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Study on Short Term Memory and Encoding Using Visual Tasks in Medical Students

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ABSTRACT

Short-term memory is continually required in human's daily routine . It is used to recollect the data from recent events that occur in day to day life. It is difficult to acquire living chores without utilizing short-term memory storage and encoding. Various stimuli seen or heard are employed in the brain to form audio-visual memory. The main objective of our study visual tasks on improving the short term memory status and to retain it. The study was conducted on 144 medical students of the 18-25 years age group in BRIMS Institute, Bidar. The short-term memory status was assessed pre and post testing by visual tasks. Paired 't' test was the analytical method for the pre and post-testing results of the memory status after applying memory improvement methods. Comparison of mean and SD between all groups was done by using one way ANOVA test. There was statistically significant improvement in short-term memory status of visual tasks after application of memory encoding methods. Due to the use of memory encoding methods, there was a statistically significant improvement in memory status in all the subjects, males and females. There were no significant differences between males and females in short-term memory status for visual tasks after application of memory encoding methods.

INTRODUCTION

Short-term memory is the conscious memory people work with in real-time. It is used to process information from the senses into long-term memory and to hold information that is manipulated by working memory. It has three key aspects capacity, duration and encoding. Short term memory also called as primary or active memory is the capacity for holding a small amount of information in mind in an active, readily available state for a short period of time. The duration of short term memory is believed to be in seconds. Most of the information kept in short term memory is stored for approximately 20-30 seconds, if not rehearsed or actively maintained. Some information can last up to a minute but most information spontaneously decays quite quickly. The most cited capacity is "The magical number seven plus or minus two" is referred as Miller's law where psychologist George Miller suggested that people can store between 5 and 9 items in short term memory[1,2]. More recent research suggests that people can store up to 4 groups or pieces of information in short term memory. In contrast, long-term memory can hold the information indefinitely. Visual memory is one of the important base of learning. The study was conducted to determine the role of encoding methods in improving short term memory retaining capacity. This study may help to enhance the understanding of effectiveness of various memory encoding methods in improving short term memory retaining capacity through vision.

MATERIALS AND METHODS

The present study was conducted in the department of physiology, Bidar Institute of Medical Sciences, Bidar, Karnataka.

Selection of Subjects: 144 Healthy medical students aged 18-25 years of Bidar Institute of Medical Sciences, Bidar were volunteers for this study. The study was done on MBBS Students of BRIMS, of 18-25 years age group. The demographic data, personal, family and past history was recorded and subjects were also examined clinically to rule out any neuropsychiatric disorders, mental disorders, any disorder which disturb STM by visual tasks, any hearing problem, head injury, drug history of any anti psychotics, antidepressants, hypnotics and any other disorders were excluded from the study. None of the participants had history of learning disability or visual impairment. In addition, all the participants were right handed and had good command of English[3]. Those who were left handed were excluded from the study as they would might have an advantage in this study compared to right handed participants[4].

Method of Collection of Data: The participants volunteered for the study were registered and were asked to sign a consent form after the nature of procedure involved was explained to them and confidentiality was also assured.

The subjects were randomly selected and were called in forenoon period after breakfast. STM were assessed for selected subjects by visual tasks. A list of 15 words, objects and pictures were the stimuli for visual memory assessment. In order to avoid error six trials were taken in each test. Short term memory using following tests, complete neuropsychological assessment made it possible to assess and evaluate visual memory by following tests.

Visual Short Term Memory Assessment:

- **Word Test:** In this test, 6 trials were given and each trial has a different set of words. Students were given a list of 15 word which were familiar to the students like table, chair, fan, book and pen etc and 30 seconds were given to look at list of words. Then the subjects were asked to recall all the words or whatever they remembered and were told to write on a paper immediately.
- **Object Test:** A tray containing 15 vegetables like tomato, potato, brinjal, onion, etc. were shown to subjects for 30 seconds. The tray was covered with a cloth and the subjects were asked to recall and write on a paper immediately.
- **Picture Test:** A tray containing photographs of fruits like apple, banana, grapes, orange etc were shown to subjects for 30 seconds. After withdrawal of tray, subjects were told to recall what ever they remembered and write on a paper.

