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The Effect of Using Smartphones on the Manual Dexterity of Dental Students

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Abstract

Background: Manual dexterity describes the ability to finely coordinate hand and finger movements, allowing object manipulation to the operator's advantage. Previous studies have reported that the excessive use of smartphones affects the various musculoskeletal tissues of the upper extremity

Objective: The aim of this study was to assess and evaluate the correlation between the amount of usage of smartphones to the level of dexterity among dental students using O Connor tweezer dexterity test.

Materials and methods : 250 dental students belonging to first year, second year, third year, final year and interns with 50 students from each year were included in the study. The study comprised of two parts, first the mobile usage time data was collected followed by O'Connor dexterity test. The correlation between the usage time and the dexterity score were calculated using the Pearson Correlation value. The mobile usage time and dexterity score were compared between each year using ANOVA test.

Results: On evaluating the Pearson correlation value, there was no statistically significant correlation between the two variables amongst students in all years. On comparing between each year, no statistical

significance was observed for dexterity score and mobile usage time.

Conclusion: Increased mobile usage time increases the manual dexterity score, however, it is not statistically significant. These findings are concordant with the existing literature. Further studies are required in this field at a large scale to achieve more statistically significant results.

Keywords: Manual Dexterity, Smartphones, Dental Students

Introduction

Manual dexterity describes the ability to finely coordinate hand and finger movements, allowing object manipulation to the operator's advantage.[1] This skill often works hand-in-hand with visuospatial reasoning, which is the ability to generate, transform, and retain structured visual images.[2] In order to perform dental procedures, a dentist must be able to work with precision on an extremely small scale. Dental surgeons have to demonstrate a high ability of manual dexterity skills and high level of proprioception recognition in every treatment. Therefore, dental students have to acquire comprehensive theoretical knowledge as well as specific manual skills during their early dental education.

Smartphone is an integral part of life which is used for educational and recreational purposes.[3] It has replaced the need for various objects such as an alarm clock or watch, a printed calendar, a phone diary, need for stepping out of the house for shopping, etc. It has become a rapid platform for the exchange of information.[4] All these factors have led to an increased prevalence of smartphone addiction among young adults. It has been reported that, the frequency of use of texting among teens have now overtaken the frequency of every other common form of interaction with their friends.

Previous studies have reported that the excessive use of smartphones affects the various musculoskeletal tissues of the upper extremity.[5-7] The pathophysiological changes may lead to an altered length-tension relationship of muscles of the upper quadrant, thereby affecting the strength of proximal as well as distal muscles causing an impact on the dexterity.[8] Dexterity levels are assessed using various tests which includes block carving, the thermometer test, the two-hand coordination machine, the O'Connor Tweezer Dexterity Test and the Purdue Pegboard Test. No consensus has been reached regarding the best predictive test; however, the O'Connor Tweezer Dexterity Test is considered to be the gold standard test for assessing the manual dexterity [9,10]

The purpose of this study is to asses and evaluate the co-relation between the amount of usage of smartphones to the level of dexterity among dental students using O Connor tweezer dexterity test.

Materials and methods

Sampling: A total of 250 students of dental college were included in the study. The sample population was selected based on cluster random sampling. The study population included first year, second year, third year, final year and interns with 50 students from each year. Ethical approval was obtained from the Institutional Ethics Committee and written informed consent was obtained from each student. Students possessing smart phones and willing to participate were included in the study. Physically challenged, not possessing smart phones and not willing to participate were excluded from study.

Method: The study was conducted in the department of oral and maxillofacial surgery. The study comprised of

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two parts, first the mobile usage time data was collected followed by O'Connor dexterity test. The students were asked to download an application called Usage time in their smart phone. The application showed the phone usage time for the past one week. The demographic details, phone model and the phone usage time of the students were collected. After the data collection, the students performed the O Connor dexterity test and were scored according to the time taken to complete the test. Each student was asked to sit comfortably at the table, the dexterity test was placed in front of the student. The examiner explained the instructions to the student. A trial round of filling the first ten holes was given, followed by which the actual test was conducted and the time taken to complete the test was noted and scored accordingly. (Table 1)

O Connor Dexterity Test: The O'Connor Tweezer Dexterity Test consists of 5 7/8" W x 11 5/8" L board with 100 holes, a cup that holds 100 pins and a tweezer. The participant places all 100 pins using the tweezer with the dominant hand into the holes. This test measures the speed with which a participant using tweezers is able to pick up pins one at a time and place them in small holes on a board.

