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CORRELATION BETWEEN SIMPLE VISUAL AND AUDITORY REACTION TIME WITH FALLS EFFICACY IN COMMUNITY DWELLING OLDER ADULTS

¹Dr Pratibha Salkar, ²Dr Jui Dave, ³Dr Medha Deo

¹Assistant Professor, ²Professor, ³Principal

¹Department of Physiotherapy ,

¹Terna Physiotherapy College, Nerul, Navi Mumbai, India

Abstract: The process of aging is characterised by generalized progressive slowdown in the ability to respond to external or internal stress, decline in physical activity. Reaction time (RT) is slowed and associated with problems of mobility in elderly. Falls efficacy is also an intrinsic aspect that influences balance. It seems important to study the relationship between reaction time and physiological factor like self-efficacy to understand the mechanism of falls and activity restrictions. Methodology- Ethical committee approval was taken. 40 subjects aged between 60 to 70 were assessed on simple reaction time using smartphone application and falls efficacy scale. Results - Data was analysed using Pearson's Correlation test. Falls efficacy scale was higher in subjects having increased visual reaction time and auditory reaction time suggesting of low falls efficacy (confidence) level in performing functional activity. There is a positive correlation between simple visual ($r = -0.39$) and auditory reaction time ($r = 0.41$) and falls efficacy with level of significance ($p = 0.01$). Conclusion - It is suggested that Falls efficacy and reaction time are important factors that can influence function and fall behaviour of community dwelling older adults and must be routinely evaluated and treated during balance rehabilitation.

Index Terms – Reaction Time, Falls Efficacy, Balance, Community Dwelling Older Adults

I. Introduction

The number of persons above the age of 60 years is fast growing, especially in India. India as the second most populous country in the world has 76.6 million people at or over the age of 60, constituting above 7.7% of total population¹. The major area of concern is the health of the elderly with multiple medical and psychological problems. Falls are one of the major problems in the elderly and are considered one of the "Geriatric Giants". Recurrent falls are an important cause of morbidity and mortality in the elderly and are a marker of poor physical and cognitive status⁽²⁾. Falls during daily activities can lead to injuries and physical disabilities among older adults, thereby affecting their quality of life. Prevention of falls is, therefore, of great public health concern, and it is important for fall prevention to address people at risk.

The process of aging is characterised by generalised progressive slow – down in the ability to respond to the external and internal stress⁽³⁾, decline in physical activity⁽⁴⁾, decrease in muscular strength, endurance⁽⁵⁾, decrease balance function⁽⁶⁾. In addition, elderly have a limited capacity for balance reactions such as

steeping or reaching movements. Older individuals display increased sway patterns and usually require stepping reactions as a protective mechanism. When this is coupled with decreased reaction time with age, the elderly individual does not have enough time to react to prevent the fall

Reaction time, i.e., the interval time between the presentation of a stimulus and the initiation of the muscular response to that stimulus It is a physiological entity that has been linked to the incidence of falls in the elderly population ⁽⁸⁾. As age increases, there is an increase in movement time and decision time. Another important intrinsic aspect that influences balance is anxiety or fear of falling. The seminal paper says that "Falls efficacy is a measure of fear of falling" has received over 2,500 citations since 1990⁽⁹⁾. It is defined as low perceived self-efficacy at avoiding falls during essential, non-hazardous activities of daily living. It is also related to activity restrictions followed by a decrease in physical capacity and an increase in the risk for future falls. 30% to 50% of elderly people have compromised mobility due to Fear of fall ⁽¹¹⁾. It is observed in older individuals irrespective of previous history of falls ^(8, 12).

Reaction Time (RT) seems to be a very important factor for the study of falls as it is one of the sensitive markers of aging central nervous system and is adversely affected when task becomes more attention demanding ⁽¹⁰⁾. Thus, it seems important to study relationship of physical factors like visual and auditory reaction time with psychological factor like Falls efficacy in order to understand the mechanism of falls and activity restriction.

Aims and objectives

Aim -To study the correlation between simple visual and auditory reaction time with fall efficacy in community dwelling older adults.

Objectives –

- To find the relationship between simple visual reaction time and falls efficacy
- To find the relationship between simple auditory reaction time and falls efficacy

II. Methodology

The study was a correlational study. Approval was taken from ethical Committee. 40 geriatrics subjects aged 60 to 70 years were recruited through convenience sampling method from Tertiary care center. Inclusion criteria both males and females, age 60 to 70 years, walking with or without assistive device, ability to understand spoken instruction, with normal or corrected-to-normal vision. Exclusion criteria were participants with known neurological disorders, recent fracture, impaired cognitive abilities, impaired hearing. Equipment used Reaction time application on android smart phone, Chair, Pen pencil.

