

## Pencil Grip Pattern and Its Effect on Handwriting in Medical Students of Maharashtra

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### Abstract

The impact of pencil grasp on handwriting has been a topic of investigation since the 1940's. Assessment of the handwriting skills in the form of speed fluency, mechanical fluency and its correlation with pencil grip pattern was done in the present study. 102 medical students were evaluated for mechanical and speed fluency in writing. Four types of pencil grips were recognised which include dynamic tripod, lateral tripod, dynamic quadrupod, lateral quadrupod in the study. Dynamic tripod grip pattern was most common grip type used by students to write but contrary to the previous belief that dynamic tripod is an ideal grip when correlated to handwriting skills like mechanical and speed fluency present study shows that both this skills has shown highest score with dynamic quadrupod grip. So further evaluation on grip type and effect on writing can be studied in kinematic fashion using advance methodology.

**Keywords:** Pencil Grip; Speed Fluency; Mechanical Fluency; Handwriting Skill.

### Introduction

Pencil grip/ grasp means the position of the fingers involved in grasping a pencil [1]. Handwriting is an important skill needed to express oneself in written form. Speed and legibility are two major components of handwriting that are believed to be affected by pencil grasp [2]. Handwriting is an essential skill for both children and adults. Even in the age of technology, handwriting remains the primary tool of communication and knowledge assessment for students in the classroom [3]. Human hand use can be separated into two types of grasping behaviours: 1) power grasping, in which the palm and digits hold an object; and 2) precision grasping, in which the digit pads are the only surfaces that hold the objects. Precision and power grasping have many variations, determined by object features. Grasping, especially precision grasping is considered to be "critical in

many daily living activities". As quoted by Wong Y [4](2004); Napier (1956) provided the first classification of grasping in adults by describing two types of grasping: 1) power grasps, in which an object is clamped between the palm and the digits of a hand, and 2) precision grasps, in which an object is grasped between the digits and the opposing thumb of one hand. There are many implications looking at the normal variance of grasping preferences in normal children, adults and elderly people. For example, knowing normal hand grasping patterns can help in the building of new prosthetic hands and arms as well as robotic arms. Normal commercial prosthetics consist of one type of grasp pattern, the pincer grasp, which is not very helpful for behaviours needing stronger or more stable grips. To have a more useful prosthetic, Light and Chappell [5] (2000) have proposed to build a multiple-axis prosthetic, and hence knowing the normal variance of grasping patterns would be very informative and helpful. Pencil grasp is a term used to describe the position of the fingers involved in grasping a pencil. The impact of pencil grasp on handwriting has been a topic of investigation since the 1940's [1].

So present study is conducted to see whether there is any correlation between pencil grasp pattern and its effect on handwriting skills. To study the pencil grasp pattern in medical students assessment of the handwriting skills in the form of speed fluency,

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mechanical fluency and its correlation with pencil grip pattern was done.

## Material and Methods

102 medical students of 1st MBBS from Government Medical Colleges of Maharashtra were included in the study (51 males and 51 females). All right handed students with no obvious anomaly of hand were included. Natraj gel ball pen was provided to students for writing. White paper with linings was provided for writing. Students were explained about the study. 6 students were evaluated at a time. Pencil grip pattern were photographed after 5 minutes of continuous writing. Mechanical and speed fluency was evaluated according to study done by Ann-Sofie Selin [6] (2003).

*Copywriting* (group assignment): A group six students at a time were asked to copy textbook text for 10 minutes. Each pupil had a book on the desk B.D.Chaurasia Volume 3 HNF 6<sup>th</sup> edition Page 60 from line 'The skin is thick....'. Students were told that the aim of present assignment was to learn more about the way pupils hold their pencils; and that the pupils would be observed while copywriting from their textbook. A photograph would be taken of the writing hand after approximately 10 minutes of writing. The writing assignment was carried out at a desk of standard height and size used by the college. Up to six pupils were simultaneously observed. For each task, sheets of A4-sized lined paper was given to the students and were ask to write a unique identification number given to them in top of the paper. Same number was used to label the photograph and other assignment to the same student. Different students were provided with different identification number. A gel pen of NATRAJ GELIX company was provided to the students for assignment. After instruction and possible questions and answers, the students were asked to copy a textbook text for period of 10 minutes. Photographs were taken after 5 minutes of continues writing. Assignment papers were collected for further observations.

