Measurement and Co-Relation of Hand Span and Dexterity Function in Paediatric Population

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ABSTRACT

Background

The measure of handgrip strength is influenced by several factors including age, gender, different angle of shoulder, elbow,wrist and grip span . there is an optimal grip span at which maximum handgrip strength is obtained in adult.Hand span affect maximal and submaximal handgrip strengths. It was found that hand span affect grip strength, grip force and dexterity function in adult as well as geriatric population. In geriatric population hand grip function decreased with age.

Methodology

Screening was done in 3 schools near PCMC area and students were selected as per the inclusion criteria. Total 150 children's age from 6 to 16 years were selected from the convenient places. Hand span was measured in both hands (Dominant and Non-dominant) from the tip of the thumb to the tip of the small finger with the hand open as wide as possible. And the results of hand span measurement were rounded to nearest whole. The dexterity function was measured using Jebsen Taylor Hand Function Test. There were 7 subtests performed in the Jebsen Taylor Hand Function Test.

Results :

The results shows that there was a strong negative correlation between the hand span and subtest1,2,3,7 of Jebsen Taylor Hand Function test. There was a moderate negative correlation between the subtest 4,5,6 of Jebsen Taylor Hand Function test.

Conclusion :

In pediatrics, as the age increases, the hand span and hand grip strength increases but the time required to complete the subtest in Jebsen Taylor hand function test decreases. So the dexterity function improves.

Keywords : Handspan, Hand Function,Jebson Taylor Hand Function Test, Dexterity

I. INTRODUCTION

The ability to perform fine motor movement using person's hand is known as manual dexterity. An individual's ability to co-ordinate fingers & manipulate object in timely manner is the importance of dexterity[1]

Hand span is the distance between the outstretched tips of the little finger and thumb and it is used for

hand grip strength measurement[2]. the important factors affecting hand span are hand grip strength and grip span[3]. Hand grip strength is widely used test in experimental and epidermiological studies in children Jabsen hand function test assesses fine motor movements, weighted and non weighted hand function activities during performance of activity of daily living. Jebsen hand function test developed to provide a standardized and objective evaluation of fine and gross motor hand function using simulated activities of daily living[4]. Jebsen hand function test must be performed on both dominant and non dominant hand.

The test measures the time taken to perform seven hand task. The time required to complete gross motor, fine motor, weighted and non weighted activities is measured with stop watch[5]. The test is simple to administer requires approximately 15 minute to complete and use simple inexpensive and radialy available test materials.

Skilled hand use involves : the ability for one to have individual control over their fingers, a somatosensory system that can guide hand movements and the ability to react with appropriate hand configuration from sensory information .When children experience difficulties with any one of these skills, challenges can permeate in simple daily tasks involving picking up object between the thumb and index fingers[6]. As children develop and continue to experience difficulties with fine motor tasks.

Manual dexterity is very much important to do the activities in daily life. The person ability greatly impacts on performance in daily activities (bathing, grooming, eating) completing work related tasks and engaging in free activities It also serve as an indicator to academic performance (eg. Hand writing) and independent living[1].

This study gives an vivid account about dexterity as measured with jebsen hand function test across the age span 5-20 years.

Jebsen hand function test assesses fine motor movements, weighted and non-weighted hand function activities during performance of activity of daily living. Jebsen hand function test developed to provide a standardized and objective evaluation of fine and gross motor hand function using simulated activities of daily living[4]. Jebsen hand function test must be performed on both dominant and non-dominant hand.

Weighted and non-weighted hand function is assessed through: writing; turning over 3 by 5 inch card; picking up small common objects; simulated feeding; stacking checkers; picking up light object; picking up heavy object.

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II. METHODOLOGY

Sub ethical committee approved was taken prior to start the study. Screening was done in 3 schools near PCMC area and students were selected as per the inclusion criteria. Written consent was taken from the teachers and parents. Parents and teachers were briefed about study protocol.

As per the inclusion criteria 150 children's age from 6 to 16 years were selected from the convenient places.

Among all the participants 85 are pre-adolescent and 65 are adolescents. Subjects were briefed about the study protocol. Dominance was determined by asking which hand was used to write or to perform activities such as cutting or painting. While performing the test the participants should be seated in a chair in front of the table. The table should be at elbow level.

Subjects were performed activities first with dominant hand and then with non-dominant hand Subjects were performed activities first with dominant hand and then with non-dominant hand :

1. CARD TURNING
2. WRITING
3. PICKING UP SMALL OBJECTS
4. STACKING CHECKERS
5. SIMULATED FEEDING
6. LIFTING LIGHT OBJECTS
7. LIFTING HEAVY OBJECTS

DATA ANALYSIS AND RESULTS.

All the data collected, and was analysed using MEDCAL software. The seven components of the Jebson Taylor Test were analysed using Pearson correlation.

WRITING: correlation between the hand span (Dominant and Non dominant) and JTHFT (Writing). P value is 0.001, which is statistically significant. P value was <0.05 and r value was -0.7187 (dominant) -0.7389 (non-dominant) that shows strong negative correlation between the hand span and JTHFT.

CARD TURNING: correlation between the hand span (Dominant and Non dominant) and JTHFT (Card turning). P value is 0.001, which is statistically significant. P value was <0.05 and r value was -0.6616 (dominant) -0.724 (non-dominant) that shows strong negative correlation between the hand span and JTHFT.

PICKING UP SMALL OBJECTS: correlation between the hand span (Dominant and Non dominant) and JTHFT (Picking up small common object). P value is 0.001, which is statistically significant. P value was <0.05 and r value was -0.6144 (dominant) -0.6771 (non-dominant) that shows strong negative correlation between the hand span and JTHFT.

