

Effect of Closed Kinetic Chain Exercises on Dynamic Balance, Muscle Power and Risk of Fall in Geriatric Population

Ruchita Narsia¹, Nijal Parmar²

¹Head of the Department and Assistant Professor (M.PT in Community Based Rehabilitation), S.S. Agrawal Institute of Physiotherapy and Medical Care Education, Navsari.

²Assistant Professor, M.PT in Rehabilitation Science, S.S. Agrawal Institute of Physiotherapy and Medical Care Education, Navsari, Gujarat, India.

Corresponding Author: Ruchita Narsia

ABSTRACT

Background: At an age of 60 years the degenerative changes are bound to take place in human body which in turn brings physical changes as well. The closed kinetic chain exercises were examined on number of people and rate of risk of fall. So, the aim of the study is to find out the effects of those exercises were examined over the muscle power, dynamic stability and risk of fall.

Purpose: To check the effectiveness of closed kinetic chain exercises in muscle power, dynamic balance and risk of fall in geriatric population.

Methodology: After the inclusion and exclusion criteria, a consent form was taken from the geriatric population who were supposed to be assessed. Out of 65 patients assessed for study, 33 were suitable according to the inclusion criteria and were taken according to the convenient sampling technique. Pre outcome scores were recorded and then the participants were given a 6 days per week of protocol for 3 weeks and were re-assessed at the end of 2nd week and at the end of the 3rd week.

Results: There was a significant increase in the value of the BBS and MMT component of the patient with the significance value of less than 0.05. But there was no significant improvement in the dynamic balance of the SEBT component of the patients

Conclusion: The effect of closed kinetic chain exercises were only helpful in preventing the risk of fall and improved muscle power but not the dynamic balance of an individual

Keywords: Dynamic balance, Closed kinetic chain exercise (CKC), Berg Balance Scale (BBS), Star excursion balance test (SEBT) and Manual muscle testing (MMT)

INTRODUCTION

According to the WHO criteria there are age groups within which we can classify the geriatric population: Class (1) Young, Age: 65 to 75; (2) Middle, Age: 75 to 85; (3) Old, Age: 85 to >85.

The number of treating elderly patients as well as promoting health and preventing disability for them in our society is a challenging job for the physiotherapists. Unfortunately, at present the physiotherapists specialized in geriatric physiotherapy are very few in numbers. Hence, it is the need of the hour to enhance

the existing knowledge and skills for the management of continually growing patient's physiotherapeutic needs while maintaining high quality care and services.¹

Aging is a natural process due to which the degenerative changes take place within body. Geriatric population faces many difficulties due to aging and its effects over the body capacity and quality of the work because of poor balance, reduced endurance, generalized weakness, or repeated falls. Therefore, increasing the risk of fall, loss in joint stability, decreased muscular strength and muscle mass and

eventually loss of balance; this study is to evaluate the close kinetic chain exercise effect on these problems in manner of balance of geriatric population.²

These groups have been frequently presenting with multiple pathology & the atypical way in which illness can present with confusion, falls, loss of mobility, day to day functioning thus affecting the quality of life and independence of a person.²

Therefore, making it must in promoting skill & knowledge for management of continually aging patient by maintaining faulty causes & services.²

Aging brings out many and profound alterations in body and its composition. As advancing age there is need of training this population with closed kinetic chain exercises for the improvement of dynamic balance, muscle power and reducing the risk of fall.³

MATERIALS AND METHODS

STUDY DESIGN: Experimental pre and post study

SAMPLE SIZE: 33 participants

STUDY DURATION: 06 months with follow up

INCLUSION CRITERIA:

- Geriatric population above 60 years of age.
- According to Berg Balance Scale Participants with Moderate risk of fall were taken.
- Participants with Minimal Systemic Illness.
- Muscle Power 3+ to 4+.
- No surgical history present.

EXCLUSION CRITERIA:

- Any congenital or Structural Deformity.
- Vestibular or Vision Impairments.
- Joint Pathology.
- Any Surgical History.
- Chronic Illness.

