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Visual Memory in Post-Anterior Right Temporal Lobectomy Patients and Adult Normative Data for the Brown Location Test (BLT)

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Abstract

Several large and meta-analytic studies have failed to support a consistent relationship between visual or “nonverbal” memory deficits and right mesial temporal lobe changes. However, the Brown Location Test (BLT) is a recently developed dot location learning and memory test that uses a nonsymmetrical array and provides control over many of the confounding variables (e.g., verbal influence and drawing requirements) inherent in other measures of visual memory. In the present investigation, we evaluated the clinical utility of the BLT in patients who had undergone left or right anterior mesial temporal lobectomies. We also provide adult normative data of 298 healthy adults in order to provide standardized scores. Results revealed significantly worse performance on the BLT in the right as compared to left lobectomy group and the healthy adult normative sample. The present findings support a role for the right anterior-mesial temporal lobe in dot location learning and memory.

Keywords

spatial; visuospatial; lateralization; memory; location; epilepsy

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1. Introduction

Epilepsy teams often use neuropsychological testing to determine lateralizing and localizing information, monitor pre-post surgical changes, and provide information to the patient regarding their areas of difficulties. This is particularly helpful among patients with medically refractory mesial temporal lobe epilepsy who may benefit from surgery, but the provider and patient would like to understand how it may affect their cognition.

When it comes to left mesial temporal lobe epilepsy, neuropsychologists can typically feel relatively confident making localizing inferences that impaired verbal memory performance is usually related to the dominant (usually left) mesial temporal lobe. This is supported by a considerable body of research has demonstrated generally good sensitivity of verbal memory tests, such as the CVLT-II [1,2], that localize to the dominant mesial temporal lobe.

On the other hand, there is typically less certainty when drawing conclusions about the association with visual memory and the right mesial temporal lobe. While some early studies [3,4] suggested a relationship between visual memory and abnormality of the right mesial temporal lobe, this association has not been consistently replicated. Indeed, large scale and meta-analytic studies have not observed a convincing relationship between right mesial temporal lobe pathology (including hippocampus resection and/or sclerosis) and commonly used visual memory tests [5–9] such as the Visual Reproduction Test from the Wechsler Memory Scale [10], the Rey–Osterrieth Complex Figure Test [11], or the Brief Visualspatial Memory Test - Revised (BVMT-R) [6,12]. Nonetheless, studies using in-vivo or experimental measures have commonly reported navigational and other spatial memory deficits in patients with right hippocampus lesions or dysfunction [13–16]. These types of measures (e.g., room sized maze or virtual reality systems) are not, however, convenient or cost effective at this time to permit routine use in clinical settings.

There are several commonly cited reasons for the lack of consistent association with the right mesial temporal lobe and visual memory tests. Many tests of visual memory rely on drawing ability which may be problematic for some patients [17]. Visual memory tests are also frequently amenable to the application of verbal encoding strategies [18,19], and demonstrate shared variance with verbal measures [10,17,20]. Furthermore, several functional magnetic resonance imaging (fMRI) studies have shown bilateral mesial temporal lobe activation during visual memory tasks, using stimuli very similar to those on clinical measures [18,21,22]. Other tests seem to have a limited range of scores such as those using only recognition formats [23], or tests which have a ceiling effect that may be due to the nature of the stimuli [24].

There are several characteristics that may be relevant to improving the sensitivity of visual memory tests to right mesial temporal lobe abnormalities. Meta-analyses suggests that dots or locations for other identical stimuli may be preferable for lateralization studies [7,25]. Though tests that require memory for both line drawing designs and locations simultaneously may be less lateralizing due to a binding effect, in which more regions of the brain are recruited for integrating more complex stimuli [7,25,26]. Functional MRI studies have found that abstract patterns were most strongly associated with right medial temporal lobe activation, with more bilateral, less right-sided activation for faces, followed by scenes, and more left sided activation for words. Though not an emphasized for the fMRI studies, it is further notable that the abstract patterns in these studies were unlike most clinical and research stimuli in that they were irregular, were not symmetrical patterns that did not use any line drawings and were clearly not related to any namable objects[18,21].

