The Application of Multiphonemic Articulation Therapy With Apraxic Patients

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Date from the present clinical investigation has suggested that the Multiphonemic Approach is a treatment option which may effectively influence certain apraxic speech behaviors.

Today, I am going to describe a portion of the Multiphonemic Articulation Therapy Program (MPA), as it is used in our clinic, and then I will discuss the performance of a single patient who was characteristic of the overall trends we observed.

Bradley and McCabe developed the MPA at the University of North Carolina School of Dentistry for use with cleft palate children. Although we have retained the essential structure of the program, certain modifications were necessary to adapt the program for use with apraxic patients.

The MPA incorporates controlled treatment hierarchies designed to elicit phonemic accuracy in responses which range from the production of phonemes in isolation to spontaneous speaking situations. Although the MPA emphasized three major phases in treatment, ESTABLISHMENT, TRANSFER and MAINTENANCE, the present report deals only with the establishment phase.

Phase I: ESTABLISHMENT

The Terminal Behavior of Phase I is the establishment of accurate production of all error phonemes in isolation by visual stimulation only.

In the Bradley & McCabe report, twenty-four phonemes were presented in a predetermined order at the beginning of each treatment session. The patient was instructed to produce the phoneme represented by a single grapheme presented on a 3x5" index card.

Performance was recorded each session on the Sound Production Sheet (SPS) which reflected the mode of stimulation required by the patient to produce each phoneme. The three modes of stimulation included:

Mode A - Visual
Mode B - Auditory and visual
Mode C - Auditory, visual and phonetic placement (Integral stimulation)

Visual stimulation in Mode A is represented by printed stimuli only. However, in Modes B and C, in addition to the printed stimuli, the patient has the opportunity to see the clinician produce the phoneme.

Mode selection was determined for each phoneme based on the patient's best performance in the previous session. A maximum of five trials were elicited for each mode of stimulation. It was possible for all three modes to be utilized for a single phoneme within a given session. Criterion levels for selection of stimulus modes are shown in Figure 1.

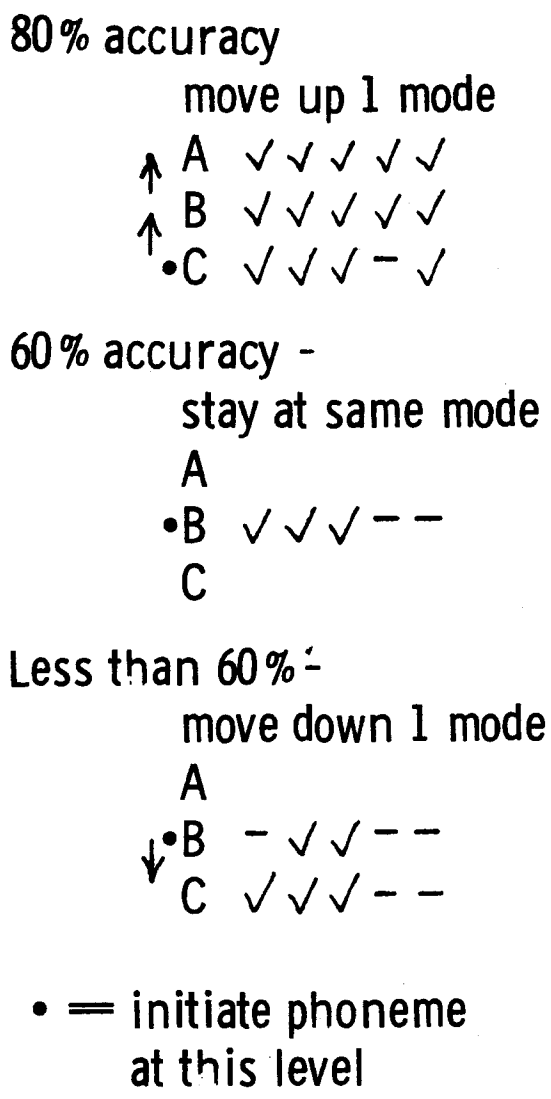


Figure 1. Example of criterion levels for stimulus modes.

To illustrate, a phoneme initiated at Mode C may progress to Mode B and continue to Mode A if 80% accuracy is achieved at each level. In the second example, a phoneme produced accurately on only three of five trials, or 60% accuracy, would be held in that mode until the next session. In the final example, a phoneme initiated in Mode B and produced with less than 60% accuracy would be moved down to Mode C. Since only 60% accuracy was achieved with integral stimulation, that phoneme would be initiated at Mode C during the next session.