TOOLS AND MATERIALS:

1. Measure Tap (Inch Tap)
2. Chairs
3. Bed/Plinth
4. Step Stool
5. Stop Watch
6. Data Sheet (Pen, Paper)
7. Berg Balance Scale
8. Star Excursion Balance Test
9. SF 36

PROCEDURE:

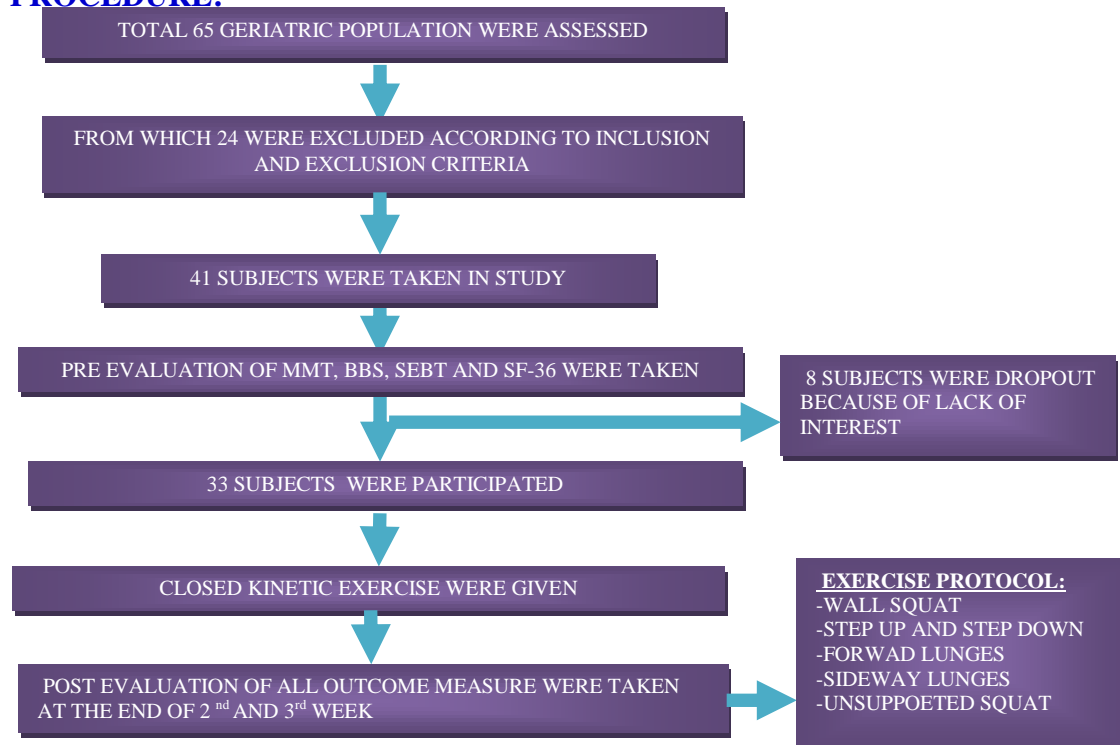


Figure 1 shows flow chart of procedure of the study

DATA ANALYSIS:

Statistical analysis was done using SPSS version 20. The subject (n=33) taken for the study, the reading were taken on the first day of the week and at the end of 2nd week and 3rd week.

Descriptive statistics including mean, standard deviation were analysed. Results were considered to be significant under the $p < 0.05$ & confidence interval was set at 95%.

Repeated measure ANOVA test was used for pre test and post 2nd week and post 3rd week value of BBS, SEBT and MMT.

FINDING:

