CHAPTER

22

Comparison of Two Modes of Aphasia Treatment:
Clinician and Computer-Clinician Assisted

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Microcomputers in the rehabilitation of brain-damaged patients continue to win popularity in some clinical settings. Cost-effectiveness, operational efficiency, and increased treatment time allocations without additional human resources are the salient features that bolster their acceptance and application. Yet data-based research in speech-language pathology concerning treatment efficacy remains sparse.

In the most recent literature there are a few investigations that begin to support the use of microcomputers as a supplement to the traditional clinician/patient treatment environment. These include work by Katz and Nagy (1982, 1983), Mills (1982), and Seron, Deloche, Moulard, and Rouselle (1980). Some caution, however, should be taken when reviewing these data. The designs implemented to examine the use of microcomputers fall short in determining their efficacy in rehabilitation. Small numbers of experimental subjects and ill-defined baselines appear to be just a few of the factors plaguing research to date. While Katz (1984) takes a more pragmatic, conservative approach by viewing existing programs as only drills with no specific intervention goals, others advocate the computer rather than the clinician as a treatment medium (Skilbeck, 1984; Bracey, 1983; Lucas, 1977). Additionally, authors such as Rushakoff (1984) state that the potential for clinician-independent therapy for home therapy is enormous and dazzling to imagine. While the imagination may be easily dazzled, it may be more appropriate and beneficial to replace imagination with a data base and put microcomputers in their proper perspective based on scientific evidence. In fact, in addition to the lack of any efficacy data, there does not seem to be an effort to establish treatment protocols. The available software for microcomputers does not address communicative strategies or the artificial intelligence necessary for establishing functional skills by the aphasic adult. Instead, software and the software industry continue to perseverate at a drill level. Wilson (1984) has pleaded for the establishment of acceptable software for the brain-injured aphasic adult. He suggests that the software should be evaluated and determined to be effective before entering the clinical environment. At present, Wilson states that literally thousands of programs are being written, but few if any are acceptable, and most go unevaluated in terms of their treatment effectiveness.

Recently, Loverso, Prescott, Selinger, Wheeler, and Smith (1985) applied a cuing-verb-treatment technique to an aphasic patient via the microcomputer and clinician. Using an alternating treatment design with internal and external probes, they found that their patient was much more efficient in reaching a criterion performance when the clinician presented all stimuli. Additionally, the fluent aphasic patient in this study demonstrated generalization to overall language function as measured by the Porch Index of Communicative Ability (PICA) (Porch, 1967). These preliminary data begin to describe the basic necessary ingredients for this treatment's effective application in terms of the following: For whom does this treatment work? What does the treatment consist of? How often does the treatment need to be adminstered? and What treatment medium is most effective? Further research appears necessary describing this treatment's effectiveness with more types and severities of aphasia and what cuing strategies are most effective in eliciting functional lan-guage structures.

It was the purpose of the present investigtion to examine whether a microcomputer/clinician-assisted delivery system was as effective as a clinician alone in treating various types and severities of aphasia utilizing a cuing-verb-treatment technique.

METHODS

SUBJECTS

The subjects for this investigation were five fluent and five nonfluent aphasic adults. Each patient met the following selection criteria: All subjects were at least 6 months post-onset of aphasia, were at or above the 50th percentile on the PICA overall measure (Porch, 1967), demonstrated stable baselines across treatment levels, had one confirmed left brain lesion, showed no more than a 30 dB HL hearing level, and had sufficient visual acuity to perform the experimental tasks.

TREATMENT

The treatment approach utilized in this investigation incorporated the cuing-verb-treatment approach (Loverso, Selinger, and Prescott, 1979; Loverso, Prescott, Selinger, Wheeler, and Smith, 1985; Loverso, Prescott, and Selinger, 1988). In this approach, verbs are presented as pivots and *wh-* questions provide strategic cues to elicit sentences in an actor-action-object framework. There are six hierarchical levels to this program. Thirty verbs that were controlled for frequency and imagery were used at each level. The microcomputer and clinician treatment packages were identical in terms of number of stimuli, types of stimuli, modality and randomization of presentation, type of feedback, and scoring.

TREATMENT FREQUENCY

All subjects were scheduled for at least two 2-hour treatment sessions at a minimum of three times weekly.

PROCEDURES AND EQUIPMENT

Using a within-subject alternating treatment design with multiple internal and external probes, a baseline of five sessions was established for both the clinician and microcomputer constituting internal probes. Time of day for each treatment was alternated, as was the mode of treatment. Following establishment of the external probes (three stable PICAs), internal probes were established. Once the internal baseline was established, the patient received level IA from both the microcomputer and a clinician daily until criterion was reached. Once criterion was reached (three times with 90 percent accuracy) at any level, the next level of treatment began. Baselines continued on all untreated levels. Following completion of any level, weekly maintenance probes (of all 10 stimuli) were administered until termination of the investigation. All stimuli and *wh*-cues within tasks for both treatment mediums were randomly presented. Additional measures constituting external baselines and probes included the initial PICAs and one PICA administration after completion of each overall treatment level measuring generalization to overall communicative functioning.

The equipment for the computer phase of this investigation consisted of an Apple IIe microcomputer with dual disk drive, Apple monitor, dot matrix printer, and an Echo II Voice Synthesizer. For the clinician mode, all stimuli were presented on index cards.

RESULTS AND CONCLUSIONS

To examine whether one form of treatment (clinician or microcomputer clinician-assisted) was more effective in bringing patients to a criterion performance across treatment tasks, all data were laid out in a traditional single-case design format. This included comparison of individual performance for both modes of treatment during baseline, treatment, and maintenance phases. Figure 22-1 depicts the performance of patient number one on both modes of treatment across treatment levels. Patient number one is a moderate-marked fluent aphasic adult who required 4-percent more treatment visits for the computer-clinican assisted mode than with the clinician alone. This patient also demonstrated statistically significant ($p < .05$) communicative improvement following overall treatment levels I and II as measured by the external PICA probes. Examination of maintenance probes, both internal and external, indicates maintenance performance following treatment.

Patient number two (Fig. 22-2), a moderately severe nonfluent aphasic adult, required 28-percent more treatment visits for the computer-clinician assisted mode. This patient demonstrated statistically significant (p

$< .05$) communicative improvement from baseline to overall treatment level II. Maintenance of performance was indicated for both internal and external probes.

Patient number three (Fig. 22-3), a moderate-marked fluent patient, needed 12 visits with a clinician and 10 with clinician-assisted treatment to reach criteria for overall level I. This patient also demonstrated statistically significant ($p < .05$) verbal improvement as measured by the PICA baseline and termination of treatment level I.

Patient number 4 (Fig. 22-4), a moderately impaired fluent aphasic subject, required 36-percent more visits with the computer-clinician assisted treatment to reach overall treatment criteria. Examination of external probes indicated statistically significant ($p < .05$) communicative improvement between baseline and treatment level I. Maintenance of performance for the task and overall functioning was indicated.

