

Effects of Tendon Gliding Exercises on the Speed of Handwriting Among Female UG Students: Pilot Study

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Abstract

Background: Handwriting is an intricate function which requires the combination of fine motor skills, visual and motor coordination abilities, and concentration. Handwriting involves two main movements: horizontal wrist motion and vertical finger movements, along with a rightward translation of the entire arm. Handwriting speed is an important factor in a student's academic performance, particularly in fields such as statistics. The strength and flexibility of hand muscles can significantly influence writing speed. Tendon gliding exercises are considered an effective method for improving finger movement and strength, which may directly impact handwriting speed. **Objective:** The aim of this study was to assess the effect of tendon gliding exercises on handwriting speed among undergraduate physiotherapy students. **Methodology:** An experimental study was conducted with 30 female students aged 18 to 23 years. The participants were randomly selected and evaluated based on specific inclusion and exclusion criteria. Handwriting speed was measured using a "words per minute" test for 3 min, following the guidelines of Wallen et al. Tendon gliding exercises were demonstrated to the participants, who were instructed to perform them unsupervised for 4 days a week over a 4-week period. The outcome was reassessed after 4 weeks using the same measurement tool. **Results:** All 30 female students completed the study. After 4 weeks, a comparison was made between pre-test and post-test results. The mean value before the intervention was 72.97, while after the intervention, it increased to 77.03. A statistically significant difference was found between the pre-test and post-test scores, with a p-value of 0.0001. **Conclusion:** The study demonstrated a significant improvement in handwriting speed after performing tendon gliding exercises, as evidenced by the statistical analysis of pre-test and post-test results. So, as a result, tendon gliding exercises showed beneficial effects on improving the handwriting speed of the undergraduate students.

Keywords: Tendon gliding exercise, speed of handwriting, undergraduate female students

INTRODUCTION

Handwriting is one of the most special quality and ability in daily life one can have. It is a combined form of presenting, achieving, and expression of creativity and knowledge. Handwriting is an intricate function which requires the combination of fine motor skills, visual and motor coordination abilities, and concentration.

It is a result of two primary movements, which includes horizontal wrist motion and also vertical finger movements, with the addition of a rightward translation of the whole arm. Speed of handwriting contributes to more productive time management, higher quality of work and enhanced overall performance in various area of life. Handwriting speed takes part as an essential tool in students' life which enables them to excel in statistics. It has been found that students complain of getting tired after

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writing for a few minutes. The incapability of writing fast and swiftly not only affects academic achievement but it also hampers students' self-esteem [1, 2].

Many factors influence handwriting such as:

1. General health,
2. Mental health,
3. Anatomy of extremity,
4. Kinaesthetic perception,
5. Visual perception,
6. Fine motor and motor planning skill, and
7. Writing instrument and surface:
 - *Pen or pencil*: The manner of grip would determine the speed of writing.
 - *Pressure on writing instrument and surface*: As speed increases, it gives rise in deviation of force application which leads to disruption of motor coordination and affects the rhythm of writing.

DYNAMIC TRIPOD GRASP

Dynamic Tripod grip is the most common grip for handwriting. It is the combination of three fingers: thumb, index and middle finger. The thumb and index are in opposition controlling the movement and middle finger slightly flexed with pen resting in the webspace. In addition, the little and ring finger are also flexed and resting against the paper during action of writing [3].

Prevalence

Studies have shown that between 10 and 34% of students experience difficulties with handwriting.

Tendon Gliding Exercise

Tendon gliding exercises are recognized as a crucial method for enhancing finger mobility and strength, which can directly influence handwriting speed. These exercises promote blood circulation, reduce muscle tension, improve flexibility, and help prevent muscle fatigue during writing. The exercises include straight hand, hook fist, full fist, tabletop, and straight fist positions, all of which maximize the range of motion at each finger joint and facilitate the gliding of the extensor and intrinsic tendons. The superficialis tendon achieves its full range of motion in the fist position, while the profundus tendon reaches its maximum in the hook position. Additionally, thumb flexion is controlled by a single flexor tendon, the flexor pollicis longus [4].