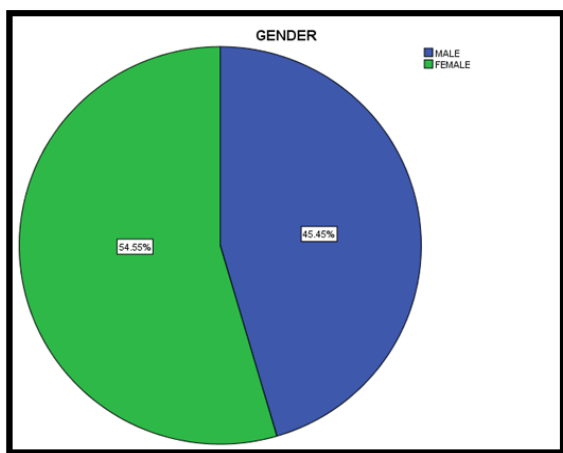


Figure 2: gender distribution of the 33 participants

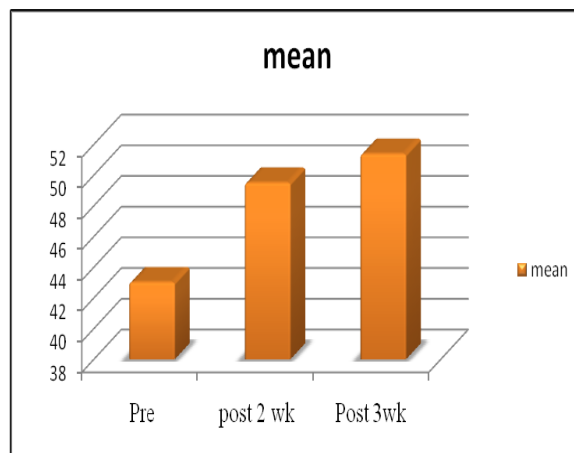


Figure 3: Descriptive Statistics of BBS

Figure 3 shows the significant improvement in the BBS after the 2nd week mean was 49.5152, after the end of 3rd week it was improved 51.3939. The BBS improved greater and significantly in the first 2 weeks.

SOURCE	F VALUE	Significant
FACTOR 1 Spherically assumed	302.442	0.000

Figure 4: ONE WAY ANOVA test for BBS

Figure that shows the analysis for the BBS within the subjects was showed highly significant improvement, in which the confidence interval was 95%, and $p < 0.05$ was taken for the significant value.

The comparison of the variables was done using repeated measures ANOVA test.