Considering the above, researchers [27] integrated the use of dot locations with an asymmetrical pattern that did not use any line drawings into a new test of visual learning and memory called the Brown Location Test (BLT). It involves the learning and recall of 12 dot

locations presented in a static asymmetrical random array of 56 circles. The test was designed to be comparable to a commonly used word list learning measure (e.g., CVLT-II)[1] with five learning trials, an interference trial, short and long delay trials, and a yes/no recognition trial. The BLT has demonstrated good psychometric properties including internal consistency and reliability of alternate forms (version A and B) [27]. A factor analysis that included BLT Form A and CVLT-II scores for a sample of healthy adults indicated the BLT subtests rested on a unitary factor that was distinct from the CVLT-II. This article compares the performance of right and left anterior temporal lobectomy patients on the BLT Form A by using age-adjusted z-scores derived from the normative data of 298 healthy adults.

2. Methods

2.1 Participants

All participants gave their written informed consent after the study was approved by the human subjects use committees and/or institutional ethics review boards at each relevant university. There were two groups of participants: healthy controls for the normative data and temporal lobe epilepsy participants for the validity data.

2.1.1. Healthy Controls—A total of 298 individuals (95 males, 203 females) from 17 to 88 years old (Mean Age = 40.16, SD = 19.19) participated in the normative sample. They were recruited from Connecticut (55.7%), Louisiana (20.8%), North Dakota (9.1%), New Hampshire (7.7%), Vermont (2.7%), and Minnesota (2.0%) with additional participants (less than 1%) from Massachusetts, New York, Virginia, and California. Ethnicity of the sample included African American (7.7%), Non-hispanic White (88.9%), Hispanic (1.7%), Asian American (1.3%), and Native American (0.3%).

Participants were only included as healthy controls who did not report any current psychiatric, or a neurological disorder at any point during their life. Healthy controls were recruited by researchers at several universities in the United States (locations in the South, Midwest, and New England). Healthy controls were recruited at public locations in multiple medical centers, employee and organization newsletters, postings at a variety of grocery stores, and through university psychology departments to students, staff, and family members. All healthy control participants either received a small stipend (\$15.00) for those from the general population, or extra credit from their teachers in the case of students. There were about twice as many females than males in this study, despite various attempts to recruit more numbers of males. This normative sample also included 110 individuals from the original standardization sample [27].

2.1.2. Temporal Lobectomy Patients—Eighteen right handed adults (age: $M=47.5$, $SD=10$; gender: 8 males, 10 females) who had undergone unilateral anteriomesial temporal lobe resection (9 right with 5 males and 4 females; 9 left with 3 males and 6 females) within the past 1 to 10 years participated in the study. This was out of a sample of about 100 patients who were contacted via a letter and met inclusions criteria based on available medical history. Out of those patients, only 48 patients responded. Nine reported having had poor seizure control (at least one seizure in the past month) and were excluded. Two had moved out of the area and were unable to return for testing. Nine had significant depression to the point that it significantly interfered with their life, including such symptoms as suicidal ideation, suicidal attempts, multiple hospitalizations, and other significant problems. All of the patients were residents of Connecticut.

All operations were completed at Yale New Haven Hospital by the same neurosurgeon which included an approximate 3.5 cm resection sparing the superior temporal gyrus from the tip of the temporal lobe, followed by removal of the hippocampus and about 95% of the amygdala.

Only one of the patients postoperatively was tapered off antiepileptic medication with that person having undergone a right temporal lobectomy (RTL). The majority of patients (15) were taking only one antiepileptic drug (AED) with the most common being carbamazepine (8 left; 6 right). Six patients were taking other AEDs. Among left temporal lobectomy (LTL) patients; two were taking phenytoin, and two were taking clonazepam. Among RTL patients, one was taking lamotrigine, and one was taking levetiracetam.

The average time since surgery was approximately 6 years ($M=6.833$, $SD=3.01$) without any significant differences between the left and right side ($M_{diff}=0.1$ year, $SE_{diff}=1.46$). The inclusion criteria were patients who were right handed, at least 18 years of age at the time of resection, histology supported mesial temporal sclerosis, and sodium amobarbital evaluation indicating left hemisphere language dominance, complete seizure control within the past six months, and a Full Scale IQ over 85. The cut-off score of 85 was used to limit differences among memory test scores that might have been related more to limited intellectual functioning rather than a specific memory problem. Exclusion criteria included a history other neurological illness other than a seizure disorder, significant psychiatric difficulties (beyond mild depression and/or anxiety), traumatic brain injury with loss of consciousness greater than one hour, history of radiation therapy, and English not being the native language.

