

## A STUDY TO EVALUATE THE REACTION TIME IN TENSION TYPE HEADACHE.

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### Abstract

The study evaluated the visual and auditory reaction time (simple and choice) in tension type headache patients and healthy controls.

**Materials and Methods:** Study included 21 Tension type headache (TTH) patients in the age group of 21- 49 years and 21 age and sex matched controls. Simple and choice auditory and visual reaction time was recorded using Medicaid Systems RTM-604. The results were statistically analyzed and were recorded as mean  $\pm$  standard deviation and Student's unpaired t-test was applied to check the level of significance.

**Results:** The mean values of simple visual reaction time (VRT) and auditory reaction time (ART) were not significantly different in Tension type headache patients and controls. The visual and auditory choice reaction time was longer in TTH patients as compared to controls although not statistically significant.

**Conclusion:** Cognitive and psychomotor impairment has been reported in headache patients. Our findings also indicate delayed central processing in TTH patients and these findings need to be further validated in larger sample size.

**Keywords:** Simple and choice Reaction time; Tension Type Headache

### Introduction

Simple reaction time is the minimal time needed to respond to a stimulus as fast as possible. It is a measure of sensorimotor association. Reaction time is a simple and non-invasive test for peripheral as well as central neuronal processing. Helmholtz first designed a reaction time task to

measure the speed of neural transmission.<sup>1</sup> Simple reaction times were first studied by Francis Galton in 19<sup>th</sup> century.<sup>2</sup> With the growth of cognitive psychology, reaction time has been used extensively to study a wide variety of mental activities in both normal and neurologically impaired populations. Three types of reaction time have been described:<sup>3</sup>

- Simple reaction time involves one stimulus and one response.
- Recognition reaction time which includes some stimulus that needs to be responded to and other that should not get response.
- Choice reaction time involves multiple stimulus and multiple responses.

Factors that can affect reaction time include age, sex, fatigue, fasting, personality type, exercise and intelligence of the subject. Practice can also influence simple reaction time. This maybe because with repetition motor circuits of basal ganglia allow automatic execution of motor task.<sup>4-6</sup>

Tension type headache (TTH) is the most prevalent primary headache and impacts most of the population at some point in life. The lifetime prevalence of TTH is 30% to 78%.<sup>6</sup> In the present study, auditory reaction time (ART) and visual reaction time (VRT) has been studied in patients with tension type headache. There are various studies evaluating cognitive impairment in tension type headache with conflicting results.<sup>7,8</sup> The present study thereby aims to explore the simple and choice reaction time to visual and auditory stimuli in tension type headache patients.

#### **Material and Method:**

The study was conducted in a tertiary care teaching hospital with approval from institutional ethics committee. Study population included 21 subjects comprising diagnosed patients of tension type headache and 21 age and sex matched controls. The subjects were diagnosed as per International Headache Society Diagnostic Criteria.<sup>9</sup>

ART and VRT were done using Medicaid Systems RTM-604 (Chandigarh, India). This instrument was equipped with a sensitive quartz clock which measured up to 1/10th of a msec. The readings were taken in a quiet secluded room between 10 am to 12 pm. All subjects were right handed and used their right index finger to press the button of the apparatus. Each subject was instructed to

press the switch as soon as he saw the light or heard the sound. 3 practice sessions were given for each visual or auditory reaction time before starting the recording. The following simple reaction times were noted:

- VRT measurement: The examiner pressed the “start” switch in the panel which was out of view of the subject and the subject responded by pressing the “stop” button in his end of panel.
- ART measurement: Examiner presses the start button on the panel which is out of view of the subject and subject responds by pressing “stop” button on panel when he/ she hears sound (1000Hz's tone) through headphone.

From the auto-display, the reaction time was noted. Three readings of each stimulus were noted after giving three practical trials and their mean was taken as the reaction time.<sup>10</sup>

For recording the choice reaction time 3 stimuli red, green and yellow were used. The colours were randomly presented to the subject. The subject responded by pressing the corresponding button in front of the light. The reaction time was noted from digital display and average of three values was taken. To record auditory choice reaction time subjects were trained to differentiate between high, medium and low frequency of sound. Similar to visual choice reaction time average of three readings was taken after practice session.

