Floor-Rise Strategy Training in Older Adults

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OBJECTIVES: To determine the effect of a 2-week (six-session) training intervention to improve the ability of disabled older adults to rise from the floor.

DESIGN: Prospective intervention trial.

SETTING: Congregate housing in Michigan.

PARTICIPANTS: Subjects aged 65 and older who admitted to requiring assistance (such as from a person, equipment, or device) in performing at least one of the following mobility-related activities of daily living: transferring, walking, bathing, and toileting.

INTERVENTION: Participants were randomly allocated to individual training (n = 17, mean age 81) in strategies to rise from the floor (using for example, certain key intermediate body positions) or a control chair-based flexibility intervention (n = 18, mean age 80).

MEASUREMENTS: At baseline and postintervention, residents were queried regarding their rise difficulty (difficulty scale) and symptoms (symptoms scale) associated with the rise and were tested in their ability to perform timed floor-rise tasks. These tasks varied in starting position (supine vs all fours) and in use of a support to assist in rising (no support, use of an end table, use of a chair).

RESULTS: Using baseline performance as the covariate, by analysis of covariance (ANCOVA), the training group showed a significant ($P < .05$) improvement in mean number of rise tasks completed (baseline mean 6.6, postintervention mean 7.3) versus essentially no improvement in the controls. Similarly, by ANCOVA, the training group (compared with controls) showed a significant ($P < .05$) improvement on the difficulty and symptoms scales. There was no intervention effect for rise time.

CONCLUSIONS: A short-term, strategy-based intervention improved floor-rise ability and perceived difficulty and symptoms associated with the rise. This approach, focusing on key intermediate body positions, may be useful in training floor-rise skills, particularly in older adults at risk for falls. **J Am Geriatr Soc 50:1702–1706, 2002.**

Key words: activities of daily living; disability; exercise

Older adults commonly have difficulty rising from the floor and, as a result, are at risk for substantial morbidity. The inability to rise after a fall is one of the most common reasons for complications in people found helpless in their homes.[1] Although most of the falls associated with the inability to rise without help (85%) are not associated with serious injury, only 49% of community-dwelling fallers are able to rise after a fall without assistance.[2] Thus, the inability to rise after a fall is not only common but is also not simply a consequence of an injury. Despite the high risk of difficulty in rising from the floor after a fall, few therapists teach older adults how to rise from the floor.[3]

In previous work, we found that older adults in congregate housing have difficulty rising from the floor.[4] Those who were able to rise used characteristic body motion patterns to facilitate the rise.[5] We then sought to determine whether we might be able to apply these findings in a controlled training program to reduce perceived rise difficulty and enhance rise performance in mobility-impaired congregate housing residents. We hypothesized that, compared with controls, residents undergoing floor-rise training would be able to complete more rise tasks and take less time in rising from the floor and report that they could perform these tasks with less difficulty and have fewer symptoms while rising from the floor.

METHODS

Subjects

Mobility-impaired older adult residents (≥65) of a congregate housing facility were eligible if they had no substan-

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tial dementia (Folstein Mini-Mental State Examination score >23[6]), were not depressed (Geriatric Depression Scale score <5[7]), were not already participating in a regular exercise program, and reported needing assistance in at least one of four mobility-related activities of daily living (ADL) tasks (transferring, bathing, toileting, or walking[8]). Using age, sex, and number of ADL dependencies as stratifiers, a computer program designed to minimize differences between groups allocated volunteers into training or control groups.[9] Forty-four volunteers were allocated, but only 35 (17 training, 18 control) completed the protocol. Of these nine dropouts, three developed an acute unrelated medical condition between allocation and posttesting; of the remaining six, three were unable to complete testing because of the extremity pain elicited by attempting to rise from the floor, and three dropped out of the training group because of extremity pain involved with the initial or intermediate positions or because they felt that they would never be able to master the rise task.

Testing

All subjects completed testing before and after a 2-week exercise program.