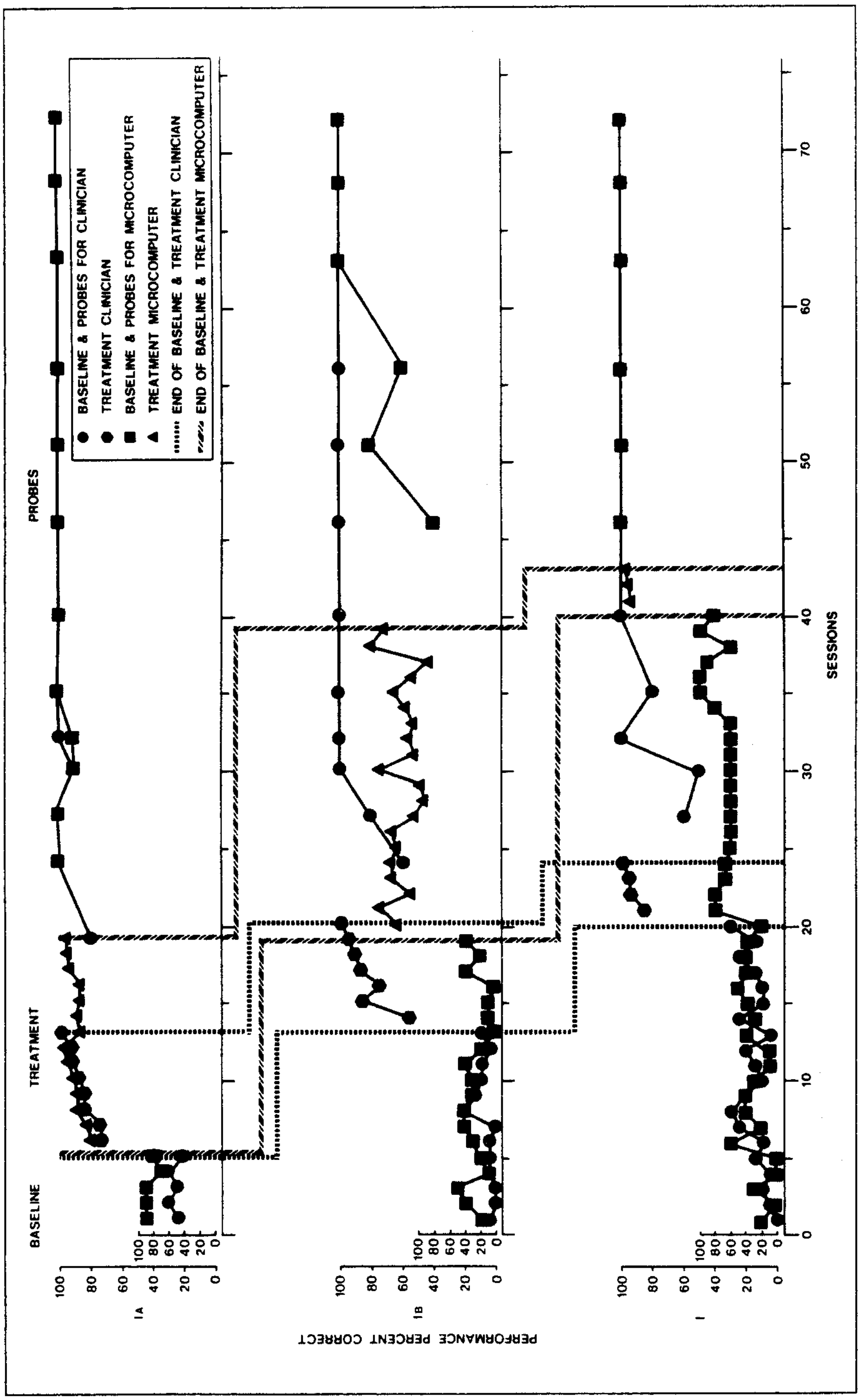
Patient number 5 (Fig. 22-5) was a moderately involved nonfluent aphasic patient who required 48-percent more treatment visits with the computer-clinician assisted program. Additionally, patient number five demonstrated statistically significant ($p < .05$) overall communicative improvement following treatment levels I and II. Maintenance of behaviors was again established.

Patient number six (Fig. 22-6), a mild to moderate fluent subject, required nine visits for both modes of treatment. Overall communicative improvement was noted for this patient between baseline and overall treatment level number II. Maintenance of performance for both the task and language functioning was noted.

Patient number seven (Fig. 22-7 and 22-8), a mild nonfluent subject, needed 26-percent more visits with the computer-clinician assisted program versus the clinician alone. While this patient met task criteria for all treatment levels, no statistically significant (.05) communicative improvement was noted for the external PICA probes. Maintenance of task performance was noted.

Patient number eight (Fig. 22-9), a moderate-marked nonfluent aphasic subject, required 17 visits with clinician alone and 16 with the computer-assisted program to reach task criteria. Overall communicative improvement as measured by the external probes was noted between baseline and treatment level II. Tasks and overall language functioning were maintained following treatment.

Patient number nine (Fig. 22-10), a moderate-marked nonfluent adult, needed 46-percent more visits with the computer assisted program than with the clinician alone. Examination of external PICA probes indicated statistically significant ($p < .05$) overall communicative improvement between baseline and treatment level II. Maintenance behavior was established for both the task and language functioning following treatment.


BASELINE
TREATMENT
PROBES
BASELINE & PROBES FOR CLINICIAN
TREATMENT CLINICIAN
BASELINE & PROBES FOR MICROCOMPUTER
TREATMENT MICROCOMPUTER
END OF BASELINE & TREATMENT CLINICIAN
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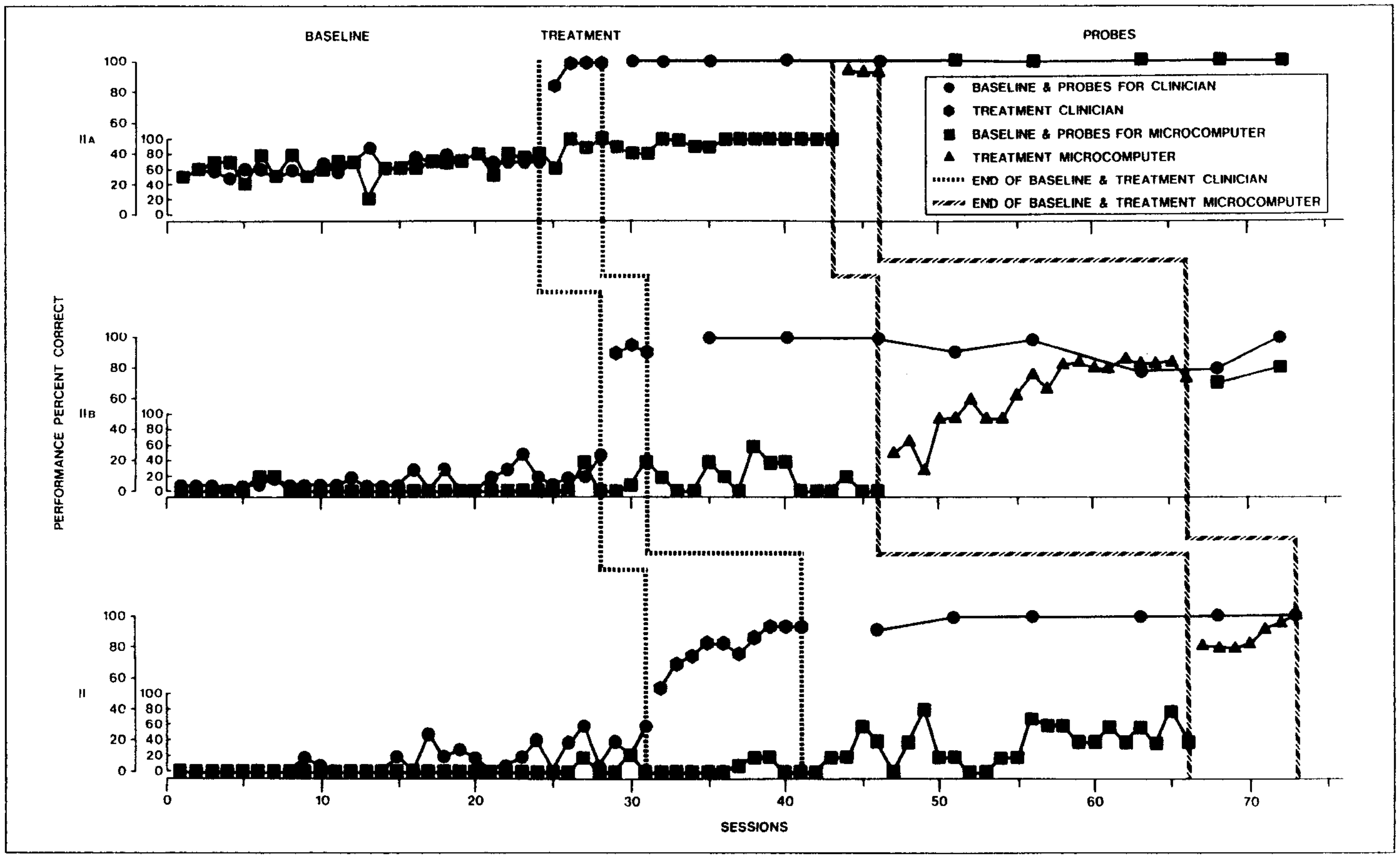

B

Figure 22-1. A. Multiple baseline alternating treatment design for clinician and microcomputer for treatment levels IA, IB, and I. B. Multiple baseline alternating treatment design for treatment levels IIA, IIB, and II.