2.2.1. Procedures for Healthy Controls

Healthy controls were collected from a variety of ongoing studies. For consistency, however, the BLT Form A was always the first cognitive test administered after completion of informed consent, and screening for medical and psychiatric difficulties. The BLT consists of five learning trials where the participant is shown 12 individually presented red dot locations on a field of 56 non-symmetrically placed circles. A simplified example is presented in Figure 1 to protect stimuli copyright security, with the actual stimuli available directly from the first author. The order of dot locations is the same for each learning trial; however, participants are not required to recall the locations in the presented order. Participants indicate the dot location with a red, checker-like chip. Following the five red dot learning trials, participants are presented with black dots in different locations on a circle array and asked to indicate these locations with black checker-like chips. The black dot locations serve as an interference trial. After the interference trial, participants are immediately asked to again indicate the red dot locations, and then again asked to indicate the locations 20 minutes later. Following this, the circle array is rotated 90 degrees clockwise and the participant is asked about the dot locations. The test concludes with a recognition trial where they simply indicate whether a dot was located in the same spot during the learning trial. The 20 minute delay was filled with questionnaires.

All participants also completed estimates of overall intelligence that included the Matrix Reasoning and Vocabulary from the Wechsler Abbreviated Scale of Intelligence (WASI) [29] or Wechsler Adult Intelligence Scale, Third Edition [23]. These two subtests were chosen because they are most strongly associated with overall intellectual functioning. Both test forms are as strongly correlated with each other as they are within the test-retest reliability [29]. In the Vocabulary test, participants are simply asked to orally define words. The Matrix Reasoning subtest requires participants to identify a missing piece of a design. Since the healthy participants were part of multiple studies, the other tests they were administered are not discussed in this section. Nor are they considered to affect BLT performance since they were all administered after the BLT was completed. All tests were directly administered by a neuropsychologist, trained psychometrician, or university student that was trained and supervised by a neuropsychologist.

2.2.2. Procedures for Clinical Sample

Patients who met the above described inclusion criteria were contacted for recruitment via a letter after the study was approved by the Yale University Human Subjects Use Committee. Prior to scheduling, seizure control was confirmed via a phone call and brief record review. All participants had previously been seen in our Neuropsychology Section and were familiar with the facility. After completing informed consent on the day of testing, participants were administered the learning and short delay trials BLT Form A. This was followed by a 20 minute delay during which participants completed questionnaires about information not used in the present study after which the delayed subtests of the BLT Form A were administered. Next, the Vocabulary and Matrix Reasoning subtests from the WASI (described above) were administered. It typically took 75 minutes to complete these tests. All of the neuropsychological tests were administered by a neuropsychologist, technician, or student who was trained and supervised by a neuropsychologist in all the testing procedures.

3. Results

3.1. Normative Data Sample

The average education of participants was 14 years ($SD = 2.13$) ranging from 11 year to 22 years of education. Participants in the normative sample had high average intellectual functioning ($M=114.25$, $SD = 11.0$). Similar to many well-established memory tests [1,28, 30], a linear regression analysis showed decreased performance with age for all the BLT variables; including Trials 1 – 5 ($r = .49$, $p < .001$), Short Delay Recall ($r = .47$, $p < .001$), Long Delay Recall ($r = .47$, $p < .001$), Rotated Long Delay Recall ($r = .40$, $p < .001$), and Recognition Total ($r = .47$, $p < .001$). Due to the strong effects of age, the normative data for the BLT were separated according to age groups (17 – 29, 30 – 39, 40–49, 50 – 59, 60–69, and 70 – 88). While most of these groups approximated decade groups, a combined 70 – 88 year old group was developed due to the limited sample size within this age range. The appropriateness of these age groups was confirmed by the lack of significant decline on BLT scores within each group using linear regression. This included the BLT performance for individuals in the 70 – 88 year old groups, which indicates that separate means for these two decade groups was not needed. The age related normative data are presented in Table 1.

Linear regression analysis did not reveal any significant relationships between education level or IQ and BLT performance on any subtest score. There were no significant differences according to gender on the BLT total learning trials 1 – 5, short delay, long delay, rotated long delay, or recognition trials. The assumption of a normal distribution was examined with a box plot analysis (available from the first author), which is a graph that showed the majority of scores were around the mean with a relatively equal distribution on either side. This indicated that all groups under 60 had a normal distribution of scores. However, the elderly groups tended to have a positively skewed distribution with most participants scoring in the lower range. In other words, elderly individuals found the test much more difficult and had significantly lower scores than the other groups.

