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The Effect Of Multisensory Training On Balance And Gait Among Elderly Populations For Fall Prevention: A Randomised Controlled Trial

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Abstract

Background: Balance And Gait Abnormalities Puts Older Persons At Increased Risk Of Falling And So Fall Prevention Has Become An Important Topic In Aged. To Determine The Effectiveness Of Multisensory Training On Balance And Gait In Elderly Populations For Fall Prevention This Study Is Done. **Methodology:** Study Design: Experimental Study; Pre And Post Type; Convenient Sampling; With 70 Subjects; Study Duration: 6 Weeks; Study Setting: Vgn Society; **Procedure**: After Ethical Clearance Subjects Fulfilling The Inclusion Criteria Were Included In The Study. An Informed Consent Was Obtained From The Individuals After Explaining Clearly About The Treatment Protocol. The Subjects Were Assessed Pre And Post To The Treatment Sessions Using Dgi, Bbs And Those Who Have Abc Score Of Greater That 50 Were Chosen. A Total Of 50 Subjects Were Taken Conveniently And Divided In Two Groups Group A And Group B With 25 Subjects In Each Group.**Result And Conclusion**: The Study Concludes That There Is Improvement In Both The Groups Of Dgi, Bbs, Abc Scale In Post Test, There Was Also A Statistically Significant Difference In The Experimental And Control Groups. In Order To Improve The Balance And Gait Multisensory Training Along With Gaze Stabilization Exercise Can Be Advised.

Keywords: **Multisensorytraining, Physiotherapy, Fall Prevention, Gait And Balance, Aging.**

Introduction

The World Health Organization Estimates That 17 Million Disability-Adjusted Life Years Have Been Lost Globally Due To Falls. Falls Account For 40% Of All Injury-Related Deaths. According To The Who, Almost 37.3 Million Senior People Require Medical Attention Each Year, And 646,000 People Die As A Result Of Falls. [1,2,3] As People Get Older, Their Fall Rate Increases, Resulting In Increased Morbidity, Death, And Loss Of Independence [4] Each Year, It Is Anticipated That 30% Of Community-Dwelling Adults Aged 65 And Older Will Die, And 50% Of Those Aged 85 And Older Will Die. A Fall-Related Injury Will Affect 12 Percent To 42 Percent Of Those Who Fall And Have Been Established As A Strong Predictor Of Admission To A Long-Term Care (Ltc) Facility In Several Meta-Analyses And Cohort Studies. [5,6,7]

Balance Is Defined As The Ability To Stay Upright While Performing Static And Dynamic Tasks, Requiring Complex Interactions Between Peripheral And Central Components Such As Vision, Somato Sensation, Vestibular Sensory, Motor Output, And Muscle. [8,9]. As People Get Older, The Loss In The Aforementioned Elements Has A Substantial Impact On Their Mobility And Functional Abilities. [10]. While A Variety Of Elements Have Been Identified As Necessary For Balance In The Elderly, Postural Stability Is Thought To Be The Most Necessary For Performing Typical Walking, Turning, Rising To Standing, And Other Activities Of Daily Living (Adl). Individual Sensory System Changes, Such As Vibration And Proprioception, Have Been Linked To Postural Instability And Balance Problems.[11]

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Aging Is A Big Issue In The Twenty-First Century; 12.3 Percent Of The World's Population Is Over 60years Old. The Physiologic Reserve In Our Body Systems, Which Is Distinguished By Rearrangements, Such As Neuroplasticity In The Neurological System, Is Reduced But Not Fully Lost As We Age. Practice Enhances Brain Processing Capacities, According To Pohl And Winstein.[12]

Falls Are A Common Cause Of Hospitalisation In The Elderly Populations. When A Frail Older Adult Falls, However, The Most Injury Is Done. Exercise Aids In The Preservation And Growth Of Muscle, Lowering The Risk Of Falling. [13] A Systematic Review Of Randomized Controlled Trials Suggested That A Low Dose Of Creatine Monohydrate Along With Resisted Exercises May Improve Upper And Lower Extremities Strength In Healthy Older Adults. A Randomised Controlled Trial Found Respond; A Telephone-Based Falls Prevention Program With A Person-Centred Approach Was Found To Be Useful At Reducing The Rate Of Falls And Fractures Compared With Usual Care, But Not Fall Injuries Or Hospitalisations.

