Effect of Music Therapy and Frenkel Exercise on Reaction Time in Geriatric Population-A Comparative Study

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Abstract

Background: Co-ordination is a key factor for smooth movements in human body. To study co-ordination of an individual measuring reaction time is an important tool.

Prolonged reaction time in addition with difficulty in recognition of stimuli affects co-ordination specially in geriatric population. Frenkel’s exercises improves reaction time, thus improves co-ordination. Listening to music is enjoyed by all and has shown to be useful in cognitive functions. Studies have shown that listening to music enhances co-ordination and improves reaction time.

Objective: To compare effects of Frenkel exercise with classical music and effects of Frenkel exercises with heavy metal music on simple and choice reaction time (SRT and CRT) in geriatric population.

Methods: 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.

Results: After analysing 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.

Keywords: Frenkel’s exercise, classical music, heavy metal music, reaction time, geriatric individuals.

Introduction

The problems of co-ordination increase with age. It has been found that as we age the neuromuscular communications becomes weak. It was noted that age related changes in visual perception affects hand eye co-ordination. Movements including those in the hand receives information from the cortex and there is a relationship between old age and decline in fine motor skills. It was observed that hand-eye coordination is compromised due to brain’s reaction time.¹

REACTION TIME –It is a measure of how quickly an individual reacts to particular stimulus.
Reaction speed is the ability to give a quick motor response to a definite stimulus, while the time that elapses between the sensory stimulation and motor reaction is called reaction time. Reaction times can be subdivided according to number of different stimuli that subject already expects and responds with a specific automatic motor reaction.

Simple reaction time- these are experiments which record the time interval with only one stimulus and one response. Choice reaction these are experiments which record the time interval with multiple stimuli responses. Reaction time depends upon many factors such as age, gender, physical fitness, fatigue, alcohol, arousal, left vs right hand, direct vs peripheral vision, brain injury, illness and other factors.

It is observed that music has a physical and a psychological component. Music has relaxation effect and changes the emotional status of individual, increasing the dopamine which is involved in neuroplasticity and neuron reward network of the brain. Music helps in relaxing effect and concentration of the individual listening to it. It is known to improve the concentration and it has been observed that effect of music on motor reaction time and interhemispheric relations showed that music shortened reaction time. Music exerts complex influences on the central nervous system manifested in changes to a number of neurophysiological reactions causing changes in flow of excitations in cortico-thalamic and cortico-limbic circles. Attempting to explain sound perception and how it affects human beings is complicated, however the physics of sound and music has its origin in changing the blood pressure and pulse rate. There are studies that prove that stimulating music cause an increase in pulse rates while decreased pulse rates that is associated with listening to sedative music.

Previous study has concluded that simple reaction time and choice reaction time is decreased in geriatric population. Studies have concluded that Frenkel exercise are beneficial to increase co-ordination among ataxic and old age patients. Listening to music effects arousal, mood which has great impact on co-ordination and can improve reaction time. Considering data from previous research, There is a need to check which music has beneficial effect with Frenkel exercise for improving reaction time in geriatric individuals.

The principal aim of the research was to compare the effect of classical vs heavy metal music as an adjunct to Frenkel exercise on simple and choice reaction time of geriatric population.

**Objective**

To assess the simple reaction time (SRT) and choice reaction time (CRT) prior to the administration of music therapy and Frenkel exercise.

To assess SRT and CRT after administration of Frenkel exercise and classical music

To assess SRT and CRT after administration of Frenkel exercise and heavy metal music and assess the difference between pre and post in SRT and CRT.
in Group with Frenkel exercise and classical music. Assess the difference between pre and post in SRT and CRT in Group with Frenkel exercise and heavy metal music.

To compare Group receiving Frenkel exercise with classical music and Group receiving Frenkel exercises with heavy metal music.

**ALTERNATIVE HYPOTHESIS** • There will be significant difference in simple reaction time and choice reaction time in group receiving classical music with Frenkel exercise and group receiving heavy metal music with Frenkel exercise.

**NULL HYPOTHESIS** • There will be no significant difference in simple reaction time and choice reaction time in group receiving classical music with Frenkel exercise and group receiving heavy metal music with Frenkel exercise.

**MATERIAL AND METHOD**

**STUDY DESIGN**

• Study Type- Experimental study

• Duration of study - 6 months Sampling- Convenient sampling

• Sample size- 60

• Target population – geriatric population

• Study place- community old age health centre

**Selection Criteria**

• Inclusion criteria

  • Individual willing to participate voluntarily who were informed about research in their vernacular language and taking written consent for the same.

