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STANDING TIME WHILE ENGAGED IN AN UPPER EXTREMITY ACTIVITY VERSUS STANDING TIME WHILE NOT ENGAGED IN AN UPPER EXTREMITY ACTIVITY

by

Wendy A. Smith

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Science
Department of Occupational Therapy

Western Michigan University
Kalamazoo, Michigan
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The standing time of recent (within four weeks) cerebral vascular accident subjects while engaged in an upper extremity activity (tile trivet) was compared to the same subjects standing time while not engaged in an upper extremity activity. The subjects from a rehabilitation center ranged in age from 30 to 85 years. For each subject three sessions were randomly recorded for each condition. Lights were connected to the knee and buttock pad so that, if activated, they alerted the data collector that the subject was leaning.

The findings from this study indicated that subjects stood longer while engaged in upper extremity activity than while not engaged in upper extremity activity. However, the data were not statistically significant. The number of prompts (subject leans for more than 5 seconds) decreased each time standing without an upper extremity activity was done.
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Wendy A. Smith
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Standing time while engaged in an upper extremity activity versus standing time while not engaged in an upper extremity activity

Smith, Wendy April, M.S.
Western Michigan University, 1990
INTRODUCTION

A cerebral vascular accident (stroke) is a traumatizing insult which usually leaves the client with some mild to severe dysfunction. The client is likely to experience hemiparesis, hemiparalysis, or hemispasticity. There is a possibility of speech, swallowing, and sight problems. Cognitive, perceptual, and spatial difficulties may result in a decrease or loss in alertness, interest, and the motivation to interact with the environment. Stroke clients also may endure many physical changes which foster a decrease in self-image, self-esteem, and confidence. Since the focus of this study is on the effect of activity (the recent stroke client using her hands doing a tile trivet) on standing duration, the following literature review focuses on recommendations for types of activities and standing as treatment for stroke clients.

Pedretti (1985) recommends that the therapist use therapeutic activities as early as possible with stroke clients because these activities will not only increase alertness, interest, and motivation but will provide the client opportunities for socialization and communication. Trombly (1983) expressed a similar view when she wrote, that "Formal teaching or discussion groups fail in the initial phase of [stroke] rehabilitation because the
patient threatened by the destruction of his physical self does not have the ego strength and energy to participate and benefit...[but] purposeful activities provide evidence to the patient of his capabilities" (p. 29).

Swenson (1980) in his discussion of stroke patients states "Early standing [following the insult] helps preserve body image, spacial relationships, and promotes early restoration of physical function" (p. 331). McCormack (1985) says this position (upright bipedal static standing) is thought to be a skill of the upper trunk because it frees the upper extremities. Trombly (1983) indicates that, according to Rood's ontogenetic motor patterns, standing is to be started as a static bilateral posture, progressing to a unilateral posture, and then to weight shifting. Trombly also recommends that a craft activity be done while standing at a high table. Pedretti (1985) suggests that in the early phase of recovery the affected arm may be used as a stabilizer and later in recovery the affected arm can take an increasingly active role in bilateral activities. Activities involving the affected arm can provide the stroke client evidence of the arm's usefulness; therefore, fostering an increase in self-image, self-esteem, and confidence, along with physical benefits.

Three of the eleven benefits of passive standing listed by Stewart (1989) were treatment goals for the clients treated in this study. These are passive
prevention of contractures, improvement in joint range of motion, and reduction of spasticity. Odeen and Knutsson (1981) found that muscle stretch by weight load in standing reduced spasticity twenty-six to thirty-two percent depending on the flexion of the foot. Therefore, passive early bilateral standing can be very beneficial to recent stroke clients.

Other authors, not discussing stroke clients directly, discuss how doing activities can influence clients. Reilly (1962) stated "That man, through the use of his hands as they are energized by mind and will, can influence the state of his own health" (p. 2). Reilly also believes there is a reservoir of sensitivity and skill in the hands of man which can be tapped for his health. Her statement implies that the rich adaptability and durability of the central nervous system can be influenced by experiences. Reilly also states "man, through the use of his hands, can creatively deploy his thinking, feelings and purposes to make himself at home in the world and to make the world his home" (p. 2). This suggests that activities may be used as a media by which to enable people to interact with their environment.