#### **RESULTS:**

21 Tension type headache (TTH) patients (mean age  $32 \pm 7$ ) and 21 controls (mean age  $36 \pm 8$ ) were evaluated for simple reaction time tasks. Simple Visual reaction time and auditory reaction time was measured in seconds. The statistical significance was determined by the Student's unpaired “t” test.

The observation was taken as significant at  $p < 0.05$ . There was no significant statistical difference in simple visual and auditory reaction time in TTH patients and controls. (Table 1)

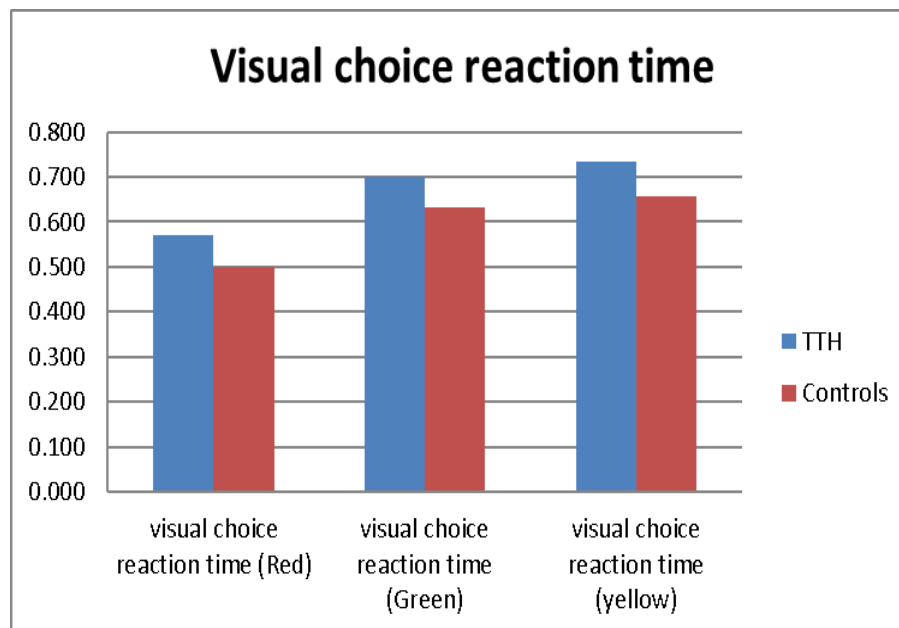
**Table 1: Simple visual reaction time in TTH patients and controls**

AGE	TTH		Controls		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
	32.190	7.903	36.000	8.198	
SIMPLE VISUAL REACTION TIME (RED LIGHT)	0.277	0.069	0.282	0.066	0.808
SIMPLE AUDITORY REACTION TIME (HIGH FREQUENCY)	0.274	0.071	0.279	0.067	0.791

**Table 2: Visual choice reaction time in TTH patients and controls.**

VISUAL CHOICE REACTION TIME	TTH		Controls		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
Red	0.569	0.169	0.499	0.147	0.159
Green	0.700	0.172	0.633	0.150	0.188
Yellow	0.733	0.173	0.658	0.133	0.124

