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Is Unilateral ECT Less Effective Than Bilateral ECT?

By GIACOMO D'ELIA and HEINO RAOTMA

There is a general agreement about the less disruptive effect on memory and the shorter post-treatment confusion after unilateral electroconvulsive therapy (UNI-ECT) as compared with the traditional bifrontotemporal ECT (BI-ECT). However, there are divergent opinions about its therapeutic efficacy.

Immediate antidepressant efficacy

The following is an attempt to present a concentrated review of the results of inquiries into the therapeutic efficacy of UNI-ECT appearing in the international literature up to the present time (February 1974). We shall confine ourselves to considering the antidepressant efficacy, since this effect can reasonably be considered as a specific one (Ottosson, 1960, 1968). Observations about the antischizophrenic efficacy are also available (Impastato and Karliner, 1966; Abrams, 1967; Giberti, 1969; Sutherland *et al.*, 1969; El-Islam *et al.*, 1970; Small *et al.*, 1970; Wessels, 1971; Doongaji *et al.*, 1973).

The different studies published until now are not strictly comparable because of the great variation in criteria of patient selection, number and frequency of treatments, parameters of electrical stimulation, and dimension of electrodes and their distance from each other. The data can therefore only be presented in part in tabulated form. For instance, the placement of the electrodes on the same hemisphere has varied so widely that one could say that there are as many unilateral ECTs as unilateral electrode placements (see Fig. 1).

However, in the following we will consider all UNI-ECTs as a group, and in order to make the exposition less complicated only electrode placements on the non-dominant hemisphere will be taken into account (ND-ECT). In Table I the number of patients, the number of treatments and the authors' general judgement of the antidepressant efficacy of ND-ECT are presented. Further, the studies are divided into the following five groups, according to methodological criteria and common shortcomings in the investigations (the numbers refer to the studies in Table I):

Group I: No control group, open trial (1–5), diagnostically heterogeneous patient series (1–3).

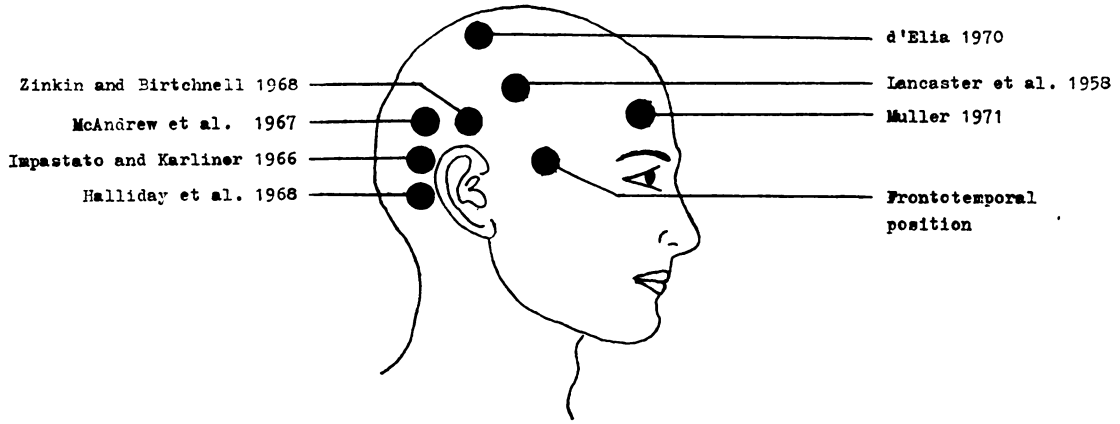


FIG. 1.—Unilateral electrode placements. The frontal temporal electrode is common to all placements. The placement according to Lancaster *et al.* (1958) is the most commonly used.

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Group II: No simultaneous control (6, 8), no randomized assignment to treatment groups and no double blind evaluation of the results (6–8), diagnostically heterogeneous patients series (8).

Group III: Simultaneous controls, randomized assignment and double blind comparison, diagnostically heterogeneous groups (15), sometimes submaximal (unilateral or focal) seizures (11, 12, 13, 15) or unreported type of seizure (9, 10, 14, 16).

Group IV: Simultaneous control, randomized assignment and double blind comparison between diagnostically homogeneous groups, with reported maximal seizures and fixed numbers of ECTs (17–21).

