

# Effects of a 12-week Exercise Intervention on Falls Risk in Community-Dwelling Older Fallers



C.J. Thompson <sup>1</sup>, A. Woodruff <sup>2</sup>, S. Simunovich <sup>1</sup>, S. Wallenrod <sup>1</sup>, T. Harrington <sup>1</sup>, R. Corn <sup>3</sup>  
 Department of Exercise and Sport Science, University of San Francisco<sup>1</sup>, YMCA of San Francisco<sup>2</sup>, PTA Global, Inc<sup>3</sup>.

## Abstract

Fully one-third of people over the age of 65 years fall annually. Risk factors for falls are numerous and include potentially modifiable physical performance parameters. Recent research has demonstrated that regular exercise can reduce the risk for future falls, but there have been very few progressive exercise program models validated for such a purpose.

**PURPOSE:** To determine if a progressive 12-week falls prevention exercise program lowers falls risk in a sample of community-dwelling older adults who have recently fallen.

**METHODS:** Fifty-four community-dwelling older adults (mean + SD, age: 78.3 + 6.8 yrs, weight: 72.6 + 15.5 kg) who had sustained at least one accidental fall in the past 6 months completed at least 83% of classes in a 12-week community-based falls prevention program held at local senior centers. Exercise classes were held two days per week for 60 minutes and included mobility exercises for the ankle, hip, thoracic spine, and shoulder; muscle strengthening exercises for the lower and upper body; and dynamic balance and gait enhancement exercises. Exercise volume and complexity progressed throughout the course of the training period. Classes were led by certified fitness professionals and assisted by undergraduate students trained by the lead researcher. Functional fitness outcomes were measured at pretest and posttest by Functional Reach Test (FRT), Timed Up-and-Go Test (TUG), and 30 Second Chair Stand Test (CS). Pre-Post comparisons were made using Paired T-Tests.

**RESULTS:** Anterior reach displacement as measured by the FRT improved significantly from pretest to posttest (21.6 + 2.0 cm to 29.3 + 2.6 cm). TUG performance improved significantly from pretest to posttest (10.4 + 2.7 sec to 9.5 + 3.2 sec). CS performance improved significantly from pretest to posttest (Exercise Group: 8.8 + 3.9 reps to 12.2 + 5.9 reps).

**CONCLUSION:** This progressive 12-week exercise program was effective at lowering falls risk among a sample of community-dwelling older adults who have recently sustained accidental falls.

## Introduction

Fully one-third of people over the age of 65 years fall annually.<sup>2</sup> Risk factors for falls are numerous and include potentially modifiable physical performance parameters such as joint mobility, muscle strength, dynamic balance, posture, and gait.<sup>14</sup> Recent research has demonstrated that exercise interventions can reduce the risk for future falls<sup>1,3,4,12</sup> but there have been very few progressive exercise program models validated for such a purpose.

Over the past 10 years, exercise program design approaches have been influenced by emerging research in kinesiology and biomechanics. It is now understood that the body must react to external forces such as gravitational force and momentum in order to exhibit adequate neuromuscular control.<sup>6,16</sup> This has led to exercise training programs that have been collectively coined "functional training". These programs involve exercises that require the body to react to external forces that may be encountered in the scope of one's life – whether it be on the athletic field or in activities of daily living.

Research from rehabilitation science has demonstrated the utility of functional training programs in the recovery from injuries to the spine and lower extremity.<sup>5,7,8,11</sup> As the data mounted suggesting the efficacy of functional training programs in athletic rehabilitation, similar programs were adopted by strength and conditioning coaches to prevent injury and improve athletic performance. There have been several recent publications where such programs have been shown to improve athletic performance in a variety of sports and age groups.<sup>9,13,15</sup>

The utility of functional training techniques may be of particular benefit in the prevention of falls in older adults because it has been previously noted that falls are often due in part to deficits in mobility, strength, balance, and gait.<sup>10</sup> These performance parameters may be effectively addressed by exercise programs that require an older individual to perform movements that integrate the task demands of maintaining balance in daily activities.

Thus, the purpose of this study was to determine the effect of a twelve-week fall prevention exercise program in a sample of community-dwelling older adults who have recently fallen.

