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ABSTRACT

The study examined the relationship in 44 preschoolers (considered to have varying degrees of predicted risk for poor school performance) between otitis media (middle ear disease) during the first 3 years of life and speech production (articulation) during preschool and school age years. Speech production accuracy was assessed by the number of consonant errors in words and sentences, intelligibility of speech, and the suprasegmental features used during conversational speech. Transcriptions were typed, stored, and analyzed via computer. The total duration of bilateral and unilateral otitis media during the first 3 years of life ranged from 4 to 884 days; the total duration of bilateral or unilateral otitis media ranged from 8 to 937 days. Preliminary speech analysis revealed that the otitis media durations were correlated with two specific types of speech errors: final sounds at age 3 and voicing at age 5. Otitis media durations were not correlated with the overall number of errors or other error types. Results suggest that otitis media is a predictor of only certain types of speech errors and must be interpreted cautiously because of the small number of subjects at each age level. (CL)

THE EFFECTS OF OTITIS MEDIA ON ARTICULATION

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This study examined the relationship between otitis media (middle ear disease) during the first three years of life and speech production (articulation) during the preschool and school age years. Several researchers (Holm & Kunze, 1969; Needleman, 1977; Northern & Downs, 1978; Shriberg & Smith, 1983) have implicated otitis media during early childhood in later disorders of speech. The fluctuating hearing loss associated with otitis media (OME) during the language formative years is believed to be responsible for these speech problems.

Previous Studies

Three studies have examined the relationship between otitis media and speech production (Holm & Kunze, 1969; Needleman, 1977; Shriberg & Smith, 1983). Home & Kunze (1969) compared the speech performance of 16 children 5 to 9 years old recruited from an ear, nose, and throat clinic who had histories of chronic otitis media with 16 children seen in a hospital with no such histories. They reported significant differences in errors on the Templin Darley Screening Tests of Articulation. Similarly, Needleman (1978) used the Templin Darley Screening Tests of Articulation to compare the articulation of one group of 20 children age 3 through 8 with a history of otitis media and a group without such a history. Needleman (1978) found that the same sounds were misarticulated in both groups, but that the otitis media group misarticulated more of these sounds. Shriberg and Smith (1983) compared retrospectively the conversational speech samples of two groups of 11 speech disordered children age 3 1/2 to 6 with and without histories of otitis media. The researchers reported qualitative differences in speech patterns of children with recurrent OME. Two distinct phonological patterns were common

in the otitis group: (a) initial consonants were deleted or substituted by [h] or glottal stop and (b) nasal sounds were either replaced by another nasal consonant or stop, denasalized, or preceded or followed by an epenthic stop. These studies linking otitis media to speech disorders have been criticized as having methodological problems (Menyuk, 1979; 1980; McWilliams, 1983; Ventry, 1980; 1983). Thus, the OME speech relationship is presently controversial.

METHOD

Subjects

Subjects were 44 children who attended the Frank Porter Graham Child Development Center (FPG) research day care program. The principal objective of the FPG research program is to characterize the development of children with varying degrees of predicted risk for poor school performance because of socioeconomic and cultural factors. Children, identified at birth as biologically normal, are selected for the program based on a risk index which includes measures of family income, maternal IQ, parental education, and family stability (Ramey & Smith, 1977). The children enter the day care program of the Center at approximately 2 months of age in yearly cohorts of 12 to 14 individuals and attend the Center daily, 50 weeks a year until age 5, when they begin school.

The sample of children in this study included 11 three year olds, 10 four year olds, 13 five year olds, and 10 seven year-olds. Twenty-eight children are males and 16 are females. Of the 44 children, 37 are from a high-risk population and 7 are from a non-high-risk population.

Occurrence of otitis media

Complete medical care was provided for the FPG children by a staff pediatrician and two family nurse practitioners. Children were under medical surveillance five days a week by the medical staff. Complete physical

examinations were performed when the medical staff, teachers, or parents reported illness symptoms. Medical data, including illness history, physical findings (e.g., tympanic membrane mobility and appearance), diagnosis, and duration of illness were recorded on computer forms.

The diagnosis of otitis media with effusion (OME) was established using pneumatic otoscopy and tympanometry. The middle ear status of the children was monitored routinely once a month by otoscopy and tympanometry. Otoscopy and tympanometry were performed on days 1, 2, 4, 8, and 15, following the diagnosis of all respiratory illnesses and at one week intervals until the child was well and tympanometry had returned to normal (peak compliance of tympanic membrane between +100 and -150mm H_2O bilaterally). Tympanograms were obtained using an automatic tympanometer (Grason Stadler Model GS-128) in accordance with ASHA (American Speech and Hearing Association guidelines, 1979).

