

**CHANGES IN QUALITY OF LIFE,  
PSYCHOLOGICAL FUNCTIONING AND COGNITIVE  
FUNCTIONING AFTER SURGICAL INTERVENTION  
FOR TEMPORAL LOBE EPILEPSY.**

**by**

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## **Acknowledgements**

I would like to extend my immense gratitude and thanks to Dr June Gilchrist and Dr Leo Harding for their continual encouragement and support and for sharing their worldly knowledge of research. I would also like to thank Dr Richard Roberts and Mr Douglas Gentleman for their invaluable advice and encouragement. My gratitude also goes to all the staff at the Clinical Psychology Department and Pain Clinic at Ninewells Hospital, in particular Lesley Ritchie, Freida Soutar and Helen Thornton who helped me maintain my sense of humour and sense of perspective. I thank my parents, Ron and Win Summers, for encouraging me to follow my dream – especially when they had to pay for it. Finally, I wish to thank all those patients who endlessly completed my questionnaires and answered my questions. Without them this research would not have been possible.

**Declaration**

“This thesis has been composed by myself and the work contained herein is my own.”

Signed: .... Fiona Summers

## **ABSTRACT**

Temporal lobe epilepsy is a common condition that often responds poorly to anti-epileptic medications and temporal lobectomies have become the most common, safest, and most effective form of surgical treatment for epilepsy (Engel, 1987). Milner (1975) found that after temporal lobectomy new learning and memory were affected, especially verbal information after left temporal surgery and visual/spatial information after right temporal excision. Non-verbal memory deficits have not been consistently identified before or after non-dominant temporal lobectomy (Lee et al., 1984). Findings on levels of depression following temporal lobectomy have been inconsistent (Rose et al., 1995, Ring et al., 1998), however, Quality of Life showed improvement in a number of areas (Rausch & Crandall, 1982). There have also been contradictory findings on changes in levels of anxiety (Bladin, 1992, Rose et al., 1995) and there is little published research on the effects of Locus of Control. Using a longitudinal, within and between subject design, the present study investigated the effects of temporal lobe surgery for epilepsy on cognitive functioning, depression, anxiety, Quality of Life and Locus of Control. The results were discussed in relation to current literature and proposals were made for further treatment.

## **CHAPTER 1 - INTRODUCTION**

# **1. INTRODUCTION**

## **1.1 EPILEPSY**

Epilepsy is a condition resulting from disordered function in neurones in the cerebral hemispheres. An epileptic attack occurs when neurons in a region of the cortex fire synchronously but inappropriately. This synchronous activity disrupts on-going behaviour and can result in loss of consciousness and production of involuntary movements. Determining the prevalence and incidence of epilepsy is problematic for a number of reasons: the lack of accurate information in reporting epileptic seizures, difficulties in defining and diagnosing seizure types and the difficulties ascertaining the duration of the disorder. As a result, most epidemiological rates for epilepsy are underestimates (Engel, 1989). Approximately one person in twenty experiences an epileptic attack in their lifetime but only one in two hundred experiences multiple attacks and is categorised as suffering from epilepsy. McIntosh (1992) reported that five out of one thousand are afflicted with chronic epileptic seizures. This makes epilepsy the second most common neurological disorder after stroke (Adams & Victor, 1993). The costs to society and to the individual are considerable, reflecting the increased morbidity in people with epilepsy: it is estimated that the costs to the National Health Service are around £109 million (1988 prices), while the costs to society as a whole have been estimated at approximately £500 million (Griffin, 1991). Though there is considerable variability depending on seizure type, six years after diagnosis 40 per cent of patients have had a substantial remission, which increases to 75 per cent after twenty

years (Lindsay, Bone & Challander, 1997). There is however evidence of increased mortality in adults with epilepsy (Nashef, Fish, Sander & Shorvon, 1995).

Epileptic seizures fall into two broad categories: partial (focal) and generalised (Gastaut, 1970). Generalised epileptic seizures involve synchronous neuronal activity in large areas of the brain, both hemispheres being affected. Partial seizures involve a localised region only and are more common, accounting for 80 per cent of adult epilepsies (Lindsay et al., 1997). Partial seizures are subdivided into simple partial seizures, complex partial seizures and partial seizures that secondarily develop into generalised seizures. An example of a partial seizure is the Jacksonian seizure, where the attack begins with jerks of single parts of the body, such as a finger, a toe or the mouth and then spreads. Complex partial seizures most commonly originate in the temporal lobe, or less commonly in the frontal lobe. They commonly have one or more of three features: (1) subjective feelings, such as forced, repetitive thoughts, alterations in mood, feeling of déjà vu or hallucinations (2) automatisms (repetitive stereotyped movements such as lip smacking or chewing or the repetition of acts such as undoing buttons) and (3) postural changes such as assuming catatonic (frozen) postures.

There are a number of different types of generalised seizure: grand mal fit, petit mal or absence attack, akinetic seizure and myoclonic spasm. The grand mal fit is characterised by loss of consciousness and stereotyped motor activity. Typically patients go through three stages: a tonic stage, in which the body stiffens and breathing temporarily stops; a clonic stage, in which there is rhythmic shaking; and a post-ictal depression stage in



which the patient is confused. About 50 per cent of these seizures are preceded by an aura.

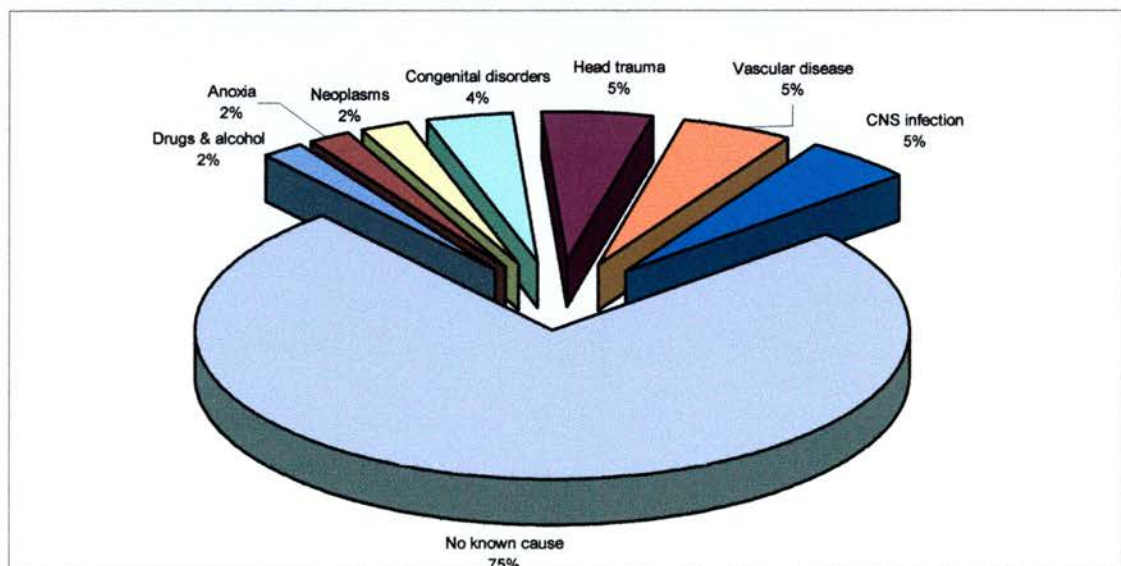
In the petit mal or absence attack there is loss of awareness, during which there is no motor activity except blinking or turning the head or rolling the eyes. These attacks are of brief duration. Akinetic seizures are ordinarily only seen in children and involve the child collapsing suddenly and without warning. These seizures are often of very short duration and the child may get up after only a few seconds. Myoclonic spasms consist of a sudden flexion or extension of the body and often begin with a cry.

The most remarkable clinical feature of epileptic disorders is the widely varying intervals between attacks – minutes, hours, weeks or years. It is therefore impossible to describe a basic set of symptoms to be expected in all or even most people with the disease. Three symptoms, however, are found in many types of epilepsy: an aura, loss of consciousness and abnormal movements. An aura is described as a warning of an impending seizure which may take the form of sensations such as odours, noises or may simply be a “feeling” that the seizure is going to occur. Loss of consciousness may take the form of a temporary coma or simply staring off into space. There is often amnesia for the seizure itself. Movements are common in seizures, although their characteristics vary considerably. In some cases there are shaking movements, while in others automatic movements such as rubbing hands and chewing occur.

Complex partial seizures form the most frequently occurring single seizure type in the population. Incidence studies indicate that epilepsy manifest primarily by partial seizures comprises 40-50 per cent of all newly diagnosed cases (Hauser, 1991) and in a study of community prevalence in Minnesota, USA almost 60 per cent of cases had partial seizures (Hauser, Annegers & Kurland, 1990). Data from population-based studies consistently demonstrate complex partial seizures to be the single most frequent class of partial seizures. Among focal seizures, the temporal lobes are the most frequent anatomical sites of epileptic discharges (Van Buren, Ajmone-Marsan, Mutsuga & Sadowsky, 1975).

Sometimes epileptic seizures are classifiable as symptomatic seizures; that is they can sometimes be linked to a specific cause, such as infection, trauma, tumour, vascular malformation, toxic chemicals or high fever (Graph 1).

**Graph 1: Causes of Epilepsy**



Other seizures (“idiopathic seizures”) appear to arise spontaneously and in the absence of other diseases of the central nervous system. Seventy-five per cent of epileptic seizures have no known cause (Lindsay, Bone & Callander, 1997; Adams, Parsons, Culbertson & Nixon, 1996).

### **1.1.1 Epilepsy and Cognitive Functioning**

Some of the more frequently observed manifestations of seizures that arise from cortical regions include memory impairment (mesial temporal regions), language impairment (lateral temporal regions), speech arrest and forced thinking (frontal regions), somatosensory disturbances (parietal regions) and visual disturbances (occipital regions) (CCTILAE, 1989). Double dissociations of memory functioning have been found among individuals with unilateral epileptogenic foci (Delaney, Rosen, Mattson & Novelly, 1980; Chelune & Bornstein 1988). Verbal memory impairment was strongly associated with left temporal lobe foci, and visual memory impairment with right temporal lobe foci.

### **1.1.2 Epilepsy and Locus of Control**

Rotter, Seeman & Liverant (1962) defined the Locus of Control dimension as a personality trait focusing on the individual’s perception of causality, with internal Locus of Control indicating the perception of ability to control events in one’s life, whereas external Locus of Control indicates that the person believes his or her life is controlled from without by such forces as fate, luck etc. Locus of Control is considered a learned

phenomenon that is believed to be acquired during a person's lifetime. Individuals with an external Locus of Control are found to be more susceptible to psychopathology, particularly depression (Lefcourt, 1976). Subjects external in their Locus of Control orientation have been found to experience greater difficulty in adjusting to life events (Kilman, Laval & Wanlass, 1978) and manifest more psychological distress when exposed to life changes (Kno, Gray & Lin, 1979). Strickland (1978) suggested that externally oriented individuals tended to have a greater degree of health related difficulties and maladjustment while the converse has been reported by Molinari & Khanna (1981).

Rotter's (1954) modification of Social Learning Theory, which emphasises that behaviour is learned through the observation of others as well as through the direct experience of rewards and punishments, stated that the potential for a person to engage in a set of functionally related behaviours in a given psychological situation is a joint function of (1) the person's expectancy that the behaviours will lead to a particular outcome in the situation and (2) the value of the outcome to the person in that situation. Rotter introduced the notion of Locus of Control as a generalised expectancy. A generalised expectancy is something the person carries from one situation to the next. It is more trait-like than state-like and is therefore akin to a personality dimension. Rotter hypothesised that people learn general ways of thinking about the world, especially about how life's rewards and punishments are controlled. The Locus of Control construct has similarities with many other constructs that emphasise the importance of perceptions of control, including mastery, self-efficacy, personal competence and

perceived competence. Its main overlap is with constructs that focus on the causes of events, such as explanatory style. Phares (1979) and Strickland (1978) reported that, compared with externals, internals were more likely to exert efforts to control their environment, to take responsibility for their actions, to seek out and process relevant information, to exhibit better learning and to show more autonomous decision-making.

By its very nature epilepsy might predispose an individual to develop an external Locus of Control. For example, the essentially random occurrence of seizures, as well as the significant and often unpredictable psychosocial complications of epilepsy, might cause persons with epilepsy to develop a world view that they have little real control over many important and basic events in their lives, which would facilitate development of a more general external Locus of Control and might set the stage for clinical depression. Minimal empirical data exist regarding the relationship between the Locus of Control and epilepsy. Hermann & Wyler (1989) found that depression was positively associated with a more external Locus of Control in pre operative patients with epilepsy but found that post operatively the correlation between depression and Locus of Control was not significant. Arntson, Droge, Norton & Murray (1986) found patients who reported epilepsy as having a strong influence on their lives had a higher external Locus of Control than patients who felt the disease had a more moderate influence. Likewise, Hermann, Whitman, Wyler & Anton (1990) found that as the Locus of Control was more external the patients developed more signs of psychopathology. Other studies have found positive relations between external Locus of Control and negative

consequences of the disease, such as its perceived severity and social stigmatisations (DeVillis, McEvoy, Strudler & Wallston, 1980, Droge, Arntson & Norton, 1986).

Unlike individuals with other chronic illnesses, people with epilepsy experience the episodes of illness in their lives in an unpredictable and random manner, and this unpredictability reduces their perceptions of having control over their own life (Adams et al., 1996). This process may become debilitating and may markedly interfere with normal social activities and interpersonal relationships. Individuals with epilepsy often feel vulnerable given the unpredictability and the perception of uncontrollability of the disorder (Adams et al., 1996). The experience of lack of control and uncertainty is central in the subjective experience of patients with epilepsy. This applies to seizures and associated lack of bodily control, dependency on medication and help provided by significant others (Snyder, 1991, Mittan, 1986, Gehlert, 1994).

Locus of Control is also an important aspect of anxiety. An external locus is often related to anxiety as the person feels out of control of circumstances and the environment while an internal locus tends to bring forth more optimal adjustment (Lee, Ho, Tsang, Cheng, Leung, Cheng & Lich-Mak, 1985).

Attribution Theory (Weiner, 1985) is similar to the notion of Locus of Control in that it addresses the question of how causes are attributed to different events. Attribution Theory argues that it is the stable-unstable dimension (rather than the internal-external dimension) that best explains expectancy change and behavioural persistence. If the

individual perceives the cause of success or failure as due to stable factors, then the same outcome can be expected in the future, and persistence is determined accordingly. If the individual perceives the cause to be due to unstable factors, then persistence may be high in the case of failure (tries harder, effort attribution) or low in the face of success (for example luck attribution in the case of gambling). In regard to depression, research demonstrated that attribution is an important variable, influencing mood changes and performance decrements (Dweck, 1975, Roth & Kubal, 1975).

### **1.1.3 Epilepsy and Depression**

Clinically, people with epilepsy have increased levels of depression (Adams et al., 1996). Existing reviews of literature suggest that depression may be one of the most frequent psychological complications of epilepsy (Betts, 1981; Robertson & Trimble, 1983). Victoroff (1994) found that 58 per cent of patients being considered for surgical intervention for epilepsy had histories of depressive disorders. Baker, Smith, Dewey, Jacoby & Chadwick (1993) found a six per cent incidence of depression, using the Hospital and Anxiety Scale (HADS), in patients with uncontrolled seizures attending an epilepsy clinic. Evidence suggests the rates of depression and/or depression severity is greater in the epilepsy patients than in other chronic illness groups (Standage & Fenton, 1975, Kogerorgos, Fonagy & Scott, 1982). Mendez, Cummings & Benson (1986) and Perini & Mendius (1984) reported an association between depression and complex partial seizures of temporal lobe origin, whereas several other groups of investigators have consistently failed to detect relationships between a wide variety of seizure related variables (such as seizure type, age at onset, side and site of the epileptogenic focus,

seizure frequency) and depression in adults with epilepsy (Trimble & Perez, 1980, Kogerorgos et al., 1982).

Psychosocial issues have been investigated as contributing to the development of depression among patients with epilepsy. People with epilepsy endure numerous stressors associated with their illness that include psychological and social stressors as well as biological and medical treatment stressors. Hermann, Whitman & Anton (1992) discovered that a majority of the variance associated with increased levels of depression was related to psychosocial factors. In particular Hermann et al. discovered that an increased number of stressful life events, poor adjustment to epilepsy, less adequate financial status and being female were significantly related to increased levels of depression among people with epilepsy.

Epilepsy is often associated with repeated disabling and distressing episodes of loss of consciousness that consequently often results in personal embarrassment and loss of dignity. Stigma, discrimination, vocational difficulties, social exclusion, transportation problems, and a wide variety of other psychosocial difficulties are similarly associated with epilepsy (Dell, 1986).

Learned Helplessness Theory (Seligman, 1975) is based on the notion that, under particular situations, there is a tendency to give up any effort to control the environment. Studies suggest that a lack of operant control (that your actions will have an effect on the environment) can lead to helplessness in humans (Kofta & Sedek, 1989). In one



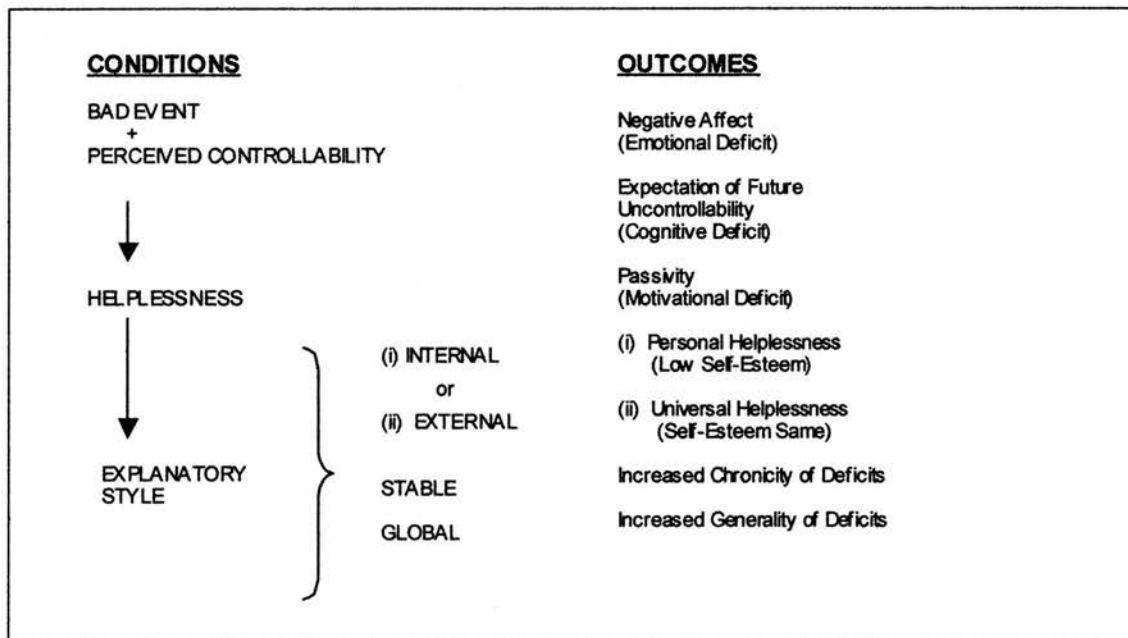
experiment, people were given a set of unsolvable problems to solve which they were doomed to fail. Later, when the same people were given a new set of problems, that could be easily solved, they failed because they did not attempt to complete the tasks. They did not try because they believed that the task was beyond their abilities (Dweck & Repucci, 1973). When people begin to believe that nothing they can do will change their lives they generally stop trying and consequently endure situations passively (Dweck & Licht, 1980). The core of learned helplessness is controllability. The idea that learning about the uncontrollability of a situation could have powerful effects on subsequent behaviour led Seligman to suggest that there may be a parallel between helplessness, learning and depression. Seligman (1975) stated that:

“When a traumatic event first occurs, it causes a heightened state of emotionality that can loosely be called fear. This state continues until one of two things happens; if the subject learns that he can control the trauma, fear is reduced and may disappear altogether; or if the subject finally learns he cannot control the trauma, fear will decrease and be replaced by depression.”

Miller & Norman (1979) reformulated Learned Helplessness Theory with a further reformulation offered by Abramson, Metalsky & Alloy (1989). Essentially the reformulated theory includes the notion of Locus of Control (Rotter, 1962) and Attribution Theory (Weiner, 1985) (Figure 1). Abramson et al. added a global-specific dimension. Global relates to whether the cause attributable is seen as influencing many areas of the person’s situation or whether the cause is seen as only influencing one area of the person’s life. The combination of Locus of Control, learned helplessness and

global-specific dimension influences how an individual reacts and copes in situations and, given a particular combination, could give rise to depression.

