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ORIGINAL ARTICLE

EFFECTS OF GLOVES ON HAND COORDINATION USING JEBSEN HAND FUNCTION TEST

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Abstract

Background and purpose: Gloves are often necessary and used by the medical professionals, mechanics, cooks and in packing industries. The gloves provides protection from infections, physical harms. Some study stated that there is no differences found in grip strength and dexterity while wearing gloves. But other study stated that the type and material of glove is made up of can affects amount of force needed to grip an object. The present study is aimed when to wear the gloves and when not to wear the gloves in their work place. **Objectives of the study:** Objective of the study was to determine whether the use of gloves can affect the coordination of the hand, in a healthy population compared with no gloves using Jebsen hand function test(JHFT). **Method:** The study included fifty healthy subjects ranging between 18 to 25 years of age. Jebsen hand function test were used to observe the coordination and function of the hand with no glove and with different types of gloves. **Result:** The result showed there is better coordination found in use of surgical rubber gloves. **Conclusion:** This study concluded that surgical rubber glove shows better coordination compared with cotton knitted glove, plastic glove and no glove.

Keywords: Gloves, dexterity, coordination, Jebsen hand function test (JHFT)

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INTRODUCTION

The hand is designed for grasping, precise movements and for serving as tactile organ¹. There are 27 bones and 20 muscles and innervations from the three peripheral nerves. Hand movements and tasks are complex and often require contraction of many or most of these muscles.

Each muscle has its own functionally appropriate architecture with two common principles of motor unit organization: Small motor units are recruited before large ones and large motor units fatigue more than small units^{2,3}. In prehensive use, the hand is considered to have two parts, the thumb and the rest of the digits. Most activity combines thumb and finger prehension.

Dexterity, the ability to perform a difficult action quickly and skillfully with the hand⁴. Gloves first used by the chief nurse (Caroline Hampton) of the operating room because she developed a severe skin reaction to mercuric chloride that was used for asepsis. The Good year rubber company produce thin rubber gloves for her protection⁵.

Now a days there are more than 200 types of gloves are available in the market with an overwhelming choice of materials, designs and cost. Gloves are often necessary and can be protective. However, wrong gloves and unfit gloves become potential risk factors. If the gloves are too small, they can cut off blood circulation and increase fatigue. If they are too large, they can interfere with tactile sensibility. The loss of sensibility affects the functions of the hand^{6,7}.

Need of the Study

Gloves are commonly used by the health care professionals, cooks, mechanics, house keepers, police officers, bike and car racers where the gloves protects the arms and hands from trauma(cuts and blisters) and also from infections. The gloves are useful where dexterity is required that gloves would restrict.

The need of the study is to determine the influence or effects of gloves on hand coordination which may affect the hand function but it provides protection.

Aim and objective of The Study

The aim and objective of the study is to determine whether the use of gloves can affect the coordination of the hand, in a healthy population compared with no gloves using Jebsen hand function test(JHFT).

Hypothesis: Ho: There is no relationship between wearing gloves and hand coordination. H1: There is a relationship between wearing gloves and hand coordination.

METHODOLOGY

Study Setting : PG lab of school of physiotherapy, Vels University.

Study Duration: One time observational study.

Sample Size : 50 Healthy adult population.

Inclusion Criteria:

1. Healthy adult population
2. Age between 18 to 25 years

Exclusion Criteria:

1. Any recent orthopaedic trauma involving right dominant hand.
2. Any recent neurological condition involving right dominant hand.

Outcome Measure : Jebsen Hand Function Test.

Procedure

A small introduction about the Jebsen Hand Function Test (JHFT) and the treatment method was explained to the participants. JHFT consists of 7 sub tests. They are listed below ;

1. Writing a sentence.
2. Card turning (simulated page turning).
3. Picking up small common objects.
4. Simulated feeding.
5. Stacking checkers
6. Picking up large light objects.
7. Picking up large heavy object

Each of sub tests was designed to be administered in precisely the same manner to the each subject. The results were measured using a stop watch. Each subject will be seated with comfortable position with the chair and desk. All the 7 sub tests are tested in the same sequence which is listed above.

Sub Test 1: Writing a Sentence

Procedure: The subject is given with black ball point pen and four A4 sheets of unruled white papers fastened one on top of the other, to a clip board. The sentences to be copied has 24 letters and is of third grade reading difficulties. The sentence is typed all in capital letters and centered on a 5/8 inch index card. The card is presented with typed side facing down on a photo stand. After the articles are arranged to the comfort of the subject , the card is turned over by the examiner with an immediate command to begin. The item is timed from the word "Go" until the pen is lifted from the page at the end of the sentence.

Instruction: Do you require glasses for reading. If so put them on. Take this pen in your right dominant hand and arrange everything, so that it is comfortable for you to write with your right dominant hand. On the other side of this card (indicate) is a sentence. When I turn the card over and say "Go" write the sentence as quickly and clearly as you can using your right dominant hand. Write , do not print. Do you understand ? Ready ? Go".