TABLE I

Immediate antidepressant efficacy

Authors	No. of patients		No. of ECTs		Antidepressant efficacy				
	BI-ECT	ND-ECT	BI-ECT	ND-ECT	−2	−1	0	+1	+2
Group I									
1. Bilikiewicz and Krzyzowski, 1964	—	13	—	4·8			x		
2. Impastato and Karliner, 1966	—	42	—	11		x			
3. Jensen, 1968	—	46	—	—		x			
4. Rinaldi *et al.*, 1967	—	—	—	—			x		
5. Pancheri, 1969	—	20	—	11			x		
Group II									
6. Cannicott, 1962a	51	40	7·2	6·3			x		
7. Abrams *et al.*, 1973a	43	33	—	—	x				
8. Hinterhuber and Nowak, 1973	61	85	6·8	8·6			x		
Group III									
9. Di Perri *et al.*, 1969	18	18	6	6		x			
10. Giberti, 1969	16	16	8	8		x			
11. Halliday *et al.*, 1968	18	18	4	4		x			
12. Lancaster *et al.*, 1958	15	21	4	4		x			
13. Pavan *et al.*, 1969	30	30	6	6			x		
14. McAndrew *et al.*, 1967	12	12	8·0	7·8			x		
15. Small *et al.*, 1970	65	12	22	22		x			
16. Sutherland *et al.*, 1969	14	13	5·6	5·5			x		
Group IV									
17. Abrams and de Vito, 1969	10	11	6	6			x		
18. Cronin *et al.*, 1970	15	16	8	8		x			
19. Fleminger *et al.*, 1970	12	11	6	6		x			
20. Levy, 1968	39	40	6	6		x			
21. Martin *et al.*, 1965	20	20	10	10				x	
Group V									
22. Bidder *et al.*, 1970	7	7	10·4	8·2			x		
23. Cannicott, 1962b	20	30	6·7	7·0		x			
24. Costello *et al.*, 1970	10	10	—	—			x		
25. d'Elia, 1970	29	30	6·2	7·0			x		
26. Sand-Strömgren, 1973	48	52	8·7	8·9			x		
27. Strain *et al.*, 1968	46	50	7·5	8·4		x			
28. Valentine *et al.*, 1968	—	—	8·8	7·2			x		
29. Zinkin and Birtchnell, 1968	20	24	8·0	8·3				x	

−2 = ND-ECT decidedly less effective
−1 = ND-ECT somewhat less effective according to clinical impression
0 = equal efficacy
+1 = ND-ECT somewhat more effective according to clinical impression
+2 = ND-ECT decidedly more effective

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Group V: As Group IV, with free number of ECTs (22–29).

With only one exception, no significant differences in antidepressive effect were found between the two treatments. In the study in which ND-ECT was maintained to be definitely less effective than BI-ECT (Abrams *et al.*, 1973), 35 attending psychiatrists gave either BI-ECT or ND-ECT according to unspecified criteria of assignments to treatment groups. Two different ECT machines were used, one for all the bilateral and one third of the unilateral treatments, the other for the remaining treatments. The evaluation of the results was not blind. Five studies (in Groups IV and V), although reporting on the whole equivalent clinical improvement with both treatment methods, also report the impression that BI-ECT works a little more quickly (Cannicott, 1962), produces a greater, non-significant, change in depression score (Levy, 1968), requires slightly fewer treatments, with a somewhat shorter stay in hospital, and produces more improvement in depressive self-rating (Strain *et al.*, 1968), shows a trend toward greater improvement (Fleminger *et al.*, 1970), or produces a more rapid improvement (Cronin *et al.*, 1970).

Summing up, some of the studies report the impression that the immediate antidepressant efficacy of ND-ECT is somewhat inferior to that of BI-ECT. However, this impression seems to get weaker the more adequate the methodological conditions under which the studies were performed (Table I). Further, if one considers all the studies in which the number of ECTs was free (6, 8, 14, 16, 22, 23, 25–29), the mean number of treatments is 7·6 for both BI-ECT and ND-ECT. The mean values for the studies of Group V are 8·0 for BI-ECT and 7·9 for ND-ECT. Thus there seem to be no valid grounds for the impression of a lower immediate antidepressant efficacy of ND-ECT.

