T.C.
FATIH UNIVERSITY
INSTITUTE OF BIOMEDICAL ENGINEERING

EEG SIGNAL ANALYSIS IN CONVERSION DISORDER PATIENTS

ZEYNEP AKTEMUR

MSc THESIS
BIOMEDICAL ENGINEERING PROGRAMME

İSTANBUL, JANUARY / 2015 (DEFENSE)

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ASSIST. PROF. DR. SAİME AKDEMİR AKAR

İSTANBUL, JANUARY/ 2015 (DEFENSE)

T.C.
FATİH ÜNİVESİTESİ
BİYOMEDİKAL MÜHENDİSLİK ENSTİTÜSÜ

KONVERSİYON BOZUKLUĞU HASTALARINDA EEG SİNYAL ANALİZİ

ZEYNEP AKTEMUR

YÜKSEK LİSANS TEZİ
BİYOMEDİKAL MÜHENDİSLİĞİ PROGRAMI

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İSTANBUL, OCAK / 2015 (SAVUNMA)

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Zeynep AKTEMUR, a MSc**.** student of Fatih University **Institute of Biomedical Engineering** student ID 520112021, successfully defended the **thesis** entitled "EEG Signal Analysis in Conversion Disorder Patients", which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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……**Prof. Dr. Sadık KARA**

Director

Date of Submission: 01 January 2015

Date of Defense : 30 January 2015

Thank to my lovely family, husband and helpful advisor,

ACKNOWLEDGEMENTS

I would like to express my gratitude towards my supervisor Assist. Prof. Dr. Saime AKDEMİR AKAR for her advices, patience and encouragement during thesis. Her guidance and to motivate me was really helpful to finish my thesis. I thanks to Bezmialem Foundation University Medical School Hospital Psychiatry Polyclinic Chairman Prof. Dr. İsmet KIRPINAR, a psychiatrist Assist. Prof. Dr. Erdem DEVECİ, Assistant Doctors and Employees to be helpful to diagnosing and evaluating patients and recording EEG data from conversion disorder patients that they were included in the research .

And thanks to my father and my all family for their support and encourage during test and thesis period. I thank to my husband -Serdar Kağan AKTEMUR- for providing any material and moral support. I also thank my best friend Pınar KARAMIKOĞLU for providing support during my grad school and my thesis.

January 2015 Zeynep AKTEMUR

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LIST OF SYMBOLS

φ	Mother wavelet
$\sum$	Sum
ψ	Positive number

ABBREVIATIONS

BAI : Beck Anxiety Inventory
BDI : Beck Depression Inventory
C : Central
CD : Conversion Disorder
CS : Conversion Symptoms
CT : Computed Tomography
CWT : Continous Wavelet Transform
DSM : Mental Illness of Descriptive and Statistical Reference Book
DWT : Discrete Wavelet Transform
ECG : Electrocardiography
ECT : Electroconvulsive therapy
EEG : Electroencephalography
EMG : Electromyography
EOG : Electrooculography
F : Frontal
fMRI : Functional Magnetic Resonance Imaging
ICD : World Health Organization Mental and Behavioural Disorders Classification
M : Music
MRI : Magnetic Resonance Imaging
N : Noise
P : Parietal
PET : Positron Emission Tomography
R1 : Resting 1
R2 : Resting 2
R3 : Resting 3
SD : Somatoform Disorders
SPECT : Single-photon Emission Computed Tomography
Std. Dev : Standart Deviation
WD : Wavelet Decomposition
WT : Wavelet Transform

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SUMMARY

EEG SIGNAL ANALYSIS IN CONVERSION DISORDER PATIENTS

Zeynep AKTEMUR

Biomedical Engineering Programme

MSc Thesis

Advisor: Assist. Prof. Dr. Saime AKDEMİR AKAR

In this thesis the signals were compared conversion disorder patients and healthy control group by receiving electrophysiological (EEG signals) parameters during auditory stimuli. Brain signals received from volunteers with consent obtained permission by using EEG Brain Vision V-Amp device. Signals were recieved 6 brain region these were Frontal, Central and Parietal right and left symmetry lobes. While signals were collecting the auditory stimuli was listened. This auditory stimulus was 10 minutes and it was formed 2 minutes silence, 2 minutes ambulance siren, 2 minutes silence, 2 minutes relaxation music and 2 minutes silence.

These EEG signals were divided subbands on MATLAB with Discrete Wavelet Transform and all bands were evaluated with engineering method that was Shannon Entropy. This process results in waves converted to digital data. These results were compared with a statistical program that was SPSS Statistics 22.Version. Independent Sample t Test was used for compare two groups (conversion disorder patients and healthy control group) and also Paired sample t test used for separately in each group and they were analyzed using the effect created by successive stimuli. Some of the bands were obtained significant decomposition; results were rejected in some bands.

Keywords: Conversion Disorder, EEG, Discrete Wavelet Transform, Shannon Entropy.

ÖZET

KONVERSİYON BOZUKLUĞU HASTALARINDA EEG SİNYAL ANALİZİ

Zeynep AKTEMUR

Biyomedikal Mühendisliği Programı

Yüksek Lisans Tezi

Danışman: Assist. Prof. Dr. Saime AKDEMİR AKAR

Bu çalışmada, konversiyon bozukluğu hastaları ile sağlıklı kontrol gruplarında işitsel uyaranlar kullanarak ve bu uyaranların beyinde oluşturduğu dalgaların elektrofizyolojik (EEG) parametreler ile ilişkilendrilip karşılaştırılması sağlanmıştır. Gönüllü onam formu ile izinleri alınmış gönüllülerden alınan beyin sinyalleri Brain Vision V-Amp EEG cihazı kullanılarak kaydedilmiştir. Sinyaller beynin 6 bölgesinden alınmıştır. Bu bölgeler, Frontal, Cental ve Parietal sağ ve sol simetrik loblardır. Sinyaller kaydedilirken kişilere sesli uyaran dinletilmiştir. Bu uyaran 10 dakikadan oluşmaktadır ve içeriğinde 2 dakika sessizlik, 2 dakika ambulans sireni, 2 dakika sessizlik, 2 dakika rahatlatıcı müzik ve 2 dakika sessizlik vardır.

Alınan EEG sinyalleri MATLAB programında Ayrık Dalgacık Dönüşümü ile alt bantlrına ayrılmıştır. Tüm bantlarda Shannon Entropy değerlerine bakılmıştır. Bu işlemler sonucunda dalgalar sayısal verilere dönüştürülmüştür. Elde edilen sonuçlar SPSS Statistics22.Versiyon programı kullanılarak karşılaştırılmıştır. Bağımsız Örneklem t Testi kullanılarak iki grubun değerleri karşılaştırılırken, Eşleştirilmiş Örneklem t Testi kullanılarak her bir grupta ayrı ayrı olmak üzere ardışık uyaranların oluşturduğu etkiye bakılmıştır. Bazı bantlarda anlamlı ayrışmalar elde edilirken, bazı bantlarda hipotez reddedilmiştir.

Anahtar kelimeler: Konversiyon Bozukluğu, EEG, Ayrık Dalgacık Dönüşümü, Shannon Entropy.

CHAPTER 1

1. INTRODUCTION

1.1 Purpose of the Thesis

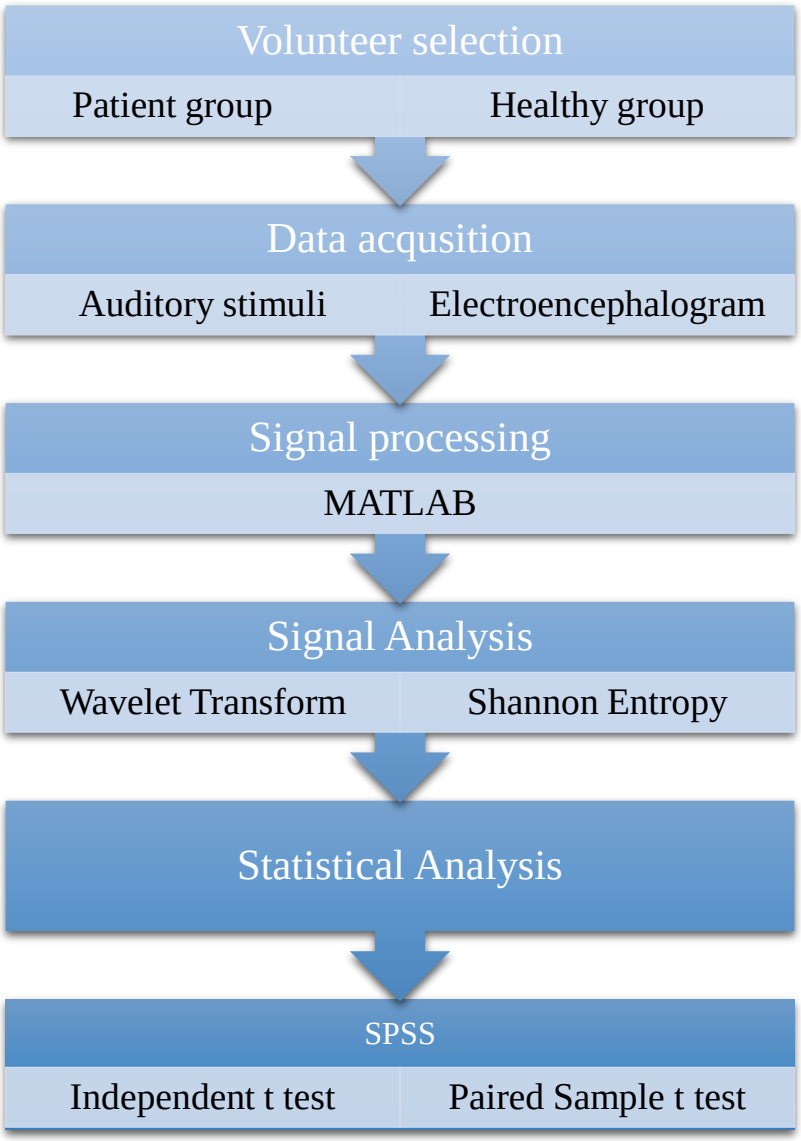
The aim of our study was investigating distinctive features between conversion disorder patients and controls based on EEG signals with the help of advanced engineering methods. Experts mostly are grading with different scores, so it causes a problem to decide about disorder for the conversion disorder patients. In this study, the goal is to research electrophysiological methods to diagnose conversion disorder. This study will help to understand the degree and treatment of conversion disorder in clinical research.

1.2 Thesis Overview

Chapter 1 consists of informations about purpose of thesis and thesis overwiev to understand which subjects are included in the thesis. **Chapter 2** includes informations that consist of mental illnesses, somatoform disorders and conversion disorder. Also there are some information about conversion disorder features, history of disease, epidemiology, diagnosis and treatment.

In chapter 3, the forming operation and collecting and processing data for the experiments, Also a device that has been used during the experiment, electroencephalogram and engineering methods (Shannon entropy, Discrete Wavelet transform etc.) that were used are also described in this chapter. The results of the experiment are given in **Chapter 4**. Results that were obtained by applying engineering methods are shown using tables and graphs. Also results of statistical analysis are shown with tables and the discussion part of this thesis is given in **Chapter 5**. These all periods are shown on Table 1.1.

Table 1.1 A block diagram of experiment



CHAPTER 2

2.1 Mental Illnesses

Mental illnesses are common characteristics of our urban societies according to epidemiological studies conducted in Europe and in the United States. Their frequency is guessed at almost one fourth of the general population in most countries. It means that one of four people is expected to report sufficient criteria to be diagnosed with a form of mental illness at some point in his/her life [1].

Diagnosis of people with mental illness and being excluded from the society is as old as history of humanity. As symptoms of mental illness were insoluble and intangible during the ages of illiteracy of history of humanity; it causes people to be seized with fear [2].

Hollingshead and Redlich' introduced the concept of "lay appraisal" to show that, long before mental health professionals may become involved, people such as family, friends, coworkers, police, and, the person himself or herself appraise the early signs ofmental disorders and make decisions about what (if anything) should be done. Others have provided vivid evidence regarding cultural stereotypes [3].

Mentally ill patients are sensed as irresponsible, unable to control themselves, irremediably lost for the society, dangerous or a subject of mercy and compassion. They are viewed as living in their own mysterious and isolated worlds [1].

2.2 Somatoform Disorder

Psychiatric disorders are common in general practice and the general practitioner has an axial role in the recognition and subsequent treatment of mentall illnesses. Although psychiatric attention tends to focus on anxiety and depressive disorders, these disorders are not the most common in general practice. A currency somatoform disorders (SD) are reported as high as 30.3% by Fink et al. The comorbidity of SDs with anxiety and depressive disorders is high and the burden off ilness may be significant [4].

The SDs category was introduced into DSM-III [5] in 1980. It summarizes conditions which are characterized by medically unexplained symptoms and substantial functional impairment. Since then, as revised diagnostic algorithms ‘multisomatoform disorder’ [6] ,‘abridged somatization disorder’ [7] or ‘polysymptomatic SD’ as has been suggested [8].

In the current International Classification of Diseases (ICD-10; World Health Organization, 1992), hysteria (Conversion Disorder) is classified as a “Dissociative Disorder,” whereas the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994) defines the same phenomena as a “Somatoform Disorder” [9].

It is considerable to note that there is no small number of patients who come to psychiatrists with somatic complaints but the much larger number who are seen by all types of doctors with somatic symptoms that can not be explained by general medical conditions [10]. SDs are characterized by the existence of multiple somatic symptoms. While the accuracy of perceiving bodily signal (interoceptive awareness) is only rarely investigated in SDs, recent research has associated autonomic imbalance with cognitive and emotional difficulties in stress-related diseases [11]. SDs are an important determinant of the use of medical care, but their impact on the use of independent somatization patients are often difficult to determine because of psychiatric and medical association [12].

For the diagnosis of SDs cause the exclusion of somatic (SMD) is required for, there is very little information on the prevalence of such disorders in the community [13]. Patients with SDs may have difficulties coping with stress defenseless against stress [14].

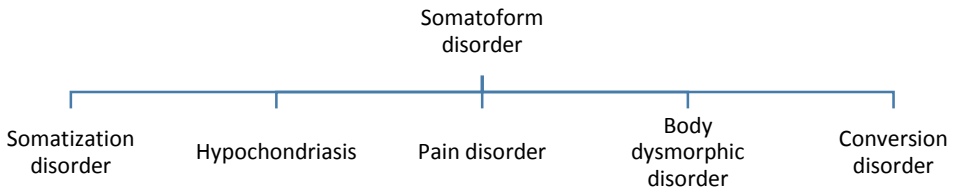


Figure 2.1 Subtypes of Somatoform disorder

2.3 Conversion Disorder

Conversion disorder (hysteria) is a psychiatric condition. Patients have medically unexplained neurological symptoms [15]. The term conversion disorder (CD) reflects an unconscious psychological conflictis "converted" into symbolic somatic symptoms. It reduces anxiety and shielding the conscious self from a painful emotion [16]. Symptoms are diagnosed approximately one third of patients with CD [17].

In general, patients with pseudoseizures [18] and somatization disorder [19] and in CD patients in general [20]. Sexual abuse and dissociation are independently related with several indicators of mental health disturbance. They include risk-taking behavior such as suicidality, self-mutilation, and sexual aggression [21].

CD is not equivalent to malingering. Their symptoms and motivation are conscious, nor to factitious disorder, whose symptoms are conscious but in which motivation is unconscious [22].

Although long dominant, now the conversion hypothesis is only one of many competing etiological hypotheses. It has little corroborative empirical evidence. The reasons of these symptoms are psychological but they may be incorrect [23].

CD has some problem. It is not explained how physiological symptoms could become such a burden. Diagnosis of hysterical paralysis is hard. For example, it could be the amplification of any 'normal' symptom, when what it appears to be is physical dysfunction de novo [24].

Subconscious psychological factors are judged to be associated with the symptom in the DSM IV criteria. Temporal relation between a psychosocial stressor or psychological conflict, and initiation or exacerbation of a symptom cause these symtoms [25]. CD has unexplained physical symptoms. Conversion symptoms (CS) are not important only for psychiatrists. This is also important for internists and neurologists. It is occupying a vital place in differential diagnostic procedures, consultation–liaison psychiatry, and in medical-surgical settings [26]. People can not understand of the mechanism how psychological stress can "convert" into physical symptoms [27].

2.3.1 History of Conversion Disorder

CD is historically linked to the notion of hysteria [21]. Usually no one yet find acceptable satisfactory definition "hysteria"; but usually it is claimed can be considered when met with the disease [28].

The puzzle of hysteria, as it was previously known, had been documented for millennia [29] but only began to assume its current form in the 19th century. Although physicians as far back as Willis had previously taken a psychological view of hysteria [30] and others had considered it to be malingering, the debate crystallised with the development of post-mortem neuropathology whereby many other neurological disorders were found to have distinct anatomical and cellular abnormalities [31].

Hysteria is a disease that like a puzzle which is previously documented thousands of years [29] but it has reached current state in the 19th century. Some of that before Willis, some doctors hysteria come up with a physiological reason [30] some of them think about on malingnering, post-mortem neuropathological studies it was found that evolves caused by different anatomical and cellular abnormalities associated with other neurological disorders [31]. In the absence of pathological research Charcot use the term ‘functional’ for the disease like CD and other diseases like migraine that can not be proven, but to identify pathological disease that causes lesions dynamic bias 'functional' used the term.

The natural image response is determined by Freud changed the topic with feigning as the best explanation [32], despite a very long time to be permanent after the model of Charcot's death.

Physiological theory of CD does not necessarily winners to Freud and Janet thought middle of the 19th century and has increased at the end of the neurological causes. Physiological theory of CD, does not necessarily winners to Freud and Janet thought, middle of the 19th century and has increased at the end of the neurological causes [33] and Janet that they prevailed. Pierre Janet, the best of argued the symptoms can be explained by the decomposition of physiological reasons. He suggested that dissociation could lead toproblems maintaining the normal conscious synthesis of experiences: “a special moral weakness, consisting in the lack of power, on the part of the feeble subject, to gather, to condense his psychological phenomena, and assimilate them to his personality” [34].

Under some situations he proposed that, including trauma, a rogue ‘idea’, like that a weak limb, could be fixed, and decomposed from the consciousness that was too weak to exert control over it. Freud later remodeled his view to debate that these traumas were only so debilitating because they stirred memories of childhood sexual abuse, and then reduced the latter idea to tolerate of his theory of puerile sexuality.Although he subsequently remodeled his view again, those early ideas of punch, conversion and sexual abuse came to dominate post Freudian psychiatric models of hysteria [35].

The agreement of these models changed hysteria from neurological situations to migraine into a purely psychiatric disorder.

During the 20th century even as psychiatrists noted its apparent disappearance from their clinics they embraced the condition [36] (although its actual prevalence showed little indicate of decline) [37]. Hysteria registered the diagnostic classification, with terminology that embodied the dominant Freudian model conversion hysteria. In the last of the century, as impetuous for biological psychiatry grew, in the UK in particular, there were moves to a more neutral model. Sequential repetitions of the diagnostic criteria became increasingly ‘agnostic’ in terms of a specific psychological model [38], and the term dissociation, still in common use in psychological circles, re-entered the denomination in ICD-10, describing ‘dissociative seizures’ and becoming a synonym in ‘dissociative (conversion) disorder’.

Doctors often have difficulty in the identification of CSs. This means that a lot of studies indicate that the extent they affect misdiagnosed. The best known of this work was published in 1965 by Slater. Working hysteria showing that the 33% luxury misdiagnosed patients, showed that there is nothing more than a delusion, and diagnostic pitfalls [39].

The nineteenth century was intimately rich in person-alities whose work gradually laid the establishments for a true medical approximately to hysteria. In the nineteenth century it was a question of causing various kind of epistemological break: i.e removing the disease from a tradition of thought, still alive at that time although dating back to Greek Antiquity, which indicated it as an tenderness of the uterus (etymologically ‘‘hysteria’’ comes from the Greek ustera, meaning matrix, uterus) [40].

2.3.2 Pathophysiology

Suppression is the main defense mechanism in CD, as reported by the close relation between conversion conditions and traumatic events in the patient's past. Negative connotations such as, fear, shame, and guilt or anger because of an impulse or a wish that cannot be fulfilled is converted into physical expression according to Freud. So the CS actually reflects a symbolic solution to the same unconscious psychological conflict. Freud emphasizes the symbolic relation existing between the type of the CS and the conflict. Primary and secondary gains are defined by Freud. An internal unconscious defensive mechanism produces the primary gain ± anxiety. It is converted into symbolic physical symptoms, while the conflict remains limited within the unconscious, thus resulting in reduction of the anxiety level [41].

The pathophysiology of somatic amplification is caused by the protracted effects of stressors and cytokines on brain functions. It plays important role in the pathophysiology of somatic amplification.

Sensitizing effects of cytokines is clearly demonstrated in the field of pain. Activated glial cells in the spinal cord produce effect of proinflammatory mediators in which the perception of pain is strongly amplified [42].

2.3.3 Epidemiology

According to the population type, the frequency of CD changes among different reports from 11/100 000 to 300/100 000 [43, 44]. The annual incidence in Monroe county, 11/100 000 cases in Iceland during 1960±1969 compared New-York was 22/100 000 cases [45]. 1%±3% of outpatients with CD is in psychiatric clinics. A frequency of 10% found in a sample patients taken 3 years was decribed by Hafeiz [46], However, up to 20% among patients referred to various evaluation procedures in reports [47].

5-15 % o f psychiatric consultations consists patients with CD in studies which are reported. The ratio of female-to-male who has CD has ranged 2-to-1 up to 10-to-1. CD is common diagnosed in adolescents and young adults, despite occurring at any age. This illness is defined more frequently in individuals who live in rural areas, with less education, with lower IQ, and in military members exposed to combat [48].

2.3.4 Clinical presentation

The patients with CD might behave in a way known as `la belle indifference', a situation in which the patient appears detached from the physical symptoms.

Subjects suffering from CD might behave in a way known as `la belle indifference', a situation in which the patient appears detached from the physical symptoms. If not, this condition would have reasoned him great anxiety. Other presentations are the dramatic of histrionic. The density of the disability usually defines activities of daily living. Anxiety and tension stats, such as the death of a relative or a war situation often aggravate the CS. Dependant behavior or adopt define the patient role during the course of the disease. Dissociative disorder, depression, and personality disorders (especially borderline anti-social and dependant accompanies psychological symptoms [44].

The doctor summarize in three points for the therapeutic process.

• make the diagnosis and be persuaded of it;

• announce the diagnosis to the patient;

• and help the patient to engage in psychotherapy

The first therapeutic step is to search for a physi-cal illness actively for for any suspicion of CD. This is particularly true for patients in the emergency department since the cultural and social plasticity hysteria. On the other hand, since the diagnosis of CD is based on clear-cutpositive arguments, further researches toward a presumedorganic disease can be seen as unnecessary, or ratherdeleterious. Firstly, physical illness’’should be investigated before the diagnosis of CD. But the diagnosis of CD is identified in a short time. Further diagnostic tests are not necessary.

Medical nomadism causes iatrogenic consequences particularly which are involved in multiplicity of additional tests. For example, the case of a patient who has chronic chest pain that presented with radiation-induced coronary artery disease due to multiple coronary angiographies performed acutely in differenthospitals over many years [22].

2.3.5 Diagnosis

CD’s diagnosis is problematic. Doctors can separate conceptually and practically from the disease neurological (organic) diseases, they assume a physiological disease, but to understand how the disease is still difficult to leave the physiological mechanisms of

feigning [49]. The diagnosis is determined after ruling out organic components or other psychogenic diagnosis [50]. The diagnosis process consists of the questioning of a person's medical history, physical examination and the use of appropriate diagnostic tools. CD's diagnostic criteria determine according to DSM-IV. They are [51];

- The formation of one or more symptoms or omissions of voluntary motor or sensory function of neurological or other health problems,
- Psychological factors judged to be associated with symptoms or deficit because the initiation or exacerbation of the symptoms or deficit is preceded by conflicts or other stresses.
- The symptoms or omissions whether willingly or not contrived that producedas in Factitious Disorder or Malingering).
- The symptoms or omissions, not be explained after an appropriate investigation with a health problem, can not be connected directly to an agent, or if there is no cultural pressure or experiences,
- The symptom or deficit causes clinically significant distress or impairment in social, occupational, or other important areas of functioning or warrants medical evaluation.
- The symptoms or omissions are not limited to pain or sexual dysfunction, the purely somatization disorder along, and can not be explained by another mental disorder.