Sub Test 2: Card Turning

Procedure: Five 3/5 inch cards ruled on one side only, are placed in a horizontal row 5cm apart on the desk in front of the patient. Each card is oriented vertically, 5cm from the front edge of the desk. This distance is indicated on the side edge of the desk with a piece of tape. Timing is from the word "Go" until the last card is turned over. No accuracy of placement after turning is necessary.

Instruction: Place your right dominant hand on the table. When I say "Go" use your right dominant hand to turn these cards over one at a time ,as quickly as you can beginning with this one (indicate card to your extreme left). You may turn them in any way that you wish and they need to be in a neat pattern when you finish. Do you understand? Ready ? Go".

Sub Test 3: Picking Up Small Common Objects

Procedure: An empty can is placed directly in front of the subject 5 inches from the front edge of the desk. Two paper clips (oriented vertically), two regular sized bottle caps (each, 1 inch in diameter) placed with the inside of the cap facing up and two Indian 50 paise coins are placed in a horizontal row to the right side of the can. The paper clips to the extreme right and the points nearest the can. The objects are 2 inches apart. Timing is from the word "Go" until the sound of the last object striking the inside of the can is heard.

Instruction: Place your right dominant hand on the table. When I say "Go" use your right dominant hand to pick up these objects one

at a time and place them in the can as fast as you can beginning with this one (indicate paper clip on the extreme right). Do you understand? Ready ?Go".

Sub Test 4: Simulated Feeding

Procedure: Five kidney beans are of approximately 5/8 inch length are place on a thermacoal board. A centre piece of thermacoal, 20 inches long, 2 inches high and 1/2 inch thick was fixed on the board 5/8 inches from the right end and 6 inches from the front of the board, clamped to the desk in front of the subject 5 inches from the front edge of the desk. The beans are oriented to the right of the center, parallel to and touching the upright of the board 2 inches apart. An empty can is placed centrally in front of the board. A regular teaspoon is provided. Timing is from the word "Go" until the last bean is heard hitting the bottom of the can.

Instruction: Take the teaspoon in your right dominant hand to pick up these beans one at a time with the teaspoon and place them in the can as fast as you can beginning with this one (indicate bean on extreme right). Do you understand? Ready ? Go".

Sub Test 5: Stacking Checkers

Procedure: Four standard sized (1-1/4 inch diameter) wooden carom board coins are place in front of and touching a board clamped to the desk in front of the subjects, 5 inches from the front edge of the desk. The checkers are oriented two on each side of the center in a 0000 configuration. Timing is from the word "Go" until the fourth checker

makes contact with the third checker. The fourth checkers need not to stay in place.

Instruction: Place your right dominant hand on the table. When I say “Go” use your right dominant hand to stack these checkers on the board in front of you as fast as you can like this one top of the other (demonstrate). You may begin with any checkers. Do you understand? Ready?Go”.

Sub Test 6: Picking Up Large Light Objects

Procedure: Five empty cans are placed in front of a board clamped to the desk in front of the subject 5 inches from the front edge of the desk. The cans are spaced 2 inches apart with the open end of the can facing down. Timing is from the word “Go” until the fifth can has been released.

Instruction: Place your right dominant hand on the table. When I say “Go” use your right dominant hand to stand these cans on the board in front of you like this (demonstrate). Begin with this one (indicate can on extreme right). Do you understand? Ready? Go”.

Sub Test 7: Picking Up Large Heavy Objects

Procedure: Five full cans (equal to 1 pound) are placed in front of a board clamped to the desk in front of the subjects 5 inches from the front edge of the desk. The cans are spaced 2 inches apart. Timing is from the word “Go” until the fifth can has been released.

Instruction: Now do the same thing with these heavier cans. Place your right dominant hand on the table. When I say “Go” use your right dominant hand to stand these cans on

the board as fast as you can. Begin here (indicate can on the extreme right). Do you understand ? Ready ?Go”.

RESULT

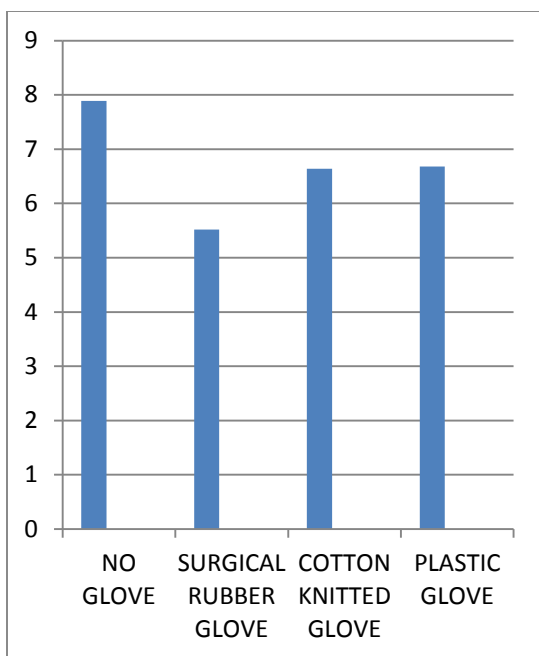
The results given in the following tables were all obtained from the data collected during the study.