  • Age: 60-75 years

  • Individual with proper visual acuity and hearing ability to hear 60 decibels in headphones –

  • Both male and female

• Exclusion criteria- • Participants with ENT defect, hearing, majorly affected vision (blindness), cataract, glaucoma, loss of vision

  • Participants with pre-existing neurological such as stroke, multiple sclerosis, Peripheral neuropathy, Parkinson disease and musculoskeletal defects such as fracture of upper limb for the past 6 months.

**OUTCOME MEASURE:**

• Deary-Liewald software

  • The Deary-Liewald computer-based software measures the simple reaction and choice reaction time. This was designed by IJD and programmed by DL.

  • Reliability for Deary-Liewald: Internal consistency for Deary-Liewald for SRT is 0.94 and choice reaction time is 0.97.10

**SIMPLE REACTION TIME**

![Figure 1. Simple reaction time](image)

In simple reaction time experiments (Fig 1), you need to wait until you see a black cross on white square and when that happens, one need to press the space bar. There is one stimulus (black cross) and a response (press space bar).
Participants will be tested for simple reaction time where there would be no distraction. Participants have to press a key in response to stimulus. This will be done to get the simple reaction time. 10 trials and the mean would be calculated for both groups.

**Choice Reaction Time:**

In choice reaction time (Fig 2) one needs to wait until a black cross appears on one of the four white squares (e.g. there are four different black cross position, which counts as four different stimuli.) when that happens, one need to press the corresponding key (Z, X, , or,).

![Figure 2 Choice reaction time](image)

Participants will be tested for choice reaction time. In choice reaction time there were four stimulus and participants had to press the key according to their choice. Participants have 10 Choice reaction experiments and the mean taken for both groups.10

**PROCEDURE**

- Subjects will be screened according to inclusion and exclusion criteria

- Those who will be selected and wish to participate in this study will be asked to sign consent form which explains the procedure in the preferred language.

- Each subject’s simple and choice reaction time will be screened by Deary –Liewald reaction time software in the following:

  - GROUP A- Participants will be given 5 practice trials before the session. Participants will have 10 test trials for simple and choice reaction times. Then the individual will be given Frenkel exercises for upper limb (10 repetitions) for each exercise and readings were recorded. Later the participants would be made to hear classical music for 10 minutes and after session the reaction times will be recorded.

  - GROUP B - Participants will be given 5 practice trials before the session and 10 test trials for both simple and choice reaction time recorded. Participants will be made to perform Frenkel exercise for upper limb 10 repetition for each exercise. Then participants would be made to hear metal music for 10 minutes and then reaction times would be recorded.

The procedure was done repeatedly 30 minutes for 2 weeks regularly for both groups.
Findings

Table 1: Mean value of SRT and CRT in both group A and B

<table>
<thead>
<tr>
<th></th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Test statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Group A</td>
<td>30</td>
<td>64.43</td>
<td>2.46</td>
<td>1.52</td>
<td>0.13</td>
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<tr>
<td></td>
<td>Group B</td>
<td>30</td>
<td>63.53</td>
<td>2.11</td>
<td></td>
<td></td>
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<tr>
<td>Pre_SRT</td>
<td>Group A</td>
<td>30</td>
<td>499.29</td>
<td>120.01</td>
<td>323.5</td>
<td>0.06</td>
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<tr>
<td></td>
<td>Group B</td>
<td>30</td>
<td>540.80</td>
<td>86.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post_SRT</td>
<td>Group A</td>
<td>30</td>
<td>379.76</td>
<td>135.69</td>
<td>179.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>30</td>
<td>586.56</td>
<td>74.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre_CRT</td>
<td>Group A</td>
<td>30</td>
<td>970.70</td>
<td>93.80</td>
<td>254</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>30</td>
<td>1107.6</td>
<td>205.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post_CRT</td>
<td>Group A</td>
<td>30</td>
<td>894.30</td>
<td>85.05</td>
<td>131</td>
<td>&lt;0.001</td>
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<tr>
<td></td>
<td>Group B</td>
<td>30</td>
<td>1151.7</td>
<td>241.81</td>
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<td></td>
</tr>
</tbody>
</table>

Unpaired t test was done to compare between age of the subjects between group A and group B. It was found that there was no significant difference between age of the subjects from group A and group B. Mean age of subjects from group A was 64.43 years and mean age of subjects from group B was 63.53 years.

Mann Whitney U test was done to compare between Pre and post simple reaction time and choice reaction time of subjects.

Ø It was found that there was no significant difference between pre SRT from group A and group B. Mean pre SRT of subjects from group A was 499.29 and mean pre SRT of subjects from group B was 540.80.