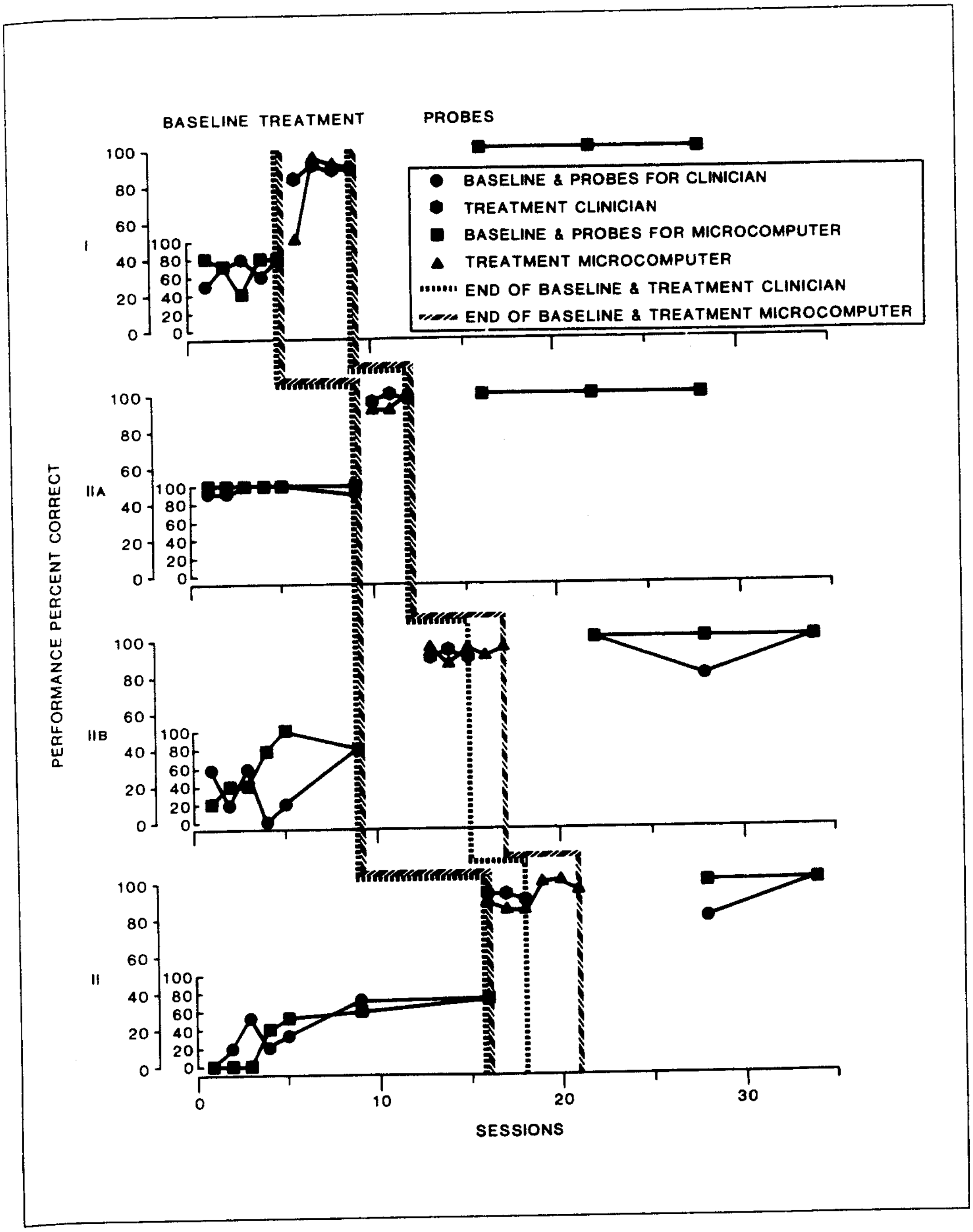

Figure 22-2. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 2.

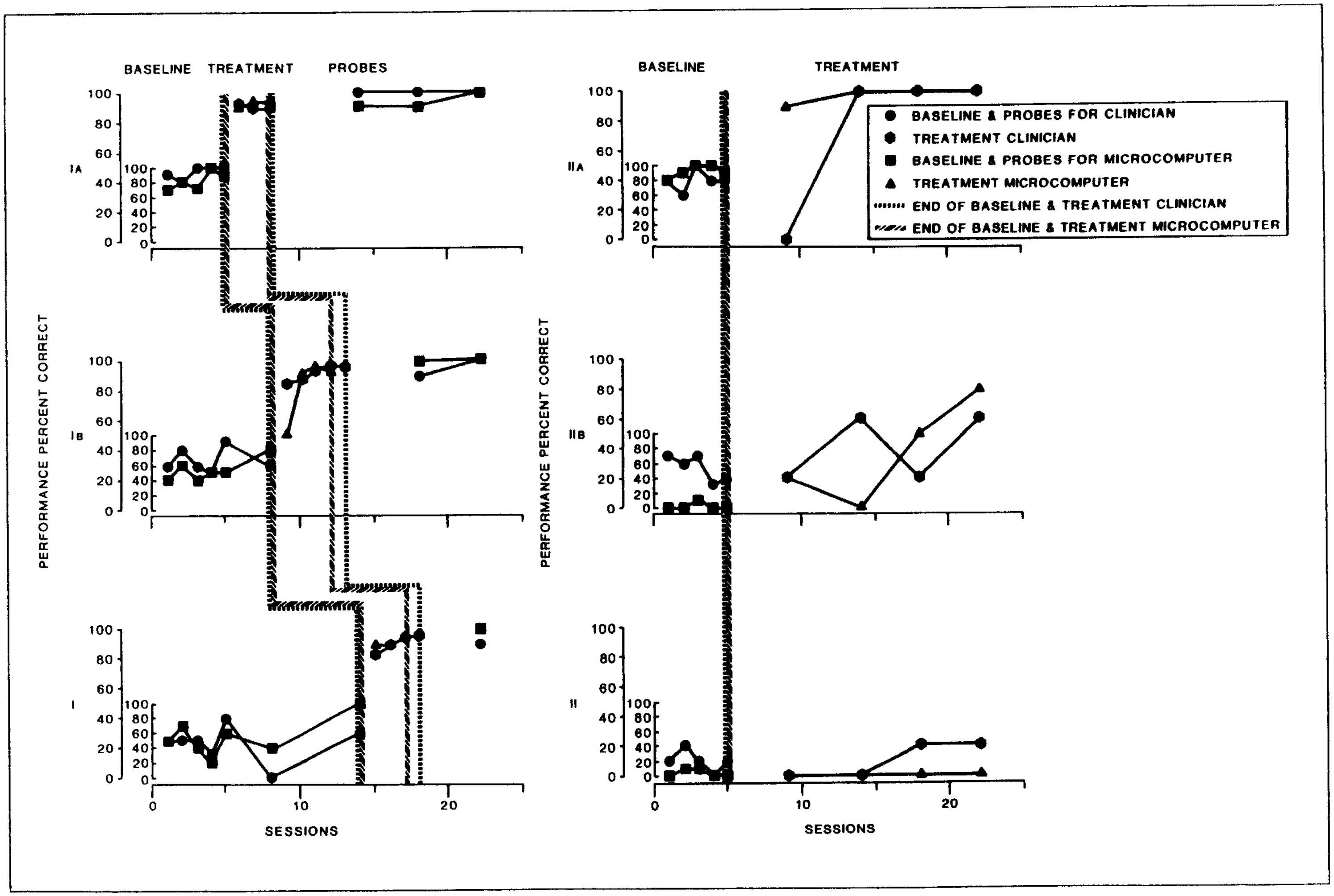

Figure 22-3. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 3.