Floor-rise Tasks

Each subject was videotaped and timed for each of eight floor-rise trials using a hand-held stopwatch. Floor-rise tasks took place on a 1.85- by 1.2-meter designated area of a standard padded, carpeted floor. For safety, all subjects wore a gait belt during the testing period. The eight testing trials used two starting positions with three conditions for each position. The starting positions were supine and all fours (arms extended, kneeling). Subjects were instructed to rise at a comfortable rate without the use of any supports to a standing position (two trials from supine position and two trials from all-fours position, four trials total). Subjects were then allowed to place their hands on a sturdy end table (55 by 60 by 60 cm) to rise to a standing position and then on a sturdy armchair to rise to a sitting position in the armchair (one trial for table and one trial for armchair each from the supine and all-fours positions, four trials total). The supportive devices were placed on the subject's dominant hand side, 25 cm from their body, with the edge of the support in line with the subject's elbow.

Questionnaire

Before performing the floor-rise tasks described above, subjects were asked questions regarding the performance of rising from the floor (difficulty scale, 7 items) and regarding any symptoms associated with rising from the floor (symptoms scale, 8 items). The 7-item difficulty scale included the following questions. How much difficulty was encountered with getting down on the floor and picking up a small object. How much concern subjects had that they could not get up off the floor. How quickly the subject could rise from the floor. How important was using a particular strategy to rise from the floor. How much a piece of furniture was needed to help rise from the floor. How much difficulty was encountered when using a piece of furniture to help rise from the floor. How much difficulty was encountered when no furniture was available to help rise from the floor. For the 8-item symptoms scale, subjects were asked whether the following conditions would contribute to their difficulty in rising from the floor: lack of leg strength, lack of arm strength, unsteadiness, trouble maintaining balance, knee pain, hip pain, back pain, and concern with falling and hurting oneself. Each scale item was scored from 1 to 4, with 1 representing unimpaired scores (such as no difficulty rising or no lack of leg strength to rise) and 4 representing impaired scores (such as unable to rise, or insufficient leg strength to rise). As evidence of internal consistency, Cronbach's alpha for the difficulty scale and the symptoms scale were 0.90 and 0.86, respectively. Test-retest reliability of the questionnaire on a previous congregate housing resident cohort (n = 45) was assessed to be adequate (e.g., $r = 0.9$ for difficulty scale). Statistically significant correlations ($r = 0.5–0.8$) were found between mean item scores for the difficulty scale and mean item scores for the symptoms scale and between mean item scores for both scales and performance (mean number of tasks completed and, if completed, mean rise time per task).

Data Analysis

Mean number of floor-rise tasks completed and, if completed, mean rise time per task were analyzed for a group (training vs control) effect by covarying baseline performance and using analysis of covariance (ANCOVA) to compare postintervention values. Similar analyses were performed for mean item scores for the difficulty scale and the symptoms scale separately.

Interventions

Both groups met for 45 minutes three times per week for 2 weeks (six sessions total).

Floor-Rise Training Group

The overall goal of the training was to master the components of the floor-rise strategy and to complete the floor rise. The training program consisted of six 45-minute sessions of individual training with an exercise trainer under the supervision of a physical therapist. The physical therapist first assessed subjects for their native floor-rise strategy, looking particularly at issues of safety, instability during the rise, potential strain on the low back and legs, and the use of certain key body positions during the rise (termed "intermediate positions"[5]). The therapist also noted any unnecessary or inefficient strategies and the fluidity of the movement. Based on each subject's performance difficulty and self-selected strategy, a new strategy was selected that increased rising efficiency, limited the strain on the body, increased subjects' awareness of their ability, and used the remaining strengths of the subject. During each subsequent session, key areas of impairment were considered in selecting floor-rise-related exercises, such as poor balance, strength deficits, and failure to remember the strategy. In each session, the subject was asked to review the new strategy orally, practice the strategy in its entirety, practice components of the strategy (particularly the components that gave that individual the most difficulty), and again practice the entire floor rise. The exercises were geared toward increasing floor-rise ability at the current level of function with a challenge to move to the next level. That is, if a subject required the use of a support, the exercises were based on using a support, but the subject was also challenged to rise without support when appropriate. Before training, for unsupported rises from a supine position, nearly two-thirds of the training group initially moved to a side-lying position (although many of them sat up before moving to side lying), then to an all fours position, to a kneeling position, and to plantigrade (walk hands up thighs) to stand. The most common strategy that was then subsequently trained (in more than three-fourths of the group) was to move from supine to prone, to an all fours position, to a single leg kneel, and to plantigrade to stand. Typical inefficiencies included the lack of a set strategy (with multiple attempts using different unfocused strategies) and stressing the lower back while moving from supine to sitting with legs extended (vs rolling to the side).