**Figure 1: Reformulated Learned Helplessness Theory (taken from Power & Dagleish, 1997)**



Abramson et al. identified an internal-stable-global attribution as being most vulnerable to depression. In epilepsy the 'Bad Event' would be a seizure that is seen as uncontrollable. This could lead to a feeling of helplessness that, regardless of anything the individual does, control is unattainable - certainly this would be the case in drug resistant epilepsy. If the individual has an internal Locus of Control the individual's self esteem is likely to reduce, according to this reformulated learned helplessness theory, however if the individual has an external Locus of Control self esteem would remain the

same. As discussed previously research indicates that people with epilepsy may have an external Locus of Control. It is likely that epilepsy is seen as a global dimension as it affects many areas of an individual's life. In addition as a seizure is likely to occur again, epilepsy is seen as a stable dimension. As a result, an individual with epilepsy is likely to have an external-stable-global attribution style. Although this does not fit exactly with the "depressive" profile it is similar and may predispose a person with epilepsy to develop depression and it is worthy of further investigation.

A further theme of depression has been the role of social mentalities which, according to Gilbert (1992), help us to orientate to role relationships in certain ways. At least four basic ways appear to exist: care eliciting, care giving, cooperating and competing. The core social mentalities reflect the characteristic ways an individual construes and experiences self in interaction. In relation to epilepsy the care eliciting role seems to play an important function. In the care eliciting role the self is seen as needing input from others for care, protection, safety and reassurance. The impression to be created in the minds of others is one of need.

There are a number of themes in relation to care eliciting: abandonment, protection, emptiness and victim. The abandonment theme arises in individuals who are preoccupied with being left and abandoned. As a result, they will exhibit behaviour to ensure that others do not abandon them such as crying and seeking reassurance. As a result they often make excess demands on their carers. The protection theme occurs when it is less aloneness and more danger that is the focus. They fear disaster may

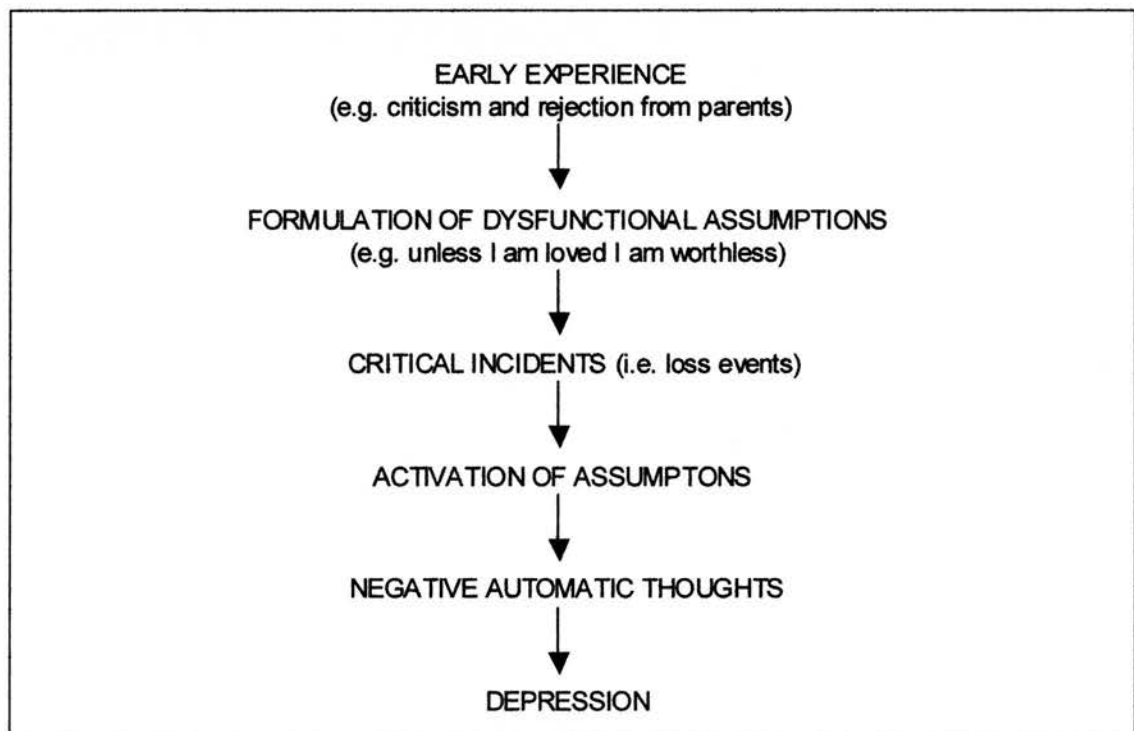
strike and require some other person as a constant source of reassurance. This reassurance is commonly seen in health care settings when individuals seek constant reassurance about medical problems. The emptiness theme describes the feeling that no one can actually give to the self a sense of being emotionally well and is used to explain the feelings of emptiness often reported in depression. There is a fear that others will see this emptiness and, as a result, disapprove of the individual. This often produces an approach-avoidance conflict. The victim theme arises in individuals who feel they have suffered more than most and, having suffered, attempt to elicit others' caring attentions. These individuals often compete to be seen as the most needy and deserving. The victim role can also hide a sense of injustice. Those with epilepsy have an enduring disease that by necessity involves the use of others in a caring role. As a result, for those who do develop depression, the victim theme may arise.

Champion & Power (1995) suggest that depression is a result of the loss of a valued goal or social role. Their model, based on a social-cognitive account of depression, proposes that those vulnerable to depression over invest in one particular goal or role while under invest in others. As a result when the over invested goal or role is not met the normal protective mechanisms, which most individuals possess, appear to malfunction and depression occurs. In epilepsy, if an individual views their role as an "epileptic" in need of care and this is removed depression could develop.

Beck (1976) developed cognitive therapy for depression that focuses on the link between cognition and emotion. This was further developed by Beck in 1987 to include the

notion of an interaction between cognition and emotion, and biological, psychological and social factors. Beck's model of depression is shown in Figure 2.

**Figure 2: Beck's (1987) Model of Depression**



Beck focuses on schemas that have been developed from early experience such as experiences of parental rejection. As a result when an incident occurs, such as being unsuccessful at a job interview, this schema is activated leading to Negative Automatic Thoughts such as I am a complete failure. Beck hypothesised that this then leads to depression. It may be that those with uncontrolled epilepsy have early experiences, which have a negative effect on how they perceive themselves, and consequently they may become more vulnerable to depression.

#### **1.1.4 Epilepsy and Anxiety**

It has been demonstrated that emotional disturbances, interpersonal stress and tension are exacerbating factors in precipitating seizures (Lishman, 1987). Gumnit (1987) reported that the sense of hopelessness and anxiety patients experience about when the next seizure will occur is psychologically devastating. Victoroff (1994) found that 31 per cent of patients being considered for surgery due to intractable complex partial seizures had histories of anxiety disorders. Hermann & Whitman (1984) reviewed studies that reported a high prevalence of affective disorders, including anxiety and depression, and found that several investigators reported a high incidence of both temporal lobe and non-temporal lobe epilepsy. Baker et al. (1993) found a 25 per cent incidence of anxiety in patients with uncontrolled seizures attending an epilepsy clinic using the HADS. Perini & Mendius (1984) noted increased anxiety in patients with left temporal lobe epilepsy compared with right temporal lobe epilepsy.

Generalised anxiety problems involve the generalised and persistent symptoms of anxiety, which are driven by worry. The worry tends to be out of proportion to the feared event, pervasive and difficult for the individual to control. It is possible that those who have uncontrolled epilepsy are more likely to experience anxiety driven by the worry of having another seizure.

There are a number of theoretical approaches to worry. Borkovec, Metzger & Pruzinsky (1986) suggested that worry “can be viewed as a cognitive attempt to anticipate and avoid a myriad of possible, future outcomes”. Borkovec et al. thus view worry as an

attempt to avoid negative outcomes by thinking through all the possibilities and anticipate difficulties. This can lead to avoidant behaviour. In the case of epilepsy it may be that worry of having a seizure in a public place, due to the fear of negative appraisal from others, causes anxiety, ruminating thoughts and possible avoidance. This is likely to be maintained by previous experiences of seizures in public places that have caused embarrassment.

Barlow's (1988) theory of worry incorporates psychological processes such as memory, attention and self-evaluation. Barlow suggests that individuals intensify their worries by focusing their attentions on them and, as a result, develop an apprehensive hypervalent cognitive schema. This then affects concentration and the ability to generate alternative solutions and problem solve.

Barlow's theory was developed further by Tallis & Eysenck (1994). They see worry as a process: worry triggers an alarm function when threat-related information is introduced, this alarm function continues to prompt ensuring a continual re-appraisal and problem solving process which then generates possible solutions to any anticipated outcomes. If failure to select an appropriate coping strategy occurs then the process continues and worry escalates. In the case of epilepsy avoidance of the situation may be seen as a coping strategy however, while reducing the anxiety, it only serves to strengthen the association between anxiety and, for example, going out in public.

Anxiety can be distressing simply because of its intensity. Continuous preoccupation with certain fears, such as risks to one's health, can make anxiety less easy to tolerate. Chronic anxiety (in the form of an anxiety disorder) can impair social relationships, work and recreation.

The relationship between anxiety and depression is difficult to assess. Mullaney (1989) outlined eight hypotheses in regard to the relationship between anxiety and depression: (1) that they are interwoven and inseparable (2) that they represent distinct disorders (3) although distinct both in dimensional and categorical terms they can remain difficult to separate (4) anxiety is part of depressive disorder (5) they are symptomatically distinct but are not mutually exclusive (6) that they are hierarchically related with depressive symptoms higher up the dysfunction hierarchy, hence (7) depression and anxiety generally occurred together but depression can manifest as a distinct entity and (8) depression and anxiety neurosis are indistinguishable and there is little therapeutic point in separating them. Goldberg, Bridges, Duncan-Jones & Grayson (1987) found that depression and anxiety symptoms are highly correlated. Barlow, DiNardo, Vermilyea, Vermilyea & Blanchard (1986) in their study of anxiety patients found that 39 per cent of agoraphobics, 35 per cent of those with panic disorder and 19 per cent with social phobia also had met the criteria (as outlined in DSM - IV) for depression. Sanderson, Beck & Beck (1990) found over 66 per cent of their depressed patients also had an anxiety disorder.



### **1.1.5 Epilepsy and Quality of Life**

Epilepsy patients carry a burden of (a) the fear of another seizure, (b) the stigma of being called "epileptic" which in turn leads to discrimination in education and employment, (c) having to take medication every day, (d) the difficulty in obtaining life insurance, (e) not being permitted to drive, and (f) problems with independent living. The related problems associated with long term, uncontrolled seizures are numerous. Trauma, including death, broken bones, brain damage from head injuries, and toxicity from anti-convulsant drugs are frequent. The side effects of anti-convulsant drugs include not just sedation, but skin and gum changes and liver problems to name a few. Uncontrolled epilepsy leads to the constant fear of having an embarrassing seizure and consequently poor self-image, which can lead to social withdrawal. Social withdrawal in turn leads inevitably to social isolation.

The discrepancy between current status and aspirations and achievement is central to the concept of Quality of Life. For people with a chronic health condition, where cure is generally not an attainable goal and therapy is often prolonged, Quality of Life has come to be seen as an important outcome of health care. However, the concept of Quality of Life remains vague. Quality of Life has been variously conceptualised as an effective response to one's role situations and values (Andrews & Withey, 1976); as satisfaction with physical, psychosocial, and economic needs (Bubolz, Eicher, Evers & Sontag, 1980); and as the discrepancy between desire and actual circumstances (Krupinski, 1980). Quality of Life has been examined from a number of different perspectives depending on the purpose of the investigation, but it is recognised as a multidimensional

concept, in which health or its absence represents an important dimension. Fallowfield (1990) states that Quality of Life is "a complex amalgam of satisfactory functioning in terms of physical, social, psychological and vocational well-being," and Spritzer (1987) argues that any measurement of Quality of Life must include physical and social functioning, burden of symptoms, and sense of well-being.

Spencer & Hunt (1996) describe health related Quality of Life as a state of overall health that includes domains of physical, social, psychological, vocational and economic well-being. There has been some debate and confusion in the literature with regard to terminology of "health related Quality of Life" and "Quality of Life". Some argue that health related Quality of Life implies an exclusion of well-being domains that are affected only indirectly by illness. However, Vickrey (1992) and Spence & Hunt (1996) have used the term health related Quality of Life to refer to both direct and indirect effects of illness. For the purpose of this discussion both health related Quality of Life and Quality of Life are used synonymously as both refer to the same multidimensional concept.

The multidimensionality refers to the coverage of a broad range of content including physical, functional, emotional, and social well-being. Although these dimensions would be generally accepted by experts, little is known about the relative importance of each of the major dimensions of Quality of Life. Subjectivity refers to the fact that the Quality of Life can only be understood from the patient's perspective. One can only assess a person's Quality of Life appropriately by asking a patient about it directly.

The patient with epilepsy experiences numerous psychosocial consequences as a result of his or her chronic illness. Some of these limitations are specific and unique to epilepsy, including occupational limitations and driving restrictions. Other consequences are more general and pertain to anyone with a stigmatising chronic illness. People with epilepsy are unable to work in certain settings because they may injure themselves or others if they have a seizure. Employment restrictions as well as job discrimination make employability difficult, and these factors contribute to the underemployment of people with epilepsy. Similar restrictions apply to leisure activities and other non-work related activities. Individuals with epilepsy should not swim alone, nor should they operate heavy machinery alone. Alcohol consumption should be restricted, particularly if the patient is on antiepileptic medication. Thought is also needed when considering conception and parenting.

An interesting study was conducted by Britten, Morgan, Fenwick & Britten (1986), which investigated the social, vocational and economic domains of Quality of Life. In this longitudinal cohort study, 5,362 individuals born in the USA during March 1946 were contacted every two years through adolescence and every five years thereafter. Of this sample, 1.1 per cent (n=58) were diagnosed with epilepsy at some time over the 36 year period. Identifying an epilepsy sample within the general population sample allowed the authors to make several important group comparisons. They found that the epilepsy cohort were significantly less likely to be in paid work and were significantly more likely to have been unemployed. Their educational and vocational qualifications and marital status, however, were not significantly different from those of controls

(when controlled for social class). Britten et al. did not report on the severity of the epilepsy, and these findings may demonstrate that the general epilepsy population have less severe psychosocial problems than those with severe epilepsy.

Thompson & Oxley (1988) investigated a sample of 92 patients with uncontrolled epilepsy. In this sample 44 per cent received special schooling and only 48 per cent had achieved some form of educational qualification, with the attainment level skewed towards lower level certificates. Like educational achievement, vocational achievement was also low: 47 per cent had experienced periods of unemployment and 91 per cent of those who were employed had unskilled jobs. Moderate to severe dissatisfaction with their daily occupation was rated by 71 per cent. The highest percentage of dissatisfaction (73 per cent) was in response to questions about social life. Of the sample 68 per cent of the sample admitted having no personal friends and 34 per cent had never formed a true friendship. Of the patients 59 per cent were assessed to be highly dependent on their family for their basic needs. Together these results demonstrate that deficits in education, occupation and social life are very important in populations with severe uncontrolled epilepsy.

### **1.1.6 Epilepsy and other reported Psychological Changes**

Metcalfe (1995) reported personality changes experienced by people suffering from temporal lobe epilepsy. He found that many sufferers lose all interest in sex and this was often accompanied by an increase in social aggressiveness. These people, compared with epileptic patients with foci outside the temporal lobes, displayed one or

more outstanding personality traits. They tended to be intensely emotional, ardently religious, extremely moralistic or lacking in humour. Metcalfe also observed differences between individuals according to which side of the brain the foci occurred. Individuals with foci in the right temporal lobe tended to be hyper-emotional while those with foci in the left tended to show persistent patterns of thought, such as a sense of personal destiny, moral self-scrutinising and a penchant for philosophical explanation. Since these investigations, there have been numerous investigations that cast doubt on the idea of a unique personality style among patients who have partial complex seizures (Mungs, 1982, Stevens, 1988). These later investigations suggest the presence of underlying non-specific psychopathology that is more likely to be environmentally related than organically related.

One further interpretation of these results is that there is no necessary connection between a brain lesion and personality disorder in epileptic subjects though verbal and social learning may be impaired during important times in development (Ounsted & Taylor, 1972) and that this increases the risk of disorders developing.

Blumer (1975) found that approximately 25 per cent of people with epilepsy experience major psychopathology. An increased incidence of psychotic episodes was reported among people with epilepsy (Pincus & Tucker, 1985). It has been suggested, however, that this finding may be due to selection biases in that more severe forms of epilepsy are usually treated at university-based medical centres where the majority of investigations are conducted. Currie, Heathfield, Henson & Scott (1971) found that psychiatric

hospitalisations increased from 5-9 per cent to 25 per cent depending on whether the patient was treated by a private physician or treated at a university-based clinic.

Victoroff (1994) reported in his sample of 60 patients with medically intractable epilepsy that 13 per cent had histories of psychotic disorders and 18 per cent had a diagnosis of personality disorder.

Hermann & Whitman (1984) reviewed several studies that demonstrated a high incidence of hyposexuality in the epilepsy (particularly temporal lobe epilepsy) population. They noted that limbic system dysfunction, general psychiatric status, anti-epileptic drug treatment and social limitations have all been demonstrated to predict hyposexuality in epilepsy patients.

## **1.2 TREATMENT OF EPILEPSY**

The treatment of choice for epilepsy is an anticonvulsant drug such as phenytoin, to dampen aberrant electrical discharges from damaged neurons. There are many antiepileptic medications currently on the market. All work best at a steady therapeutic level, which varies from patient to patient and must be monitored and adjusted if necessary to achieve optimal seizure control and to minimise toxic side effects.

In general, the medical prognosis for people with epilepsy is excellent. The majority of individuals followed from diagnosis will achieve complete control of seizures, and a substantial proportion will be successfully withdrawn from anti-epileptic medication.

This chronic condition on average has a duration of ten to twelve years from diagnosis to seizure control and successful medication withdrawal (Hauser, 1991). However for a number of patients complete control is never achieved, and surgical intervention has to be considered. There is also an important group of patients where epilepsy is secondary to a condition that requires surgery in its own right, e.g. a brain tumour.

Pazzaglia, D'Alessandro, Lozito & Lugaresi (1982) identified 596 patients with partial epilepsy over a four-year period (332 with partial complex seizures), which represented 63 per cent of all cases referred. Prognosis was evaluated for only 191 patients that were followed for two years or more from the time of referral. Of this group, over 70 per cent had a diagnosis of epilepsy for more than five years at the time of referral. Only 38 per cent of the 140 cases with complex partial seizures were controlled, i.e. no seizures or occasional nocturnal seizures only. The prognosis of 95 patients with partial seizures (30 with complex partial) was evaluated in a clinical series from India (Kaliapeumal, Sundararaj & Mani, 1989). Two-year remission occurred in only 27 per cent of those with complex partial epilepsy compared with 45 per cent of those with simple partial seizures. In a clinical series of 189 patients with epilepsy referred to a paediatric centre in Siena, 39 per cent were unresponsive to therapy (Fois, Tomaccini, Balestri, Malandrini, Vascotto & DeFeo, 1988). Four of the five patients with an anterior/midtemporal focus were unresponsive. In a long-term follow-up of a clinical series of 100 children with temporal lobe epilepsy (into adulthood) about one-third were reported to be seizure free and off medication while two-thirds were categorised as being drug resistant (Lindsay, Ounsted & Richards, 1979). In another study, a registry of all

cases of seizures seen at medical facilities in Aarhus, Denmark between 1963 and 1977 was used to study prognosis (Juul-Jensen & Foldspang, 1983). There were 123 cases of complex partial seizures included in the series (18 per cent of the total). At the time of follow-up, 28 per cent were seizure free, whereas 27 per cent had severe epilepsy. Loiseau (1987) reported only a 38 per cent remission rate in patients with simple partial seizures with presumed onset in the temporal lobe. In a small clinical series, 19 of 28 patients with complex partial seizures were controlled but only one out of five with temporal lobe epilepsy were (Fois et al., 1988).

Most of the cases with partial epilepsy that will ultimately enter remission will do so in the first two years following diagnosis. The overriding factor predicting remission is total control in the first year. If remission is not entered within five years of diagnosis, only about 15 per cent of remaining cases will be expected to enter remission at any time in the future (Hauser, 1991).

The side effects of anti-epileptic medications should not be ignored. Other than physical side effects such as nausea, allergic reaction and pins and needles there are also some reported cognitive side effects including hyperactive behaviour, impaired concentration and memory, and slowness in activities. The older drugs such as phenobarbitone and phenytoin have been shown to reduce a patient's concentration. This can adversely affect learning and the ability to do certain tasks.



Other treatments for epilepsy include hypnosis, aromatherapy, biofeedback and acupuncture. The success of these techniques, for which there is little or no scientific evidence of effectiveness, is variable and limited. However, patients may find them of value in giving a sense of control over their bodies and their lives. A new procedure, long-term stimulation of the vagus nerve, is at present being evaluated.

