

Effect of Tendon Gliding Exercises and Forearm Stretching on Speed of Writing among College Students

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ABSTRACT

Background: Handwriting is a complex activity that consists of visual motor coordination abilities, motor planning, cognitive and perceptual skills, as well as tactile and kinesthetic sensitivities. Higher academic grades can be achieved with the help of better handwriting speed.

Handwriting speed is affected by strength and flexibility of muscles. Tendon gliding is important which dictates motion and strength. Stretching improves flexibility and releases tension of muscle.

Objectives: (1) To determine the effect of tendon gliding exercises on speed of writing among college students and (2) To determine the effect of forearm stretching on speed of writing among college students.

Methods: Ethical clearance was obtained from the Institutional Ethical Committee. A total of 64 students were selected based on inclusion criteria. Randomization was done by simple random sampling. Tendon gliding exercises and forearm stretching were given to the students. The outcome measure for handwriting speed was assessed by Handwriting Speed Test. Post test assessment was taken after 4 weeks of intervention.

Result: The statistical result of this study showed that there was a statistically significant difference in pre test and post test of both 3 min test ($p < 0.0001$) and 9 min test ($p < 0.0001$) of Handwriting speed Test.

Conclusion: Tendon gliding exercises and forearm stretching focus on strength and flexibility respectively which have effect on improving handwriting speed among college students.

KEY WORDS: Tendon gliding exercises, forearm stretching, speed of writing, college students

INTRODUCTION

The physical act of writing, of moving the pen or pencil across the page to form decipherable words is fundamental to the development of writing skills.^[1]

Development of handwriting begins with early scribbling, which becomes more intentional with time.

Handwriting is a complex activity that consists of visual motor coordination abilities, motor planning, cognitive and perceptual skills, as well as tactile and kinesthetic sensitivities.^[2] Handwriting is a

result of two primary movements, one horizontal from wrist motion and one vertical from finger movements, with the addition of a rightward translation of the whole arm.

In school age children prevalence of handwriting difficulties varies between 10-34%. When a student graduate from school, the difficulties in handwriting do not disappear and these problems become more complicated and difficult to resolve.^[3,4,5,6] Difficulty while writing reduces the energy as well as creativity while fast writing

improves the power of inspiration and imagination.^[7]

Factors affecting writing performance:

- Pencil grip- An awkward or unconventional grip would affect the speed and legibility of handwriting.
- Pressure on writing instrument and surface- Increased speed leads to increased variation in force application. Relaxation training can lead to improved handwriting performance by reducing muscle tension.
- Kinesthetic perception
- Visual perception
- Visual-motor integration
- Fine motor and motor planning skills.^[8]

Now a days technology has integrated into our lives, the act of writing with the pen has decreased, but handwriting still forms an integral part of our education system, because most of our examinations are still handwritten.^[9]

Anatomy of extremity, general health, mental acuity, writing instrument and surface are the factors which influence the handwriting.

During writing, in upper extremity complex, fine motor skills, precise and coordinated movements occurs. Minimum movements occur at fingers and wrist which come from forearm while shoulder provides the power. Student's achievement is dependent on handwriting speed regardless of ability.

In academic success handwriting speed plays an important role with the ability to express knowledge about different subjects. Handwriting speed is a unique feature of human's cultural development. Coordination between musculoskeletal and nervous system results in speed of handwriting. Higher academic grades can be achieved with the help of better handwriting speed.

Handwriting speed is affected by strength and flexibility of muscles. Delays information processing, difficulties with spelling, improper motor coordination and intensive writing styles causes slow handwriting which can lead to loss of

motivation. The study was performed to see the effect of upper limb strengthening exercises on handwriting speed. Strength training induces muscular contraction and size of skeletal muscle. Benefits of strengthening exercises are decrease in muscle fatigue level and increases energy level.^[10]

For finger motion, tendon gliding is important which dictates motion and strength. Maximum amount of tendon gliding is called tendon excursion which varies with finger and wrist position and effort.