*Speedwriting* (individual task): Students were asked to write a 20 letter six word sentence in a decipherable

cursive script as many times as possible during 2 minutes. The sentence "yes I am your best friend" was easy to memorise and included 14 different letters of various shapes. After learning the sentence by heart and repeating it, the students was instructed to keep writing until told to stop. We timed the assignment by setting the stopwatch for 2 minutes.

All this criteria's were used to minimise the bias in the study.

*Mechanical Fluency* was estimated from the copywriting task by counting the words written in ten minutes. The score was equal to the number of words written in stipulated time.

*Speedwriting Fluency* was measured from the speedwriting task by counting the number of letters produced in two minutes. The score was equal to the number of letters.

## Observations and Results

Four types of pencil grips were recognised which include dynamic tripod, lateral tripod, dynamic quadrupod, lateral quadrupod in the study. The tripod grasp involves the thumb, index and middle finger in opposition, functioning as a "tripod" and allowing small, very co-ordinated movements [1]. In quadrupod grasp additional involvement of ring finger is there along with thumb, index and middle finger. In dynamic tripod grip (Figure 1) thumb and index finger helps in holding the shaft of the pen by its pulp and middle finger rest below for support. In dynamic quadrupod grip (Figure 2) thumb and middle finger helps in holding the shaft of the pen by its pulp, index finger overrides the shaft and ring finger rest below for support. In lateral tripod grip (Figure 3) thumb overrides the shaft of pen and pulp of middle finger touches the shaft and middle finger rest below for support. In lateral quadrupod grip (Figure 4) thumb from one side and index finger from other side overrides the shaft of pen and pulp of middle finger touches the shaft of the pen and ring finger rest below for support.

Frequency of grip pattern and its effect on mechanical and speed fluency score is shown in table

Table 1: Showing grip pattern, its frequency and mean score of each grip in mechanical and speed fluency

Type of grip	Mechanical fluency score (Mean ± SD)	Speed fluency score (Mean ± SD)	Grip type frequency (Total = 102 subjects)	Percentage
Dynamic tripod	310.28 ± 40.84	269.76 ± 42.63	73	71.56%
Dynamic quadrupod	321.15 ± 36.39	271.21 ± 38.49	19	18.62%
Lateral tripod	293.25 ± 47.67	265 ± 42.42	8	7.84%
Lateral quadrupod	243.5 ± 33.23	250 ± 98.99	2	1.96%

