



ROLE OF UPPER LIMB STRENGTHENING EXERCISE TO OVERCOME THE PAIN DURING HANDWRITING AMONG COLLEGE STUDENTS

Physiotherapy

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ABSTRACT

Background & Objective- Writing needs the use of joints in the upper extremities. Students need to write for three hours during the theory exam time. We noticed that some students experience pain & cramps while writing the papers, which causes them to take frequent breaks. Additionally, students find it difficult to hold the pens & write due to pain or cramps, especially if they are using small or medium diameter pens, which slows down their writing speed and affects their performance. In this study we took 32 college going students those who complained of pain & cramps during handwriting. The aim of the study is to determine the effectiveness of upper limb strengthening exercises to overcome the pain/ cramps & to prevent the difficulty in gripping a pen while writing for longer period of time due to pain & cramps further. The outcome measure was VAS score to measure pain pre & post upper limb strengthening exercises for 6 weeks for the cervical muscles, upper trapezius, shoulder joint muscles, forearm muscles, wrist joint muscles and overall handwriting muscles, thenar and hypothenar muscles & correction of posture. The study concluded that in order to overcome the hand pain or cramps while writing for more than an hour or more & because of pain/cramps difficulty in gripping a pen while writing, this study found that upper limb strengthening exercises for the overall handwriting muscles, cervical muscles, upper trapezius, shoulder joint muscles, forearm muscles, wrist joint muscles, and the hand muscles, thenar & hypothenar muscles & correction of posture are significantly effective for the college going students to overcome the pain & cramps while writing for a longer period of time.

KEYWORDS

Handwriting, Upper Limb Strengthening Exercise, Pain & Cramps During Handwriting

INTRODUCTION

Writing requires the use of upper extremity joints. The wrist and fingers carry out various essential tasks, the elbow offers support, and the shoulder joint offers stability. When writing by hand, fine motor abilities are necessary.^{3,4,11} Handwriting involves the coordination between the nerve signals, senses, circulatory system, brain & the muscle memory. Handwriting is an intricate procedure where neurological system & musculoskeletal system work closely. Fine, accurate, coordinated motor skills are required for this intricate task^{2,3,4,5,11}. Muscles of hand composed of extrinsic muscles & intrinsic muscles. Intrinsic muscles produce fine motor movements are the main output of these muscles like thenar, hypothenar, and adductor compartment, 4 Interossei Muscles. These hand's intrinsic interossei muscles are situated in the space between the metacarpals. The metacarpophalangeal joints flexion and the interphalangeal joints extension are facilitated by the palmar and dorsal interossei^{1,13}. 4 Lumbricals all together make Intrinsic muscles of the hand. These muscles will help in adduction & abduction of the hand. The extrinsic muscles of hand is composed of superficial & deep flexors compartment of muscles & extensors compartment of muscles. The hand and wrist's gross movements are executed by these muscles¹. Previous study showed that strong handwriting ability is essential for school-age children to function well academically and is a prerequisite for academic advancement. Children who struggle with handwriting participate less in school activities and have less self faith⁷. Previous study showed in the past that 89% of children with developmental coordination problem have trouble writing by hand⁷. According to previous studies there are 6 types of pen holding technique out of which an EMG investigation showed under hand & over hand technique causing the greatest amount of muscular exhaustion also extensors group of muscles showed more fatigue level than the flexor group². "Writer's cramp" is more commonly seen in students, it is also called as "ballpoint pen tenosynovitis" are disorders of muscles of the hands, fingers, arms, forearm, shoulders, and neck when the person is writing^{5,8,12}. Writer's cramp is defined as a condition when specific hand and forearm muscles will get cramp or spasm^{5,8,12}. According to previous study students those who have a prolonged writing task along with neck pain had increased upper trapezius muscle activity⁹. Writer's Cramp (WC) causes unwanted muscle spasms in fingers, hands & forearms and odd postures that impair motor function when writing¹². According to these previous studies writing with the dominant hand activated the left parietal and premotor regions¹⁰. Previous study showed that handwriting speed can be increased by strengthening exercises of the intrinsic and forearm muscles when applied isotonic contraction, it causes change in the muscle length & intramuscular contraction^{11,12}. Strong or tight pen gripping pressure with the ballpoint pens had been observed to be a major factor in the development of cervicobrachial disorders (OCD)¹². Previous study showed that the forearm makes up the majority of the motions, the shoulder supplies the force, and the fingers and wrist make up the least

amount of movement during handwriting¹⁴. During theory examination time students need to write in a papers for 3hours exam continuously, we observed that students will get pain after 15 minutes or post 1 hour & some students gets cramps while writing the papers which causes them taking a frequent breaks while writing, also they cannot able to hold the pens due to pain/cramps specially if students are holding small or medium diameter pens due to which their writing speed will slow down & thereby affecting their performance. Students had complained of pain in fingers & some students complained of pain in forearm . For Some students we observed if they want to write also students cannot able to grasp pen & cannot able to write due to pain. Writing is accompanied by a variety of problems. For writing, correct pen with a correct diameter along with a good flowing ink, good quality of paper is very important to avoid pain & cramps in hands. We observed that pen with a medium diameter will give somewhat less amount of stress in the muscles of hand as compared to pens with a thin diameter. A pen with a thin diameter will take more efforts to grasp or to hold a pen for writing. It needs a efforts to write thereby produce more fatigue & pain while writing.