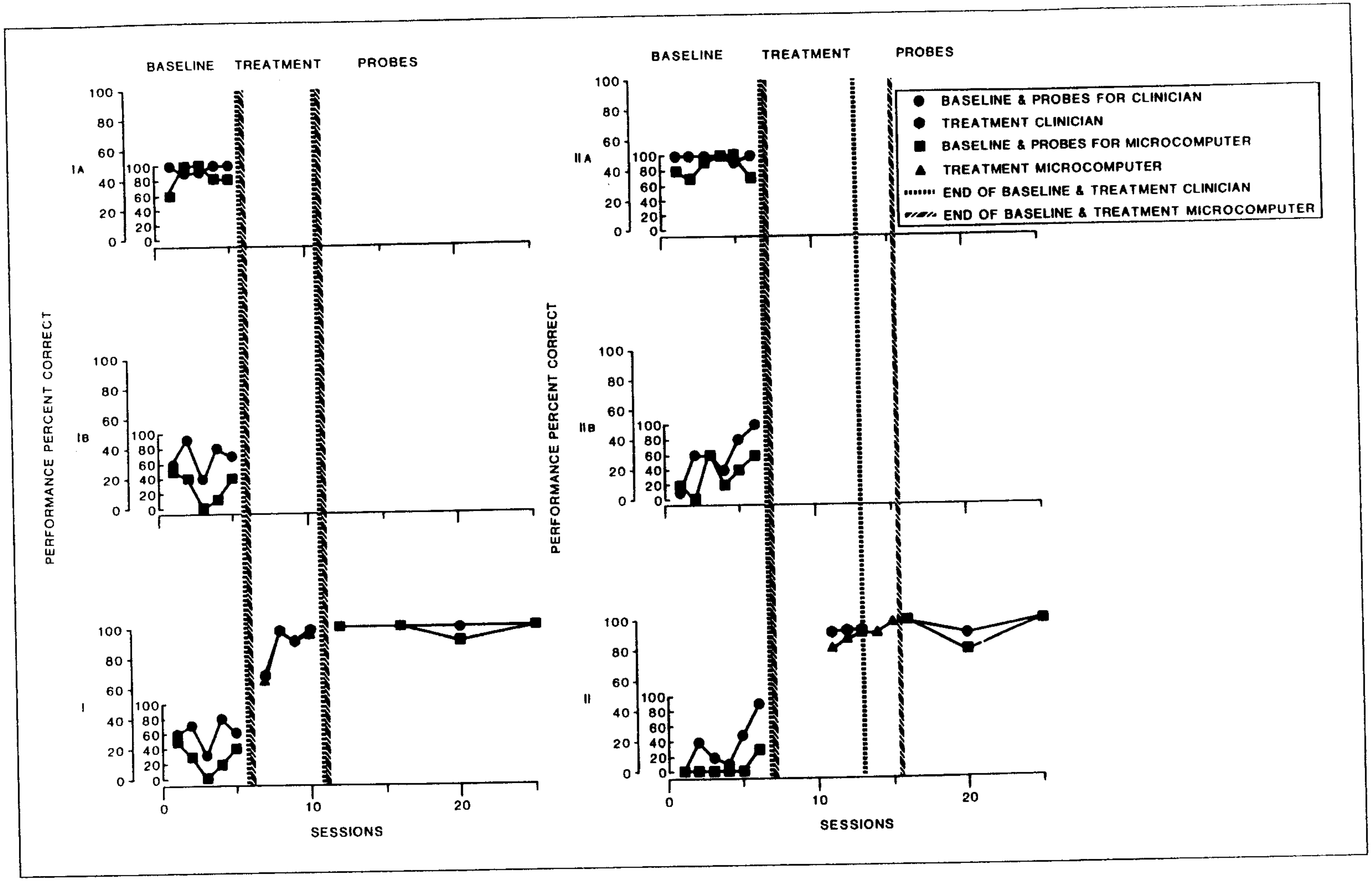

Figure 22-4. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 4.

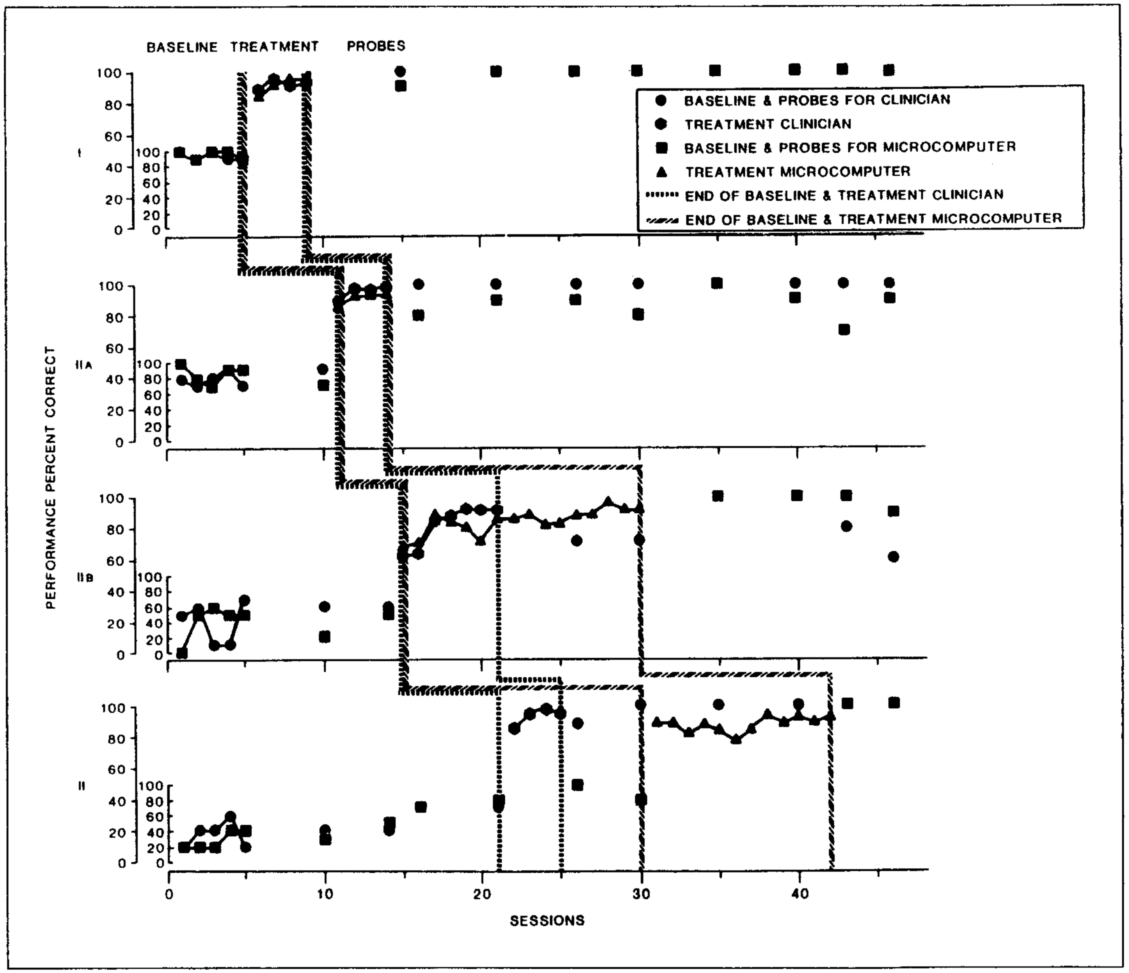

Figure 22-5. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 5.