An informed Consent was obtained from the participants after informing them about the objectives and data collection process. The participants were included in the study based on the inclusion and exclusion criteria. Visual reaction time and auditory reaction time was assessed by using smart phone application of reaction time and falls efficacy were evaluated respectively

Falls Efficacy Scale - Falls Efficacy Scale (FES), an instrument to measure fear of falling, based on the operational definition of this fear as "low perceived self-efficacy at avoiding falls during essential, non-hazardous activities of daily living." the reliability and validity of the FES were assessed in two samples of community-living elderly persons. the FES showed good test-retest reliability (Pearson's correlation 0.71). Subjects who reported avoiding activities because of fear of falling had higher FES scores, representing lower self-efficacy or confidence, than subjects not reporting fear of falling the independent predictors of FES score were usual walking pace (a measure of physical ability), anxiety, and depression. the FES appears to be a reliable and valid method for measuring fear of falling. this instrument may be useful in assessing the independent contribution of fear of falling to functional decline among elderly people ⁽¹⁴⁾.

Reaction time- visual reaction time and auditory reaction time was assessed by using smart phone application of reaction time developed by kovets an app developer company, version 1.0, android 5.0 using dominant hand. the app lets you find out your visual response time, your audible response time. ⁽¹⁵⁾.

III. Statistical analysis

The data was analysed using SPSS Windows version 16.0. Descriptive statistics was performed to describe the baseline demographic data. Pearson correlation test was then used to study the association between Visual and auditory reaction time with Falls efficacy.

IV. Results

The sample consisted of 40 community-dwelling older adults with mean age of 65.34 ± 6.97 years. Out of the total 40 subjects, there were total 19 subjects aged between 60-65 years, 21 subjects aged between 66-70 years old.

Community dwelling older adults with high falls efficacy (Fear of fall)

70% of the total 40 subjects studied, were found to be having a high risk of falls according to falls efficacy scale (Table 1). Between the ages of 60-65 years, 62.8 of subjects had high risk of fall. This percentage increased to 12% and 74% for 66-70-year age groups respectively (Table 2).

Table 1 Percentage of community dwelling older adults at high risk of fall

Age Group	Total No	High Risk Of Falls
60-70 Years	40	70%

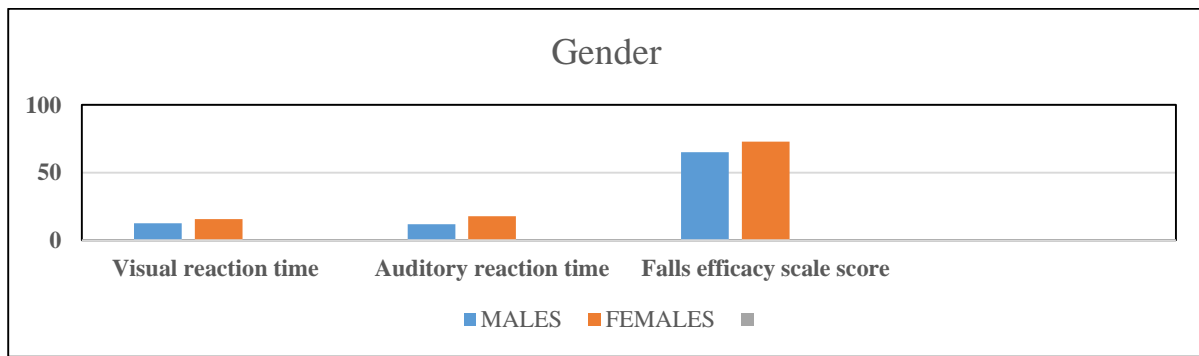
Table -2 Average Falls Risk with Falls Efficacy Score –With increasing age falls efficacy score is increasing

Age Group	Total No	Average Falls Efficacy Score
60-65 Years	19	62
66-70 Years	21	74

(Table 3) & Graph 1 -Comparison between males and females for Reaction time and Falls efficacy

There is difference between the average visual and auditory reaction time and falls efficacy score in both males and females, males showing less reaction time and less falls efficacy score than females.