The SPS in Table I illustrates the presentation order (across) and scoring of each phoneme. In the first example, the /p/ was initiated at Mode B,

visual and auditory stimulation, and, following the accurate production on five trials was moved up to Mode A. Since the patient achieved 100% accuracy on five trials with visual stimulation, the /p/ would be initiated at Mode A in the following session. The patient would then be directed to /b/, the next phoneme on the SPS.

Table 1. Sound Production Sheet.

University of North Carolina School of Dentistry
MULTIPHONEMIC ARTICULATION THERAPY
SOUND PRODUCTION SHEET

Name: _____
Date: _____
Age: _____
Time: 1:10 - 1:30 20 min

Code:
A = Visual stim.
B = Aud-Visual
C = Aud-Visual Phonetic Placement

p
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

b
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

m
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

w
A - 1 2 3 4 5
•B - [illegible] no Voicing
C - 1 2 3 4 5

t
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

d
A - [illegible] 5 VLess
•B - [illegible]
C - 1 2 3 4 5

n
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

l
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

k
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

g
A - [illegible] VLess
B - [illegible]
C - 1 2 3 4 5

f
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

v
A - 1 2 3 4 5
•B - [illegible]
C - 1 2 3 4 5

s
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

z
A - 1 2 3 4 5
•B - [illegible] voicing inconsistent
C - 1 2 3 4 5

th[1]
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

th[2]
A - 1 2 3 4 5
•B - [illegible]
C - [illegible]

ch
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

j
A - 1 2 3 4 5
•B - [illegible] "junK"
C - 1 2 3 4 5

y
A - 1 2 3 4 5
•B - [illegible] "yunK"
C - 1 2 3 4 5

sh
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

zh
A - 1 2 3 4 5
B - 1 2 3 4 5
•C - [illegible]

h
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

r
A - 1 2 3 4 5
•B - [illegible]
C - 1 2 3 4 5

ng
A - [illegible]
•B - [illegible]
C - 1 2 3 4 5

Total Responses A 75
B 115
C 10

Total Correct Responses A 68
B 88
C 2

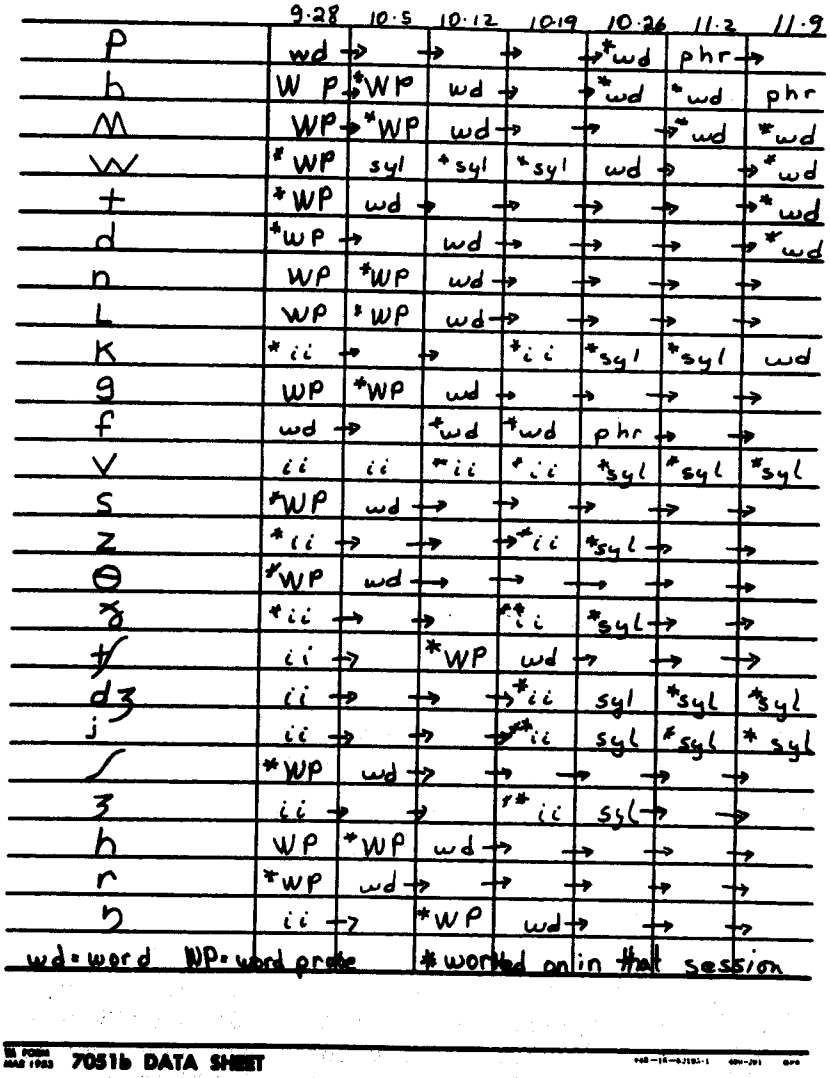
87%

The /b/ was also initiated and successfully produced at Mode B, visual and auditory stimulation, and was moved to Mode A. Failure on three trials to produce /b/ with visual stimulation indicated that the patient required more stimulation than this mode allowed. Production of /b/ would be terminated and reinitiated at Mode B in the next treatment session.