STACKING CHECKERS: correlation between the hand span (Dominant and Non dominant) and JTHFT (Stacking checkers). P value is 0.001, which is statistically significant. P value was <0.05 and r value was -0.6144 (dominant) -0.6771 (non-dominant) that shows strong negative correlation between the hand span and JTHFT.

SIMULATED FEEDING: correlation between the hand span (Dominant and Non dominant) and JTHFT (Simulated feeding) . P value is 0.001, which is statistically significant. P value was <0.05 and r value was -0.5065 (dominant) -0.582 (non-dominant) that shows moderate negative correlation between the hand span and JTHFT.

PICKING UP LIGHT OBJECTS: correlation between the hand span (Dominant and Non dominant) and JTHFT (Picking up light object) . P value is 0.001, which is statistically significant. P value was <0.05 and r value was -0.5065(dominant) -0.582 (non-dominant) that shows moderate negative correlation between the hand span and JTHFT.

PICKING UP HEAVY OBJECTS: correlation between the hand span (Dominant and Non dominant) and JTHFT (Picking up heavy object). P value is 0.001, which is statistically significant. P value was <0.05 and r value was -0.6098 (dominant) -0.627 (non-dominant) that shows strong negative correlation between the hand span and JTHFT.

	HAND SPAN	JEBSON TAYLOR TEST						
			WRITING	CARD TURNING	SMALL OBJECT	STACKING CHECKERS	SIMULATED FEEDING	LIGHT OBBJECTS	HEAVY OBJECTS
MEAN	DOMINANT	14.44	46.57	4.435	4.313	4.361	11.05	4.127	4.74
	NON DOMINANT	14.43	59.75	4.732	4.585	4.656	12.05	4.414	4.74
SD	DOMINANT	2.73	18.33	1.134	0.9756	0.7278	1.464	0.7377	0.8074
	NON DOMINANT	2.74	19.25	1.094	0.9627	0.7195	2.02	0.722	0.8079
r	DOMINANT		-0.7187	-0.6616	-0.6144	-0.3783	-0.5065	-0.4802	-0.6098
	NON DOMINANT		-0.7389	-0.724	-0.6771	-0.4479	-0.582	-0.4794	-0.627
p VALUE	DOMINANT		0.001	0.001	0.001	0.001	0.007	0.001	0.007
	NON DOMINANT		0.001	0.001	0.001	0.001	0.004	0.001	0.001

III. DISCUSSION

The nervous, muscular, skeletal and sensory system all undergo age related changes that can influence the functional abilities of the hands.

In this study hand span was correlated with seven subtest of JTHFT for both dominant and non-dominant hand. It concluded that as the hand span increases, hand grip strength increases and time required for completing JTHFT decreases.

Also the normative values of Hand Span and Jebsen Taylor hand function test were developed in the present study. Children aged 6 to 16 (preadolescent and adolescent) n = 150

Kun-His Liao (2016) concluded that hand grip strength was influenced by hand size and grip span in both hands. This results supports our study to prove that there is strong correlation between hand span and dexterity functions in both the hands.

First subtest WRITING shows the strong correlation, as the hand span increases, grip strength of extensor carpi radialis longus, brevis, thenar and hypothenar muscles increases. That means if one variable increases other variable decreases. In our study hand span increases with the age and time required for JTHFT (writing) decreases. The r value shows that strong correlation between hand span and dexterity function.

Second subtest CARD TURNNING shows the strong correlation, as hand span increases, hand grip strength to turn the card increases. P value is 0.001, which is statistically significant. That means if one variable increases other variable decreases. In our study hand span increases with the age and time required for JTHFT (Card turning) decreases. The r value shows the strong correlation between hand span and dexterity function.

Third subtest (PICKING UP SMALL COMMON OBJECT) shows strong correlation, as hand span increases grip strength of flexor digitorum superficialis and profundus increases to hold the object. That means if one variable increases other variable decreases. In our study hand span increases with the age and time required for JTHFT (Picking up small common object) decreases. The r value shows that moderate correlation between hand span and dexterity function.

Fourth subtest (STACKING CHECKERS) shows strong correlation, as hand span increases, grip strength increases In our study hand span increases with the age and time required for JTHFT (Stacking checkers) decreases. The r value shows that moderate correlation between hand span and dexterity function.

Fifth subtest (SIMULATED FEEDING) shows that correlation between the hand span (Dominant and Non dominant) and JTHFT (Simulated feeding). In our study hand span increases with the age and time required for JTHFT (Simulated feeding) decreases. The r value shows that moderate correlation between hand span and dexterity function.

Sixth subtest (PICKING UP SMALL OBJECT) shows that correlation between the hand span (Dominant and Non dominant) and JTHFT (Picking up light object). In our study hand span increases with the age and time required for JTHFT (Picking up light object) decreases. The r value shows that moderate correlation between hand span and dexterity function.

Seventh subtest (PICKING UP HEAVY OBJECT) shows that correlation between the hand span (Dominant and Non dominant) and JTHFT (Picking up heavy object) . P value is 0.001, which is statistically significant. In our study hand span increases with the age and time required for JTHFT (Picking up heavy object) decreases. The r value shows that moderate correlation between hand span and dexterity function.

IV. CONCLUSION

In pediatrics hand span and dexterity function has moderate to high positive correlation. As the age increases hand span increases, hand grip strength increases and time required to complete the subtest in Jebsen Taylor hand function test was decreases.

V. LIMITATIONS

One of the limitations of the study is that the Sample size is small. The Study setup was conducted in limited area.

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