

Role Of Explicit Prioritization In Improving Motor Skill Learning In Postmenopausal Women

Sunita Kumari¹,

Physiotherapist at Apollo hospital

Deepti Sharma²,

Assistant Professor, Manav Rachna International University

Deepti Parashar³,

Assistant Professor, Manav Rachna International University

Pooja Sharma⁴

Assistant Professor, Manav Rachna International University

Abstract:

AIM:

The aim of the study is to describe three approaches to train balance task- single task, dual task with variable priority and dual task with fixed priority type of instruction in postmenopausal women.

Background and purpose:

There is difference in learning of a motor skill with and without instructional set. It has been proposed that dual tasking with variable priority type instruction is better than dual task with fixed priority and single task.

Subjects:

A total of 27 post menopausal women were included in the present study. Group 1 ie. variable priority with mean age of 53.33 ± 3.39 years and BMI 23.21 ± 1.12 (kg/m^2), group 2 ie fixed priority with mean age of 53 ± 2.91 years and BMI $23.42 \pm 1.19.7$ (kg/m^2), and group 3 single task group without any prioritization with mean age 51.11 ± 1.32 years and BMI $23.25 \pm .86$ (kg/m^2).

Method:

At pretest and post test visits, participants walked on a narrow path with secondary and tone discrimination task and obstacle crossing with secondary and tone discrimination task. Practice included three session for 45 minutes per week for four weeks.

Results:

The group with variable priority improved better in narrow walking and obstacle crossing with secondary and tone discrimination task than the group with fixed priority and single task($p \leq 0.05$). learning as well as retention was found to be better in group with variable priority($p \leq 0.05$).

Discussion and conclusion:

Result suggest that the acquisition and retention of dual task skills can be aided by embedding part task training within the context of whole task (eg. Variable priority group) when compared with whole task training (eg. Fixed priority group) and single task .With training both rate of learning and level of mastery achieved during training were the result of both automatization of single task component of dual task as well as the acquisition of a generalisable task coordination or management skill.

Key words: *dual task, explicit learning, implicit learning.*

1. Introduction

Motor learning is a set of (internal) process associated with a experience leading to relatively permanent changes in the capability for responding¹.It is the process of improving motor skill through practice, with long lasting changes. The cerebellum and basal ganglia nuclei play a major role in such coordination.

Motor skill acquisition domain falls on the boundaries of instructional, specially with respect to the role that a change agent (such as teacher, instructor, or coach) may play in facilitating the acquisition of skills. This area of study is sometimes called training².

Motor learning researchers have investigated many variables to better understand how motor skill learning and performance are influenced through manipulation of environment

One area of motor learning research that has received a considerable amount of investigation in the past decade is how the focusing of learner's attention during practice influences motor performance and learning². The method that is commonly used to investigate focus of attention involves providing participants with various form of verbal instruction or augmented feedback, designed to induce either an internal or external focus of attention². Type of instruction (variable and fixed priority) play important role in acquisition of motor skill. In the variable priority condition, attention is switched between tasks whereas in fixed priority condition participants are asked to place the same amount of attention on both tasks at all times.

Dual task is the method which requires participants to perform multiple tasks simultaneously³. The ability to modulate attention may also play an important role in the acquisition of dual task coordination skill.

Menopause is a time of life with many symptoms and poor health status which affect quality of life. It is associated with various physical, psychological and social changes. Many studies have found that menopause is associated with deteriorating quality of life ⁴.

An estimated 75-85% of women experience some or all of the menopause symptoms including vasomotor disturbances (hot flushes/night sweats), fatigue, sleep impairments, mood disturbances, cognitive difficulties, musculoskeletal pain and headaches¹⁴.

Loss of balance and increased body sway are important risk factors for fall in the postmenopausal women. The age-associated increase in the incidence of osteoporotic fractures results from a combination of increased fall risk and reduced bone strength. Although various factors are associated with falls, impaired balance and mobility have been consistently identified as the main risk factors. Fall prevention should be routine in the management for postmenopausal women⁹.

Maintaining balance require both sensory as well as motor system coordination. Cognitive difficulties has been reported as one of the symptoms in postmenopausal women (hormonal)¹⁰.This may lead to compromised balance and in daily living activities. During many activities women need to perform multiple task at a time which requires a high coordination of maintaining balance as well as accomplishing the task of daily living.

Motor learning researches have investigated the learning phenomenon in children, young population, and elderly with or without balance impairment¹¹. There is dearth of study focusing postmenopausal women and effect of motor learning in this phase of various psychological disturbances.