Controls

The controls participated in a group chair-based flexibility program consisting of gentle neck, trunk, and extremity movements led by an exercise trainer. These exercises included elbow flexion and extension, arm abduction and adduction movements (swings), shoulder shrug and roll, hip adduction and rotation (cross leg while extended), knee flexion and extension (kicks), ankle plantar and dorsiflexion (lifting and lowering heels while feet are in contact with floor), and gentle trunk motions (twist at waist, gentle bending forward, backward and to each side).

RESULTS

Seventeen training (13 female) and 18 controls (13 female) completed the protocol and did not differ significantly in mean age ± standard deviation (training 81 ± 6, controls 80 ± 7) or mean number of ADL disabilities (training 2.0 ± 1.7, controls 1.7 ± 1.7).

Ability Data

Mean number of floor-rise tasks completed (out of a total of eight tasks attempted) at baseline and postintervention appears in Figure 1. Using baseline performance as the covariate, by ANCOVA, the training group showed a significant ($P < .05$) improvement in rise ability (baseline mean 6.6, postintervention mean 7.3) versus essentially no improvement in the controls in rise ability (baseline mean 6.1 postintervention mean 5.8). The range of tasks performed varied from four to eight tasks for baseline and postintervention and for training and control groups. Most of the intervention group changes in rise-task ability occurred in the trials without support use and did not differ by starting position (supine vs all fours).

Questionnaire Data

Mean scores per item for the difficulty scale (see Figures 2A and 2B) and the symptoms scale (see Figures 2C and 2D) show individual subject scores at baseline and postintervention, according to training and control groups. Using baseline questionnaire response as the covariate, by ancova, the training group showed a significant ($P < .05$) improvement on the difficulty scale (baseline mean 2.4, postintervention mean 1.9) and on the symptoms scale (baseline mean 2.3, postintervention mean 1.8) versus controls (difficulty scale baseline mean 2.7, postintervention mean 2.4, symptoms scale baseline mean 2.3, postintervention mean 2.1). There were no specific items in either scale that individually showed significant intervention effects.

Rise Time Data

Rise times generally did not differ across support use condition, from baseline to postintervention, and between groups. For tasks beginning in a supine position, mean rise time varied from 21 to 25 seconds at baseline and from 20 to 27 seconds postintervention. For tasks beginning in the all-fours position, mean rise time varied from 8 to 12 seconds at baseline and postintervention.

DISCUSSION

Previous studies of training older adults to rise from the floor are rare. After this controlled intervention, mobility-impaired older adults were better able to rise from the floor and reported decreased difficulty and fewer symptoms while rising from the floor. Although the improvement in ability was modest (small absolute change in number of tasks completed), a few of the intervention subjects improved in their ability to do the tasks without support. The controls made essentially no improvements on any task. As is apparent in Figure 1, some subjects in each group did not improve their rise task abilities, (i.e., they were not able to complete a rise task before training and were still unable after training). These subjects may have been limited in their