## Methods

### Subjects

- 54 Community-dwelling Older Adults (mean+SD, age: 78.3 + 6.8 yrs, weight: 72.6 + 15.5 kg)
- Participants must be at least 65 years old
- Participants must have sustained at least one accidental fall in the past 6 months
- Participants must be able to walk at least 30 feet without an assistive device
- Participants must receive clearance from their physician to participate in this study
- Each participant had completed at least 83% of classes in a 12-week community-based falls prevention program held at local senior centers

### Testing Procedures (Pre/Post)

#### Functional Assessments

- Functional fitness outcomes were measured at pretest and posttest by:
- Functional Reach Test (FRT) – assessing limits of stability and static balance
- Timed Up-and-Go Test (TUG) – assessing agility and dynamic balance
- 30 Second Chair Stand Test (CS) – assessing lower body strength

### Data Analysis

- Pre-Post comparisons were made using Paired T-Tests.
- Data analyzed using SPSS Version 16.0 for Windows



## Training Program

Exercise classes were held two days per week for 60 minutes

Exercise sessions led by a certified fitness professional and assisted by undergraduate exercise science students

Classes included:

- Mobility exercises for the ankle, hip, thoracic spine, & shoulder
- Sensory integration exercises for balance maintenance
- Muscle strengthening exercises for the lower and upper body
- Dynamic balance and gait enhancement exercises

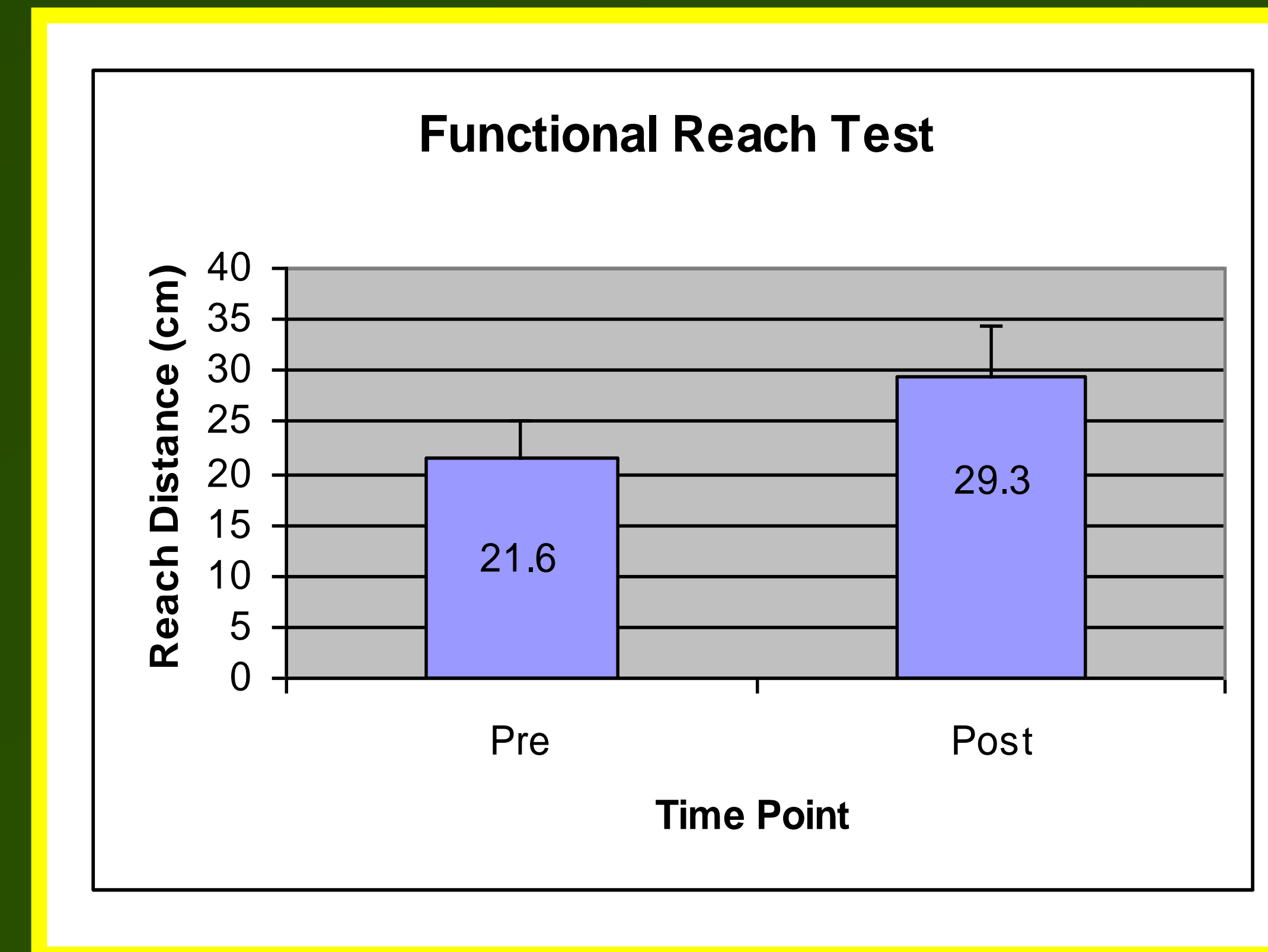
Exercise volume and complexity progressed throughout the course of the training period