Tendon gliding exercises are straight hand, hookfist, fullfist, tabletop, straight fist. These exercises are important to the hand as aerobic exercise to the heart which provide maximum range of motion at each finger joint as well as gliding of the extensor and intrinsic tendons. Maximum superficialis excursion occurs in fist position. Profundus tendon excursion occurs in hook position. Thumb flexion involves only one flexor tendon that is flexor pollicis longus.^[11]

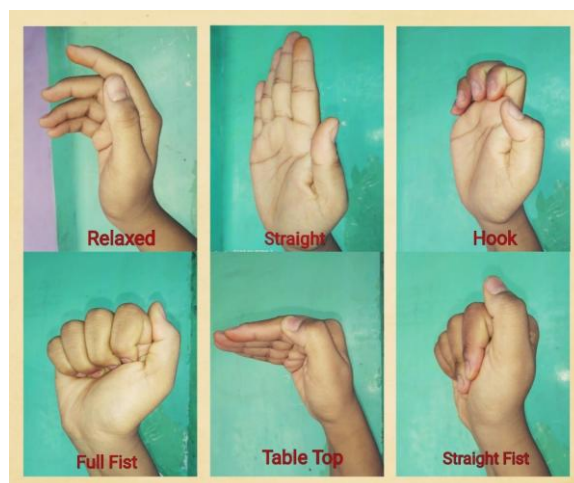


Figure 1: Tendon gliding exercises

Stretching is the process of placing particular parts of the body into a position that will lengthen the muscles and their associated soft tissue.

Benefits of stretching –

- Improved range of motion
- Increased power, and reduced fatigue
- Promote circulation

- Increase energy
- Improve relaxation
- Stress relief.^[12]



Figure 2: Wrist flexor stretching



Figure 3: Wrist extensor stretching

MATERIALS AND METHODOLOGY

Methodology

Type of study: Experimental study

Study design: Pre and post test

Place of study: Karad

Sample size: 64

Sampling method: Simple random sampling

Study duration: 6 months

Inclusion Criteria

Age between 16-18 years

Both sex

Students having tripod grip

Exclusion Criteria

Any orthopedic or neurological conditions

Materials Used

Pen, Paper, Stopwatch, Bell, Consent form

Outcome Measure

Handwriting Speed Test

PROCEDURE

After approval from institutional protocol and ethical committee, 64 Students were selected as per the inclusion and exclusion criteria. Students, their parents and teachers were informed about the study and consent was taken.

Pre test assessment: Handwriting speed test was used to assess speed of writing.

Following treatment was given to the selected students-

1. Forearm stretching-stretching of wrist flexors and extensors. (5 repetitions, 30 sec in position of stretching, 30 sec in position of release with elbow extended): 2 times/day.

2. Tendon gliding exercises-straight hand, hookfist, fullfist, tabletop, straight fist (5 sec hold, 10 reps): 2 times/day.

Post test assessment was taken after 4 weeks by using Handwriting speed test.

The interpretation of the study was done on the basis of comparing pre test and post test assessment of Handwriting speed test.

Statistical Analysis

Data of all outcome measures was measured as pre treatment and post treatment values. Mean and standard deviation was calculated for each outcome measure.

Within the groups the data was analyzed by paired t test. The p and t values were calculated.

RESULT

1. GENDER DISTRIBUTION IN THE STUDY

GENDER	FREQUENCY	PERCENTAGE
MALE	19	30
FEMALE	45	70
TOTAL	64	100

Table no.1-gender distribution

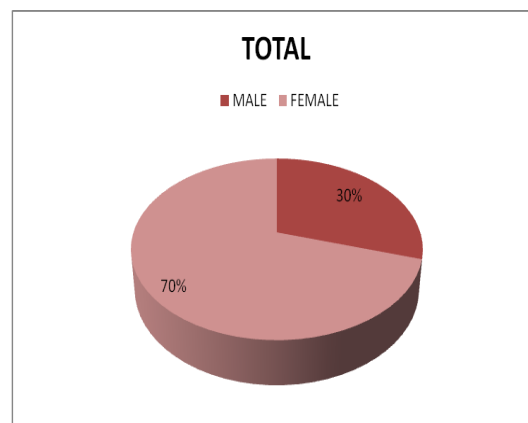


Fig.no.4-gender distribution

Interpretation-The diagram shows 19 males study. and 45 female subjects participated in the

DATA ANALYSIS

1. Within group comparison

Parameter	Pre test	Post test	Mean diff	t value	p value	Remark
HST(3MIN)	70.641±15.506	97.438±15.166	-26.797	51.295	<0.0001	Extremely significant