### **1.2.1. Surgical Intervention**

Surgical intervention for epilepsy represents a reasonable alternative to long-term anti-epileptic drug therapy in those destined to achieve incomplete control of seizures. Temporal lobe epilepsy is a common condition that often responds poorly to anti-epileptic medications and temporal lobectomies have become the most common and most effective form of surgical treatment for epilepsy (Engel, 1987). The indication for resections for medically intractable epilepsy include not only the identification of an epileptic focus, but also that the focus be in a dispensable part of the brain which is unlikely to lead to a new functional deficit if removed. In practice this generally means that the focus is not in areas essential for language and that the homologous area of the opposite hemisphere is functionally intact. The use of epilepsy surgery has grown tremendously in the USA from approximately 3,400 procedures recorded before 1985 (Engel & Shewmon, 1993) to approximately 8,300 surgical procedures taking place between 1986-1990. In the United Kingdom it has been estimated that there is an annual need for 600-2000 such operations (Duncan, Shovon & Fish, 1995) although the number of operations performed each year is inadequate to meet demand. Surgical rates are however increasing. For approximately 80-90 per cent of patients with medically

intractable seizure disorders, epilepsy surgery can offer improved seizure control (Walczak, Radtke, McMamang, Lewis, Luther, Thompson, Wilson, Friedman & Hashold, 1990). When seizures do persist after operation, they are frequently more amenable to control with anti-epilepsy medications (Ivnik, Sharbrough & Laws, 1987).

Before deciding to perform epilepsy surgery many potential candidates undergo a intracarotid amytal test (ICAT). The purpose of the ICAT procedure is to evaluate each hemisphere separately for speech dominance and memory capacity before surgery. There are two basic components of the ICAT administration – anaesthetising and psychometric assessment. Each hemisphere is separately anaesthetised and cognitive assessments are conducted to find hemisphere dominance for auditory comprehension, verbal expression and recognition memory. If the foci are found to be in the dominant hemisphere for language the neurosurgeon is likely to be more conservative when removing the foci.

Surgery involves removal of the focus of abnormal functioning in patients with focal seizures. The most commonly employed surgical technique is the temporal lobectomy (Figure 3).

This involves the removal of the part of the temporal lobe that incorporates the epileptogenic focus. Over half of the patients who undergo this surgery become seizure free and a further 30 per cent gain significant improvement in seizure control (Lindsay et

al., 1997). Post operational cognitive deficits are rare when less than 5-6 cm of an epileptic temporal lobe is removed (Rausch & Crandall, 1982).

**Figure 3: Area removed in Temporal Lobe Surgery**



A selective amygdalo-hippocampectomy is conducted when tests confirm a focus is in the medial temporal structures. Less tissue is removed than with the temporal lobectomy, but no evidence exists yet to suggest that this improves seizure control or reduces the mild cognitive changes that are occasionally seen.

In a long-term follow-up of 666 patients with temporal lobe epilepsy referred to a surgical centre 62 patients were selected to undergo surgery, of which 70 per cent were seizure free afterwards (Currie et al., 1971). In 1983 Rasmussen followed-up on 894 patients operated on between 1928 and 1980. In his sample 22 per cent were seizure free since discharge, 15 per cent became seizure free after some early epileptic attacks, 13 per cent had a marked reduction of seizures and 37 per cent had a moderate or less reduction of seizure tendency. In a more recent study conducted by Oliver (1988) 63 per cent of the patients were either seizure free or had a maximum of three seizures per year,

16 per cent had at least a 50 per cent reduction in seizure frequency and 21 per cent of the patients had no worthwhile improvement in seizure control.

### **1.2.1 (a) Cognitive Functioning following Surgical Intervention**

The observations of Penfield, Milner and Scoville, to name a few, provided the first evidence that related the temporal lobe to memory (Penfield & Milner, 1958, Scoville & Milner, 1957). They observed global deficits in recent memory after resections. These deficits prevented the formation of new long-term memories, and extended in a retrograde fashion for several years, but did not affect earlier long-term memories. Immediate memory was also intact in these patients (Drachman & Arbit, 1966). Substantial recent verbal memory deficits have been present in several series of dominant hemisphere temporal lobectomies (Novelly, Augustine, Mattson, Glaser, Williamson, Spencer & Spencer, 1984, Rausch & Crandall, 1982).

Rausch & Crandall (1982) were the first to suggest differential cognitive effects of right versus left temporal lobe excisions. Although complete psychometric data were not obtained on every subject, their findings suggest both impairment and facilitation of specific IQ and memory scores as a function of the side of the operation. Left temporal lobectomies resulted in unchanged verbal IQs, higher performance IQs, diminished immediate verbal memory, and stable immediate visual memory. Right lobectomies produced higher verbal IQs, stable performance IQs, enhanced verbal memory, and stable visual memory. The expression of these results was influenced further by the degree of post-surgical seizure control. Novelly et al. (1984) also suggested that

memory changes as a result of temporal lobectomies may differ as a function of the side of the operation. Dominant temporal lobe excisions produced significantly worsened verbal memory, but improved visual recall. In contrast, non-dominant temporal lobe removal resulted in improved verbal memory and unchanged visual recall.

In the great majority of patients, areas essential for language will be confined to the left cerebral hemisphere. This pattern is present in over 99 per cent of right-handed patients and 60-70 per cent of left-handed patients (Rasmussen & Milner, 1977, Mateer & Dodrill, 1983). There is some evidence that occasionally either hemisphere can process language understanding independently, although language output is confined to the left (Siditis, Volpe, Wilson, Rayport & Gassaniga, 1981). Based on the occurrence of crossed aphasia, Zangwill (1979) estimated that, at most, only 1-2 per cent of the normal right-handed population has right hemisphere language dominance (RHLD). The probability of RHLD in the left-handed population is considerably greater and has been estimated to be as high as 20 per cent (Satz, 1979).

Non-verbal memory deficits have not been consistently identified before or after non-dominant temporal lobectomy (Lee, Loring & Thompson, 1984, Novelly et al., 1984). Research using the Wechsler Memory Scale – Revised (WMS-R; Wechsler, 1987) fails to demonstrate significant differences between left and right temporal lobe seizure groups on the Visual Memory Index prior to or six months after surgery; and right temporal lobectomy patients do not show significant changes in the Visual Memory Index or Visual Reproduction scores on immediate or delayed recall six months after

surgery (Naugle, Chelune, Cheek, Luders & Awad, 1993). Meier & French (1966) examined 56 patients who had temporal lobe seizures, both before and one to three years after operation. No significant differences were seen in patients who had left lobectomy, but the right lobectomy group showed visual/spatial deficits that appeared after operation. These results have not been replicated in subsequent studies.

Milner (1975) summarised her experience with anterior temporal lobectomy for seizures and concluded that few patients experience any lasting impairment of general intelligence, whereas some show mild gains after greater seizure control. She found that specific cognitive deficits, which may be worsened slightly by operation, are associated with focal epileptogenic lesions and that these deficits are usually mild and do not interfere significantly with the patients' daily activities. Milner also found that after temporal lobectomy new learning and memory are affected most adversely, especially verbal information after left temporal operation and visual/spatial information after right temporal excision.

The results of Ivnik et al. (1987) emphasised that learning and memory are the primary areas of cognitive change after temporal lobectomy, with other cognitive abilities less influenced. They found that left temporal lobe removal impaired verbal memory, but permitted improved performance on tests of immediate visual recall. Right temporal lobectomy did not substantially alter recall of visual or verbal information. When Ivnik et al. used a more complex test of verbal learning and memory they found that immediate verbal recall, learning over trials, short-term and delayed free recall,

recognition memory and per cent forgetting were all affected differentially by right and left lobe removals; left lobectomies worsened and right lobectomies enhanced performance. In addition they found that left temporal lobe removal diminished verbal reasoning and problem-solving, practical judgement, verbal abstractions and vocabulary definition. Right-sided lobectomies improved geometric and meaningful visual/spatial functions. Although Ivnik's patients suffered from serious neurologic illness and underwent neurosurgery, their intelligence and most basic cognitive skills were not substantially different from those of average neurologically intact individuals. Other than the few patients with clear memory problems and occasionally subtle language difficulties after operation Ivnik et al. reported that their patients were an unremarkable population of patients from a cognitive perspective.

Some anterograde amnesia is a well recognised but rare complication of temporal lobe excisions in the treatment of epilepsy (Dimsdale, Logue & Piercy, 1964, Loring, Hermann, Meador, Lee, Gallagher, King, Murro, Smith & Wyler, 1994, Penfield & Mathieson, 1974, Rausch & Crandall, 1982). Severe and permanent anterograde amnesia resulting from surgery for epilepsy was originally reported after bilateral medial temporal lobe resection in the well-documented case of HM (Scoville & Milner, 1957). The assumption that when amnesia results from unilateral excision there is a pre-existing abnormality in the non-operated temporal lobe has been confirmed at autopsy in two cases (Penfield & Mathieson, 1974, Warrington & Duchon, 1992). As a result of these case studies severe amnesia is recognised to occur when there has been a previously

unrecognised impairment of unoperated hippocampus. This needs to be recognised as a rare hazard of the surgery.

Milner's publications over several decades have been seminal in establishing the importance of the medial temporal lobe structures as a substrate for memory. These medial temporal lobe structures include not only the hippocampus and amygdala, but also the cortex of the parahippocampal gyrus with the entorhinal cortex and the parahrinal cortex. All have been implicated as possibly playing a crucial part in memory (Eacott, Gaffan & Murray, 1994, Meunier, Bachevaliur, Mishkin & Murray, 1993, Miller, Lai & Munoz, 1995, Milner, 1972).

Given the frequency of temporal lobe surgery and the body of evidence showing that a major function of the temporal lobe is the mediation of memory processes, memory evaluation becomes a prime goal in pre operative neuropsychological assessments.

Although measures of general intelligence are not thought to be the most sensitive indices of temporal lobe functioning (Milner, 1975) they have often been routinely administered before and after temporal lobectomies because they reflect an individual's general cognitive capacity. Assessment of intelligence within the first two months immediately following a temporal lobectomy demonstrates an initial decrement from baseline (Milner, 1975) with possibly dominant temporal lobectomy resulting in somewhat greater initial decrements than non-dominant temporal lobectomies. These initial losses in Full Scale IQ are reported to resolve over time (Milner, 1975, Augustine

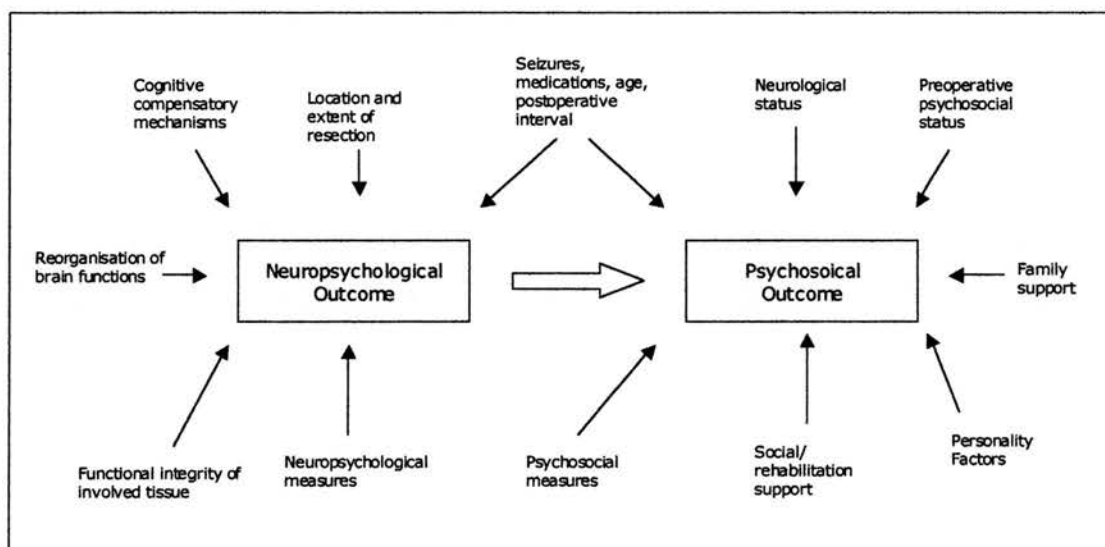


& Novelly, 1981). Performance IQ scores are almost invariably improved compared to baseline, regardless of side of surgery (Blakemore & Falconer, 1967, Rausch & Crandall, 1982). The picture is somewhat more variable for changes in Verbal IQ. Patients who had right temporal lobectomies showed larger positive gains compared to baseline than left temporal lobectomies (Rausch & Crandall, 1982, Blakemore et al., 1967). Dodrill & Wilensky (1990) however found similar incremental increases for a non-surgical group of 105 epileptics after a five-year test-retest interval. Seidenberg, O'Leary, Giordani, Berent & Boll (1981) also found increases in IQ performance at one to two years follow-up among non-surgical epileptics whose seizure frequency had improved during the follow-up interval. Thus, patients undergoing surgical intervention for their epilepsy may be expected, as a group, to show some modest increase in the IQ scores following temporal lobectomy, especially if they undergo non-dominant resection and become seizure free. However, these increments in mean level of performance are similar, and sometimes smaller, than those seen among the non-surgical seizure patients re-tested over comparable or longer follow-up intervals. The absence of an improvement in IQ performance among temporal lobectomy patients at follow up may reflect an actual decrement in cognitive capacity, since a positive practice effect or carry over on IQ test performance appears to be the general norm.

Rausch (1991) summarised the various factors that influence the neuropsychological and psychosocial outcome of epilepsy surgery (Figure 4). As can be seen there are a large number of neuropsychological and psychosocial outcomes that need to be considered when assessing overall outcome. In order to effectively determine the overall outcome

of surgery, the complexity of these factors and the multivariate interactions of the contributing factors have to be considered. For outcome to be successful neuropsychological and psychosocial outcomes need to be considered and evaluated.

**Figure 4: Factors affecting the Neuropsychological and Psychosocial outcome of Epilepsy Surgery (Rausch 1991)**



### **1.2.1 (b) Changes in Levels of Depression following Surgical Intervention**

Emotional disturbances are more frequently found in epileptic patients who have had temporal lobe surgery (Milner, 1975, Saykin, Gur, Sussman, O'Connor & Gur, 1989, Dodrill, 1983). Depressive illnesses are said to occur commonly in patients after lobectomy, although figures are difficult to obtain. However, most are transient episodes that do not usually last for more than the first three months, although some may go on for longer. Fenwick (1987) found that the mean proportion of patients operated

on for temporal lobectomy in the USA that subsequently developed a severe depressive illness was 4.4 per cent, with a range of 0-25 per cent. The mean number of patients who subsequently committed suicide was 0.15 per cent, which is what might be expected in subgroups of the general population. Many of the centres suggested that when depressive illnesses occur after surgery they usually do so in those who have had non-dominant resections. When Burton (1988) reanalysed the data from Falconer's 1950-1975 temporal lobectomy series of 248 patients, he found that before operation only one person was rated as suffering from a depressive illness however post operatively 24 people (10 per cent) became depressed. Of the 24 patients six committed suicide. Burton found no clear relationship between left or right-sided lobectomies and depression or suicide but there was a relationship between depression, poor social outcome and failure to control seizures. However Mace & Trimble (1991) found that patients with right sided temporal lobectomies may be prone to more severe psychiatric disturbances.

Ring, Moriarty & Trimble (1998) found that pre operatively 21 per cent of their sample of 60 patients who had undergone surgery for epilepsy had a major depressive disorder. At six weeks after surgery 24 per cent were classified as having depression and by three months after surgery this figure had risen to 38 per cent. In most patients the depression was of only mild to moderate severity, but it nevertheless represented an important clinical issue. They found no significant difference between those who had right or left sided hemisphere surgery for these depressive states. They also observed that at the six week assessment almost half of all patients were noted to have increased emotional

lability. By the time three months had elapsed after surgery this emotional lability had become much less common, by then occurring in only 10 per cent of patients. King and his colleagues suggested several possible mechanisms which may underlie this early post-surgical emotional lability, including an emotional response to the trauma of surgery and relief at surviving, together with concerns regarding the longer term outcome, a biologically emotional response specifically to surgical disruption of a temporal lobe (given the well established role of medial temporal structures in the control and manifestation of emotion), or a biologically determined emotional response to some of the more general physiological effects of a neurosurgical procedure.

The role of the amygdala, which is situated close to the temporal lobe, has been found to be critical to emotional responses in animal learning (Mishkin & Appleton, 1981). In discussing how the brain forms memories for the emotional significance of events LeDoux (1992) describes the amygdala as an “emotional computer” in the initial establishment of affective memories. LeDoux (1992) suggested that there may be a link between surgical intervention, the functioning of the amygdala and emotional disturbance.

Rose, Derry & McLachlan (1995) failed to demonstrate significant differences pre and post operatively for those patients who were not seizure free after surgery. However they found that those patients who were seizure free had significantly lower scores in post operative depression and anxiety.

Barraclough (1980) estimated that patients with epilepsy have a rate of suicide five times that of the general population while Fenwick (1991) found that amongst those with temporal lobectomy there was a rate 25 times that of the general population. In Taylor's post-temporal lobectomy study (Taylor & Marsh, 1977) there were nine suicides, a rate 45 times higher than would have been expected. A similar figure was found by Jensen & Larson (1979).

### **1.2.1 (c) Changes in Levels of Anxiety following Surgical Intervention**

For patients who have had to live with uncontrolled seizures for many years a cure of their epilepsy following surgery may come as something of a shock requiring a major adjustment in their lives. Ring et al. (1998) found that pre operatively 18 per cent of their patients who were to undergo epilepsy surgery had anxiety. This figure increased to 42 per cent six weeks after surgery but dropped to 10 per cent three months post-surgery. They found that patients with left hemispheric focus were more likely to experience persisting anxiety. Short-term post operative anxiety was also reported after temporal lobectomy by Bladin (1992), in 52 per cent of his sample, but responded well to treatment.

Wheelock (1998) found, in her sample of 32 patients who had undergone surgery and 17 significant others, that prior to surgery 16 per cent of patients and 12 per cent of significant others had anxiety regarding the ongoing threat of seizures following surgery. After surgery 52 per cent of patients and 9 per cent of significant others reported reduced anxiety regarding threat of seizures.

Bladin (1992) found that 54 per cent of his patients had significant post operative anxiety following temporal lobe surgery for epilepsy, with a significant number needing brief hospital admission for psychotherapeutic intervention. He found that post operative anxiety was significantly more common in patients undergoing left temporal lobectomies as compared with the right temporal lobectomies.

#### **1.2.1 (d) Changes in Locus of Control following Surgical Intervention**

There is little research on the changes in Locus of Control following temporal lobe surgery for epilepsy. Hermann & Wyler (1989) found no significant differences between pre and six months post operative scores for Locus of Control in their sample of 37 patients. They suggest that this may be due to the nature of Locus of Control, in that it is hypothesised that Locus of Control is acquired during a person's lifetime therefore changes may not have occurred by six months post surgery.

#### **1.2.1 (e) Changes in Quality of Life following Surgical Intervention**

One of the aims of surgical intervention should be to achieve an improvement in the patient's Quality of Life. According to investigations by Taylor & Falconer (1968), Crandall (1975) and Crandall, Rausch & Engel (1987) the global psychosocial situation deteriorates post operatively for 10-17 per cent of those who undergo surgery, even if the operation results in freedom from seizures or an improvement in the seizure situation. They also report that for most patients there is no change whatsoever in global psychosocial function. Crandall et al. (1987) however reported that a decrease in psychosocial functioning is not likely with surgery. They found that even in the

presence of a poor indicator the probability is still below chance that a patient would worsen after surgery. They also found that good family support in conjunction with stable personality characteristics increased the likelihood of a significant improvement in Quality of Life by 83 per cent. Taylor & Falconer (1968) found no change in sexual adjustment following surgery in their sample of 100 patients, but some improvement in living situations and a slight improvement in use of leisure time. They also found that relationships with family and non-family improved but vocational capacity improved in only four of 21 persons unemployed before surgery. Rausch & Crandall (1982) evaluated psychosocial outcome and Quality of Life issues including degree of dependency, work and school performance, and family and non-family relationships. Patients who underwent temporal lobectomy and obtained relief from their seizures showed improvement in degree of dependency, work and school performance, and non-family relationships at one year follow-up as compared to patients who did not elect to have or were not candidates for surgery and patients in whom the surgery was unsuccessful. Guldvog (1993) reported an improved Quality of Life and increased patient satisfaction in a group of patients who underwent temporal lobe surgery for epilepsy.

