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Effect of Frenkel exercise along with brain gym exercise to improve coordination in elderly population

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Abstract
Background- Background Improving Coordinated movement will provide more secure foundation which involves multiple joints and muscles that are activated at the appropriate time and with the correct amount of force so that smooth, efficient, and accurate movement occurs. Objectives-: to evaluate the effect of Frenkel exercise along with brain gym exercise to improve coordination in elderly population. This population was taken from Jalgaon who had coordination problem in their daily life activities Methods-a sample size of 38 subject of both genders were taken in the study for a duration of 6 weeks. The subject included who had coordination problem. The coordination was measured before and after the various forms of frenkel along with brain gym exercises. Result it was observed that there was substantial variation in their coordination before and after the coordination exercises. Paired T-Test revealed extremely significant value 'P; < 0.0001.' hence conclusion can be arrived at that Frenkel exercises along with brain gym exercises extremely effective in improving coordination in elderly population. We concluded from this study Frenkel exercises along with brain gym exercises plays an important role in coordination in elderly population.

Keywords: Frenkel exercise, brain gym exercise, co-ordination exercises

Introduction

Coordination is the ability to execute smooth, accurate, controlled movement. "Coordinated movement Involves multiple joints and muscles that are activated at the appropriate time and with the correct amount of force so that smooth, efficient, and accurate movement occurs. Thus, the essence of coordination is the sequencing, timing, and grading of the activation of multiple muscles groups1.

Incoordination occurs due to cerebellum, basal ganglia act together with, the cortex in the production of coordinated movement, lesions in any of these areas affect higher level processing and execution of coordinated motor responses.1 Aging is a period in the life cycle experienced by everyone [2]. A better understanding of an aging society helps us better understand the issues that older people face 3. Due to physiological and anatomical changes resulting from the increase in biological age,3 led to a progressive loss of nerve extensions, bone mass, skeletal muscle mass, and strength. Consequently, frailty and sarcopenia may be present in approximately 10% of people over the age of 65 and 25–50% of those aged over 85 (World Health Organization, 2007). During normal aging, physiological changes occur in one's visual, vestibular, and somatosensory inputs, as well as in the central processing and muscular effectors (Horak, 2006; Rubenstein, 2006).4 Due to motor deficit in older adults' impairment in coordination occurs, which leads to increased variability of slowing of movement and difficulties with balance and gait in older adults. 5 Coordination exercise with low velocity, low impact, and a high interest level, which also provides a good training effect, is preferred for most older persons. These exercises were associated with high activation in visual – spatial network in

the brain of older Coordination exercises is known to involve an activation of the cerebellum which is responsible for motor control and motor learning. 6 Frenkel's exercises are a series of motions of increasing difficulty performed to facilitate the restoration of coordination. These exercises are used to improve coordination which may improve reaction time and prevent falls in the elderly population.7 Exercises require a high degree of mental concentration and effort The main principles of Frenkel exercises are- Concentration, Precision, Speed and range, Command, Repetition, Complication.

Brain Gym is an academic kinesiological program that was initially developed for children with learning disabilities. It involves the performance of specific movement patterns that incorporate the head, eyes, and extremities, focusing on three dimensions: laterality, attention, and centering. During a typical BG session, participants engage in a wide variety of tasks that engage different aspects of cognitive and physical functioning. These tasks include dynamic movements involving coordination such as double doodle, alphabet 8s, the rocker, think of an x, space buttons. According to its founders, BG practice stimulates various brain regions, with a particular emphasis on the corpus callosum, facilitating inter- hemisphere communication. Additionally, Brain Gym is believed to enhance perception and reasoning abilities through neural remodeling. Building upon these principles, BG has been suggested as a potentially beneficial physical therapy approach for enhancing brain functioning among older individuals.8

Need of Study

The impairment in coordination increases with age because as ageing occurs neuromuscular communication becomes weak. Due to impaired coordination many older adults face a risk of fall during ADL, which impair the quality of life, and result in physical limitation, anxiety, loss of confidence and fear of falling, slowed reaction time.

There is need to improve coordination in elderly people to improve quality of life and reduce the limitation in ADL's by using Frenkel's exercise along with brain gym exercise

Aim

Effect of Frenkel exercise along with brain gym exercise on coordination in elderly Population.

Objectives

To find the impaired coordination in elderly populations by non-equilibrium coordination test.

To see the efficacy of Frenkel exercise along with brain gym exercise in elderly on coordination.