Branching steps are available for a phoneme which fails to achieve a pass criterion after three consecutive sessions. A phoneme would be programmed in Phase II, Transfer, when the patient has achieved 80% accuracy on four of five trials in Mode A (visual stimulation) for two consecutive sessions. However, a review of that phoneme would be continued on the SPS to maintain accuracy by the visual modality, and to insure coverage of each phoneme each session.

The level of activity for each phoneme was recorded on the Modified Data Sheet (MDS) illustrated in Table II. Prior to each treatment session the clinician recorded the date and status of each phoneme on the MDS. For example, in Column I, date 9/28, the /p/ was programmed at the word level, the /b/ was

Table 2. Modified Data Sheet.



eligible for the Word Probe (Step 1, Transfer) and, farther down the list, the /k/ was receiving treatment in intensive isolation. An asterisk (*) was placed by each phoneme which was selected for treatment.

A record of phonemes actually completed during a treatment session was available on the Articulation Data Sheet (ADS), shown on Table III. The clinician recorded the phoneme, task and performance of each phoneme presented in a single session. For example, on 10/26, the eighth session, 124 responses on the SPS were elicited with 83% accuracy. Thirty responses on /k/v/z/θ/ were elicited in syllables with varying degrees of success; the /p/ and /b/ were successfully produced in words. Similar information was recorded for the ninth session.

Table 3. Articulation Data Sheet

ARTICULATION DATA SHEET
ORAL-FACIAL AND COMMUNICATIVE DISORDERS PROGRAM
University of North Carolina School of Dentistry

Patient E
Clinician
Date 10/26 — 11/2/76
Transfer
Maintenance
Step

Date	Session	Activity	Inc.	Syl.	Words	Sent.	Read	Conv.	Time	Tot. Resp.	Tot. Error	Tot. Corr.	% Corr.	Comments
10/26	8	SPS	✓							124	20	104	83%	
		K		✓						30	2	28	93	
		V		✓						30	12	18	60	
		Z		✓						30	14	16	53	
		th+		✓						30	8	22	73	
		P			✓					30	0	30	100	
		b			✓					30	2	28	93	
11/2	9	SPS	✓							120	17	103	85	
		K*		✓						30	1	29	96	
		V*		✓						30	1	29	96	
		Z*		✓						30	6	24	80	
		th+*		✓						30	1	29	96	
		dʒ'		✓						30	2	28	93	
		Y'		✓						30	0	30	100	
		b*			✓					30	0	30	100	
		m'			✓					30	4	26	86	

The MPA has departed from the traditional method of articulation therapy in the manner and efficiency of recording, the systematic work with phonemes on the SPS in Phase I and by the presentation of each phoneme on one of the three phases each session. Thus, an hourly treatment session would allow approximately 15 minutes to complete the SPS, with the remainder of the session directed to the treatment of the individual phonemes, treatment of a particular feature such as voicing, and treatment of phonemes in the transfer phase.

In brief, Phase II, Transfer, identified specific reinforcement schedules, criterion levels and branching procedures for six steps which ranged from the syllable level to conversation.

Phase III provided for both immediate and long term maintenance procedures.

Case Report

The MPA has been employed with five patients in our clinic. Of these five, we selected one patient who was characteristic of the overall trends we observed. The subject used in the present study was a 43 year old male referred to the VA Hospital, New Orleans, Louisiana, Audiology and Speech Pathology Service, at two months post onset with a medical diagnosis of left hemisphere thromboembolic C V A with subsequent aphasia and apraxia.

At the time the MPA was initiated, the patient demonstrated good auditory comprehension, was responsive to stimulation and demonstrated facility for self-corrective behavior. Verbal output was characterized by unintelligible or perseverative responses and frequent inconsistent sound substitutions.

The MPA was initiated at three months post onset as one form of his overall treatment program. Out of a total of 10 treatment hours per week, one hour was devoted to the MPA. The present data have been drawn from 25 hourly treatment sessions over a course of 30 weeks. Treatment was interrupted between weeks two and ten and is so indicated on the graphs. The remaining data points represent weekly intervals.