Short term memory status by visual tasks by using words, objects, pictures and digit span after application of memory improvement method was analysed according to scoring method by giving them one mark each for correct answer and zero for wrong answer. The memory retention was determined by the words, digits, objects and pictures being able to be accurately recalled by the participants through the scores and comparison between pre-test and post-test scores was done to find which of above used improvement method is effective to improve the short term Memory.

Chunking Method: Chunking information in small groups makes it easier to remember more items for a short period. Grouping of each piece into large group can improve memory for longer. This method was used for encoding information from word and picture tests. For example in word test of trial no. 5 (Apple, banana, grapes, orange etc.) are associated with fruits chunking allows subjects to take small bits of information and

combined them into more meaningful and therefore more memorable.

Creating Mental Associations: This is also called as linking method. It means to relate units to each other in meaningful ways, grouping because there are four letter words because they start with the same letter OR because they share a similar purpose. Associate-linking groups of items from memory help to make things more memorable. This method was used for encoding object and picture by linking with each other and trying to remember them. For example in object test trial no. 1 consisted of objects like (Tomatoe, potato, brinjal and onion, etc) were associated with vegetables. Similarly, for visual picture test in trial no.3 consisted of pictures of fruits like apple, banana, grapes, orange and pine apple belonging the same group.

Statistical Analysis: The Sample size 144 was calculated using statulator software, that can achieve a power of 80% to detect a difference of 2 in the corrected trial before and after training methods with a standard deviation of 8.5 with a significant level of 0.05 using sample size calculation for two sided two sample paired t test design.

Comparison of mean and SD between all groups was done by using one way ANOVA test. If ANOVA comes significant, then Post Hoc Tukey's HSD test was carried out to assess whether the mean difference between a pair of group is significant or not. A $p<0.05$ was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

RESULTS AND DISCUSSIONS

Visual Tasks:

Word Test: Table 1 shows mean and SD of memory status before and after application of memory encoding methods in all the subjects. The mean of the same are graphically depicted in figure 1.

Memory Status Before Application of Memory Encoding Methods:

In all the Subjects: The mean+SD of memory status in all the subjects of six trials was 7.72+/-0.56 as seen in table 1. After post hoc analysis, the memory status found to be less than and was statistically significant when compared to visual-object test ($p<0.01$) and visual-picture test ($p<0.01$) as seen in Table 6.

Males Vs Female: The mean of memory status before application of memory encoding methods was found to be more in males than females, however it was statistically not significant ($p>0.05$) as shown in table 4.

Memory Status After Application of Memory Encoding Methods:

In all the Subjects: The mean+SD of memory status in all the subjects was 12.71+/-0.62.The memory status found to be increased and was statistically highly significant when compared to the memory status before application of memory encoding methods ($p<0.01$) as shown in table 1.

After post hoc analysis, the memory status was found to be lesser and statistically significant when compared to visual-object test ($p<0.05$) and visual-picture test ($p<0.01$) as seen in table 7.

Males Vs Females: The mean of memory status after application of memory encoding methods was found to improve more in males than females, however it was statistically not significant ($p>0.05$) as shown in table 5. Saher[5], showed that progressive decrease in memory status in higher trials of alphabetical test is due to increase in number of bits/items >7 as an individual can hold 7+2 bits of information. Due to effectiveness of memory improvement methods, there is statistically significant improvement in memory status in all subjects, more so in females visual memory and working memory.

Object Test: Table 2 shows mean and SD of memory status before and after application of memory encoding methods in all the subjects. The mean of the same are graphically depicted in fig 2, present study the memory status for object test was significantly greater than visual-word test which may be due to good sight and also females have shown better short term memory status when compared to males which could be due to their better consciousness, participation in task and purposeful attention and effort in the study, similar results were obtained by saher[5], Kanwar[6], Zeba[7], Achutan and Rohit[8].

Memory Status Before Application of Memory Encoding Methods:

In all the Subjects: The mean+SD of memory status in all the subjects of six trials was 9.43+0.39 as seen in table 2 and figure 2. The memory status found to be greater when compare to visual-picture test, visual-word test and was significant when compare to visual-picture test ($p<0.05$) and visual-word test ($p<0.01$) in table 6.

Males Vs Females: The mean of memory status before application of memory encoding methods was found to more in females than males, however it was statistically not significant ($p>0.05$) as shown in Table 4.