The diagnosis is always momentary and provisory, on account of the time factor relative until the appearance of organic evidence (as in systemic disease).

the significance is the fact that between 25 and 50% of patients diagnosed as conversion, will instantly be diagnosed with an organic medical condition [52, 53].

There are no pathological findings in laboratory tests, supporting CD. On the other hand, however, pathological findings will not necessarily rule out CD [54].

Extra tests, ie, imaging (X-ray, CT, and MRI) and electrophysiological studies (electroencephalography, sensory and motor evoked potentials, and urodynamics) are generally normal; however, entity of findings precious represents the clinical symptoms. When a subject is recieved with paraplegia, normal reflexes and all control of sphincters, a routine X-ray is su • cient, and the diagnosis is clinical. CT and MRI are redundant, and are performed just as extra supporting evidence for the clinical diagnosis [54, 55].

2.3.5.1 A Case Report

There is a boy who is 10 years old. He is presented complaints of stiffness in body and inability to flex knee joints. Body pain which is an occasional complaints for the last 2 months which was abated by body maasage. The body pain appeared one week and he womited after breakfast. He didn't go to the school and he slept for about 2 hours. He woke with stiffness of body and inability to flex upper and lower limbs after 2 hours sleeping. He went to hospital and he regained mobility of the upper limbs in there. However, he was not able to bend his knees and walked with a stiff gait.

His mother said that when his son was sleeping, his limbs were not rigid and would be flexed. The next morning he was able to walk and run. Every thing was normal. When discharge was planned there was a recrudesce. He was moved the hospital, in psychology department. Significant psychiatric or neurological disturbances didn't occur past history of person. Developmental history which was unremarkable was reported. However, good prognostic indicators were defined for resolution of problems. Dissociative motor disorder is defined in the clinical picture according to ICD 10 [56].

For treatment, he has five therapy sessions. Firstly, after unabling to flex his kness, the child sits in the chair with his legs parallel to the ground and he was seen. While he was walking, he dragged. The symptoms were defined. He exercised by slightly moving his feet preceded by deep breathing. Some exercises were suggested to him and he was moving his feet. The exercise was about 10- 15 minutes. After exercise, he could bend his knees and sit in a normal position in a short time. The following morning, he was able to bend his kness to right angels as suggested and he could walk less stiffly in the second session. His parents should encourage him for free lifestyle. So they were educated about this and the psychosomatic nature of his symptoms.

In third session, the next day he could flex his kness but he has pain in lower limbs. These are reported. So he could not bend his knees fully. The next day, he was asymptomatic. He was resuming his earlier routine by the fourth session.He was seen once more after a period of one week during which improvement was maintained. Follow up was maintained for 2 more sessions with the parents with a week's interval in between during which also improvement was maintained. Telephonic contact was maintained upto 3 months during which he continued to be symptom free. The diagnosis of CD, SD, and malingering are difficult for clinicians. Identification of these patients, use of ppropriate and validated physical examination manoeuvres, and

coordination of care may make easy the impetuous care of these patients in a cost effective manner [57].

2.3.6 Treatment

The phenomenon of CD is complicated to understand. It has some functions of the unconscious in the pathophysiology of this requirements [57, 58].

Patients can not go to the hospital to follow-up check for after psychiatric diagnosis. Workup for diagnosis of CD quite quickly is available. In addition, it can be monitored in parallel studies on the physical and psychological factors. Doctors avoid from invasive diagnostic and therapeutic interpositions and giving the patient the imprint that you feel there is nothing wrong with them.

- There is no specific drug treatment of CD, but the mood disorder associated with CD or anxiety disorders maintenance to be carried out.
- Treatment of CD should be avoided from dependence-producing psychotropic drugs.
- Physical therapy may be desirable for the diagnosis of CD. This can often provide relief from ego-synotic patients [59, 60].

Another way for the treatment of CD disease is more available. Patients with past moves towards the physical department, this situation has changed over time, and patients have turned to rehabilitation department because of due to functional losses [61, 62]. There are no long term studies on these topics. The reference to treatment is minimal, contradicting and vague, offering autosuggestion, placebo, and hypnosis as the main treatments of choice. When the psychological intervention fails, inter-disciplinary rehabilitation treatment becomes even more of an imperative [63]. Rehabilitation therapy should be implement to patients as soon as possible [64]. There is necessity to rule out neurological, orthopedic and other potential medical etiologies. The patients must be screened and diagnosed, and to sideline those with suspected subjective disorder, malingering, or where there is secondary gain [61].

2.4 Electroencephalogram

Electroencephalogram (EEG) is most widely used tools for imaging brain activity in humans. First EEG is used over 80 years ago. This imaging technique is noninvasive and it is an ideal for neuroimaging of brain. It is routinely used in clinical applications

like other noninvasive neuroimaging techniques, such as functional magnetic resonance imaging [65].

Brain waves are the oscillations of electrical potential in the brain. EEG is also neurophysiological diagnostic tool for understanding these electrical waves in brain. EEG is used as electrography of brain. It helps to provide information for the physiological situtaion of patients. So it is responsible for treatment [66].

In our study, EEG data are collected from some of brain regions. These are determined according to activation of the region during listening auditory stimuli. These regions were determined as Left Frontal Lobe (F3), Central Lobe (C3), Parietal Lobe (P3) and Right Frontal Lobe (F4), Central Lobe (C4), Parietal Lobe (P4). These points were selected symetrically.

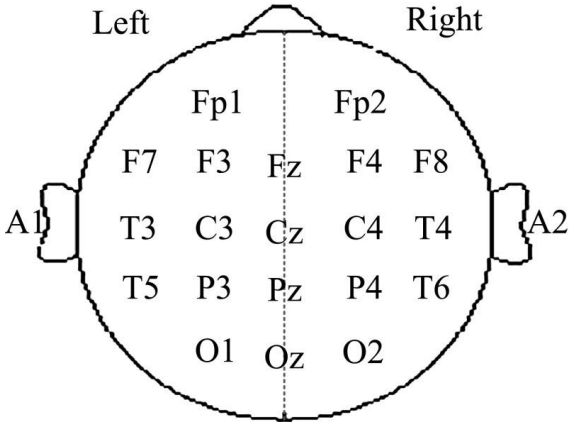


Figure 2.2 Locations of EEG scalp electrodes according to the international 10–20 system [67]

2.4.1 Delta, Alpha, Beta, Theta and Gamma Bands

The pure oscillations generally are not observed in brain regions.Brain regions do not generally display pure oscillations. A combination of delta, theta, alpha, beta, and gamma waves, generally ascribed to network operations in cortico-thalamic systems. Fast Fourier transform was used to calculate the power spectrum to determine the spectral characteristics of the artifact-free EEG data. The power spectrum was averaged in epochs of 1,200 ms. It is corresponding to the volume TR, and over all EEG channels [68].

In 1929, Hans Berger found EEG system. He measured a signal by small electrodes which are connected the scalp. EEG is used to show development of congnitive neuroscience and it is the longest history of all diagnostic technigues [69]. Brain waves

are called according to frequency of bands. If the frequency is lower than 4 Hz, it is called delta wave. If it is between 4 and 7 Hz, it is referred theta wave. The frequency of beta band is between 16 and 31 Hz. Gama band's frequency is bigger than 32 Hz [70].

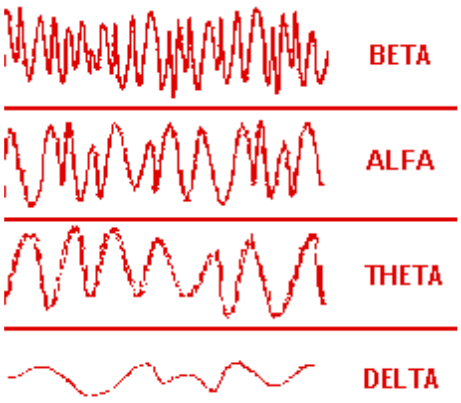


Figure 2.3 Brain wave samples with dominant frequencies belonging to beta, alpha, theta, and delta band [70].

2.5 EEG and Conversion Disorder

In EEG studies, P300 component which is brain waves is focused in event-related response [71]. A paradigm is designed by Lorenz and Colleagues. They recorded EEG data during application electrical stimulation to patient's hands. Patients were asked to verbally report the awareness [72]. The P300 component of the event-related potential was observed, when healty people were asked to feign lack of awareness of the electrical stimulus on one side. It represented the processing of the stimulus and the active withholding of a response. The same procedure was applied to patients with sensory loss due to CD. There is no P300 response to stimulation of the affected limb. This condition is the first evidence about CD that is neurophysiologically distinct from feigning, but the evidence awaits replication. The amplitude P300 waves decreases in patients with visual neglect due to parietal lobe lesions and there is a lengthening of latency [73].

2.6 fMRI and Conversion Disorder

The functional imaging that was first reported was applied on a female nurse who had developed left-sided hysterical paralysis and paresthesia in 1995. Single-photon emission computed tomography (SPECT) was conducted when her left median nerve was stimulated, both while she was symptomatic and when she had recovered (6 weeks later). The perfusion increased in the right frontal lobe. When her symptoms were present, hypoperfusion in the right parietal region [74].

SPECT is applied to five patients with astasia–abasia. Resting cerebral blood flow was measured in study of Yazici and Kostakoglu. Perfusion decreased in four patients in their left temporal areas. But one patient has decreased perfusion in their left parietal lobe compared with the right side [75]. However, the validity of these finding are questioned by significant methodological issues. Most importantly, an adequate control condition is not provided by the contralateral hemisphere, particularly as patients' symptoms were bilateral. In addition, heterogeneous symptoms are observed in the patients. Many patients had previous or current psychiatric conditions requiring medication or electroconvulsive therapy (ECT).

In another study, five patients with medically unexplained visual loss meeting criteria for CD with normal controls are compared by fMRI. The activation of patients reduced in their visual cortex during visual stimulation. Patients has increased activation in their left inferior frontal cortex, left insula, left corpus striatum, bilateral thalami, limbic structures, midbrain, and the left posterior cingulate cortex. The networks activated in these patients are similar to those that are activated in blindsight. The authors suggest this may imply a shift towards implicit visual processing in hysterical blindness [76].

CHAPTER 3

MATERIAL AND METHOD

3.1 Subjects

Totally 10 CD patients and 10 controls data were recorded by EEG. Patients's and controls data were taken from Bezmialem Vakıf University Faculty of Medicine Department of Psychiatry. The ethical approval was signed by Bezmialem Vakıf University Faculty of Medicine (Appendix E). 10 patients who are diagnosed with CD according to DSM-IV criteria and they were diagnosed and evaluated by Assist.Prof.Dr.Erdem Deveci. Ten age-matched control subjects were involved for this study as shown Table 3.1. Patients consisted of 5 male and 5 female, controls consisted of 4 male and 6 female people. Their age means are 26,3 / 30,1 as conversion/control groups. Ratio of smokers and non-smokers of conversion group was 3/7 and control group was 1/9. Volunteers signed concent form to participate this experiment (Appendix A). Volunteers filled the questionnaire of sociodemographic characteristics (Appendix B), Beck Anxiety Inventory (BAI) (Appendix C) and Beck Depression Inventory (BDI) (Appendix D).

Table 3.1 Features of conversion and Control groups

Features	**Conversion disorder**	**Control group**
Number	10	10
Male/Female	5/5	4/6
Age (Mean±Std Deviation)	26,3±11,36	30,1±6,2
Smokers/ Nonsmokers	3/7	1/9

Patients were selected accorcding some criterias;

Inclusion Criteria:

- Between 18 – 40 years old
- Diagnosed with PB according to DSM-IV
- Giving written, informed consen

Exclusion Criteria:

- Having any other mental disorders
- Having pathological, endocrinological, cardiovascular disorders
- Psychotropic medication usage
- Cardiovascular medication usage
- Having head trauma or other neurological disorder
- Having cardiac pacemaker or any device that affect cardiac autonomic function
- Having substance abuse disorders (including alcohol abuse)
- Having hearing loss
- Being pregnant or lactation period in females
- Epilepsy history about patient or among relatives
- If in the last 6 months treated patients with ECT
- Agent in the last one week from measurements with benzodiazepine drugs (DIAZEM, VALIUM, XANAX, NERVIUM, ATIVAN, RIVOTRIL etc.) patients who received,

3.2 Procedure and Auditory Stimuli

The EEG signals were recorded between 9.00 AM and 17.00 PM. In order to get the good quality data, quiet and illuminated room is provided at Bezmialem Hospital, Department of Psychiatry.The hospital employees have adjusted a room for us to study that was silent. External voices are prevented to get good quality data.

Fisrtly, the EEG procedure was applied to subjects who were quietly sitting on chair in relaxed position and they close their eyes during process like Figure 3.1. Then, their heads were measured with a meter. The middle-point was found and the cap was weared. The nasion-anion ratio was considered. Later the points that are blank on the cap to put electrode were cleaned with alcohol and the gel was squeezed. Also gel was squeezed to earlobe of the patient to place reference electrode. The electrodes were placed on the cap on frontal (F3, F4),

central (C3, C4), parietal (P3, P4) regions of brain. We placed electrodes according to 10-20 system as shown in Figure 3.2 and Figure 2.1.

Then the program of the V-Amp was opened on the computer as shown Figure 3.3. This program is aid to see the impedances. If ımpedance is high it is showed with red colour, if impedance is low it is showed with green colour. When all colours are green this means the V-Amp procedure was ready. The earset was placed ear of volunteers to listen voices. The procedure was explained for patient. They must be silent and out of action. Also they should gulp as little as.After that the program and the Mp3 were started at the same time and control the subjects during procedure.

Each subject was exposed to 10 minutes EEG registration. In our study, five channels which are consist of 2 minutes periods. Figure 3.4 shows process of experiment. First period was resting period with 2 minutes duration. It is labeled with R1. Second period is first auditory stimuli period and lasted 2 minutes that are chosen as voice of an ambulance. It is labelled with N. Third period is labelled R2 which is resting 2. It takes 2 minutes. Other one is M period. It has relaxing music. Final period takes 2 minutes. It is labelled R3 which is resting 3 period.

listen voices. The procedure was explained for patient. They must be silent and out of action. Also they should gulp as little as.After that the program and the Mp3 were started at the same time and control the subjects during procedure.

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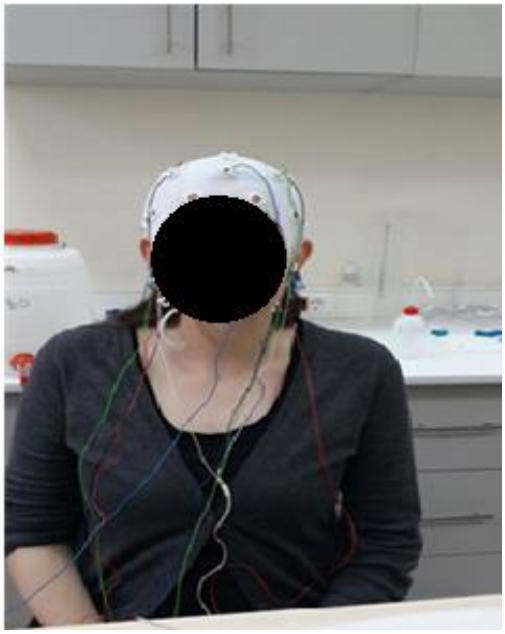


Figure 3.1 Eyes of subjects are closed during process application

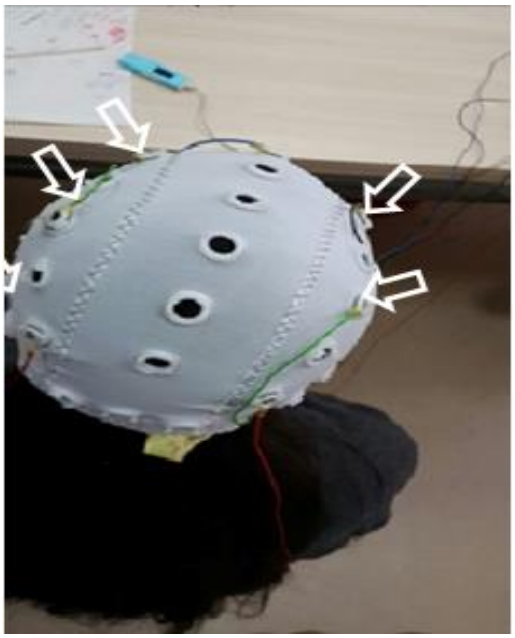


Figure 3.2 Location of channels

Figure 3.3 V-Amp DC model of Brain Vision Product [87]

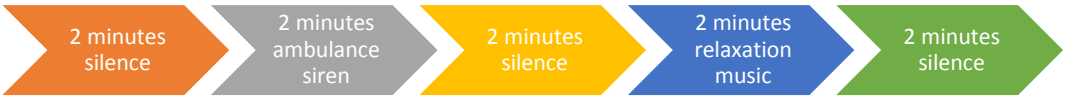


Figure 3.4 Time process of the experiment

3.3 Signal Processing

Signal processing is used to analyze the EEG data. Data were collected with a 250 Hz sampling rate. Before signal processing, an example of recorded data is shown Figure 3.5.

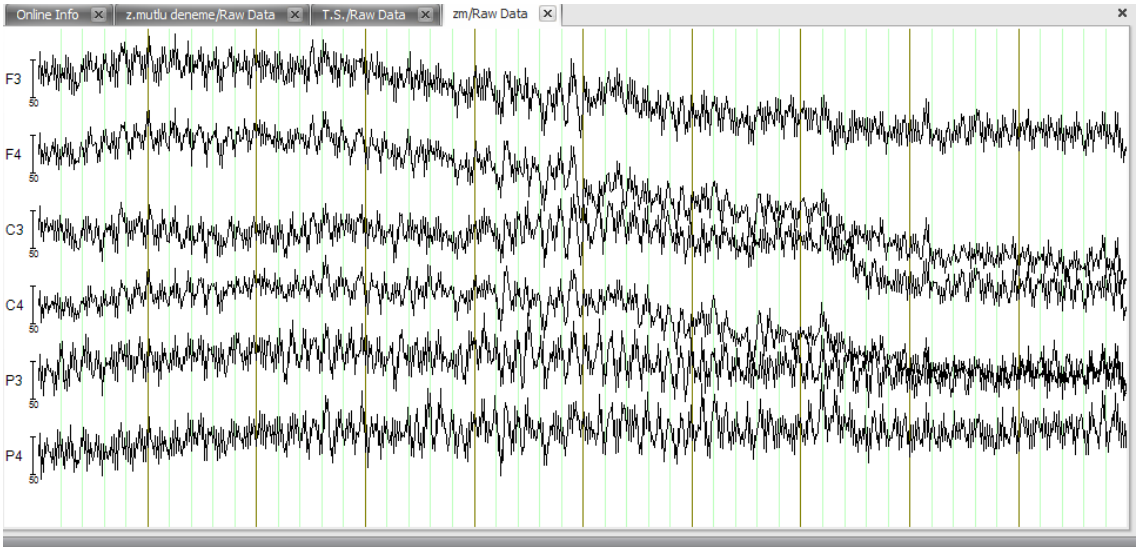


Figure 3.5 The EEG signals which is recorded from healthy person

3.3.1 Wavelet Transform

There is no information about time because of frequency-domain EEG data is based on stationary sinusoidal functions that provide maximal frequency dissolution. Approximation and detail components are defined by using wavelet decomposition (WD) [77].

Wavelet based on the work of Ingrid Daubechies, is a concept of orthogonal wavelets treasures a discrete wavelet transform (DWT) and characterized by a maximal number of vanishing moments for some given support. For each wavelet type of this class, there is a scaling function (called the father wavelet) which generates an orthogonal multiresolution analysis. We used Shannon entropy in this study to indicate irregularities of data. The Daubechies wavelet is used as a wavelet form. Data were decomposed into sub-bands. (delta, alpha, beta, and theta) with WD at 4th level with db3. These procedures were performed to differentiate patients and healthy groups.

3.3.1.1 Discrete wavelet transform

The discretized continous wavelet transform (CWT) enables the estimation of the CWT by computers because it is not a true discrete transform. In fact, the wavelet series is simply a sampled version of the CWT, and the information it provides is highly ridiculous as far as the reconstruction of the signal is influenced.This redundancy, anyhow, demands a substantial amount of computation time and resources.

The DWT, on the other hand, offers sufficient knowledge both for analysis and synthesis of the original signal, with a significant reduction in the computation time. The DWT is enormous easier to implement when compared to the CWT. The main idea is the same as it is in the CWT.

The CWT was computed by changing the scale of the analysis window, shifting the window in time, multiplying by the signal, and integrating over all times. On the other hand for analyzing signal filters of different cut off frequencies can use to at different scales in the discrete case. The signal is passed through a series of high pass filters to analyze the high frequencies, and it is passed through a series of low pass filters to analyze the low frequencies [78].

The x[n] is the original signal. It is decomposed and h[n] and g[n] which are low pass and high pass filter and $\downarrow 2$ denotes subsampling [79] in Figure 3.6. The f is showed at each level as the bandwidth of the signal [80]. The basic principle of wavelet theory is expressed in Gabor's paper in 1945 [81].

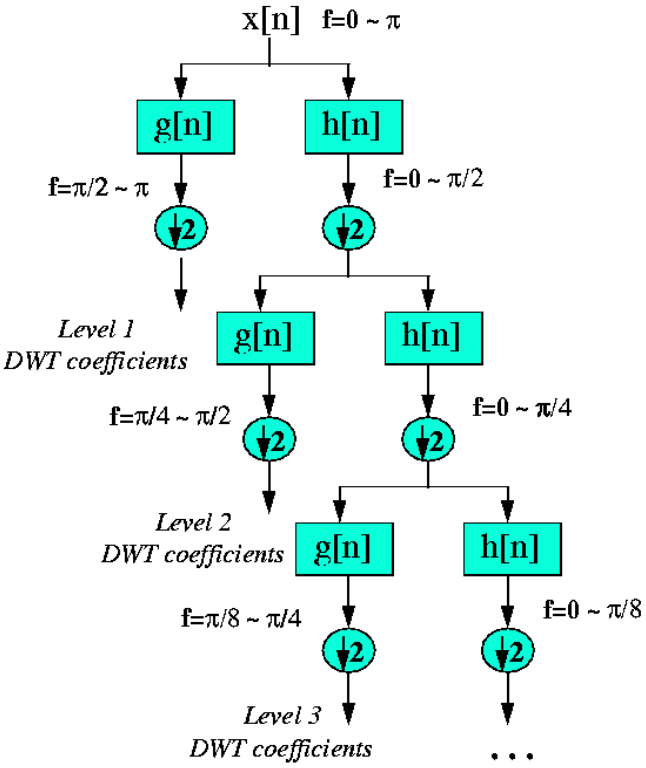


Figure 3.6 Diagram of dividing subbands with Discrete Wavelet Transform

In discrete wavelet analysis, a multi-resolution description is used to decompose a given signal $x(t)$ into increasingly finer detail based on two sets of basis functions, the wavelets and the scaling functions, as follows:

$$x(t) = \sum 2^{j_0/2} a_{j_0}(k)\varphi(2^{j_0}t - k) + \sum_{j=j_0}^{\infty}\sum_{k} 2^{j/2} d_j(k)\psi(2^j t - k)\, j_0 \qquad (3.1)$$

where functions $\varphi(t)$ and $\psi(t)$ are the basic scaling and mother wavelet, respectively. In the above expansion, the first summation represents an approximation of $x(t)$ based on the scale index of j_0 while the second term adds more detail using larger j (finer scales). The coefficients in this wavelet expansion are called the (DWT) of the signal $x(t)$.

3.3.2 Shannon Entropy

Shannon firstly introduced information-theoretic or simply informational entropy in 1948. It is now more frequently reffered to as Shannon Entropy (SE). Realizing that when information was stated, obscurity was reduced or removed, he sought a measure of uncertainty. The SE may be viewed as the hesitation of an observer who guesses the nature of one outcome, or as the disorder of a system in which different formations can

be found. This measure is not consider meaning or value, it only consider about the possibility of occurence of an event. Entropy concept's main limitation is that.

