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EFFECT OF HAND GRIP EXERCISE ON FINGER DEXTERITY IN GERIATRIC POPULATION USING NINE-HOLE PEG BOARD TEST: A PILOT STUDY

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ABSTRACT

Hands are used to grasp, move and exert force to perform various functions. Human manual function is largely reflected by skillful use of the fingers in grasping, lifting, and manipulating objects between the pulps of thumb and one of the four fingers. Its dysfunction exerts a direct impact on functional independence. Elderly individuals have great difficulties in their daily life due to age related loss of manual dexterity. A pilot study was conducted to observe the effect of hand grip exercises on finger dexterity in 20 geriatric individual aged 65 to 75 years with right handed dominance. These individuals were assessed for finger dexterity pre and post exercise intervention for a week. Outcome measures used were Finger dexterity score in seconds with nine-hole pegboard test and grip strength in kilograms with hand dynamometer. Statistical significant improvement in dexterity scores and grip strength were observed in all the participants. Post exercise intervention utilized in this scenario has effectively improved the finger dexterity in elderly which can be helpful to improve their quality of life and confidence.

KEYWORDS: ***Elderly, dexterity, nine-hole pegboard, grip strength, hand grip exercises.***

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INTRODUCTION

The hand is considered as the most important tactile organ and an important creative tool for nonverbal communication. Hands are used to grasp, move and exert forces to perform various functions.[1] Fine motor skill by hand is required for various activities of daily living. Whole-arm coordination, eye-head coordination, visual acuity, and muscle strength are important factors for well-coordinated upper extremity function.[2] The hand is capable of performing extremely fine, sensitive movements as well as executing tasks that require considerable strength. Functions of the hand and manual dexterity determines the quality and performance of a person in work-related activities of daily living and recreational activities,[1.1]Fine and skillful voluntary movements used to manipulate small objects during a specific task is called dexterity. Manual dexterity is the ability to execute controlled, accurate, and coordinated movements using the hand and fingers in daily activities such as writing, chopping, and knitting.[3] Hand dysfunction exerts a direct impact on functional independence. Several age-related neurological changes especially after the age of 65 are well documented in elderly leading slowness of movement, gait, reduced muscle strength, sensation and impaired dexterity.[1] Ranganthan et al reported a decline in finger and hand muscle strength, and the maintenance of a steady precision pinch posture in healthy elderly subjects in comparison to young subjects.[4] Elderly individuals show a disproportional loss of strength in the intrinsic hand muscles compared with the extrinsic hand flexors.[5- 7] Imbalance between the strength of these muscle groups impairs the ability of elderly individuals to stabilize the total force and total moment of force in multi-finger tasks as well as to the decrease in dexterity with aging.[7, 8] The loss of fine manual dexterity puts severe impact on the activities of daily living in older adults. Reduced dexterity limits the ability of elderly to perform basic tasks such as moving objects, getting dressed, eating, and writing, and hence affects quality of life.[3] Dexterity can be assessed by various assessment tools like nine hole pegboard test (NHPT)9, Jebsen hand function test[10], Chopsticks Manipulation Test[1o], Williams Doors[11], Purdue pegboard test[9,12], Bruininks-Oseretsky Test[13], Grooved pegboard test[13]. Finger dexterity & hand grip strength assessment is useful to have an idea of hand function. In this study an attempt was made to observe the effect of hand gripping exercise on the finger dexterity Finger dexterity was assessed by using nine hole pegboard test & grip strength is measured with Jamar hand dynamometer. The objectives of the study were: 1) to measure and compare the pre and post exercise finger dexterity score in seconds by using nine holes peg board test. 2) To measure and compare the pre and post exercise intervention hand grip strength in kilogram by using the hand dynamometer.

MATERIALS AND METHOD

A pilot study was conducted at V.S.P.M's Physiotherapy, Nagpur, Maharashtra, India after obtaining permissions from head of the institution and Ethical Committee of V.S.P.M's College of Physiotherapy, Nagpur. 20 older adults aging from 65 to 75 years were selected through convenient sampling. The inclusion criteria for the study were the elderly individuals of either sex with right handed dominance aging from 65 to 75 years. The Exclusion criteria for the study were the individuals with left handed dominance, uncorrected vision or serious visual impairment, significant cognitive impairments dizziness or other vestibular impairment, and a history of severe alcohol or medication abuse, any neurological or musculoskeletal condition causing problem in hand movements and hand deformity. Materials/equipment used in the study was: Nine Hole Peg Board (figure 1) to measure the finger dexterity in sec; Jamar hand dynamometer (figure 2) to measure the grip strength in kg; Stopwatch to record the time taken (figure 3); weighing machine to measure the body weight in kg and Stature meter to measure the height in cm. gripper (figure 4) for hand grip exercise.