Speech Assessment

Measures. Speech production accuracy was assessed by the number of consonant errors in words and sentences, the intelligibility of speech, and the suprasegmental features used during conversational speech. The Goldman Fristoe Test of Articulation (1972) assessed single consonants and consonant blends in words. A sentence imitation task developed by the investigators was used to assess speech accuracy in sentences. Consonants were tested in the initial and final position of words and in blends using 34 sentences of three or four words and morphemes. To quantify speech accuracy further, a series of rating scales developed by the investigators assessing intelligibility and suprasegmental features during conversational speech were used. These scales were devised after a review of available measures of intelligibility and suprasegemental feature use. See Appendix for measures.

Procedures. Each child was tested individually in the double-walled IAC sound-treated room at FPG during one session. To rule out hearing impairment at the time of assessment, each child passed a hearing screening at 20dB at the frequencies 1000 Hz and 2000 Hz and at 15 dB at the frequencies 500 Hz and 4000 Hz. Children who failed the hearing screening were retested two weeks later. Each child was then shown pictures on the Goldman Fristoe Test of Articulation and asked to name the pictures. Next, each child participated in the sentence imitation task. After several practice trials, the child was instructed to "follow the leader" and say what the lady on the tape says. Sentences were presented via audiotape by a southern dialect speaker at a comfortable conversational level of 50 dB HL. Finally, each child participated in a 20-25 minute conversational speech sample with the examiner. The activities and materials centered around a circus. The examiner presented required prompts during play.

Responses on all three tasks were recorded on a tape recorder (Yamaha, Model K960) connected to a Sure matching transformer and Crown pressure plate microphone. Two graduate research assistants collected the data under the supervision of the ASHA certified investigator. The research assistants were unaware of the OME experience of each child.

Transcription. The articulation test was transcribed live during the session by the research assistants. The sentence imitation task was transcribed from audiotapes. Entire words were transcribed using the narrow transcription system of Shriberg and Kent (1982). To rate intelligibility and suprasegmental features, the experimenters listened to ten minutes beginning at minute six of the spontaneous speech sample and rated each of the factors on the rating scale. Transcription reliability was assessed by computing the percentage of agreement between experimenters for all consonants in the

sample. The total number of consonants transcribed by both experimenters was computed. From that number, a percentage was computed reflecting the percentage of consonants for which the transcription of the experimenters agreed with in regard to the consonants used. Inter-examiner reliability on the Goldman Fristoe Test of Articulation was computed on a third of the sample and was 84%.

Data preparation for speech analyses. The entire transcribed word, transcribed sentence, and intelligibility and suprasegmental ratings were typed in, stored, and analyzed on a computer program developed by the investigators.

RESULTS

Otitis media durations. The total duration of bilateral and unilateral otitis media during the first three years of life ranged from 4 to 884 days and the total duration of bilateral or unilateral otitis media ranged from 8 to 937 days.

Table 1 shows the distribution of the otitis media experience.

Speech errors. Currently, data analyses using the computer program are in process. The preliminary results described below were hand computed for the articulation test only and are a sample of the planned analyses. These analyses are based on the high-risk subjects only. Since there were only seven non-high-risk subjects, there were too few non-high-risk subjects at each age level to permit analyses. Black dialect patterns such as f/o were credited as correct.

The types of errors on the articulation test made by each age groups is shown in Table 2.

Table 1

Number Of Children Falling Within Each Otitis Media Duration

Type of Otitis Media	Duration of days of otitis media								
	0-50	50-100	100-150	150-200	200-250	250-300	300-350	350-400	More than 450
Bilateral	9	9	6	6	0	0	0	5	2
Bilateral or Unilateral	3	4	9	4	6	0	3	2	6

Table 2

Mean Number of Speech Errors on Articulation Test by Age

Type of Errors	AGE 3 N = 9	4 N = 5	5 N = 13	7 N = 10
Total Errors	22.2	8.8	8.7	4.2
Initial	13.0	4.2	3.7	2.3
Medial	4.6	2.6	2.2	0.9
Final	4.7	2.0	2.8	1.1
Substitution	12.8	4.6	2.2	0.7
Distortions	4.9	2.6	4.2	2.9
Omissions	5.6	1.6	2.2	0.7
Place	9.6	2.6	2.2	0.7
Manner	6.0	3.4	1.1	0.5
Voice	2.2	.8	0.4	0.3

Table 3

Pearson Product-Moment Correlations for Duration of Otitis Media and Speech Errors on Articulation Test

Type of Error	AGE 3 N = 9	5 N = 13	7 N = 10
Errors	.426	-.169	0.13
Initial	.008	.386	-.079
Medial	.118	-.455	.059
Final	.818*	-.233	.231
Substitution	.318	.288	-.123
Distortion	.445	-.334	.063
Omission	.177	-.160	.099
Place	.289	.316	-.123
Manner	-.340	.154	-.019
Voice	-.243	.754*	.239

*P<.05

As can be seen, the overall number of errors decreased with age. Pearson product-moment correlations were computed between the duration of OME during the first three years of life and speech errors at ages three, five, and seven. Since there were only five subjects at age four, correlations were not run. It can be seen in Table 3 that a significant relationship occurred only between OME duration and final sounds at age three and voicing at age five. The overall number of errors and other error types were not significant in their relationship to otitis media experience.

