

The Effect of Mode of Instructions on Training of Wheelchair Curb Negotiation and Transfers in Paraplegics

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Abstract

Background and purpose: The principles of motor learning have been used in neuro-rehabilitation for the learning and re-learning of a skill. Wheelchair skill training is one such aspect in the field of neuro-rehabilitation. As dependence on wheelchair is an important part of daily life in majority of persons with spinal cord injury an effective method of training wheelchair skills is important. The purpose of this study was to evaluate the effects of video and verbal modes of instructions on training of three important wheelchair skills. **Methods:** 30 participants with paraplegia were recruited into two groups randomly. Group one received video instructions and group two received verbal instructions for three wheelchair skills; ascending 10cm curb, descending 10cm curb and transfers. participants were given a maximum of five day training sessions. Each task was trained for 20min daily, until passed. Total training time as well as training time for each task was recorded. Success rate for both the groups was also calculated. **Results:** The video instruction group required significantly less training time as compared to the verbal instruction group for training of the three wheelchair skills. However, the success rate for both the groups came out to be 100 percent. **Conclusion:** This study provides the evidence that video mode of instruction is effective in terms of time for training of wheelchair skills in persons with spinal cord injury.

Keywords: Motor Learning; Curb Negotiation; Transfer; Spinal Cord Injury.

Introduction

The learning of motor skills can be characterized by the continuous interaction of cognitive and sensory processes with the motor processes. There is consistent evidence that motor skill performance and learning can be enhanced by giving learners instructions that direct their attention to the effects of their movements[1]. The principles of motor learning have been used for learning or re-learning of a skill [2-7]. Wheelchair skill training is one such aspect in the field of neuro-rehabilitation.

Wheelchair is among the most important therapeutic tools in rehabilitation [8-11]. Environment and personal factors as well as lesion

characteristics, impact wheelchair skill performance during and after inpatient rehabilitation [12]. A thorough mastery of wheelchair skills, combined with optimal physical capacity, can enhance mobility. Increasing physical capacity and specific wheelchair skills therefore are important goals of rehabilitation especially after SCI [13]. For many people with spinal cord injury, a wheelchair is the primary means of locomotion [15]. For these persons, wheelchair use is conditional to achieve independent mobility [14]. To function independently, manual wheelchair users must possess a variety of wheelchair skills, enabling them to deal with the physical barriers they will inevitably encounter in various environments [12-14]. Thus, mastering wheelchair skills can make the difference between dependence and independence in daily life [12-14].

However, the means by which skill acquisition and modification occurs has been the primary concern of the motor learning theorists for many years [16]. According to Newell, Magill and McCullough and Weiss, any task related information provided to the learner plays an important role in motor skill acquisition. This information can be given before the movement in the form of verbal instruction or model

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demonstrations [17]. Modeling is the primary process by which individuals imitate the observed behavior of others and potentially obtain performance proficiency with the observed behavior by doing so. Coaches' rank modeling among the most frequently used means to enhance performance. Continuing advances in video and digital technology have resulted in progressive ease and economic efficiency in using video and computer equipment for modeling [18].

There is evidence to suggest that verbal cueing will facilitate skill acquisition beyond that permitted by visual observation alone. Early research in sport pedagogy illustrated that verbal instructions are among the most common teaching behaviors (McKenzie et al). Furthermore, Newell documented that the verbal modality is especially helpful in developing recognition memory. In line with this suggestion, verbal instructions have been shown to be beneficial to the sequencing of skills during task performance [18]. However, despite good progress, there has been relatively little scientific study to date on the optimum method of teaching wheelchair skills [19]. Out of these one important but potentially dangerous skill is the curb ascent [20]. Also throughout the course of a day an individual with a spinal cord injury is required to move or transfer between his wheelchair and various surfaces including bed, chair, tub, commode, and car. Therefore, learning to perform transfers is a vital component in the rehabilitation of any patient with an SCI [21].

This study focuses on comparing the effect of video and verbal mode of instructions on training of three important wheelchair skills- curb ascent, curb descent, transfers.