Improvement in language skills recorded on the PICA cannot be entirely attributed to the efficacy of this treatment approach since some of the treatment occurred during the spontaneous recovery period. Moreover, an eclectic treatment approach such as the one designed for this patient made it difficult to isolate any concrete effects of the MPA. However, the response patterns recorded on the SPS do provide a systematic measurement of change in the accuracy of phonemic production.

Discussion

The objective of Phase I was the accurate production of all error phonemes by visual stimulation only. The Theoretical Model shown in Figure 2 would predict that at the initiation of treatment, maximum stimulation would be required which would be observed in a preponderance of responses in Mode C. Through the course of treatment this model would predict the gradual reduction of Mode C responses with the concomitant increase in Mode A. In short the model would allow for a gradual reduction of cues from integral stimulation, Mode C, to visual and auditory stimulation, Mode B, to visual stimulation only, Mode A.

As can be observed in Figure 3, this is exactly what occurred. Mode C, integral stimulation, was required to initiate 96% (or 23 of 24) of the phonemes during the first session. Only 50% of the phonemes were initiated in Mode C during the second week, with the remaining phonemes divided equally into Modes A and B. Mode C was permanently retired after the 21st week. Thus, as the patient became less dependent on the phonetic placement cues inherent in Mode C, phonemes moved into modes with less stimulus power.

Although Mode B, visual and auditory stimulation, was the predominant mode of stimulation throughout the program, only one phoneme, /t/, was initiated in Mode B in the first session. The remaining 23 phonemes were eventually channeled through Mode B since the program does not allow movement directly from Mode C to Mode A. Therefore, as Mode C decreased, Mode B increased. Mode B was still required for three phonemes, /d_3/$_3$/j/, in Week 30.

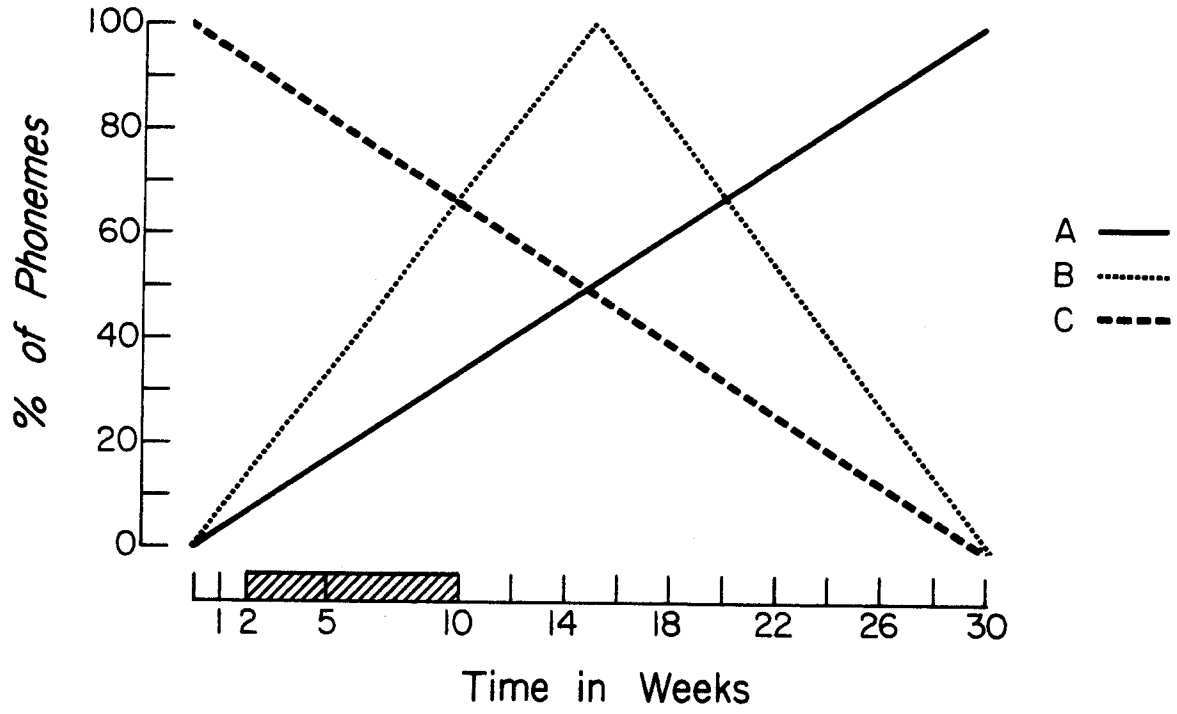


Figure 2. Theoretical model demonstrating expected percentage of phonemes initiated each session for three stimulus modes.