Hypothesis

1. Hypothesis (H0): There will be significant effect of 6 week of Frenkel exercise along with brain gym exercise in elderly population to improve coordination.

2. Null hypothesis (H1): There will be no significant effect of 6-week Frenkel exercise along with brain gym exercise in elderly population to improve coordination.

Material and Methodology

Materials

1. Pen
2. Paper
3. Marker
4. Plinth
5. Chair

Methodology

1. **Study Design:** Pre-Post Experimental study

Sample Size:

N = Z12S2/D2

Were,

M = guess of population means = 9.92

S = standard deviation = 2.59

Z1 = 1.96 at alpha = 5% level of significance

D = absolute precision = + 0.9

N = (1.96)2 (2.59)2/ (0.9)2

N = 32

Minimum sample size for the study will be 32.

1. **Study Population:** Above 65 years to 85 years
2. **Study Duration:** 6 weeks
3. **Sample Method:** convenient sampling
4. **Study Setting:** Jalgaon

Criteria of Selection

Inclusion Criteria

- Individual willing to participate voluntarily and taking written consent for the same.
- Age: above 65 years to 85 years.
- People with co-ordination problem assessed by non-equilibrium coordination test.
- Individual with proper visual acuity and hearing ability.
- Both male and female

Exclusion Criteria

- Participants with pre-existing neurological condition such as stroke.
- Multiple sclerosis
- Parkinson disease
- ENT defect hearing loss
- Affected vision(blindness)
- Cataract
- Glaucoma
- Mental disorders and behavior caused by the use of psychoactive substances.
- Participants with musculoskeletal problem, recent fractures, recent surgeries.
- Peripheral neuropathy

Outcome Measures

Non Equilibirium Coordination test

1. Finger to Finger

The shoulder is abducted to 90° with the elbow extended. The patient is asked to bring the tip of the index finger to the tip of his or her nose. Alterations may be made in the initial starting position to observe performance from different planes of motion.

2. Alternate Nose to Finger

The patient alternately touches the tip of his or her nose and the tip of the therapist's finger with the index finger. The position of the therapist's finger may be altered during testing to observe ability to change distance, direction, and force of movement.

3. Pointing and Past Pointing

The patient and therapist are opposite each other, either sitting or standing. Both patient and therapist bring shoulders to a horizontal position of 90° of flexion with elbows extended. Index fingers are touching or the patient's finger may rest lightly on the therapists. The patient is asked to fully flex the shoulder (fingers will be pointing toward ceiling) and

then return to the horizontal position such that index fingers will again approximate. Both arms should be tested, either separately or simultaneously. A normal response consists of an accurate return to the starting position. In an abnormal response, there is typically a "past pointing," or movement beyond the target. Several variations to this test include movements in other directions such as toward 90° of shoulder abduction or toward 0° of shoulder flexion (finger will point toward floor). After each movement, the patient is asked to return to the initial horizontal starting position.

4. Rebound Phenomena
The patient is positioned with the elbow flexed. The therapist applies sufficient manual resistance to produce an isometric contraction of biceps. Resistance is suddenly released. Normally, the opposing muscle group (triceps) will contract and "check" movement of the limb. Many other muscle groups can be tested for this phenomenon, such as the shoulder abductors or flexors and the elbow extensors.

5. Drawing Circle or Figure of 8 with Hand
The patient draws an imaginary circle in the air with either UE or LE (a table or the floor also may be used). This also may be done using a figure-eight pattern. This test may be performed in the supine position for the LE

6. Alternte Heel to Knee
From a supine position, the patient is asked to touch the knee with the heel of the opposite extremity.

7. Toe to Examiner's Finger
From a supine position, the patient is instructed to touch the great toe to the examiner's finger. The position of finger may be altered during testing to observe ability to change distance, direction, and force of movement

8. Heel to Shin
From a supine position, the heel of one foot is slid up and down the shin of the opposite LE.

9. Drawing a Circle
The patient draws an imaginary circle in the air with LE. This also may be done using a figure-eight pattern. This test may be performed in the supine position for the LE.

10. Tapping (Foot)
The patient is asked to "tap" the ball of one foot on the floor without raising the knee; heel maintains contact with floor

Procedure
- The ethical clearance was taken from ethical committee prior to the commencement of the study.
- Subjects were taken according to the inclusion and exclusion criteria.
- Prior to starting the study, the procedure was explained and a written consent form was taken from the subjects.
- 32 subjects were taken.
- They were explained about the study and given information about how it would benefit them.
- Initially, the demographic data that was Name, Age, gender of the subject will be assessed.
- Then pre-test assessment was taken using non equilibrium coordination test and grading was done.
- After 6 weeks of intervention of Frenkel exercise along with brain gym exercise on alternate day for one hour, 3-4 repetition of each exercise was given.