Let α be a random variable with a finite range $a_1,\ldots,a_n$. Let p_i be the probability of the event α=a_i . Then the SE of α is defined as [82],

$$H = -\sum p_k \log p_k \tag{3.2}$$

3.4 Statistical Analysis

SPSS Statistics Version 22 program was used to make statistical analysis. Tests made for compare p values. Independent sample t test and paired sample t test was applied for patients and control groups. p values are indicate a significant difference if they are smaller than 0.05. We also selected p values if they are smaller than 0.08 as closest value to significant difference.

3.4.1 The Indepent Sample Student's t-test

This test is only used when both:

- The two sample sizes (that is, the number, n, of participants of each group) are equal;
- It can be assumed that the two distributions have the same variance [83],

We used this test for compare healthy group and conversion patients. This test is used to compare all subbands of EEG signal in each periods (R1, N, R2, M, R3) at F3, F4, C3, C4, P3, P4 regions. Independent t test first pooled standart deviation has to be calculated by,

$$S_p{}^2 = \frac{(n_1 - 1)s_1{}^2 + (n_2 - 1)s_2{}^2}{n_1 + n_2 - 2} \tag{3.3}$$

Where $n_1 + n_2 - 2$ is the degree of freedom. The equation for calculation t value become,

$$t = \frac{\overline{x_1} - \overline{x}_2}{\frac{sP^2}{n_1} + \frac{sp^2}{n_2}} \tag{3.4}$$

3.4.2 Paired samples t test

Paired sample t test also named as dependent t test, use for indicate distribution of the differences in the dependent variable between the two related groups should be approximately normally distributed. Dependent t-test only requiring approximately normal data because of it's "robust" to violations of normality, meaning that the assumption can be a little violated and still provide valid results [84]. The SPSS program was used to test normality of our data by Shapiro-Wilk test.

We used this test for compare p values. This test was used to assessed patients and healthy groups in itself for all bands and between sequential periods. This test is used to compare all subbands of EEG signal in each sequential periods (R1-N, N-R2, R2-M, M-R3) at F3, F4, C3, C4, P3, P4 regions.

$$t = \frac{\frac{\sum \mathrm{d}}{N}}{\sqrt{\frac{\sum d^2 - \frac{\left(\sum d\right)^2}{N}}{N\left(N-1\right)}}} \tag{3.5}$$

In formula, d is the difference between matched samples and N is number of samples.

CHAPTER 4

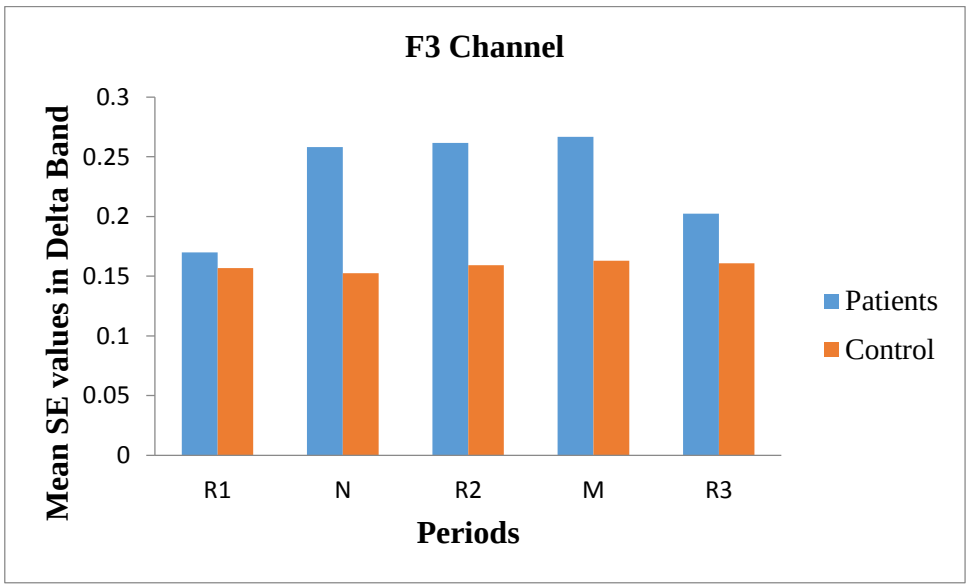
RESULT

In this chapter, results of analyzed EEG signals exist. EEG was recorded from F3, F4, C3, C4, P3 and P4 regions of brain. These signals were recorded from 10 CD patients and 10 healthy people. EEG data were decomposed into brain waves which are alpha, beta, theta and beta sub bands by DWT. After that, SE was calculated in each sub bands. Signals were processed by MATLAB® software algorithms (v. 7.6.0. R2008a). Processed data are used to do statistical analysis by SPSS® (v.20) software. This statistical analysis program consists of independent sample t test and paired sample t test. SE values in CD patients and healty people are compared by independent sample t test. The values between periods in each group are compared by paired sample t-test because of feasibility of normal distribution. This test gives two Sig.(2-tailed) (p value) was determined according to Levene's Test for Equality of Variances Sig. value. If this value much than 0,05 the upper p value if less than 0,05 the lower p value of Independent sample t test value was used to comparison.

In conclusion, after all recordings and analysis mean and standart deviation of SE values of all periods in all bands were calculated. While Table 4.1 shows calculated SE values of each periods (R1, N, R2, N, R3) for patients and control group in each sub bands respectively delta, theta, alpha and beta in F3 Region Figure 4.1, 4.2, 4.3, 4.4 shows their relation with column graph (a) and with line graph (b). Table 4.2 shows p values of each period between patients and controls in each sub bands respectively delta, theta, alpha and beta in F3 Region.

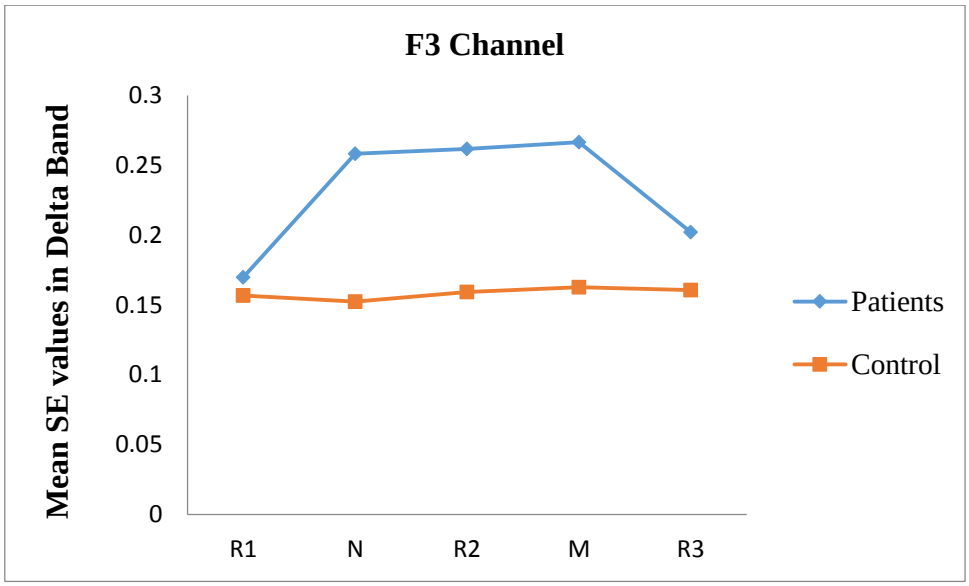
Table 4.1 Comparison of SE values that recorded during all measurements between patients and controls in F3 channel for all periods and bands

	Patients (Mean± Std Deviation)				Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1	-0,18 ±0,06	-0,41 ±0,11	-0,43 ±0,11	-0,28 ±0,06	-0,16 ±0,03	-0,42 ±0,04	-0,47 ±0,04	-0,24 ±0,09
N	-0,31 ±0,11	-0,50 ±0,19	-0,49 ±0,19	-0,42 ±0,28	-0,26 ±0,26	-0,42 ±0,04	-0,53 ±0,18	-0,23 ±0,07
R2	-0,27 ±0,26	-0,49 ±0,19	-0,50 ±0,18	-0,34 ±0,23	-0,16 ±0,02	-0,45 ±0,06	-0,44 ±0,02	-0,24 ±0,14
M	-0,27 ±0,25	-0,51 ±0,17	-0,51 ±0,17	-0,35 ±0,23	-0,16 ±0,02	-0,47 ±0,07	-0,51 ±0,17	-0,24 ±0,08
R3	-0,2 ±0,07	-0,44 ±0,13	-0,43 ±0,10	-0,27 ±0,04	-0,16 ±0,02	-0,44 ±0,04	-0,45 ±0,05	-0,22 ±0,05



(a)

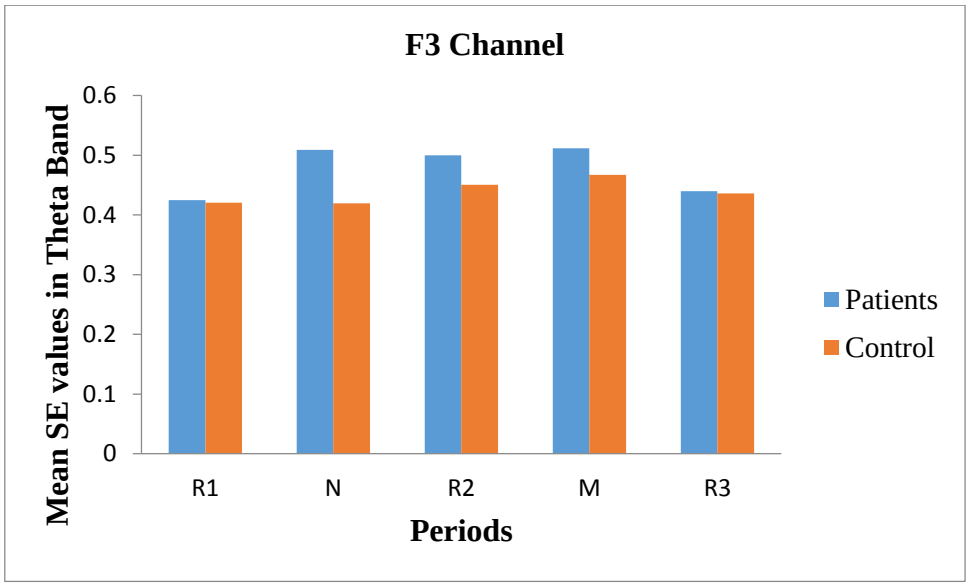
Figure 4.1 Graphs show the mean of SE values of F3 Channel Delta band during all periods (a) with column graph (b) with line graph



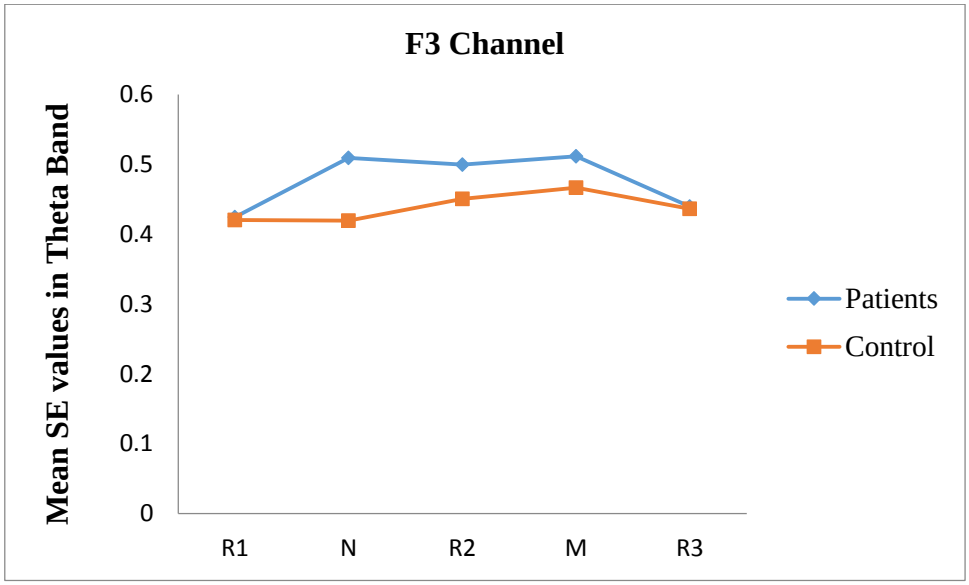
(b)

Figure 4.1(Continue) Graphs show the mean of SE values of F3 Channel Delta band during all periods (a) with column graph (b) with line graph

Figure 4.1 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. Because of better understanding this and other graphic figures, all of SE values are shown with absolute values. When procedure is starting R1, patients have higher mean of SE values than controls. During N, R2 and M periods, patient's mean of SE values increase while controls nearly stay the same as R1 period. In R3 period, mean of SE value of patients decrase while controls are not changing. Generally patients show higher values than controls in F3 channel's delta band.



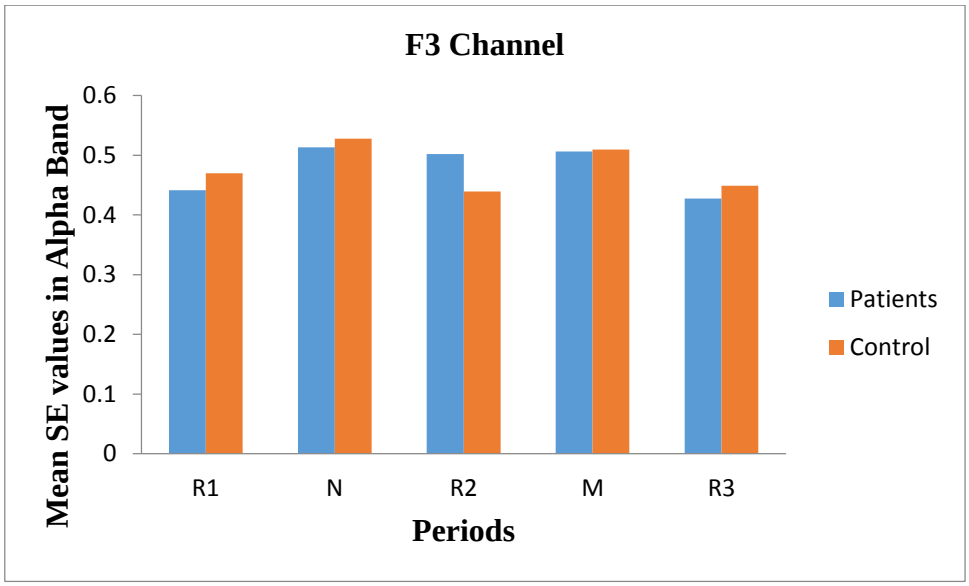
(a)



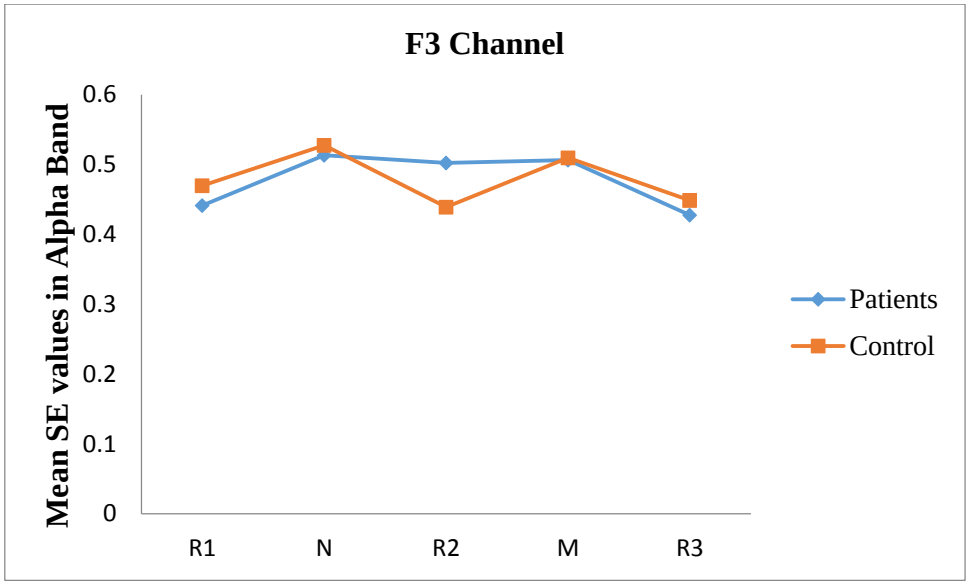
(b)

Figure 4.2 Graphs show the mean of SE values of F3 Channel's theta band during all periods (a) with column graph (b) with line graph

Figure 4.2 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. While procedure is starting R1, patients and controls have nearly same mean of SE values. During N period while patients mean of SE value is increasing controls stay nearly same. In M period patients and controls have increasing SE values while they have decreasing value in R3 period.



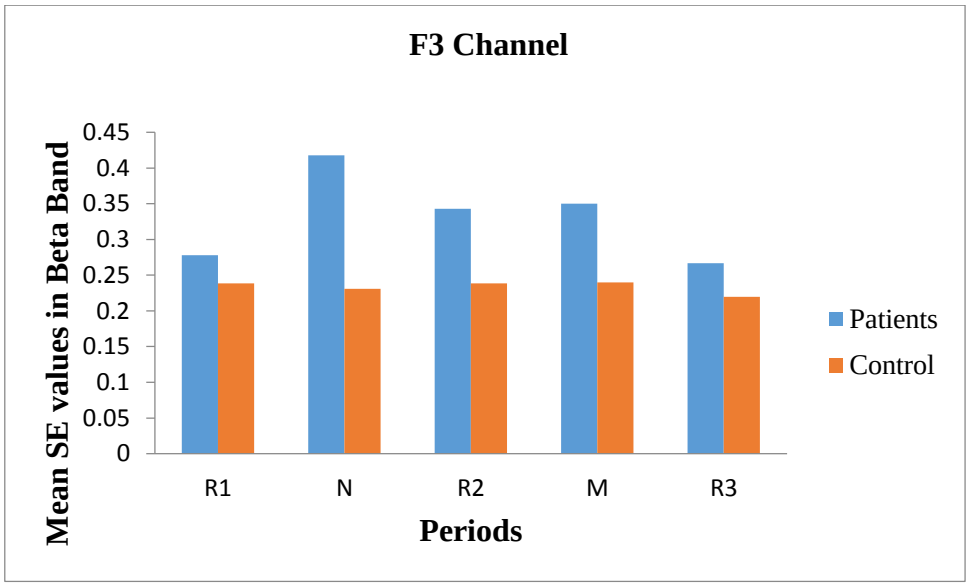
(a)



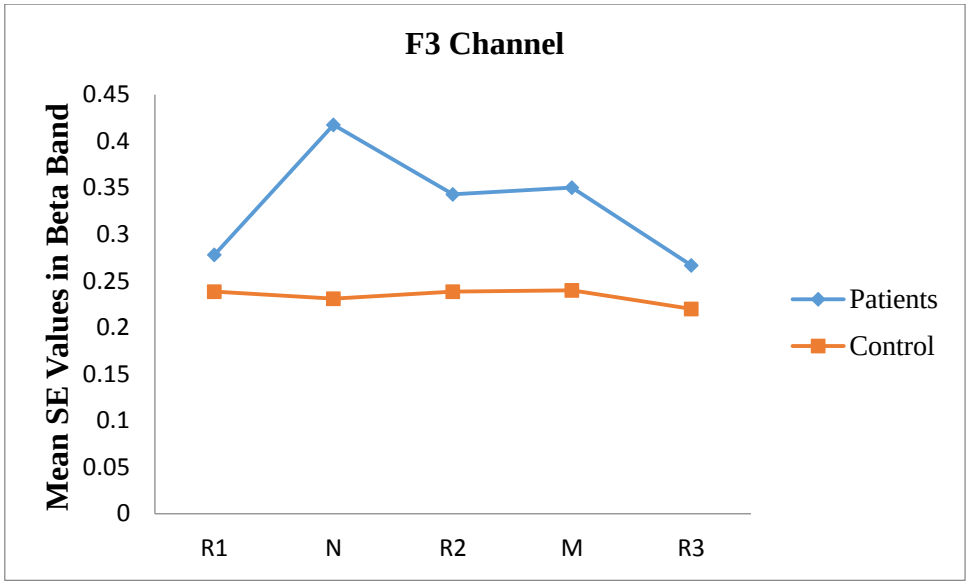
(b)

Figure 4.3 Graphs show the mean of SE values of F3 Channel's alpha band during all periods (a) with column graph (b) with line graph

Figure 4.3 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. Patients and controls show nearly same mean of SE values in all periods except R2 period. In R2 period control's mean of SE values decreasing while patient's mean of SE value is nearly same as N and M periods.



(a)



(b)

Figure 4.4 Graphs show the mean of SE values of F3 Channel's beta band during all periods (a) with column graph (b) with line graph

Figure 4.4 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. During all periods patients show higher mean of SE values than controls. Patients have highest value for mean of SE value in N period and lowest value in R3 period.

Table 4.2 p values of independent sample t test for all bands in F3 Channel

F3 (p values)				
Period	Delta	Theta	Alpha	Beta
R1	0,605	0,825	0,286	0,228
N	0,540	0,223	0,699	0,059*
R2	0,188	0,574	0,281	0,240
M	0,225	0,443	0,964	0,168
R3	0,089	0,940	0,543	0,040*

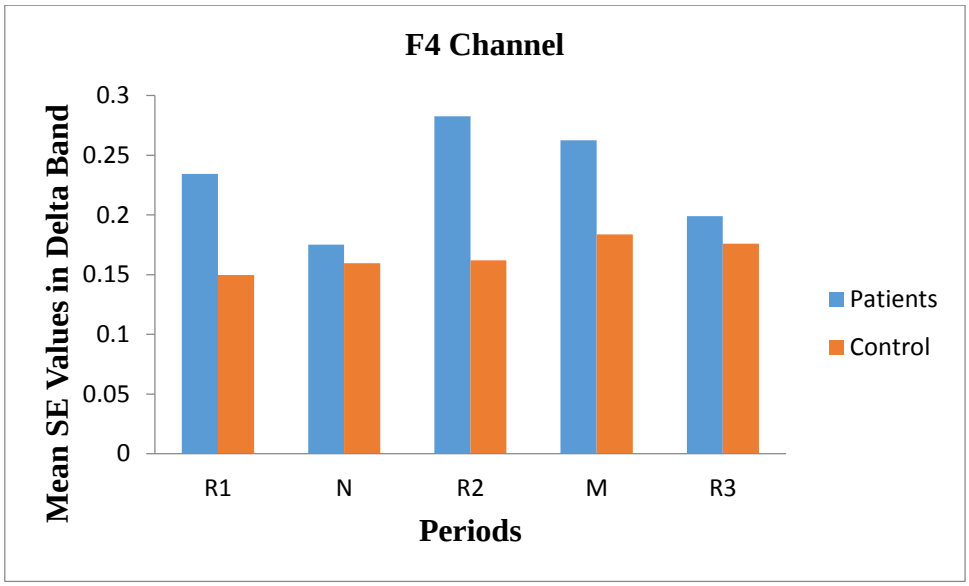
*$p \leq 0.05$ is accepted for significant difference

Table 4.2 shows that the p value of beta band in R3 period is less than 0.05. It is accepted for significant difference. There is also p value of beta band in N period is less than 0.08. It is accepted closest value for significant difference.