3.2. Clinical Sample Results

3.2.1 Education and IQ—The mean education for the clinical sample was 13.11 years ($SD = 3.28$). Estimated [29] intellectual functioning was within the average range ($M = 105.39$, $SD = 18.61$), although a one-way ANOVA indicated the left side resection group had a significantly ($F(1,16)=16.83$, $p = .001$, partial $\eta^2 = .51$) lower estimated FSIQ ($M=92.44$, $SD=9.7$) than those with a right side resection ($M=118.33$, $SD=16.26$). This was apparently due to greater difficulties with verbal than visual skills in the left resection group with a one-way ANOVA indicating the left resection group had significantly ($F(1,16)=16.04$, $p = .001$, partial $\eta^2 = .50$) lower age adjusted T-scores for Vocabulary ($M=36.89$, $SD=11.3$) than the right

sided surgical group ($M=58.67$, $SD=11.75$). There were no significant differences on Matrix Reasoning for side of surgery. In other words, the estimated IQ is formed from the combination of the Vocabulary and Matrix Reasoning subtests. As a result, the overall IQ was lowered for the LTL group because of the significantly lower Vocabulary score; whereas the RTL group performed equally well for both the Vocabulary and Matrix Reasoning subtests thereby not lowering the overall IQ.

3.2.2 BLT Performance—A multivariate analysis of variance (MANOVA) was conducted with the side of surgery as the independent variable and BLT subtest scores as the dependent variables. The results indicated that right sided surgery was associated with lower scores on BLT Trials 1 – 5 ($F(1,16) = 12.14$, $P = .003$ partial $\eta^2 = .431$), Short Delay ($F(1,16) = 5.83$, $P = .028$, partial $\eta^2 = .267$), Long Delay ($F(1,16)=5.26$, $P = .036$, partial $\eta^2 = .247$), and Rotated Long Delay ($F(1,16)=5.76$, $P=.029$, partial $\eta^2 = .265$). There were no significant differences for the interference or recognition scores. Descriptive statistics can be found in Table 2. Regarding distribution, 8 cases from the RTL group was more than 1.5 SD below the mean, while only two LTL cases were lower than 1.5 SD below the mean. To give more information about the score distribution for BLT Trials 1 – 5 which had the strongest effect size, frequency bar graphs can be found on Figure 2.

4. Discussion

4.1 Normative Sample Discussion

The first goal of this article was to present normative data for the Brown Location Test, a new test of visual location memory. We collected such data on 298 healthy adults. Though this is a limited sample size when compared to the normative data released by test publishing companies, it is certainly as strong as many of the normative data samples used by neuropsychologists on a daily basis[31]. Regardless, it does allow the use of the BLT Form A in a clinical sample, keeping in mind some of the limitations given this size and reduced sensitivity among individuals over 60 years of age.

First, like many normative samples, we lacked data from individuals with less than 12 years of education. On a similar note, the normative sample for the BLT used individuals whose intellectual functioning was typically within the high average range. However, again there was no relationship between IQ and BLT performance which may make this less of an issue, although the lack of lower education and intellectual functioning individuals may have contributed to a restricted range. However, it is also worth acknowledging that memory for dot location may also be tapping into a novel ability that may be more related to experience than education, since there are few educational domains with a emphasis on memory for dot locations. For example spatial navigation associated with Taxi Drivers [32] may be related to volume changes in the hippocampus based on experience, and not associated with IQ or educational background.

While of limited educational variety, there was data collected from several different geographic regions including the Southern, Northeastern, Midwestern United States, and a small contingency from the Western United States. Thus, this sample does provide a good geographical representation for those individuals who have a high school education or higher. Approximately 88% of the sample was white and non-hispanic which somewhat under-represents minority populations. This would suggest the need to collect more data on non-white participants, and also to determine whether the scores are affected by such differences.

As can be seen on Table 1, the means and standard deviations on the learning trials (1 through 5) suggest a steady improvement in memory for locations over the learning trials, indicating that participants benefited from repeated exposure. However, subjects over the age of 60

appeared to demonstrate a less steep learning slope which is consistent with the regression examining age with BLT performance. There was also a positively skewed distribution for those over 60. This was particularly true for the recognition subtest where older individuals would be able to score at the chance level and still be within the “low average” range.