Table-1: Comparison of Memory Status Before (Pre Test) and After (Post Test) Application of Memory Encoding Methods in Visual-Word Test

Test	Before (Pre Test Mean+/- SD	After Post Test Mean+/- SD	Paired t test P-value and significant
Visual-word test	7.72 +/-0.56	12.71+/-0.62	t = -146.70, p (<0.01)HS

Table-2: Comparison of Memory Status Before (Pre Test) and After (Post Test) Application of Memory Encoding Methods in Visual-Object Test

Test	Before (Pre Test) Mean+/- SD	After (Post Test) Mean+/- SD	Paired t test P-value and significant
Visual-object test	9.43 +/-0.39	14.45 +/-0.46	t = -98.32, p (<0.01) HS

Table- 3: Comparison of Memory Status Before (Pre Test) and After (Post Test) Application of Memory Encoding Methods in Visual-Picture Test

Test	Before (Pre Test) Mean+/- SD	After(Post Test) Mean+/- SD	Paired t test P-value and significant
Visual-picture test	8.33 +/-0.46	13.18+/-0.34	t = -112.55, p (<0.01) HS

Table-4: Comparison of Visual- Word Test, Visual-Object Test and Visual-Picture Test in Males and Females, Before (Pre Test) Application of Memory Encoding Methods.

Test	Males Mean+/- SD	Females Mean+/- SD	Paired t test P-value and significant
Visual-word test	7.75 +/-0.56	7.68 +/-0.55	t = 0.723, p (>0.05) NS
Visual-object test	9.37 +/-0.36	9.48 +/-0.41	t = -1.680, p (>0.05) NS
Visual-picture test	8.36 +/-0.50	8.29+/-0.42	t = 0.84, p (>0.05) NS

Table-5: Comparison of Visual- word Test, Visual-Object Test and Visual-Picture Test in Males and Females, After (Post Test) Application of Memory Encoding Methods.

Test	Males Mean+/- SD	Females Mean+/- SD	Paired t test P-value and significant
Visual-word test	12.78+/-0.60	12.64 +/-0.63	t = 1.375, p (>0.05) NS
Visual-object test	14.44 +/-0.49	14.47 +/-0.43	t = 0.720, p (>0.05) NS
Visual-picture test	13.21 +/-0.33	13.15+/-0.35	t = 0.26, p (>0.05) NS

Table-6: Comparison of Visual-word Test, Visual-Object Test and Visual-Picture Test, Before (Pre-test) Application of Memory Encoding Methods.

Test	Before (Pre Test) Mean +/-SD	F , p value and signigicant
Visual-word test	7.72 +/-0.56	244.55 , (<0.01) HS
Visual-object test	9.43+/- 0.39	244.55 , (<0.01) HS
Visual-picture test	8.33+/-0.46	244.55 , (<0.01) HS

Post Hoc Tukey's HSD test (Pre Test)

Tests	Visual -Word Test	Visual -Object test	Visual-picture test
Visual-Word Test		-1.71*	0.6*
Visual -Object test			-1.1*
Visual-picture test			

*indicates that the mean difference is significant at 0.05 level (p<0.05)

Table-7: Comparison of Visual-Word Test, Visual-Object Test and Visual-Picture Test, After (Post-test) Application of Memory Encoding Methods.

Test	After (Post test) Mean +/-SD	F , p value and significant
Visual-word test	12.71 +/- 0.62	790.64, (<0.01) HS
Visual-object test	14.45 +/-0.46	790.64, (<0.01) HS
Visual-visual-picture test	13.18 +/- 0.34	790.64, (<0.01) HS

Post Hoc Tukey's HSD test (Post Test)

Tests	Visual-Word Test	Visual-Object test	Visual-picture test
Visual-Word Test		-1.74*	0.47*
Visual -Object test			-1.27*
Visual-picture test			

*indicates that the mean difference is significant at 0.05 level (p<0.05)

Memory Status After Application of Memory Encoding Methods:

In all the Subjects: The mean+SD of memory status in all the subjects was 14.45+0.46. The memory status found to be increased and was statistically highly significant when compared to the memory status before application of memory encoding methods (p<0.01) as shown in table 2 and figure 2. The memory