Antidepressant efficacy at follow-up

The stability of antidepressant efficacy, as evaluated by means of observations at follow-up, is shown in Table II. From these studies it appears that ND-ECT is at least as effective as BI-ECT.

Patients as their own controls

Kalinowsky (1970) reported the impression that patients whose previous periods of depression he successfully treated with BI-ECT showed less convincing improvement and early relapse when they were treated with UNI-ECT in later depressive periods. On the other hand, patients of Cannicott (1962) and Valentine (1968) previously treated with BI-ECT reported, after the same number of unilateral treatments, the same subjective feeling of improvement.

The results of a more systematic comparison are presented in Table III. Bidder *et al.* (1970) treated 14 patients previously included in their comparative study (Strain *et al.*, 1968) with the alternative treatment method. The difference in number of treatments in the two groups is not statistically significant, but there were clearly fewer ECTs in the ND-ECT group in the later study (Bidder *et al.*, 1970).

In the other study (Sand-Strömgren, 1973), of 45 patients who had previously received ECT by means of the bilateral treatment, 25 were treated with ND-ECT (mean number 8·5,

TABLE II

Efficacy at follow-up

Authors	No. of patients		No. of ECTs		Efficacy					Duration of follow-up in months
	BI	ND	BI	ND	−2	−1	0	+1	+2	
Bidder *et al.*, 1970 ..	7	7	7·5	8·4			x			3–12
d'Elia, 1970	29	30	6·2	7·0				x		1
Fleminger *et al.*, 1970 ..	12	10	8·2	8·0			x			1
Halliday *et al.*, 1968 ..	17	16	?	?				x		3
Small *et al.*, 1970	65	12	22	22			x			2–3

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previous BI-ECT 8·0) and 20 with BI-ECT (mean number 8·7, previous BI-ECT 8·3). The interval between the preceding and the present treatment series varied between 1 and 23 years. When number of treatments and effect of age were considered, the author concluded that there was no indication of the superiority of either ND-ECT or BI-ECT.

Efficacy in severe depression

Sand-Strömgren (1973) found no support for the hypothesis that the severest depression responded better to BI-ECT than to ND-ECT. In order to test this observation we reconsidered the results of an earlier study (d'Elia, 1970).

In this the patients were divided into groups according to severity of depression. In the severe depression groups were included all the patients with an initial total rating score (Cronholm-Ottosson Depression Rating Scale) above the median value for the whole group, in the mild depression group the patients with an initial total rating score below the median. Global improvement was rated from 'unchanged' (0) to 'recovered' (3). In Table IV it is shown that there were no difference between the modes of treatment. In the ND-ECT group a female patient is included who did not improve after 15 treatments. She was subsequently treated with antidepressant drugs, and again with BI-ECT some months after the first treatment series, with no therapeutic benefit.

How is the impression of lower efficacy to be explained?

One may speculate why some people have got the impression of lower immediate efficacy of ND-ECT. A possible explanation is that the temporary regressive effect of BI-ECT (the so-called organic shock syndrome, characterized by memory disturbance, post-treatment confusion and some degree of emotional blunting) may contain some 'therapeutic' component. This hypothesis would find support in the observation of an identical antidepressant effect of ND-ECT and BI-ECT at the follow up. Some patients and some personnel may feel that ND-ECT is not as 'strong' as BI-ECT, since the patients awake so quickly after ND-ECT and are less or not at all emotionally blunted. Another possible factor may be preconceived expectations about ND-ECT, since passage of the electric current through the deep structures of the brain, as in BI-ECT, may be wrongly considered as therapeutic.

Another possible explanation is that submaximal seizures are provoked by means of unilateral technique. Since optimal antide-

TABLE III

Patients as their own controls: average number of treatments during the later and previous series

Authors	Later BI-ECT	Previous ND-ECT	Later ND-ECT	Previous BI-ECT	Antidepressant efficacy −2	−1	0	+1	+2
Bidder *et al.*, 1970 ..	10·4 (n = 7)	8·2	7·1 (n = 7)	6·8			x		
Sand-Strömgren, 1973 ..	—	—	8·5 (n = 25)	8·0			x		

TABLE IV

Antidepressant efficacy and severity of depression

Severity of depression	No. of patients BI	ND	Mean age BI	ND	Total rating score (Mdn) Before BI	ND	4 days after BI	ND	Global improvement score (Mdn) 4 days after BI	ND	1 month after BI	ND	Mean no. of ECTs BI	ND
Severe ..	13	14	48·9	46·7	12·8	14·5	1·0	1·3	2·6	2·6	2·0	2·6	6·4	7·3
Mild ..	16	16	53·0	49·7	9·4	10·4	1·3	2·9	2·5	2·2	2·3	2·4	6·0	6·7

None of the intergroup differences reaches the level of statistical significance

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TABLE V

Mean values (and range) of seizure duration in EEG studies (in sec.)