This, along with the significant effects of age on all the scores, suggests that memory capacity for visual location of dots decreases with age. This is not surprising since performance decreases with age for most (if not all) published memory tests [1,28]. This pattern also, however, suggests that perhaps a less difficult version, or possibly a version with larger circles and dots, should be developed for those over 60. Another option may be to adjust standardized scores for a non-normal distribution. Regardless, the normative data and distribution for those under the age of 60 was rather strong and supports the ability of clinicians to compare patient to the normative sample.

4.2 Clinical Sample Discussion

First, it is important to acknowledge that this is a small sample size. However, the primary purpose was to provide preliminary information about the clinical validity of the BLT to determine whether it is worth studying more extensively among epilepsy populations. From this perspective, the current study has provided some strong preliminary evidence that the BLT may be an excellent addition to epilepsy test batteries and warrants further study.

Specifically, individuals whose surgical resection included the right hippocampus had significantly lower scores than those with left sided surgery for all the BLT scores except the interference and recognition trials. As can be seen on Table 2, the LTL group's Z scores were a bit weaker than the normative sample with most of the scores in what many consider to be the low average range (e.g. $Z = -.6$ through -1.3) while most (all but 1) of the right RTL group scores were more than 1.5 standard deviations below the mean ($Z < -1.5$) which is often considered borderline to impaired according to commonly accepted normative descriptors [31]. Though this does suggest both groups performed below the mean, the magnitude of difference was much greater for the RTL than the LTL group. Thus, there were some moderate clinically relevant differences, in addition to statistically significant differences. Though it is certainly important to conduct much larger and multiple studies before viewing BLT performance with the same degree of confidence with which we view the relationship between verbal memory and left mesial temporal lobe function, the current findings are promising.

The lack of significant differences for the recognition subtest is not particularly surprising since this subtest had the weakest reliability during the initial standardization sample [27]. In addition, there is more of a restricted range for the recognition subtest as discussed in the normative sample section. Furthermore, there may be a non-memory visual discrimination component to that subtest which complicates interpretation. We have considered eliminating the recognition trial, but decided this may still hold some relevance for specific clinical populations. Regardless, these results would suggest that the total for trials 1 through 5, the short and long free recall delays may be useful for identifying problems and predicting cognitive changes in individuals with right mesial temporal lobe abnormalities.

While there were differences in IQ test scores between the right and left surgical groups, this may actually make the BLT findings stronger. Specifically, the right sided group had significantly higher IQs, and Vocabulary scores, yet still scored significantly lower on the BLT. Not only does this lend credence to the possibility that the BLT is not strongly associated with IQ, but it also provides some evidence that the BLT is not associated verbal abilities, which has been one of the limitations in some of the more popular visual memory tests. [10,17,20].

Though it may have been useful to add IQ as a co-variance in the MANOVA, this would weaken the statistical strength of the analysis by removing a degree of freedom in an already limited sample size. Such an analysis was not strongly supported by the standardization sample, which did not find a relationship with IQ and BLT performance. Both the normative sample and clinical sample also had a restricted range of IQ which would reduce the likelihood of this analysis adding any meaningful data. In making this statement, it is also, however important to acknowledge that quite a number of individuals with epilepsy may have IQ scores below those included in this sample. Thus, larger studies that include those with lower scores on intellectual functioning measures are certainly indicated.

As indicated by the above, the rather strict inclusion and exclusion criteria of the clinical sample are both strengths and limitations of this study. Specifically, we sought to have a group of surgical patients who were as similar as possible to reduce the potential for confounding variables. Thus, these findings do suggest that lower scores will likely occur among individuals with sclerosis of the right hippocampus, and who have undergone RTL resection. Though further studies are needed in this area, this would help us to explain the possible consequences of surgery upon cognitive functioning. There have already been several clinical cases at Yale where post RTL patients with persistent memory complaints had previously passed all memory tests, while they did poorly on the BLT. This information was successfully used to help then develop compensatory strategies for visual memory difficulties at home and work. Though limited in number, these experiences do suggest the need to better understand the effects of anterior RTL resections and that such information may help patients compensate for their expected difficulties.