Methods

Selection and Description of Participants

Thirty spinal cord injury patients were recruited from Indian spinal injury center, New Delhi, in this study. To participate, participants had to meet the following criteria: 1) participants with spinal cord injury, resulting in paraplegia [12,22]. 2) participants with ASIA impairment grade A,B,C or D [14]. 3) participants with age between 18-50 years [12]. 4) Body size that fits the wheelchair being used [20,24]. 5) Able to perform forward and reverse propulsion, right and left turns and a 5 degree incline ascent to ensure that subject had at least moderate strength, skill and coordination needed for the tasks [20,24]. 6) Untrained in transfers and curb climbing

determined by the components of Wheelchair skills test. 7) participants who were able to understand either English or Hindi language 8) participants should have a good sitting balance [25-26]. 9) Alert, cooperative and able to follow the instructions and who have given informed consent.

Procedure

A post test only experimental design was used. The study was in accordance with ethical guidelines and was approved by institutional review board. The participants were invited to participate in the study and then were randomly divided into two groups- Group 1: Video Instructions group, Group 2: Verbal Instructions group. Each group consisted of 15 participants. A detailed explanation of the procedure was given to the patients after which they signed the informed consent.

All participants were given a standardized wheelchair for the practice sessions and retention tests. The participants were trained on three tasks (acquired from the Wheelchair Skills Training Program version 1.0): ascending 10cm curb, descending 10cm curb, and transfer from wheelchair to bench and back. On day 1 before the training for 3 tasks began the participants were given a brief description about the wheelchair and its parts. A general introduction of the tasks was then provided to all the participants followed by the demonstration of the tasks by a trained therapist irrespective of their groups.

Training Protocol

The three tasks were trained on the same day. For each task the participants attended a maximum allowable of five days training sessions. Each training session lasted for 60 minutes or less (20minutes for each task). There was a single trainer for both groups. Each training session began and ended with warm-ups and cool-downs which included rolling forward and backward, left and right turns. Warm-up was followed by training of the tasks. Each of the 3 tasks was trained for approximately 20minutes. The groups received instructions based on their divisions: Group 1- Video instruction group, watched a silent video of a trained therapist performing the tasks, Group 2 –Verbal instruction group, and listened to the audio track of the instructions for the tasks. Each of the 20 minute periods of the training session for the individual task was divided into four 5 minute periods. Each period began with video demonstration for Group 1 and verbal instructions for Group 2 (taking up to 1 min) followed by the practice of the task (for the remaining

4-5min). Feedback was provided in the form of knowledge of results at the end of each period. After last period of the session a final test for that task was done. When a particular task was safely and successfully performed the training ceased, the time was recorded & retention test was scheduled.

Retention Test

The retention test was administered at least 2 days after completing the training on a particular task.²⁴ The tester was different from trainer and blinded to the particular training method. Success consisted of the subject performing the task successfully and safely twice consecutively. If the participants passed the first retention test then his involvement in the study was complete. If the participant failed the first retention test then they were referred back to the trainer for further training if they had not already had a total of five day training sessions. If successful during this subsequent training, a second and final retention test was scheduled. Regardless of the result of second retention test, the participant's involvement was complete [20,24]. A participants were considered successful only if he passed all the 3 tasks.

The training time was noted and after all the participants participation was over, success rate was calculated for the group. At the end of the training the participants were required to rate their perceived effectiveness of the given mode if instruction on a 0-100 percent scale.

Statistics

Statistics was performed using SPSS software version 10.5.

Results

Comparison of Training Time for Task 1(Curb Ascent)

The analysis of Task 1 shows that the mean training time for the task for Group 1 is 60min and that for Group 2 is 66.67(±9.76) min. Since there was no variance for number of sessions and training time in Group 1, the standard deviation for this group could not be calculated, thus the t-value for Task 1 could not be calculated. (Figure 1)

Comparison of Training Time for Task 2(Curb Descent)

The analysis of Task 2 shows that mean training time for the task for Group 1 is 40min and that for Group 2 is 42.67(±7.04) min. (Figure 1)