Handwriting Speed Test (HST)

The "Handwriting Speed Test" (HST) was created by Wallen *et al.* in New South Wales, Australia, to offer a quick, convenient, yet objective and reliable way of measuring handwriting speed [1]. The HST was designed to assist physiotherapists and occupational therapists in evaluating an individual's handwriting speed. The test measures words per minute and compares the results to national averages, both under test and non-test conditions. In a study conducted by Wallen *et al.*, it was concluded that the 3-minute Handwriting Speed Test (HST) is a standardized assessment that helps increase an individual's writing speed through targeted exercises [1].

AIM OF THE STUDY

To examine the impact of tendon gliding exercises on handwriting speed among undergraduate physiotherapy students.

NEED FOR STUDY

It was observed that a significant number of students struggle with slow writing speed during academic exams. Therefore, an experimental study was conducted to evaluate the effectiveness of tendon gliding exercises in enhancing writing speed [5, 6].

MATERIALS AND METHODOLOGY

Methodology

- *Type of study:* Experimental study.
- *Study design:* Pre-test and post-test.
- *Place of study:* Assam Women's University, Jorhat.
- *Sample size:* 30.
- *Sampling method:* Simple random sampling.
- *Study duration:* 4 weeks.

Inclusion Criteria

- *Age:* Between 18 and 23 years.
- *Sex:* Female.
- *Dominant:* Right.
- *Grip:* Dynamic Tripod Grasp.

Exclusion Criteria

- Subject with orthopaedic and neurological issues.
- History of upper limb fracture within 6 months.
- Visual and auditory impairments.
- Recent surgeries of the dominant hand.

Materials Used

- Pen.
- Paper.
- Bell.
- Stopwatch.
- Consent form.
- A 150-word paragraph photography.

Outcome Measure

Handwriting Speed Test: For writing speed.

PROCEDURE

1. An experimental study was conducted on 30 female students between the ages of 18 and 23 years. These students were randomly selected and then evaluated as per the specified inclusion and exclusion criteria.
2. The pre-test was taken in a single classroom with same writing surface and sitting space. We provided standardized pen, a paper and photocopy of 150 words to perform handwriting speed test which was a 3-min test.
3. Students were instructed to begin writing immediately after the first bell and to stop writing exactly 3 min later when the bell rang again and at the end the numbers of words were counted and writing speed was calculated. The average writing speed was found to be 72.97 WPM.
4. Tendon gliding exercises were demonstrated to the participants, who were instructed to perform them unsupervised, 4 days a week for a duration of 4 weeks, as illustrated in Figure 1. The exercises included: straight hand, hook fist, full fist, tabletop, and straight fist, with each exercise held for 5 sec and repeated 10 times, performed twice daily (Figure 2).

Straight Hand

Begin with the hand open and the fingers extended straight [7].

1. *Hook Fist:* Start with straight hand and bend the proximal interphalangeal (PIP) joint and the distal interphalangeal (DIP) joint of fingers while keeping the metacarpophalangeal (MCP) joint straight, forming a hook shape.

2. *Full Fist*: Begin with a straight hand, then form a fist by bending all the finger joints towards the palm.
3. *Tabletop Position*: Start with a straight hand, then bend only the MCP joints while keeping the fingers straight.
4. *Straight Fist*: Begin with a straight hand and bend your fingers so that they touch the base of your palm, while keeping the DIP joints straight.
5. An outcome measures were taken at the end of 4th week and then pre and post test data were compared. Data was analysed by GraphPad software.

RESULTS

The collected data of the pre and post-test was done using HST and mean value was calculated which are 72.96 and 77.03 respectively and the mean difference is 4.07. The above data was statistically analysed using paired t test where t value is 5.7854 and p value is 0.0001 as shown in Table 1 and Figure 3. There was a statistically significant difference between the pre-test and post test results which shows that tendon gliding exercises is beneficial for improving the speed of writing.



Figure 1. Exercises demonstration.



Figure 2. Tendon gliding exercises.

Table 1. Comparison between pre and post HST(3 min) mean value.