On the other hand these results do not provide information about how accurate the BLT would be at differentiating right from left mesial temporal lobe epilepsy prior to surgery, nor do the results indicate how function changes with surgery. Thus, a future study should clearly include pre and post surgical right and left mesial temporal lobe epilepsy patients. Indeed, the BLT is currently being included in all pre and post adult epilepsy cases in the Yale Neuropsychology Section, but the heterogeneity of such cases would naturally require a larger sample size than in the current study. Such a study will help us better understand whether this test may provide additional clinical evidence for localization of seizure onset, help patients better understand the potential risks in anterior mesial temporal lobectomies, and thereby provide additional information for informed choices.

4.3 Conclusions

In summary, these results suggest that the BLT does differentiate the cognitive effects associated with right versus left mesial temporal lobe resection. In addition to providing some clinical support for this test, this article also provides normative data for adults which can further promote its clinical use. The use of Z scores in the current study further suggests that there is a clinically relevant difference between right and left TL resection groups, in addition to the statistical differences between these groups. Though, additional studies are warranted that include both pre and post surgical data using larger sample sizes, this is a solid first step at exploring the efficacy of a test that measures memory for locations in a new manner.

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Fig. 1.
Simplified Example of the Circle Array with a Dot Location

Figure 2.
Frequency Graphs of Z Scores for Side of Surgery

Table 1

BLT Normative Data, 17 – 88 Years

Age Range	17 – 29 (N = 118)		30 – 39 (N = 29)		40 – 49 (N = 40)	
BLT Subtest	M	(SD)	M	(SD)	M	(SD)
Trial 1	5.24	(2.14)	4.28	(1.98)	4.35	(1.98)
Trial 2	7.03	(2.26)	6.34	(2.13)	5.98	(2.44)
Trial 3	8.47	(2.46)	7.55	(2.37)	7.03	(2.50)
Trial 4	9.68	(2.14)	9.00	(2.25)	7.88	(2.56)
Trial 5	10.51	(1.65)	9.90	(2.09)	9.13	(2.78)
Trials 1 – 5	40.90	(8.55)	37.07	(8.33)	34.35	(10.38)
Interference Trial	5.46	(2.17)	4.76	(1.68)	3.70	(1.80)
Short Delay	9.35	(2.39)	8.41	(2.98)	7.68	(2.52)
Long Delay	9.38	(2.32)	8.17	(2.83)	7.80	(2.48)
Rotated Long Delay	8.31	(2.60)	7.38	(2.94)	6.48	(3.20)
Recognition Total	19.43	(3.08)	18.69	(3.60)	17.78	(3.25)
Age Range	50 – 59 (N = 48)		60 – 69 (N = 33)		70 – 88 (N = 30)	
BLT Subtest	M	(SD)	M	(SD)	M	(SD)
Trial 1	4.25	(1.45)	4.48	(1.72)	3.59	(1.37)
Trial 2	5.92	(2.40)	5.39	(1.85)	4.74	(1.81)
Trial 3	6.69	(2.08)	6.91	(2.02)	4.93	(1.94)
Trial 4	7.88	(2.24)	7.18	(2.28)	6.19	(1.71)
Trial 5	8.58	(2.43)	7.97	(2.23)	6.59	(2.31)
Trials 1 – 5	33.33	(8.26)	31.94	(7.87)	26.04	(6.79)
Interference Trial	4.00	(1.94)	3.76	(1.52)	3.37	(1.62)
Short Delay	7.48	(2.50)	6.97	(1.88)	5.26	(2.46)
Long Delay	7.50	(2.58)	6.58	(1.85)	5.67	(2.24)
Rotated Long Delay	6.56	(2.62)	5.91	(1.89)	4.74	(1.58)
Recognition Total	17.36	(2.82)	16.18	(2.49)	14.12	(2.98)

Table 3

BLT Z-Scores for Side of Surgery

Side of Surgery	LTLE		RTLE		P Sig.
BLT Subtest	Mean	(SD)	Mean	(SD)	
Trials 1 – 5	–1.09	(.46)	–1.69	(.24)	.003
Interference Trial	–.26	(1.36)	–.87	(1.12)	.312
Short Delay	–1.19	(.36)	–1.63	(.41)	.028
Long Delay	–1.11	(.70)	–1.70	(.31)	.036
Rotated Delay	–.81	(.70)	–1.49	(.47)	.029
Recognition Total	–.80	(.57)	–1.14	(.77)	.298