Fidler and Fidler (1978) selected the word "doing" to convey a sense of performing, producing, or causing. She believes a reduction in doing generates pathology. Fidler stated "It is through such action [doing] with feedback
from both nonhuman and human objects that an individual comes to know the potential and limitations of self and the environment and achieves a sense of competence and intrinsic worth" (p. 306). Fidler also states that when one accomplishes something, that is, verifies one's competence and others give it value, one's efficacy and value as a human being is confirmed. Huss (1981) further elaborates by stating "Occupational therapy with its unique foundation of broad basic sciences that enables the occupational therapist to understand the functioning of the whole person and the importance of purposeful activity for health, can, by enabling clients to be actively involved in their program, help those individuals reach their maximum adaptive potential in whatever state of health and environment they may be, through the use of purposeful activity" (p. 580). Huss believes occupational therapists have the skills to enable clients to reach their maximum adaptive potential regardless of their state of health or their environment. Other authors describe adaption in different ways, although many contain the same major concepts. King (1978) listed four characteristics of the adaptive response as:

1. it is an active response; (2) it is evoked by the specific environmental demands of needs, tasks and goals; (3) it is most efficiently organized below the level of consciousness, with conscious attention being directed to objects or tasks; and (4) it is self-reinforcing with each successful adaptation serving as a stimulus for tackling the
next more complex environmental challenge (p. 433).

Versluys (1983) states "An adaptive response cannot truly be said to have occurred until the individual consistently carries it out in the course of ordinary activities. Thus, the occupational therapist is responsible for utilizing tasks and goal-orientated activities within a structured environment to elicit specific adaptive responses and stimulate acquisition of new habits and skills" (p. 29).

Huss (1981) believes "pure exercise without purposeful activity...does not call for organization of an adaptive response at a subcortical level" (p. 577). These authors feel an adaptive response has been elicited if the client consistently carries it out during ordinary daily activity and it is organized below a level of consciousness.

Trombly (1982), in a letter to the editor of the American Journal of Occupational Therapy regarding Huss' (1981) discussion of purposeful activity, states that Huss does not take into account that any goal to move involves an internally organized plan to move. Therefore pure exercise can be purposeful. Trombly also believes that this is an issue that stems in part from the unclear definition of purposeful, goal directed activity that excludes exercise. Other authors, to address this issue, have identified exercise as a single-purpose activity and exercise embedded in another activity as a dual or added-purpose activity (Bloch, Smith, & Nelson, 1989; Miller &

Nelson and Peterson (1989) use this terminology as they focus on therapeutic exercise demonstrating the importance of movement and motor skills in the health and well-being of the elderly person. Nelson and Peterson list five possible motives for engaging in therapeutic exercise:

(1) desire for enhanced health; (2) pleasure in the sensory experience of movement and muscle contraction for its own sake; (3) desire for the sense of autonomy that may be experienced when actual performance matches intention in movement; (4) extrinsic motivators, such as the desire to please others, the tendency to obey authority figures, or the wish to "escape" from the exercise situation to a more favored activity; and (5) pursuit of added goals in such a way that the exercise is a by-product of the activity from the exerciser's point of view (p. 3).