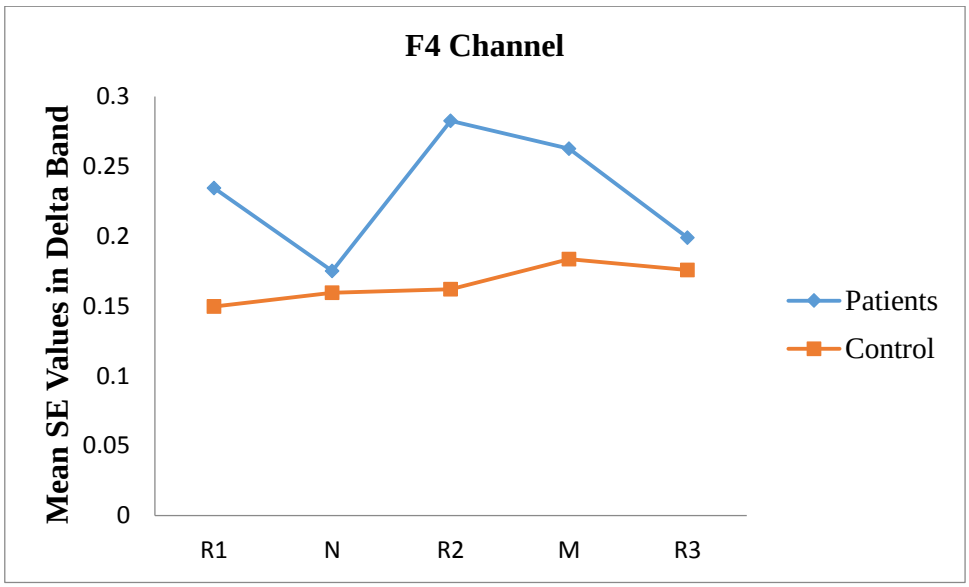
While Table 4.3 shows calculated SE values of each periods (R1, N, R2, N, R3) for patients and control group in each sub bands respectively delta, theta, alpha and beta in F4 Region Figure 4.5, 4.6, 4.7, 4.8 shows their relation with column graph (a) and with line graph (b). Table 4.4 shows p values of each period between patients and controls in each sub bands respectively delta, theta, alpha and beta in F4 Region.

Table 4.3 Comparison of SE values that recorded during all measurements between patients and controls in F4 channel for all periods and bands

	Patients (Mean± Std Deviation)				Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1	-0,23 ±0,17	-0,23 ±0,17	-0,53 ±0,17	-0,42 ±0,20	-0,15 ±0,02	-0,51 ±0,17	-0,45 ±0,02	-0,23 ±0,08
N	-0,18 ±0,05	-0,42 ±0,11	-0,45 ±0,15	-0,39 ±0,18	-0,16 ±0,02	-0,42 ±0,04	-0,46 ±0,08	-0,22 ±0,08
R2	-0,28 ±0,25	-0,50 ±0,18	-0,53 ±0,17	-0,40 ±0,22	-0,16 ±0,03	-0,42 ±0,04	-0,44 ±0,02	-0,22 ±0,06
M	-0,26 ±0,25	-0,51 ±0,17	-0,53 ±0,18	-0,44 ±0,21	-0,18 ±0,06	-0,45 ±0,06	-0,47 ±0,05	-0,24 ±0,11
R3	-0,20 ±0,05	-0,41 ±0,10	-0,44 ±0,11	-0,36 ±0,11	-0,18 ±0,05	-0,44 ±0,03	-0,46 ±0,07	-0,23 ±0,08



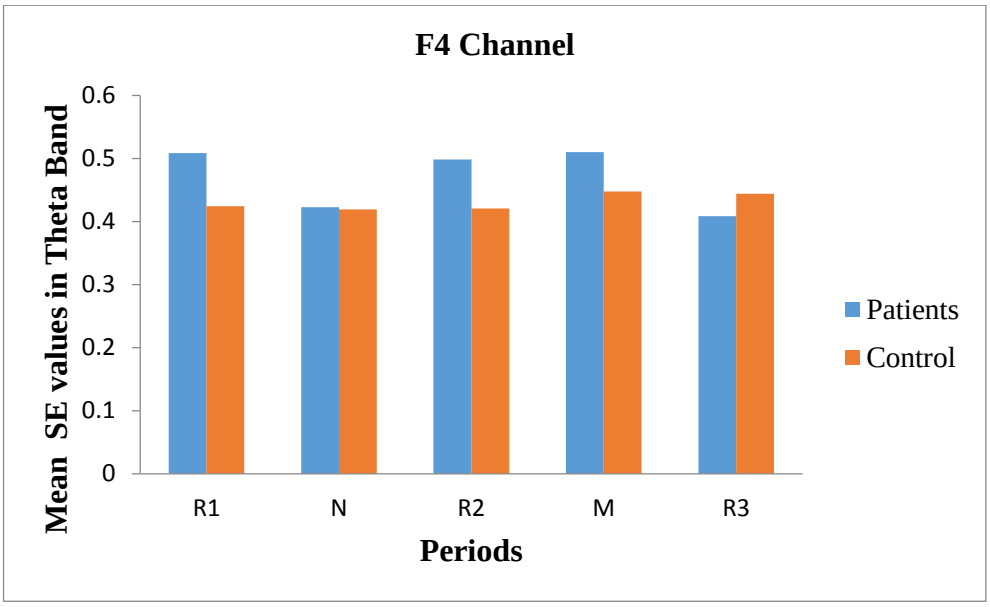
(a)



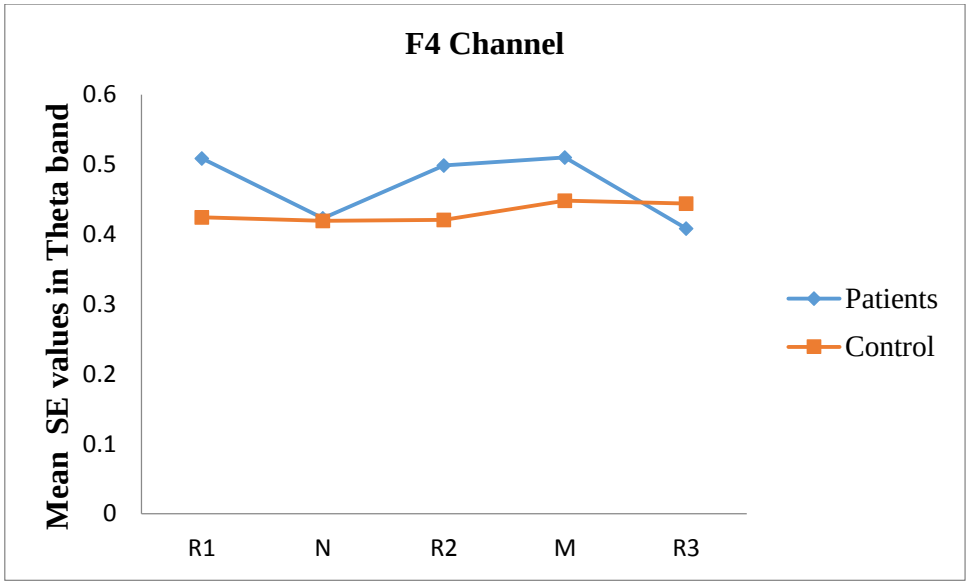
(b)

Figure 4.5 Graphs show the mean of SE values of F4 Channel's Delta band during all periods (a) with column graph (b) with line graph

Figure 4.5 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. In R1 period patients have higher mean of SE values than controls but between R1 and N period patients show suddenly fall and become nearly same as controls. Between N and R2 periods patient's SE values are increasing while control's SE values are increasing between R2 and M periods.



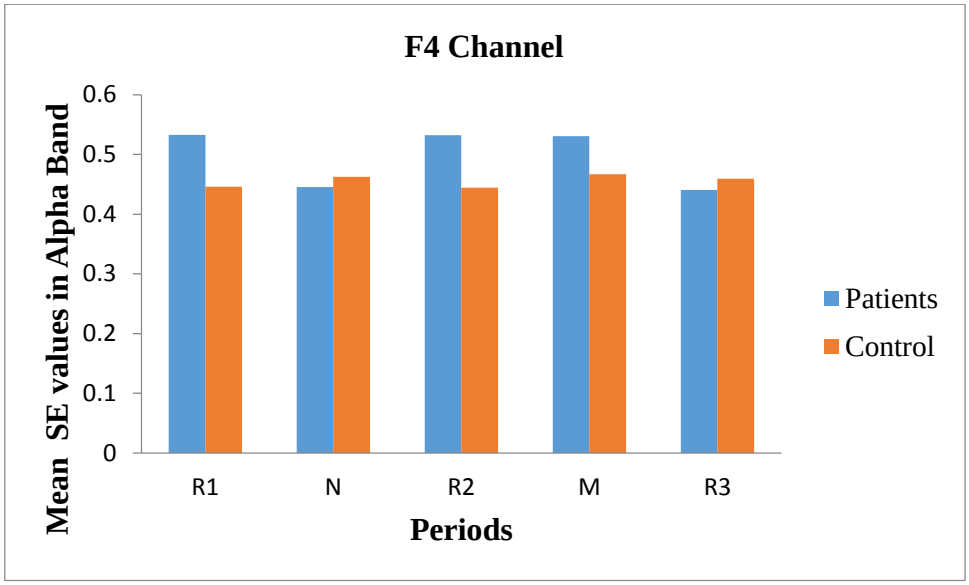
(a)



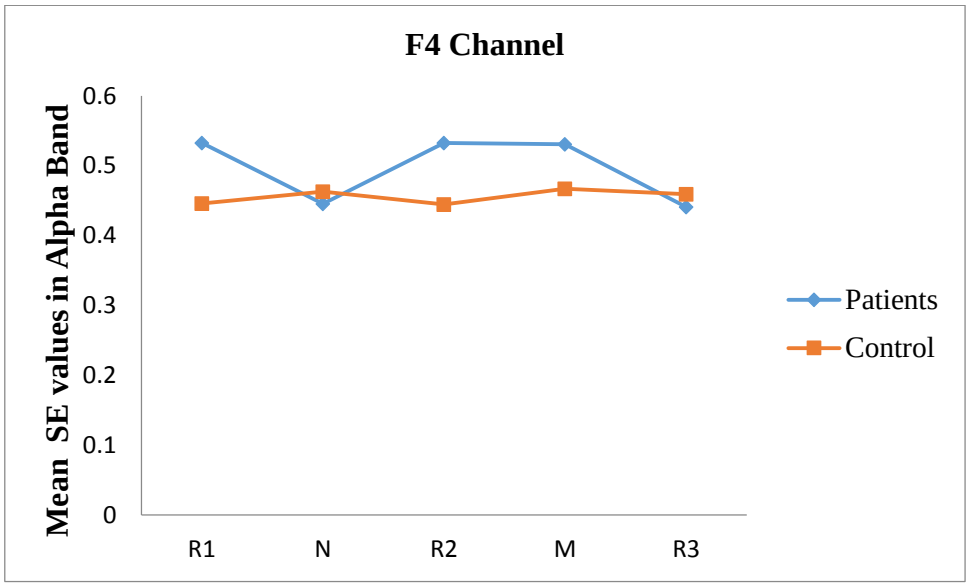
(b)

Figure 4.6 Graphs show the mean of SE values of F4 Channel's theta band during all periods (a) with column graph (b) with line graph

Figure 4.6 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE values than controls but at N period patients and controls become on same value. At R3 period patients show highly decreasing and become less than control's mean of SE values.



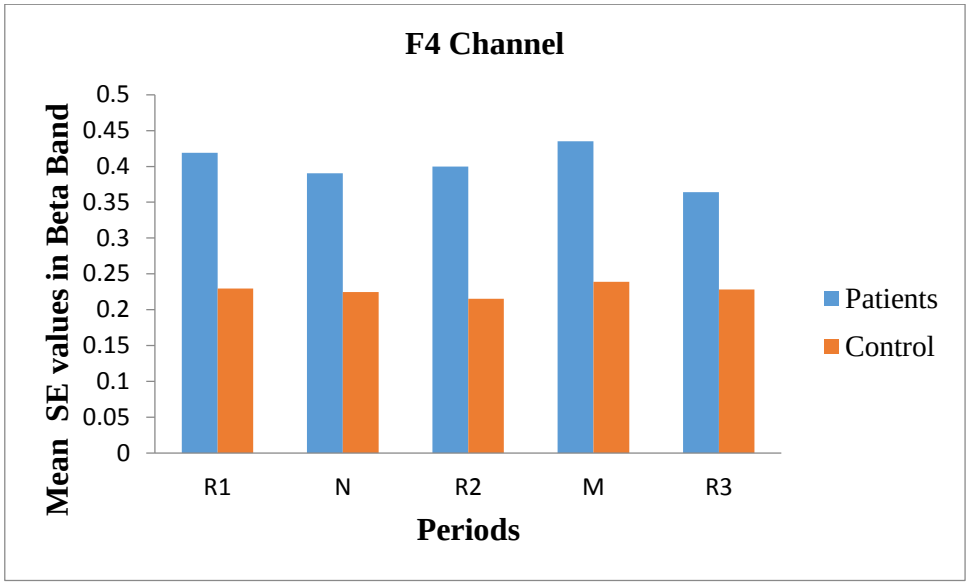
(a)



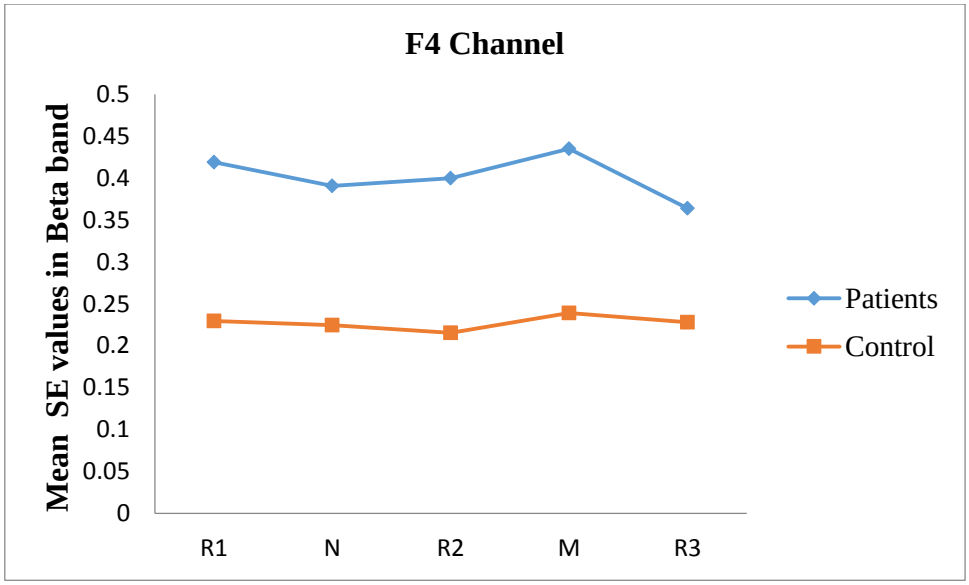
(b)

Figure 4.7 Graphs show the mean of SE values of F4 Channel's alpha band during all periods (a) with column graph (b) with line graph

Figure 4.7 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and controls become higher that patients. While patient's SE values are increasing during R2 and M periods, they are decreasing between M and R3 periods.



(a)



(b)

Figure 4.8 Graphs show the mean of SE values of F4 Channel's beta band during all periods (a) with column graph (b) with line graph

Figure 4.8 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. Patients have higher mean of SE values than controls at all periods in F4 channel beta band.

Table 4.4 p values of independent sample t test for all bands in F4 Channel

F4 (p values)				
Period	Delta	Theta	Alpha	Beta
R1	0,144	0,002*	0,143	0,014*
N	0,335	0,920	0,758	0,014*
R2	0,152	0,201	0,120	0,023*
M	0,346	0,291	0,309	0,018*
R3	0,319	0,279	0,656	0,006*

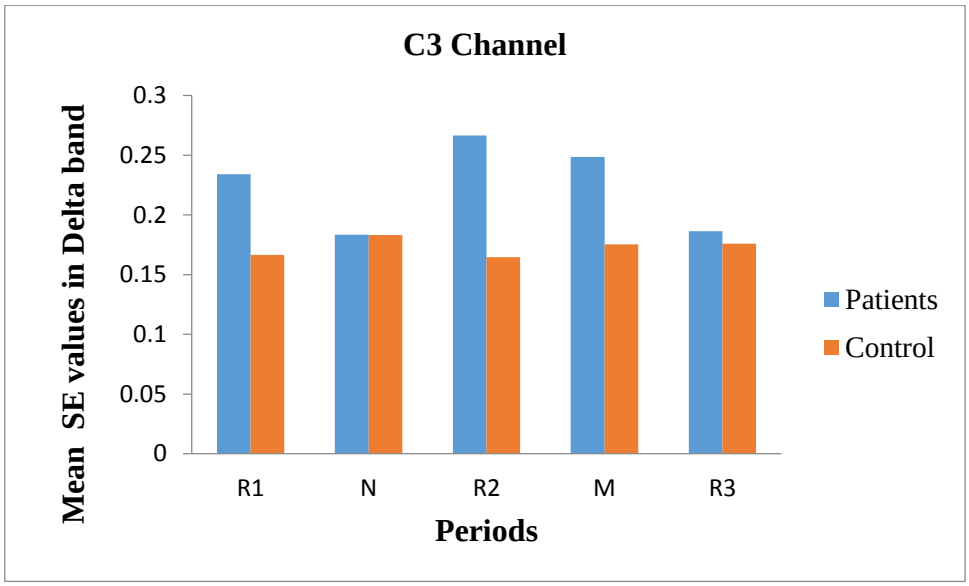
*$p \leq 0.05$ is accepted for significant difference

Table 4.4 shows that the p value of theta band at R1 period and beta band at all periods are less than 0.05. It is accepted for significant difference.

While Table 4.5 shows calculated SE values of each periods (R1, N, R2, N, R3) for patients and control group in each sub bands respectively delta, theta, alpha and beta in C3 Region, Figure 4.9, 4.10, 4.11, 4.12 shows their relation with column graph (a) and with line graph (b). Table 4.6 shows p values of each period between patients and controls in each sub bands respectively delta, theta, alpha and beta in C3 Region.

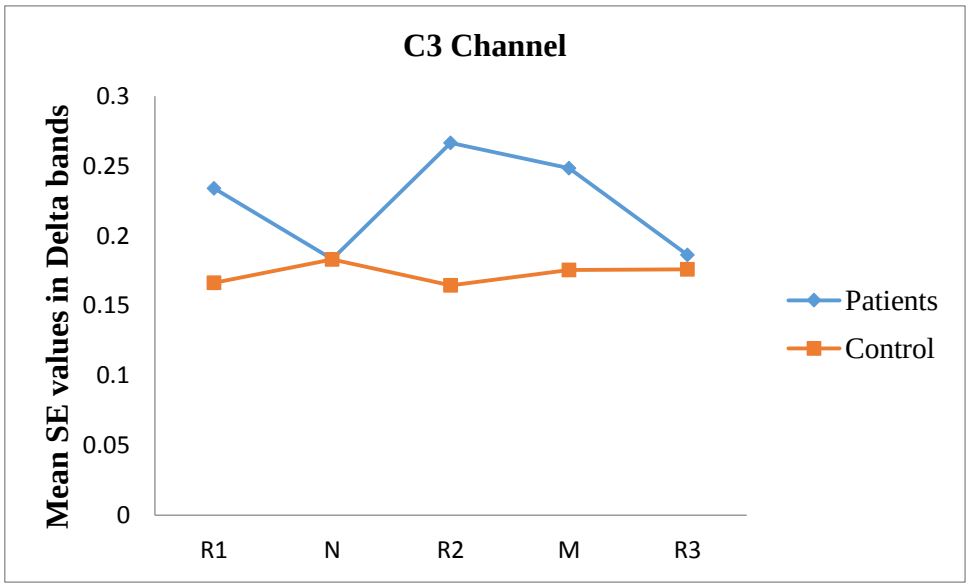
Table 4.5 Comparison of SE values that recorded during all measurements between patients and controls in C3 channel for all periods and bands

	Patients (Mean± Std Deviation)				Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1	-0,23 ±0,20	-0,52 ±0,15	-0,54 ±0,15	-0,37 ±0,22	-0,17 ±0,04	-0,43 ±0,05	-0,45 ±0,03	-0,22 ±0,06
N	-0,18 ±0,04	-0,42 ±0,12	-0,48 ±0,17	-0,37 ±0,20	-0,18 ±0,06	-0,43 ±0,04	-0,48 ±0,07	-0,22 ±0,07
R2	-0,27 ±0,26	-0,50 ±0,18	-0,52 ±0,17	-0,37 ±0,23	-0,16 ±0,03	-0,44 ±0,04	-0,46 ±0,05	-0,20 ±0,05
M	-0,25 ±0,25	-0,52 ±0,17	-0,52 ±0,17	-0,38 ±0,22	-0,18 ±0,05	-0,46 ±0,05	-0,47 ±0,05	-0,22 ±0,06
R3	-0,19 ±0,04	-0,42 ±0,10	-0,44 ±0,10	-0,33 ±0,11	-0,18 ±0,04	-0,45 ±0,05	-0,45 ±0,06	-0,22 ±0,07



(a)

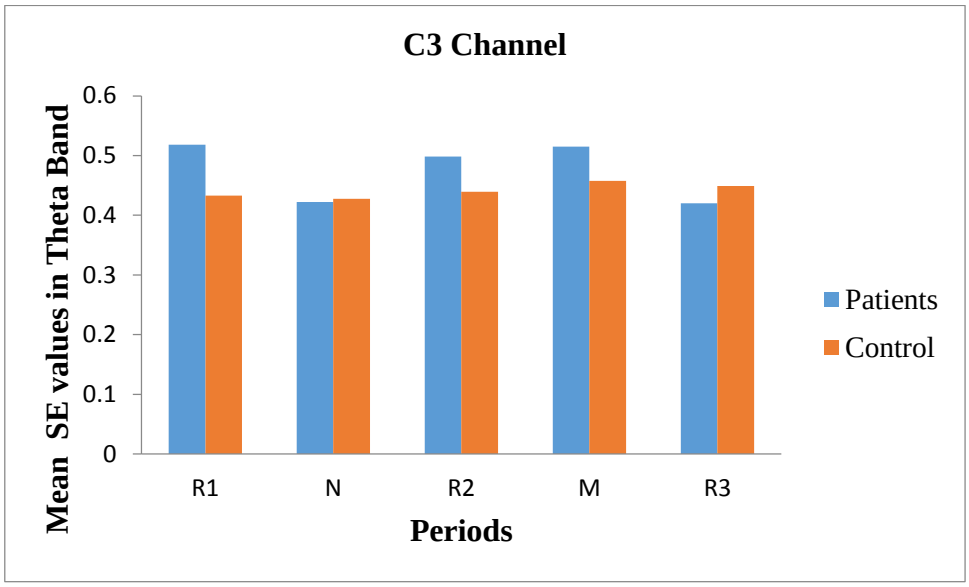
Figure 4.9 Graphs show the mean of SE values of C3 Channel's Delta band during all periods (a) with column graph (b) with line graph



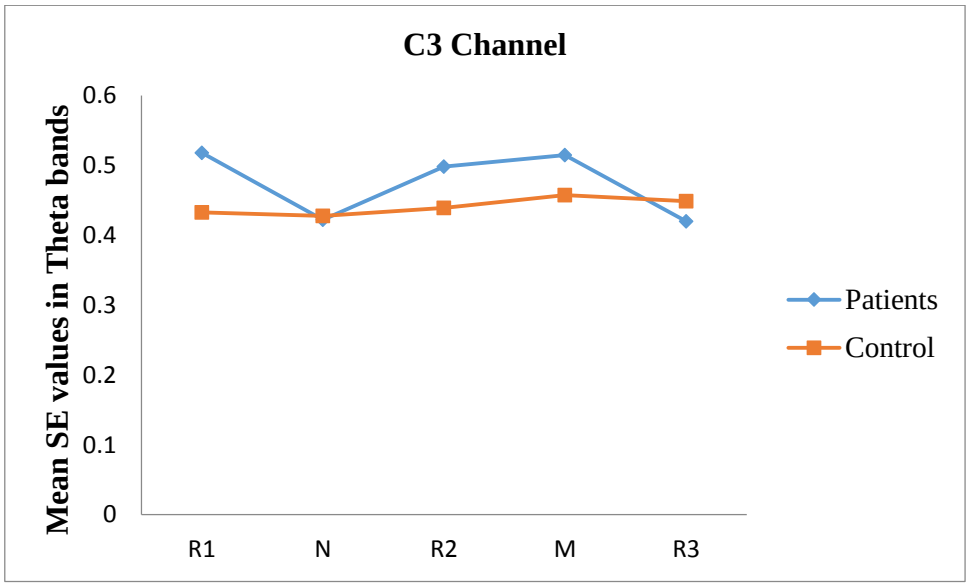
(b)

Figure 4.9 Graphs show the mean of SE values of C3 Channel's Delta band during all periods (a) with column graph (b) with line graph

Figure 4.9 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become on same value. While patient's SE values are increasing during R2 period, control's SE values are decreasing. At R3 period controls and patients are nearly same.