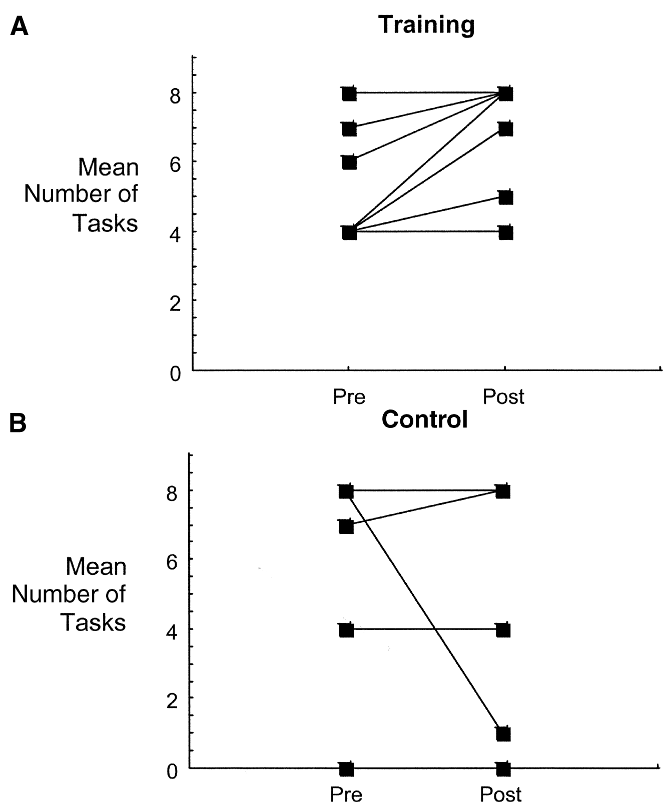

Figure 1. Mean number of floor-rise tasks completed at baseline (pre) and postintervention for (A) training group and (B) control group.