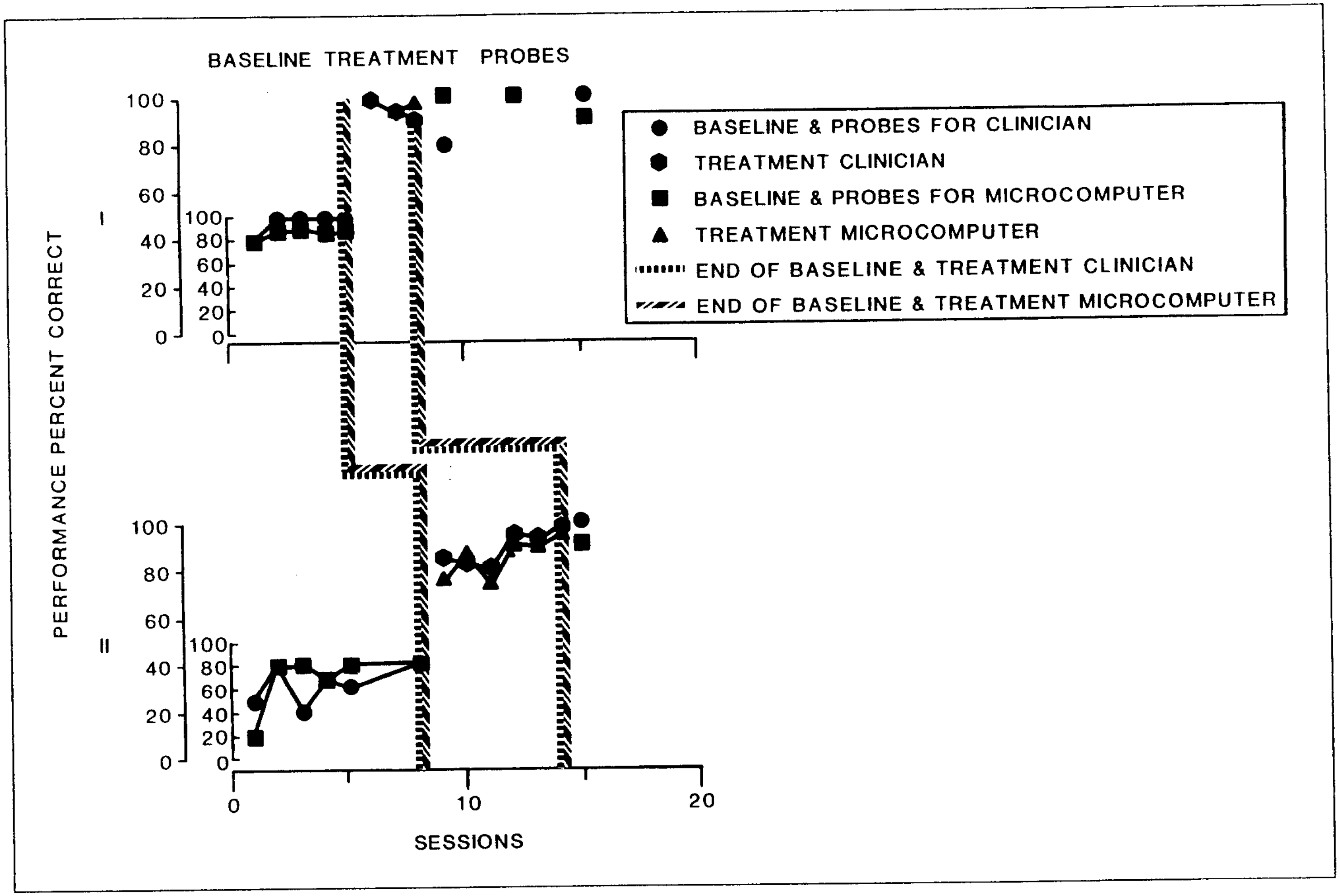

Figure 22-6. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 6.

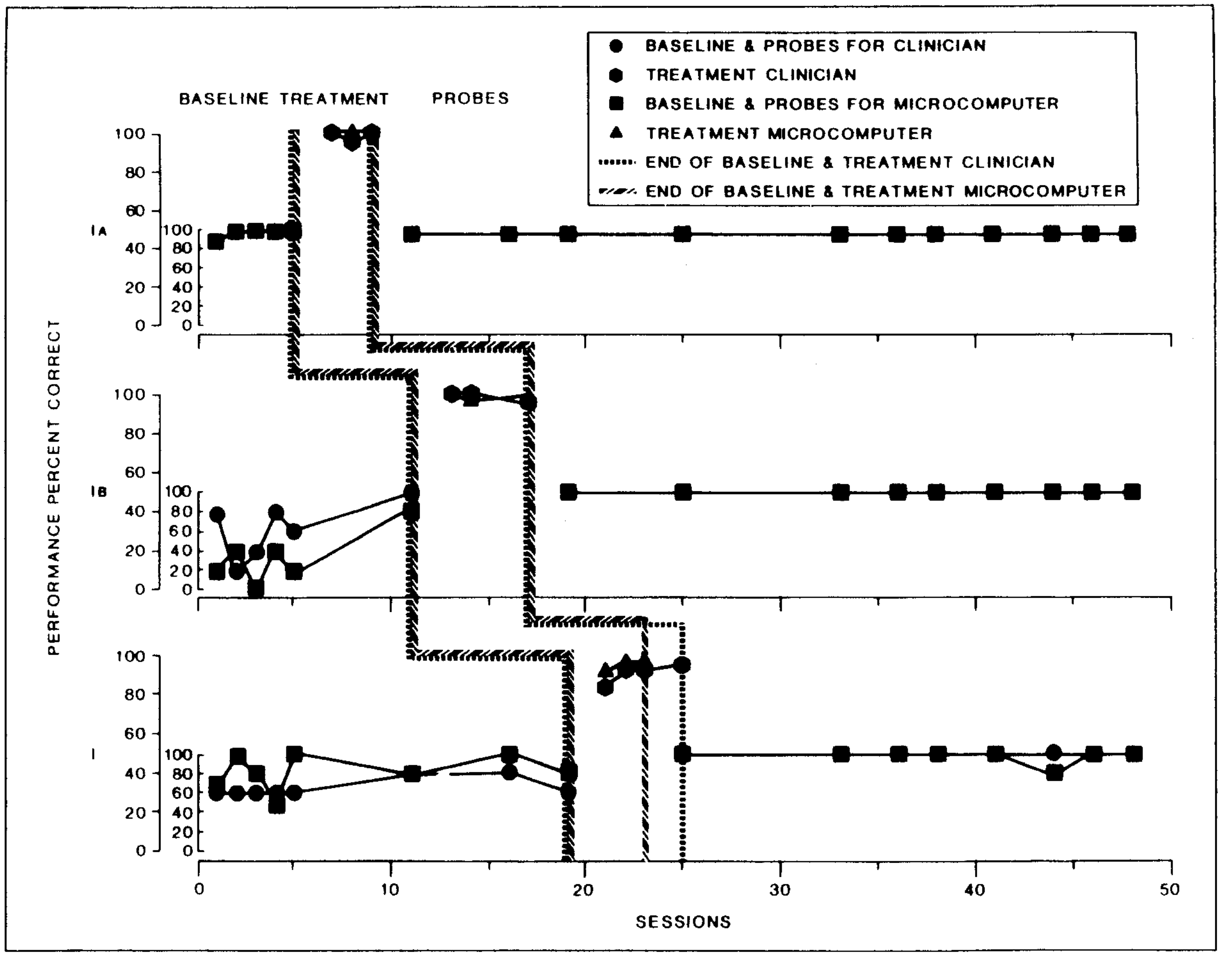

Figure 22-7. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 7.