Kellett, Smith, Baker & Chedwick (1997) found that seizure free patients following surgery scored significantly better on a Quality of Life measure than either patients deemed unsuitable for surgery or those having more than 10 seizures per year after surgery. There was no difference between the groups unsuitable for surgery or having more than 10 seizures per year post operatively. They found that employment rates were

significantly different between the three groups, 80 per cent of seizure free and 53 per cent of patients having less than 10 seizures per year in gainful employment post operatively, compared with 28 per cent and 27 per cent of patients having greater than 10 seizures per year or those who were unsuitable for surgery. They found that post operative Quality of Life was clearly related to seizure outcome.

Rose, Derry, Wiebe & McLauchlan (1996) found that following surgery for temporal lobe epilepsy, patients exhibited significant improvement in five Quality of Life domains: social function, health perceptions, energy fatigue, cognitive function and role limitations due to physical problems. Although significant improvements were observed, this was not the case for all patients. Specifically, patients with low or medium pre operative Quality of Life scores were found to have the greatest degree of improvement post operatively. Patients with high pre operative scores did not exhibit these same improvements, although they continued to report high scores.

Green & Scheetz (1964) found that 36 out of 60 patients who had undergone resection surgery for epilepsy had become more independent and self-supporting while seven had become partially independent. None were even partially independent before surgery. Savard & Walker (1965) found 74 per cent of their patients had improvements in self-image, functioning at home, sexual interest, vocational training, interpersonal relationships and self-care. These investigators also reported that this improvement was related to relief from seizures. Vickrey, Hays, Graber & Rausch (1992) found that those classified as seizure free following surgery had higher increases in overall Quality of



Life compared to those who continued to have seizures. However, both had improved Quality of Life.

Wheelock (1998) found that before surgery patients showed considerable problems with psychosocial adjustment. After surgery patients in the seizure free group showed improvements at two months and one year after temporal lobectomy whereas patients with continued seizures showed improvement at the two month follow up but then declined to baseline or worse at the time on the one year follow-up. They also found that prior to surgery, subjects (32 patients and 17 significant others) anticipated that patients would experience a number of changes including more friendships (49 per cent), greater independence (47 per cent), and the ability to engage in activities such as driving (71 per cent) and working (65 per cent). Most subjects (61 per cent) did not anticipate that the patient would experience any difficulties associated with seizure elimination or reduction. Following surgery they found that subjects in the seizure free group were more likely than subjects in the continued seizures group to report relationship changes and positive life changes.

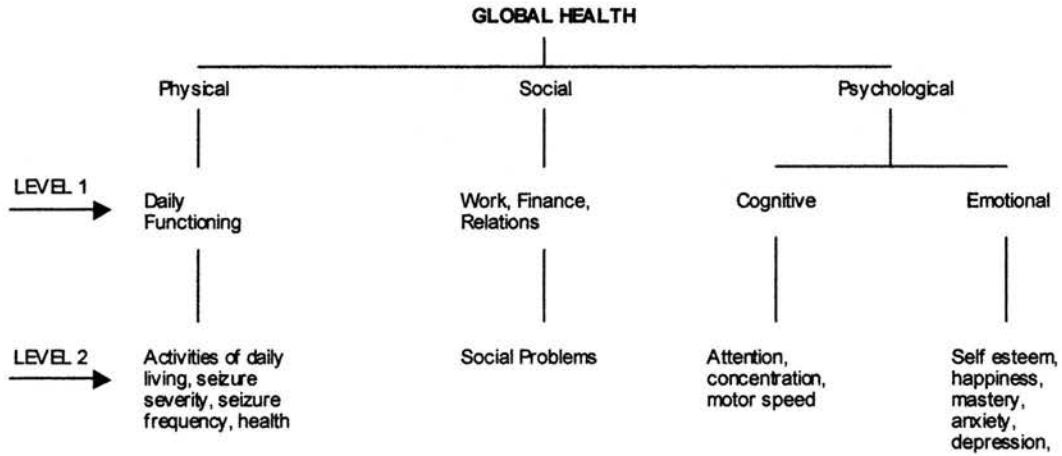
Langfitt, Wood, Brand & Giuseppe (1999) studied family interactions associated with psychosocial outcome of epilepsy surgery and found that predominant affect (the balance of positive and negative affect expressed in the family including warm tone of voice, laughter, eye contact, respectful disagreement) was predictive of patients' social adjustment independent of post operative seizure status and other disease characteristics. They concluded that family interventions to improve post-surgical social adjustment

should be adopted and should include the development of family interactions that support a predominantly positive affective climate and patient autonomy.

Williams, Roth, Kuzniecky, Faught & Morawetz (1994) investigated post operative psychosocial status of 77 temporal lobe epilepsy surgery patients conducted at an average of three and a half years after surgery. They reported that at the time of post operative interview 62 per cent of patients were either employed or enrolled in classes as compared with only 42 per cent of the same patient sample pre operatively. In addition, 65 per cent of the patient sample was driving post operatively as compared with only 25 per cent pre operatively. To investigate further the nature of post-surgical changes in employment Williams et al. classified patients into “improved”, “stable” and “unimproved” groups based on whether patients received promotion or obtained a better job. According to this breakdown, 47 per cent improved, 26 per cent were stable and 27 per cent were unimproved. These results demonstrate favourable vocational outcomes in patients undergoing temporal lobectomies. Bladin (1992) reported that 12 per cent of successful patients indicated that they harboured grief and bitterness that the operation had not been attempted sooner.

Following a literature review, a Quality of Life model was derived to measure the clinical, psychological and social problems in patients with epilepsy (Smith, 1991). The model encompasses a series of social and psychological constructs for which validated scales have already been developed (Figure 5). Level 1 contains broad areas relevant to health and Quality of Life while Level 2 includes specific measurable elements.

**Figure 5: Global health for people with epilepsy (adapted from Smith, 1991)**



The aim of the model was to construct an instrument, containing a series of selected scales, capable of detecting the common consequences of intractable seizures and of measuring change attributable to treatment. Global Health was divided into three domains: Physical, Social and Psychological. Each of these domains was developed to describe functions that could be evaluated and, at Level 2, more detailed information about what specifically could be measured. For example to evaluate Physical Health activities of daily living, seizure severity and frequency and health should be measured.

McLachlan, Rose, Derry, Bonnar, Blume & Girvin (1997) provided evidence that temporal lobectomy is a more effective treatment to promote improvement in Quality of Life than continued medical management among patients with uncontrolled temporal lobe epilepsy. Their results suggested that although seizure control was immediate

following surgery for 90 per cent of his sample improvements in Quality of Life took time to evolve and to become fully evident in patient reports. The positive benefits of improved Quality of Life occurred in patients with either a complete cessation of seizures or at least in 90 per cent reduction. Although at twelve months there was a difference in the overall Quality of Life for patients, at 24 months the score had changed significantly. They suggested that follow-up assessments at less than two years may not demonstrate improvements in Quality of Life after surgery. They also found that the patients who did not experience a reduction in seizure frequency following either surgical or medical treatment were susceptible to some deterioration in Quality of Life.

#### **1.2.1 (f) Other Psychological Changes following Surgical Intervention**

Falconer's (1973) published series of over 250 patients who had undergone surgery for epilepsy and had significant behaviour problems such as aggression, indicates that improvement was demonstrated in both their aggressive behaviours as well as epilepsy. In patients with "schizophrenia-like states" most demonstrated some improvement, with either remission or reduced severity of their psychotic symptoms, or a change from a thought disorder to a mood disorder. Only two of 12 patients showed little or no change. These findings are supported by Taylor (1972).

The incidence of post operative psychosis has been reported at approximately 6 per cent (Flanigin, King & Gallagher, 1985, Jenson & Larsen, 1979, Polkey, 1988, Taylor, 1972).

The diagnostic criteria employed in these cases are not known however and whether

these psychoses are of a temporary nature reflecting short term traumatic life events or a persistent disorder is unclear.

### **1.3 PRESENT STUDY – AIMS AND HYPOTHESIS**

The aim of this study is to investigate the psychological and cognitive consequences of surgery for temporal lobe epilepsy. There are inconsistencies in reported levels of Depression and Anxiety and Quality of Life following surgery, while little research has been conducted on changes in Locus of Control. Whilst cognitive functioning following surgery has been extensively studied, few of these studies have been conducted recently which is particularly important considering changes in both surgical techniques and criteria selection for surgery.

#### **1.3.1 Specific Hypotheses**

It is hypothesised that:

#### **SURGICAL GROUP**

##### **Verbal IQ**

- (i) Those who have undergone temporal lobe surgery for epilepsy will have a significant reduction in Verbal IQ.
- (ii) Those who have undergone temporal lobe surgery for epilepsy on their dominant hemisphere will have a significant reduction in Verbal IQ

compared to those who have undergone temporal lobe surgery on their non-dominant hemisphere.

### **Performance IQ**

- (iii) Those who have undergone temporal lobe surgery for epilepsy will show no change in Performance IQ.

### **Verbal Memory**

- (iv) Those who have undergone temporal lobe surgery for epilepsy will have a significant reduction in verbal memory.
- (v) Those who have undergone temporal lobe surgery for epilepsy on their dominant hemisphere will have a significant reduction in verbal memory compared to those who have undergone temporal lobe surgery on their non-dominant hemisphere.

### **Visual Memory**

- (vi) Those who have undergone temporal lobe surgery for epilepsy will show no change in visual memory.

### **Attention and Concentration**

- (vii) Those who have undergone temporal lobe surgery for epilepsy will show no change in attention and concentration.

### **Delayed Memory**

- (viii) Those who have undergone temporal lobe surgery for epilepsy will have a significant reduction in delayed memory.
- (ix) Those who have undergone temporal lobe surgery for epilepsy on their dominant hemisphere will have a significant reduction in delayed memory compared to those who have undergone temporal lobe surgery on their non-dominant hemisphere.

### **Anxiety**

- (x) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly higher level of anxiety than those who have undergone surgery over five years ago.
- (xi) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly lower level of anxiety than those who have had a poor/moderate outcome.

### **Depression**

- (xii) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly higher level of depression than those who have undergone surgery over five years ago.
- (xiii) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly lower level of depression than those who have had a poor/moderate outcome.

### **Locus of Control**

- (xiv) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly higher Locus of Control (a more external Locus of Control) than those who have undergone surgery over five years ago.
- (xv) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly lower Locus of Control (a more internal Locus of Control) than those who have had a poor/moderate outcome.

### **Quality of Life**

- (xvi) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly lower Quality of Life (on all variables) than those who have undergone surgery over five years ago.
- (xvii) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly higher Quality of Life (on all variable) than those who have had a poor/moderate outcome.

### **SURGICAL V NON-SURGICAL GROUP**

#### **Anxiety**

- (xviii) Levels of anxiety will be significantly lower in patients who have undergone temporal lobe surgery for epilepsy compared to a comparative group who have not undergone surgery.



### **Depression**

- (xix) Levels of depression will be significantly lower in patients who have undergone temporal lobe surgery for epilepsy compared to a comparative group who have not undergone surgery.

### **Locus of Control**

- (xx) Those who have undergone temporal lobe surgery for epilepsy will have a significantly lower Locus of Control score (a more internal Locus of Control) when compared to a comparative group who have not undergone surgery.

### **Quality of Life**

- (xxi) Those who have undergone temporal lobe surgery for epilepsy will have a significantly higher Quality of Life (on all variables) when compared to a comparative group who have not undergone surgery.

## **CHAPTER 2 - METHOD**

## **2. METHOD**

### **2.1 Design**

A longitudinal, mixed variable, within and between subject design was used. Each participant was seen once and placed in one of two groups: those who had undergone surgical intervention for temporal lobe surgery and those who had uncontrolled temporal lobe epilepsy some of whom had been considered for surgery but did not fully meet the surgical criteria. For the surgical group, pre and post surgery cognitive assessment scores were taken from neuropsychology patient files.

The Tayside Committee on Medical Research Ethics granted approval for this study to be carried out.

### **2.2 Participants**

The participants were twenty-seven individuals who had either undergone surgery for temporal lobe epilepsy (n=20) or had uncontrolled temporal lobe epilepsy but had not undergone surgery (n=7). Reasons for not undergoing surgery included not being able to identify the exact foci of the temporal lobe epilepsy or another medical reason that would preclude the patient undergoing surgery (for example, heart problem). The inclusion criteria were as follows:

Surgical Group:

- had undergone surgery for uncontrolled temporal lobe epilepsy
- aged between 16 and 65 at the time of surgery.

Non-Surgical Group:

- had uncontrolled temporal lobe epilepsy
- aged between 16 and 65.

The exclusion criteria were as follows:

- those with a Learning Disability
- those with a current episode of psychosis
- longstanding alcohol/substance misuse
- previous neurosurgery.

## **2.3 Measures**

### **2.3.1 Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983)**

The Hospital Anxiety and Depression Scale (HADS) (Appendix 1) was developed as a screening tool for mood disorder in non-psychiatric patients attending hospital outpatient clinics and is recognised as a useful clinical tool. Zigmond & Snaith (1983) report a high level of internal consistency and reasonable validity when compared with psychiatric ratings of 100 medical outpatients ( $r=0.54$  for anxiety and  $r=0.79$  for depression). It measures patients' perception of mood during the previous week indicating that this is a state sensitive to change attributable to treatment. There are similarities between the general medical population that the HADS has been standardised with, for example stress and frequent visits to hospital, and the participants in this study. The HADS contains seven items in each scale to provide a brief state measure of anxiety and depression. A four point Likert scoring system

produces score ranges for non-case/“normal” (<8), borderline cases/“mild” (8-10) and cases (> 10) which can be further subdivided into 11-14 for “moderate” and 15-21 for “severe” for both anxiety and depression. The scale however considers only negative aspects of mood and the score of less than 8 cannot be equated with psychological well-being. Both the surgical and non-surgical groups were asked to complete the HADS.

### **2.3.2 Internal-External Scale (Rotter, 1966)**

Rotter’s (1966) I-E Scale (UK Version) (Appendix 2) is made up of twenty-five statements and the respondent is asked to choose which one is more strongly believed. Twenty of the items are “real” items and five are “filler” items. No manual has been written for the I-E Scale, no specific population was targeted and items are applicable to many life settings. Having gone through a sequence of constructional steps the I-E Scale is internally consistent and reliable. Scoring the I-E Scale is relatively straightforward. Responses are scored 1 or 0 based on a key for scoring and the higher the score the more external the Locus of Control. Both groups were asked to complete the I-E Scale.

### **2.3.3 WHOQOL-BREF (WHOQOL Group, 1996)**

This twenty-six item measure is a brief measure of Quality of Life derived from the WHOQOL-100, a 100 item questionnaire developed by the WHOQOL Group within 15 international field centres (Appendix 3). The WHOQOL-100 consists of four items for each of 24 facets of Quality of Life and a further four items concerned with overall Quality of Life and health. The WHOQOL has been shown to have high

validity and reliability (WHOQOL Group, 1998). Factor analysis has shown that four domains account for the majority of the variance in this instrument and as such the WHOQOL-BREF is based on these four domains with an additional two questions looking at overall Quality of Life and health. These four domains are: domain 1 – physical health, domain 2 – psychological, domain 3 – social relationships and domain 4 – environment. Each item is scored on a five point Likert Scale and the higher the domain score the greater the Quality of Life. As a self-report measure the WHOQOL-BREF is a measure of perceived Quality of Life and as such is not a symptom checklist or a health profile but a subjective measure of the effects of diseases, illnesses and interventions on Quality of Life. A generic Quality of Life measure was used to cover the complete spectrum of subjective function, distress and well-being as opposed to a disease-specific instrument, which have been proved to be useful in clinical trials (Guyatt et al., 1989) in which change is the primary focus. Both groups were asked to complete the WHOQOL-BREF questionnaire.

#### **2.3.4 Wechsler Adult Intelligence Scale – Revised (WAIS-R) (Wechsler, 1987)**

The WAIS-R was designed to test cognitive functioning and composes of eleven tests, six verbal and five non-verbal. The verbal and non-verbal groups may be administered separately or together to yield, respectively, a Verbal, Performance, and Full Scale IQ.

The reliability coefficients for the WAIS-R are high: Verbal IQ  $r=0.97$ , Performance IQ  $r=0.93$  and Full Scale IQ  $r=0.97$ . A body of evidence, both rational and

empirical, attests to the validity of the WAIS-R scale as a measure of global intelligence. The WAIS-R was used at the first assessment (pre-surgical) and this has been continued for the sake of consistency, despite the introduction on the WAIS-III. The WAIS-R has been used extensively in evaluations of people with epilepsy (Jones-Gotman et al., 1993). Only the surgical group was asked to complete the WAIS-R. Given the overlap on some subtests with the Wechsler Memory Scale, the Information, Digit Span and Picture Completion subtests were not administered.

### **2.3.5 Wechsler Memory Scale – Revised (WMS-R) (Wechsler, 1987)**

The WMS-R is an individually administered clinical instrument for appraising major dimensions of memory functions in adolescents and adults. The scale is intended as a diagnostic and screening device for use as part of a general neuropsychological examination. The functions assessed include memory for verbal and figural stimuli, meaningful and abstract material, and delayed as well as immediate recall. The scale comprises a series of brief subtests designed to test Verbal Memory, Visual Memory, Attention/Concentration and Delayed Recall.

The WMS-R shows good reliability: Verbal Memory  $r=0.77$ , Visual Memory  $r=0.70$ , Attention/concentration  $r=0.90$  and Delayed Memory  $r=0.77$ . As with the WAIS-R, there is a large body of evidence supporting the validity of the WMS-R. The WMS-R was used at the first assessment (pre-surgical) and this has been continued for the sake of consistency, despite the introduction on the WMS-III. Only the surgical group was asked to complete the full WMS-R.

## **2.4 Procedure**

Patients who underwent temporal lobe surgery for epilepsy at Ninewells Hospital, Dundee (or its predecessor Dundee Royal Infirmary) or were currently patients of the Consultant Neurologist at Ninewells Hospital for uncontrolled epilepsy were approached to take part in this study. Information regarding the details of surgery, including date of surgery was taken from medical files. After the patients were identified they were approached by letter asking them to participate in the study. The surgical group were sent a letter that included a tear off slip to be completed giving permission for the researcher to telephone to arrange a suitable time to visit (Appendix 4) to conduct both the WAIS-R and WMS-R and the three questionnaires. The non-surgical group was sent a covering letter (Appendix 5) with the consent form, a Hospital Anxiety and Depression Scale, Locus of Control Scale and WHOQOL-BREF questionnaire. Each letter also included one of two information sheets (surgical or non-surgical) giving details of the study (Appendix 6 & 7). A stamped addressed envelope was enclosed for the patients' convenience. Once permission had been forthcoming from the surgical group the researcher telephoned to arrange a suitable time to visit, obtain consent and administer the tests. Participants were given the option of a home visit or visiting Ninewells hospital. Eighteen participants were seen at home whilst two requested to be seen at Ninewells Hospital. The appointments lasted from one hour thirty minutes to two hours forty-five minutes and, prior to the assessment beginning, the study was again explained and any questions answered. The confidential nature of all the information gathered was reiterated. Those who agreed to participate in the non-surgical group returned the questionnaires by post. All participants were encouraged in the letters to



telephone if they had any questions. A summary of the information and questionnaires used is shown in Table 1.

**Table 1: Information and Data collected for each group**

<b>Group/Time of data collection</b>	<b>Pre-surgery</b>	<b>Post-surgery</b>	<b>Follow-up</b>
Surgical Group	WAIS-R WMS-R (scores taken from medical notes)	WAIS-R WMS-R (scores taken from medical notes)	WAIS-R WMS-R WHOQOL HADS I-E Scale
Non-Surgical Group	N/A	N/A	WHOQOL HADS I-E Scale

## **2.5 Data Analysis**

All statistical analyses were run using SPSS for Windows, Version 9. Group means and standard deviations were calculated for both groups for each variable. Independent samples t-tests, ANOVA's and MANOVA's were run for comparisons as the assumptions for parametric assessment were met.

## **CHAPTER 3 - RESULTS**

### **3. RESULTS**

#### **3.1 Participants**

##### **3.1.1 Surgical Group Characteristics**

Twenty patients (twelve females and eight males) who had undergone temporal lobe surgery for epilepsy took part in this study and completed a WAIS-R, a WMS-R and the three questionnaires. Table 2 shows the numbers for each age range.

