in forensic documents examination*, New Jersey
- [3] Alston J (1995) Assessing and promoting writing skills, *Nasen publication*
- [4] Ziviani J (1984), Some elaborations on hand writing speed in 7-14 years old. *Perception and motor skills*; 58 (2):535-539
- [5] Rogers MW, Wilder FV. (2007), The effect of strength training among person with hand osteoarthritis. *Journal of hand therapy*
- [7] Schoemaker MM, Niemeijejr AS, Smits Engelman BCM. (2003), *Effectiveness of neuromotor task training for children for developmental co- ordination disorder: a pilot study: neural plasticity.*