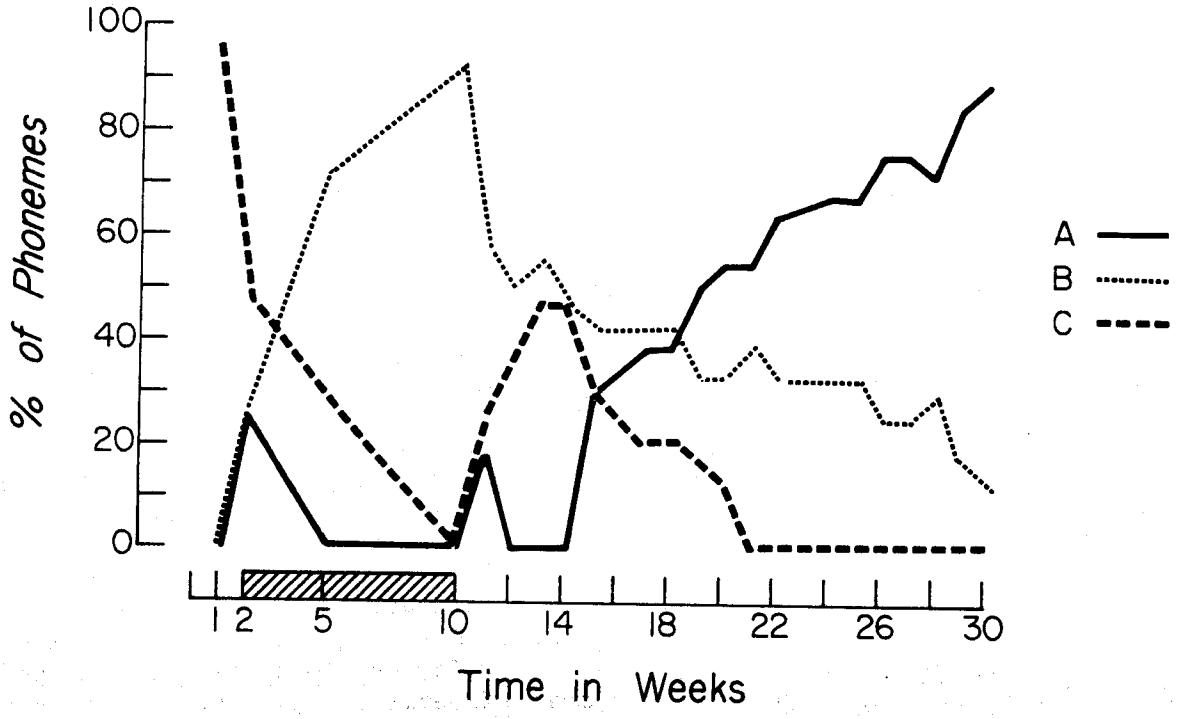


Figure 3. Percent of phonemes initiated in three stimulus modes.

Response patterns on the SPS revealed a greater incidence of error on voiced than voiceless phonemes, a commonly noted characteristic of apraxia. The number of voiced vs. voiceless phonemes which were initiated in each mode was compared to the theoretical model previously mentioned. Performance on voiceless phonemes, (Figure 4a), compared favorably with the model. Mode C was required to initiate seven of the eight voiceless phonemes (88%) on the first session but was eliminated after Week 15.

Performance on voiced phonemes failed to support the model (Figure 4b). Mode C decreased from 100% to zero in 24 weeks in conformance with the model but Mode B prevailed over Mode A until Week 30.

These data suggest that, while errors occurred on both voiced and voiceless phonemes, more stimulation was required for a longer period of time to initiate voiced phonemes.

The increased rate of recovery of voiceless over voiced phonemes can be further demonstrated by examining performance on a single mode in Figure 5. Mode C, integral stimulation was eventually eliminated for both voiced and voiceless phonemes. However, voiceless phonemes (bottom line) required Mode C stimulation for only 16 weeks while the voiced phonemes (top line) required Mode C stimulation for 21 weeks.

The number of voiceless phonemes shown in Figure 6 (top line) initiated in Mode A surpassed the voiced phonemes (bottom line) in both time and number. There appears to be a concomitant increase in the number of phonemes initiated in Mode A for both conditions after Week 16.

The rate of improvement for voices vs. voiceless phonemes for combined stimulus modes is illustrated in Figure 7. The voiceless phonemes (top line) appear to improve at a faster rate than the voiced phonemes. Of further note, the improvement appears consistent for this patient. Although the voiced phonemes (bottom line) improved at a slower rate, the increments are relatively stable following Week 14.