Balance And Functional Exercises Are The Most Common Types Of Exercises Used To Prevent Falls, Although Programmes That Are Likely To Prevent Falls Contain A Variety Of Exercise Types (Typically Balance And Functional Exercises Plus Resistance Exercises). Tai Chi May Also Help To Reduce Falls. [14]

Multisensory Training (Mst) Has Impact On More Than One Sense At A Time. Multisensory Training Involves Several Bodily Senses That Is Combines Three Learning Senses Auditory, Visual And Kinesthetic. [15] Mst Teach Students To Receive And Express Information Utilizing Two Or More Of These Modalities At The Same Time. Visual, Auditory, Kinesthetic, And Tactile (Vakt) Senses Are Commonly Used In Multimodal Learning (I.E. Seeing, Hearing, Doing, And Touching). According To Several Studies, The Benefits Of Multisensory Learning Are Best When All Five Senses Are Used Simultaneously. [16,17]

Elderly Peoples Started Experience Manifestations Of Imbalance And Body Instability, They Develop Impairments In Tactile Sensitivity, Vibration Sense, Proprioception And Kinaesthesia Associated To Impaired Balance, Altered Gait Patterns And Increased Risk Of Falling, Therefore, Simple Activities Like Stair Climbing, Rising Up From Chair And Standing Up May Become Limited Because They Are Dependent On Gait And Balance, So To Improve The Balance And Gait Multisensory Training Is Given. [18] Also Multisensory Training Are Effective In Improving Balance In Elderly Populations And Reduce Falls Rate (By 23%) And May Reduce The Risk Of Fractures (By 27%). The Majority Of The Exercises In The Mst Programme Are Balancing And Functional. Mst Lowers The Rate Of Falls And The Number Of People Who Experience Them Among Community-Dwelling Seniors (High-Certainty Evidence). Exercise Programmes That Reduce Falls Typically Focus On Balancing And Functional Exercises, Whereas Programmes That Are Likely To Reduce Falls Include A Variety Of Exercise Categories And Also Assist In The Prevention

Of Falls. 19,20

The Nice Guidelines Recommend Strength And Balance Training Should Be Included In A Falls Prevention Programme. They Should Be Individually Prescribed And Monitored By A Trained Professional. This Is Because Exercise Is Dose-Dependent And Needs To Be Set At A Suitable Level For It To Be Effective. [21]

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The Outcome Measures For This Study Are The **Activities-Specific Balance Confidence Scale** (Abc Scale) Is A Structured Questionnaire That Measures An Individual's Confidence In Performing Activities Without Losing Balance, Consists Of 16 Questions. Lower Than 50 %: Low Level Of Physical Functioning, 50-80 %: Moderate Level Of Physical Functioning And Above 80 %: High Level Of Physical Functioning. [22,23] The **Berg Balance Scale** Is Used To Determine A Patient's Ability (Or Inability) To Safely Balance During A Series Of Predetermined Tasks. It Is A 14 Item List With Each Item Consisting Of A Five-Point Ordinal Scale Ranging From 0 To 4, With 0 Indicating The Lowest Level Of Function And 4 The Highest Level. [24] The **Dynamic Gait Index** (Dgi) Tests The Ability Of The Participant To Maintain Walking Balance While Responding To Different Task Demands, Through Various Dynamic Conditions. It Is A Useful Test In Individuals With Vestibular And Balance Problems And Those At Risk Of Falls. It Includes 8 Items, Each Item Is Scored On A Scale Of 0 To 3, With 3 Indicating Normal Performance And 0 Representing Severe Impairment. [25,26]

A Greater Understanding Of Gait And Balance May Be Crucial For Old Population Safety, And It Was Thought That Programmes Designed For The Elderly Would Also Enhance Gait And Balance. Decreased Vestibulo-Ocular Reflex Instability In The Elderly Population Makes Them Vulnerable To Losing Balance While Walking In Public Or Even During Stance Phase Or When There Is A Sudden Distraction Causing Increased Postural Sway And A Higher Risk Of Falling, Which Can Be Retrained Through Gaze Stability Exercises.[27,28] Vestibular Adaptation And Substitution Exercises Are Among These Exercises. Gaze Stability Exercises Are Designed To Improve Both Static And Dynamic Postural Stability. It Is Thought That Subtle Age-Related Changes In Gaze Stability And Fixation Ability Can Predispose Elderly People To Balance, Gait, And Postural Instability. [29]

As A Result, It Is Expected That Multisensory Training Combined With Gaze Stability Exercises For Balance And Gait Training Will Be Useful Among Elderly Populations And The Current Study Will Look At The Effectiveness Of Multisensory Training In Reducing The Risk Of Falling In The Elderly.