**TABLE 2: Age Range of Surgical Group**

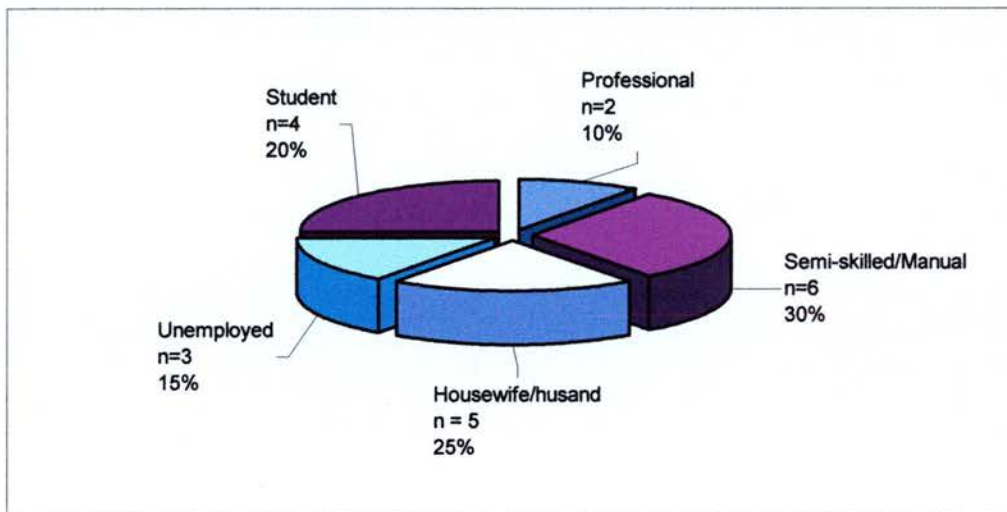
<b>Age Range in Years</b>	<b>n (%)</b>
16 - 25	2 (10%)
26 - 35	9 (45%)
36 - 45	5 (25%)
46 +	4 (20%)

The majority of those in the surgical group were between 26 – 45 years of age (70%) at the time they completed the questionnaires. The surgical group was further sub-divided into those who had undergone surgery over five years ago (n=15, 75%) and those who had undergone surgery five or less years ago (n=5, 25%).

Of the twenty patients who had undergone surgery twelve (60%) had surgery on their dominant hemisphere for language whilst seven (35%) had surgery on their non-dominant hemisphere. One person (5%) had bilateral hemispheric dominance.

A breakdown of the group by socio-economic status is shown in Graph 2. The socio-economic status was divided according to five categories: professional, semi-skilled/manual, student, housewife/husband and unemployed. The majority of the surgical group were in employment or full-time education (60%).

**Graph 2: Socio-economic Status of Surgical Group**



Surgical outcome was also determined by asking patients if they either no longer had seizures with or without very occasional auras (good outcome), had two seizures or less a year with or without occasional auras (moderate outcome) or had more than two

seizures a year, the same amount or more seizures than before surgery (poor outcome).

Table 3 shows the self-reported surgical outcome.

**Table 3: Self-reported Surgical Outcome**

<b>Self-reported Surgical Outcome</b>	<b>n (%)</b>
Poor	1 (5%)
Moderate	5 (25%)
Good	14 (70%)

Seventy per cent of the twenty patients who had undergone temporal lobe surgery for epilepsy no longer had seizures or had very occasional auras. Only one patient (5%) reported a poor outcome.

### **3.1.2 Non-Surgical Group Characteristics**

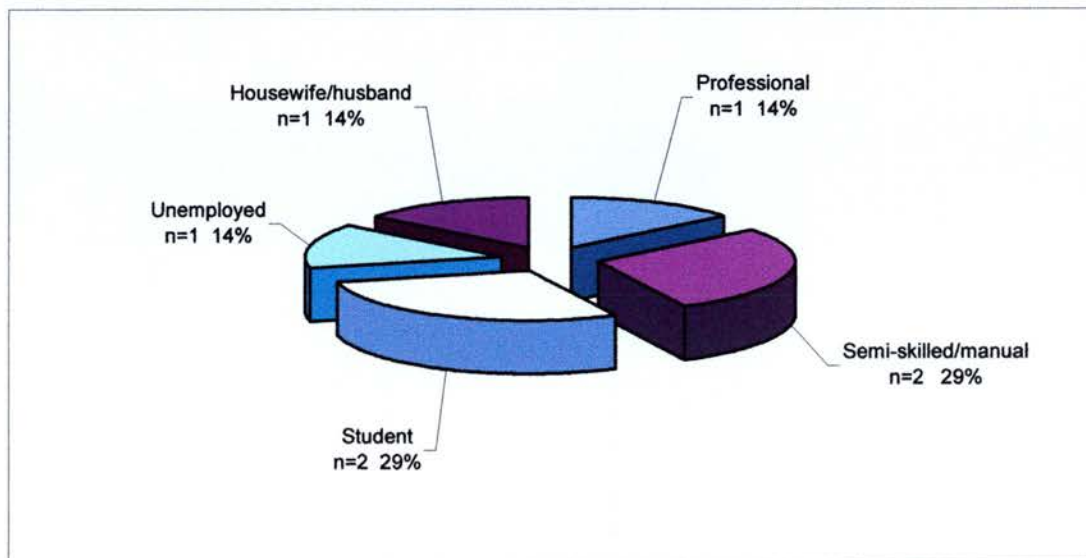
Seven patients (five females and two males) who were on the waiting list for surgical intervention or who did not meet the criteria for surgery completed all three questionnaires. Table 4 shows the numbers for each age range. As with the surgical patients, the majority of the non-surgical patients were between the ages of 26 and 45 (71%).

**TABLE 4: Age Range of Non-Surgical Group**

Age Range in Years	n (%)
16 - 25	2 (29%)
26 - 35	3 (42%)
36 - 45	2 (29%)
46 +	0 (0%)

A breakdown of the group by socio-economic status is shown in Graph 3. The socio-economic status was divided, as before, according to five categories: professional, semi-skilled/manual, student, housewife/husband and unemployed.

**Graph 3: Socio-economic Status of Non-Surgical Group**



The majority of the non-surgical group were in employment or full-time education (72%).

### **3.2 Results – Surgical Group**

#### **3.2.1 WAIS-R Verbal IQ**

Each patient in the surgical group (n=20) completed the Verbal IQ subtests of the WAIS-R pre operatively and at follow-up. Unfortunately only eighteen completed the assessment immediately following their surgery. A summary of the descriptive statistics is displayed in Table 5.

**Table 5: Descriptive Statistics of WAIS-R Verbal IQ**

<b>WAIS-R</b>	<b>n</b>	<b>Mean (S.D.)</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Pre operative</b>	20	90.1 (11.9)	69	118
<b>Post operative</b>	18	91.3 (13.0)	72	110
<b>Follow-up</b>	20	93.3 (10.8)	76	114

Although there is an increase in mean Verbal IQ scores pre operatively to post operatively and post operatively to follow-up an ANOVA was conducted to determine whether patients' Verbal IQ had significantly changed since surgery (Table 6).

**Table 6: ANOVA comparing pre, post and follow-up scores on WAIS-R Verbal IQ**

	df	Error df	F	Sig.
WAIS-R Verbal IQ	1	17	3.313	0.086 (NS)

The results on Table 6 show that there is no significant difference in mean Verbal IQ scores between pre operative, post operative and follow-up.

A MANOVA was conducted to investigate any significant difference in Verbal IQ (pre, post and follow-up) between those who had surgery on their dominant hemisphere (n=11) and those who had surgery on their non-dominant hemisphere (n=6) (Table 7). As only one patient had bilateral dominance they were excluded from the analysis.

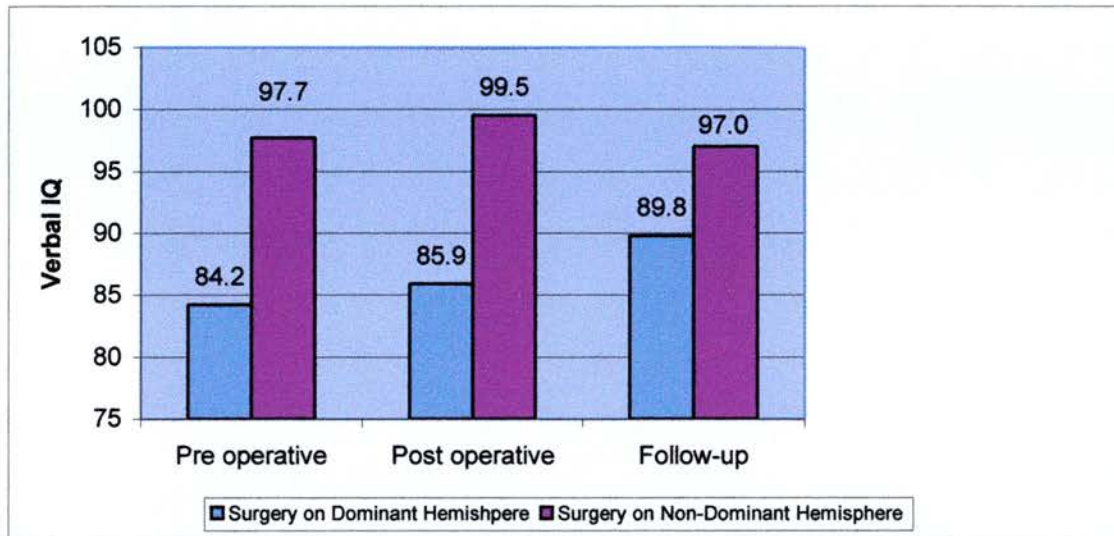
**Table 7: MANOVA comparing Verbal IQ between those with Dominant and Non-Dominant Hemisphere Surgery (Pre, Post and Follow-up)**

Verbal IQ	df	F	Sig.
Dominant v Non-Dominant	1	2.111	0.167 (NS)

There was no significant difference in Verbal IQ between those who had surgery on their dominant or non-dominant hemisphere. As the F value (F=2.111) was approaching significance (P=0.167) the means for each group were plotted (Graph 4).



**Graph 4: Means of Verbal IQ for those with Dominant and Non-Dominant Hemisphere Surgery for Pre, Post and Follow-up assessments.**



Independent samples t-tests were conducted to investigate any significant differences between those who had surgery on the dominant or non-dominant hemisphere for pre operative, post operative and follow-up Verbal IQ means (Table 8).

**Table 8: Independent Samples T-Tests for pre, post and follow-up WAIS-R Verbal IQ between Dominant and Non-Dominant Hemisphere Surgery**

	Dominant Surgery Group - Mean	n	Non-Dominant Surgery Group - Mean	n	t-value	2-tailed sign.
Pre operative	83.92	12	100.57	7	3.752	0.002**
Post operative	85.91	11	99.50	6	2.295	0.037*
Follow-up	89.42	12	99.00	7	1.981	0.064 (NS)

\*\* Significant at the 0.01 level.

\* Significant at the 0.05 level.

Significant differences were found between those who had surgery on their dominant or non-dominant hemispheres for pre operative (P=0.002) and post operative (0.037) Verbal IQ but not for follow-up Verbal IQ (0.064).

### **3.2.2 WAIS-R Performance IQ**

Each patient in the surgical group (n=20) completed the Performance IQ subtests of the WAIS-R pre operatively and at follow-up. Unfortunately only eighteen completed the assessment immediately following their surgery. A summary of the descriptive statistics is displayed in Table 9.

**Table 9: Descriptive Statistics of WAIS-R Performance IQ**

<b>WAIS-R</b>	<b>n</b>	<b>Mean (S.D.)</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Pre operative</b>	20	101.5 (13.0)	76	128
<b>Post operative</b>	18	110.6 (16.3)	83	133
<b>Follow-up</b>	20	108.5 (15.9)	85	137

Although there is an increase in mean Performance IQ scores pre operatively to post operatively there is a slight decrease between post operative and follow-up. An ANOVA was conducted to determine whether patients' mean Performance IQ had significantly changed since surgery (Table 10).

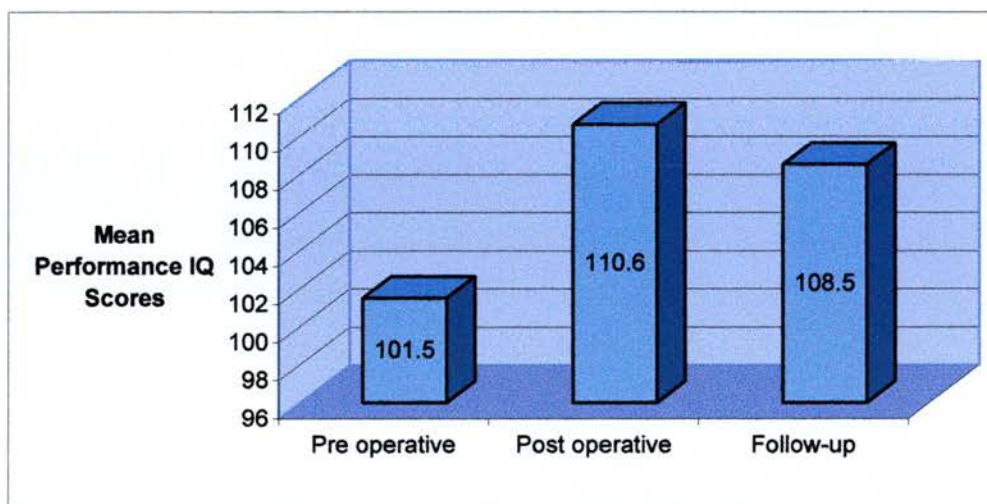
**Table 10: ANOVA comparing pre, post and follow-up scores on WAIS-R Performance IQ**

	<b>df</b>	<b>Error df</b>	<b>F</b>	<b>Sig.</b>
WAIS-R Performance IQ	1	17	6.087	0.025*

\* Significant at the 0.05 level.

The results on Table 10 show that there is a significant difference in Performance IQ mean scores between pre operative, post operative and follow-up. Graph 5 shows the different performance IQ means at pre, post and follow-up assessment.

**Graph 5: Mean Performance IQ Scores**



A post hoc t-test pairwise comparison was conducted to determine which pair of scores had a significant difference (Table 11).

**Table 11: Post hoc T-Test pairwise comparisons between pre, post and follow-up WAIS-R Performance IQ**

Pair	Mean Difference	Sig.
Pre operative with Post operative	8.889	0.001**
Post operative with Follow-up	-1.278	0.605 (NS)
Pre operative with Follow-up	7.611	0.025*

\* Significant at the 0.05 level.

\*\* Significant at the 0.01 level.

The results on Table 11 show that there is a significant difference between mean Performance IQ scores pre operatively and post operatively ( $P=0.001$ ) and pre operatively and follow-up ( $P=0.025$ ) however not between post operative and follow-up.

A MANOVA was conducted to investigate any significant difference in Performance IQ (Pre, Post and Follow-up) between those who had surgery on their dominant hemisphere ( $n=11$ ) and those who had surgery on their non-dominant hemisphere ( $n=6$ ) (Table 12).

**Table 12: MANOVA comparing Performance IQ between those with Dominant or Non-Dominant hemisphere Surgery (Pre, Post and Follow-up)**

Performance IQ	df	F	Sig.
Dominant v Non-Dominant	2	1.078	0.316 (NS)

There was no significant difference in Performance IQ between those who had surgery on their dominant or non-dominant hemisphere.

### **3.2.3 WMS-R Verbal Memory**

Each patient in the surgical group ( $n=20$ ) completed the verbal memory subtests of the WMS-R pre operatively and at follow-up. Unfortunately only nineteen completed the assessment immediately following their surgery. A summary of the descriptive statistics is displayed in Table 13.

**Table 13: Descriptive Statistics of WMS-R Verbal Memory**

WMS-R	n	Mean (S.D.)	Minimum	Maximum
Pre operative	20	87.4 (17.6)	57	122
Post operative	19	83.8 (14.3)	56	110
Follow-up	20	84.4 (15.2)	51	104

Although there is a decrease in mean Verbal IQ scores pre operatively to post operatively there is a slight increase post operatively to follow-up. An ANOVA was conducted to determine whether patients' Verbal IQ had significantly changed since surgery (Table 14).

**Table 14: ANOVA comparing pre, post and follow-up scores on WMS-R Verbal Memory**

	df	Error df	F	Sig.
WMS-R Verbal Memory	1	18	0.672	0.423 (NS)

The results on Table 14 show that there is no significant difference in verbal memory scores between pre operative, post operative and follow-up.

A MANOVA was conducted to investigate any significant difference in verbal memory (pre, post and follow-up) between those who had surgery on their dominant hemisphere (n=11) and those who had surgery on their non-dominant hemisphere (n=7) (Table 15).

**Table 15: MANOVA comparing Verbal Memory between those with Dominant and Non-Dominant hemisphere Surgery (Pre, Post and Follow-up)**

<b>Verbal Memory</b>	<b>df</b>	<b>F</b>	<b>Sig.</b>
Dominant v Non-Dominant	1	0.239	0.631 (NS)

There was no significant difference in verbal memory between those who had surgery on their dominant or non-dominant hemisphere.

### **3.2.4 WMS-R Visual Memory**

Each patient in the surgical group (n=20) completed the visual memory subtests of the WMS-R pre operatively and at follow-up. Unfortunately only nineteen completed the assessment immediately following their surgery. A summary of the descriptive statistics is displayed in Table 16.

**Table 16: Descriptive Statistics of WMS-R Visual Memory**

<b>WMS-R</b>	<b>n</b>	<b>Mean (S.D.)</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Pre operative</b>	20	94.5 (16.6)	67	136
<b>Post operative</b>	19	101.9 (13.7)	77	126
<b>Follow-up</b>	20	102.1 (14.3)	70	126

Although there is an increase in mean visual memory scores pre operatively to post operatively and post operatively to follow-up an ANOVA was conducted to determine whether patients' visual memory had significantly changed since surgery (Table 17).

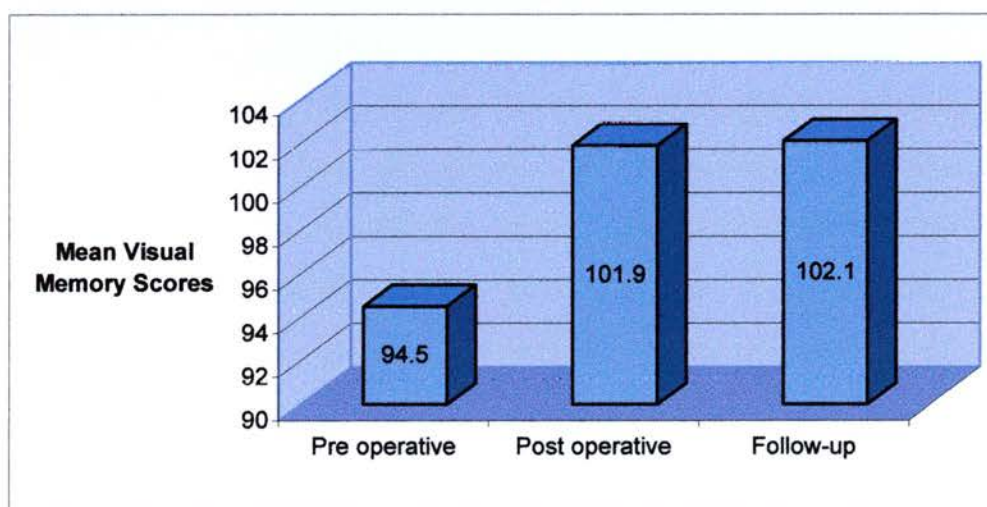
**Table 17: ANOVA comparing pre, post and follow-up scores on WMS-R Visual Memory**

	df	Error df	F	Sig.
WMS-R Visual Memory	1	18	7.400	0.014*

\* Significant at the 0.05 level.

The results on Table 17 show that there is a significant difference in visual memory mean scores between pre operative, post operative and follow-up. Graph 6 shows the mean visual memory scores for pre, post and follow-up assessments.

**Graph 6: Mean Visual Memory Scores**





A post hoc t-test pairwise comparison was conducted to determine which pair of scores had a significant difference (Table 18).

**Table 18: Post hoc T-Test pairwise comparisons between pre, post and follow-up WMS-R Visual Memory**

Pair	Mean Difference	Sig.
Pre operative with Post operative	7.105	0.040*
Post operative with Follow-up	0.947	0.767 (NS)
Pre operative with Follow-up	8.053	0.014*

\* Significant at the 0.05 level.

The results on Table 18 show that there is a significant difference between mean visual memory scores pre operatively and post operatively (P=0.040) and pre operatively and follow-up (P=0.014) however not between post operative and follow-up.

A MANOVA was conducted to investigate any significant difference in visual memory (pre, post and follow-up) between those who had surgery on their dominant hemisphere (n=11) and those who had surgery on their non-dominant hemisphere (n=7) (Table 19).

**Table 19: MANOVA comparing Visual Memory between those with Dominant and Non-Dominant hemisphere Surgery (Pre, Post and Follow-up)**

Visual Memory	df	F	Sig.
Dominant v Non-Dominant	1	0.054	0.819 (NS)

There was no significant difference in visual memory between those who had surgery on their dominant or non-dominant hemisphere.

### **3.2.5 WMS-R Attention & Concentration**

Twenty patients in the surgical group completed the attention and concentration subtests of the WMS-R before their surgery, eighteen completed the assessment immediately following their surgery and nineteen patients completed the assessment at follow-up. A summary of the descriptive statistics is displayed in Table 20.