- Volume progressed from week to week
- Complexity progressed at Week 5 and Week 9

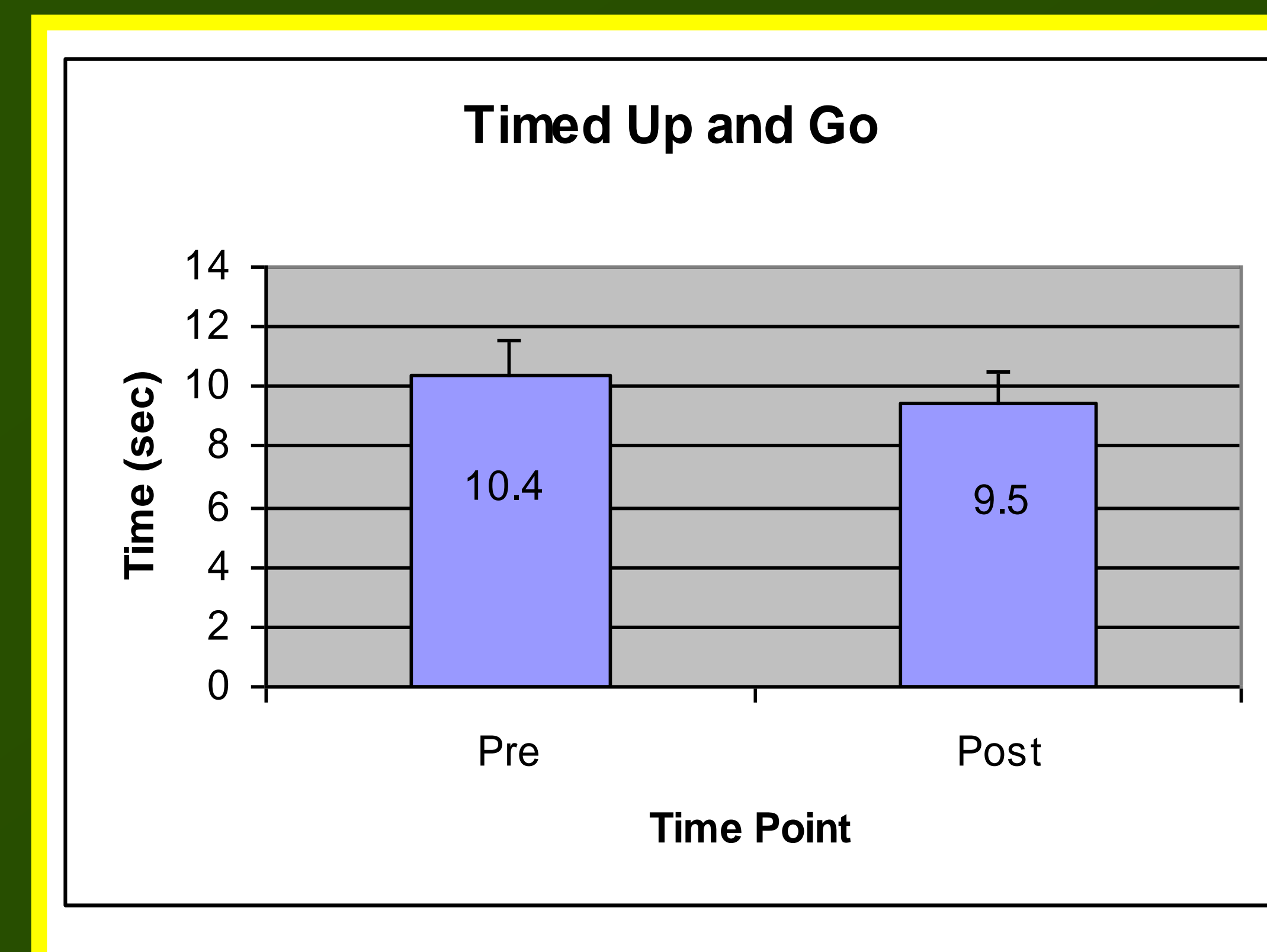
Exercise	Week 4	Week 8	Week 12
Hip Rotations	Seated 30 sec each	Seated 30 sec each	Standing 30 sec each
Stand w/ Rotating Head (eyes fixed) – 30 sec	No March	March 15 sec	March 30 sec
Chair Squats w/ Forward Reach	2x15	3x15	3x25
Dumbbell Cobra (Back)	Seated 2x15	Standing 3x15	Standing 1 Arm 3x15 each
Side Steps (Wide Steps to Feet Together)	2 steps Forward Reach 60 sec	3 steps Same Reach 90 sec	4 steps Opposite Reach 120 sec
Mobility Ladder Pattern	Forward Stepping 2x through	Alt. Wide & Narrow Steps 2x through	Diagonal Steps to 1 Leg Balance 2x through
Partner Squat & Ball Pass	Face-to-Face 1x20 each	Side-by-Side 2x20 each	Side-by-Side Low to High 2x20 each

