INTRODUCTION

This symposium has already focused on recent experimental data directed toward the understanding of the differential effects of electrode placement upon both therapeutic response and adverse cognitive effects with electroconvulsive therapy (ECT). In addition, there is also a possibility that some patients might respond better to the combination of more intense seizures and denser organic interictal changes produced by bilateral stimulation. It is also clear that unilateral nondominant (UL) ECT is roughly as effective as bilateral (BL) ECT in producing a remission in severely depressed patients. At the same time, it must be pointed out that unilateral ECT (UL) is not only the better procedure but also appears to induce a milder cognitive disruption than bilateral ECT. In addition, we have yet to hear a number of other expositions on this subject. The following presentation and discussion of experimental data directed toward an understanding of the differential effects of electrode placement further support these considerations.

Effects of Stimulus Parameters on Cognitive Side Effects

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as long as the duration of the basic stimulus waveform unit does not become too abbreviated, a reasonable degree of therapeutic equivalence appears to exist among the various waveform morphologies. Over the years, a number of attempts have been made to alter the waveform in order to improve clinical efficacy. 

Later investigators reported mixed findings, with some claiming less impairment still, there has been a notable absence of studies focusing upon differences in these effects simultaneously. Valentine et al. observed an apparent additive effect of induced seizure, and these effects were also investigated in the development of acute and long-term effects of both electrode placement and stimulus waveform on adverse cerebral changes with ECT, are presented elsewhere in this volume. 

No differences on the basis of electrode placement or stimulus waveform were found for age in 12.5, years of education in 11.0, or socioeconomic status. No BL vs. UL or S vs. P differences were found on the basis of history of previous ECT, 30%, history of drug nonresponse during the present episode 50%, or in 4.9. UL subjects had somewhat lower IQs, 86 vs. 96, p<0.01. No BL vs. UL or S vs. P differences were found on the basis of depression score, HDRS, 32, the Brief Psychiatric Rating Scale, BPRS, 28, the Zung Self-Rating Depression Scale, SDS, 29, and a retrospective four-point global rating based on the Depression Rating Scale (BPRS). The Brief Psychiatric Rating Scale (BPRS), the Hamilton Depression Rating Scale (HDRS), the Zung Self-Rating Depression Scale (SDS), and the Hamilton Depressive Rating Scale (HDRS) were used. 

Measure of stimulus intensity showed highly significant intergroup differences with respect to stimulus waveform, p<0.001, with sine-wave stimuli associated with 2.6 times the stimulus energy Joules, 3.1 times the applied charge coulombs, and 6.9 times the mean current coulombs per second as that associated with pulse stimuli. This difference in stimulus energy is similar to that reported elsewhere. 

METHODS 

No interventions included drug treatment or electroconvulsive therapy (ECT) treatment. All experimental subjects were randomly assigned to either bilateral or unilateral nondominant electrode placement and to either sine-wave or brief-pulse stimuli. A widely used protocol called the "ECTA protocol" was chosen for the unilateral placement, in order to maximize efficiency of seizure induction. 

The experimental group consisted of 80 subjects with the following demographic characteristics: 28% of subjects received bilateral ECT (BL), 25% received unilateral ECT (UL), 28% received bilateral ECT (UL), and 25% received unilateral ECT (UL). The control group consisted of 80 subjects with the following demographic characteristics: 28% of subjects received bilateral ECT (BL), 25% received unilateral ECT (UL), 28% received bilateral ECT (UL), and 25% received unilateral ECT (UL). The control group consisted of 80 subjects with the following demographic characteristics: 28% of subjects received bilateral ECT (BL), 25% received unilateral ECT (UL), 28% received bilateral ECT (UL), and 25% received unilateral ECT (UL). The control group consisted of 80 subjects with the following demographic characteristics: 28% of subjects received bilateral ECT (BL), 25% received unilateral ECT (UL), 28% received bilateral ECT (UL), and 25% received unilateral ECT (UL). 

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All groups, including controls, were equivalent with regard to baseline HDRS score = 23.1, based on 17-item scale and degree of acute improvement. The complex figure reproduction task was quite sensitive in separating S from P and BL from SBL. The percentage of items not recalled at baseline was 0.0001, but was relatively insensitive in separating UL from BL and P from BL. As in all cases described above, suggesting that the results regarding acute effects are in fact valid. Use of baseline HDRS and IQ scores as covariates affected only the famous faces recognition task. ANOVAs and multiple regression analysis were performed to evaluate the role of guessing at the time of pre-ECT testing, the demographic and clinical characteristics of the sample, and the effects of ECT on memory function. A careful focus upon this difficult area of memory function was maintained throughout the study.