**Table 20: Descriptive Statistics of WMS-R Attention & Concentration**

<b>WMS-R</b>	<b>n</b>	<b>Mean (S.D.)</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Pre operative</b>	20	101.5 (15.5)	67	132
<b>Post operative</b>	18	101.3 (12.8)	66	117
<b>Follow-up</b>	19	109.2 (14.5)	72	138

Although there is an increase in mean attention and concentration scores pre operatively to post operatively and post operatively to follow-up an ANOVA was conducted to determine whether patients' attention and concentration had significantly changed since surgery (Table 21).

**Table 21: ANOVA comparing pre, post and follow-up scores on WMS-R Attention & Concentration**

	df	Error df	F	Sig.
WMS-R Attention & Concentration	1	17	4.177	0.057 (NS)

The results on Table 21 show that there is no significant difference in attention and concentration scores between pre operative, post operative and follow-up.

A MANOVA was conducted to investigate any significant difference in attention and concentration between those who had surgery on their dominant hemisphere (n=10) and those who had surgery on their non-dominant hemisphere (n=7) at pre, post and follow-up (Table 22).

**Table 22: MANOVA comparing Attention & Concentration between those with Dominant and Non-Dominant hemisphere Surgery (Pre, Post and Follow-up)**

Attention & Concentration	df	F	Sig.
Dominant v Non-Dominant	1	0.861	0.368 (NS)

There was no significant difference in attention and concentration between those who had surgery on their dominant or non-dominant hemisphere.

### 3.2.6 WMS-R Delayed Memory

Each patient in the surgical group (n=20) completed the delayed memory subtests of the WMS-R pre operatively and at follow-up. Unfortunately only eighteen completed the assessment immediately following their surgery. A summary of the descriptive statistics is displayed in Table 23.

**Table 23: Descriptive Statistics of WMS-R Delayed Memory**

WMS-R	n	Mean (S.D.)	Minimum	Maximum
Pre operative	20	80.5 (19.4)	49	113
Post operative	18	90.1 (17.4)	65	123
Follow-up	20	92.3 (18.1)	61	128

Although there is an increase in mean delayed memory scores pre operatively to post operatively and post operatively to follow-up an ANOVA was conducted to determine whether patients' delayed memory had significantly changed since surgery (Table 24).

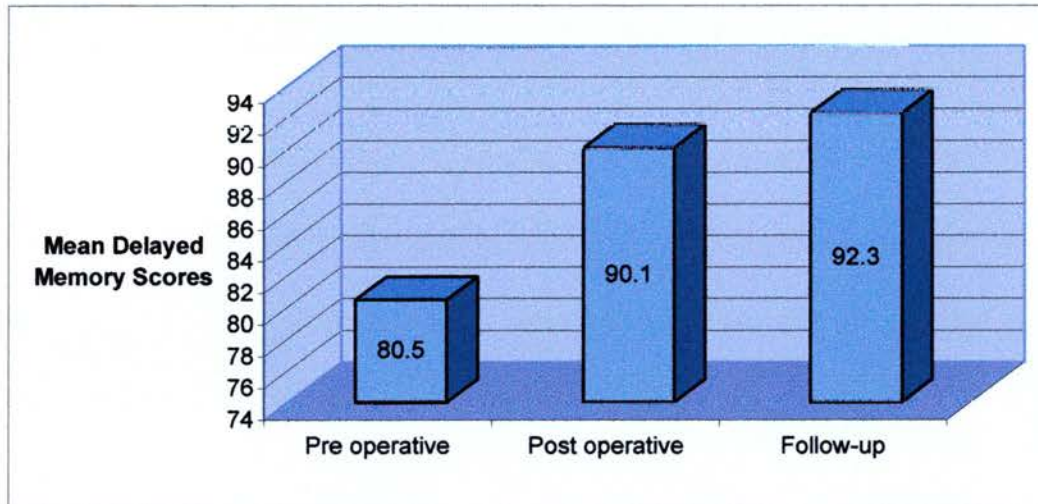
**Table 24: ANOVA comparing pre, post and follow-up scores on WMS-R Delayed Memory**

	df	Error df	F	Sig.
WMS-R Delayed Memory	1	17	9.062	0.008**

\*\* Significant at the 0.01 level.

The results on Table 24 show that there is a significant difference in Delayed memory mean scores between pre operative, post operative and follow-up. Graph 7 shows the mean delayed memory Scores for pre, post and follow-up assessments.

**Graph 7: Mean Delayed Memory Scores**



A post hoc t-test pairwise comparison was conducted to determine which pair of scores had a significant difference (Table 25).

**Table 25: Post hoc T-Test pairwise comparisons between pre, post and follow-up WMS-R Delayed Memory**

Pair	Mean Difference	Sig.
Pre operative with Post operative	9.778	0.009**
Post operative with Follow-up	4.333	0.224 (NS)
Follow-up with Pre operative	14.111	0.008**

\*\* Significant at the 0.01 level.

The results on Table 25 show that there is a significant difference between mean delayed memory scores pre operatively and post operatively (P=0.009) and pre operatively and follow-up (P=0.008) however not between post operative and follow-up.

A MANOVA was conducted to investigate any significant difference in delayed memory between those who had surgery on their dominant hemisphere (n=10) and those who had surgery on their non-dominant hemisphere (n=7) pre, post and at follow-up (Table 26).

**Table 26: MANOVA comparing Delayed Memory between those with Dominant and Non-Dominant hemisphere Surgery (Pre, Post and Follow-up)**

<b>Delayed Memory</b>	<b>df</b>	<b>F</b>	<b>Sig.</b>
Dominant v Non-Dominant	1	0.296	0.594 (NS)

There was no significant difference in delayed memory between those who had surgery on their dominant or non-dominant hemisphere.

### **3.2.7 Surgery Five Years Ago or Less v Over Five Years Ago**

#### **3.2.7 (a) Time of Surgery and Levels of Anxiety**

Levels of anxiety were assessed using the HADS. An Independent samples t-test was conducted to investigate any significant difference between those who had their surgery five years ago or less and those who had their surgery over five years ago (Table 27).

**Table 27: Independent Samples T-Test comparing levels of anxiety between those who had surgery five years ago or less and those who had surgery over five years ago**

	Mean - five years or less	n	Mean – over five years	n	t-value	2-tailed sign.
Anxiety	5.20	5	8.53	15	1.62	0.123 (NS)

There was no significant difference in levels of anxiety between those who had surgery five year ago or less and those who had surgery over five years ago.

**3.2.7 (b) Time of Surgery and Levels of Depression**

Levels of depression were assessed using the HADS. An Independent samples t-test was conducted to investigate any significant difference between those who had their surgery five years ago or less and those who had their surgery over five years ago (Table 28).

**Table 28: Independent Samples T-Test comparing levels of depression between those who had surgery five years ago or less and those who had surgery over five years ago**

	Mean - five years or less	n	Mean – over five years	n	t-value	2-tailed sign.
Depression	2.60	5	4.67	15	1.11	0.280 (NS)

There was no significant difference in levels of depression between those who had surgery five year ago or less and those who had surgery over five years ago.

**3.2.7 (c) Time of Surgery and Locus of Control**

Locus of Control was assessed using the Rotter I-E Scale. An Independent samples t-test was conducted to investigate any significant difference between those who had their surgery five years ago or less and those who had their surgery over five years ago (Table 29).

**Table 29: Independent Samples T-Test comparing Locus of Control between those who had surgery five years ago or less and those who had surgery over five years ago**

	Mean - five years or less	n	Mean – over five years	n	t-value	2-tailed sign.
Locus of Control	10.00	5	10.20	15	0.13	0.901 (NS)

There was no significant difference in Locus of Control between those who had surgery five year ago or less and those who had surgery over five years ago.

**3.2.7 (d) Time of Surgery and Quality of Life**

Quality of Life was assessed using the WHOQOL-BREF that subdivides Quality of Life into General Quality of Life, Physical Quality of Life, Psychological Quality of Life, Social/Relationship Quality of Life and Environmental Quality of Life.



Independent samples t-tests were conducted to investigate any significant differences between those who had their surgery five years ago or less and those who had their surgery over five years ago for each of the Quality of Life variables (Table 30).

**Table 30: Independent Samples T-Test comparing General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between those who had surgery five years ago or less and those who had surgery over five years ago**

	Mean - five years or less	n	Mean – over five years	n	t-value	2-tailed sign.
General	3.80	5	3.93	15	0.39	0.698 (NS)
Physical	28.00	5	26.40	15	0.636	0.533 (NS)
Psychological	23.20	5	19.73	15	1.559	0.136 (NS)
Social/Relationship	11.00	5	10.27	15	0.423	0.677 (NS)
Environmental	27.80	5	29.27	15	0.604	0.553 (NS)

There was no significant difference in General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between those who had surgery five year ago or less and those who had surgery over five years ago.

### **3.2.8 Surgical Outcome**

Surgical outcome was divided into two groups: good outcome (n=14) and moderate/poor outcome (n=6).

### 3.2.8 (a) Surgical Outcome and Levels of Anxiety

An Independent samples t-test was conducted to investigate any significant differences in levels of anxiety between those with good surgical outcome and those with moderate/poor surgical outcome (Table 31).

**Table 31: Independent Samples T-Test comparing levels of anxiety between those with moderate/poor surgical outcome and those with good surgical outcome**

	Mean – moderate/poor outcome	n	Mean – good outcome	n	t-value	2-tailed sign.
Anxiety	9.17	6	7.07	14	1.035	0.314 (NS)

There was no significant difference in levels of anxiety between those with moderate/poor surgical outcome and those with good surgical outcome.

### 3.2.8 (b) Surgical Outcome and Levels of Depression

An Independent samples t-test was conducted to investigate any significant difference in levels of depression between those with good surgical outcome and those with moderate/poor surgical outcome (Table 32).

**Table 32: Independent Samples T-Test comparing levels of depression between those with moderate/poor surgical outcome and those with good surgical outcome**

	Mean – moderate/ poor outcome	n	Mean – good outcome	n	t- value	2-tailed sign.
Depression	6.33	6	3.21	14	1.882	0.076 (NS)

There was no significant difference in levels of depression between those with moderate/poor surgical outcome and those with good surgical outcome.

### **3.2.8 (c) Surgical Outcome and Locus of Control**

An Independent samples t-test was conducted to investigate any significant difference in Locus of Control between those with good surgical outcome and those with moderate/poor surgical outcome (Table 33).

**Table 33: Independent Samples T-Test comparing Locus of Control between those with moderate/poor surgical outcome and those with good surgical outcome**

	Mean – moderate/poor outcome	n	Mean – good outcome	n	t- value	2-tailed sign.
Locus of Control	10.17	6	10.14	14	0.016	0.987 (NS)

There was no significant difference in Locus of Control between those with moderate/poor surgical outcome and those with good surgical outcome.

### 3.2.8 (d) Surgical Outcome and Quality of Life

Independent samples t-tests were conducted to investigate any significant differences in General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between those with good surgical outcome and those with moderate/poor surgical outcome (Table 34).

**Table 34: Independent Samples T-Test comparing General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between those with moderate/poor surgical outcome and those with good surgical outcome**

	Mean – moderate/poor outcome	n	Mean – good outcome	n	t- value	2-tailed sign.
General	3.50	6	4.07	14	1.568	0.165 (NS)
Physical	24.67	6	27.71	14	1.328	0.201 (NS)
Psychological	16.83	6	22.21	14	2.249	0.065 (NS)
Social/Relationship	8.50	6	11.29	14	1.845	0.082 (NS)
Environmental	27.00	6	29.71	14	1.219	0.239 (NS)

There was no significant difference in General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between those with moderate/poor surgical outcome and those with good surgical outcome.

### 3.3 Surgical v Non-Surgical Comparisons

#### 3.3.1 Levels of Anxiety

Independent samples t-tests were conducted to investigate any significant differences in levels of anxiety between the surgical group and the non-surgical group (Table 35).

**Table 35: Independent Samples T-Test comparing levels of anxiety between surgical and non-surgical groups**

	Mean – Surgical Group	n	Mean – Non-Surgical Group	n	t-value	2-Tailed Sign.
Anxiety	7.70	20	6.29	7	0.803	0.429 (NS)

There was no significant difference for levels of anxiety between the surgical and non-surgical group.

#### 3.3.2 Levels of Depression

Independent samples t-tests were conducted to investigate any significant differences in levels of depression between the surgical group and the non-surgical group (Table 36).

**Table 36: Independent Samples T-Test comparing levels of depression between surgical and non-surgical groups**

	Mean – Surgical Group	n	Mean – Non-Surgical Group	n	t-value	2-Tailed Sign.
Depression	4.15	20	5.86	7	1.031	0.312 (NS)

There was no significant difference for levels of depression between the surgical and non-surgical group.

### **3.3.3 Locus of Control**

Independent samples t-tests were conducted to investigate any significant differences in Locus of Control between the surgical group and the non-surgical group (Table 37).

**Table 37: Independent Samples T-Test comparing Locus of Control between surgical and non-surgical groups**

	<b>Mean – Surgical Group</b>	<b>n</b>	<b>Mean – Non-Surgical Group</b>	<b>n</b>	<b>t-value</b>	<b>2-Tailed Sign.</b>
Locus of Control	10.15	20	11.86	7	1.383	0.179 (NS)

There was no significant difference for Locus of Control between the surgical and non-surgical group.

### **3.3.4 Quality of Life**

Independent samples t-tests were conducted to investigate any significant differences in General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between the surgical group and the non-surgical group (Table 38).

**Table 38: Independent Samples T-Test comparing General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between surgical and non-surgical group**

	<b>Mean – Surgical Group</b>	<b>n</b>	<b>Mean – Non-Surgical Group</b>	<b>n</b>	<b>t- value</b>	<b>2-Tailed Sign.</b>
General	3.90	20	3.43	7	1.740	0.094 (NS)
Physical	26.80	20	26.57	7	0.114	0.910 (NS)
Psychological	20.60	20	19.57	7	0.554	0.584 (NS)
Social/Relationship	10.45	20	10.14	7	0.233	0.818 (NS)
Environmental	28.90	20	30.14	7	0.659	0.516 (NS)

There was no significant difference for General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between the surgical and non-surgical group.

### **3.4 Results in Relation to Specific Hypotheses**

It was hypothesised that:

#### **3.4.1 SURGICAL GROUP**

##### **Verbal IQ**

- (i) Those who have undergone temporal lobe surgery for epilepsy will have a significant reduction in verbal IQ.

The results show that there is no significant difference in mean Verbal IQ scores between pre operative, post operative and follow-up and therefore do not support the hypothesis.

- (ii) Those who have undergone temporal lobe surgery for epilepsy on their dominant hemisphere will have a significant reduction in verbal IQ compared to those who have undergone temporal lobe surgery on their non-dominant hemisphere.

There was no significant difference in Verbal IQ between those who had surgery on their dominant or non-dominant hemisphere therefore the results do not support this hypothesis.

### **Performance IQ**

- (iii) Those who have undergone temporal lobe surgery for epilepsy will show no change in performance IQ.

The results show that there is a significant difference in Performance IQ mean scores between pre operative, post operative and follow-up and therefore do not support the hypothesis.



### **Verbal Memory**

- (iv) Those who have undergone temporal lobe surgery for epilepsy will have a significant reduction in verbal memory.

The results show that there is no significant difference in verbal memory scores between pre operative, post operative and follow-up and therefore do not support this hypothesis.

- (v) Those who have undergone temporal lobe surgery for epilepsy on their dominant hemisphere will have a significant reduction in verbal memory compared to those who have undergone temporal lobe surgery on their non-dominant hemisphere.

There was no significant difference in verbal memory between those who had surgery on their dominant or non-dominant hemisphere therefore this hypothesis is not supported.

### **Visual Memory**

- (vi) Those who have undergone temporal lobe surgery for epilepsy will show no change in visual memory.

The results show that there is a significant difference in visual memory mean scores between pre operative, post operative and follow-up and therefore do not support the hypothesis.

### **Attention and Concentration**

- (vii) Those who have undergone temporal lobe surgery for epilepsy will show no change in attention and concentration.

The results on show that there is no significant difference in attention and concentration scores between pre operative, post operative and follow-up therefore this hypothesis is supported.

### **Delayed Memory**

- (viii) Those who have undergone temporal lobe surgery for epilepsy will have a significant reduction in delayed memory.

The results on show that there is a significant increase in delayed memory mean scores between pre operative, post operative and follow-up and therefore do not support the hypothesis.

- (ix) Those who have undergone temporal lobe surgery for epilepsy on their dominant hemisphere will have a significant reduction in delay memory compared to those who have undergone temporal lobe surgery on their non-dominant hemisphere.

There was no significant difference in delayed memory between those who had surgery on their dominant or non-dominant hemisphere therefore this hypothesis is not supported.

### **Anxiety**

- (x) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly higher level of anxiety than those who have undergone surgery over five years ago.

There was no significant difference in levels of anxiety between those who had surgery five years ago or less and those who had surgery over five years ago therefore this hypothesis is not supported.

- (xi) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly lower level of anxiety than those who have had a moderate/poor outcome.

There was no significant difference in levels of anxiety between those with moderate/poor surgical outcome and those with good surgical outcome therefore this hypothesis is not supported.

## **Depression**

- (xii) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly higher level of depression than those who have undergone surgery over five years ago.

There was no significant difference in levels of depression between those who had surgery five years ago or less and those who had surgery over five years ago therefore this hypothesis is not supported.

- (xiii) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly lower level of depression than those who have had a moderate/poor outcome.

There was no significant difference in levels of depression between those with moderate/poor surgical outcome and those with good surgical outcome therefore this hypothesis is not supported.

## **Locus of Control**

- (xiv) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly higher Locus of Control (a more external Locus of Control) than those who have undergone surgery over five years ago.

There was no significant difference in Locus of Control between those who had surgery five years ago or less and those who had surgery over five years ago therefore this hypothesis is not supported.

- (xv) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly lower Locus of Control (a more internal Locus of Control) than those who have had a moderate/poor outcome.

There was no significant difference in Locus of Control between those with moderate/poor surgical outcome and those with good surgical outcome therefore this hypothesis is not supported.

### **Quality of Life**

- (xvi) Those who have undergone temporal lobe surgery for epilepsy five years ago or less will have a significantly lower Quality of Life (on all variables) than those who have undergone surgery over five years ago.

There was no significant difference in General Quality of Life, Physical Quality of Life, Psychological Quality of Life, Social/Relationship Quality of Life and Environmental Quality of Life between those who had surgery five years ago or less and those who had surgery over five years ago therefore this hypothesis is not supported.

- (xvii) Those who have undergone temporal lobe surgery and have a good outcome will have a significantly higher Quality of Life (on all variables) than those who have had a moderate/poor outcome.

There was no significant difference in General Quality of Life, Physical Quality of Life, Psychological Quality of Life, Social/Relationship Quality of Life and Environmental Quality of Life between those with moderate/poor surgical outcome and those with good surgical outcome therefore this hypothesis is not supported.

### **3.4.2 SURGICAL V NON-SURGICAL GROUP**

#### **Anxiety**

- (xviii) Levels of anxiety will be significantly lower in patients who have undergone temporal lobe surgery for epilepsy compared to a comparative group who have not undergone surgery.

There was no significant difference for levels of anxiety between the surgical and non-surgical group therefore this hypothesis was not supported.

#### **Depression**

- (xix) Levels of depression will be significantly lower in patients who have undergone temporal lobe surgery for epilepsy compared to a comparative group who have not undergone surgery.

There was no significant difference for levels of depression between the surgical and non-surgical group therefore this hypothesis was not supported.

### **Locus of Control**

- (xx) Those who have undergone temporal lobe surgery for epilepsy will have a significantly lower Locus of Control score (a more internal Locus of Control) when compared to a comparative group who have not undergone surgery.

There was no significant difference for Locus of Control between the surgical and non-surgical groups therefore this hypothesis was not supported.

### **Quality of Life**

- (xxi) Those who have undergone temporal lobe surgery for epilepsy will have a significantly higher Quality of Life (on all variables) when compared to a comparative group who have not undergone surgery.

There was no significant difference for General Quality of Life, Physical Quality of Life, Psychological Quality of Life, Social/Relationship Quality of Life and Environmental Quality of Life between the surgical and non-surgical group therefore this hypothesis is not supported.

## **CHAPTER 4 - DISCUSSION**



#### **4. DISCUSSION**

In the United Kingdom it has been estimated that there is an annual need for 600-2000 surgical procedures for temporal lobe epilepsy (Duncan, Shovon & Fish, 1995). Although the number of operations is currently inadequate to meet demand, surgical rates are increasing. Consequently a better understanding of the post operative response to temporal lobe surgery for epilepsy is required so that early identification of problems can lead to better and prompt treatment. The aim of this study was to investigate the psychological and cognitive consequences of surgery for temporal lobe epilepsy.

In this study 70% of those who had surgery no longer had seizures with a further 25% having a significant reduction in seizure frequency. Only one person in the twenty patients studied reported a poor outcome, which resulted from cardiovascular difficulties during surgery and left him with left-sided paralysis. Despite this the patient reported that his seizures had reduced slightly and that he was glad he had agreed to surgery.