The study includes fifty healthy subjects ranging between 18 to 25 years of age. Jebsen hand function test were used to observe the coordination and function of the hand with no glove and with different types of gloves.

DIFFERENT TYPES OF GLOVES	MEAN VALUE
No glove	7.89
Surgical rubber glove	5.52
Cotton knitted glove	6.64
Plastic glove	6.68

Table 1. Mean values of coordination and function of the hand with no glove and with different types of gloves users.

The result shows there is better coordination found in surgical rubber gloves.



Graph 1 Coordination of hand with no glove and with different types of gloves users

DISCUSSION

Shrawan kumar (1997)⁹, stated that the type and the material of the glove is made of can also affects amount of force needed to grip an object. Tsuyuki S et al (2016)¹⁰, from his study says that use of surgical gloves reduces nanoparticle albumin-bound paclitaxel (nab-PTX) induced neuropathy but at the same time surgical gloves decreases microvascular flow to the fingertip.

Drabek T et al (2010)¹¹, in their study 20 healthy subjects performed the grooved pegboard test by wearing different types of a

gloves in which wrong size gloves impairs manual dexterity whereas peg insertion time was not affected by wearing preferred size gloves. Hammond A et al (2016)¹², in their study 40 subjects with rheumatoid arthritis and hand osteoarthritis were wearing compression gloves at night times and placebo gloves in which compression gloves reduces finger joint swelling but also they develop pain and stiffness and no differences found in grip strength and dexterity. Tiyan Y et al (2016)¹³, in their study 10 healthy male subjects wearing gloves in a variety of simulated environments in which it affects maximum grip strength and fatigue. Ram.R.Bishu et al (2004), stated that one of the reason for reduction and performance when gloves are donned is the lack of tactile sensitivity.

Sara Mateos-toset et al (2016)¹⁴, in their study single hand exercises given for 30 subjects with Parkinson disease for 15 minutes and their dexterity tested using purdue pegboard test they showed improvement in dexterity and strength. Kizony et al (2016)¹⁵, in their the performance of tablet app-based (tap it) hand activities was affected by impaired hand dexterity in 32 healthy older adults. Daroit H.Aaron (2003)¹⁶, the aim of the Functional Dexterity Test is to measure the ability of subject to perform a dynamic 3-jaw

chuck prehension through the time manipulation of pegs in a peg board in relation to performing daily precision tasks that use 3-jaw chuck prehension. Daroit H. Aaron (2003), the Functional Dexterity Test was designed to combine 3 components of dexterity: Manipulation, Time and accuracy, and 3-jaw chuck prehension pattern. Daroit H. Aaron (2003), stated that dexterity as a component of function is defined as the ability to manipulate objects with hands.

Jebsen et al (1969)¹⁷, reports that this test may be of value in clinical or research situation by providing an objective evaluation of several major aspects of hand function and by providing objective evidence of the possible value of physical or occupational therapy, bracing, surgery or medication in improving hand function. Lynette A. Jones (1989)¹⁸, concludes the estimation of the Jebsen test, retest reliability has been obtained from a mixed sample of patients with hand disorders and those range from 0.60 to 0.99 across the seven sub test, with a mean of 0.84, indicating that this evaluation of hand function does give consistent results. Susan M. Blackmore M.S (1992), quotes that Jebsen, Taylor hand function assessment evaluates unilateral grasp and prehension patterns. Although this cannot be purchased commercially. It can be assembled

inexpensively by the therapist. Jebsen, Taylor hand function test is fast and easy to administer. Villeneuve M, Lamontagne A (2013)¹⁹, in their study 3 stroke patient participated in 3 week piano training program in which all the 3 participants showed improvement in their fine (peg test) and gross (box and block test) manual dexterity, as well as in the functional use of the upper extremity (JHFT). Reedman SE et al (2016)²⁰, concludes that good test-retest reliability for the Jebsen Hand Function Test total score to measure hand function in typically developing children aged 6 to 10 years.

Gloves are often necessary and used by the medical professionals, mechanics and in packing industries. Gloves provides protection from infections, physical harm. The present study focused on to observe the hand coordination by using different types of gloves and also aimed when to wear the gloves and when not to wear the gloves in their work place. The result shows the output of the performance of the jebsen hand function test (JHFT) with no glove and with donning each glove type. Surgical rubber gloves produces better hand coordination (5.52) in jebsen hand function test because this glove has highest friction coefficient²¹.

CONCLUSION

This study concluded that surgical rubber glove shows better coordination compared with cotton knitted glove, plastic glove and no glove.

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