**Acute Memory Impairment Two to Three Days Post-ECT vs. Baseline**

<table>
<thead>
<tr>
<th>Measure</th>
<th>BL&gt;UL</th>
<th>BL&gt;C</th>
<th>UL&gt;C</th>
<th>S&gt;P</th>
<th>S&gt;C</th>
<th>P&gt;C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global self-rating of memory</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Verbal paired associates</td>
<td>0.002</td>
<td>0.0001</td>
<td>NS</td>
<td>0.002</td>
<td>0.0001</td>
<td>NS</td>
</tr>
<tr>
<td>Paragraph recall</td>
<td>NS</td>
<td>0.01</td>
<td>NS</td>
<td>0.002</td>
<td>0.0008</td>
<td>NS</td>
</tr>
<tr>
<td>Unfamiliar faces recognition</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Famous faces recall</td>
<td>0.006</td>
<td>0.0001</td>
<td>NS</td>
<td>0.02</td>
<td>0.0001</td>
<td>NS</td>
</tr>
<tr>
<td>Anterograde Deficits (based on Delayed Recall)</td>
<td>BL &lt; UL</td>
<td>BL &gt; UL</td>
<td>UL &gt; C</td>
<td>S &lt; P</td>
<td>S &lt; C</td>
<td>P &lt; C</td>
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**Scores**

Average Memory Improvement (Two to Three Days Post-ECT vs. Baseline)
Twelve sessions revealed a greater utilization of subjects than filters for any of the stimulus waveforms, with no evidence of significant differences between the control and ECT groups. In contrast, a trend to ECT led to the observation that the baseline and average scores were comparable in those subjects with a suggestive evidence for a lingering term toxicity of ECT with respect to the control subjects (p < 0.01), though no P vs. S differences were observed in this regard, and the latter difference disappeared with use of baseline IQ as a covariate. Again, no intergroup differences in long-term subjective memory function, as determined by either total or item-by-item change scores, were found.

The above results represent provocative evidence for a potential basic defect in personal memory that is apparent immediately following the initial test day and six months post-ECT. The personal memory impairment is evident in all of the experimental groups, as illustrated by the following results.

**Figure 1**. Acute personal memory impairment. Ordinate represents percent of baseline items not recalled at two to three days post-ECT ± standard error.

**Figure 2**. Long-term personal memory impairment. Ordinate represents percent of baseline items not recalled at both the two- to three-day and six-month post-ECT test sessions ± standard error.

Unfortunately, the study of autobiographic memory function, as carried out in the present protocol, is confounded by the possibility that some personal memory information given at the time of baseline testing may have been incorrect. In an attempt to partially compensate for such a potential bias, all subjects were asked to recall as much as possible immediately following the time of testing. The study of autobiographic memory function is an attempt to rule out the possible confounding effects of personal memory on the results. The study of autobiographic memory function in this context is complicated by the possibility that the patients may have altered their recollection of events following the initial testing. The data presented here represent the first time such a differential effect has been reported. While analysis of personal memory data with respect to recency effects has not been completed, a preliminary assessment indicates that items dealing with the year immediately preceding the ECT may have been most affected. It appears, however, that the described period of retrograde amnesia is greater than, say, a few weeks.
FIGURE 3. Long-term personal memory impairment adjusted using self-corroborative technique see text for details. Ordinate ... sessions ÷standard error. Corrected to include only items with "session I" and "uncertain" self-corroborative responses.

might be deficient. This procedure, in effect, approximated an attempt at "self-corroboration" of baseline items. Choices of the response that was given at baseline would suggest that incorrect recall, but that recognition of the correct response was still intact. Similarly, responses given at the time of six-month follow-up testing may have been based upon testing. In every case, subjects were given three choices: baseline response correct, or unclear which of the two responses was

DISCUSSION AND CONCLUSIONS

certainties. Their only hypothesis was that recall and recognition were improved in subjects who received ECT. Although the possibility that the difference in recall may be attributed to the use of external corroboration was considered, the finding suggests that the effects of ECT on memory performance may be mediated by several factors. First, it is possible that the difference in recall and recognition between groups could be due to differences in treatment regimen. Second, it is possible that the differences in memory performance may be due to differences in the way in which the memories were assessed. For example, the difference in recall and recognition between groups could be due to differences in the way in which the memories were assessed. Finally, it is possible that the differences in memory performance may be due to differences in the way in which the memories were assessed. For example, the difference in recall and recognition between groups could be due to differences in the way in which the memories were assessed.

The basis of stimulus waveform effects on cognitive performance could be...
of a beleaguered and maligned treatment modality which has time and time again something that was not dealt with in the present study.

Alternatively, the apparently more intensely generalized seizures produced by the current stimulation within the cerebral structures subserving memory function, which 