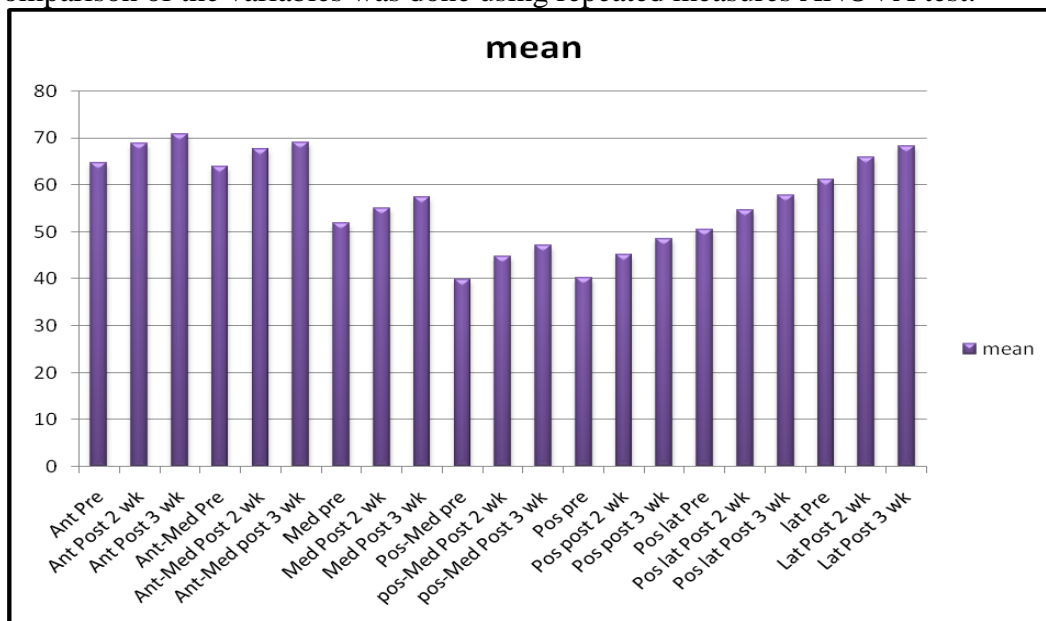


Figure 5: left component of SEBT

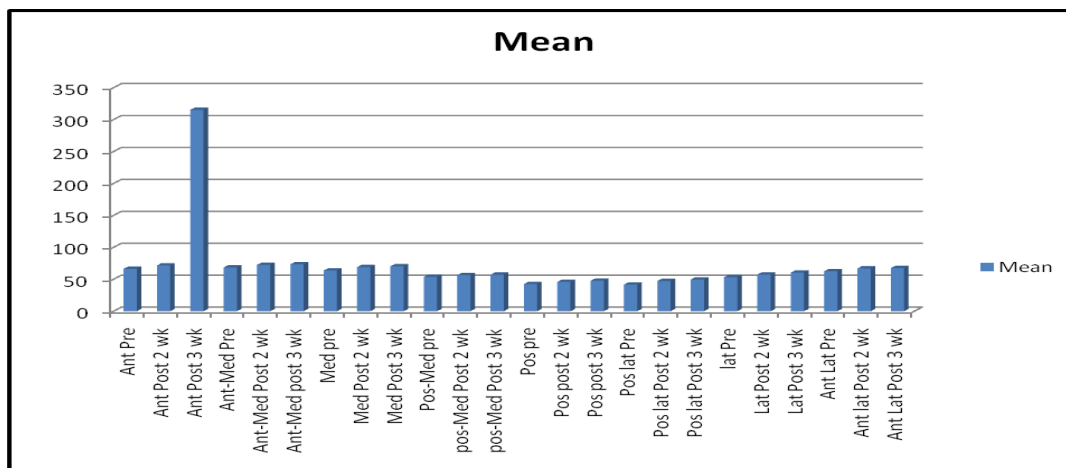


Figure 6: Right side component of SEBT

After using REPEATED MEASURE ANOVA test, The Comparison of pre, post 2nd and Post 3rd week are not showing significant improvement but value of pre and post 2nd week SEBT showing significant improvement as comparing mean value of both variables.

	DIRECTIONS	F VALUE	SIGNIFICANCE
Left side direction of SEBT	Anterior	2.235	0.113
	Anterior Medial	2.177	0.119
	Medial	5.250	0.007
	Posterior Medial	2.743	0.069
	Posterior	2.558	0.083
	Posterior Lateral	1.701	0.188
	Lateral	4.077	0.020
Right side direction of SEBT	Anterior Lateral	3.459	0.035
	Anterior	5.503	0.005
	Anterior Medial	2.955	0.057
	Medial	3.007	0.054
	Posterior Medial	0.459	0.633
	Posterior	0.905	0.408
	Posterior Lateral	1.745	0.180
	Lateral	2.909	0.059
	Anterior Lateral	0.793	0.455

Figure 7: ONE WAY ANOVA test was done for SEBT in 33 participants

After using ONE WAY ANOVA test, the statistical analysis was showing that SEBT is only improving in the right anterior direction only and not in the either directions. The other component was not showed improvement. The significant value was above the p value ($p < 0.05$).