So the objective of the study is to describe three approach to train balance task- single task, dual task with variable priority and dual task with fixed priority type of instruction in postmenopausal women.

2. Method:

Participants:

27 (9 in each group) postmenopausal women were included for the study. Group 1 ie. variable priority with mean age of 53.33 ± 3.39 years and BMI 23.21 ± 1.12 (kg/m²), group 2 ie fixed priority with mean age of 53 ± 2.91 years and BMI 23.42 ± 1.19 .7(kg/m²), and group 3 single task group without any prioritization with mean age 51.11 ± 1.32 years and BMI $23.25 \pm .86$ (kg/m²). Convenient sampling was done. The inclusion criteria for participation in the study was age 45-55, Mini Mental Status Score ≥ 24 , more than 12 months amenorrhea, able to walk for 10 meter independently and 1-5 years of post menopause. The subjects were excluded if they had any fixed deformity of lower limb, underlying neurological deficits affecting gait and balance, patient having sensory deficits of foot, uncontrolled hypertension, undergone balance training at the time of enrollment or ever had any training for balance.

3. Procedure:

We explained all procedures to parents and participants, each of whom signed a consent form prior to participation. Pretest and posttest data collections took place at session 1st and 12th of training and 1st day and 7th day post training assess immediate and delayed retention test. There were some participants who discontinued the study in between n = 3. Training session lasted for 1 hour with 45 minutes practice trial. Baseline measurement for Extended TUG, Berg balance scale, Five chair raises.

Subjects were asked to walk on 6 meter walkway with both narrow walking and obstacle crossing. For narrow width of narrow path 50% of width of ASIS was taken of all subjects. Obstacles were placed at the distance of 2 meter in total 6 meter pathway.

Group 1(Variable priority instruction): In this group subjects were instructed to switch their attention between the task ie. half of the training was done with focus on balance task and half done with a focus on cognitive task performance.

Group 2: In this group subjects were asked to place same amount of attention on both the tasks ie. motor as well as cognitive at all the time.

Group 3 performed single task of narrow walking and obstacle crossing.

Secondary task included 1)Name things/words: Patients were asked to name things such as types of flowers, states, and men’s names, 2) Counting backward (eg, by twos, threes),3) N-Back task: Patients were asked to recite numbers, days, or months backward (eg, December, November, January).

Tone discrimination tasks: Patients were asked to identify the noises or voices from a compact disc such as: 1) Identifying voices (man, woman, child) 2) Identifying noises (hand clap, door close, dog bark, cat meow).

Narrow walking and obstacle crossing with secondary and tone discrimination task:

1. Variable Priority type instruction: Following instruction were given “You have to complete narrow walking and obstacle crossing task focusing on the secondary or tone discrimination task for half (3 trials) in total of 6 trails and half of the (3 trails) focusing on motor task”.

2. Fixed priority type instruction: Following instruction were given “You have to complete narrow walking and obstacle crossing task with your focus on both cognitive and motor task equally during the all trails(6 trails).



Subject performing narrow walking with cognitive task

Subject performing obstacle crossing with cognitive task

4. Operational definition:

Variable priority: In the variable priority condition, attention is switched between tasks ie. half of the training was done with a focus on balance training and half done with a focus on cognitive task performance.

Fixed priority: Participants are asked to place the same amount of attention on both tasks at all times.

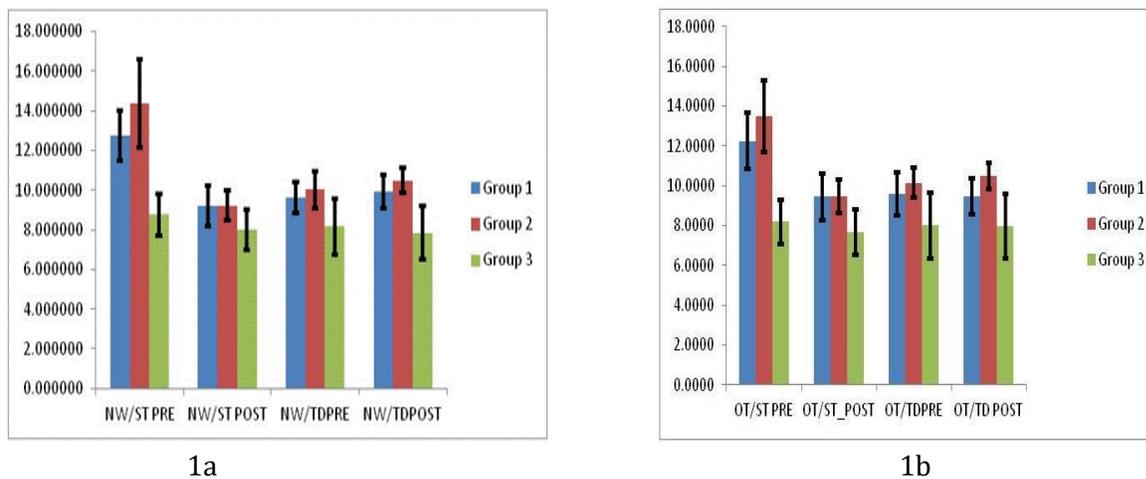
5. Outcome measures:

Primary outcome measure (motor learning): Total time taken (in seconds) to complete the task ie. Narrow walking and Obstacle crossing with secondary and tone discrimination task, immediate retention test ,delayed retention test

Secondary outcome measure (balance measures): Extended TUG, Berg balance scale, Five chair raises.

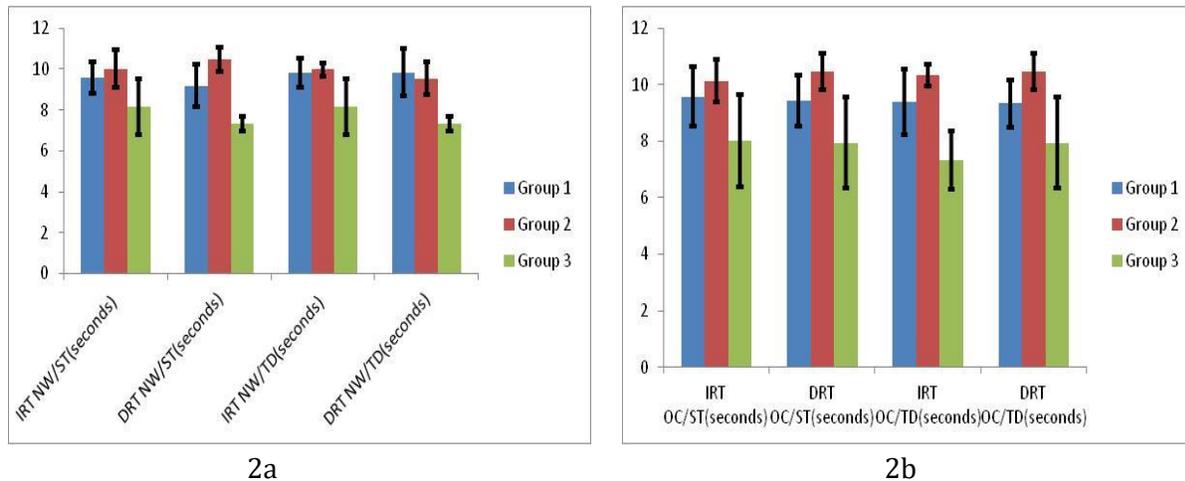
6. *Data analysis:* Paired T test and repeated measures ANOVA was used for finding difference within group and between group respectively for all the task of narrow walking and obstacle crossing and balance measures ie. BBS, TUG and Five Times Chair Raises.
7. *Results:* The Group1 (variable priority) improved and retained (immediate and delayed retention) better than Group 2 (fixed priority) and Group 3 (single task) in all task of narrow walking and obstacle training and with p value ≤ 0.05 . The percentage change in group 1,2 and 3 for BBS(4.7%,4.7% and 1.4%), TUG(14.3%,6.1% and 6% and Five Times Chair Raises(17.6%, 11.6% and 1.6%)

Figure 1: Within and Between group comparison of pre and post value of all the condition of narrow walking(1a) and obstacle crossing(1b)

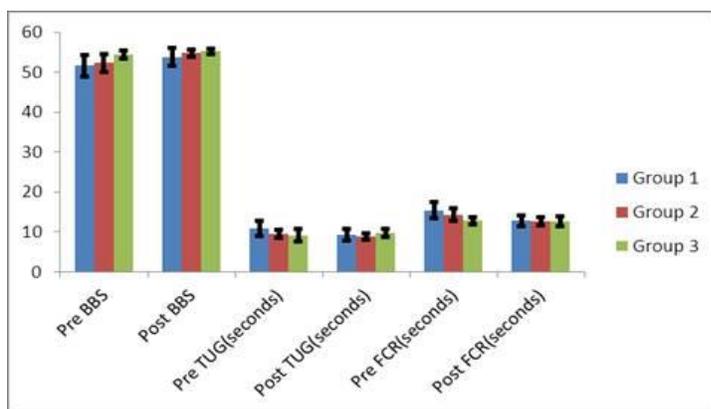


Group 1- variable priority ,Group 2- fixed priority,Group 3- single task, OC/ST- obstacle crossing with secondary task, OC/TD- obstacle crossing with tone discrimination task, NW/ST- narrow walking with secondary task, NW/TD- narrow walking with Tone Discrimination task