Authors	BI-ECT	(n)	ND-ECT	(n)	p
d'Elia and Perris (1970)* ..	63·8 37–118	(12)	75·1 52–126	(12)	n.s.
d'Elia (1970)	89·1 36–204	(24)	72·8 32–129	(25)	n.s.
Small *et al.* (1970)	Alike		Alike		
Abrams *et al.* (1973b)	61·9	(15)**	51·5	(124)	<·01

* Intra-individual comparison.
** Number of seizures in multiple ECT.

pressant effect is, for each individual, bound to maximal cerebral seizure activity, this circumstance may be the reason for an actually lower efficiency.

Although duration of seizure activity is not correlated to treatment effect (Ottosson, 1962), it may give some indication as to whether maximal or submaximal seizures are induced.

In Table V the duration of EEG recorded seizure is shown. There are differences between the studies dependent on the method of ND-ECT used, the mode of recording, oxygenation, relaxation, age and sex, inter-individual differences, and number of previous treatments in the series. If a real difference can be demonstrated, as in Abrams *et al.* (1973b), it indicates that ND-ECT did not induce maximal seizures.

During seizure, no asymmetry (Rinaldi *et al.*, 1967) or higher amplitude on the side opposite to the stimulation (Small *et al.*, 1970) have been reported. However, higher amplitude on the stimulated hemisphere was detected by means of electronic voltage integrators, where interhemispheric differences could not be assessed by visual inspection (d'Elia and Perris, 1970). If significant interhemispheric differences are found they can indicate submaximal seizures.

Seizure termination after ND-ECT is as a rule clearly limited (Rinaldi *et al.*, 1967; Abrams *et al.*, 1973b), but it is followed by flat records (at least on the unstimulated side) less often than after BI-ECT (Rinaldi *et al.*, 1967; Small *et al.*, 1970; Abrams *et al.*, 1973b). The tendency of ND-ECT to terminate without electrical silence has been interpreted in multiple ECT (3–4 treatments at the same session) (Abrams *et al.*, 1973b) as a consequence of submaximal seizures which have lower antidepressant effectiveness.

Summing up, significant differences in seizure duration, in seizure and post-seizure pattern between the hemispheres indicate submaximal seizures and reflect inadequacy in treatment technique.

CONCLUSIONS

The review of studies performed under adequate methodological conditions shows that ND-ECT has the same antidepressive effect as BI-ECT. This is in agreement with our knowledge that the antidepressive factor of ECT is bound to the seizure. ND-ECT has the advantage of a much lower frequency and intensity of side effects. In endogenous depression, ND-ECT should be the treatment of choice.

The data concerning the therapeutic efficacy of ND-ECT in other mental disturbances, such as schizophrenia and confusion, do not at present allow any objective evaluation. In these cases it is not clear whether ECT is an electrical or a convulsive treatment. However, present evidence indicates that ND-ECT and BI-ECT are equally efficacious.

Practical advice

Technically, ND-ECT may be less simple than BI-ECT. In order to obtain a maximum of antidepressant efficacy coupled to a minimum of side effects some technical requirements are necessary. We would recommend the following:

(1) Drugs with anticonvulsant effect, such as diazepines and long-acting barbiturates, should be avoided.

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(2) A minimum dose of narcotic should be used; deep anaesthesia is not necessary.

(3) The electrodes should be sufficiently large, at least 4 cm. in diameter, in order to avoid focal stimulations.

(4) The distance between the (midpoints of the) electrodes should be at least 12–13 cm. in order to stimulate a sufficiently large area, capable of inducing and sustaining a generalized seizure.

(5) A long sweep of brief stimuli should be used in order to allow stimulation on the seizure threshold.

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