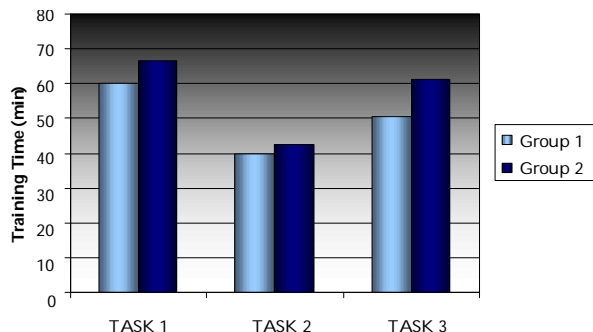


Fig. 1: Comparison of training time for Task 1 , Task 2 and Task 3 between Group 1 and Group 2

Group 1: N=15, Video Instructions Group
 Group 2: N=15, Verbal Instructions Group
 Task 1: Ascending 10cm curb
 Task 2: Descending 10cm curb
 Task 3: Transfers

Comparison of Training Time for Task 3(Transfers)

The analysis of Task 3 shows that there was a significant difference in the training time for the task for Group 1 (Mean=50.67±10.33 min) and Group 2 (Mean=61.33±5.16 min), with t=3.58 and p=.001. (Table I, Figure 1)

Comparison of Total Training Time (Task 1, 2 and 3)

The analysis of total training time shows that there was a significant difference between Group 1 (Mean=150.67±10.33 min) and Group 2 (Mean=170.67±12.79), with t=4.71 and p=.001. (Table II, Figure 2)

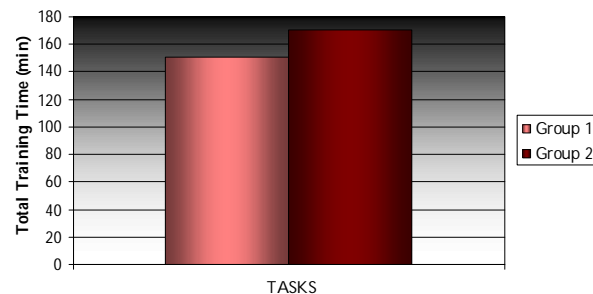


Fig. 2: Comparison of total training time between Group 1 and Group 2

Group 1: N=15, Video Instructions Group
 Group 2: N=15, Verbal Instructions Group

Success Rate

All the participants in both the groups were successful in learning all the three tasks. Hence, the success rate was 100 percent for both the groups.

Comparison of Patient's Perception for Effectiveness of the Given Mode of Instruction

There was no significant difference between the groups for patient's perception about the effectiveness of the given mode of instruction, determined by VAS in which the patient had to rate

the effectiveness on a 0-100 percent scale. For Group 1 (Mean=86.33±4.42percent) and Group 2 (Mean=85±4.22percent), with $t=.84$ and $p=.405$. (Table III, Figure 3)

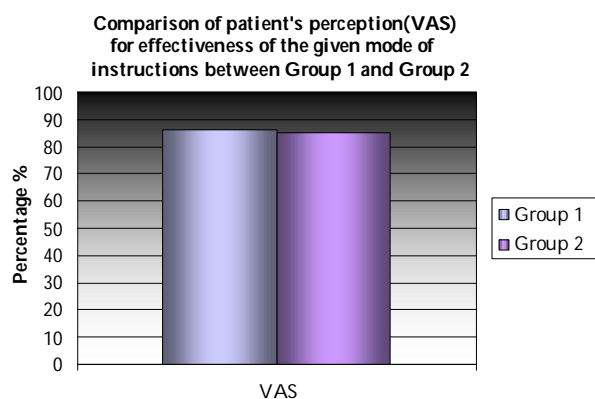


Fig. 3: Comparison of VAS between Group 1 and Group 2

Group 1: N=15, Video Instructions Group
Group 2: N=15, Verbal Instructions Group

Table 1: Comparison of training time for Task 3 (Transfers) (TT3) between Group 1 and Group 2

| Variable | Group 1 N=15 | | Group 2 N=15 | | t-value |
|--------------|-----------------|-------|-----------------|------|---------|
| | Mean | S.D | Mean | S.D | |
| TT3 (in min) | 50.67 | 10.33 | 61.33 | 5.16 | 3.58* |