Table no.2-comparison between pre and post HST (3MIN) mean values within group

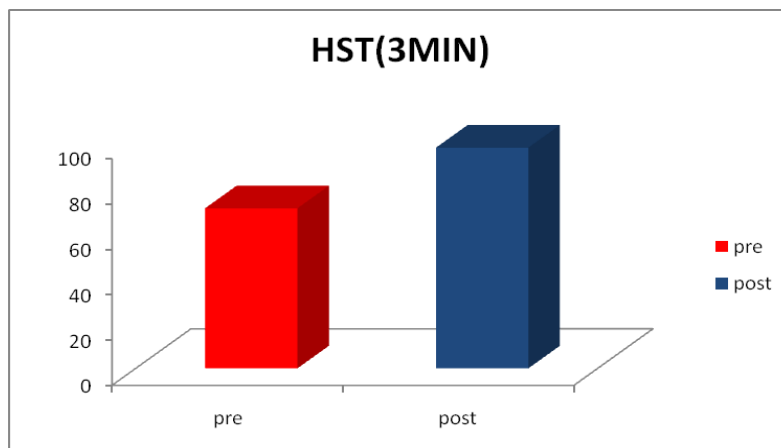


Fig. no.5- comparison between pre and post HST (3MIN) mean values within group

Interpretation: The above table and graph shows pre and post comparison within the group. Post training there was a significant improvement noted according to the p value.

Parameter	Pre test	Post test	Mean diff	t value	p value	Remark
HST(9MIN)	196.31±36.76	237.86±36.907	-41.547	64.637	<0.0001	Extremely significant

Table no.3-comparison between pre and post HST (9MIN) mean values within group

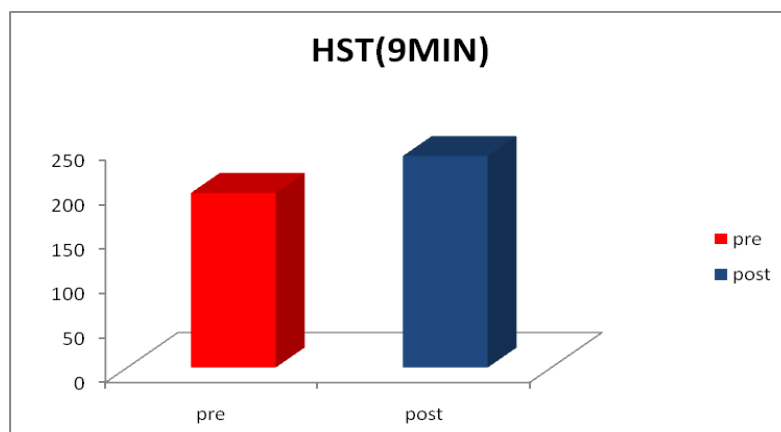


Fig.no.6-comparison between pre and post HST (9MIN) mean values within group

Interpretation: The above table and graph shows pre and post comparison within the group. Post training there was a significant improvement noted according to the p value.

DISCUSSION

This study was focused on to find out the effect of tendon gliding exercises and forearm stretching on speed of writing among college students.

The objective of the study was to find the effect of tendon gliding exercises on speed of writing among college students. To find the effect of forearm stretching for the same.

Writing is a complex process which involves coordination between musculoskeletal and nervous system. Difficulties while writing can affect the successful participation in academic which leads to lowered self-esteem.

Margaret wallen et al,(1998)concluded that Handwriting Speed Test (HST) which is 3 minute test, is a standardized, norm by increasing the writing speed of an individual through exercise. Paul O'mahony, Mairead Denpsey and Hazel Killein performed a study in which they concluded that the addition of the 9 minute writing test period would enhance the accuracy of the HST.^[13]

Previous study was done to see effect of upper limb strengthening exercises on handwriting speed in undergraduate students in which 30 subjects were selected and divided into 2 groups. Group A who underwent strengthening exercises for upper limb and Group B who underwent writing practice. Strength training induces muscular contraction and size of skeletal muscle. Benefits of strengthening exercises are decrease in muscle fatigue level and increases energy level. The study was concluded that the upper limb strengthening exercises showed greater improvement in handwriting test.

In this study 64 college students were selected randomly .Aims and objectives of the study was explained to the students and informed consent was taken. The pre-interventional outcome measure was taken by counting the number of words written by the students in 3 minutes and 9 minutes from the given paragraph on first day. Later the students trained for 4 weeks with tendon gliding exercises and forearm stretching.

Tendon gliding exercises maintain the finger motion as they are necessary for writing. Stretching improves flexibility and releases tension on muscles, increases blood supply leads to nutrient supply and energy. These benefits prevent muscle fatigue while writing.

After 4 weeks the post outcome measure was taken.

The statistical result of this study showed that there was a statistically significant difference in pre test and post test of both 3 min test($p < 0.0001$) and 9 min test($p < 0.0001$) of Handwriting speed Test.

This study shows tendon gliding exercises and forearm stretching showed significant improvement in outcome measure concluding that it improves writing speed.

CONCLUSION

The results of the study prove that the tendon gliding exercises and forearm stretching are effective in improving writing speed among college students.

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