Statistical Analysis: The mean and standard deviation for mobile usage time and dexterity score were calculated and statistical analysis was done using SPSS Software. The co-relation between the usage time and the dexterity score were calculated using the Pearson Correlation value. The Pearson Correlation value is a measure of the linear correlation between two variables X and Y, it has a value between +1 and −1, where 1 is total positive linear correlation, 0 is no linear correlation, and −1 is total negative linear correlation. The mobile usage time and dexterity score were compared between each year using ANOVA test. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 250 students, 50 from each year were included in the study. Of which 147 were females and 103 were males. The age range was 17-25 years with the mean being 20.3 years. The details and demographics are included in Table 2.

The dexterity score was calculated according to the time taken to complete the test, and was scored from minimum score of 3.0 to maximum score of 7.0. Out of 250 students, 116 (46.4%) students obtained 3.0 score, 80 students (32%) obtained 4.0, 40 students (16%) got 5.0 score, 12 students (4.8%) scored 6.0 and 02 students (0.8%) scored 7.0.

The mean and standard deviation of dexterity score for first year was 3.55 ± 0.933, second year 3.90 ± 1.32, third year 4.00 ± 0.98, final year 3.85 ± 1.1 and Interns 3.86 ± 0.92. The mean and standard deviation of mobile usage time for first year was 2551 ± 819, second year 2493 ± 979, third year 2729 ± 2002, final year 2402 ± 1419 and interns 2160 ± 776.

The statistical analysis was done using SPSS software. On evaluating the Pearson correlation value between the dexterity score and mobile usage time, there was no statistically significant correlation between the two variables amongst students in all years (Table 3). On comparing between each year, no statistical significance was observed for dexterity score and mobile usage time. (Table 4)

Discussion

In the past decade the use of smartphones has exponentially increased. Significant increase in smartphone use and their capabilities allow young individuals to access the internet, communicate, and entertain themselves anywhere and anytime. Most

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students in 15-25 years of age group find the smartphone as a constant companion.[11]

Berelo et al reported that Canadian university students spend on average >3.5 hours/day texting, emailing, scheduling, and internet browsing on their mobile phones.[12] Our study was conducted among 250 dental students with age range of 17-25 years and mean being 20.3 years. The average mobile usage time amongst the study population was 5.8 hours per day.

According to a study by US-based media agency Zenith in 2018, China has the highest number of smart phone users in the world with 1.3 billion people, followed by India with 530 million users.[13] The overall increase in usage of smart phones has a significant social morbidity in society.[14] Its after effects due to increased usage include physical health-related problems, such as musculoskeletal disorders of the hand, wrist, cervical spine, back muscles, ocular manifestations and elevated risk of psychological disorders such as attention deficit, aggression and even sleep disturbance.[15-19]

The design of the smartphones, demands the users to often hold the device with a single hand, which forces only the thumb to use the keys. Single-hand-held smartphone use compels individuals to engage in repetitive flexion/extension of the wrist. These repetitive wrist movements are involved in the etiopathogenesis of carpal tunnel syndrome.[20,21]

The pathological changes to the neck and upper extremity can significantly alter the manual dexterity. The importance of manual dexterity in dentistry is well established in literature. However, the inclusion of dexterity as one of the parameters for selecting students into dental college is still debatable.[22]

Esra Erkol Inal et al investigated the flexor pollicis longus (FPL) tendon and median nerve in 100 smartphones users by ultrasonography and found that the smartphone overuse enlarges the median nerve, causes pain in the thumb, and decreases pinch strength and hand functions.[23] Akkaya N et al performed a similar study on 149 participants and suggested that the Flexor pollicis longus tendons seem to be thicker at the mid thenar level in subjects who frequently use mobile phone texting. Because this increase in thickness parallels the number of messages per day.[24] In literature the effects of over usage of smartphone on the anatomical structures is well documented. However, the effect of the smart phone usage on the manual dexterity level among dental students is not being reported to our level.