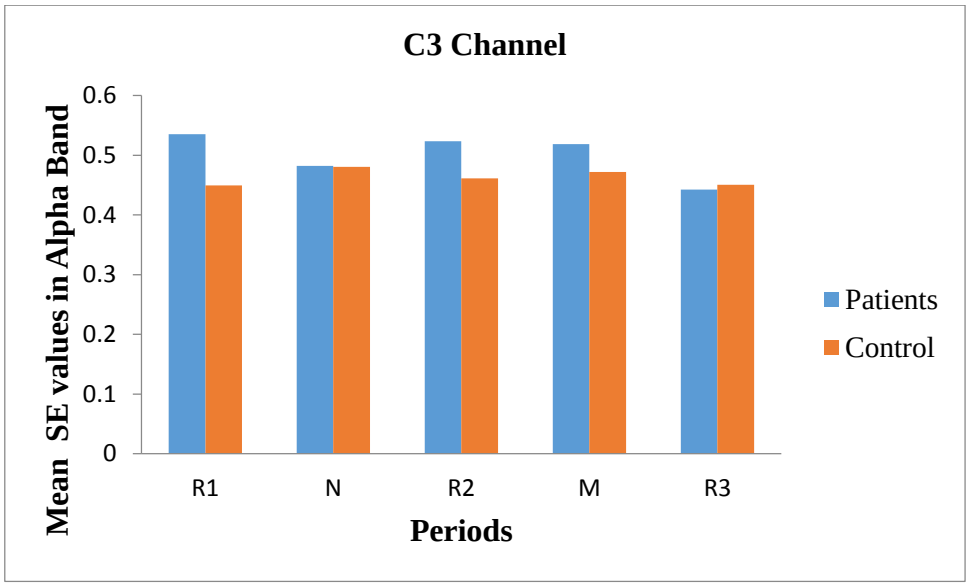
(a)



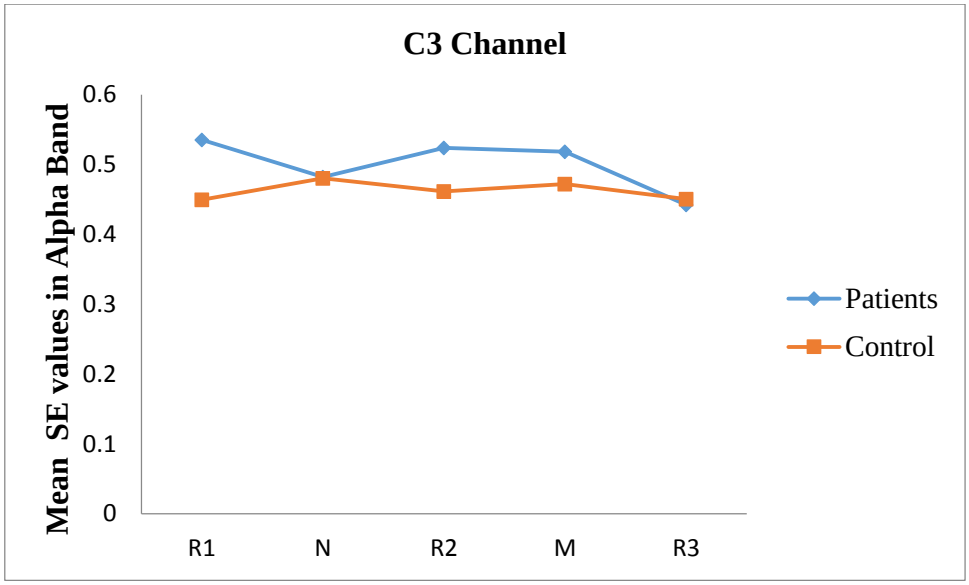
(b)

Figure 4.10 Graphs show the mean of SE values of C3 Channel's theta band during all periods (a) with column graph (b) with line graph

Figure 4.10 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become on same value. While patient's SE values are increasing during R2 and M period, control's SE values are also increasing. At R3 period controls have higher values than patients.



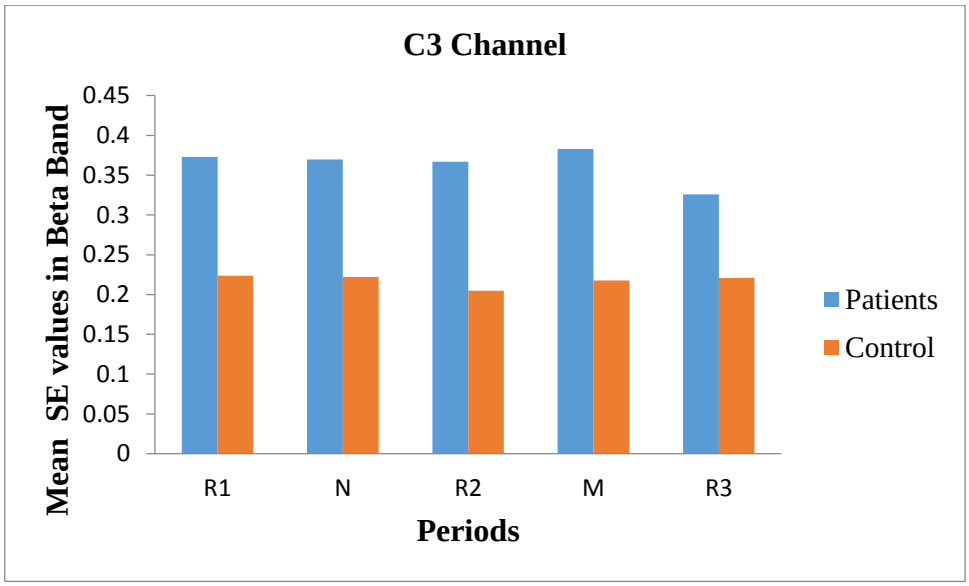
(a)



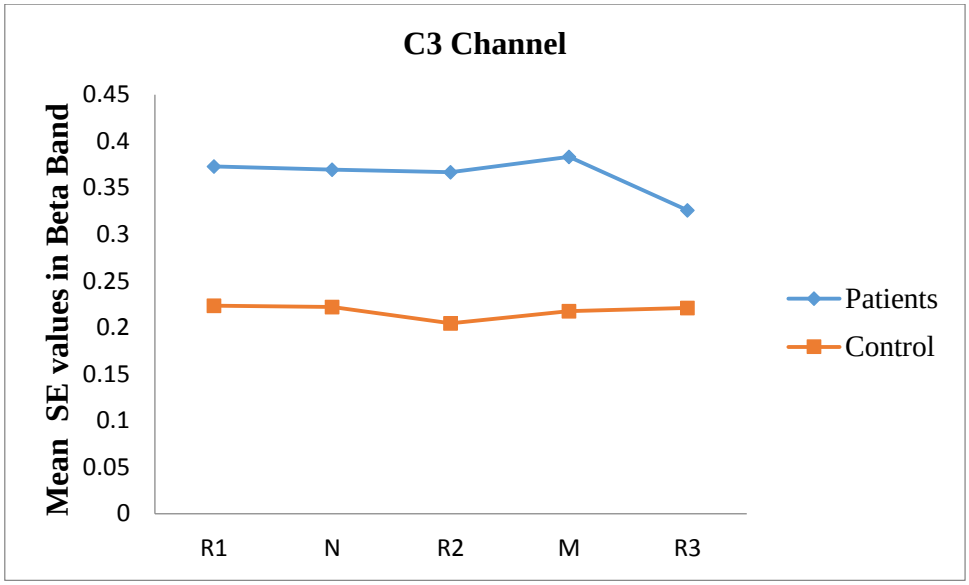
(b)

Figure 4.11 Graphs show the mean of SE values of C3 Channel's alpha band during all periods (a) with column graph (b) with line graph

Figure 4.11 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become on same value. While patient's SE values are increasing during R2 period, control's SE values are decreasing. At R3 period controls and patients have nearly same values.



(a)



(b)

Figure 4.12 Graphs show the mean of SE values of C3 Channel's beta band during all periods (a) with column graph (b) with line graph

Figure 4.12 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. Although there are little changes for mean of SE values between all periods in C3 Channel Beta band, controls have higher values than controls. Small changes in all periods except R3 period concerned because patient's values are decreasing at R3 period.

Table 4.6 p values of independent sample t test for all bands and all periods in C3 Channel

C3 (p values)				
Period	Delta	Theta	Alpha	Beta
R1	0,308	0,110	0,100	0,052*
N	0,994	0,894	0,978	0,038*
R2	0,228	0,326	0,279	0,044*
M	0,380	0,328	0,417	0,037*
R3	0,578	0,422	0,830	0,023*

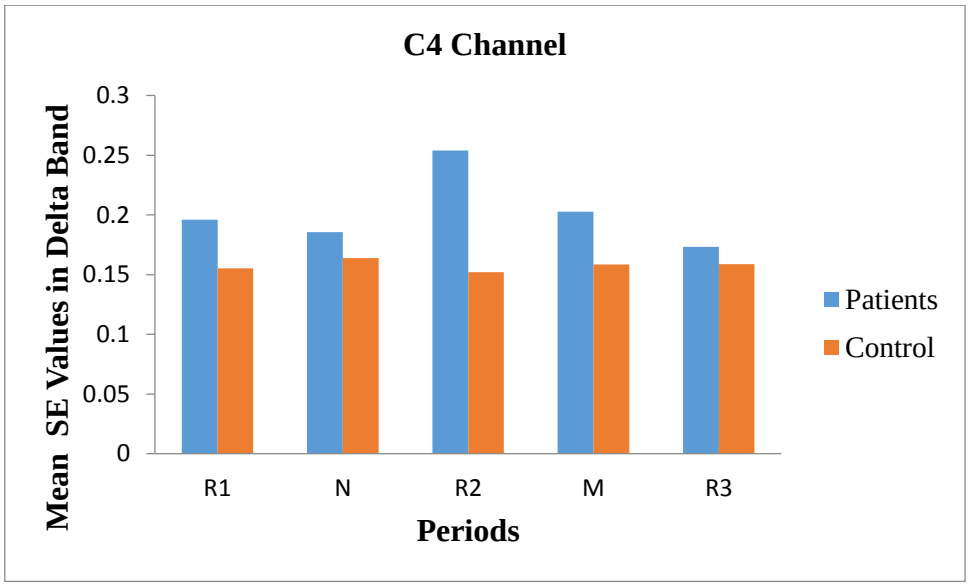
*$p \leq 0.05$ is accepted for significant difference

Table 4.6 shows that the p value of beta band at all periods are less than 0.05. It is accepted for significant difference.

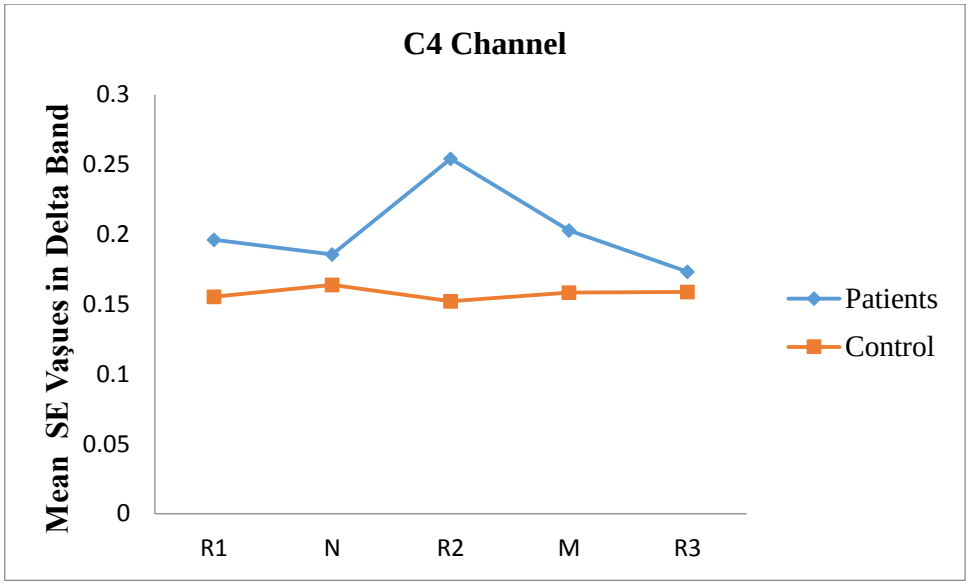
While Table 4.7 shows calculated SE values of each periods (R1, N, R2, N, R3) for patients and control group in each sub bands respectively delta, theta, alpha and beta in C4 Region Figure 4.13, 4.14, 4.15, 4.16 shows their relation with column graph (a) and with line graph (b). Table 4.8 shows p values of each period between patients and controls in each sub bands respectively delta, theta, alpha and beta in C3 Region.

Table 4.7 Comparison of SE values that recorded during all measurements between patients and controls in C4 channel for all periods and bands

	Patients (Mean± Std Deviation)				Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1	-0,20 ±0,03	-0,51 ±0,17	-0,51 ±0,17	-0,41 ±0,21	-0,16 ±0,03	-0,42 ±0,05	-0,45 ±0,06	-0,22 ±0,08
N	-0,19 ±0,04	-0,43 ±0,11	-0,46 ±0,17	-0,42 ±0,22	-0,16 ±0,02	-0,42 ±0,04	-0,47 ±0,06	-0,22 ±0,08
R2	-0,25 ±0,26	-0,52 ±0,18	-0,51 ±0,18	-0,41 ±0,22	-0,15 ±0,02	-0,44 ±0,06	-0,48 ±0,08	-0,21 ±0,06
M	-0,20 ±0,15	-0,48 ±0,12	-0,56 ±0,14	-0,46 ±0,20	-0,16 ±0,02	-0,44 ±0,06	-0,49 ±0,08	-0,24 ±0,12
R3	-0,17 ±0,03	-0,48 ±0,08	-0,50 ±0,10	-0,40 ±0,13	-0,16 ±0,02	-0,45 ±0,06	-0,49 ±0,09	-0,22 ±0,08



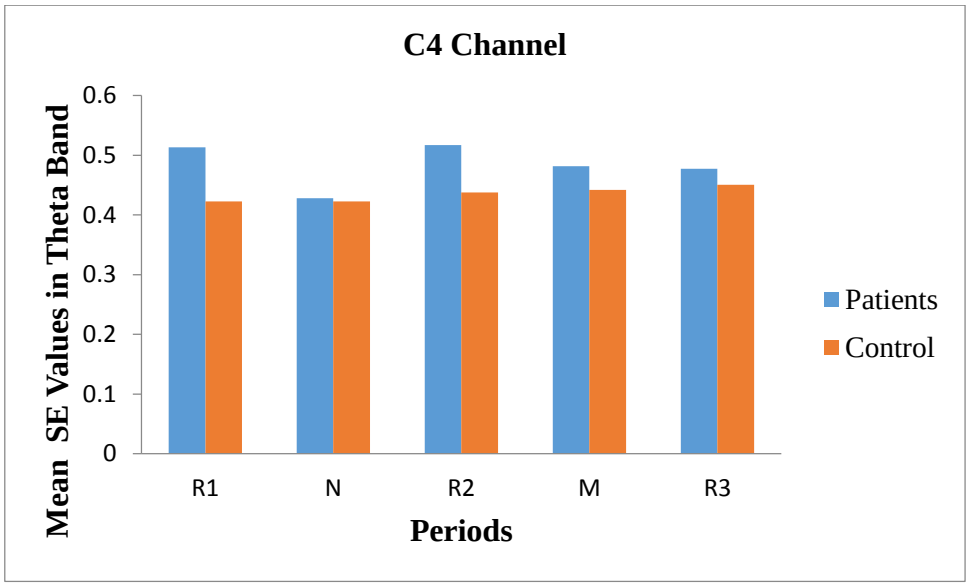
(a)



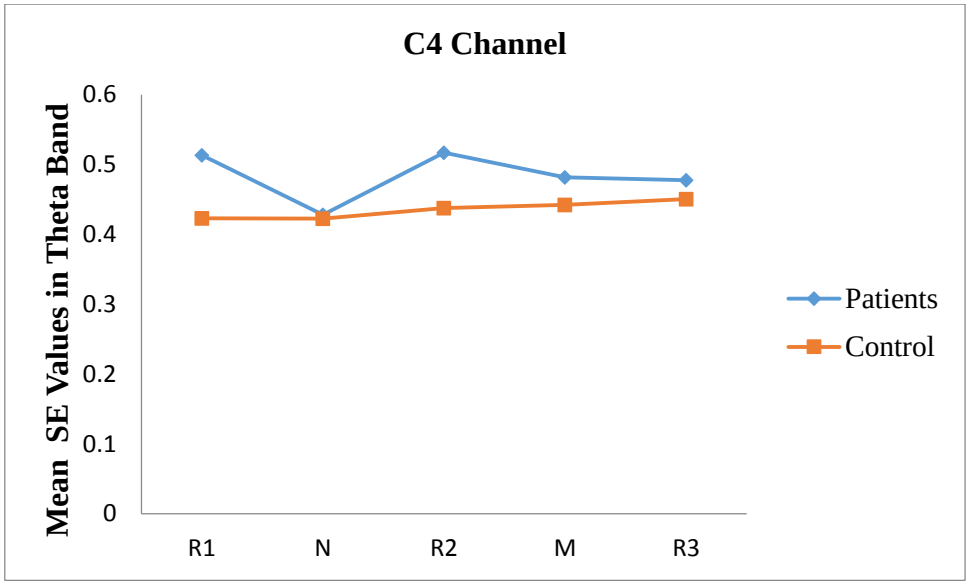
(b)

Figure 4.13 Graphs show the mean of SE values of C4 Channel's Delta band during all periods (a) with column graph (b) with line graph

Figure 4.13 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls. At R2 period, patients are reached the highest value. After R2 period patients SE values are decreasing as nearly same controls.



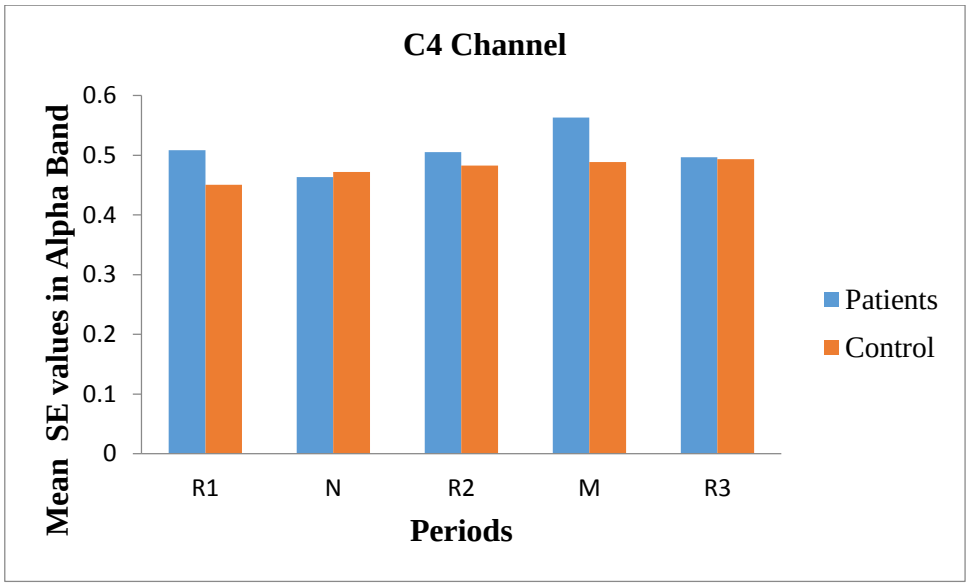
(a)



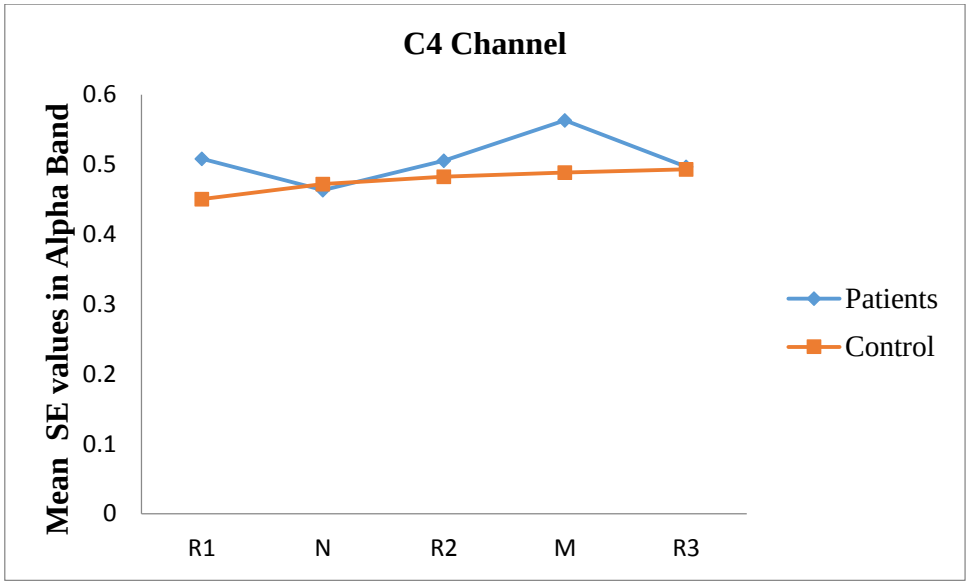
(b)

Figure 4.14 Graphs show the mean of SE values of C4 Channel's theta band during all periods (a) with column graph (b) with line graph

Figure 4.14 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become on same value. While patient's SE values are increasing during R2 period, control's SE values are state same.



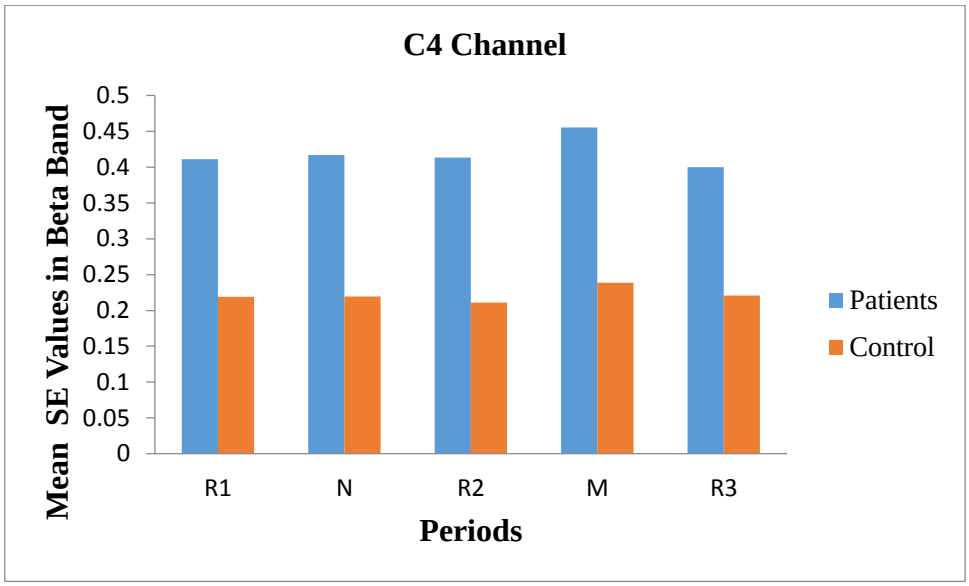
(a)



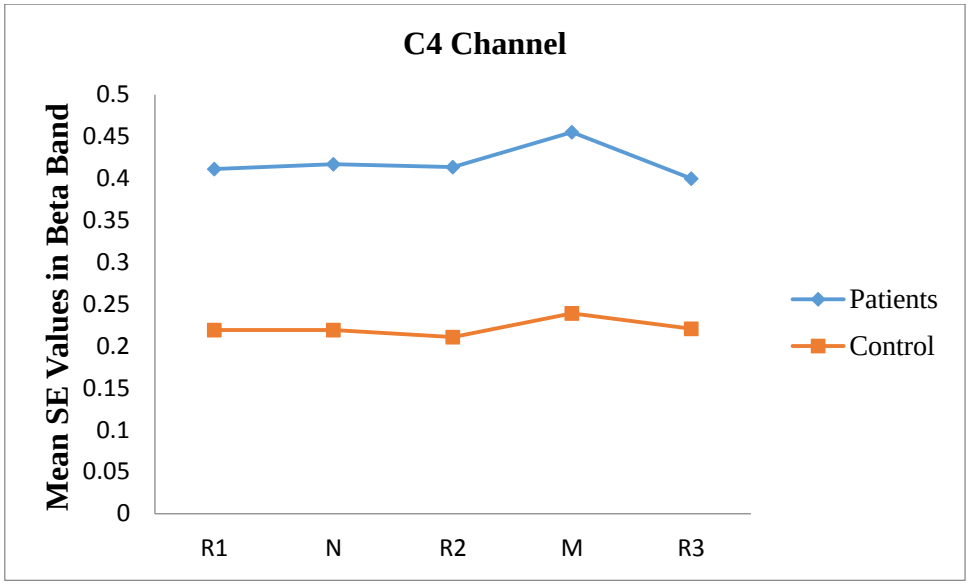
(b)

Figure 4.15 Graphs show the mean of SE values of C4 Channel's alpha band during all periods (a) with column graph (b) with line graph

Figure 4.15 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become nearly same. Patient's SE values are increasing during R2 and M period. At R3 period controls and patients have nearly same values.



