

## HAND MOVEMENT ANALYSIS OF THE ELDERLY WHEN USING A REMOTE CONTROL

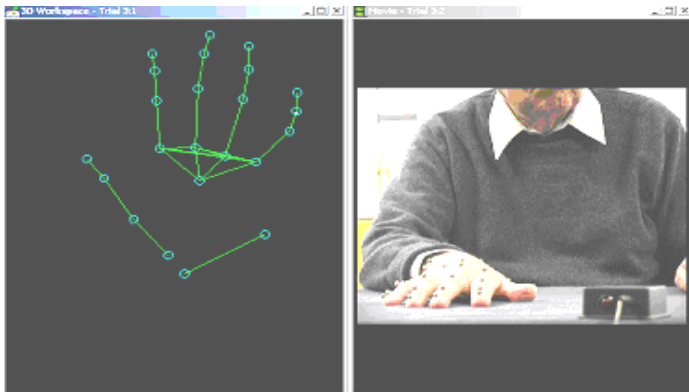
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### INTRODUCTION

Hand function decreases with age in both men and women due to age related degenerative changes in the musculoskeletal, vascular and nervous systems [1]. Functional performance in activities of daily living and recreational activity of the elderly are determined to a large degree by in-hand manipulation and dexterity. One of the most predominant activities an elderly person does is to watch television. With the advent of interactive television they are able to watch both digital TV as well as to surf the Internet, and the remote control is the way in which they are able to choose what they want to do. The aim of the current project is to study the ability of older subjects to perform basic remote control manipulations and also to specify the minimal functional requirements to perform this activity of daily living.

### METHODS

Three groups of healthy and normal to their age elderly subjects in the age range of 60-69, 70-79, 80+ years were recruited. Three-dimension biomechanical evaluation of the hand was carried out using a Vicon 612 (Oxford Metrics) motion analysis system (Figure 1a). Twenty-three, 6 mm markers were skin mounted at the mid point of each joint (Figure 1b). Subjects were asked to press a number on the remote control for a single button test or a set of three numbers sequentially for a three-button test (Table 1). Subjects preformed 10 single button tests and 10 three-button tests.

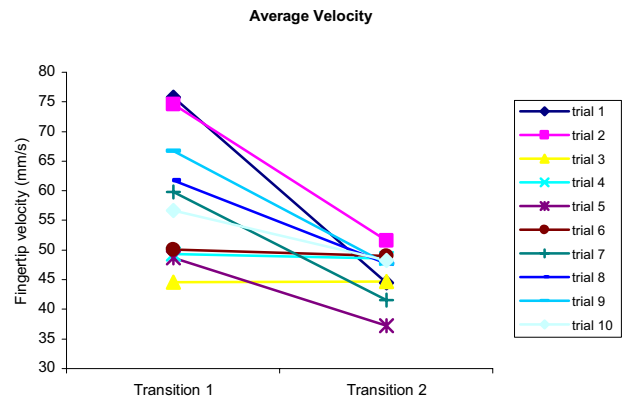


**Figure 1a** Screenshot of image from Vicon software. **Figure 1b** Video image of markers.

The infrared signal from the remote was captured by a video camera, which was in turn connected to the workstation. Digit span of up to nine numbers was assessed to check the short-term memory, and working memory was assessed with the digit span on the remote control. Digit span is the measure of how many sequential digits can be taken in, stored, processed, and recalled in the correct order. Bodybuilder software was used to process and analyze the data.

### RESULTS AND DISCUSSION

The measures that were analyzed include velocity and acceleration profiles of the tip of the finger, which is used for the desired activity. Reaction time, time of button contact and time difference between two button contacts were also looked into. The graph (Figure 2) below shows the average velocities of the fingertip between two button contacts, in the three-button test in an 80-year-old subject. Transition 1 is the period from which the fingertip goes from button 1 to button 2 and transition 2 is the period from button 2 to button 3 in the three-button test (Table 1). The graph clearly indicates that the average velocity during transition 1 is more than that of transition 2. Possible explanations include, the emphasis on the pre-planning process, online control and corrective directional measures and other strategic considerations.



**Figure 2** Average velocities during a three-button trial in an 80-year-old subject.

### REFERENCES

1. Ranganathan VK, Siemionow V, Sahgal V, and Yue GH. Effects of aging on hand function. *Journal of American Geriatric Society*, **49(11)**: 1478-84, 2001.

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
Transition 1	Button 1-2	Button 4-5	Button 7-8	Button 1-2	Button 6-1	Button 3-9	Button 3-4	Button 7-8	Button 5-8	Button 6-9
Transition 2	Button 2-3	Button 5-6	Button 8-9	Button 2-9	Button 1-7	Button 9-1	Button 4-9	Button 8-9	Button 8-2	Button 9-4

**Table 1** Details of the three-button test