Figure 2: Within and Between group comparison of IRT and DRT of all the condition of narrow walking(2a) and obstacle crossing(2b)



Group 1- variable priority ,Group 2- fixed priority,Group 3- single task, , IRT- immediate retention test DRT- delayed retention test ,NW/ST- narrow walking with secondary task, NW/TD- narrow walking with Tone Discrimination task, OC/ST- obstacle crossing with secondary task, OC/TD- obstacle crossing with tone discrimination task,



Group 1- variable priority ,Group 2- fixed priority,Group 3- single task,BBS-Berg balance scale, TUG- timed up and go test, FCR- Five times chair raises

Figure 3: Between group comparison of Pre and Post intervention values of BBS, TUG and FCR.

Discussion:

The result of the present study shows significant improvement in all the group suggesting the possible benefits of motor learning. The improvement suggest the practice effect of a task.

There is consistent evidence in the motor learning literature that motor skill performance and learning can be enhanced by giving instruction to the learners that directs their attention to the effect of their movement. This study shows the same result that both group with prioritization(variable and fixed) performed better than the group with no prioritization.

In the present study group 1 with variable priority type of instruction performed better than group 2 with fixed type of instruction and group 3 with single task in all the condition of narrow walking and obstacle crossing which is in consistent with the study of Syamala et al (2012)¹³, Silsupadol et al.(2009)¹⁵ and Kramer et al (1995)³. The possible rationale behind the improvement could be the decreased processing demand to perform the task when the attention was switched between the two tasks, as was required in dual task training with variable priority instruction group. Dual task training has been used as it suggests that the sensory motor processing essential for motor control require attention resource.

Researchers found that participants in dual task training group with either variable priority or fixed priority type instruction could help to coordinate the two task. This could explain why participants with variable priority instruction group were able to learn task faster and retain it than the group with fixed priority type instruction. The benefits of variable priority training approach over fixed was demonstrated by faster mastery of the task and better performance.

Previous work of Kane and Engle(2003), Miyake et al(2000) has established working memory and response distractor inhibition as two empirically derived construct that represents aspects of executive function related to attention control¹².

The current study shows that both immediate and delayed retention was found to be better in group 1 with variable priority instruction than group 2 with fixed priority and group 3 with single task training as supported by the study of Silsupadol et al (2009)¹⁵.Result suggest that the acquisition and transfer of dual task skills can be aided by embedding part task training within the context of whole task (eg. Variable priority group) when compared with whole task training (eg. Fixed priority group).

The secondary analysis was also done to assess the effect on balance following the 4 week training period. The result was found to be non significant in contrary to the study of Silsupadol et al (2009) which found the training effect on balance impaired individuals. During the course of study some changes were also observed in balance measures in these females so to see the effect of the training on balance secondary analysis was done to document the changes in balance measures . The result was found to be statistically non significant ($p \geq 0.05$) for balance measures which is in contrary to the study of Silsupadol et al (2009) and Syamala et al (2012). The result was found to be clinically significant as group 1 with variable priority improved better than group 2 with fixed priority and group 3 with single task. Although all the group improved in measures of balance .The %age improvement in the score of Berg Balance Scale, Timed Up And Go Test(in seconds) and Five Times Chair Raises (in seconds) was found to be better in group 1 as compared to group 2 and group 3. The possible rationale behind the improvement can be explained by the principle of motor learning that skill can learned by practice.Hu and Woolcott reported improved balance as a result of exercise aimed at optimizing the interaction of visual, vestibular and somatosensory system¹³.

According to task coordination and management hypothesis coordinating and managing multiple task is crucial for dual task performance and this ability might be reduced in elderly people. These outcome suggest the condition under which balance should be trained to older individuals. Dual task training appears to be necessary to optimize stability during the performance of concurrent task

Limitation of the study: Small sample size, balance impaired female were not included so the result could not be generalized.

Future scope of the study: The influence of hormonal replacement therapy on learning can be documented in this population. Which range of age is influenced more by motor learning can be ruled out if grouping is done according to postmenopausal year.

Conclusion:

From the result of current study it can be concluded that type of instruction can be an influential factor in process of learning and it can be applied to any age group for better performance. As its effect has already been proved in elderly population with or without balance impairment and sports specific performance. With the positive result of this study type of instructions has proved to be of great importance in learning in this age group also.

Type of instruction should be a integral part of any rehabilitation programme for better performance or outcomes.

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