Figure 1
Nine Hole Pegboard

Figure 2
Jamer hand Dynamometer

Figure 3
Stop Watch

Figure 4
Hand Gripper

Outcome measures used were nine-hole pegboard test score in seconds and Grip strength in kilograms.

Method

20 right handed elderly individuals (10 males and 10 females) fulfilling inclusion criteria were randomly selected for the study. All the subjects participating in the study were well explained about the techniques and procedures used in the study. Written consent was obtained. Demographic data was collected from all the participants: age, gender, dominance, height (cm), weight (kg). Each participant was asked to perform the Nine Hole Pegboard Test [9] to measure the dexterity score in second. Single session practice trial was given to perform the Nine Hole Pegboard Test and performance time of second trail was recorded in seconds by using the stopwatch. Then participants were assessed for grip strength with Jamar hand dynamometer. The score of three successive trials was recorded & the average score of the three trials was taken in kilograms. All the subjects were administered with one week exercise intervention.

The protocol used for exercise intervention was as follows

- Instrument: Hand gripper
- Number of repetions: 10/session
- Number of session: 5/week
- Area of exercise: dominant hand
- Time of hold: 5 second
- Measures taken : pre & post exercise intervention

Procedure

For nine hole peg test[9]

The subject was asked to seat comfortably in a chair with a nine-hole pegboard placed just in front of him/her on a table. The pegs were in a container next to the

board on the same side as the hand being tested. The subject was asked to pick one peg at a time using his dominant hand and put them into holes in any order until all the holes are filled. Then he/she was asked to remove the pegs one at a time and return them into the container. The stopwatch was started as soon as subject touches the first peg and stopped when the last peg hits the container. Time required to perform the test was recorded in seconds. Single session practice trial was given & performance time of second test was recorded. During the test if the participant dropped a peg or if the trial was interrupted in any way, then the participant was asked to stop and a new trial was initiated.

For grip strength [14, 15,]

The individual was seated in an arm chair with the shoulder adducted and neutrally rotated, elbow flexed at 90^0, forearm and wrist in neutral position.[14] Jamar hand dynamometer was set to the second handle position from the inside.[15] The subject was then asked to hold the dynamometer. The subject was positioned properly & asked to squeeze the handle to maximum of his/her capacity. The score of three successive trials was recorded.

For hand gripper exercise program [4,6,16]

The individual was seated in an arm chair with the shoulder adducted and neutrally rotated, elbow flexed at 90^0, forearm and wrist in neutral position. The subject was then asked to hold the gripper in the hand. The subject was positioned properly & asked to squeeze the gripper to his/her maximum capacity and was asked to maintain up to 5 seconds. The procedure was repeated for ten times with rest period 10 seconds for five days in a week. The statistical software SPSS version 20 was used for data analysis. Data obtaioned was statistically analyzed by using paired t-test. P-value< 0.05 was considered to be statistically significant for both the parameters.

RESULTS

Table 1
Comparison of Pre and post intervention finger dexterity score in seconds with nine holes peg board test

Finger dexterity (sec)	Mean	SD (±)	t- value	p-value
Pre-intervention	26.4	3.3	6.3	0.0001
Post-intervention	20.78	5.6		

(p < 0.05)

Table 2
Comparison of pre and post intervention hand grip strength in Kg with hand dynamometer

Grip strength (kg)	Mean	SD (±)	t- value	p-value
Pre-intervention	17.4	5.8	4.58	0.0001
Post-intervention	24.22	9.9		

(p < 0.05)

DISCUSSION

The mean ages with standard deviations for men and women participants were 69±3.24 and 70±4.12. Then they were told to do grip strength exercise with hand gripper for a week daily. At the end of one week the finger dexterity and grip strength were found increased. The study was conducted by Erikson M. et al[17] and noticed a decrease in dexterity with Perdue pegboard in healthy elderly individuals as compared to young individuals. Chiang-Soon Song[18] investigated the relationships of visual perceptual function and cognitive function with the manual dexterity with nine hole pegboard in 58 community-dwelling older adults and he observed decrease in manual dexterity due to visual perceptual impairment and cognitive dysfunction. Sara Mateos et al[15] observed single session hand training with therapeutic clay effective in improving dexterity and hand grip strength in patients with Parkinson disease. Soke F. et al[19] found reduced dexterity in geriatric population of Parkinson's disease as compared to non-geriatric. Dogu B. et al[16] found the isotonic and isometric hand exercises both effect on hand dexterity with nine hole pegboard test in rheumatoid arthritic females.

CONCLUSION

It was concluded from the study that there was significant improvement in nine hole peg board test score and grip strength and the gripping exercise found helpful in improving these parameters. Therefore in geriatric rehabilitation, the hand function exercise program should always be added to maintain and improve the skillful activities which will give them good quality and independent life. Further studies in different geriatric homes in multiple locations with multiple centric use could add further validity to this study.