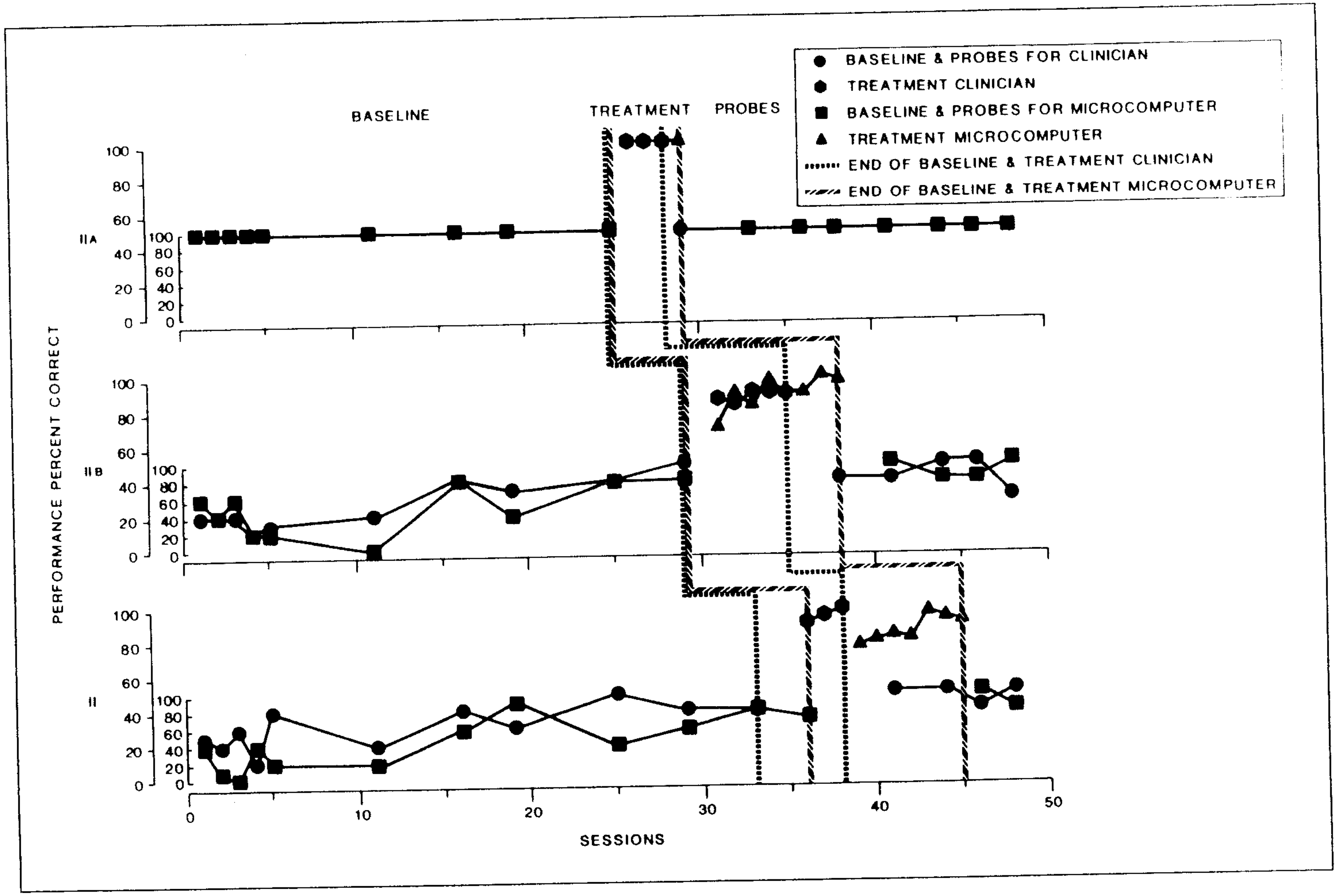

Figure 22-8. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 7.

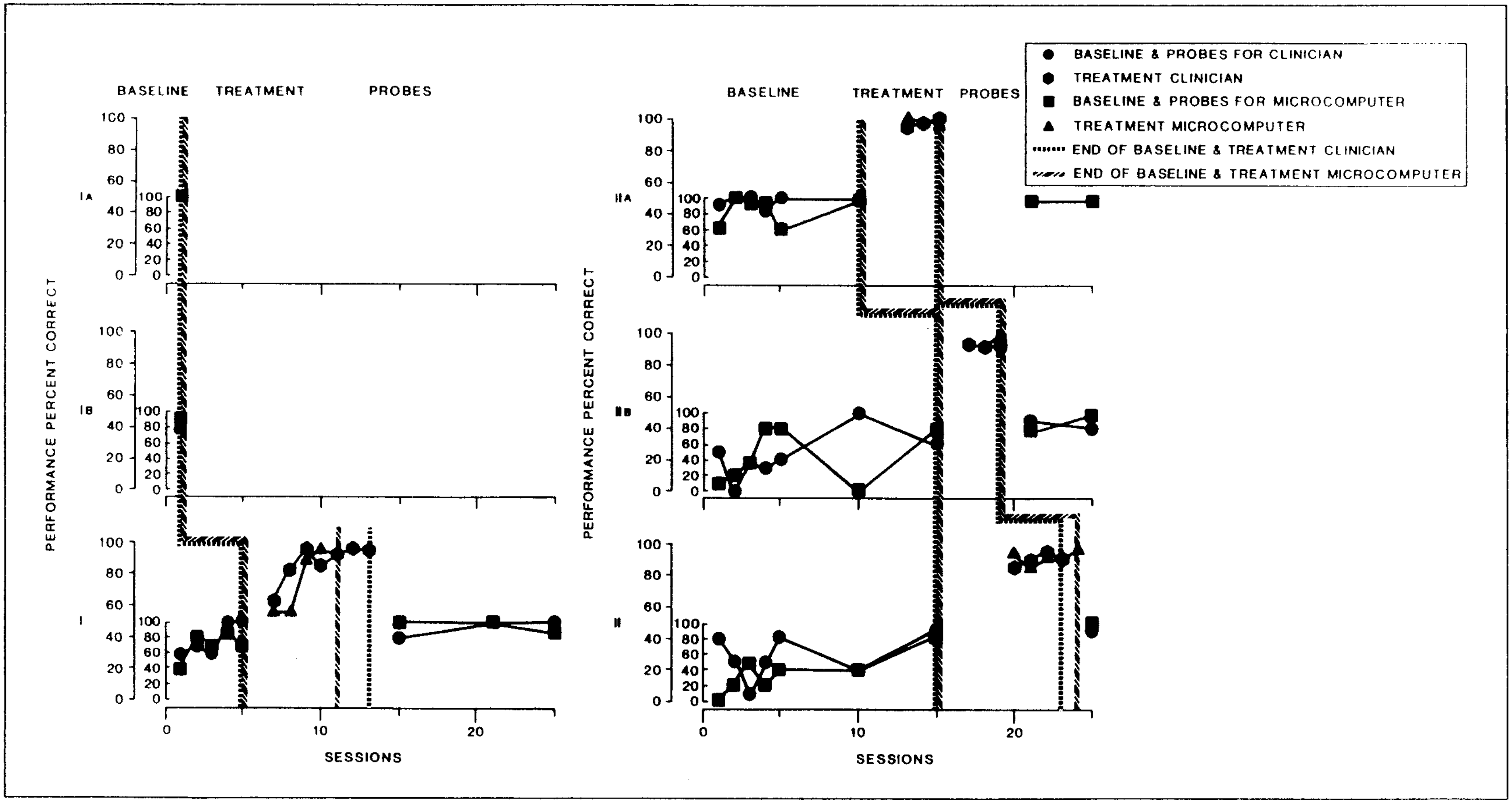

Figure 22-9. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 8.