(a)



(b)

Figure 4.16 Graphs show the mean of SE values of C4 Channel's beta band during all periods (a) with column graph (b) with line graph

Figure 4.16 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. In C4 channel beta band, patient's mean of SE values have higher values than control's. But they are similar in exchange points of value during all periods.

Table 4.8 p values of independent sample t test for all bands in C4 Channel

C4 (p values)				
Period	Delta	Theta	Alpha	Beta
R1	0,355	0,117	0,321	0,015*
N	0,172	0,885	0,878	0,014*
R2	0,228	0,201	0,712	0,013*
M	0,367	0,347	0,156	0,008*
R3	0,187	0,415	0,935	0,001*

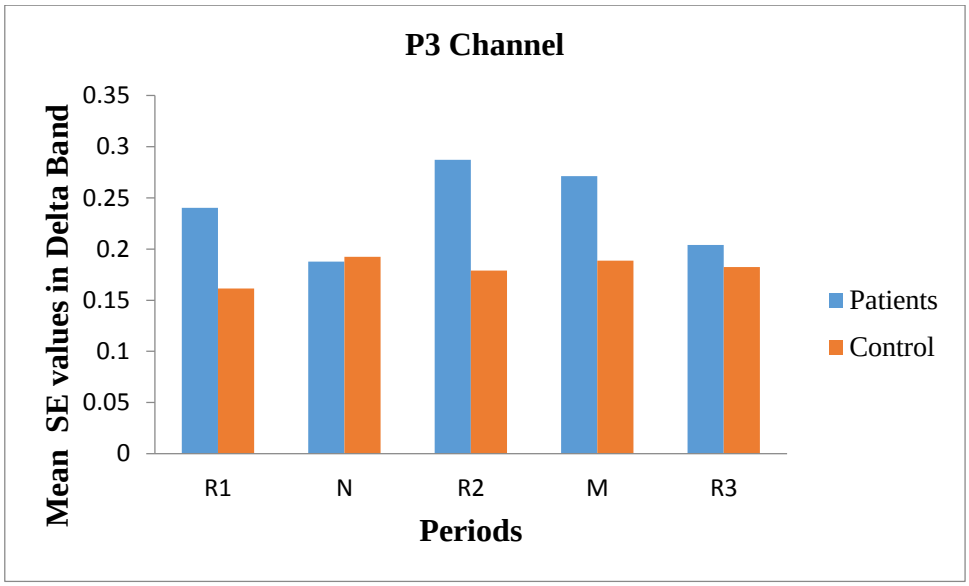
*$p \leq 0.05$ is accepted for significant difference

Table 4.8 shows that the p value of beta band at all periods are less than 0.05. It is accepted for significant difference.

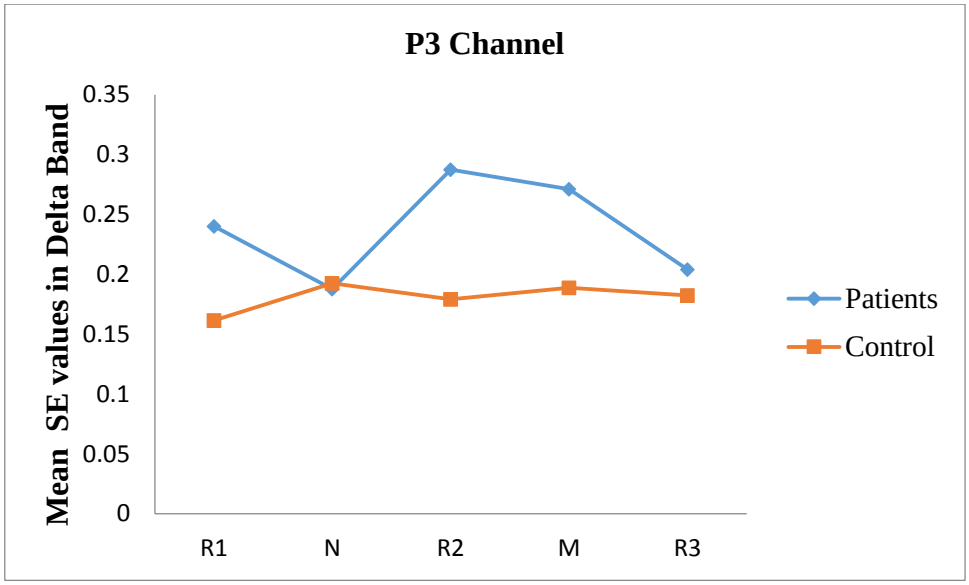
While Table 4.9 shows calculated SE values of each periods (R1, N, R2, N, R3) for patients and control group in each sub bands respectively delta, theta, alpha and beta in P3 Region Figure 4.17, 4.18, 4.19, 4.20 shows their relation with column graph (a) and with line graph (b). Table 4.10 shows p values of each period between patients and controls in each sub bands respectively delta, theta, alpha and beta in P3 Region.

Table 4.9 Comparison of SE values that recorded during all measurements between patients and controls in P3 channel for all periods and bands

	Patients (Mean± Std Deviation)				Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1	-0,24 ±0,21	-0,51 ±0,17	-0,54 ±0,16	-0,39 ±0,22	-0,16 ±0,03	-0,43 ±0,06	-0,44 ±0,03	-0,20 ±0,03
N	-0,19 ±0,04	-0,41 ±0,10	-0,46 ±0,14	-0,38 ±0,17	-0,19 ±0,05	-0,43 ±0,05	-0,47 ±0,04	-0,20 ±0,03
R2	-0,29 ±0,25	-0,50 ±0,18	-0,52 ±0,17	-0,37 ±0,23	-0,18 ±0,05	-0,44 ±0,03	-0,47 ±0,04	-0,19 ±0,03
M	-0,27 ±0,25	-0,51 ±0,18	-0,52 ±0,17	-0,37 ±0,22	-0,19 ±0,04	-0,48 ±0,07	-0,47 ±0,04	-0,20 ±0,03
R3	-0,20 ±0,04	-0,45 ±0,14	-0,46 ±0,12	-0,30 ±0,06	-0,18 ±0,05	-0,46 ±0,05	-0,47 ±0,05	-0,20 ±0,04



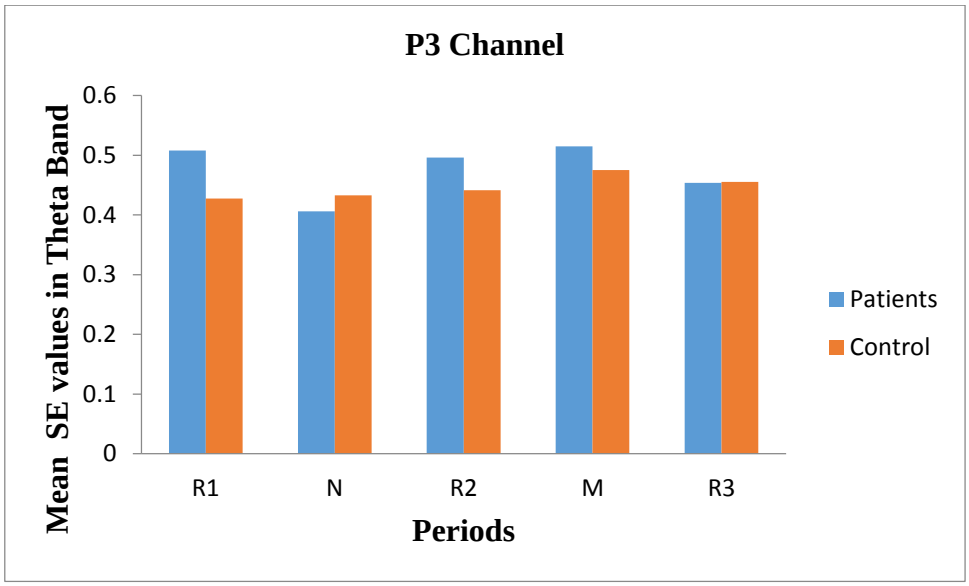
(a)



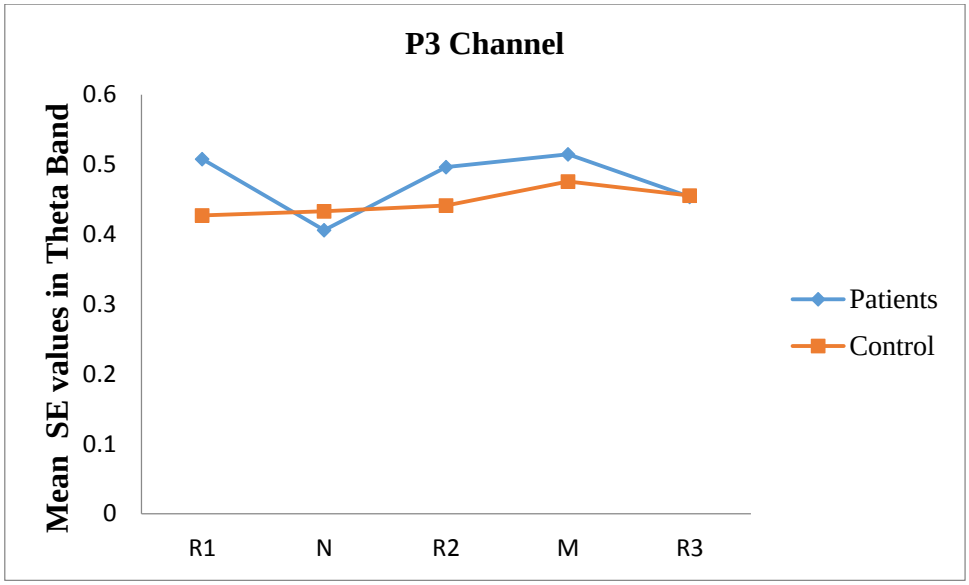
(b)

Figure 4.17 Graphs show the mean of SE values of P3 Channel's Delta band during all periods (a) with column graph (b) with line graph

Figure 4.17 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become nearly same. Patient's SE values are increasing during R2 period. At R3 period controls and patients have nearly same values.



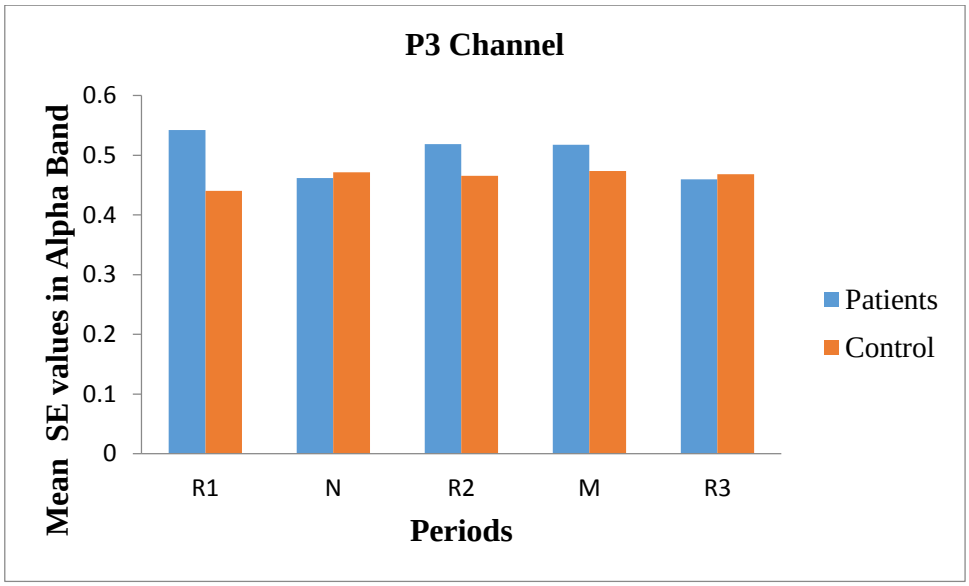
(a)



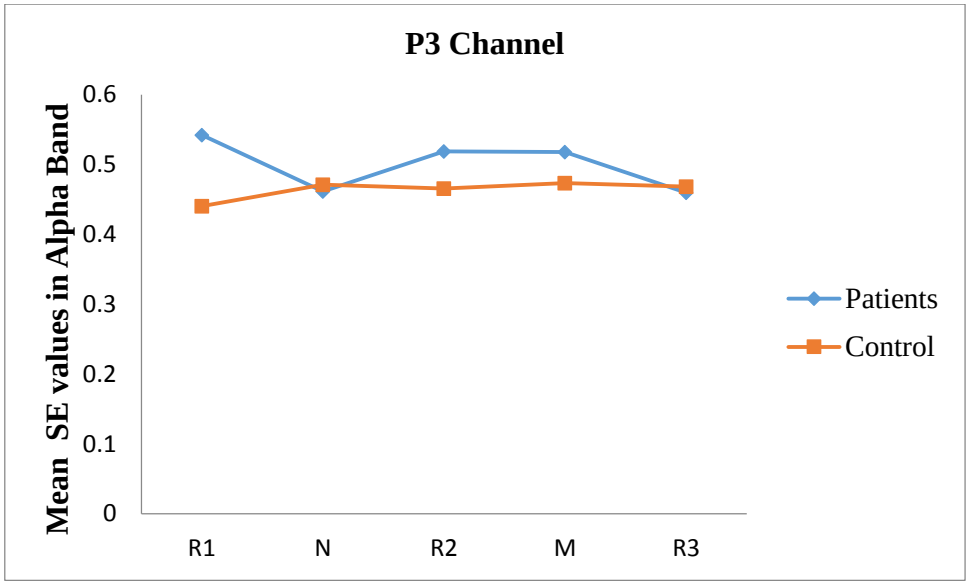
(b)

Figure 4.18 Graphs show the mean of SE values of P3 Channel's theta band during all periods (a) with column graph (b) with line graph

Figure 4.18 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. Although patients have higher mean of SE values than control at R1 period, at N period controls become higher than patients. At R3 period patient's and control's mean of SE values become on same value.



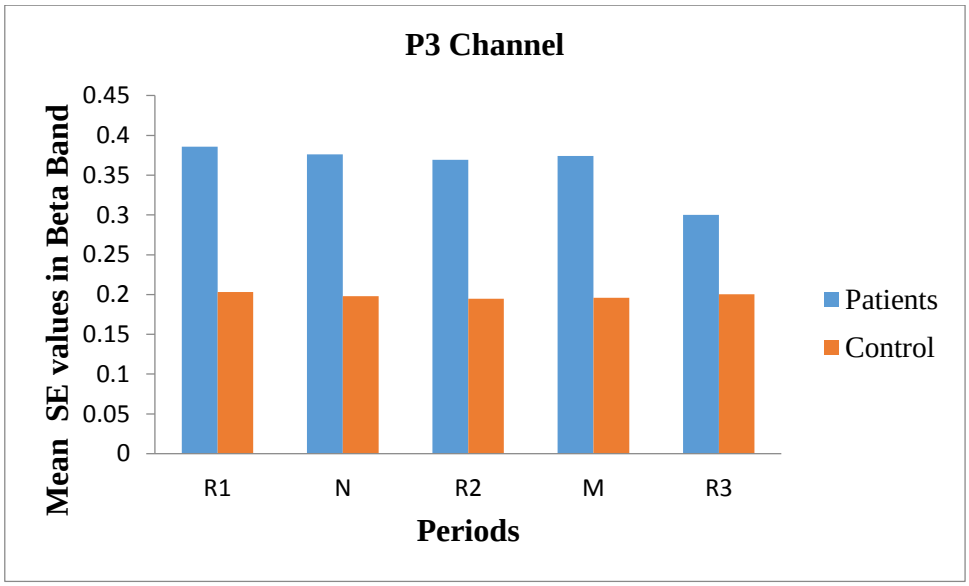
(a)



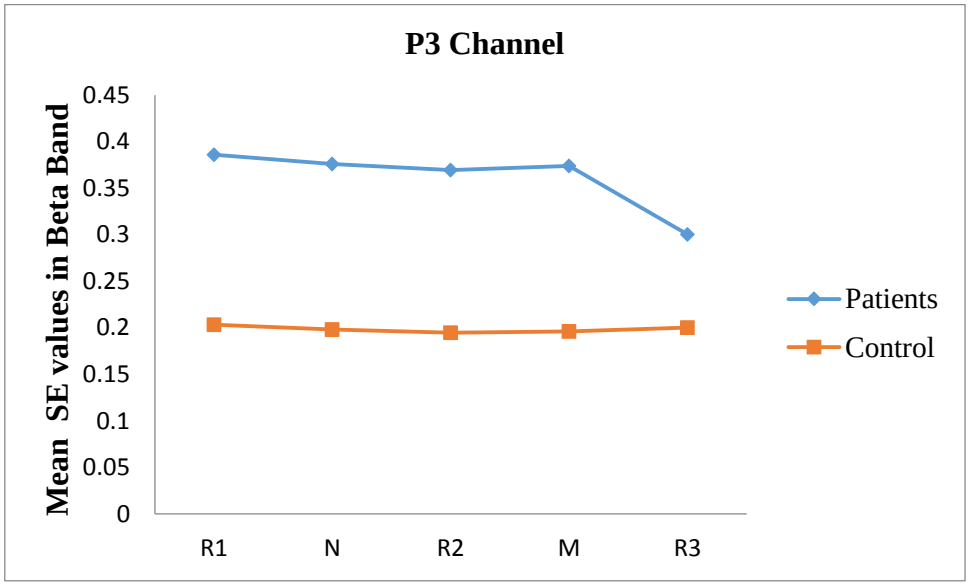
(b)

Figure 4.19 Graphs show the mean of SE values of P3 Channel's alpha band during all periods (a) with column graph (b) with line graph

Figure 4.19 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become nearly same. Patient's SE values are increasing during R2 and M period. At R3 period controls and patients have nearly same values.



(a)



(b)

Figure 4.20 Graphs show the mean of SE values of P3 Channel's beta band during all periods (a) with column graph (b) with line graph

Figure 4.15 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become nearly same. Patient's SE values are increasing during R2 and M period. At R3 period controls and patients have nearly same values.

Table 4.10 p values of independent sample t test for all bands in P3 Channel

P3 (p values)				
Period	Delta	Theta	Alpha	Beta
R1	0,256	0,172	0,065*	0,017*
N	0,813	0,431	0,838	0,005*
R2	0,203	0,351	0,354	0,027*
M	0,321	0,518	0,432	0,021*
R3	0,337	0,967	0,834	0,001*

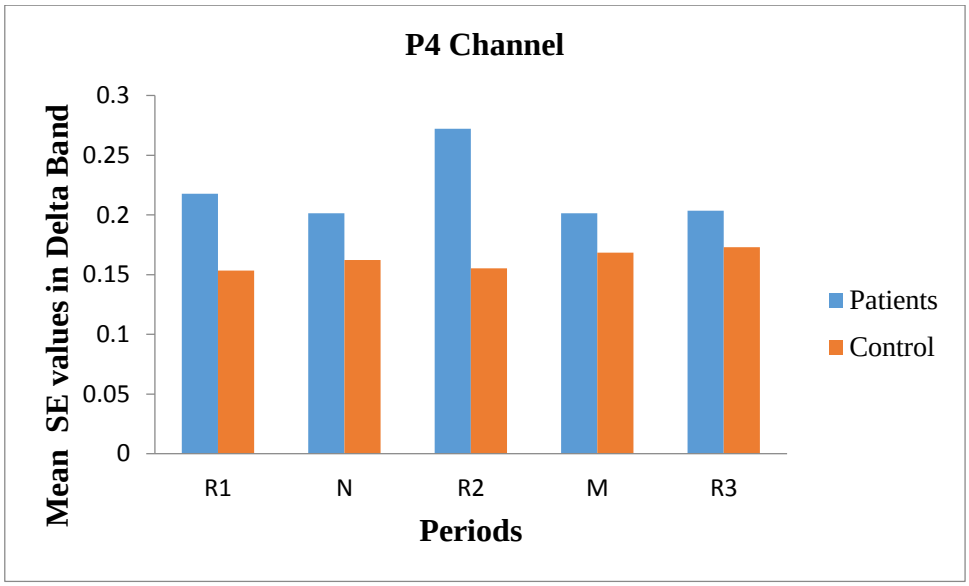
*$p \leq 0.05$ is accepted for significant difference

Table 4.10 shows that the p value of alpha band in R1 period is less than 0.08. It is accepted closest value for significant difference. There is also p value of beta band at all period are less than 0.05. It is accepted for significant difference.

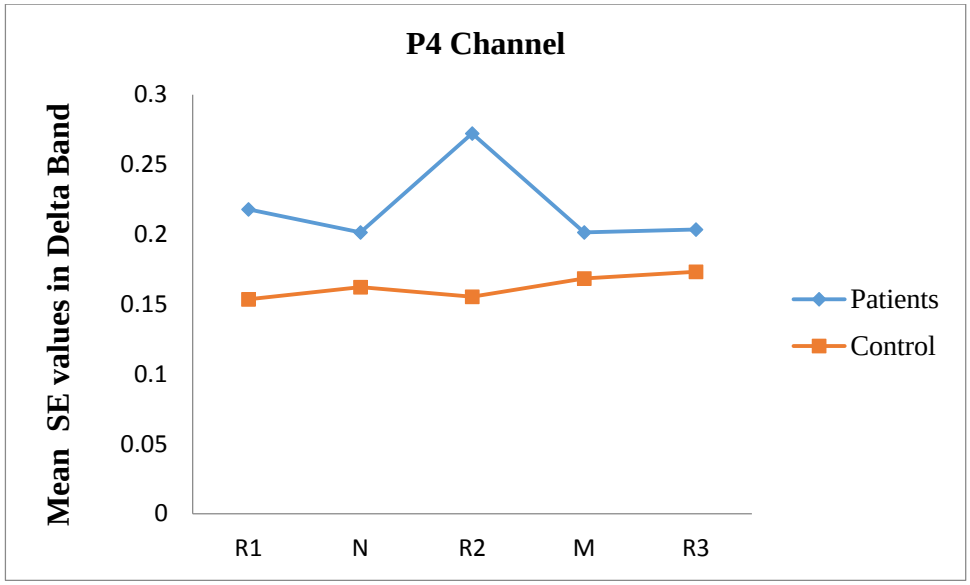
While Table 4.11 shows calculated SE values of each periods (R1, N, R2, N, R3) for patients and control group in each sub bands respectively delta, theta, alpha and beta in P4 Region Figure 4.21, 4.22, 4.23, 4.24 shows their relation with column graph (a) and with line graph (b). Table 4.12 shows p values of each period between patients and controls in each sub bands respectively delta, theta, alpha and beta in P4 Region.