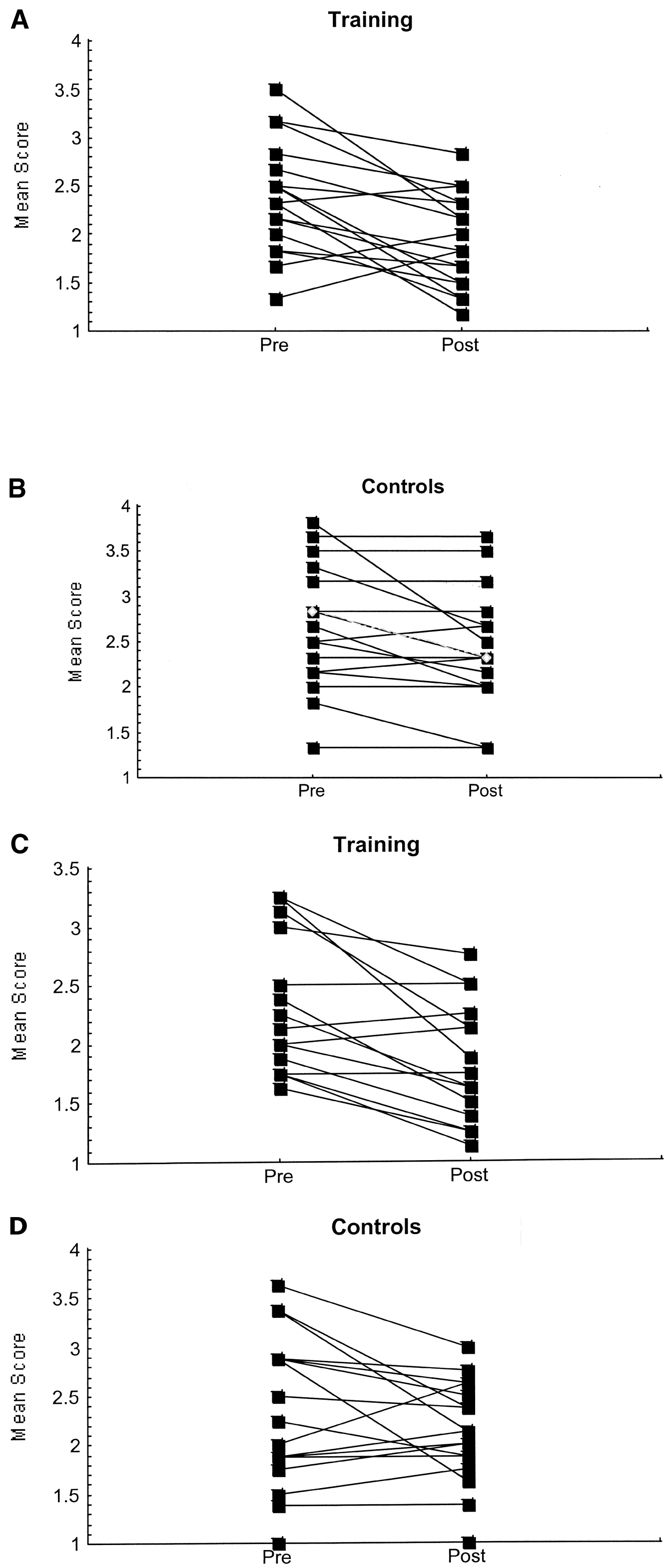

Figure 2. Mean total questionnaire scores at baseline (pre) and postintervention for the difficulty scale (A) training group and (B) control group and for the symptoms scale (C) training group and (D) control group.

rise ability by pain, weakness, or balance impairments, and the trainers had to focus on optimizing rising with the use of a support. Thus, these subjects may never be able to be trained to rise without a support. Our sample size precluded a quantitative analysis of the effect of physical impairment (such as weakness) on these study outcomes. Similarly, the relatively high number of tasks completed suggests a possible ceiling effect for some of the subjects. For example, subjects who were already able to rise without the use of a support gained no benefit from the use of the table support. Nevertheless, our choice of tasks (and the accompanying ceiling and floor effects) is justifiable given that we tried to simulate common situations that an older adult might encounter. We considered increasing the rise challenge by reconfiguring the task demand (e.g., rise as fast a possible) or by artificially simulating an acute impairment (e.g., simulating severe acute knee impairment by splinting the knee joint) but felt that these situations were too contrived and not generalizable. Certainly, the pain and joint impairment created by an acute limb (especially hip) injury would require an altered rise (and decreased unilateral weight bearing) strategy and might be a consideration for future floor-rise training studies. What is the proper rise strategy post-limb injury or even postfracture?

Training subjects, as compared with controls and baseline, also perceived better performance, less difficulty, and fewer symptoms when rising postintervention. A number of studies underscore the importance of fear of falling and have in fact demonstrated training-related reductions in fear of falling.[10,11] Although our sample size is insufficient for an item-by-item analysis, it appears that a battery of questions going beyond assessing confidence and fear might also be useful, to include assessment of perceived difficulty, performance strategy, and performance-related symptoms. Note also that the controls themselves demonstrated small improvements on the self-report scales, perhaps as a result of their flexibility training. This may suggest that the floor-rise training could have had a greater effect if a nonexercise control group had been used for comparison. Given the wide use of chair-based flexibility programs in congregate housing in our geographic area, we felt that this activity represented the standard to which other interventions should be compared.

There was no apparent training effect in rise time. In one uncontrolled study,[12] patients with Parkinson's disease reduced the time taken to rise, primarily in the time taken to reach feet-only contact with the floor, but this change was not statistically significant. It appears then that, as long as someone is able to complete the task, at least in rising from the floor, there may be a relatively constant, safe rise speed that is maintained. In addition, as we have noted previously,[4] use of a support to rise does not necessarily improve rise speed. The present training program was designed to alter rise strategy, decrease pain and effort, and improve safety, not to increase speed. Training subjects may have slowed their rise deliberately to concentrate on proper body mechanics and postural stability as taught in the floor-rise training. Training the ability to rise under a different set of scenarios at a safe speed (as we have attempted to do), such as when no support is immediately available (e.g., when attempting to rise after a fall on the street or yard), would seem to be a more important goal.