Parameter	Pre-test	Post- test	Mean diff	t value	p value	Remark
HST(3 min)	72.966	77.03	4.07	5.7854	0.0001	Extremely statistically significant

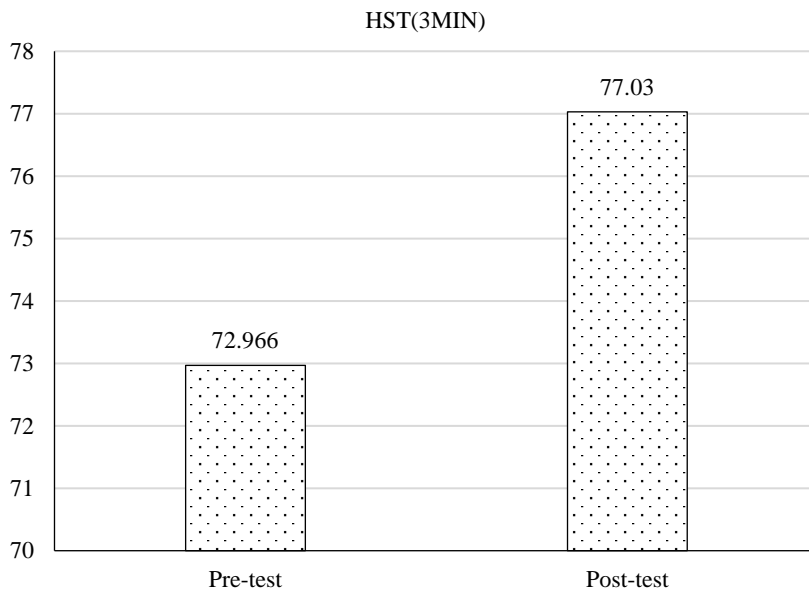


Figure 3. Comparison between pre and post HST(3 min) mean value.

DISCUSSION

This study aimed to evaluate the effectiveness of tendon gliding exercises in enhancing handwriting speed among female undergraduate students. Handwriting speed was measured using the Words Per Minute (WPM) test, a 3-min assessment developed by Wallen *et al.* [1]. A total of 30 female undergraduate students were randomly selected according to specific inclusion and exclusion criteria. The purpose of the study was explained to the participants. The pre-test was taken on the first day by counting the number of words written in 3 min by using the provided material: pen, paper and a photocopy of 150 words paragraph. Tendon gliding exercises were demonstrated and instructed the students to perform them unsupervised for 4 days a week over a period of 4 weeks (Figure 1). For a duration of 5 sec hold with 10 times repetitions twice daily.

The outcome of the intervention was taken after 4 weeks by the same outcome measure. The comparison of the pre and post-test is evaluated using HST is shown in Table 1 and is graphically documented in Figure 3. Prior to the intervention, the mean score was 72.97, while after the intervention, the mean score increased to 77.03, resulting in a mean difference of 4.07. This indicates a statistically significant difference between the pre-test and post-test results, with a p-value of 0.0001 and a t-value of 5.7854, as determined by the paired 't' test statistical analysis. Tendon gliding exercise plays an important role in maintaining the finger motion, smooth and well-organized writing. According to study accomplished by Desai and Vyas, it have been shown that tendon gliding exercise have improved the speed of writing. The exercises are straight extension, hook Fist, straight fist, full fist and table top as shown in Figure 1; which improved the extension, flexion and intrinsic muscles to develop strength and suppress finger muscle fatigue during writing. These combinations of tendon gliding exercises improve fingers' range of motion, reduced stiffness and tiredness which ultimately improved the speed of writing skill [8, 9].

As the data shows significant changes in the speed of writing by executing the exercise intervention, so the tendon gliding exercises can be given to the UG students as it reduces tiredness and improves the speed of writing [10].

CONCLUSION

In this experimental study, it was observed that there is a difference between the pre-test and post-test after the intervention as there is difference in statistical analysis. So, as a result, tendon gliding exercises showed beneficial effects on improving finger motion leading in increased handwriting speed of the undergraduate female students.

Limitations

1. A larger sample size would have given strength to the study.
2. The study sample were selected from a single locality.
3. The study duration was relatively short.
4. The absence of supervision during the exercise program may have compromised its effectiveness; supervised exercise may have been more favourable.

Recommendations

1. More advanced study could be done to investigate the differences in speed of handwriting between males and females.
2. Future research can expand this study to explore the effects of tendon gliding exercise on fine motor skill in deeper perspective.
3. Inclusion of Artificial Intelligence in practice of handwriting speed for deeper studies.

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