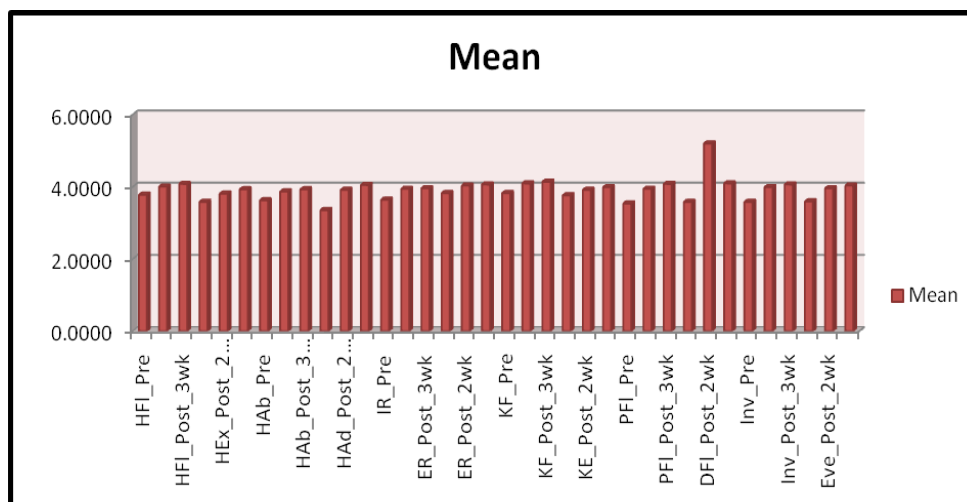


Figure 8: mean and SD score of Left lower limb MMT

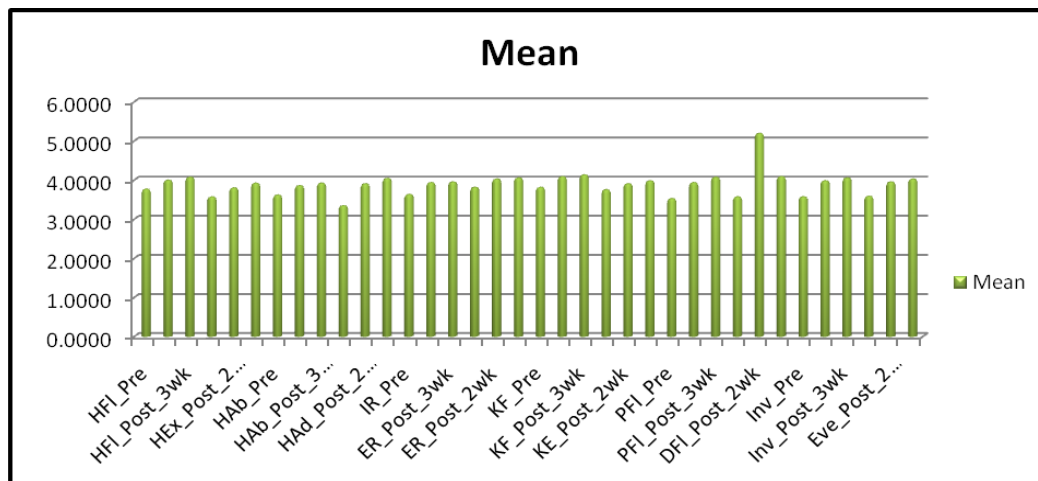


Figure 9: mean and SD score of Right lower limb MMT

Figure 8 and 9 shows significant improvement in mean and standard deviation by using Repeated Measure ANOVA.

		F VALUE	Significance
Left leg MMT	Hip Flexor	13.746	0.000
	Hip Extensor	16.343	0.000
	Hip Abductor	16.103	0.000
	Hip Adductor	13.636	0.000
	Internal Rotator	11.146	0.000
	External Rotator	5.398	0.006
	Knee Flexor	7.957	0.001
	Knee Extensor	3.312	0.041
	Planter Flexor	2.813	0.065
	Dorsi Flexor	11.920	0.000
	Invertor	14.506	0.000
	Evertor	16.403	0.000
Right Leg MMT	Hip Flexor	8.652	0.000
	Hip Extensor	4.815	0.010
	Hip Abductor	5.024	0.008
	Hip Adductor	35.571	0.000
	Internal Rotator	6.502	0.002
	External Rotator	6.311	0.003
	Knee Flexor	8.709	0.000
	Knee Extensor	2.017	0.139
	Planter Flexor	22.375	0.000
	Dorsi Flexor	18.709	0.000
	Invertor	16.349	0.000
	Evertor	17.693	0.000

Figure 10: ONE WAY ANOVA TEST for left and right lower limb MMT

For the statistical analysis of MMT the One way ANOVA test was used for the comparison of both left and right lower limb MMT, it shows highly significant improvement in the most of the group of the muscles of the body. As significant value of all muscles MMT is showing <0.05 . But left knee extension, Right hip extensor and Right knee extensors doesn't show significant improvement.

DISCUSSION

Many studies were done to check the effectiveness of open vs closed kinetic chain exercises. In our study we obtained the result that closed kinematic chain exercise help to improve BBS and prevent the risk of fall. During the end of the 2nd week the people showed the significant gain in BBS. It was same at the end of 3rd week.

After repeated measures ANOVA test, we found that there was a significant improvement in BBS score of 33 participants because the significance level was 0.00 as the closed kinetic chain exercises focused on co activation of the lower extremity muscles by stimulating the joint mechanoreceptors and improving the joint proprioception Therefore improving the muscle control and reducing the risk of fall at the end of 3rd week of protocol.