Training subjects were taught to move into the all-fours position in preparation to rise. Previously, most subjects had been observed sitting up from the supine position with legs extended, thereby placing stress on their lower back, and then moving into a side-lying position. Subjects were subsequently trained to move into a prone position, then to all fours, then to a single kneel, to plantigrade, to standing. This training maneuver may have accounted for the apparent trend (although too small for statistical analysis) in training-related improvement for rises without support, and may be a preferred strategy to use where no apparent support device is available (such as outdoors).

Future studies should consider how subjects use the support device optimally. In our testing situation, we placed the support table or chair at the subject's dominant side. The subjects might have more efficiently utilized these devices if they were placed on the nondominant side. The subject could then reach across the body with the dominant hand while rolling over, thus using the dominant hand to push on the support while rising, but, because the device was already at the dominant side, the subjects would sometimes grab the furniture with the dominant hand and not roll. Rather, they would attempt to pull themselves up to a sitting position and struggle to place their feet under them, making the effort somewhat awkward. The close proximity of the table or chair further complicated this strategy. Those who did choose to roll would subsequently use their nondominant hand to push up.

Future studies should also consider the optimal methods to train and ultimately assess improvements in task performance. The training program presented here focused on training overall strategies, particularly using key intermediate body positions, rather than merely training to reduce impairments in balance or limb strength. Floor-rise task performance degrades with increasing age and physical impairment,[4] so, for most mobility-impaired older adults, an altered rise strategy must be considered. A number of impairments (such as knee pain or poor postural control with positional changes) may singly or in combination require an overall motion strategy. Given that strategy training involves a behavioral (rather than merely strength or balance) intervention, it seems appropriate to consider behavioral (such as self-report) measures, to monitor strategy learning and competency. Generating successful movement strategies might be as effective in improving function as reversing individual impairments such as limb weakness and poor balance. To disseminate these strategies more widely, the feasibility and efficacy of teaching the most commonly used strategies might be explored in group exercise settings, such as those found frequently in congregate housing facilities.

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REFERENCES

1. Gurley RJ, Lum N, Sande M et al. Persons found in their homes helpless or dead. N Engl J Med 1996;334:1710–1716.
2. Tinetti ME, Liu WL, Claus EB. Predictors and prognosis of inability to get up after falls among elderly persons. JAMA 1993;269:65–70.
3. Simpson JM, Salkin S. Are elderly people at risk of falling taught how to get up again? Age Ageing 1993;22:294–296.
4. Alexander NB, Ulbrich J, Raheja A et al. Rising from the floor in older adults. J Am Geriatr Soc 1997;45:564–569.
5. Ulbrich J, Raheja A, Alexander NB. Body positions used by healthy and frail older adults to rise from the floor. J Am Geriatr Soc 2000;48:1626–1632.
6. Folstein M, Anthony JC, Parhad I et al. The meaning of cognitive impairment in the elderly. J Am Geriatr Soc 1985;33:228–235.
7. Sheikh JI, Yesavage JA. Recent evidence and development of a shorter version. Clin Gerontol 1986;5:165–172.
8. Smith LA, Branch LG, Scherr PA et al. Short-term variability of measures of physical function in older people. J Am Geriatr Soc 1990;38:993–998.
9. Taves DR. Minimization. A new method of assigning patients to treatment and control groups. Clin Pharm Ther 1974;15:443–453.
10. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. J Gerontol 1990;45:P239–P243.
11. Tennstedt S, Howland J, Lachman M et al. A randomized, controlled trial of a group intervention to reduce fear of falling and associated activity restriction in older adults. J Gerontol B Psychol Sci Soc Sci 1998;53B:P384–P392.
12. Yekutiel MP, Pinhasov A, Stroka H. A clinical trial of the re-education of movement in patients with Parkinson's disease. Clin Rehabil 1991;5:207–214.