Aims & Objectives

To evaluate the effectiveness of upper limb strengthening exercise for cervical muscles, upper trapezius, shoulder joint muscles, forearm muscles, wrist joint muscles, hand muscles, thenar & hypothenar muscles, overall handwriting muscles & correction of posture to overcome the pain & cramps in the hand while writing for more than an hour, problem in grasping a pen during writing due to pain/cramps.

Need of the Study

Students will complain of pain & cramps in hands during writing for more than 15 minutes or sometimes after 1 hours. The aim of the study is to strengthen the upper limb muscles commonly involved in handwriting & correction of posture while writing. Many studies had been done to investigate the prevalence and impact of strengthening exercises on writing speed while writing, impact of pens while writing, impact of particular muscles, hand positions while writing in the past. To our knowledge none of the studies had been done to evaluate the effectiveness of upper limb strengthening exercise to overcome the pain or cramps while writing. Hence the need of the study is to find out the effectiveness of upper limb strengthening exercise for cervical muscles, upper trapezius, shoulder joint muscles, forearm muscles, wrist joint muscles, hand muscles, thenar & hypothenar muscles, overall handwriting muscles & correction of posture to overcome pain & cramps while writing for a prolonged period of time.

MATERIALS & METHODOLOGY

Study Design- Experimental study, convenient & purposive Sampling design

Study Duration- 6 weeks

Sample Size- 32 patients**Material Used-**

1. Consent form
2. Pen , paper, record sheet
3. Data collection sheet
4. Visual analogues questionnaire sheet
5. Treatment couch and chair
6. Smiley ball
7. Theraband
8. Weight cuffs & sandbags.
9. Dumbbells

Inclusion Criteria

1. Both gender- males and females
2. Age between 18years to 25years students
3. Pain whether acute, subacute in the dominant hand
4. Pain while writing in the cervical region, upper trapezius, upper arm, forearm, shoulder joint , elbow joint, wrist joint or in the hands/fingers, pain in palm, thenar muscles, hypothenar.
5. Difficulty in holding pen due to cramps or pain
6. Pain occur after 15 minutes of writing or more time of writing
7. Cramps in hands/shaking of hands
8. Due to pain writing speed is coming down
9. Taking frequent breaks while writing
10. Students using thin, medium diameter pens

Exclusion Criteria

1. Fracture/recent injuries/swelling
2. Surgical history
3. Subjects who are not willing for study.
4. Incomplete Questionnaire filled by participants.
5. Presence of trauma or post trauma
6. Malignancy/cancer
7. Congenital disorder
8. Infections
9. Autoimmune disease
10. Unstable joint
11. Neurological disorder like paralysis
12. Any pathology in cervical region, shoulder, forearm, elbow, wrist joints & hands/fingers.
13. Burns

Procedure

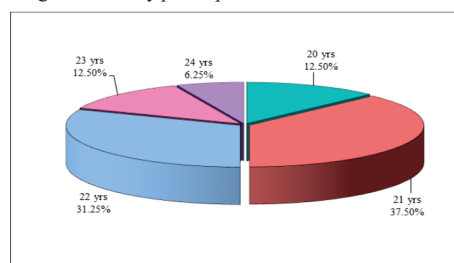
32 Students were taken by convenient & purposive sampling for the study purpose those who were willing to participate in the study design & those students who met with the inclusion criteria. Then their informed written consent were taken. The study's goal was elucidated to them. Students were taken randomly for the study who encountered pain & cramps while writing for more than 15 minutes or 1 hour or more, students complained of pain in dominant hand side, finger specifically little finger, middle finger, hands, wrist joint, forearm, arms, elbow joint, shoulder joint & upper trapezius & cervical region. For some students pain was extending till shoulder joint while writing for 3 hours. Some students complained of pain in upper arm, shaking of he hands & cramps. Some student complained of pain & cramps in palmar arch, thenar and hypothenar side. Some students complained of pain only in thumb region. For some students pain appear after 5 to 10minutes of writing , for some students pain appear after 15 minutes of writing & some student experienced pain after writing for 1 hour. Also those students were taken who were using thin or medium diameter pens while writing any tests or exams. Students complained because of pain they need to take frequent breaks while writing, students cannot able to hold pens due to pain/cramps specially if the pen diameter is small or medium & thereby this will slow down the writing speed & this is having an impact on writing tests, exams, assignments. Both males and females students age between 18years to 25years, were selected for the study purpose, who discussed their problems while writing, on observation basis & showed interest in the rehabilitation & in the study. 29 female student & 3 males students were selected. Before the rehabilitation exercise, the participants who were consented underwent sufficient evaluation, detailed history, & examination. Pain assessment was done by using pain visual analogue scale^{15,16} (VAS) before and after 6 weeks of upper limb strengthening rehabilitation exercises for the overall handwriting muscles, cervical muscle, upper trapezius, shoulder muscles, forearm muscles, wrist joint muscle, hand muscles, thenar & hypothenar muscle ,correction of posture. Upper limb Strengthening exercise given for 10 repetition, 3 sets for each exercise gradually all strengthening exercises was