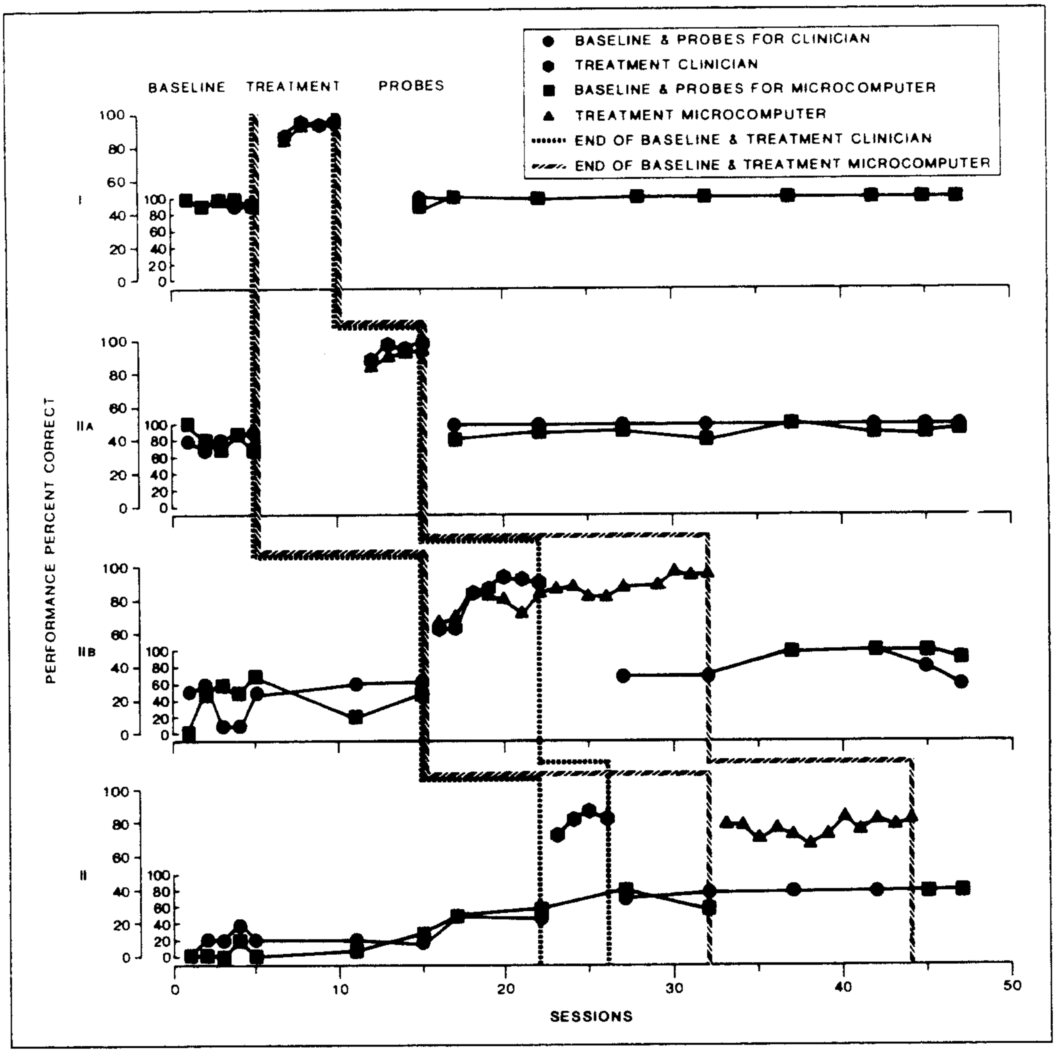

Figure 22-10. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 9.

Finally, patient number 10 (Figs. 22-11 and 22-12), a moderate-marked fluent patient, required only 11-percent more visits with the computer than with the clinician alone. Overall language functioning statistically significantly ($p < .05$) improved between baseline and treatment level II. Maintenance of performance was again established.

Additionally, aphasic patients as a group required approximately 28-percent more visits to reach overall treatment criteria with the microcomputer-clinician assisted treatment than with the clinican alone (Table 22-1). These data represent individual configurations for number of treatment visits across tasks and subjects. When these data were examined by type of aphasia, a statistically significant difference ($p < .05$) in number of visits emerged. The fluent group required 24-percent more visits with the

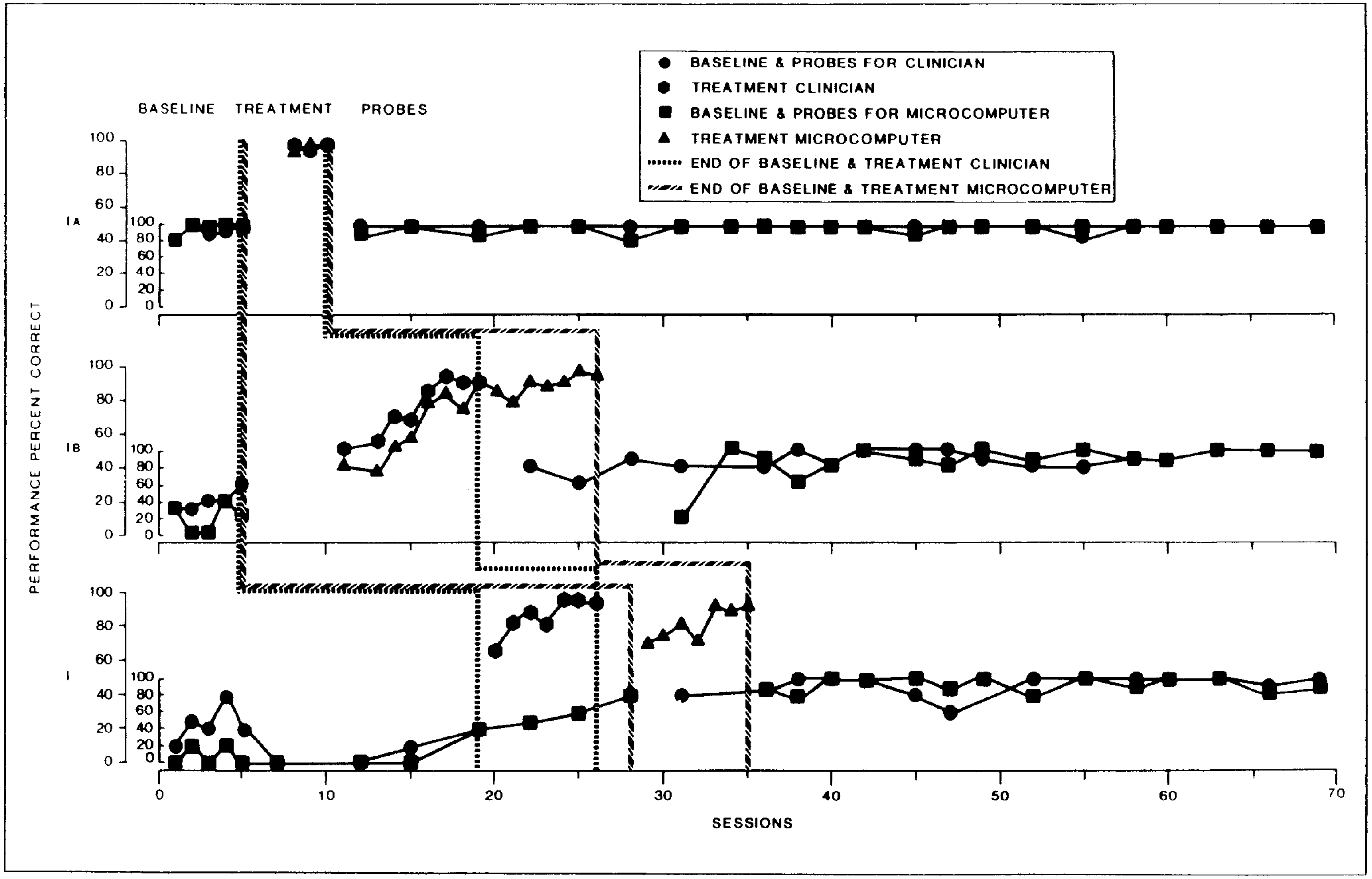

Figure 22-11. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 10.