Aim Of The Study

To Determine The Effectiveness Of Multisensory Training On Balance And Gait Among Elderly Populations For Fall Prevention.

Need Of The Study

Elderly Individuals Starts Experiencing Of Imbalance And Body Instability, Therefore, Simple Activities Like Stair Climbing, Rising Up From Chair And Standing Up May Become Limited Because They Are Dependent On Gait And Balance. Hence To Improve Their Balance And Gait And Also To Reduce Risk Of Fall, This Study Is Done. And Also To Shown Effectiveness Of Multisensory Training In Reducing Risk Of Falling Among Elderly Populations, But There Is Less Evidence Thus, The Study Helps In Finding Out The Effect Of Multisensory Training On Balance And Gait Among Elderly Populations.

Methodology

Study Design : Experimental Study

Study Type : Pre And Post Type

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Sampling Method	: Convenient Sampling
Sample Size	: 50 Subjects
Study Duration	: 6 Weeks
Study Setting	: Vgn Society, Kattankulathur 603203.

Inclusion Criteria

Both Male And Female Were Selected.

Age Group Between 50-79 Years

Subjects Who Have Good Confident Level, Abc Score >50.

Exclusion Criteria

Presence Of Other Neurological, Ent, Neoplastic Disorders

Coronary Artery Disease

Subjects With Epileptic

Subjects Who Are Unwilling To Participate In The Study

Procedure

Participants Were Selected Based On Inclusion And Exclusion Criteria, Then The Test Procedure Was Explained To The Patients. Then Informed Consent Was Taken From The Individuals After Explaining Clearly About The Treatment Protocol. The Subjects Were Assessed Pre And Post To The Treatment Sessions Using Dgi, Bbs And Those Who Have Abc Score Of Greater Than 50 Were Chosen. A Total Of 50 Subjects Were Taken Conveniently And Divided In Two Groups Group A And Group B With 25 Subjects In Each Group. The Subjects In Group A Received Multisensory Training Along With Gaze Stabilization Exercise Whereas Group B Received Only Gaze Stabilization Exercise. After The Completion Of 6 Weeks Of Exercise Program Post-Test Was Assessed To Check The Improvement For Balance. The Obtained Pre-Test And Post-Test Scores Were Compared And Analysed Statistically.

Group A (Experimental Group): Group A Were Given Multisensory Training Along With Gaze Stabilization Exercises. A Warm-Up Exercise For 5minutes Before The Activity Are Included Like Short Walks With Normal Speed And Games With Medicine Balls, Using Hands And Feet.

Participants Were Asked To Walk Forwards, Backwards, And Sideways At Various Speeds And Distances With Their Eyes Open And Then Closed. Aside From The Normal Floor, Several Types Of Ground Surfaces Were Included, Such As Mattresses And Foam Rubber. Obstacles Such As Ropes, Cones, And Sticks Presented Hurdles To The Contestants. The Participants Were Asked To Stand On Unipedal Or Bipedal Support With Their Eyes Open And Then Closed, Depending On Their Abilities. As Part Of The Multisensory Training, They Performed Exercises Under The Following Conditions:

(1) Eyes Open - Firm Surface & Soft Surface And
(2) Eyes Closed- Firm Surface & Soft Surface

The Activities Included Standing In A Double-Legged Stance For 10 Seconds, Standing In A Tandem Stance For 10 Seconds, And Rising From A Chair Without Using Arms; Walking

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Forward And Backwards In A Tandem Walking Pattern; And Standing In A Single-Legged Stance For 10 Seconds.

For Gaze Stabilization Exercise The Participants Were Made To Sit Facing A Blank Wall And Hold Out Their Thumb Straight In Front Of The Therapist.

Participants Are Requested To Maintain Their Eyes Fixated On Your Thumb At All Times During This Exercise, Then To Turn Their Head A Little To The Right And Then To The Left. Alternate Turning From Left To Right And Back In A Rhythmic Pattern. The Transition From Left To Right Took About A Second And Went Nicely.

Group B (Control Group): Group B Was Given Only Gaze Stabilization Exercise As Mentioned Above.

Fig : Maintaining Balance By Sitting In Swiss Ball

Fig: Tandem Walking With Cones Placed On Firm Surface With Theraband.