In terms of age and socio-economic status the surgical and non-surgical group were similar. It was noted that those who were students in the surgical group commented that it was only as a result of undergoing surgery that they were able to begin further education. The two students in the non-surgical group stated that they were currently struggling with their courses and felt that they may be forced to leave as they had difficulties, in particular, with memory.

## **4.1 Surgical Group**

### **4.1.1 Cognitive Functioning**

#### **4.1.1 (a) WAIS-R Verbal IQ**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would have a significant reduction in Verbal IQ.

The results show that there is no significant difference in mean Verbal IQ between pre, post and follow-up and the hypothesis is not supported. It was thought that, as verbal skills are located in the temporal lobes, removal would have a detrimental effect on Verbal IQ. The results suggest that this is not the case and that removing one of the temporal lobes has no effect on Verbal IQ. It may be that the remaining temporal lobe was in fact already, in some way, compensating for the lobe with the epileptic focus and therefore removing the lobe with the focus had no effect. Although this result was not significant the F value (3.313) was approaching significance ( $P=0.086$ ) and, due to the small numbers, it may be that the null hypothesis is being accepted when it should be rejected. It was surprising that the means for each group (pre=90.1, post=91.3, follow-up=93.3) were in the opposite direction to that predicted. One possible explanation for this unexpected change in mean is that location of the focus of the epilepsy in the temporal lobe was in some way having an inhibitory effect on language processing skills and that the removal of the focus is allowing the remaining lobe to work more efficiently although in this case not significantly.

Alternatively the changes in mean Verbal IQ may be a result of test re-test of the WAIS-R and are an anomaly of testing. This would support the findings of Dodrill & Wilensky (1990) who found increases in Verbal IQ for a non-surgical group of 105 epileptics after a five-year test-retest interval. This would imply that an increase in Verbal IQ would be expected but not as a result of the removal of the temporal lobe. They suggest that an absence of any improvement could indicate an overall decline in Verbal IQ. Given that there is an improvement in mean Verbal IQ it could suggest that Verbal IQ has remained the same for this group.

It was further hypothesised that those who had undergone temporal lobe surgery for epilepsy on their dominant hemisphere would have a significant reduction in Verbal IQ compared to those who had undergone surgery on their non-dominant hemisphere.

The results show that there was no significant difference in Verbal IQ between these two groups. This is surprising given that eleven patients had their dominant temporal lobe for language removed. However it does support the idea that the lobe that was not removed has, in some way, already compensated for the lobe that was removed. Once again the F value (2.111) was approaching significance ( $P=0.167$ ) and, given the low numbers in each group, it may be that the null hypothesis is being accepted when it should be rejected. To further investigate this result the means for the two groups at each stage of testing were graphed (Graph 4, page 68) and statistical analysis conducted. This analysis shows that those with surgery on their dominant hemisphere had significantly lower mean Verbal IQ scores pre and post operatively

but not at follow-up. This is an interesting result and suggests that those who had their non-dominant temporal lobe removed show no, or little change, while those who had their dominant lobe removed improved in Verbal IQ and seemed to catch up with the non-dominant group at follow-up although this result was also approaching significance ( $P=0.064$ ). This would support the notion that removal of the focus in the dominant lobe allows the non-dominant lobe to work more efficiently while removal of the non-dominant lobe has no effect on the dominant lobe. Given the small numbers, however, caution should be taken with the interpretation of these results.

These results do not support the findings of Rausch & Crandall (1982) and Blakemore et al. (1967) who found that those who had surgery on their right hemisphere produced significantly larger positive gains in Verbal IQ than those who had surgery on their left hemisphere. One of the difficulties with these studies, however, is that they assume that the left hemisphere is the dominant hemisphere and that the right hemisphere is the non-dominant. As discussed in the introduction this is not necessarily the case and few of the studies divided their results into dominant versus non-dominant. Given the small numbers often reported in these studies this is an important consideration.

#### **4.1.1 (b) WAIS-R Performance IQ**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would show no change in Performance IQ.

The results show that there is a significant difference between mean Performance IQ pre and post operatively and between pre and follow-up but not between post and follow-up therefore the hypothesis is not supported. This is an interesting and unexpected result given that Performance IQ has not been anatomically related to the temporal lobes. It may be that there is a kindling effect in that the electrical discharges from the focus of the epilepsy are spreading beyond the immediate area into other area. This electrical discharge then stimulates and interferes with the normal functioning of other lobes and, hence, may affect Performance IQ. In addition many of the Performance IQ tasks in the WAIS-R also have a verbal component as most tests require a verbal response and instructions a given verbally. Although there was no significant difference in Verbal IQ scores the result was approaching significance and the means did show some improvement. It may be that the removal of a kindling effect and the improvement of Verbal IQ, although not significant, together result in an improvement of Performance IQ. The results support the findings of Blakemore & Falconer (1967) who found that Performance IQ improved compared to baseline, regardless of side of surgery.

It is also possible that this result is due to test re-test of Performance IQ supporting the findings of Seidenberg et al. (1981). However this is unlikely since the difference between post and follow-up was insignificant and the change from pre to post was maintained at follow-up.

As a significant difference in Performance IQ was found, further analysis was conducted to investigate any differences in dominant verses non-dominant

hemisphere surgery. No significant difference was found, which would be expected given that Performance IQ is not anatomically associated with the temporal lobes. This adds to the notion of a kindling effect.

This does not support the findings of Rausch & Crandall (1982) who found that those who had surgery on their left temporal lobe had higher Performance IQ after surgery while those who had surgery on their right temporal lobe had a stable Performance IQ. As previously discussed however, it was thought that the assumption had been made that surgery on the left temporal lobe was within the dominant hemisphere and that surgery on the right was within the non-dominant but this cannot always be assumed.

#### **4.1.1 (c) WMS-R Verbal Memory**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would have a significant reduction in verbal memory.

The results show that there was no significant difference in verbal memory following temporal lobe surgery and, therefore, the hypothesis is not supported. This is initially surprising given that the temporal lobes are anatomically associated with verbal memory however this finding adds further support to the notion that the temporal lobe that remains was already compensating for the temporal lobe with the focus before surgery occurred and, therefore, removal of the lobe with the focus had little effect on overall verbal memory. It should be noted that the WMS-R Verbal Memory Index only assesses immediate verbal memory and not delayed memory.

It was further hypothesised that those who had undergone temporal lobe surgery for epilepsy on their dominant hemisphere would have a significant reduction in verbal memory compared to those who had undergone temporal lobe surgery on their non-dominant hemisphere.

The results show that there is no significant difference and the hypothesis is not supported. Given that no difference was found in verbal memory, regardless of hemispheric dominance, this result is not surprising and supports the notion that the temporal lobe without the epileptic focus was already compensating for the lobe with the focus.

This result does not support the findings of Novelly et al. (1984), Rausch & Crandall (1982), Milner (1975) and Ivnik et al. (1987) who found that there were substantial recent verbal memory deficits in those with surgery on their dominant hemisphere. In addition Novelly et al. found non-dominant temporal lobe removal resulted in improved verbal memory.

#### **4.1.1 (d) WMS-R Visual Memory**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would show no change in visual memory.

The results show that there is a significant difference in visual memory pre and post operatively and pre and follow-up but not between post and follow-up. This result is

particularly surprising given that a significant number of those assessed reported having some eyesight deficits as a result of surgery. This finding is similar to the finding of the WAIS-R Performance IQ and could be accounted for by the same phenomenon. It may be that a kindling effect has a detrimental effect on visual memory and when the focus is removed visual memory is able to work more efficiently. This could be combined with the fact that testing visual memory is intrinsically associated with verbal skills, as most tests require a verbal response and instructions are given verbally, and together this and the kindling effect account for this result. It should be noted that the WMS-R Visual Memory Index only assesses immediate visual memory.

As there was a significant finding a comparison was made between dominant and non-dominant hemisphere surgery and no significant results were shown.

This supports the findings of Rausch & Crandall (1982) who found that there was no difference between right or left hemispheric surgery in visual memory although they found no changes in overall visual memory which does not support the findings of this study. The results do not support the findings of Novelly et al (1984) who found that those with dominant excisions produced improved visual memory and that non-dominant removal resulted in unchanged visual memory. Naugle et al. (1993) failed to demonstrate any significant differences between left and right temporal lobe groups on visual memory prior to or six months after surgery. Meier & French (1966) and Milner (1975) found that those with right temporal surgery showed visual deficits however substantial developments have been made in surgical techniques



since these studies were published. Overall there are inconclusive findings in this area.

#### **4.1.1 (e) WMS-R Attention & Concentration**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would show no change in attention and concentration.

Although the results show that there is no significant difference and the hypothesis is supported, surprisingly the F value (4.177) was approaching significance ( $P=0.057$ ) and warrants further discussion. As with Performance IQ and Visual Memory it may be that attention & concentration is also compromised by a kindling effect and removal of the focus allows attention & concentration to work more efficiently. What is more surprising however is that the mean difference between pre and post is only 0.2 however the difference between pre and follow-up is 7.7 and between post and follow-up is 7.9. There is an important difference between this statistic and Performance IQ and Visual Memory, where the differences were observed immediately following surgery. It may be that following surgery there are more distractions in relation to life changes and the immediate medical implications of surgery (for example, regular check-ups). It is possible that it is only when life style changes settle down and medical treatment reduces or ceases altogether that the ability to concentrate and pay attention improves. The WMS-R does not differentiate between the different aspects of attention and concentration, for example divided, dual and selective, and it would be interesting to assess where the differences lie.

#### 4.1.1 (f) WMS-R Delayed Memory

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would have a significant reduction in delayed memory.

The results show that there was a significant increase between pre and post operative and between pre and follow-up and therefore does not support the hypothesis. There was no difference between post and follow for delayed memory. This result was not expected given the role of the temporal lobe in delayed memory however it does support the notion that removal of the temporal lobe with the epileptic focus enables the lobe without the focus to work more efficiently. One of the difficulties however in further discussing this result is that the WMS-R Delayed Memory Index does not differentiate between delayed verbal or delayed visual memory therefore it is unclear as to whether verbal and/or visual memory has improved. It may be that the modality of the memory is unimportant and that any type of delayed memory is affected or alternatively, given the results so far, that verbal delayed memory does not change and visual delayed memory does. Previous research would suggest that verbal memory changes (although not in this direction!) but visual does not. Nevertheless inferences cannot be made from these results about the nature of the delayed memory without further investigating the changes in verbal and visual delayed memory separately.

#### **4.1.1 (g) Summary of Cognitive Functioning Findings**

The results of this study suggest that there is no detrimental effect of undergoing temporal lobe surgery for epilepsy on cognitive functioning and that there is much to gain. There were no significant differences in overall Verbal IQ, verbal memory and attention & concentration. There were significant gains in Verbal IQ (for those with surgery on their dominant hemisphere), Performance IQ, visual memory and delayed memory. The results support the notion that the removal of the temporal lobe with the epileptic focus allows the lobe without the focus to work more efficiently and allow other areas of the brain affected by an electrical kindling effect to operate more effectively. There are however methodological difficulties with these results, which will be discussed in detail later, and any inferences should be made with caution.

#### **4.1.2 Psychological Functioning**

##### **4.1.2 (a) Anxiety**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy five years ago or less would have a significantly higher level of anxiety than those who had undergone surgery over five years ago.

Although statistical analysis was conducted to determine any significant differences between these two groups the numbers were technically too low (n=5, n=15) and the groups were notably unequal for robust analysis. Nevertheless the mean differences were not in the expected direction and those over five years post operative had a

higher mean level of anxiety (8.53) than the five years or less group (5.20). Although the mean difference between the groups was not significant the t-value (1.62) was approaching significance ( $P=0.123$ ). The range in the HADS for normal levels of anxiety is 0-7 whilst the range for mild anxiety is 8-10. Consequently it appears as if the group who had surgery over five years ago have mild levels of anxiety whilst those who had surgery more recently appear to have levels within normal limits. This is a surprising result as it might be expected that the further away the surgery was the less anxious individuals would be. It is possible however that initially after surgery patients are relieved that they have survived intact but, as time progresses, they become more anxious about having to readjust to life without epilepsy. Clearly this is highly speculative given the small numbers and the fact that dividing the groups into before and after five years was decided by the investigator and not based on any theoretical background. It may be that there is a critical period when anxiety changes from within normal limits to becoming a mild problem but that this is before the five year cut off used in this study.

It was further hypothesised that those who have undergone temporal lobe surgery and have a good outcome would have a significantly lower level of anxiety than those who had a moderate/poor outcome.

No significant difference was found suggesting that surgical outcome has no effect on levels of anxiety. This does not support the findings of Rose et al. (1995) who found that patients who were seizure free had significantly lower scores in post operative anxiety however in this study anxiety was assessed at least a year and, for

some, substantially longer following surgery and Rose et al. assessed patients a few months following surgery. It may be that surgery itself and changes in lifestyle, regardless of outcome, has more of an effect on anxiety.

#### **4.1.2 (b) Depression**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy five years ago or less would have a significantly higher level of depression than those who had undergone surgery over five years ago.

The methodological issues raised earlier when discussing anxiety also apply to the discussion on levels of depression and time since surgery: small numbers, notably unequal group numbers and the arbitrary cut off of five years. There was no significant difference between the two groups for levels of depression therefore the hypothesis was not supported. Given that the normal range for levels of depression in the HADS is 0-7 neither group showed any clinically significant levels of depression. This does not support the findings of Ring et al. (1998) who found that 21 per cent of their sample had a major depressive disorder.

It was further hypothesised that those who had undergone temporal lobe surgery and had a good outcome would have a significantly lower level of depression than those who had a moderate/poor outcome.

The results show that there was no significant difference between the two groups for levels of depression however the t-value (1.882) was approaching significance

( $P=0.076$ ). The mean level of depression in the good outcome group was 3.21 (within normal levels) whilst the mean for the moderate/poor outcome was 6.33 (again within normal levels). This change in level of depression is in the predicted direction and it stands to reason that if an individual is continuing to have seizures when there was a chance that surgery would result in no longer having seizures, levels of depression might increase. The mean for the moderate/poor group was approaching the clinical level for mild depression.

This does not support the findings of Burton (1988) and Rose et al. (1995) who found a relationship between increased levels of depression and failure to control seizures although the result was approaching significance.

#### **4.1.2 (c) Locus of Control**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy five years ago or less would have a significantly higher Locus of Control (a more external Locus of Control) than those who had undergone surgery over five years ago.

Once again the same methodological considerations (small number, notably unequal group numbers and a cut off of five years) apply. There was no significant difference between the two groups for Locus of Control. It may be that changes in Locus of Control take a much longer time to develop, if indeed it changes at all, as it involves a change in attribution and attitude which are learned and entrenched at an early age. This would support the notion of Rotter et al. (1962) that Locus of Control

is a personality trait and add further support to the findings of Hermann & Wyler (1989) who found no significant differences between pre and six months post operative Locus of Control scores. However, in the present study, Locus of Control was assessed anything from one year to ten years after surgery.

It was further hypothesised that those who had undergone temporal lobe surgery and had a good outcome would have a significantly lower Locus of Control (a more internal Locus of Control) than those who had a moderate/poor outcome.

There was no significant difference between the two groups which would further support to the notion that Locus of Control is difficult, if not impossible, to change.

#### **4.1.2 (d) Quality of Life**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy five years ago or less would have a significantly lower Quality of Life (on all variables) than those who had undergone surgery over five years ago.

Once again the same methodological considerations discussed above apply. There was no significant difference in General, Physical, Psychological, Social/Relationship and Environmental Quality of Life between the two groups. The mean difference in Psychological Quality of Life between those who had surgery five years ago or less (23.20) and those who had surgery over five years ago (19.73) was approaching significance ( $P=0.136$ ). This is a surprising result and not in the expected direction. It would be expected that the further away an individual is from

having had surgery the more psychologically adjusted they would be. This result may reflect difficulties in coming to terms with no longer having epilepsy and the loss of possible secondary gains, for example losing the sick role.

Gilbert (1992) suggests that one of the four basic social mentalities, which help to orientate role relationships, is care eliciting and that within care eliciting is the theme of victim. It may be that as a result of losing the care eliciting victim role psychological Quality of Life is reducing. This also supports the notion of Champion & Power (1995) that psychological distress is a result of the loss of a valued role. Whilst there were no significant differences in anxiety and depression for these groups the Quality of Life measure is subjective whilst the HADS is a measure of symptoms i.e. changes in sleep patterns.

This result does not support the findings of McLachlan et al. (1997) who found that improvements in Quality of Life took time to evolve and to become fully evident. This suggests that Quality of Life should have improved by over five years post-surgery.

It was further hypothesised that those who had undergone temporal lobe surgery and had a good outcome would have a significantly higher Quality of Life (on all variables) than those who had a moderate/poor outcome.

The results show that there was no significant difference on any of the Quality of Life variables however there were a number which were approaching significance:



General (P=0.165), Psychological (P=0.065) and Social/Relationship (P=0.082). All of these were in the expected direction: the better the surgical outcome the higher the Quality of Life. It stands to reason that if an individual no longer has significant seizures their Quality of Life should improve particularly if you consider that many of the patients were able to find employment, had retrained and found more fulfilling employment and were also able to drive. This overall improvement may well have a positive effect on social lives, relationships and psychological well-being.

This result supports the findings of Rausch & Crandall (1982) and Savard & Walker (1965) who found that those who obtained relief from their seizures showed improvements in relationships. Kellett et al. (1997), Vickrey et al. (1992) and McLachlan et al (1997) found that patients with significantly reduced seizure frequency scored significantly better in general Quality of Life.

#### **4.1.2 (e) Summary of Psychological Functioning Findings**

The results suggest that having temporal lobe surgery for epilepsy has no significant detrimental or positive effects on the areas of psychological functioning tested in this study. Many of the results, however, were approaching significance. Inferences from these results should be made with caution given methodological considerations nevertheless there appear to be some interesting trends.

## **4.2 Surgical verses Non-Surgical Groups**

### **4.2.1 Anxiety**

It was hypothesised that levels of anxiety would be significantly lower in patients who had undergone temporal lobe surgery for epilepsy compared to a comparative group who had not undergone surgery.

There was no significant difference found and both groups had means indicating normal levels of anxiety. This is surprising given previous findings that those who have uncontrolled epilepsy have a sense of hopelessness and anxiety about when the next seizure will occur (Gumnit, 1987, Victoroff, 1994, Baker et al., 1993). This does not seem to support the view of Borkovec et al. (1986) that worry is an attempt to avoid negative outcomes by thinking through all the possibilities and anticipate difficulties unless worry has become so entrenched that those who no longer have seizures still find it difficult to cope with the anxiety of possibly have another one. The fact that 25% of the surgical group still have occasional seizures means that their anxiety is being intermittently reinforced. This would also support Barlow's (1988) theory of worry, which suggests that individual's intensify their worries by focusing their attentions on them.

### **4.2.2 Depression**

It was hypothesised that levels of depression would be significantly lower in patients who had undergone temporal lobe surgery for epilepsy compared to a comparative group who had not undergone surgery.

There was no significant difference found and both groups had means indicating normal levels of depression. This does not support the findings of Adams et al. (1996), Betts (1981), Robertson & Trimble (1983) and Victoroff (1994) who found that people with uncontrolled epilepsy have increased levels of depression.

In addition this result does not support the Learned Helplessness Theory (Seligman, 1975) in that there does not seem to be a parallel between helplessness and depression. This is however based on the assumption that those with uncontrolled epilepsy are helpless. The reformulated Learned Helplessness Theory (Abramson et al., 1978), however, does seem to account for this result. It appears, from this study, that those with uncontrolled epilepsy have a slightly more external Locus of Control however the reformulated Learned Helplessness Theory identifies that a combination of internal-stable-global attribution leads to a vulnerability to depression and, as a result, those with uncontrolled epilepsy do not fit the profile for vulnerability to depression.

This result does not seem to support the notion of Champion & Power (1995) that depression is a result of the loss of a valued social role however it may be that the role of an “epileptic” was not valued and therefore losing it was of no significant consequence.

There is little support for Beck’s (1987) model of depression however it could be that those with uncontrolled epilepsy do not have dysfunctional assumptions and

consequently negative automatic thoughts. I would find this surprising as most of the patients in the surgical group spoken to appeared to have low self-esteem and were critical of themselves. This is a point for further investigation.

#### **4.2.3 Locus of Control**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would have a significantly lower Locus of Control (a more internal Locus of Control) when compared to a comparative group who had not undergone surgery.

There was no significant difference in Locus of Control however the t-value (1.383) was approaching significance ( $P=0.179$ ). The surgical group had a Locus of Control mean of 10.15 whilst the non-surgical group had a more external Locus of Control with a mean of 11.86. Whilst these results should be considered with caution given the low numbers the change is in the direction hypothesised and it seems that having surgery may affect Locus of Control however not when you had surgery or how successful surgery was.