Nelson and Peterson (1989) also list possible motives for not engaging in the therapeutic movement: avoidance of pain and fatigue, fear of further injury, fear of failure and fear of appearing incompetent. Nelson and Peterson state that purposefulness in exercise is frequently multidimensional and that "A major part of the art of therapy is to set up (synthesize) the exercise situation in such a way as to maximize the client's motivation to engage in the exercise" (p. 14). Activities providing dual or added-purposes provide exercise while embedded in an activity which is perceived as meaningful and purposeful by the client.
Many studies have been reported in the occupational therapy literature where the differences between single-purpose (exercise) versus dual or added-purpose (purposeful activity) have been investigated. Mullins et al. (1987) conducted a study with institutionalized elderly men and women. Subjects were seen individually in their rooms where, following a demonstration, they practiced two activities; an exercise (holding arm out in front of body and moving it through shoulder flexion from approximately forty-five degrees to full range) and a stencil wall design activity (which incorporated the exercise pattern). Following the activities, each subject was asked which activity was preferred. This study examined the dependent variable of choice by the residents as it related to the independent variable of dual-purpose craft-and-exercise activity versus the single-purpose exercise activity. Choice of the dual-purpose activity approached but was not significantly greater than the choice of the single-purpose activity. The authors identified a number of factors which might have contributed to the lack of significance: the butterfly stencil design may have contributed to a feminine connotation affecting the men in the study, past experience, the individual’s perception of the two activities, time of day, winter season, presence of the researcher, and the environment.

Heck (1988) studied the effect of purposeful activity
on pain tolerance to electric stimulation with college students. The pain threshold was established by administering increasing amounts of electrical stimulation to the lower extremity of the subject until the subject indicated that a very unpleasant level of discomfort was felt. Then this threshold of pain was provided in a counter-balanced design under two conditions: as the subject used a blunt stylus to trace an X repeatedly (non-purposeful activity) and duplicated an X in as many squares as possible (purposeful activity) before being told to stop. "Dependent t-tests indicated that the mean number of seconds of electrical stimulation the subject endured while performing the purposeful activity was significantly greater than the mean number of seconds of electrical stimulation the subject endured while performing the nonpurposeful activity" (p. 580). Heck concluded that the results support the assumption that activities that are intrinsically motivating engage one's attention, and thereby, provide distraction from noxious experiences.

Kircher (1984) conducted a study involving motivation as a factor of perceived exertion in purposeful versus non-purposeful activity. The motivation was jumping with a rope (purposeful) as opposed to jumping without rope (non-purposeful). Female subjects between 19-37 years of age were instructed to jump until they felt they were working "very hard" as determined by the Borg rating scale of
perceived exertion. The heart rate increases under the two conditions using a counter-balanced design were compared. The author concluded that exertion level was perceived to be less by the subject in purposeful versus in non-purposeful activity since subject's heart rates were significantly higher when they jumped with a rope until they perceived they were working "very hard". A replication of this study by Bloch et al. (1989) supports Kircher's finding.

Miller and Nelson (1987) conducted a study with 30 female undergraduate students. The subjects were divided into two groups and asked to stir (turn a handle on a pot) for as long as they could. Subjects in the experimental group added vanilla and were told they were stirring cookie dough. Subjects in the control group were asked to stir as long as they could and no reference was made to cookie dough. The experimental group (added-purpose) stirred significantly longer than the control group (single-purpose). Yoder et al. in a replication of the Miller and Nelson study with female nursing home residents also found that the added-purpose, occupationally embedded exercise, elicited significantly more repetitions than did the rote exercise.

Thibodeaux and Ludwig (1988) in a study concerning intrinsic motivation compared sanding a cutting board (product-orientated activity) and sanding a piece of wood (non-product-orientated activity). Each subject partici-
pated in both activities. They were told to work until they felt that they were working at a rate of 15, or "hard," on the Borg scale. The number of seconds, taken to obtain "hard" on the Borg scale, was compared to the increase in heart rate, from starting to the moment when subjects perceived themselves as working "hard." Neither of the dependent variables, amount of time required nor the increase in heart rate, were significantly greater for the cutting board activity versus sanding a piece of wood. However, significantly more subjects reported that they enjoyed sanding the cutting board versus sanding a piece of wood.

The above studies were taken into consideration for the current study. Incorporated into this design were added-purpose versus single-purpose activity. Heck's (1988) results related to tolerance to noxious stimuli are relevant to this study, since standing may be difficult or painful for the stroke subjects, but the activity may provide distraction from this difficulty and/or pain.

In addition the recommendation for standing as a treatment for stroke clients is included in both independent variables. The tile trivet activity can be completed with one extremity as a stabilizer early in recovery or as a bilateral activity later in recovery as suggested by Pedretti (1985). Trombly (1983) suggested standing at a high table while doing a craft activity.
HYPOTHESES

Three null hypotheses will be tested in this study.