Ø It was found that there was significant difference between post SRT from group A and group B. Mean post SRT of subjects from group A 379.76 was significantly lower than mean post SRT of subjects from group B 586.56 (p<0.001)

Ø It was found that there was significant difference between pre CRT from group A and group B. Mean pre CRT of subjects from group A 970.70 was significantly lower than mean pre CRT of subjects from group B 1107.6 (p<0.001)

Ø It was found that there was significant difference between post CRT from group A and group B. Mean post CRT of subjects from group A 894.30 was significantly lower than mean post CRT of subjects from group B 1151.7 (p<0.001)
Table 2: Mean difference of SRT between group A and B

<table>
<thead>
<tr>
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<th>Mean</th>
<th>Std. Dev.</th>
<th>W statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre SRT</td>
<td>Post SRT</td>
<td>Pre SRT</td>
<td>Post SRT</td>
</tr>
<tr>
<td>Group A</td>
<td>499.29</td>
<td>379.76</td>
<td>120.01</td>
<td>135.69</td>
</tr>
<tr>
<td>Group B</td>
<td>540.80</td>
<td>586.56</td>
<td>86.16</td>
<td>74.59</td>
</tr>
</tbody>
</table>

Wilcoxon matched pair sign rank test was done between pre and post SRT for both the groups A and B.

For group A, there was significant difference between Pre SRT and Post SRT (p<0.001).

Mean pre SRT (499.29) was significantly higher than post SRT (379.76).

For group B, there was significant difference between Pre SRT and Post SRT (p<0.001).

Mean pre SRT (540.80) was significantly lower than post SRT (586.56).
Figure 4. Comparison of CRT in both groups

Table 3: Mean difference of CRT between group A and B

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>W statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre CRT</td>
<td>Post CRT</td>
<td>Pre CRT</td>
<td>Post CRT</td>
</tr>
<tr>
<td>Group A</td>
<td>970.70</td>
<td>894.30</td>
<td>1107.60</td>
<td>1151.70</td>
</tr>
<tr>
<td>Group B</td>
<td>93.80</td>
<td>85.05</td>
<td>205.19</td>
<td>241.81</td>
</tr>
</tbody>
</table>

Wilcoxon matched pair sign rank test was done between pre and post CRT for both the groups A and B.

For group A, there was significant difference between Pre CRT and Post CRT (p<0.001).

Mean pre-CRT (970.70) was significantly higher than post CRT (894.30).

For group B, there was significant difference between Pre CRT and Post CRT (p<0.001).

Mean pre-CRT (93.80) was significantly lower than post CRT (205.19).

Discussion

Here is an experimental study of classical and heavy metal music as an adjunct to Frenkel exercises. The results indicate improvement in reaction time for using classical and heavy metal music with Frenkel exercise. But significant improvement in the study was found with using classical music together with Frenkel exercise for both simple and choice reaction time. This proves that there is facilitation in the
processing of stimuli in somatosensory cortex and hence leading to acute motor response. Music exerts complex influences on the central nervous system causing an increase in interhemispheric co-ordination and arousal, which coupled with Frenkel exercises promotes in decreasing reaction time.

Roopa Harish Thakker, Parag Kulkarni found that Frenkel exercises gave an improvement in geriatric population by conducting tests for simple reaction time and choice reaction time. They found that since Frenkel exercises improves co-ordination and arousal, better performances was noted. Two groups were made, one receiving Frenkel exercises and the control group that did not receive it. They were made to respond simple and choice reaction time. Their analysis showed that there was significant difference for the group that received Frenkel exercise.1

Prasad B.K conducted a study with instrumental and heavy metal music on reaction time for visual reaction time and auditory reaction time. He found that there was significant improvement for visual and auditory reaction time after listening to instrumental music.3

Maja Meško, Strojnik, Videmšek, Karpljuk examined the effect of reaction time for participants listening to techno music which is a stimulant music. In this study, shortened reaction time was noted after listening to instrumental music.4

The results of this study are similar to the study conducted by BK Prasad to compare the effect of music on visual and heavy metal music.

**Conclusion**

This study concludes that there is improvement in simple and choice reaction time with classical and heavy metal music as an adjunct to Frenkel exercises. It proves the hypothesis that significant difference for classical and heavy metal music with Frenkel exercise. Also, significant improvement was found using classical music with Frenkel exercise as it is a relaxing type of music, better arousal was noted. It should also be noted that majority of geriatric population in India prefers to listen classical instrumental music over heavy metal music.11 The results of the study have to be confirmed over larger population and among the patients whose reaction time is disturbed due to lack of co-ordination in hand and brain network.

**Conflict of Interest:** -None

**Source of Funding:** - Self

**Ethical Clearance:** - Obtained by College of Physiotherapy, Wanless Hospital.

**References**

7. Lee SE. Neural activation on guided imagery and music: a functional MRI study.