Table 4.11 Comparison of SE values that recorded during all measurements between patients and controls in P4 channel for all periods and bands

	Patients (Mean± Std Deviation)				Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1	-0,22 ±0,13	-0,49 ±0,17	-0,51 ±0,17	-0,41 ±0,14	-0,15 ±0,02	-0,41 ±0,06	-0,45 ±0,04	-0,21 ±0,07
N	-0,20 ±0,05	-0,40 ±0,10	-0,45 ±0,14	-0,42 ±0,21	-0,16 ±0,02	-0,43 ±0,04	-0,48 ±0,07	-0,22 ±0,07
R2	-0,27 ±0,25	-0,50 ±0,18	-0,50 ±0,18	-0,40 ±0,22	-0,15 ±0,02	-0,44 ±0,05	-0,47 ±0,07	-0,21 ±0,06
M	-0,20 ±0,07	-0,50 ±0,13	-0,51 ±0,13	-0,41 ±0,17	-0,17 ±0,05	-0,45 ±0,07	-0,52 ±0,08	-0,22 ±0,08
R3	-0,20 ±0,04	-0,50 ±0,13	-0,52 ±0,13	-0,38 ±0,15	-0,17 ±0,04	-0,47 ±0,06	-0,50 ±0,08	-0,21 ±0,06



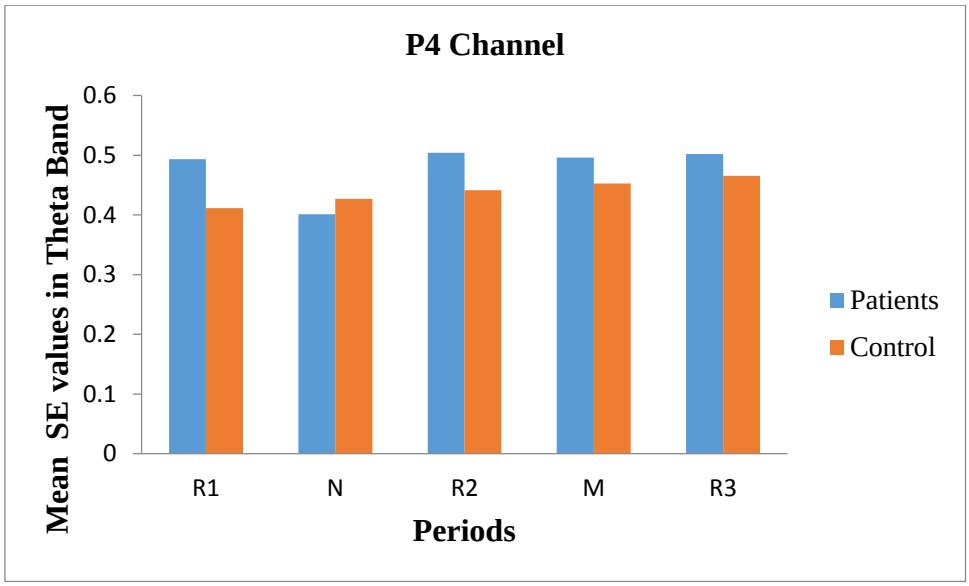
(a)



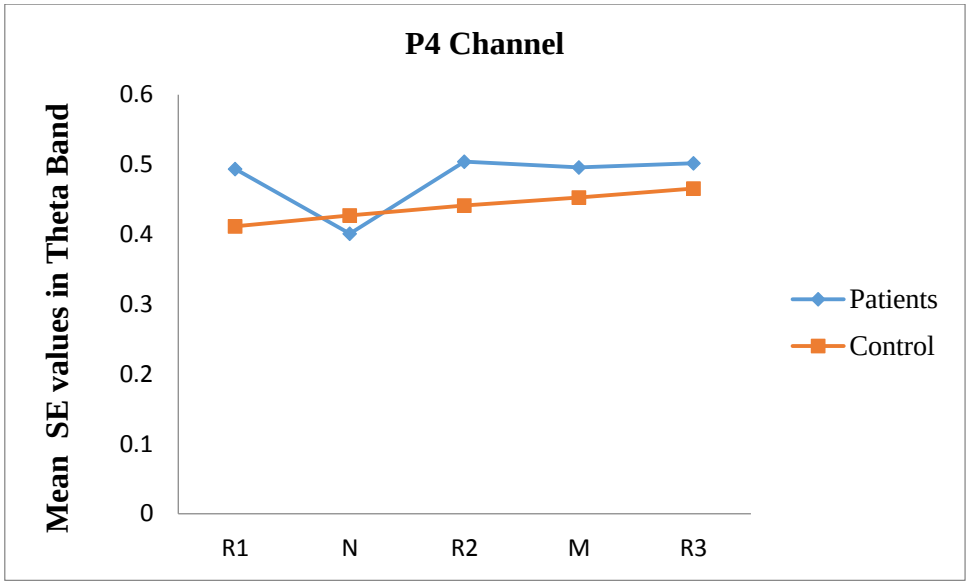
(b)

Figure 4.21 Graphs show the mean of SE values of P4 Channel's Delta band during all periods (a) with column graph (b) with line graph

Figure 4.21 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls. Patient's mean of SE has highest value at R2 period.



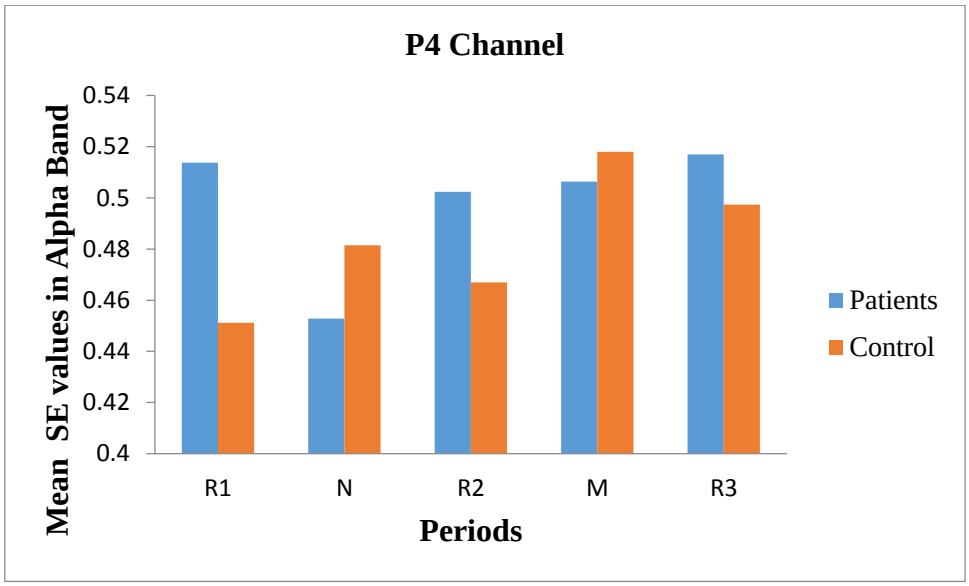
(a)



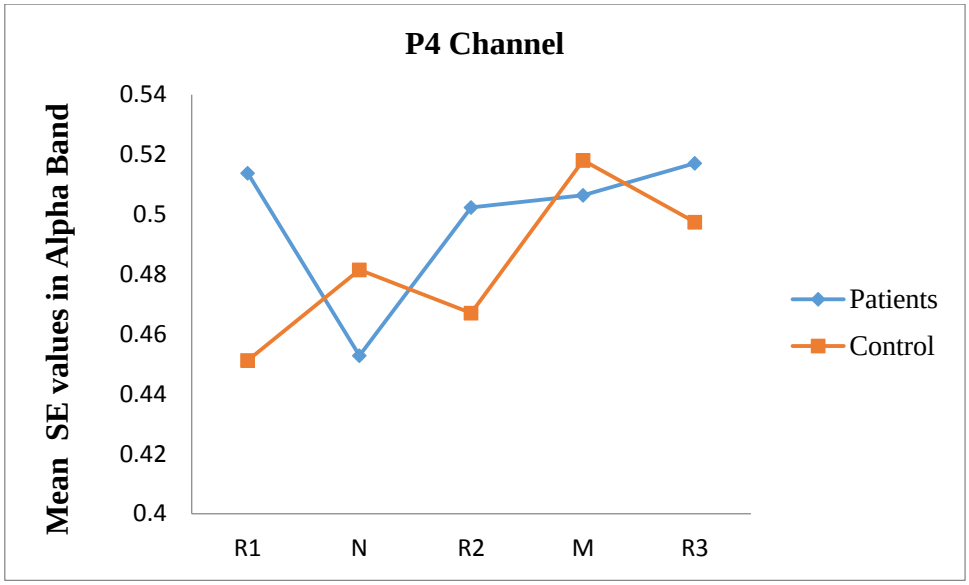
(b)

Figure 4.22 Graphs show the mean of SE values of P4 Channel's Theta band during all periods (a) with column graph (b) with line graph

Figure 4.22 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patients and controls values are become nearly same. Patient's SE values are increasing during R2 and M period. At R3 period controls and patients have nearly same values.



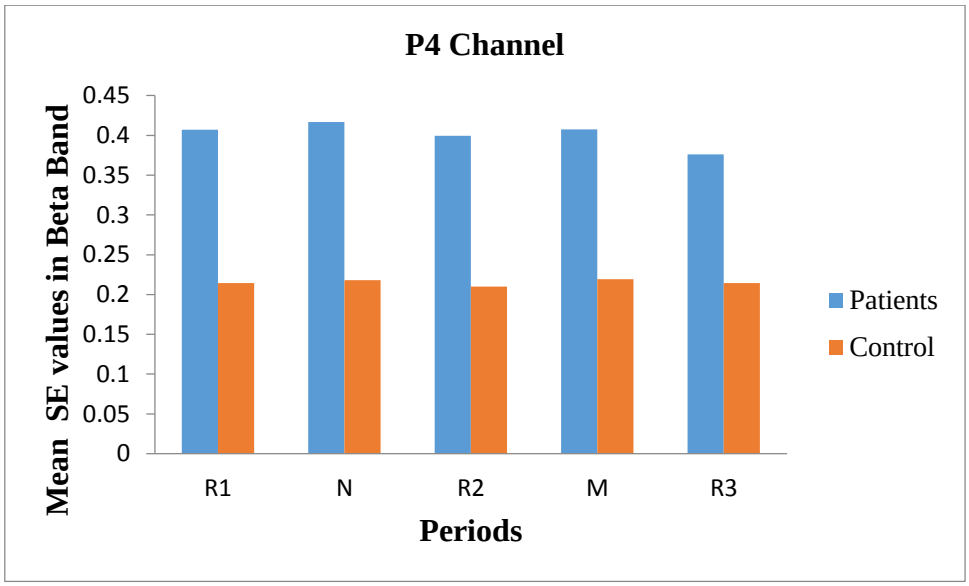
(a)



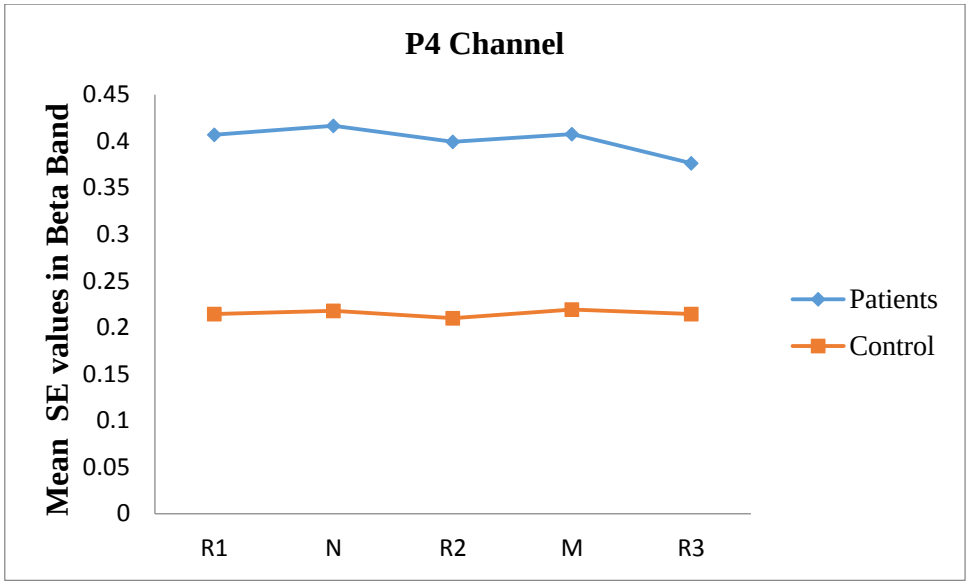
(b)

Figure 4.23 Graphs show the mean of SE values of P4 Channel's alpha band during all periods (a) with column graph (b) with line graph

Figure 4.23 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. At R1 period patients have higher mean of SE value than controls but at N period patient's SE value decrease and patient's SE value increase. Patient's SE values are increasing during R2 and M period than N period. At R3 period patients have higher mean value than controls.



(a)



(b)

Figure 4.24 Graphs show the mean of SE values of P4 Channel's beta band during all periods (a) with column graph (b) with line graph

Figure 4.24 shows patient's mean SE values with blue and control's mean SE values with orange columns and lines. In all periods patients have higher mean of SE values than controls.

Table 4.12 p values of independent sample t test for all bands in P4 Channel

P4 (p values)				
Period	Delta	Theta	Alpha	Beta
R1	0,150	0,176	0,259	0,014*
N	0,038	0,445	0,568	0,010*
R2	0,162	0,308	0,562	0,019*
M	0,220	0,374	0,811	0,005*
R3	0,129	0,448	0,689	0,005*

*p≤0.05 is accepted for significant difference.

Table 4.12 shows that the p value of beta band in R1 period is less than 0.05. It is accepted for significant difference.

Table 4.13 Mean± Std Deviation of SE values that recorded during all measurements of patients in F3 channel for all bands between sequential periods

F3	Patients (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	0,084±0,222	-0,085±0,264	-0,087±0,282	-0,028±0,271
N-R2	0,003±0,030	0,076±0,273	0,087±0,282	0,009±0,294
R2-M	0,005±0,067	0,012±0,050	-0,002±0,076	0,035±0,059
M-R3	-0,064±0,227	-0,102±0,261	-0,090±0,267	-0,071±0,224

Table 4.14 Mean± Std Deviation of SE values that recorded during all measurements of controls in F3 channel for all bands between sequential periods

F3	Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,004±0,027	-0,001±0,026	0,058±0,194	-0,008±0,069
N-R2	0,007±0,010	0,031±0,054	-0,088±0,182	0,008±0,101
R2-M	0,004±0,015	0,016±0,072	0,070±0,174	0,001±0,132
M-R3	-0,002±0,011	-0,031±0,047	-0,061±0,187	-0,020±0,072

Table 4.15 p values of patients and controls paired sample t test for all bands between sequential periods in F3 Channel

F3	Patients (p values)				Controls (p values)			
Periods	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1-N	0,241	0,354	0,425	0,145	0,621	0,891	0,372	0,736
N-R2	0,73	0,435	0,514	0,161	0,056*	0,1	0,159	0,815
R2-M	0,822	0,199	0,711	0,001*	0,473	0,495	0,232	0,973
M-R3	0,394	0,425	0,364	0,234	0,536	0,069	0,33	0,396

*p values show that patients have a significant difference (≤0,05) in beta band at R2-M period while controls having a closest value of significant difference (≤0,08) in delta band at N-R2 period.

Table 4.16 Mean± Std Deviation of SE values that recorded during all measurements of controls in F4 channel for all bands between sequential periods

F4	Patients (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,059±0,136	-0,085±0,264	-0,087±0,282	-0,028±0,271
N-R2	0,108±0,214	0,076±0,273	0,087±0,282	0,009±0,294
R2-M	-0,020±0,059	0,012±0,050	-0,002±0,076	0,035±0,059
M-R3	-0,064±0,223	-0,102±0,261	-0,090±0,267	-0,071±0,224

Table 4.17 Mean± Std Deviation of SE values that recorded during all measurements of controls in F4 channel for all bands between sequential periods

F4	Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	0,010±0,023	-0,005±0,034	0,017±0,090	-0,005±0,022
N-R2	0,002±0,034	0,001±0,025	-0,018±0,086	-0,009±0,020
R2-M	0,021±0,037	0,027±0,048	0,023±0,057	0,024±0,054
M-R3	-0,008±0,037	-0,004±0,039	-0,008±0,099	-0,011±0,051

Table 4.18 p values of patients and controls paired sample t test for all bands between sequential periods in F4 Channel

F4	Patients (p values)				Controls (p values)			
Periods	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1-N	0,2	0,333	0,353	0,749	0,198	0,642	0,568	0,477
N-R2	0,147	0,404	0,353	0,923	0,822	0,86	0,523	0,189
R2-M	0,307	0,489	0,944	0,094	0,097	0,107	0,24	0,196
M-R3	0,39	0,249	0,315	0,341	0,52	0,755	0,806	0,511

*p values show that patients and controls have no significant differences.

Table 4.19 Mean± Std Deviation of SE values that recorded during all measurements of patients in C3 channel for all bands between sequential periods

C3	Patients (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,051±0,165	-0,096±0,251	-0,053±0,300	-0,003±0,305
N-R2	0,083±0,220	0,076±0,274	0,041±0,298	-0,003±0,319
R2-M	-0,018±0,027	0,017±0,043	-0,005±0,038	0,016±0,034
M-R3	-0,062±0,219	-0,095±0,262	-0,076±0,261	-0,057±0,222

Table 4.20 Mean± Std Deviation of SE values that recorded during all measurements of controls in C3 channel for all bands between sequential periods

C3	Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	0,017±0,071	-0,005±0,020	0,031±0,063	-0,001±0,042
N-R2	-0,019±0,050	0,012±0,034	-0,019±0,097	-0,018±0,031
R2-M	0,011±0,040	0,018±0,041	0,011±0,067	0,013±0,026
M-R3	0,001±0,027	-0,009±0,042	-0,022±0,084	0,003±0,044

Table 4.21 p values of patients and controls paired sample t test for all bands between sequential periods in C3 Channel

C3	Patients (p values)				Controls (p values)			
Periods	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1-N	0,358	0,26	0,587	0,972	0,475	0,416	0,157	0,917
N-R2	0,262	0,404	0,67	0,98	0,267	0,3	0,55	0,104
R2-M	0,065*	0,253	0,684	0,162	0,409	0,187	0,627	0,156
M-R3	0,392	0,283	0,38	0,435	0,951	0,521	0,438	0,811

*p values show that patients have a significant difference (≤0,05) in delta band at R2-M period while controls having no any significant difference.

Table 4.22 Mean± Std Deviation of SE values that recorded during all measurements of patients in C4 channel for all bands between sequential periods

C4	Patients (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,010±0,101	-0,085±0,269	-0,045±0,299	0,006±0,321
N-R2	0,068±0,225	0,089±0,273	0,042±0,305	-0,003±0,319
R2-M	-0,051±0,110	-0,035±0,078	0,058±0,107	0,042±0,073
M-R3	-0,029±0,140	-0,004±0,060	-0,066±0,077	-0,055±0,121

Table 4.23 Mean± Std Deviation of SE values that recorded during all measurements of controls in C4 channel for all bands between sequential periods

C4	Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,010±0,101	-0,085±0,269	-0,045±0,299	0,006±0,321
N-R2	0,068±0,225	0,089±0,273	0,042±0,305	-0,003±0,319
R2-M	-0,051±0,110	-0,035±0,078	0,058±0,107	0,042±0,073
M-R3	-0,029±0,140	-0,004±0,060	-0,066±0,077	-0,055±0,121

Table 4.24 p values of patients and controls paired sample t test for all bands between sequential periods in C4 Channel

C4	Patients (p values)				Controls (p values)			
Periods	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1-N	0,75	0,343	0,644	0,956	0,497	0,974	0,058*	0,967
N-R2	0,361	0,33	0,673	0,974	0,055*	0,416	0,507	0,123
R2-M	0,176	0,187	0,121	0,105	0,121	0,804	0,774	0,181
M-R3	0,522	0,832	0,023*	0,182	0,957	0,661	0,818	0,43

*p values show that patients have a significant difference (≤0,05) in alpha band at M-R3 period while controls having a closest value of significant difference (≤0,08) in delta band at N-R2 period and alpha band at R1-N period.

Table 4.25 Mean± Std Deviation of SE values that recorded during all measurements of patients in P3 channel for all bands between sequential periods

P3	Patients (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,052±0,178	-0,102±0,257	-0,081±0,278	-0,010±0,300
N-R2	0,100±0,221	0,091±0,266	0,057±0,284	-0,007±0,307
R2-M	-0,016±0,061	0,018±0,064	-0,001±0,039	0,005±0,025
M-R3	-0,067±0,224	-0,061±0,272	-0,058±0,267	-0,074±0,208

Table 4.26 Mean± Std Deviation of SE values that recorded during all measurements of controls in P3 channel for all bands between sequential periods

P3	Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,031±0,031	0,006±0,055	0,031±0,039	-0,005±0,014
N-R2	-0,014±0,025	0,008±0,056	-0,005±0,070	-0,003±0,006
R2-M	0,010±0,041	0,034±0,049	0,008±0,067	0,001±0,004
M-R3	-0,006±0,036	-0,020±0,062	-0,005±0,059	0,004±0,009

Table 4.27 p values of patients and controls paired sample t test for all bands between sequential periods in P3 Channel

P3	Patients (p values)				Controls (p values)			
Periods	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1-N	0,375	0,241	0,383	0,92	0,011*	0,744	0,034*	0,28
N-R2	0,188	0,31	0,54	0,946	0,122	0,658	0,811	0,09
R2-M	0,427	0,389	0,941	0,562	0,471	0,055*	0,724	0,274
M-R3	0,368	0,496	0,508	0,291	0,59	0,34	0,785	0,175

*p values show that patients have no significant difference while controls having a closest value of significant difference (≤0,08) in theta band at R2-M period and significant difference (≤0,05) in delta and alpha band at R1-N periods.

Table 4.28 Mean± Std Deviation of SE values that recorded during all measurements of patients in P4 channel for all bands between sequential periods

P4	Patients (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	-0,017±0,112	-0,092±0,262	-0,061±0,277	0,001±0,289
N-R2	0,071±0,228	0,103±0,265	0,050±0,284	-0,017±0,311
R2-M	-0,071±0,195	-0,008±0,084	0,004±0,064	0,008±0,074
M-R3	0,002±0,048	0,006±0,038	0,011±0,055	-0,031±0,050

Table 4.29 Mean± Std Deviation of SE values that recorded during all measurements of controls in P4 channel for all bands between sequential periods

P4	Controls (Mean± Std Deviation)			
Period	Delta	Theta	Alpha	Beta
R1-N	0,009±0,017	0,016±0,034	0,030±0,072	0,004±0,011
N-R2	-0,007±0,022	0,014±0,031	-0,015±0,070	-0,008±0,011
R2-M	0,013±0,048	0,012±0,052	0,051±0,074	0,009±0,026
M-R3	0,005±0,052	0,013±0,046	-0,021±0,095	-0,005±0,040

Table 4.30 p values of patients and controls paired sample t test for all bands between sequential periods in P4 Channel

P4	Patients (p values)				Controls (p values)			
Periods	Delta	Theta	Alpha	Beta	Delta	Theta	Alpha	Beta
R1-N	0,65	0,294	0,504	0,918	0,128	0,175	0,217	0,342
N-R2	0,352	0,25	0,595	0,865	0,348	0,181	0,528	0,055*
R2-M	0,281	0,768	0,847	0,73	0,413	0,494	0,056*	0,284
M-R3	0,897	0,635	0,556	0,08*	0,783	0,405	0,51	0,706

*p values show that patients have a closest value of significant difference (≤0,08) in beta band at M-R3 period while controls having a closest value of significant difference (≤0,08) in alpha band at R2-M period and in beta band at N-R2 periods.

CHAPTER 5

DISCUSSION

In the last century we live in, psychiatric disorders have increased considerably but many people live without knowing that they have a psychiatric disorder but when they consult a doctor the diagnosis of psychiatric disorders is mostly done through verbal tests made by the psychiatrist. This showed difficulties in diagnosis. Some work for the transformation of abstract concepts to concrete methods of diagnosis is made.

First problem about CD is that it can not be explained how CSs could exist in the first place while physiological symptoms could become such a burden [24].

There are some studies to understand the brain activity on CD. Some methods were used to invastigate the brain activity. These methods could be fMRI, anatomical MRI or EEG.