1. There will be no significant difference between standing while not engaged in an upper extremity activity versus standing while engaged in an upper extremity activity (tile trivet) for the duration of standing time.

2. There will be no significant difference between standing while not engaged in an upper extremity activity versus standing while engaged in an upper extremity activity (tile trivet) in number of times a light is lit (this results from pressure on pads at the knee).

3. There will be no significant difference between standing while not engaged in an upper extremity activity versus standing while engaged in an upper extremity activity (tile trivet) in number of prompts given (after the light is lit for five seconds).
METHODS

Subjects

Seven female residents of an in-patient rehabilitation program ranging from 30 to 85 years of age were subjects in this study. A subject was selected if she met the following criteria: (a) a recent (within four weeks) victim of a stroke, (b) non-dominant side was affected and dominant side was unaffected, (c) could stand at least one minute in the standing table without leaning on the knee and buttock pads, (d) could understand directions, and (e) could perform the upper extremity fine motor activity (tile trivet) as determined by previous experience with this modality.

Apparatus

Each subject stood in a specially designed standing table during each session. See Appendix A for a picture of this table. The dimensions of the counter top of the standing table are 31 by 41 inches and it adjusts from 41 to 61 inches in height. The table is enclosed on three sides. The back can be opened but has a wide board that slides across the back of the subject to secure her in the
box. This standing table was equipped with two paddle switches, one placed at the knee height and one at the buttock's level. Both switches were connected to the same light box on the back of the table. When a pad was pressed the light was activated to indicate to the observer that the subject was leaning on one or both pads. The buttock pad could be moved forward and back. The knee pad could be moved forward and back as well as up and down. These adjustments allowed accommodation for people of different heights and weights.

Procedure

Each subject stood in the standing table for a total of six times in a three week period. The data was collected by the subject's therapist and not the author. Three of the six times that subjects stood in the standing table they were engaged in the upper extremity activity (tile trivet). The other three times they stood without doing an upper extremity activity. The tile trivet consisted of a wire frame (six by eight inches) with a wood base to which up to 50 tiles are glued. After the tiles are glued grout is applied to fill in the spaces between tiles to make the surface level. After drying, the excess grout is wiped away with a damp cloth and a water sealer is applied. The subjects were used as their own control group in a counter-
balanced design. The two conditions (added-purpose and single-purpose) were randomly assigned to each subject to control for order effects. The subjects stood at the beginning of their normal treatment time. The research session was concluded when the subject said she could not stand anymore, or had leaned for more than 5 seconds on the knee and/or buttock pad and had not been able to resume independent standing after a verbal prompt. The subject and recorder were in a semi-private area (an area in the corner of the dining area facing the window) while engaged in the standing activities. The subject was asked not to talk during the session unless it directly pertained to standing or to the activity. Standing duration, number of lights, and number of prompts were measured.
RESULTS

Five of the seven subjects always showed a longer duration for standing when doing an upper extremity activity compared to standing without an upper extremity activity (tile trivet). See Appendix B. Subjects number one and four each had one occasion out of three when standing without an upper extremity activity was longer than standing while doing an upper extremity activity. For all subjects the mean from standing with upper extremity activity (mean = 13.1) was higher than standing without upper extremity activity (mean = 7.7). See Appendix C. The number of lights, activated due to leaning on the knee or buttock pad was greater each time during standing while doing an upper extremity activity (mean = 4.4) and fewer when standing without doing an upper extremity activity (mean = 4.0). See Appendix D. The number of prompts (subject leans for more than five seconds and was prompted) was also greater when standing doing an upper extremity activity (mean = 1.2) versus when not doing an upper extremity activity (mean = 0.8). See Appendix E.
DISCUSSION

In each of the seven cases the average time standing when doing an upper extremity activity was higher than the average time standing when not doing an upper extremity activity. See Appendix C. However, even though the subjects' standing time increased when doing an upper extremity activity, the hypotheses could not be tested statistically because of the small number of subjects in the study.