Summary and Conclusions

In summary, four major points have emerged from the present data:

1. This patient was able to achieve phonemic accuracy in isolation by visual stimulation in 88%, or 21 of 24 of the phonemes.

2. Although improvement was noted for both voiced and voiceless phonemes, voiceless phonemes improved at a markedly faster rate and required less stimulation than did the voiced phonemes.

3. Maintenance of accuracy of phonemes produced in isolation reflected a consistency of performance.

4. The accountability and record keeping system of the MPA permit the systematic collection of data relating to patient behavior without disruption of treatment.

Implications for future research:

1. The preliminary results presented today need to be substantiated with a larger N.

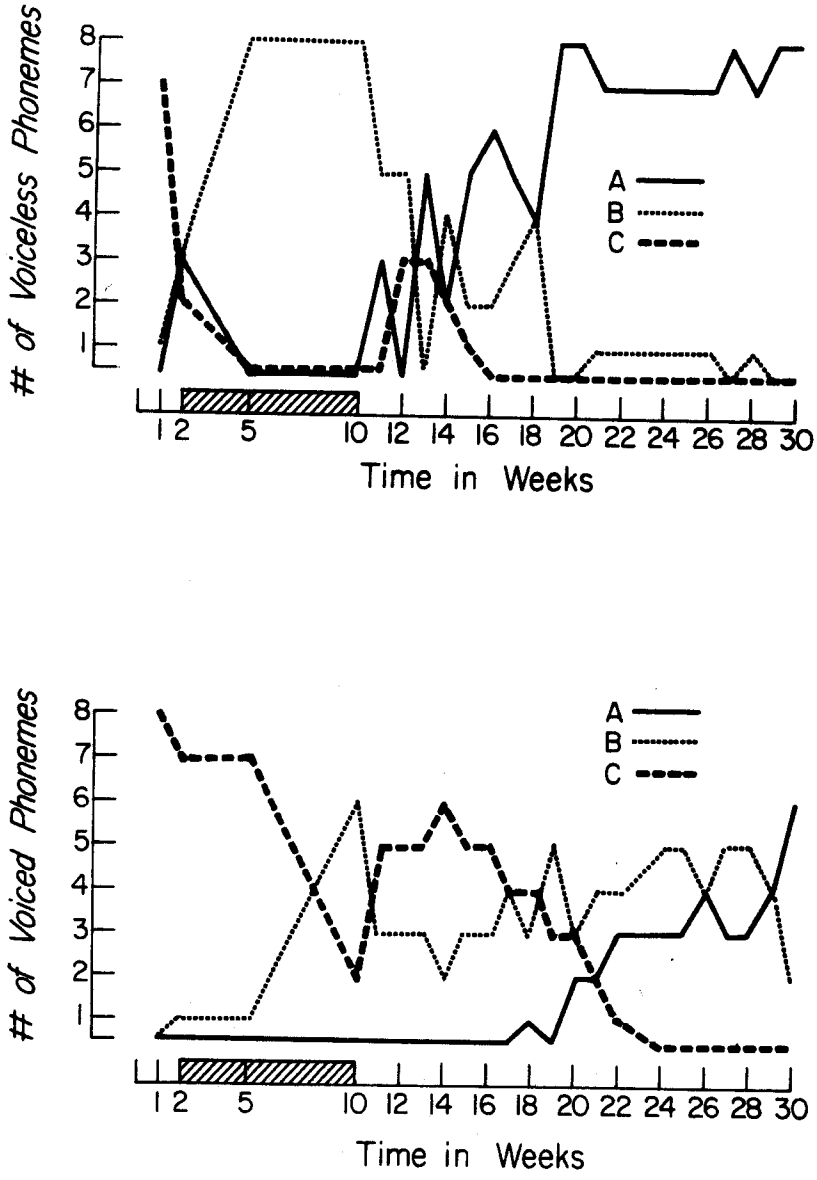


Figure 4. Number of voiced and voiceless phonemes initiated per week in stimulus modes A, B, and C.