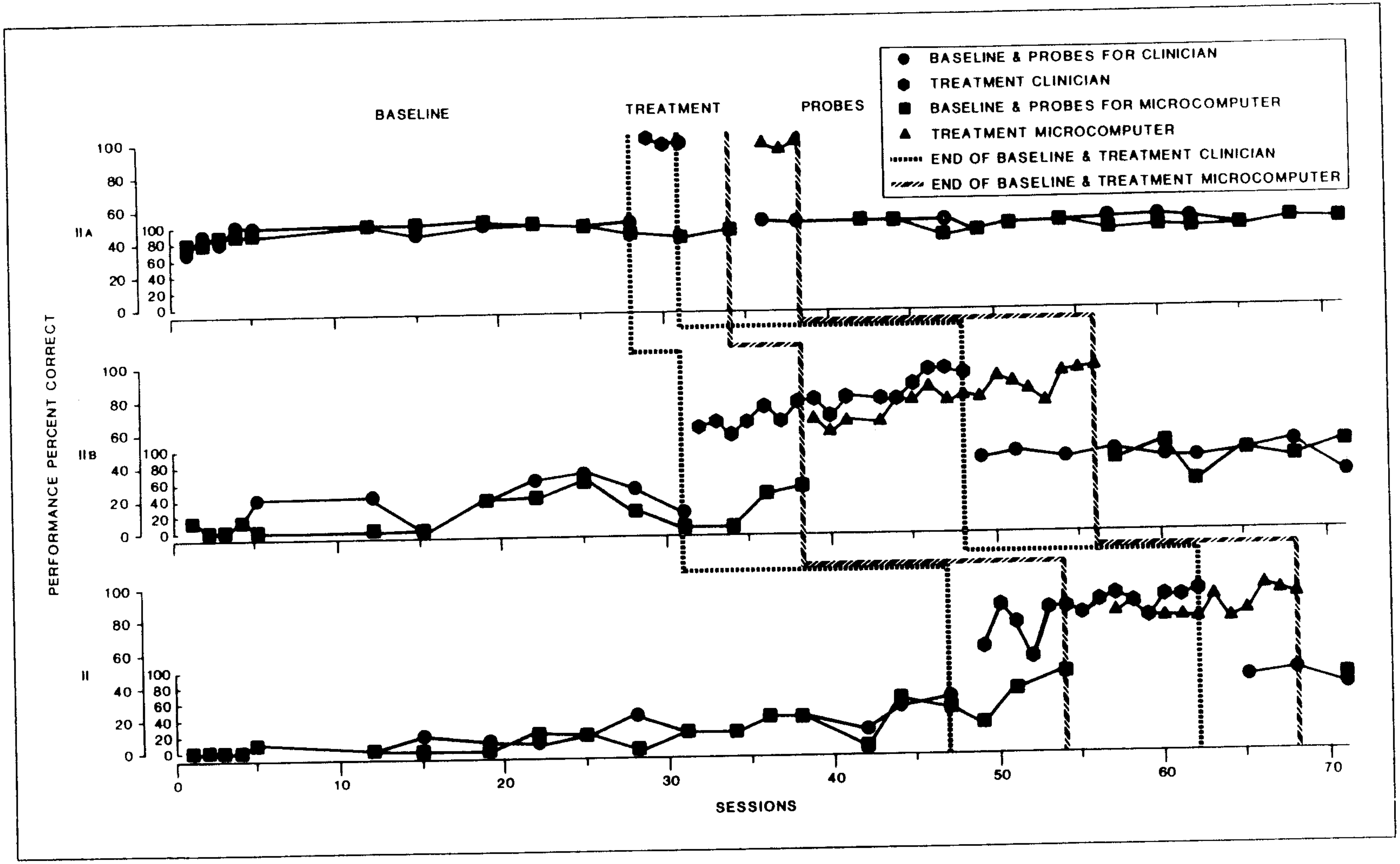

Figure 22-12. Multiple baseline alternating treatment design for clinician and microcomputer: Patient 10.

TABLE 22-1. NUMBER OF VISITS REQUIRED TO MEET CRITERIA: CLINICIAN (211); COMPUTER 202

Patient number by clinican (CLIN.) and computer (COMP.)

TREATMENT LEVEL	1		2		3		4		5		6		7		8		9		10		TOTAL
	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	CLIN.	COMP.	
I_A	8	14	—	—	3	3	—	—	—	—	—	—	3	3	—	—	—	—	3	3	40
I_B	7	20	—	—	5	4	—	—	—	—	—	—	3	3	—	—	—	—	8	15	65
I	4	3	4	4	4	3	3	4	4	4	3	3	4	3	7	5	4	4	7	7	84
II_A	4	3	3	3	4	4	—	—	4	4	—	—	3	3	3	3	4	4	3	3	55
II_B	3	20	3	5	4	4	—	—	7	16	—	—	5	8	3	3	7	15	16	17	136
II	10	7	3	6	—	—	3	5	4	12	6	6	3	7	4	5	4	12	14	12	123
TOTAL	36	67	13	18	20	18	6	9	19	36	9	9	21	27	17	16	19	35	51	57	

computer-clinician assisted treatment (160) than with the clinician alone (122). The nonfluent subjects needed 33-percent more with the computer-assisted treatment (132) versus the clinician alone (89). It was also established that overall treatment levels I, IIB, and II required statistically significantly ($p < .05$) more sessions to reach criteria than treatment levels IA, IB, or IIA. The major differences in performance between modes of treatment occurred on levels IB and IIB. Examination of these data by various severity levels of aphasia yielded no significant (.05) differences.

Besides specific treatment data, this research also explored the impact of this program on overall communicative functioning as measured by the PICA. Interpretation of external PICA probes for each patient are presented in Table 22-2. Collectively, 8 of 10 patients showed significant improvement on the PICA overall measure from baseline to maintenance probes, with the most significant increases occurring after treatment level I. Eight of 10 patients showed significant improvement across the verbal modality measure and 8 of 10 patients across the graphic modality measure. All patients maintained these gains after a maintenance phase of no less than 1 month post-treatment.

In summary, the present research demonstrates that this treatment program is an effective tool for aphasic adults. It further replicates previous research and establishes a data base regarding themicrocomputer-clinician assisted medium as a primary treatment delivery system. It appears that the use of microcomputers in the clinical setting should be approached with caution. The present investigation demonstrates that the clinician was generally more efficient than the microcomputer-clinician assisted treatment for both fluent and nonfluent aphasic patients above the 50th percentile on the PICA.

TABLE 22-2. SUMMARY OF ANOVA WITH REPEATED MEASURES

Subject	*Significant (PICA) modality differences ($p < .05$)*
1	Overall, verbal, graphic
2	Overall, verbal, graphic
3	Verbal
4	Overall, verbal, graphic
5	Overall, verbal, graphic
6	Overall, verbal, graphic
7	Not significant
8	Overall, verbal, graphic
9	Overall, graphic
10	Overall, verbal, graphic

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DISCUSSION

Q = question; A = answer; C = comments.

Q. Could you specify what the clinician's role was in the computer assisted condition?

A. They sat beside the patient and really helped boot the disk but gave no feedback whatsoever. We also recorded all verbal responses and that verbal recording was accomplished by the clinician sitting by the patient.

Q. Did you ever try it with the clinician not doing anything?

A. We only used the computer for our research effort so we followed the research protocol very closely over the last 3 years. To answer your question, we didn't give it a good try, but we have give it a try on some occasions. We're guilty as most everyone else in that there have been a few times a year when we put a patient in front of the microcomputer to get them started or something like that.

Q. Is is possible for you to speculate about some tasks where the computer might do better than the clinician? Is your statement about differences between these two modes, in your view, generalizable across any number of tasks, or might there be some where actually the reverse is true?

A. Without a doubt I think for clerical support to the professional staff, in any service, that the computer is a really effective tool. It crunches a lot of numbers a lot more accurately and efficiently than I do. But, to my knowlege, right at this moment I don't think there is a program, for aphasic adults at least, that I would feel comfortable saying that the opposite is true. I think that these data speak for themselves in that the effectiveness, as well as the efficiency of the clinician was far superior to that of the microcomputer with the clinician present. I do think that, for support purposes, the computer's role is a significant one. I think that Dr. Katz has given us things like the PICA pad that are more efficient than I am. But they're just tools and they're just a means to an end. I'm not sure we're at the point of using the microcomputer as a treatment medium. I think it's premature to put our patients on a microcomputer, and my caution would be to evaluate your programs well. We sent our programs out to a national committee for review, and the striking feature from this review was that nobody knew what to look at. Each evaluator was looking at completely different sets of criteria. I think we're still learning about the treatment that clinicians deliver before we put it on a microcomputer.

Q. First of all I think we should applaud you and your co-authors' efforts because there are very few studies, in fact none that I know of other than your work, with such extensive replication. Given the time series nature and intensive approach to treatment that you're taking, I think it's really remarkable to have a pool of 10 or 12 patients. That's a career for a lot of us. My question is, have you or have you thought about pooling your statistical analyses for the 10 patients, or did I miss that point? It seemed like you did an individual analysis for each of your 10 patients. The obvious question then is, are you concerned at all about multiple tests? Judging from your data I don't think you'd have any differences; in other words, if you treated your 10 patients as a group, my guess is that you're going to have highly statistically significant results. Looking at the differences, are you concerned by talking about individuals?

A. I'm not that concerned about that, but we did do some pooling on the fluent-nonfluent groups as well as across tasks to see if there were differences and whether or not maybe some of these treatment levels were superfluous. So we did pool the data across subjects and across treatment levels. I do think that the individual cases are representative of the group. The data that we pooled didn't surprise us at all. I think that the true data lie in the individual representation and the alternating treatment design. The analyses are really separate from one another and consequently not multiple tests.

C. I'm going to react to the previous comment. I think you're exactly on the right track. I'd be real cautious about pooling. We're all aware of the statistical problems, but I think if we're going to get to the point where we can begin to figure out if certain software-based approaches are going to help particular patients, then we really need to look at the individual patient and what is going on with that patient. I really applaud your comments regarding how we're looking at software. It's frustrating. Sure we need to review software in terms of its user friendliness and how good the instruction manuals are, and so forth, but until people actually start to look at the kinds of contingencies that are built into the software themselves, the if-then statements that enable the software to respond to the patient, and until we take a closer look at that and develop software along those lines, and then look at the patients that it does seem to work with, and what their specific processing deficits are, I think we're going to continue to get the kind of results that you have.