During the occurrences when the time standing during the upper extremity activity was less than the time standing without the upper extremity activity, one subject made a comment about not liking the tile trivet during that session. The other subject commented on not feeling well that day.

Longer duration of standing time while doing a dual-purpose activity versus a single-purpose activity was similar to other studies discussed earlier. Bloch et al., 1989; Kircher, 1984; Miller and Nelson, 1987; Mullins et al., 1987; Thibodeaux and Ludwig, 1988; and Yoder et al., 1989 reported that subjects performed a dual-purpose activity longer than a single-purpose activity.

Heck (1988) found that subjects could tolerate pain
significantly longer during what he termed purposeful activity compared to non-purposeful activity. The current study is similar in that subjects tolerated standing longer while doing an added-purpose activity.

In order to apply statistical analysis to the data more subjects were needed. This was a major limitation to this study. A similar study should be done including males and using different activities. Another limitation of this study is that only stroke clients who were residents of one in-patient rehabilitation center were included in this research.

The result that subjects lit more lights and required more prompts during standing while doing an upper extremity activity was not expected. The lights may have occurred when the subject leaned to reach for objects used in the activity. This raises a question about the goals for therapy. If the goal of therapy is to stand independently without leaning, one may not want to have the client involved in an upper extremity activity. If the goal of therapy is to stand longer even if it means leaning, then one may find it beneficial to have the client involved in an upper extremity activity while standing.

Another aspect to consider is that the clients did not get immediate feedback when they were leaning on the knee and buttock pads. A prompt was given by the data collector after the lights were lit for 5 seconds. If they leaned
only for one to four seconds to pick up something, they had no indication that they had leaned. In the future, researchers may want to look at placing the light in the subject’s view so that the subject receives more direct and immediate feedback.

In conclusion, this study provides slight support to the belief that standing duration (which can contribute to standing tolerance) is increased when a subject is involved in an upper extremity activity. However, the subjects leaned more during the standing with an upper extremity activity as indicated by more lights and prompts versus standing without an upper extremity activity.
Appendix A

Figure of Standing Table
Appendix B

Graphs for Standing Time
Graphs for Standing Time for Each of Seven Subjects for Six Session

Legend.  A=Standing Not Doing an Activity
B=Standing Doing an Upper Extremity Activity

Subject 1

(mean A=4)

(mean B=6.4)

Subject 2

(mean A=13.5)

(mean B=25.6)

Subject 3

(mean A=8.1)

(mean B=12.7)

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Subject 4

(mean B = 28.8)  
(mean A = 18.2)

Subject 5

(mean B = 7.6)  
(mean A = 3.7)

Subject 6

(mean B = 5.8)  
(mean A = 3.8)

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Appendix C

Graph for Average of All Subjects
Standing Time
Graph of the Mean Standing Time for Each of Six Sessions (N=7)

Legend. A=Standing Not Doing an Activity
B=Standing Doing an Upper Extremity Activity

(mean B=13.1)
(mean A=7.7)
Appendix D

Graph for Lights
Graph of Means for Lights for Each of Six Sessions (N=7)

Legend.  
A = Standing Not Doing an Activity  
B = Standing Doing an Upper Extremity Activity
Appendix E

Graph for Prompts
Graph of Means for Prompts for Each of Six Sessions (N=7)

Legend. A=Standing Not Doing an Activity
B=Standing Doing an Upper Extremity Activity

(mean B=1.2)
(mean A=.8)
Appendix F

Confirmation from Human Subjects
Institutional Review Board
Date: November 1, 1989

To: Wendy A. Smith

From: Mary Anne Bunda, Chair

This letter will serve as confirmation that your research protocol, "Standing Time While Engaged in an Upper Extremity Activity Compared to Standing Time While not Engaged in Activity on Two Variables: 1. Length and 2. Leaning", has been approved as expedited by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application. You must seek reapproval for any change in this design.

The Board wishes you success in the pursuit of your research goals.

xc: D. Smith, Occupational Therapy

HSIRB Project Number 89-10-11
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