*Significant at $p \leq 0.05$

Table 2: Comparison of total training time (TTT) between Group 1 and Group 2

| Variable | Group 1 N=15 | | Group 2 N=15 | | t-value |
|--------------|-----------------|-------|-----------------|-------|---------|
| | Mean | S.D | Mean | S.D | |
| TTT (in min) | 150.67 | 10.33 | 170.67 | 12.79 | 4.71* |

*Significant at $p \leq 0.05$

Table 3: Comparison of patient's perception (VAS) for effectiveness of the given mode of instructions

| Variable | Group 1 N=15 | | Group 2 N=15 | | t-value |
|----------|-----------------|------|-----------------|------|--------------------|
| | Mean | S.D | Mean | S.D | |
| VAS | 86.33 | 4.42 | 85.00 | 4.23 | 0.84 ^{NS} |

NS- Non-significant

Discussion

In the present study three important wheelchair tasks: ascending 10cm curb, descending 10cm curb, and transfers were used. The patients were divided into 2 groups; Group 1 was the video instruction group, in which the patients watched a silent video of a trained therapist performing the tasks and Group 2 was the verbal instruction group, in which the patient listened to the audio track of the instructions for the task. The three tasks used in the study were chosen because they are important [20,21] and easy to teach. The safety of the patients was given utmost importance, the therapist stood beside the patient during transferring task and a spotter strap [36] was

used during curb negotiation to prevent the patients from tipping backwards. A silent environment was preferred for the training sessions.

For task 1 (ascending curb), group 1 on an average required 60 min of training time whereas, group 2 required an average of 66.67 min of training time. This might have happened because a proper technique of curb climbing requires effective hand placements on the hand rims [25] of the wheelchair in order to apply effective forces and move the wheelchair, especially during the pop up phase in which the casters are popped onto the curb and the curb ascend phase in which the rear wheels are brought onto the curb. These important hand placements though given in the verbal instructions

might not have been effectively conveyed to the verbally instructed group, but the participants in the video instruction group might have well grasped it on seeing it. However this cannot be solely attributed to the mode of instructions alone, as this task requires a lot of strength.

It was seen that the task 2 (descending curb) was learnt early and at equally the same time by both the groups. Group 1 required an average of 40 min and group 2 required an average of 42.67min of training time. This might be because descending curb is a relatively easy task and requires lesser strength and coordination. All the participants were able to learn this task in 2 training sessions except two participants in group 2 who completed the task in 3 sessions. This might be attributed to certain subjective factors, as one of these patients reported feeling of fatigue during the training sessions.

For task 3 (transfers), a significant difference was found between the two groups on training time. Group 1 on an average required 50.67min of training time, whereas group 2 required an average of 61.33 min of training time. This might be because the task of transferring has a number of subcomponents to it. These subcomponents might have been easily grasped and remembered by the video instructed group as compared to the verbally instructed group as the patient might have got confused by so many steps and components of the task and hence leading to more time required to pass the task.

When compared on total training time required for all the three tasks, there was a significant difference between the two groups. The patients in group 1 required an average of 150.67 min of training time and that in group 2 required an average of 170.67 min of training time. This might have happened because the learners have a limited capacity to attend¹⁹ and the participants might have got overwhelmed and confused by the amount of information given to them by verbal instructions and hence might have missed upon certain important aspects of the technique required for the task. Whereas the video instructed participants might have grasped the important aspects of the technique, hence requiring lesser training time as compared to the verbally instructed group. The results of this study are supported by the study results of Saleh A. Al-Abood and K.Davids but the task used there was a dart-aiming task [16].

Also, it was found that the participants in both the groups were equally successful in all the three tasks. Hence both the groups had a success rate of 100 percent.

Finally for getting an insight into the patient's perception of the effectiveness of the given mode of instruction a VAS was administered, in which the patient had to rate the effectiveness of the mode of instruction given to them on a 0-100 percent scale. It was found that there was no significant difference between the two groups for the perceived effectiveness, but in general the patients in the video instruction group told that they quite enjoyed their training sessions.

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