## Results

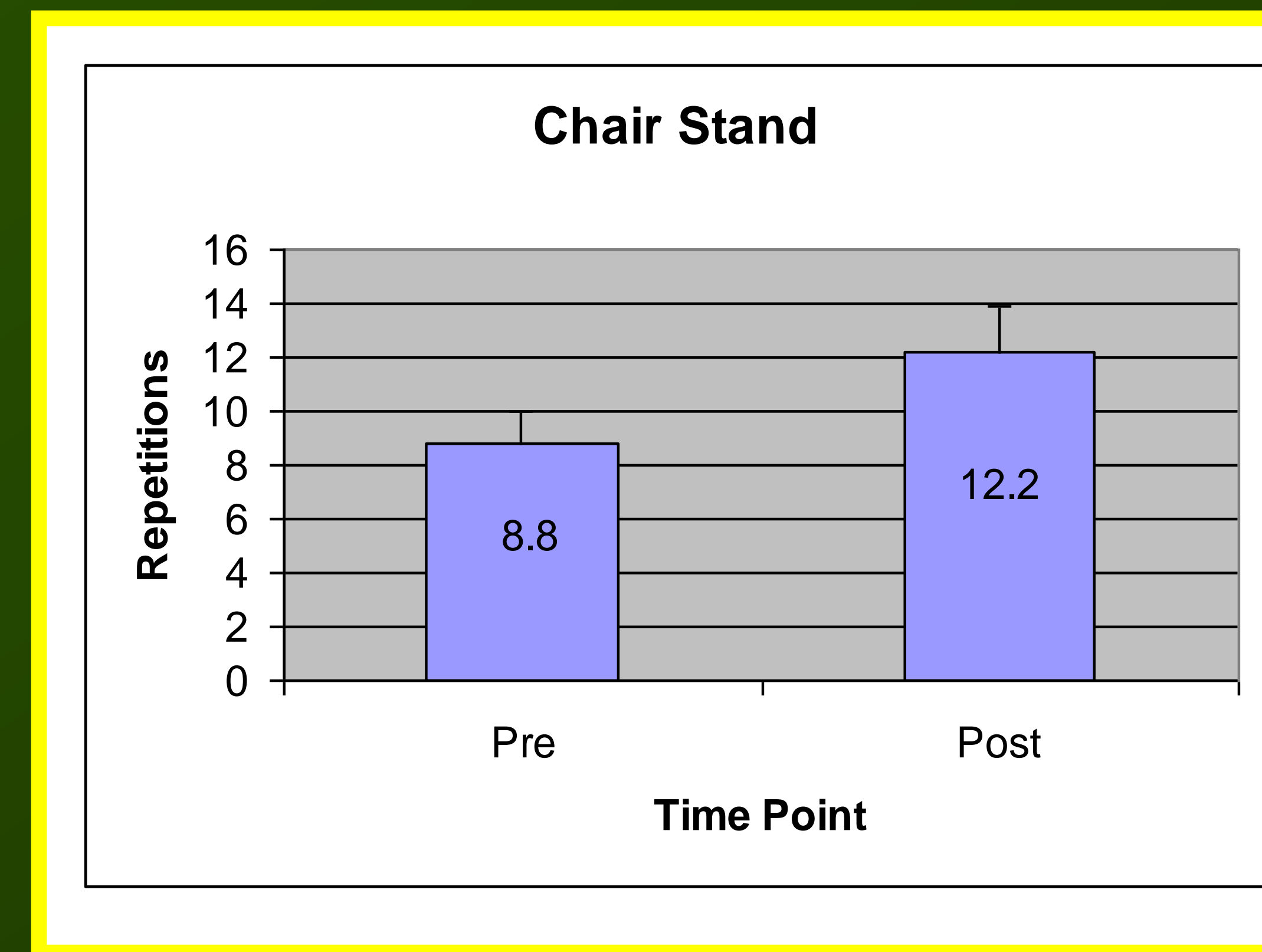
\*Anterior reach displacement as measured by the FRT improved significantly from pretest to posttest (21.6 + 2.0 cm to 29.3 + 2.6 cm)



\*TUG performance improved significantly from pretest to posttest (10.4 + 2.7 sec to 9.5 + 3.2 sec)



\*CS performance improved significantly from pretest to posttest (Exercise Group: 8.8 + 3.9 reps to 12.2 + 5.9 reps)



## Conclusions

This progressive 12-week exercise program was effective at lowering falls risk among a sample of community-dwelling older adults who have recently sustained accidental falls.