One of the earlier studies works CD with fMRI. Omar Ghaffar et al. used three subjects that have unexplained sensory loss. Their complaints match on the criteria of CD. on their study. They used brain fMRI during unilateral and bilateral vibrotactile stimulation. They recognized in each subject, stimulation of the affected limb did not produce activation of the contralateral primary somatosensory (S1) region, whereas bilateral limb stimulation did [85].

Also one of the earlier studies was about comparing malingering and CD patients. The methodology of evoked potentials (EP) was applied to reveal the functional level of abnormality in patients with circumscribed complete anaesthesia due to CD. EP components about for sensory and perceptual processing of both innocuous electrical and noxious laser stimuli were not anormal but when a modified oddball task was used with rare stimuli applied to the anaesthetic right hand a P300 component indicating cognitive processing failed to appear. These conclusions suggested that cognitive deficits underlying sensory loss as CS which can be differentiated from malingering by use of P300 [72]. EEG was recorded while in psychiatric disorders are sometimes used in visual and sometimes auditory stimuli similar studies. Similarly, in our study we have used two auditory stimuli. We studied subjects that criteria for unilateral CD, sensory subtype. They had no history of neurologic disease and none met criteria for a comorbid

neurologic or psychiatric diagnosis. EEG was recorded from F3, F4, C3, C4, P3 and P4 regions of brain. These signals were recorded from 10 CD patients and 10 healthy people. EEG data were decomposed into brain waves which are alpha, beta, theta and beta sub bands by DWT. After that, SE was calculated for each sub bands. Results can show that there is a significant change in CD is expected wave of healthy control group patients.

We applied two statistical tests to data, one of them is independent t test to compare healthy and conversion groups for all bands and all periods. Other statistical test is paired sample t test which was used to compare each group in itself for all bands and all sequential periods. These tests were used to understand there is any difference of brain waves for CD patients and healthy control groups.

The mean of SE values were calculated for all brain channels and their sub bands (delta, theta, alpha and beta). When the results were analyzed, it was found that the period of music instantly have a high value of the patients while we expecting lower values. The values of music period should be lower than noise period values. Except P3 channel's beta band and P4 channel's delta and beta bands, all channels and their sub bands have higher values.

All bands (delta, theta, alpha and beta) and all periods (R1, N, R2, M, R3) of all channels (F3, F4, C3, C4, P3, P4) shows that CD patients generally have higher mean of SE values than healthy groups. These results are shown with graphs and differences can be observed easily.

In the beta band of all channels, the mean of SE values of healthy group remained stable and patients in almost all periods are high compared to healthy group values. The reason of this result can be explained with a study that has done before. Especially beta bands in all periods show high significant differences that can be discriminate both groups from each other in all channels. Beta band is more significant in all channels. Beta band is high frequency band. Beta waves are connected with active brain and alert state of mind [86].

This work was some difficulties because of the actual data are collected from healthy volunteers and patients and made quite realized we did. In this study, electrophysiological data were collected using audio stimuli that are not used before. Another difficulty is about patients. It is very hard to understand they were not given the

false-positive result. Because it is very common about diagnosis of CD and there is no way to understand this. Other studies can be done with more healthy and patient groups to get more significant differences on the statistical analysis. Also the procedure of study can replaceable with another procedure that is shortened or auditory stimuli can be changed.

As a result, in this study distinctive features searched between CD patients and in healthy volunteers by using advanced engineering methods (Shannon, DWT, etc.). Any significant differences and generalizable results were not observed between healthy and patients group in the study.

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APPENDICES

APPENDIX A

Bilgilendirilmiş Onam Formu

Bezmialem Vakıf Üniversitesi Tıp Fakültesi Hastanesi'nde "Konversiyon bozukluğu tanısına yönelik elektrofizyolojik parametrelerin mühendislik yöntemleriyle değerlendirilmesi ve psikiyatrik ölçeklerle ilişkilendirilmesi" isimli tez çalışması kapsamında katılımcılardan bazı elektrofizyolojik kayıtlar alınacaktır.

Çalışma kapsamında ,60 katılımcıdan EEG ölçümleri alınacaktır. İşitsel uyaran olarak müzik ve siren sesi kullanılacaktır. Bu çalışma esnasında hiçbir girişimsel işlemde bulunulmayacak ve herhangi bir ilaç verilmeyecektir. Ayrıca bu çalışma ile birlikte Beck Anksiyete ve Beck Depresyon testi uygulanacaktır.

Bilgilendirilmiş Gönüllü Onam Formu'ndaki tüm açıklamaları okudum. Bana, yukarıda konusu ve amacı belirtilen araştırma ile ilgili yazılı ve sözlü açıklama Zeynep MUTLU tarafından yapıldı ve yapılacak olan araştırma sonrasında herhangi bir sorun ya da sorular olduğunda araştırmayı yapan Zeynep Mutlu'ya telefon ya da e-mail adresinden ulaşabileceğim bana bildirildi (Tel no: 0554 791 63 07 e-mail:zeynepmutluzm@gmail.com).

Ayrıca araştırmaya katılımımın isteğe bağlı olduğu ve istediğim zaman, herhangi bir cezaya veya yaptırıma maruz kalmaksızın, hiçbir hakkımı kaybetmeksizin araştırmaya katılmayı reddedebileceğimi veya araştırmadan çekilebileceğim bana bildirildi.

Çalışma kapsamında elde edilen tüm verilerin ve katılımcıların isimlerinin gizli tutulacağı, bilimsel bir amaçla bu verilerin toplandığı ve sadece bilimsel çalışma kapsamında kullanılacağı, bana bildirildi. Söz konusu araştırmaya, hiçbir baskı ve zorlama olmaksızın kendi rızamla katılmayı kabul ediyorum.

Araştırmacı:	Katılımcı:
Tarih:	Tarih:
İmza:	İmza:

APPENDIX B

SOSYODEMOGRAFİK TEST

SOSYODEMOGRAFİK ÖZELLİKLER ANKET FORMU

HASTA ADI/SOYADI:

CİNSİYETİ :

DOĞUM YERİ/YILI :

MEDENİ DURUM?

EĞİTİM DURUMU: MEZUNIYET YILI: MEZUN OLDUĞU OKUL:

HANGİ ELİNİZİ BASKIN KULLANIRSINIZ?

HAMİLE OLMA VEYA EMZİRME DÖNEMİ DURUMU:

SON MENSTRÜASYON TARİHİNİZ? (bayanlar için)

ALKOL KULLANIM DURUMU:(bir hafta içerisinde kullananlar alınmayacak)

SİGARA KULLANIM DURUMU: PAKET/GÜN

KAÇ YILDIR BU RAHATSIZLIĞINIZ VAR? / HERHANGİ BİR TEDAVİ UYGULANDI MI?

BAŞKA BİR PSİKİYATRİK RAHATSIZLIĞINIZ VAR MI?

HİÇ EKT YAPILDI MI? (YAPILDIYSA NE KADAR SÜRE ÖNCEYDİ?)

(6 ay içerisinde yaptıranlar alınmayacak)
SON 3 AY ANTIPSIKOTIK KULLANIMI

SON 1 HAFTA İÇERİSİNDE ETKEN MADDESİ BENZODİAZEPİN OLAN İLAÇLAR KULLANDINIZ MI? (diazem, valium, xanax, nervium, ativan, rivotril vb. kullanıyorsa alınmayacak.)

Şikayet BAYILMA ise, ne sıklıkta ve ne kadar sürmekte?

HİS KAYBI ise, ne kadar sürmekte ve şiddeti ne derecede oluyor?

MOTOR KAYIPLAR ise, Hangi bölgeleri tutmakta ve ne kadar sürmekte?

1.YUTKUNMADA ZORLUK VAR MI?

2.KONUŞMADA ZORLUK ÇEKME VAR MI?

3.SAĞIRLIK VEYA BULANIK,ÇİFT GÖRME VAR MI?

4.KASILMALAR OLUYOR MU?

BAŞKA NÖROLOJİK HASTALIK DURUMU:

BAŞKA CİDDİ BİR RAHATSIZLIĞINIZ VAR MI? (KALP RAHATSIZLIĞI, DİYABET, TANSİYON)

KULLANDIĞINIZ DİĞER İLAÇLAR NELERDİR?

AİLENİZDE NÖROLOJİK YA DA PSİKOLOJİK BİR RAHATSIZLIĞI OLAN VAR MI?

AÇLIK-TOKLUK DURUMU

TUVALET DURUMU

APPENDIX C

Beck Anksiyete Ölçeği

Hastanın Soyadı, Adı:..... Tarih:.....

Aşağıda insanların kaygılı ya da endişeli oldukları zamanlarda yaşadıkları bazı belirtiler verilmiştir. Lütfen her maddeyi dikkatle okuyunuz. Daha sonra, her maddedeki belirtinin **BUGÜN DAHİL SON BİR (1) HAFTADIR** sizi ne kadar rahatsız ettiğini yandakine uygun yere (x) işareti koyarak belirleyiniz.

	Hiç	Hafif düzeyde Beni pek etkilemedi	Orta düzeyde Hoş değildi ama katlanabildim	Ciddi düzeyde Dayanmakta çok zorlandım
1. Bedeninizin herhangi bir yerinde uyuşma veya karıncalanma				
2. Sıcak/ ateş basmaları				
3. Bacaklarda halsizlik, titreme				
4. Gevşeyememe				
5. Çok kötü şeyler olacak korkusu				
6. Baş dönmesi veya sersemlik				
7. Kalp çarpıntısı				
8. Dengeyi kaybetme duygusu				
9. Dehşete kapılma				
10. Sinirlilik				
11. Boğuluyormuş gibi olma duygusu				
12. Ellerde titreme				
13. Titreklik				
14. Kontrolü kaybetme korkusu				
15. Nefes almada güçlük				
16. Ölüm korkusu				
17. Korkuya kapılma				
18. Midede hazımsızlık ya da rahatsızlık hissi				
19. Baygınlık				
20. Yüzün kızarması				
21. Terleme (sıcaklığa bağlı olmayan)				

Toplam BECK-A skoru:.....

APPENDIX D

BDI (Beck Depresyon Ölçeği)

Ad:_____ Tarih:_____

Yönerge: Aşağıda kişilerin ruh durumlarını ifade ederken kullandıkları bazı cümleler verilmiştir. Her madde, bir çeşit ruh durumunu anlatmaktadır. Her maddede o ruh durumunun derecesini belirleyen 4 seçenek verdir. Lütfen bu seçenekleri dikkatle okuyunuz. Son bir hafta içindeki (şu an dahil) kendi ruh durumunuzu göz önünde bulundurarak, size en uygun olan ifadeyi bulunuz. Daha sonra, o maddenin yanındaki rakamın üzerine (x) işareti koyunuz.

1.Hüzün
0 Kendimi üzgün hissetmiyorum
1 Kendimi üzgün hissediyorum
2 Her zaman için üzgünüm ve kendimi bu duygudan kurtaramıyorum
3 Öylesine üzgün ve mutsuzum ki dayanamıyorum

2. Karamsarlık
0 Gelecekten umutsuz değilim
1 Geleceğe biraz umutsuz bakıyorum
2 Gelecekten beklediğim hiçbir şey yok
3 Benim için bir gelecek yok ve bu durum düzelmeyecek

3. Geçmiş başarısızlıklar
0 Kendimi başarısız görmüyorum
1 Çevremdeki birçok kişiden daha fazla başarısızlıklarım oldu sayılır
2 Geriye dönüp baktığımda, çok fazla başarısızlığımın olduğunu görüyorum
3 Kendimi tümüyle başarısız bir insan olarak görüyorum

4.Zevk alamama
0 Herşeyden eskisi kadar zevk alabiliyorum
1 Herşeyden eskisi kadar zevk alamıyorum
2 Artık hiçbirşeyden gerçek bir zevk alamıyorum
3 Bana zevk veren hiçbirşey yok. Her şey çok sıkıcı

5.Suçluluk Duyguları
0 Kendimi suçlu hissetmiyorum
1 Arada bir kendimi suçlu hissettiğim oluyor
2 Kendimi çoğunlukla suçlu hissediyorum
3 Kendimi her an için suçlu hissediyorum

6.Cezalandırılma Duyguları
0 Cezalandırıldığımı düşünmüyorum
1 Bazı şeyler için cezalandırılabileceğimi hissediyorum
2 Cezalandırılmayı bekliyorum
3 Cezalandırıldığımı hissediyorum

7.Kendinden hoşlanmama
0 Kendimden hoşnutum
1 Kendimden pek hoşnut değilim
2 Kendimden hiç hoşlanmıyorum
3 Kendimden nefret ediyorum

8.Kendini Eleştirme
0 Kendimi diğer insanlardan daha kötü görmüyorum
1 Kendimi zayıflıklarım ve hatalarım için eleştiriyorum
2 Kendimi hatalarım için çoğu zaman suçluyorum
3 Her kötü olayda kendimi suçluyorum

9.İntihar Düşünceleri veya İstekleri
0 Kendimi öldürmek gibi düşüncelerim yok
1 Bazen kendimi öldürmeyi düşünüyorum, fakat bunu yapmam
2 Kendimi öldürebilmeyi isterdim
3 Bir fırsatını bulsam kendimi öldürürüm

10. Ağlama
0 Her zamankinden daha fazla ağladığımı sanmıyorum
1 Eskisine göre şu sıralarda daha fazla ağlıyorum
2 Şu sıralarda her an ağlıyorum
3 Eskiden ağlayabilirdim, ama şu sıralarda istesem de ağlayamıyorum

1. sayfanın toplamı:_____

Devamı Arka Sayfa

11.Sinirlilik
0 Her zamankinden daha sinirli değilim
1 Her zamankinden daha kolayca sinirleniyor ve kızıyorum
2 Çoğu zaman sinirliyim
3 Eskiden sinirlendiğim şeylere bile artık sinirlenemiyorum

12.İlgi kaybı
0 Diğer insanlara karşı ilgimi kaybetmedim
1 Eskisine göre insanlarla daha az ilgiliyim
2 Diğer insanlara karşı ilgimin çoğunu kaybettim
3 Diğer insanlara karşı hiç ilgim kalmadı

13.Kararsızlık
0 Kararlarımı eskisi kadar kolay ve rahat verebiliyorum
1 Şu sıralar kararlarımı vermeyi erteliyorum
2 Kararlarımı vermekte oldukça güçlük çekiyorum
3 Artık hiç karar veremiyorum

14.Dış Görünüm
0 Dış görüntüşümün eskisinden daha kötü olduğunu sanmıyorum
1 Yaşlandığımı ve çekiciliğimi kaybettiğimi düşünüyor ve üzülüyorum
2 Dış görünüşümde artık değiştirilmesi mümkün olmayan olumsuz değişiklikler olduğunu hissediyorum
3 Çok çirkin olduğumu düşünüyorum

15.Çalışma
0 Eskisi kadar iyi çalışabiliyorum
1 Bir işe başlayabilmek için eskisine göre kendimi daha
fazla zorlamam gerekiyor
2 Hangi iş olursa olsun, yapabilmek için kendimi çok zorluyorum
3 Hiçbir iş yapamıyorum

16.Uyku düzeninde değişiklik
0 Eskisi kadar rahat uyuyabiliyorum
1 Şu sıralarda eskisi kadar rahat uyuyamıyorum
2 Eskisine göre 1 veya 2 saat erken uyanıyor ve tekrar uyumakta zorluk çekiyorum
3 Eskisine göre çok erken uyanıyor ve tekrar uyumakta zorluk çekiyorum

17.Kolay yorulma
0 Eskisine kıyasla daha çabuk yorulduğumu sanmıyorum
1 Eskisinden daha çabuk yoruluyorum
2 Şu sıralarda neredeyse her şey beni yoruyor
3 Öyle yorgunum ki hiç bir şey yapamıyorum

18.İştahta Değişiklik
0 İştahım eskisinden pek farklı değil
1 İştahım eskisi kadar iyi değil
2 Şu sıralarda iştahım epey kötü
3 Artık hiç iştahım yok

19.Kilo Kaybı
0 Son zamanlarda pek fazla kilo kaybettiğimi sanmıyorum
1 Son zamanlarda istemediğim halde üç kilodan fazla kaybettim
2 Son zamanlarda istemediğim halde beş kilodan fazla kaybettim
3 Son zamanlarda istemediğim halde yedi kilodan fazla kaybettim
Daha az yemeğe çalışarak kilo kaybetmeye çalışıyoru
Evet ( ) Hayır ( )

20.Sağlık Endişesi
0 Sağlığım beni pek endişelendirmiyor
1 Son zamanlarda ağrı, sızı, mide bozukluğu, kabızlık gibi
sorunlarım var
2 Ağrı, sızı gibi bu sıkıntılarım beni epey endişelendirdiği
için başka şeyleri düşünmek zor geliyor
3 Bu tür sıkıntılar beni öylesine endişelendiriyor ki, ar
başka hiçbir şey düşünemiyorum

21.Cinsel İsteğin Kaybolması
0 Son zamanlarda cinsel yaşantımda dikkatimi çeken b
şey yok
1 Eskisine oranla cinsel konularla daha az ilgileniyor
2 Şu sıralarda cinsellikle pek ilgili değilim
3 Artık cinsellikle hiç bir ilgim kalmadı

Sayfa 1'in toplamı:___ Sayfa 2' nin toplamı: ___ = Toplam skor _____

APPENDIX E

ETİK KURUL ONAYI

BEZMİALEM VAKIF ÜNİVERSİTESİ KLİNİK ARAŞTIRMALARI ETİK KURULU KARAR FORMU

SAYI : 71306642/050-01-04 /246 11.12.2013

KONU: Etik Kurulu Kararı

ETİK KURUL BİLGİLERİ		
	ETİK KURULUN ADI	Bezmialem Vakıf Üniversitesi Klinik Araştırmalar Etik Kurulu
	AÇIK ADRESİ:	Adnan Menderes Bulvarı Vatan caddesi 34093 Fatih/İstanbul
	TELEFON	(0212) 523 22 88 - 1028
	FAKS	(0212) 533 23 26
	E-POSTA	etikkurulu@bezmialem.edu.tr

BAŞVURU BİLGİLERİ			
	ARAŞTIRMANIN AÇIK ADI	Konversiyon Bozukluğu Tanısına Yönelik Elektrofizyolojik (Elektroensefalografik Sinyaller) Parametrelerin Mühendislik Yöntemleriyle Değerlendirilmesi ve Psikiyatrik Ölçeklerle İlişkilendirilmesi	
	ARAŞTIRMA PROTOKOL KODU		
	KOORDİNATÖR/SORUMLU ARAŞTIRMACI UNVANI/ADI/SOYADI	Prof. Dr. İsmet KIRPINAR	
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ UZMANLIK ALANI	Ruh Sağlığı ve Hastalıkları	
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ BULUNDUĞU MERKEZ	Bezmialem Vakıf Üniversitesi Tıp Fakültesi Hastanesi	
	DESTEKLEYİCİ		
	DESTEKLEYİCİNİN YASAL TEMSİLCİSİ		
	ARAŞTIRMANIN FAZI VE TÜRÜ	FAZ 1	☐
		FAZ 2	☐
		FAZ 3	☐
		FAZ 4	☐
		Gözlemsel ilaç çalışması	☐
		İlaç dışı klinik araştırma (akademik amaçlı)	☒ Tanı kriterleri oluşturmak
		Diğer ise belirtiniz	
	ARAŞTIRMAYA KATILAN MERKEZLER	TEK MERKEZ ☒	ÇOK MERKEZLİ ☐ / ULUSAL ☐ / ULUSLARARASI ☐

	Belge Adı	Tarihi	Versiyon Numarası	Dili
DEĞERLENDİRİLEN BELGELER	ARAŞTIRMA PROTOKOLÜ	15.12.2013	-	Türkçe ☒ İngilizce ☐ Diğer ☐
	BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU	-	-	Türkçe ☒ İngilizce ☐ Diğer ☐
	OLGU RAPOR FORMU			Türkçe ☐ İngilizce ☐ Diğer ☐
	ARAŞTIRMA BROŞÜRÜ			Türkçe ☐ İngilizce ☐ Diğer ☐
DEĞERLENDİRİLEN DİĞER BELGELER	**Belge Adı**		**Açıklama**	
	SİGORTA	☐		
	ARAŞTIRMA BÜTÇESİ	☒		
	BİYOLOJİK MATERYEL TRANSFER FORMU	☐		

	İLAN	☐	
	YILLIK BİLDİRİM	☐	
	SONUÇ RAPORU	☐	
	GÜVENLİLİK BİLDİRİMLERİ	☐	
	DİĞER:	☒	- Sorumlu araştırmacı ve yardımcı araştırmacılara ait özgeçmiş formları - Çalışmanın Helsinki Bildirgesi, İKU/İLU'ya uygun yürütüleceğine dair taahhütname - Araştırma ile ilgili yayınlar
KARAR BİLGİLERİ	**Karar No: 47 / 13**	**Tarih: 11.12.2013**	
	Yukarıda bilgileri verilen başvuru dosyası ile ilgili belgeler araştırmanın/çalışmanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş ve uygun bulunmuş olup araştırmanın/çalışmanın başvuru dosyasında belirtilen merkezlerde gerçekleştirilmesinde etik ve bilimsel sakınca bulunmadığına toplantıya katılan etik kurul üye tam sayısının salt çoğunluğu ile karar verilmiştir. Klinik Araştırmalar Hakkında Yönetmelik kapsamında yer alan araştırmalar/çalışmalar için Türkiye İlaç ve Tıbbi Cihaz Kurumu'ndan izin alınması gerekmektedir.		

BEZMİALEM VAKIF ÜNİVERSİTESİ KLİNİK ARAŞTIRMALARI ETİK KURULU	
ETİK KURULUN ÇALIŞMA ESASI	Klinik Araştırmalar Hakkında Yönetmelik, İyi Klinik Uygulamaları Kılavuzu
BAŞKANIN UNVANI / ADI / SOYADI:	Prof. Dr. Reha ERKOÇ

Unvanı/Adı/Soyadı	Uzmanlık Alanı	Kurumu	Cinsiyet		Araştırma ile ilişki		Katılım *		İmza
Prof. Dr. Reha ERKOÇ	İç Hastalıkları	Bezmialem Vakıf Üniversitesi Tıp Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Prof. Dr. Orhan ÖZTURAN	Kulak Burun ve Boğaz Hastalıkları	Bezmialem Vakıf Üniversitesi Tıp Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Prof. Dr. Faruk ÖKTEM	Çocuk Sağlığı ve Hastalıkları	Bezmialem Vakıf Üniversitesi Tıp Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Doç. Dr. Özcan KARAMAN	İç Hastalıkları	Bezmialem Vakıf Üniversitesi Tıp Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Doç. Dr. Adem KIRIŞ	Radyoloji	Mehmet Akif Ersoy G.K.D.C Eğitim Araştırma Hastanesi	E☒	K☐	E☐	H☒	E☐	H☒	
Doç. Dr. Ahmet MİHMANLI	Ağız-Diş ve Çene Cerrahisi	Bezmialem Vakıf Üniversitesi Diş Hekimliği Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Doç. Dr. Hayrullah KÖSE	Biyofizik	Bezmialem Vakıf Üniversitesi Tıp Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Yrd. Doç. Dr. Ertuğrul KAYA	Tıbbi Farmakoloji	Düzce Üniversitesi	E☒	K☐	E☐	H☒	E☐	H☒	
Yrd. Doç. Dr. Ömer UYSAL	Bioistatistik ve Tıp Bilişimi	Bezmialem Vakıf Üniversitesi Tıp Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Yrd. Doç. Dr. Mahmut GÜRGAN	Deontoloji ve Tıp Tarihi	Bezmialem Vakıf Üniversitesi Tıp Fakültesi	E☒	K☐	E☐	H☒	E☒	H☐	
Mehmet AKHOROZ	Emekli	Kurum Dışı	E☒	K☐	E☐	H☒	E☒	H☐	
Avukat Şevkiye KARAHAN	Hukuk	Bezmialem Vakıf Üniversitesi	E☐	K☒	E☐	H☒	E☒	H☐	

* :Toplantıda Bulunma

Karar: ☒Onaylandı ☐Reddedildi

CURRICULUM VITAE

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