Linda D Bogle et al conducted a study on 66 residents of two independent life case communities to determine whether the berg balance test could be used to predict an older person's risk of falling. For that subjects completed a questionnaire pertaining to their fall history and activity level. 6 months later subjects again completed the questionnaire. The result shows that there was a difference between the subjects who were prone to falling and those who were not prone to falling, but the test demonstrated poor sensitivity for predicting who would fall.⁴

Susan W Muir et al conducted study on 210 community-dwelling older adults. They have received a comprehensive geriatric assessment at base line, which included the BBS to measure balance. To evaluate the validity of the BBS for the identification of future risk of fall. The data were collected monthly for a year. The result showed that the use of BBS dichotomous scale to identify people at high risk for falling should be discouraged because it fails to identify the majority of such people.⁵

By giving closed kinetic chain exercise there was muscle hypertrophy which lead to increase in muscle growth and muscle mass, so after giving 3 week of closed kinetic exercise there was significant improvement in muscle power of lower extremities. The significance level of Group of muscles of hip and knee joints was 0.000 which shows that there was highly improvement in the muscles of lower extremities except planter flexor of ankle joint on left side and knee extensors on right side. CKC exercise generates the muscular co-contraction resulting in greater stability. CKC exercise involve more co ordination and co contraction of the anti gravity muscles which improve muscle power in lower extremities. Sean Flanagan et al⁶ concluded that the squat places greater demand on the knee extensors and ankle plantar flexors. But here in our study, the closed kinematic exercise is not highly improving knee extensor and planter flexor muscles power in right and left leg. But it shows improvement in over MMT of right and left legs

Phillip A Gribble et al conducted a study to assess dynamic postural control deficit and outcome in lower extremity. The study shows that it is a highly representative, non-instrumented dynamic balance test for physically active individual. It is a reliable measure and has validity to predict risk of fall and dynamic balance deficit.⁷

But there was no significant improvement in SEBT scores of 33

participants because SEBT is a series of single-limb squats using the non-stance limb to reach maximally to touch a point along 1 of 8 designated lines on the ground which is difficult in our population due to physiological changes like fatigue and muscle tightness. In our study we found that there was an improvement in right anterior direction. The dominant side was not taken. The improvement likely to be improving on dominant side. The shorter protocol of the 3 week and the only closed kinematic chain exercise failed to improve SEBT in all directions. Our study does not show the 100% improvements in participants.

CONCLUSION

The effects of closed kinetic exercises are significant in improving the prevention of risk of fall, improving the muscle power but there was no significant improvement was seen in dynamic balance.

Conflict of Interest:

The authors declare that there are no conflicts of interest concerning that content of present study.

Source of Funding: Self-Funded

REFERENCES

1. Narinder Kaur Multani SKV. Principles of Geriatric Physiotherapy. First Edition ed. New Delhi: Jaypee Brothers; 2007.
2. Guccione AA. Geriatric Physical Therapy. 2nd ed. White K, editor.: John Schrefer; 2000.
3. Vincent j ma. Comparative Effects of 6-Week Balance, Gluteus Medius Strength, and Combined Programs on Dynamic Postural Control. Journal of Sport Rehabilitation. 2010;: p. 268-287.
4. Linda D Bogle Thorbahn RAN. Use of the Berg Balance Test to Predict Falls in Elderly Persons. Physical Therapy. 1996; 76(6).
5. Susan W Muir KBBCMS. Use of the Berg Balance Scale for Predicting Multiple Falls in Community-Dwelling Elderly People:A Prospective Study. American Physical Therapy Association. 2008 April; 88(4).

6. Sean Flangan Gjsmywses. Squatting Exercises in Older Adults: Kinematic and Kinetic Comparisons. *Med Sci Sports Exerc.* 2003 April; 35(4): p. 635-643.
7. Phillip A. Gribble JHPP. Using the Star Excursion Balance Test to Assess Dynamic Postural-Control Deficits and Outcomes in Lower Extremity Injury: A Literature and Systematic Review. *Journal of Athletic Training.* 2012 June; 47(3): p. 339–357.

How to cite this article: Narsia R, Parmar N. Effect of closed kinetic chain exercises on dynamic balance, muscle power and risk of fall in geriatric population. *Int J Health Sci Res.* 2020; 10(7):218-224.