progressed . Exercises were created to improve the strength for all the handwriting muscles, upper trapezius, cervical region, shoulder muscles, forearm muscles, wrist muscles, hand muscles, thenar & hypothenar muscles for 6 weeks, 6 days per weeks, 3 sets for 10 repetition for each exercise, correction of posture followed by evaluation of the students by asking them to write paper for 3 hours & took pain assessment by VAS score.

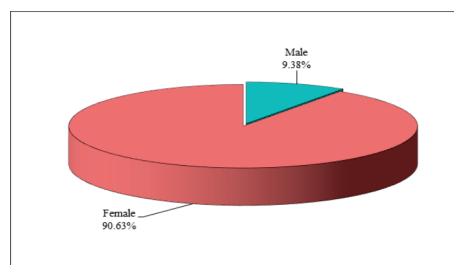
0–10 Numeric Pain Rating Scale**RESULTS****Table 1: Age Wise Distribution**

Age	Number	Percent
20 yrs	4	12.50
21 yrs	12	37.50
22 yrs	10	31.25
23 yrs	4	12.50
24 yrs	2	6.25
Total	32	100.00
Mean	21.63	
SD	1.07	

The mean age of the study participants is 21.63±1.07

**Figure 1: Age Wise Distribution****Table 2: Gender Wise Distribution**

Gender	Number	Percent
Male	3	9.38
Female	29	90.63
Total	32	100.00

**Figure 2: Gender Wise Distribution****Table 3: Summery Of Pre And Post Exercise VAS Scores**

Summery	Pre exercise	Post exercise
Minimum	4.0	0.0
Maximum	9.0	6.0
Range	5.0	6.0
Mean	7.2	3.0
Std.Dev.	1.3	1.4
Median	7.0	3.0
Quartile range	2.0	2.0

Table 4 : Comparison Of Pre Exercise And Post Exercise VAS Scores By Wilcoxon Matched Pairs Test

VAS at	Mean	Std. Dev.	Median	Mean change	% of change	Z- value	p- value
Pre exercise	7.2	1.3	7.0	4.2	58.04	4.9365	0.0001*
Post exercise	3.0	1.4	3.0				

*p<0.05

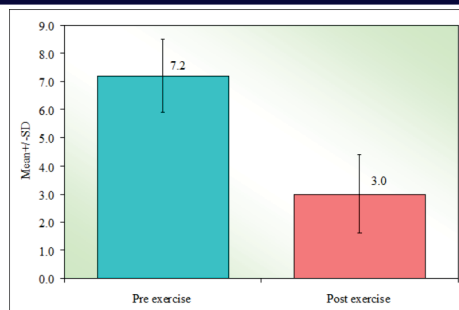


Figure 4: Comparison Of Pre Exercise And Post Exercise VAS Scores

DISCUSSION

In table number & figure number 1 Age wise distribution table the mean age of the study participants is 21.63 ± 1.07 . In table & figure number 2 Gender wise distribution, the most of the participants in the study are female with 90.63% followed by only 9.38% are males. In the table & figure 3 Summary of pre and post exercise VAS scores it can be seen that, Mean $\pm$ SD of VAS at Pre exercise is 7.2 ± 1.3 and Pre exercise is 3.0 ± 1.4 followed by median is 7.00 and 3.0 respectively. In table & figure number 4 showed Comparison of pre exercise and post exercise VAS scores by Wilcoxon matched pairs test showed that a significant difference was observed between pre exercise and post exercise VAS scores ($Z=4.9365$, $p=0.0001$) at 5% level of significance. It means that, the post exercise VAS scores are significantly lesser as compared to pre exercise VAS scores. In another words, a significant of 58.04% reduction or changes in VAS scores after post exercise was seen. It means that, the exercise is significantly beneficial in reduction of the VAS or pain scores.

CONCLUSION

This study concluded that after giving 6 weeks of upper limb strengthening exercises for overall handwriting muscles, cervical muscles, upper trapezius, shoulder muscles, forearm muscles, wrist joint muscles & the hand muscles, thenar & hypothenar muscles & correction of posture is having significant positive impact to overcome the pain & also in cramps in the hand while writing for more than an hour or more & also problem in grasping a pen by the students had been decreased during writing.

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