Additional research should determine the ability for this type of training to be implemented by community volunteers and senior center staff to enable sustainable programming.

Additional research should determine the effect of this type of training on reduction of falls occurrence over time.

## Acknowledgements

We would like to thank our participants for their outstanding efforts; also, our community sites where the falls prevention classes were offered: Castro Senior Center, Aquatic Park Senior Center, and Prasadio Gate Apartments; our project partners: 30<sup>th</sup> Street Senior Centers and San Francisco Senior Centers, Inc.; and the following for their assistance with the project: Trudy May, Stacie Yamasaki, Jen Dimon, Jermelle Newman, Ben Dessard, Matt Lieb, Brigitte Dubon, Marc Lai, Marcus Mellberg, Josie McGann, and Irina Fedulow. This study was supported by a grant from the Department of Aging and Adult Services for the City of San Francisco and the University of San Francisco's Faculty Development Fund.



## References

1. Barnett A, Smith B, Lord S, Williams M & Baumand A. (2003). Community based group exercise improves balance and reduces falls in at-risk older people: a randomized controlled trial. *British Geriatrics Society*, 32, 407-414.
2. Centers for Disease Control and Prevention (2010). Falls statistics. [www.cdc.gov](http://www.cdc.gov).
3. Day L, Fildes B, Gordon I, Fitzharris M, Flamer H & Lord S. (2002). Randomized factorial trial of falls prevention among older people living in their own homes. *British Medical Journal*, 325, 128-134.
4. Dibrezzo R, Shadden B, Raybon B & Powers M. Exercise intervention designed to improve strength and dynamic balance among community-dwelling older adults. *Journal of Aging and Physical Activity*, 13, 198-209.
5. Ericsson Y, Dahlberg L & Roos E. Effects of functional exercise training on performance and muscle strength after meniscectomy – a randomized trial. *Scandinavian Journal of Medicine and Science in Sports*, 19, 156-165.
6. Grabiner M, Koh T, Lundin T & Jahnigen D. (1993). Kinematics of recovery from a stumble. *Journal of Gerontology*, 48, M97-M102.
7. Kulig K et al. (2009). An intensive, progressive exercise program reduces disability and improves functional performance in patients after single-level lumbar discectomy. *Physical Therapy*, 89, 1145-1157.
8. Litbrand L, Lundin-Olsson L, Gustafson Y & Rosendahl E. (2006). The effect of a high intensity functional exercise program on activities of daily living – a randomized controlled trial in residential care facilities. *Journal of the American Geriatrics Society*, 57, 1741-1749.
9. Pistilli E, Ginther G & Larsen J. Sport-specific strength training exercises for the sport of lacrosse. *Strength and Conditioning Journal*, 30, 31-38.
10. Province M, et al. (1995). The effects of exercise on falls in elderly patients – a preplanned meta-analysis of the FICSIT trials. *Journal of the American Medical Association*, 273, 1341-1347.
11. Risberg M, Holm I, Mykelbust G & Engebretsen L. (2007). Neuromuscular training versus strength training during the first 6 months after anterior cruciate ligament reconstruction – a randomized clinical trial. *Physical Therapy*, 87, 737-750.
12. Rubenstein L, et al. (2000). Effects of a group exercise program on strength, mobility, and falls among fall-prone elderly men. *Journal of Gerontology*, 55, M317-M321.
13. Thompson C, Meyers-Cobb K & Blackwell J. (2007). Functional training improves club head speed and functional fitness in older golfers. *Journal of Strength and Conditioning Research*, 21, 131-137.
14. Tinetti M, Speechley M, Ginter S. (1988). Risk factors for falls among elderly persons living in the community. *New England Journal of Medicine*, 319, 1701-1707.
15. Treiber F, Lott J, Duncan J, Slavens G & Davis H. (1998). Effect of theraband and light dumbbell training on shoulder rotation torque and serve performance in college tennis players. *American Journal of Sports Medicine*, 26, 510-515.
16. Wakeling J, Von Tscharnar V, Nigg B & Stegiou P. (2001). Muscle activity in the leg is tuned to ground reaction forces. *Journal of Applied Physiology*, 91, 1307-1317.