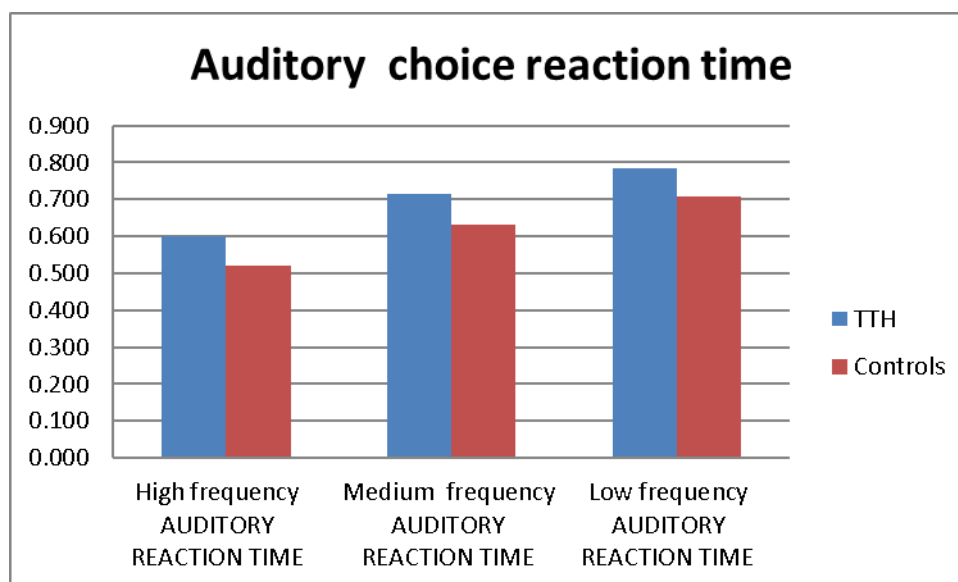
The mean average choice reaction time in TTH patients for red light ( $0.569 \pm 0.169$ ) ; green light ( $0.700 \pm 0.172$ ) ; yellow light ( $0.733 \pm 0.173$ ) was longer when compared to controls although not statistically significant. The mean average visual choice reaction time values in controls were as follows : for red light ( $0.499 \pm 0.147$ ) ; green light ( $0.633 \pm 0.150$ ) ; yellow light ( $0.658 \pm 0.133$ ). (Table 2 ; Figure 1).

**Figure 1: Visual choice reaction time in TTH patients and controls.**

**Table 3: Auditory choice reaction time in TTH patients and controls.**

AUDITORY CHOICE REACTION TIME	TTH		Controls		p value
	Mean	Std. Deviation	Mean	Std. Deviation	
High frequency	0.601	0.156	0.519	0.149	0.087
Medium frequency	0.715	0.133	0.632	0.160	0.076
Low frequency	0.785	0.171	0.707	0.162	0.134

Similar findings were also noted for auditory choice reaction time. The mean average choice reaction time in TTH patients for high frequency ( $0.601 \pm 0.156$ ); medium frequency ( $0.715 \pm 0.133$ ); low frequency ( $0.785 \pm 0.171$ ) was longer when compared to controls although not statistically significant. The mean average auditory choice reaction time values in controls were as follows: for high frequency ( $0.519 \pm 0.149$ ); medium frequency ( $0.632 \pm 0.160$ ); yellow light ( $0.707 \pm 0.162$ ). (Table 3; Figure 2).

**Figure 2: Auditory choice reaction time in TTH patients and controls.**

## DISCUSSION:

Reaction time is one of the important factors helping an animal cope with the environmental changes and for maintaining homeostasis. It is especially important when driving, playing sports, in emergency situations and in many day to day activities.<sup>9</sup> Reaction time consists of mainly 2 components:

- **Mental processing time:** It is the time required for subject to perceive the stimulus, identify it and decide proper motor response.

- **Movement time:** It is the time required to perform the movement after selection of appropriate response.

Tension type headache has been historically ascribed to persistent contraction of scalp, neck and jaw musculature. It has been variously known as essential headache, ordinary headache, psychogenic headache and idiopathic headache. The pathogenesis of headache is not well understood and various pathophysiological factors influencing tension type headache have been suggested. Peripheral pain mechanisms are most likely to play a role in episodic tension type headache while central pain mechanisms play an

important role in chronic tension type headache.<sup>11</sup>

In the present study we did not find significant difference in simple reaction time tasks between tension type headache patients in inter-ictal period and controls. The choice reaction time however was more prolonged in TTH patients as compared to controls although not statistically significant. This could mean that central processing was more delayed in TTH patients as compared to controls. Smith AP confirmed that having an acute TTH was associated with an increase in negative affect, poorer performance on working memory and semantic memory tasks, slower psychomotor performance, and increased distraction from irrelevant stimuli. He concluded that that an acute headache is associated with behavioural changes.<sup>12</sup> Kuhajda MC et al reported decreased attention (encoding) and memory (recognition) with headache pain.<sup>13</sup>

Rasmussen BK et al found 59% of headache subjects had moderate to severe impairment in their daily activities.<sup>14</sup> This can have implications for safe performance of daily tasks in TTH patients.

## CONCLUSION:

Simple reaction time parameters for visual and auditory reaction time were not significantly affected in our study. The study needs to be done in a larger population and reaction time need to be studied during the headache period to further validate and compare the findings.

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