Post-test assessment was taken using non equilibrium coordination test.

Precautions taken during exercises were as follows
- Subjects was ask to wear appropriate clothing.
- Exercises was avoid when the subject ill such as fever, etc.
- Exercises was ask to stop immediately if the subject feel dizzy or complains of pain in the lower limb.

Intervention
Frenkel's Exercises
In sitting
For upper limb
- Elbow flexion and extension
- Wrist flexion and extension
- Elbow flexion and touching shoulder with the palm
- Placing hand and finger on specified mark
- Alternate nose to finger, finger to finger

Table 1: For lower limb

Gender	No. of subjects
Male	17
Female	15

1. Knee flexion and extension.
2. Hip abduction and adduction.
3. Dragging foot and placing over mark and halt on command.
4. Unsupported foot and placing over mark.
5. Unsupported foot and touching the therapist's finger.

Age groups	No. of subjects
Young old	12
Middle old	15
Old old	5

Fig 1

Brain Gym Exercises
1. Space buttons
2. Think of an x
3. Double doodle
4. Arm activation
5. Balance button
6. lazy 8
7. cross crawl
8. gravity glider
9. the elephant
10. water intake

Statistical Analysis
- Age wise distribution of subjects

In total 32 elderly people 12 peoples were young old, 15 peoples were middle old and, 5 peoples were old old.
- The average mean of age is 77 years

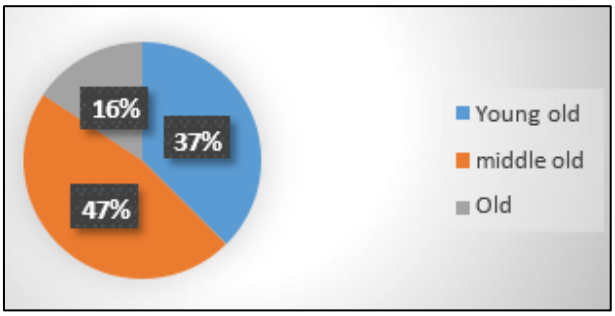

Fig 2: Age group wise distribution

Gender wise distribution of Subjects

In total 32 elderly people males are 17 and females are 15. The data pre & post assessment score of 32 subjects was entered in MS Excel before it was statistically analyzed.

- Statistical analysis was performed using graphed instant (version 3.05) software using paired t test
- Mean and standard deviation were calculated for all the needed variables.
- Level of significance was set at 95%.
- The p value was obtained < 0.0001 which is considered extremely significant.

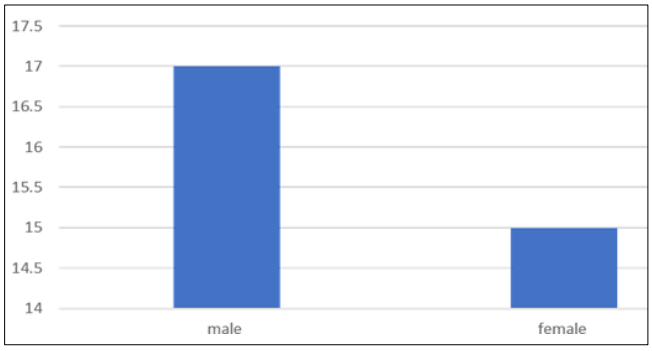

Fig 3: Gender wise subjects distribution

Table 2

Non equilibrium coordination test	mean ± Sd	P value	T value	Significance
Pre assessment	28.8 ± 3.62	< 0.0001	22.34	extremely significant
Post assessment	36.4 ± 3.72			

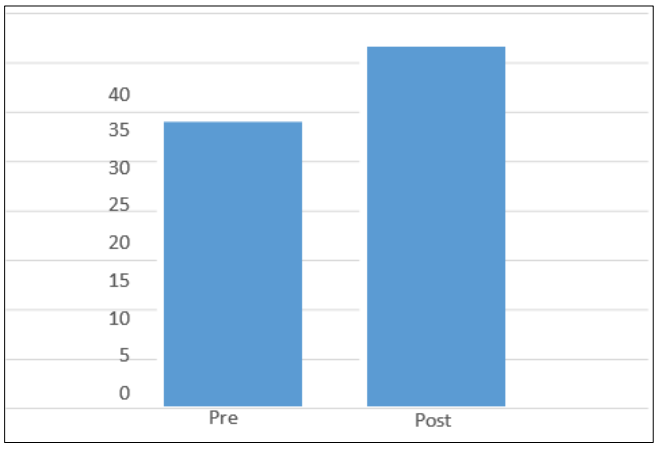

Fig 4: Non equilibrium coordination test

Results

Statistical analysis was done with paired T test and 'P' Value was found to be extremely significant 'P < 0.0001'. Frenkel's exercise along with brain gym exercises was effective on improving coordination in elderly population.