This again supports the suggestion by Hermann & Wyler (1989) that Locus of Control is acquired during a person's lifetime therefore changes may develop over a long period of time.

#### **4.2.4 Quality of Life**

It was hypothesised that those who had undergone temporal lobe surgery for epilepsy would have a significantly higher Quality of Life (on all variables) when compared to a comparative group who had not undergone surgery.

There was no significant difference found on any of the variables however the t-value for General Quality of Life (1.740) was approaching significance ( $P=0.094$ ) and the means indicate that those who had surgery may have a higher General Quality of Life. As this is a subjective measure it is possible that on the individual variables there was no reported difference but that generally those who had surgery felt they had a better General Quality of Life. In addition it may be that the Quality of Life measure used was not specific enough for epilepsy and that a more specific epilepsy Quality of Life measure may be more sensitive.

This result supports the findings of Crandall et al. (1975) and Crandall et al. (1987) who found no change in global psychosocial functioning following surgery however does not support the findings of Guldvog (1993), Kellett et al. (1997), Rose et al. (1996) and McLachlan et al. (1997) who reported an improved Quality of Life following surgery.

#### **4.2.5 Summary of Psychological Findings between Surgical and Non-Surgical Groups**

There were no significant differences on any of the variables measured between those who had surgery and those who had not. This is surprising given that 95% of

those who had surgery either have no seizures or have a significant reduction in seizure frequency. However a number of variables were approaching significance and it may be with increased power changes in psychological functioning become more evident.

### **4.3 Methodological Considerations**

One of the difficulties in making conclusions about the results of this study is the reduced power due to small numbers. This is an inherent problem in work where a major procedure, which requires investigation, is carried out on a limited number of patients. Power calculations suggest that twenty patients would have been need in each group to ensure that the null hypotheses were not being accepted when they should in fact be rejected. In addition, for some of the calculations there were notably unequal groups.

There were a number of practical difficulties in enlisting patients to take part in this study. As Ninewells Hospital in Dundee is a national centre for epilepsy surgery many of the patients lived as far a field as The Shetlands and London. Financial and time constraints meant that interviewing these patients was impractical, however, despite this some patients were visited as far north as Fraserburgh and as far south as Edinburgh. There was generally a poor return rate of questionnaires from the non-surgical group particularly those who were not on the waiting list for surgery. There could be a number of reasons for this. Those with uncontrolled epilepsy tend to lead more chaotic lives and many of the questionnaires were return "moved away". In addition it could be argued that they have no vested interest in returning the

questionnaires: the surgical group tended to be thankful for the surgery being a success and the group on the waiting list for surgery saw this assessment as part of the build up for surgery. A further factor is that there are currently a number of Quality of Life studies being conducted on epilepsy in Ninewells Hospital. Those who have had surgery and no longer have seizures are excluded from the study as they no longer are classed as “epileptic” however for the uncontrolled epilepsy group this could have potentially been their third set of questionnaires.

It could be argued that the non-surgical group was not comparable to the surgical group as there was always a reason that these patients did not have surgery although some of the group were on the waiting list. Given the small numbers for this group (n=7) mixing the waiting list group with the group who did not have surgery for other reasons could have had an effect. Ideally the control group would include only those who were on the waiting list, however, given the time constraints for this study and the fact that those who meet the criteria for surgery only wait for a short period of time before they undergo surgery it would have been difficult to enlist patients. In addition it could be argued that as the non-surgical group were sent their questionnaires, rather than completing them when the investigator was present as was the case for the surgical group, they were freer to reply more honestly which could have an effect on the results.

There were also methodological considerations for the two within surgical group comparisons: surgical outcome and before and after five years. Surgical outcome was self reported and based on average number of seizures following surgery. It may

be that patients over or under estimated number of seizures. In addition basing outcome on seizure frequency did not allow for any other problems that arose as a consequence of surgery, for example paralysis or eyesight deficits. This meant that in theory someone who was now wheelchair bound as a result of surgery but no longer had seizures would be in the good outcome group. Clearly taking account of other problems should be considered when assessing surgical outcome. Time post surgery is an important consideration when assessing for change following surgery. Given the broad range of years after surgery in this study (1-10) the mid point of five years was chosen as a cut off point. On reflection it would have been interesting to look at psychological functioning immediately after surgery or at least within six months, then a few years later followed by an assessment over five years later. This would have allowed investigations into any critical periods of change. Unfortunately time constraints and limited numbers did not permit this to be investigated. In addition the post operative cognitive assessment was done anything from one month after surgery to a year after surgery. Ideally this should have been conducted at approximately the same time.

There are three areas which were not investigated in this study but which may have a bearing on the results. Medical notes for all the patients were seen at some point during the study and it was noted that some of the patients, although only a few, of both the surgical and non-surgical groups were currently receiving psychological input from the Adult Mental Health Department in Dundee. This was not investigated in the study and may have an effect on responses to the HADS and the Quality of Life questionnaire. In addition all of patients in the non-surgical group



and some of the patients in the surgical group were on anti-epilepsy medication. This was not investigated in this study and may have had an effect on responses particularly the cognitive assessments. Finally, those who have died since surgery were not included in the demographic information and therefore suicide rates were not reported.

#### **4.4 Recommendations for Future Practice**

It is difficult given the methodological considerations discussed above to make any firm recommendations for future clinical practice however there does appear to be some scope for improvement. At present those who have had surgery are assessed twice: once immediately after surgery (although this can mean up to a year post-surgery) and once at a later stage (usually over a year later). This however is variable and some patients were seen two weeks following surgery then three months later. This study only looked at the assessments conducted immediately given the large variation of dates. The results of this study suggest that only one assessment is needed. Attention & concentration was the only variable which change significantly at follow-up therefore it may be more cost effective to assess patients once at a year post-surgery. This also reduces the effect of test re-test in the WAIS-R. This is clearly beneficial to both clinician and patient.

In addition it may be of benefit for patients to complete a HADS at the pre operative assessment. This would allow the clinician to assess whether the patient needs some short term counselling, from perhaps an epilepsy nurse, to help with anxiety management, discuss changes which may result from surgery and given general

information and support. This could be done in a group setting provided there were enough participants and could be extended to cover post-surgery. This should then be evaluated.

#### **4.5 Future Research**

There is plenty of scope for further research. Firstly a replication of this study but with higher numbers would be beneficial particularly since there were many results that were approaching significance. Quality of Life is complex and multidimensional concept and warrants a study in its own right. This would allow more time for a more qualitative investigation. Further research could also be conducted on delayed memory involving the separation of delayed visual and delayed verbal memory, particularly as research evidence is inconclusive in this area, and it would also be interesting to know if there is a relationship between cognitive functioning and psychological functioning in this client group. Further investigating the effects of family support, personality factors, satisfaction and expectancy of surgery and the relationship of self-esteem and helplessness for this client group would be of interest. Exploring the possibility of a critical period following surgery for anxiety and depression would also be fascinating and may well lead to recommendations for treatment after surgery. Clearly in the field of epilepsy surgery there is much to investigate.

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**APPENDIX 1 – HOSPITAL ANXIETY  
AND DEPRESSION SCALE**

# HAD Scale

Date: **APPENDIX 1**

Name:

Doctors are aware that emotions play an important part in most illnesses. If your doctor knows about these feelings he will be able to help you more.  
 This questionnaire is designed to help your doctor to know how you feel. Read each item and place a firm tick in the box opposite the reply which comes closest to how you have been feeling in the past week.  
 Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought-out response.

*Tick only one box in each section*

**I feel tense or 'wound up':**

- Most of the time .....
- A lot of the time .....
- Time to time, Occasionally .....
- Not at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I feel as if I am slowed down:**

- Nearly all the time .....
- Very often .....
- Sometimes .....
- Not at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I still enjoy the things I used to enjoy:**

- Definitely as much .....
- Not quite so much .....
- Only a little .....
- Hardly at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I get a sort of frightened feeling like 'butterflies' in the stomach:**

- Not at all .....
- Occasionally .....
- Quite often .....
- Very often .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I get a sort of frightened feeling as if something awful is about to happen:**

- Very definitely and quite badly .....
- Yes, but not too badly .....
- A little, but it doesn't worry me .....
- Not at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I have lost interest in my appearance:**

- Definitely .....
- I don't take so much care as I should.....
- I may not take quite as much care .....
- I take just as much care as ever .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I can laugh and see the funny side of things:**

- As much as I always could .....
- Not quite so much now .....
- Definitely not so much now .....
- Not at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I feel restless as if I have to be on the move:**

- Very much indeed .....
- Quite a lot .....
- Not very much .....
- Not at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**Worrying thoughts go through my mind:**

- A great deal of the time .....
- A lot of the time .....
- From time to time but not too often ...
- Only occasionally .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I look forward with enjoyment to things:**

- As much as ever I did .....
- Rather less than I used to .....
- Definitely less than I used to .....
- Hardly at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I feel cheerful:**

- Not at all .....
- Not often .....
- Sometimes .....
- Most of the time .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I get sudden feelings of panic:**

- Very often indeed .....
- Quite often .....
- Not very often .....
- Not at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I can sit at ease and feel relaxed:**

- Definitely .....
- Usually .....
- Not often .....
- Not at all .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

**I can enjoy a good book or radio or TV programme:**

- Often .....
- Sometimes .....
- Not often .....
- Very seldom .....

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

*Do not write below this line*

**APPENDIX 2 – ROTTER I-E SCALE (UK VERSION)**

Social Reaction Inventory

This is a questionnaire to find out the way in which certain important events affect different people. This is a measure of personal belief: obviously there are no right or wrong answers. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you're concerned, and put a ring around the appropriate letter, thus (a) or (b). Be sure to select the one you actually believe to be more true than the one you think you should choose or the one you would like to be true. Please put your age, sex and occupation in the spaces provided before completing it.

Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice. In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be the case as far as you're concerned. Also try to respond to each item independently when making your choice; do not be influenced by your previous choices.

REMEMBER – select that alternative which you personally believe to be more true.

AGE: \_\_\_\_\_ SEX: \_\_\_\_\_ OCCUPATION: \_\_\_\_\_

1. a. Children get into trouble because their parents punished them too much.  
b. The trouble with most children nowadays is that their parents are too easy with them.
2. a. Many of the unhappy things in people's lives are partly due to bad luck.  
b. People's misfortunes result from the mistakes they make.
3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.  
b. There will always be wars, no matter how hard people try to prevent them.
4. a. In the long run people get the respect they deserve in this world.  
b. Unfortunately, an individual's worth often passes unrecognised no matter how hard he tried.
5. a. Without the right breaks one cannot be an effective leader.  
b. Capable people who fail to become leaders have not taken advantage to their opportunities.
6. a. No matter how hard you try some people just don't like you.  
b. People who can't get others to like them don't understand how to get along with others.
7. a. Heredity plays the major role in determining one's personality.  
b. It is one's experience in life which determine what they're like.
8. a. I have often found that what is going to happen will happen.  
b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.
9. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.  
b. Getting a good job depends mainly on being in the right place at the right time.

I more strongly believe that:

10. a. The average citizen can have an influence in government decisions.  
b. This world is run by the few people in power, and there is not much the little guy can do about it.
11. a. When I make plans, I am almost certain that I can make them work.  
b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
12. a. There are certain good people who are just no good.  
b. There is some good in everybody.
13. a. In my case getting what I want has little or nothing to do with luck.  
b. Many times we might just as well decide what to do by flipping a coin.
14. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.  
b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.
15. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.  
b. By taking an active part in political and social affairs, the people can control world events.
16. a. Most people don't realise the extent to which their lives are controlled by accidental happenings.  
b. There is really no such thing as "luck".
17. a. One should always be willing to admit one's mistakes.  
b. It is usually best to cover up one's mistakes.
18. a. It is hard to know whether or not a person really likes you.  
b. How many friends you have depends upon how nice a person you are.
19. a. In the long run the bad things that happen to us are balanced by the good ones.  
b. Most misfortunes are the result of lack of ability, ignorance, laziness or all three.
20. a. With enough effort we can wipe out political corruption.  
b. It is difficult for people to have much control over the things politicians do in office.
21. a. A good leader expects people to decide for themselves what they should do.  
b. A good leader makes it clear to everybody what their jobs are.
22. a. Many times I feel that I have little influence over the things that happen to me.  
b. It is impossible for me to believe that chance or luck plays an important role in my life.
23. a. People are lonely because they don't try to be friendly.  
b. There's not much use in trying too hard to please people, if they like you, they like you.
24. a. What happens to me is my own doing.  
b. Sometimes I feel that I don't have enough control over the direction my life is taking.
25. a. Most of the time I can't understand why politicians behave the way they do.  
b. In the long run the people are responsible for bad government on a national as well as on a local level.

**APPENDIX 3 – WHOQOL-BREF**



# WHOQOL-BREF

Field Trial Version  
December 1996

PROGRAMME ON MENTAL HEALTH

WORLD HEALTH ORGANISATION

GENEVA

	Very poor	Poor	Neither poor nor good	Good	Very good
How would you rate your quality of life?	1	2	3	4	5

	Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
How satisfied are you with your health?	1	2	3	4	5

following questions ask about **how much** you have experienced certain things in the last two weeks.

	Not at all	A little	A moderate amount	Very much	An extreme amount
To what extent do you feel that (physical) pain prevents you from doing what you need to do?	1	2	3	4	5
How much do you need any medical treatment to function in your daily life?	1	2	3	4	5
How much do you enjoy life?	1	2	3	4	5
To what extent do you feel your life to be meaningful?	1	2	3	4	5

	Not at all	A little	A moderate amount	Very much	Extremely
How well are you able to concentrate?	1	2	3	4	5
How safe do you feel in your daily life?	1	2	3	4	5
How healthy is your physical environment?	1	2	3	4	5

Following questions ask about **how completely** you experience or were able to do certain things in the last two weeks.

	Not at all	A little	Moderately	Mostly	Completely
Do you have enough energy for everyday life?	1	2	3	4	5
Are you able to accept your bodily appearance?	1	2	3	4	5
Have you enough money to meet your needs?	1	2	3	4	5
How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
To what extent do you have the opportunity for leisure activities?	1	2	3	4	5

	Very poor	Poor	Neither poor nor good	Good	Very good
How well are you able to get around?	1	2	3	4	5



**APPENDIX 4 – LETTER TO SURGICAL GROUP**

## **APPENDIX 4 – LETTER TO SURGICAL GROUP**

TAYSIDE AREA CLINICAL PSYCHOLOGY DEPARTMENT

### **NEUROPSYCHOLOGY**

Our ref:

Enquiries to:

**Ninewells Hospital**  
**Dundee DD1 9SY**  
Tel. 01382 425612  
Fax 01382 496325

Dear

I am inviting you to take part in a study that we are carrying out at Ninewells Hospital to help us understand more about the long-term consequences of undergoing surgery for epilepsy. Your details were obtained from Dr R Roberts, Consultant Neurologist at Ninewells Hospital.

Involvement in the study would be for one session of approximately two hours and, should you agree, my colleague Fiona Summers would visit you at your home. You would be asked to complete a number of short questionnaires and a series of short paper and pencil tasks similar to the ones you completed shortly after your surgery.

Further details about the study are included in the information sheet I have enclosed for you to read. Should you agree to participate please complete the tear-off slip below, remembering your signature, and return this in the pre-paid envelope provided. Fiona will then telephone you to arrange a suitable time to visit you.

Thank you very much.

Yours sincerely

Dr June Gilchrist  
Consultant Neuropsychologist

✂ -----

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Tel No: \_\_\_\_\_

I would be interested in participating in this research and I have no objection to being contacted by telephone to arrange a home visit.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

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**APPENDIX 5 – LETTER TO NON-SURGICAL GROUP**

APPENDIX 5 – LETTER TO NON-SURGICAL GROUP

TAYSIDE AREA CLINICAL PSYCHOLOGY DEPARTMENT

**NEUROPSYCHOLOGY**

Our ref:

Enquiries to:

**Ninewells Hospital**  
**Dundee DD1 9SY**  
Tel. 01382 425612  
Fax 01382 496325

Dear

I am inviting you to take part in a study that we are carrying out at Ninewells Hospital to help us understand more about the long-term effects of epilepsy. Your details were given to me by Dr R Roberts, Consultant Neurologist at Ninewells Hospital.

Involvement in the study would be for approximately fifteen minutes and involves you completing the three questionnaires enclosed.

Further details about the study are included in the information sheet I have enclosed for you to read. Should you agree to participate please complete the questionnaires and consent form and return them in the pre-paid envelope provided.

Thank you very much.

Yours sincerely

Dr June Gilchrist  
Consultant Neuropsychologist

**APPENDIX 6 – INFORMATION SHEET FOR  
PARTICIPANTS (SURGICAL PATIENTS)**

**INFORMATION SHEET FOR PARTICIPANTS (Surgical Patients)**

**Changes in Quality of Life, Psychological Functioning and Cognitive Functioning after Surgical Intervention for Temporal Lobe Epilepsy**

We invite you to participate in a research project. We believe it to be of potential importance. However, before you decide whether or not you wish to participate, we need to be sure that you understand firstly why we are doing it, and secondly what it would involve if you agreed. We are therefore providing you with the following information. Read it carefully and be sure to ask any questions you have, and, if you want, discuss it with outsiders. If you do have any further questions or would like more information please do not hesitate to contact either Fiona Summers or Dr June Gilchrist at the Clinical Psychology Department, Ninewells Hospital (Tel 01382 660111).

**The Study**

As someone who has undergone epilepsy surgery you have been chosen as a possible participant in this study. The aim of the study is to gain a greater understanding of the effects on patients who have had surgical intervention for their epilepsy by comparing them with a group who have not had surgical intervention. It is hoped that any results from the research will help us have a greater understanding of the needs of patients from both of these groups which should improve the quality of our service. We are hoping to have approximately forty participants in the study.

**What you would be asked to do**

Participating in the study would involve you completing a number of short questionnaires about any current difficulties you have and how happy you are with your life. In addition you will be asked to complete a series of short paper and pencils tasks which are designed to assess your memory and other mental processes such as your attention. In total this will take approximately two hours. It is hoped that I will be able carry out these tests in your own home thereby saving you having to travel to Ninewells Hospital. All information given to me will be treated as confidential and will be password protected. If your responses indicate that you seem significantly distressed by your current situation this will be discussed with you and

you may wish me to inform your General Practitioner. Your General Practitioner will only be contacted with your permission.

Participation in this study is entirely voluntary and you are free to refuse to take part or to withdraw from the study at any time without having to give a reason and without this affecting your future medical care or your relationship with medical staff looking after you.

The Tayside Committee on Medical Research Ethics that has responsibility for scrutinising all proposals for medical research on humans in Tayside has examined the proposal and has raised no objections from the point of view of medical ethics. Your research records may be examined by monitors from the Tayside Medical Research Ethics Committee.

**APPENDIX 7 – INFORMATION SHEET FOR  
PARTICIPANTS (NON-SURGICAL PATIENTS)**



**INFORMATION SHEET FOR PARTICIPANTS (Non-surgical patients)**

**Changes in Quality of Life, Psychological Functioning and Cognitive Functioning after Surgical Intervention for Temporal Lobe Epilepsy**

We invite you to participate in a research project. We believe it to be of potential importance. However, before you decide whether or not you wish to participate, we need to be sure that you understand firstly why we are doing it, and secondly what it would involve if you agreed. We are therefore providing you with the following information. Read it carefully and be sure to ask any questions you have, and, if you want, discuss it with outsiders. If you do have any further questions or would like more information please do not hesitate to contact either Fiona Summers or Dr June Gilchrist at the Clinical Psychology Department, Ninewells Hospital (Tel 01382 660111).

**The Study**

As someone who has suffered from epilepsy for some time you have been chosen as a possible participant in this study. The aim of the study is to gain a greater understanding of the effects on patients who have had surgical intervention for their epilepsy by comparing them with a group who have not had surgical intervention. It is hoped that any results from the research will help us have a greater understanding of the needs of patients from both of these groups which should improve the quality of our service. We are hoping to have approximately forty participants in the study.

**What you would be asked to do**

Participating in the study would involve you completing a number of short questionnaires about any current difficulties you have and how happy you are with your life. In total this will take approximately fifteen minutes. All information given to me will be treated as confidential and will be password protected. If your responses indicate that you seem significantly distressed by your current situation this will be discussed with you and you may wish me to inform your General Practitioner. Your General Practitioner will only be contacted with your permission.

Participation in this study is entirely voluntary and you are free to refuse to take part or to withdraw from the study at any time without having to give a reason and without this affecting your future medical care or your relationship with medical staff looking after you.

The Tayside Committee on Medical Research Ethics that has responsibility for scrutinising all proposals for medical research on humans in Tayside has examined the proposal and has raised no objections from the point of view of medical ethics. Your research records may be examined by monitors from the Tayside Medical Research Ethics Committee.