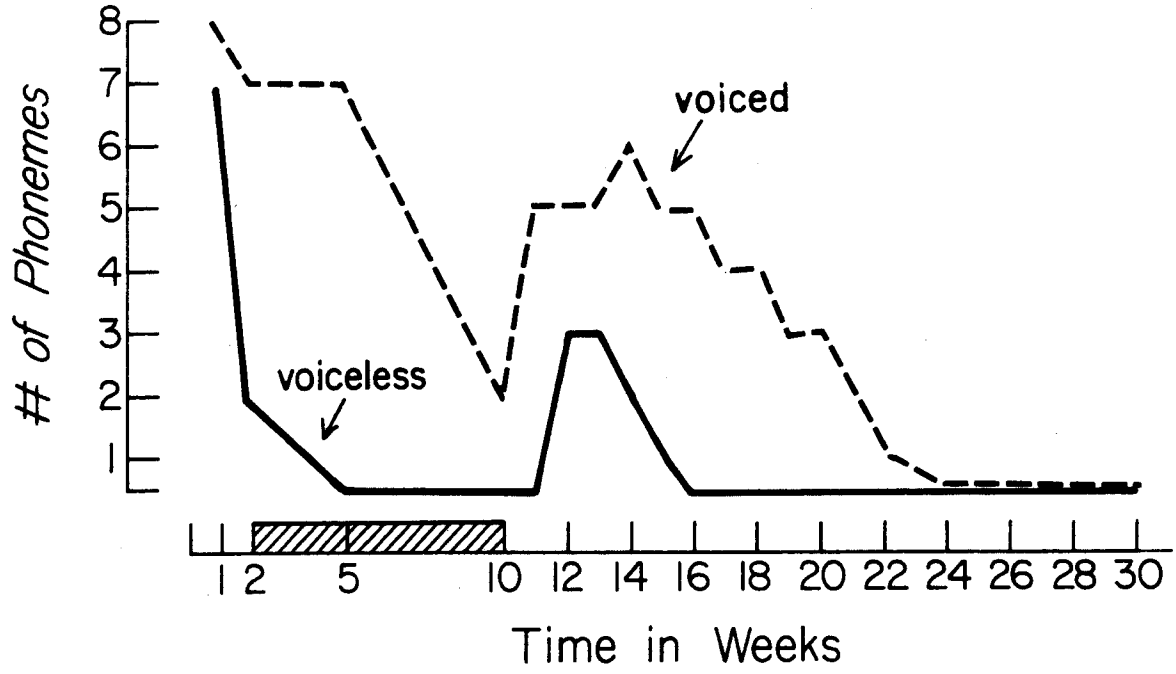


Figure 5. Number of voiced vs voiceless phonemes initiated weekly in Stimulus Mode C.

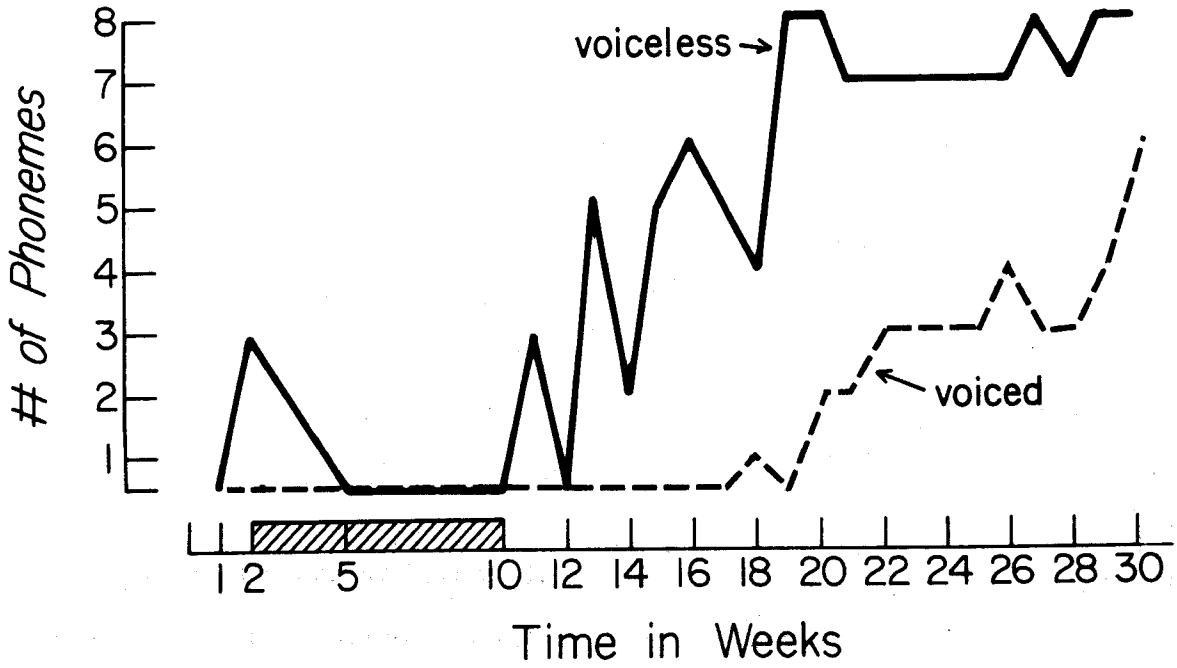


Figure 6. Number of voiced vs voiceless phonemes initiated weekly in Stimulus Mode A.