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Outcome Measures

Dgi- Dynamic Gait Index

Bbs – Berg Balance Scale

Abc-Activities Specific Balance Confidence Scale

Data Analysis

The Data Collected Were Tabulated And Analyzed Using Version 20.0 Of Ibm Spss Software. Paired T- Test And Independent T Test Were Used To Check The Findings Among Group A And Group B. Mean And Standard Deviation Were Used To Assess All The Parameters.

Table-1
Pre-Test And Post-Test Mean Values Of Group A (Experimental Group)

		Pre Test		Post Test			
		Mean	S.D	Mean	S.D	T-Test	P-Value
Group-A	Dgi	12.28	4.6	18.9	2.82	-10.1	.000
	Bbs	32.40	7.1	41.8	6.06	17.7	.000
	Abc	61	8	70.8	6.33	15.6	.000

Table 2
Pre-Test And Post-Test Mean Values Of Group B (Control Group)

		Pre Test		Post Test			
		Mean	S.D	Mean	S.D	T-Test	P-Value

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Group B	Dgi	13.5	3.8	17.5	2.1	-10.3	.000
	Bbs	36.1	7.8	39.1	7.6	-14.4	.000
	Abc	69.2	10.3	75.1	9.5	-13.4	.000

Table-3

Post-Test Mean Values Of Group A And Group B

		Post Test			
		Mean	S.D	T-Test	P-Value
Group A Vs Group B	Dynamic Gait Index	18.9	6.33	-1.851	.070
		17.56	2.82		
	Berg Balance Scale	41.89	.16	1.352	.183
		39.16	7.65		
	Abc Score	70.88	6.33	1.970	.055
		75.12	9.53		

Results

- **Table-1** Shows The Comparison Of The Mean Pre Test Value Of Dgi Of Group A Has Shown Increased In The Mean Value From 12.28 To 18.96. The Mean Value Of Pre Test Of Bbs Of Group A Increased From 32.40 To 41.80. The Mean Pre Test Value Of Abc Scale Of Group A Increased From 61.00 To 70.88. The Table Shows That There Is A Statistically Significant Difference Between Pre And Posttest Measure Of Dynamic Gait Index, Berg Balance Scale And Also Activities Specific Balance Confidence Among Group A With P< 0.05.
- **Table-2** Shows The Comparison Of The Mean Pre Test Value Of Dgi Of Group B Has Shown Increased In The Mean Value From 13.52 To 17.56. The Mean Pre Test Value Of Bbs Of Group B Increased From 36.16 To 39.16. The Mean Pre Test Value Of Abc Scale Of Group B Increased From 69.20 To 75.12. The Table Shows That There Is A Statistically Significant Difference Between Pre And Post Test Measures Of Dynamic Gait Index, Berg Balance Scale And Also Activities Specific Balance Confidence Scale Among Group B P< 0.05.

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- **Table-3** Shows The Comparison Of Post Test Values Of Dynamic Gait Index Of Group A And Group B Has Shown Increased In The Mean Value From 18.96 To 17.56 Between Experimental And Control Group. Berg Balance Scale Has Shown Increased Mean Value From 41.89 To 39.16 Between Experimental And Control Group. Activities Balance Confidence Scale Has Shown Increased Mean Value From 70.88 To 75.12 Between Experimental And Control Group. The Table 3 Shows No Significant Difference In Dgi, Bbs, Abc Between Pre And Post Test With P>0.05.

Discussion

This Study Is Done On Elderly Peoples To Prevent Risk Of Falling By Improving Their Balance And Gait By Giving Multisensory Training. Elderly Individuals Starts Experiencing Of Imbalance And Body Instability, Therefore, Simple Activities Like Stair Climbing, Rising Up From Chair And Standing Up May Become Limited Because They Are Dependent On Gait And Balance. Hence To Improve Their Balance And Gait And Also To Reduce Risk Of Fall, This Study Is Done.

Falls Are Arising Health Problem Due To Increased Older Population In India. A Literature Reviews On Falls Within Elderly Indian States That The Incidence Ranges From 14 Percent To 53 Percent. Keeping This In View And The High Cost Incurred Due To Injuries Following A Fall, Most Of The Developed Countries Use Quick And Reliable Screening Tool To Identify Those Elders At Greater Risk In Order And Implement Preventive Measures. Fall Prevention Has Become A Prominent Priority Among The Aged, As Falls Are A Major Source Of Morbidity In This Community. Older People With Balance And Gait Issues Are At A Higher Risk Of Falling, Which Can Be Life-Threatening. [30] A Main Intrinsic Component Contributing To Falls Has Been Recognised As A Decline In Somatosensory System (Vision, Vestibular, Proprioception) And Motor (Strength, Coordination, Endurance) Performance That Happens With Age. [31]