Discussion

- The aim of this study was to assess the Effect of Frenkel exercise along with brain gym exercise to improve coordination in elderly Population.
- Eye-hand coordination is central to so many human activities–the tool used eating, sports and work, to name few as to be defining characteristics of typical human life.
- Several pieces of research have been done to evaluate the efficacy of brain gym exercise to improve coordination in elderly and efficacy of Frenkel's exercise to improve coordination in elderly population.
- To acquire a normal coordination, one must have intact neuromuscular system. A balance of normal reciprocal innervation and co-contraction, leading to smooth reciprocal movements and appropriate stability, is necessary in carrying out a motor skill. Sensory input and sensory feedback are an essential part of motor skills and coordination.
- Brain gym exercise helps to increase peripheral vision, binocular vision, eye – hand coordination, spatial awareness, visual discrimination, improved body awareness, relaxation of central nervous system, increased ability to cross midline.
- Frenkel exercise also use to improve coordination. It works on some principle
  - Concentration of the attention
  - Precision
  - Repetition
- Frenkel exercise, alone are useful to improve coordination in reference to the article "Effectiveness of Chair Aerobics and Frenkel's Exercise in Geriatric Population on Balance and Coordination– Randomized Control Trial" by Vaishali Jagtap, Amrutkuvar Rayjade, Trupti Warude, K Arundhati Shiva Prasad, in the year 2023, the results showed that at the end of 3 months rehabilitation treatment, statistically significant differences were observed. Both groups showed improvement but controlled group showed much more and statistically significant improvement, which coincides with my study.
- Brain gym exercise, alone are useful to improve coordination in reference to the article "brain gym

exercises improve eye-hand coordination in elderly males" by Maryam Sepehrikia, Rasool Abedanzadeh, Esmaeel Saemi, in the year 2023 The results of mixed-ANOVA indicated a significant difference between the experimental and control groups ($p < 0.05$) and in favor of experimental group, which also coincides with my study.

- Another article which coincide with my study conducted by Donal Chundakal1, Parag Kulkarni2, Shwetambari Chavan3, Ronald Prabhakar4 on Effect of Music Therapy and Frenkel Exercise on Reaction Time in Geriatric Population-A Comparative Study 60 geriatric individuals with age group 65-70 years were examined for simple and choice reaction time. Individuals were divided into 2 groups equally. Group A received classical music with Frenkel exercises and group B heavy metal music with Frenkel exercise. Participants were given Frenkel exercise 2 weeks daily for 30 minutes and post reaction readings were taken for reaction time. They concluded that after analyzing the results by Mann Whitney U test, Mean pre SRT group A was 499.29, mean pre SRT group B was 540.80. Mean post SRT group A was 379.76, mean post SRT group B was 586.56 ($p<0.001$)
- Mean pre-CRT group A was 970.70, mean pre-CRT group B was 1107.6 ($p<0.001$). Mean post CRT group A was 894.30, mean post CRT group B was 1151.7 ($p<0.001$).
- Conclusion: There is significant difference in simple and choice reaction time after receiving classical music and heavy metal music with Frenkel exercise Training for co-ordination can yield significant improvement on receiving classical music as an adjuvant to Frenkel exercise.
- But when both the interventions are administered together it has given extremely significant result i.e. $p <0.0001$.

Limitations

- No long term follow up was maintained.

Clinical Implication

- As the age increases physiological and anatomical changes occurs in body, which will lead coordination impairment and affect activity of daily living, to reduce this problem we can give Frenkel exercise along with brain gym exercise to improve coordination.

Conclusion

- Frenkel's exercise has already been proved on coordination but in our study Frenkel's exercise along with brain gym exercise are more effective to improve coordination in elderly population.

Future Scope

- Frenkel's exercise along with Brain gym can be combine with balance exercise and asses by non-equilibrium and equilibrium coordination test to improve the balance and coordination in the elderly population.

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