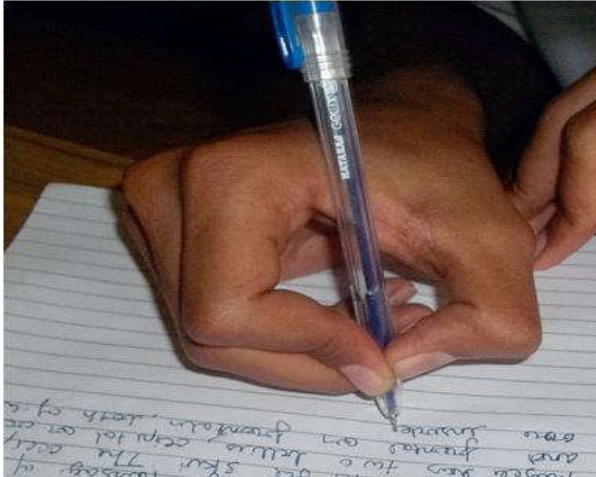


Fig. 1: Dynamic tripod grip

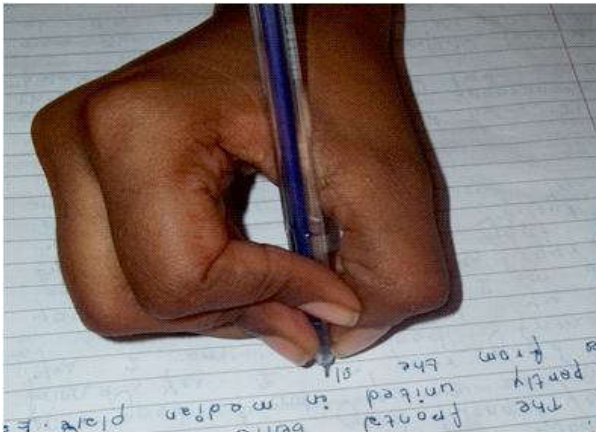


Fig. 2: Dynamic quadrupod grip



Fig. 3: Lateral tripod grip



Fig. 4: Lateral quadrupod grip

below (Table 1). Dynamic tripod grip pattern was most common grip type used by students to write. And mechanical as well as speed fluency score was higher for dynamic quadrupod grip.

### Discussion

Schwellnus H et al [1] (2012) stated that four grasp patterns that have been identified as mature and appropriate for functional writing are dynamic tripod, lateral tripod, dynamic quadrupod, lateral quadrupod. But when they conducted study on 120 typically developing fourth grade students they found six categories of pencil grasp: four mature grasp patterns, one immature grasp pattern, and one alternating grasp pattern. Multiple linear regression results revealed no significant effect for mature grasp on either legibility or speed. And they concluded that pencil grasp patterns did not influence handwriting speed or legibility in this sample of typically developing children. This finding adds to the mounting body of evidence that alternative grasps may be acceptable for fast and legible handwriting.

Selin AS [6] (2003) stated that the dynamic tripod grip is considered by many teachers and therapists to be ideal. However, the basis for recommending the dynamic tripod pencil grip and for excluding other grips is subjective and lacks scientific underpinning. For example, little is known about the possible detrimental effects on writing caused by deviation from this recommended grip. Pencil grasp can have effect on writing.

Gladson B & Shah LJ [2] (2015) study shows 85% grips are dynamic tripod & no significant difference seen between grip type and speed, mechanical fluency. Schwellnus H et al [1] (2012) also stated that grasp pattern has no influence on speed & mechanical fluency in children's between age group of 6-13yrs. Bergmann KP [7] (1990) found dynamic tripod grip in 86% subjects and lateral tripod in 10% as second common type. But correlation with writing skill was not studied. In present study dynamic quadrupod appears to be best grip when correlated with writing speed and mechanical fluency. Dynamic tripod is recommended as correct grip for writing despite of lack of evidence in form of writing output [2]. Wong Y [4] (2004) suggested that grip pattern analysis should be assisted by videos and behavioral analysis in order to obtain better understanding of grip patterns. Grip pattern was studied and variations were found but they stated that these variations are not obviously related to external factors such as object size, hand size, sex and handedness.

Contrary to the previous belief that dynamic tripod is an ideal grip when correlated to handwriting skills like mechanical and speed fluency present study shows that both these skills have shown highest score with dynamic quadrupod grip. So from this finding we can say that dynamic quadrupod grip can be better grip when concerned with speed and mechanical fluency. But further evaluation on grip type and effect on writing is required to be studied in kinematic fashion using digitizing tablet and pressure sensitive instrumented styli to measure force and pressure while writing with particular grip pattern.

### Conclusion

In present study dynamic quadrupod appears to be best grip when correlated with writing speed and mechanical fluency. Dynamic tripod is recommended as correct grip for writing despite of lack of evidence in form of writing output. So further evaluation on grip type and effect on writing can be studied in kinematic fashion using advance methodology.

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