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CONFLICT OF INTEREST

Conflict of interest declared none

REFERENCES

1. Carmeli E, Patish H, Coleman R. The Aging Hand. *J. Gerontol. Med. Sci*. 2003;58a(2):146-152.
2. Dayanidhi S, Valero-Cuevas FJ: Dexterous manipulation is poorer at olderages and is dissociated from decline of hand strength. J Gerontol A Biol Sci Med Sci, 2014, 69: 1139–1145.
3. Liubicich ME, Magistro D, Candela F, Rabagliett Ei, Ciairano S. Physical Activity, Fine Manual Dexterity and a Coach's Self-Efficacy in a Physical Activity Program for Older Persons Living in Residential Care Facilities. Psychology 2012:3:5, 384-392.
4. Ranganathan VK, Siemionow V, Sahgal V, Liu JZ, Yue GH. Skilled Finger Movement Exercise Improves Hand Function. Journal of Gerontology.2001.56:8, M518–M522.
5. Shim JK, Lay B, Zatsiorsky VM, Latash ML. Age-related changes in finger coordination in static prehension tasks. J Appl Physiol. 2004. 97: 213–224.
6. Shinohara M, Latash ML, Zatsiorsky VM. Age effects on force produced by intrinsic and extrinsic hand muscles and finger interaction during MVC tasks. J Appl Physiol. 2003. 95: 1361–1369.
7. Shinohara M, Li S, Kang N, Zatsiorsky VM, Latash ML. Effects of age and gender on finger coordination in MVC and submaximal force-matching tasks. J Appl Physiol. 2003. 94: 259–270.
8. Shinohara M, Scholz JP, Zatsiorsky VM, Latash ML. Finger interaction during accurate multi-finger force production tasks in young and elderly persons. Exp Brain Res. 2004. 156: 282–292.
9. Virgil Mathiowetz, Karen Weber, Nancy Kashman & Gloria Volland. Adult norms for Nine Hole Peg Test of finger dexterity. The occupational therapy journal of research 1984; 5(1): 24-38.
10. Janis Poon Yee Lam, Vincent Wong Pak Kei, Alec Wong Fong and Cecelia Li Wai Ping. A study of the hand function of Chinese elderly with and without cerebrovascular accident in Hong Kong. HKJOT 2001; 11: 26-31.
11. Sunderland A, Bowers MP, Sluman SM, Wilcock DJ, Ardron ME. Impaired Dexterity of the Ipsilateral Hand After Stroke and the Relationship to Cognitive Deficit. Stroke. 1999; 30: 949-55.
12. Smutok MA, Grafman J, Salazar AM, Sweeney JK, Jonas BS, DiRocco PJ. Effects of unilateral brain damage on contralateral & ipsilateral upper extremity function in hemiplagia. Physical ther 1989; 69: 26;195-34/203.
13. Wang YC, Magasi SR, Bohannon RW, Reuben DB, McCreath HE, Bubela DJ. Assessing Dexterity Function: A Comparison of Two Alternatives for the NIH Toolbox. J Hand Ther. 2011; 24(4): 313–321.
14. Mathiowetz V, Kashman N, Volland G, Weber K, Dowe M, Rogers S. Grip and Pinch strength: normative data for adults. Arch Phys Med Rehabil. 1985. 66: 69-72.
15. Mateos-Toset S, Sanchez T, Valenza C, Jimenez G. Effects of a Single Hand–Exercise Session on Manual Dexterity and Strength in Persons with Parkinson Disease: A Randomized Controlled TriaJournal of Hand Therapy2003.16:1:22-28.
16. Dogu B, Sirzai H, Yilmaz F, Polat B, Kuran B. Effects of isotonic and isometric hand exercises on pain, hand functions, dexterity and quality of life in women with rheumatoid arthritis. Rheumatology International. 2013. 33:10; 2625–2630.
17. Tiffin, J., & Asher, E. J.(1948). The Purdue Pegboard: Norms and studies of reliability and validity. *Journal of Applied Psychology, 32*(3), 234-247.
18. Chiang-Soon Song Relationship between visuo-perceptual function and manual dexterity in community-dwelling older adults. J. Phys. Ther. Sci.2015; 27:6; 1871–1874.
19. Soke F, Genc A, Colakoglu BD, Keskinoglu P. Comparison of hand dexterity in geriatric and non-geriatric patients with Parkinson's disease. European geriatric medicine. 2015 September, Volume 6, Supplement 1, Page S74.

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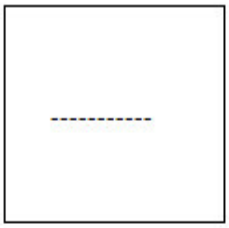

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