Multisensory Training Are Effective In Improving Balance In Elderly Populations And Reduce Falls Rate (By 23%) And May Reduce The Risk Of Fractures (By 27%). The Majority Of The Exercises In The Mst Exercise Programme Are Balancing And Functional. Mst Lowers The Rate Of Falls And The Number Of People Who Experience Them Among Community-Dwelling Seniors (High-Certainty Evidence). Exercise Programmes That Reduce Falls Typically Focus On Balancing And Functional Exercises, Whereas Programmes That Are Likely To Reduce Falls Include A Variety Of Exercise Categories And Also Assist In The Prevention Of Falls. [19,20]

In This Study Selected Individuals Was Divided Into Two Groups Group A- Experimental Group Had Intervention Program Of 6 Weeks Based On Balance Confidence Score. Subjects With Less Than 50% Abc Score Were Excluded Due To Less Balance Confidence Score, The Given Activities Enhance Them To Improve Balance Confidence Score And Also Help Them To Improve Balance And Gait. Group B-Control Group Had Gaze Stabilization Exercises Alone For 6 Weeks.

There Is Statistically Significant Difference In Comparing Pre And Post-Test Values Of Dgi,Bbs,Abc Score Among Group A And Also Group B Which Shows $P<0.05$.
Thus, In This Study The Intervention Was Given For 6 Weeks As Thrice A Week Each Session Was Carried Out For About 60 Minutes. But There Is No Statistically Significant Difference Between The Two Groups Of Experimental And Control Group Shows $P>0.05$ Level.

According To Result 1 And Half Months Is Enough To Enhance Balance In Older People. The Expected Findings Given To The Substantial Evidence That Targeted Treatment Protocol Which Improves Balance And Gait. Moreover, It Should Be Determined Whether These Exercises Along With The Gait Training, Cognition, Grip Strength, Environmental Hazard Etc. Can Be Given And Also Promoting Psychological Counseling Will Show A Greater Results. There Is Strong Evidence That Connection Between Cognition Function And Walking Pattern In Practicing Another Task. The Required Demand Of Some Items In The Dgi Which Requires Additional Cognitive Resources.

Research Study By Natalia Moya Pereira Et Al. (2020) Found Significant Improvement In Postural Balance, Gait Speed Of The Institutionalised Older Adults With Treadmill Training Which Was Carried Out Two Times Per Week For 10 Weeks. An Exercise Programme Must Consist Of Mainly Balance And Functional Exercises. This Review Could Not Determine How Effective Resistance Exercise Is In Isolation And Also Notes That Walking Is Not An Effective Strategy To Reduce Falls Risk.

The Goal Of The Gaze Stability Exercises Is To Improve Both Static And Dynamic Postural Stability. It Is Thought That Small Age-Related Changes In Gaze Stability And Fixation Ability Can Predispose Elderly People To Balance, Gait, And Postural Instability. [9] Studies Have Indicated That Multimodal Training Combined With Gaze Stabilisation Exercises Can Help Elderly People Avoid Falling.. [31]

The Goal Of This Study Was To See If Multisensory Training Combined With Gaze Stability Exercises Can Help Elderly Persons Improve Their Balance And Gait While Also Lowering Their Chance Of Falling.[32]

As A Result, It Is Hypothesised That Multisensory Training Combined With Gaze Stability Exercises In Balance And Gait Training Will Be Beneficial To The Elderly. As A Result, The Current Study Will Look Into The Effectiveness Of Multisensory Training In Reducing The Risk Of Falling Among The Elderly.

Conclusion

The Study Concludes That There Is Improvement In Both The Groups Of Dgi, Bbs, And Abc Scale In Post Test Also There Was Statistically Significant Difference In Between The Experimental And Control Groups. In Order To Improve The Balance And Gait Multisensory Training Protocols Can Be Advised.

Limitations

Small Sample Size.

This Study Consisted Of Short Course Of Intervention Over A Mean Period Of 6 Weeks.

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Recommendations

Since It Can Be Done By Own, Home Based Protocol Can Be Given, Instead For A Daily Visit For The Therapy Session.

Future Studies Should Have A Larger Sample Size.

A Long-Term Intervention Period Should Be Included In Future Studies. A Follow-Up Assessment Should Be Conducted To Determine The Effectiveness Of These Interventions In Terms Of Retention.

Conflict Of Interest

There Is No Conflict Of Interest

There Is No Fund By Any Agencies For The Study.

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