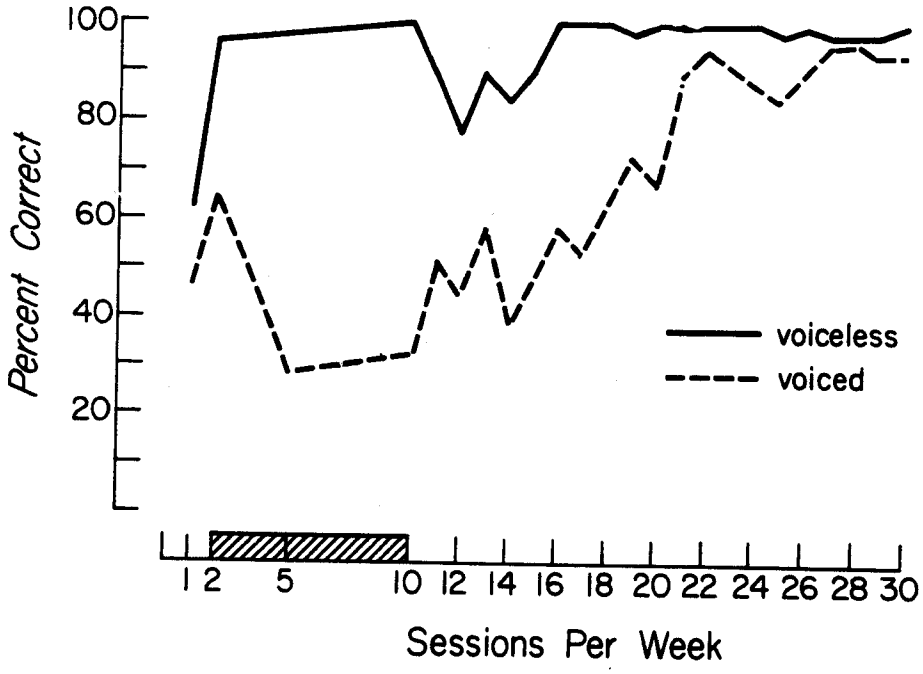


Figure 7. Percent correct of voiced vs voiceless phonemes per week for combined stimulus modes.

2. The MPA needs to be utilized on a patient population beyond six months post onset so that the question of spontaneous recovery vs. therapeutic intervention may be investigated.

3. It will be important to obtain data relating to a variety of etiologies in order to determine which types of patients are the best candidate for MPA.

4. Finally, it would appear interesting to investigate types of intervention strategies as they related to voiced and voiceless phoneme errors. For example, if the patient received treatment on the distinctive feature of voicing with the voiced phonemes and individual phoneme work on voiceless phonemes, would an interaction occur that would eliminate the need to provide individual phoneme work on voiced phonemes?

Reference

Bradley, D. and Mc Cabe, R. Systematic Multiple Phonemic Approach to Articulation Therapy. Acta Symbolica 1, 1:18 (1975).

Discussion

Q: What was your visual cue?

A: Printed stimuli in Mode A, printed plus facial cues in Modes B and C.

Q: Do you have some pre- and post-therapy information about how this generalized to the patient's speech?

A: As you recall, Speech Pathology treatment was initiated at 2 mpo and the MPA was initiated at 3 mpo, for one hour per week out of his ten hours of treatment.

However, you cannot isolate any concrete effects of the MPA because he had such an eclectic treatment program. Treatment during his MPA hour included work on posturing the articulators, sequencing, ease and consistency of production, initiation of phonation, et cetera. We attempted to integrate these skills into the task hierarchies used in other treatment sessions.

Q: Would achieving 100% be easier to maintain?

A: The holding procedure in the MPA allows for one response in Mode A; however, for an apraxic patient we like to elicit five responses on the SPS for each phoneme at 100% accuracy.

Q: How did you set priorities for selecting certain phonemes for treatment?

A: That was difficult. We selected Mode A, visual only, in an attempt to move quickly to Phase II. We did not want that hour to be spent only with phonemes in isolation. We were trying to include as much of a variety of the levels based on his best scores.

Q: Isn't this anti-linguistic and also in the terms of neurological consideration why use the visual mode?

A: When we were trying to decide whether to use this program, the question seemed to be can the patient use this information to generate his own cues? At that point, if he could write down that first letter and sound it out to produce the word, fine. In addition, it may aid in situations where we are providing the initial phoneme as a cueing device.

Comment

The ordering effect is important here. We tried random order and reversing the voiced/voiceless. Another point is the determination of the criterion for accuracy.