Gender	Average Visual reaction time	Average Auditory reaction time	Falls efficacy score
Males	12.56	11.82	65
Females	15.69	17.86	73

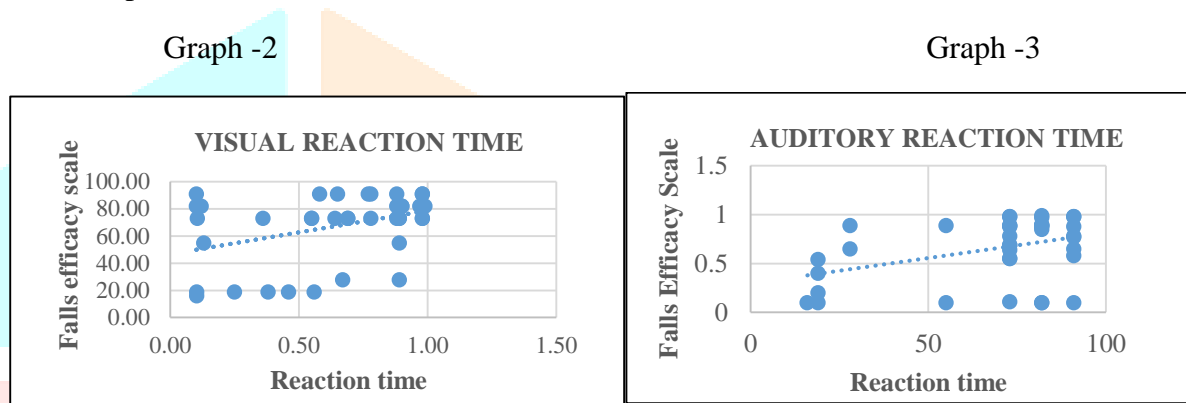


Graph -2 Correlation of Falls efficacy with Visual reaction time

There is a weak positive correlation between simple visual ($r=0.39$) and fear of fall on falls efficacy scale with level of significance ($p=0.01$).

Graph -3 Correlation of Falls efficacy with Auditory reaction time

Moderate correlation between auditory reaction time ($r=0.41$) fear of fall on falls efficacy scale with level of significance ($p=0.01$)



V. Discussion

Males have faster Reaction time as compared to females. Male-female difference is due to the lag between the presentation of the stimulus and the beginning of muscle contraction. It is documented in the literature that the muscle contraction time is the same for males and females⁽¹⁶⁾ and motor responses in males are comparatively stronger than females⁽¹⁷⁾ this explains why males have faster simple RTs for both auditory as well as visual stimuli.

High scores on falls efficacy scale indicate low level of balance confidence in doing daily activities owing to high fear of fall. Researches done in past have suggested as fear of fall and risk of falls are closely related. In the ages of 60-65years, and 66-70 years average falls efficacy score was 62 and 74 respectively. This shows that the risk of fall steadily increases as the age increases. Thus it is possible that older adults with low falls efficacy may restrict their daily activities to reduce their fall risk and are less likely to engage in exercises making them prone to postural instability and muscular weakness associated with deconditioning and with increased reaction time. Potentially, this sequela of activity restriction may lead to increased long-term fall risk⁽¹⁸⁾.

Falls efficacy (Fear of fall) is found to be positively correlated with Visual Reaction Time. This means that longer reaction time is related to increased fear of falls and that their balance confidence is low.

Auditory reaction time shows a moderate correlation with fear of fall suggesting that increase auditory reaction time can be predictor for fear of falls and low efficacy to perform functional task.

A study done by Wang et al, also suggested that increased reaction time (as choice stepping reaction time) was significantly associated with increased risk of falls. They proposed that prevention of falls depended upon the timely initiation of appropriate postural responses, which in older adults were characterized by the

absence of speed and dexterity that was necessary to ensure the recovery of stability in challenging situations that are seen in daily activities⁽¹⁸⁾.

Thus, Low falls self-efficacy and balance confidence have been associated with both physical and psychological adverse outcomes such as poor balance, depression, anxiety, and decreased quality of life⁽¹⁷⁾.

Findings from our study have important implications to fear of fall and suggest that interventions that enhance Reaction time may reduce fear of fall. A client-centered approach in physiotherapy must include not only objective, physically based outcomes but also subjective information that may influence physical performance, such as that which is gathered from measures of fall-related efficacy and reaction time. These findings highlight the potential need to address fall-related efficacy and reaction time when promoting physical engagement in this population.

VI. Future Scope

Further steps in this area would be to find if the use of training for Visual reaction time and Auditory Reaction time as a part of balance training for elderly is beneficial for reducing fear of fall and falls in elderly. Another research area may be the studying of development of fear of falling in various age groups.

VII. Conclusion

Falls self-efficacy (Fear of fall) is seen to be higher when Visual reaction time and auditory reaction time are poor. As, a lot of community dwelling older adults had level of Falls efficacy high above 70 which puts them at high risk of fall, it can be said that falls efficacy and reaction time are important and related factors that influences fall risk and function in community dwelling older adults. So, reaction time and falls efficacy must be routinely evaluated and treated during rehabilitation in community dwelling older adults.

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IX. Conflict of interest: This study shows no conflict of interest.

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