Interestingly there are documented evidence which suggest that the use smartphone and computer can increase the manual dexterity level. Mugdha Oberoi studied the impact of smartphone addiction on Gross-Hand Dexterity in Young Adults. He concluded that the means of dexterity of severely addicted group was more than the mildly or moderately addicted groups, however, the difference was not statistically significant.[25] Smita P.Ghate et al found that mobile texters had increased finger dexterity and better audiovisual reaction time.[26]

Z. Alsafi et al investigated the effect of playing computer games and manual dexterity on catheter wire manipulation in a mechanical aortic model on 50 students. It was concluded that playing computer games is associated with better manual dexterity and ability to complete a basic interventional radiology task for novices.[27]

Similar results were observed in our study, the mobile usage time was recorded highest (2729 ± 2002 minutes) for the third-year students which corresponded to the highest dexterity score (4.00 ± 0.98). In dentistry third year is considered to be comparatively leisure year

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which could be the reason for the increased mobile usage time. It was observed that the intern students had the least mobile usage time (2160 ± 776 minutes). This could be due to various factors like preparing for competitive exams or working as assistant in dental clinics which can reduce the free time.

The mean and standard deviation dexterity score of all the participants was 3.83 ± 1.05. The dexterity of the interns was second highest among all the year which suggest that the dexterity might improve during the course of dentistry. The lowest dexterity score was recorded among the first-year students.

In spite of these observations, there was no statistical significance in the Pearson Correlation value. The increase in the mobile usage time neither has a positive or negative correlation on the dexterity value. Likewise, among each year, the difference between the usage time or the difference between the dexterity did not have any statistical significance.

Manual Dexterity have always been closely associated with improved clinical performance in dentistry yet in recent years there has been a contradiction of the same. Studies and literature review failed to confirm that those with higher aptitudes or better finger dexterity achieve superior levels of performance. Lundergan WP et al conducted a literature review and found that the complex nature of modern dental practice requires a broad range of skills that dexterity contributes only a small increment or that technical dental procedures are completely trainable in the course of dental education.[28]

Conclusion

Increased mobile usage time increases the manual dexterity score, however, it is not statistically significant. These findings are concordant with the existing literature. Further studies are required in this field at a large scale to achieve more statistically significant results. More importantly, the importance and necessity of manual dexterity in dentistry should be analysed. In future more research should be conducted to understand whether the concept of manual dexterity in dentistry is fact or myth.

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Legends Tables

Table 1: Standard Scoring Norms for the O'Connor Tweezer Dexterity Test

Men (Seconds)	Women (Seconds)	Score
- 289	- 279	7.0
290 – 333	280 – 318	6.0
334 – 393	319 - 369	5.0
394 – 479	370 - 440	4.0
480 -	441 -	3.0

Table 2: Demographic Details

S.N.	Variable		Value
1	No of students		250
	Female		147
	Male		103
2	Age	Range	17 – 25 Years
		Mean	20.3 Years
2	Mean mobile usage time for past one week in minutes		2467 ± 1199 (41.1 hours)
3	Mean mobile usage time per day in minutes		352 ± 171 (5.8 hours)
4	Mean Dexterity Score		3.83 ± 1.05

Table 3: Statistical analysis - Pearson Correlation Value

Year	Mobile Usage Time Per Week (Mean ± SD)	Dexterity Score (Mean ± SD)	Pearson Correlation Value	P-Value	Statistical Significance
First Year	2551±819	3.55 ± 0.933	0.135	0.122	No
Second Year	2493±979	3.90 ± 1.32	0.101	0.211	No
Third Year	2729±2002	4.00 ± 0.98	0.18	0.156	No
Final Year	2402±1419	3.85 ± 1.1	0.155	0.166	No
Interns	2160±776	3.86 ± 0.92	0.123	0.185	No

Table 4: Statistical Analysis – Anova Test

Variables	First Year	Second Year	Third Year	Final Year	Interns	P-Value	Statistical Significance
Dexterity Score	3.55±0.933	3.90±1.32	4.00±0.98	3.85±1.1	3.86±0.92	0.641	No
Mobile Usage Time Per Week	2551±819	2493±979	2729±2002	2402±1419	2160±776	0.518	No

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