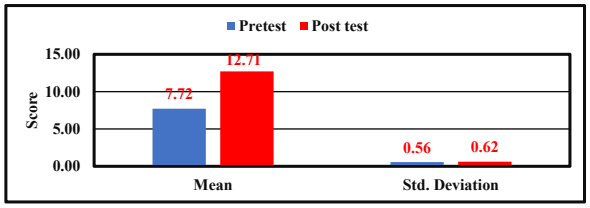

Fig. 1: Graphical Representation of Memory Status Before and After Application of Memory Encoding Methods in Visual-Word Test

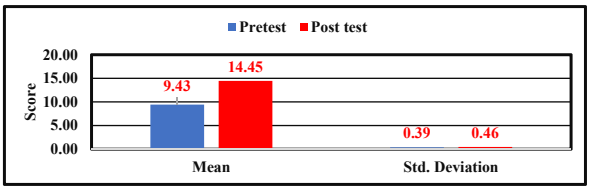

Fig. 2: Graphical Representation of Memory Status Before and After Application of Memory Encoding Methods in Visual-Object Test

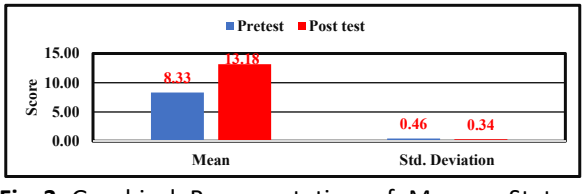

Fig. 3: Graphical Representation of Memory Status Before and After Application of Memory Encoding Methods in Visual-picture test

status found to be increased and was statistically significant when compare to visual-picture test ($p<0.01$) and visual-word test ($p<0.01$) as seen in table 7.

Males Vs Females: The mean of memory status after application of memory encoding methods was found to improve more in females than males, however it was statistically not significant ($p>0.05$) as shown in table 5.

Picture Test: Table 3 shows mean and SD of memory status before and after application of memory encoding methods in all the subjects. The mean of the same are graphically depicted in figure 3.

Memory Status Before Application of Memory Encoding Methods:

In all the Subjects: The mean+SD of memory status in all the subjects was 8.33+0.46 as seen in table 3 and figure 3. The memory status found to be lesser and was statistically significant when compared to visual-object test($p<0.05$).The memory status was found to be greater than visual word test and was statistically significant ($p<0.01$) as seen in table 6.

Males Vs Females: The mean of the memory status before application of memory encoding methods was found to be numerically more in males than females which was not statistically significant ($p>0.05$) as shown in table 4.

Memory Status After Application of Memory Encoding Methods:

In all the Subjects: The mean+SD of memory status in all the subjects was 13.18+/-0.34. The memory status found to be increased and was statistically highly significant when compared to the memory status before application of memory encoding methods ($p<0.01$) as shown in table 3 and figure 3.

After post hoc analysis the memory status was found to be increased and was statistically significant when compared to visual word test ($p<0.05$). The memory status was found to be decreased and was statistically significant when compared to visual-object test ($p<0.05$) as seen in table 7.

In our present study pictures were recalled better than words when presented visually. Our results are consistent with outcomes of Hern[9].

Males Vs Females: The mean of memory status after application of memory encoding methods was found to improve more in males than females, however it was statistically not significant ($p>0.05$) as shown in table 5. In our present study females have better short term memory for visual object test. The results are consistent with the studies done by zeba[8], saher[6], and kanwar[6]. Gabriel and Sridevi[10], conducted a research in Chennai and concluded that women performed well in verbal episodic memory tasks and men excelled in visuo-spatial processing.

CONCLUSION

There was statistically significant improvement in short-term memory of all the subjects, males and females using visual tasks. The overall results of our present study revealed the important observation showing better short term memory status for objects and pictures when compare to words before and after application of memory encoding methods which may be attributed to good eyesight, familiar objects, individuals relationship with the surrounding. world, dependency on this method of memory encoding, attention, curiosity and the use of familiar objects most commonly used in day to day life.

Males showed better short term memory for words and pictures compare to females showing better short term memory for objects, before and after application of memory encoding methods which may be due to more attention and good eyesight and use of familiar words. Short term memory enhancement in visual tasks has occurred due to the productiveness of memory encoding training done in medical students. Hence, these memory encoding training methods can be utilised by them for more efficient learning and improving academic performance. Short term memory status can be assessed by simple visual tasks and so can be recommended as bedside tests to evaluate the short term memory status in healthy individuals and to differentiate them from various psychological and neurodegenerative diseased conditions like Alzheimer's disease, Parkinson's disease and senile dementia.

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