Discussion

These preliminary analyses indicate that the otitis media durations were correlated with two specific types of speech errors, final sounds at age three and voicing at age five. It was not correlated with the overall number of errors nor other error types. These results may suggest that the duration of otitis media is a predictor of only certain types of speech errors. The results must be interpreted cautiously due to the small number of subjects at each age level, large number of tests (30) run at the .05 level, and lack of consistent patterns over time. Additional data are being collected during the second year of the study which will increase the number of subjects at each age level. For these data, we will make a prior hypotheses and examine the relationship of specific error types to otitis media experience.

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Appendices

A. Articulation Test Words

B. Sentence Imitation Task

C. Intelligibility and Suprasegmental Scale

GOLDMAN FRISTOE TEST OF ARTICULATION

NAME _____ DATE _____ ID _____ E_1 _____ E_2 _____

IDENTIFIES PICTURES CORRECTLY:

1 Always 2 Often 3 Sometimes 4 Infrequently 5 Never

1. _____ (hʌʊs)
2. _____ (tʃɪlɛfon)
3. _____ (kʌp)
4. _____ (gʌn)
5. _____ (naɪf)
6. _____ (wɪndo)
7a. _____ (wɑgʌn)
7b. _____ (wil)
8. _____ (ʃɪkɪn)
9. _____ (zɪpɚ)
10. _____ (sɪz ɚz)
11a. _____ (dʌk)
11b. _____ (jɛlo)
12. _____ (vækjum)
13. _____ (mæʃɪz)
14. _____ (læmp)
15. _____ (ʃʌ vɚl)
16. _____ (kar)
17. _____ (ræbɪt)
18. _____ (fɪʃɪŋ)
19. _____ (bɔɪ)
20. _____ (ʃurʃ)
21. _____ (fɛðɚ)
22a. _____ (pɛnsɪlz)
22b. _____ (ðɪs) (æt)
23a. _____ (kɑrɪt)
23b. _____ (ɔrɪnʤ)

24a. _____ (bæθtʌb)
24b. _____ (bæθ)
25a. _____ (θʌm)
25b. _____ (fɪŋgɚ)
25c. _____ (rɪŋ)
26. _____ (ʤʌmpɪŋ)
27. _____ (pʌʤæmʌz)
28a. _____ (plenn)
28b _____ (blu)
29. _____ (brʌʃ)
30. _____ (drʌm)
31. _____ (flæg)
32. _____ (sæntəklaʊz)
33. _____ (krɪsmʌstri)
34. _____ (skwɪrl)
35a. _____ (slipɪŋ)
35b. _____ (bɛd)
36. _____ (stov)
37. _____ (spun)
38. _____ (skaɪ)
39. _____ (prɛzɪnt)
40. _____ (grin)
41. _____ (smok)
42. _____ (glæs)

Name _____ ID _____ Date _____ E_1 _____ E_2 _____

SENTENCE IMITATION TASK

1. Open the window.
2. I see my teacher.
3. Please shut the door.
4. I use my pocket.
5. Climb up the hill.
6. Mother broke a glass.
7. I see Bobby.
8. See the tiger.
9. I like you too.
10. Tell me a story.
11. Get my red robe.
12. I see a slide.
13. I like grape jelly.
14. Go to the church.
15. I visit George.
16. Clean the bathtub.
17. Stop pushing me.
18. I cut my thumb.
19. Vickie took a bath.
20. Get off the sofa.
21. I wash the dog.
22. We go to school.
23. Give mommy your spoon.
24. I see the treasure.
25. Give me the present.
26. Buy a new shovel.
27. I cry alot.
28. Button my blue dress.
29. Fix the zipper.
30. Give me the ring.
31. I lost my pencil.
32. I smell the flower.
33. Give me a penny.
34. I hurt my finger.

INTELLIGIBILITY AND SUPRASEGMENTAL SCALE

NAME: ID DATE E1 E2

A. INTELLIGIBILITY

1	NORMAL	Speech is completely intelligible.
2	NORMAL/MILD	Speech occasionally has slight errors.
3	MILD	Speech frequently has slight errors.
4	MILD/MODERATE	Speech is noticably in error, but major content is intelligible.
5	MODERATE	Speech is noticeably in error, but is intelligible only with careful listening.
6	MODERATE/severe	Speech is unintelligible most of the time.
7	SEVERE	Speech is completely unintelligible.

B. LOUDNESS

-2	-1	0	1	2
Very Loud	Loud	Normal	Soft	Very Soft

C. PITCH

-2	-1	0	1	2
Very High	High	Normal	Low	Very Low

D. NASALITY

-2	-1	0	1	2
Very Hypernasal	Nasal	Normal	Denasal	Very Denasal

E. HOARSENESS

-2	-1	0
Very Hoarse	Hoarse	Normal

F. BREATHINESS

-2	-1	0
Very Breathy	Breathy	Normal

G. HARSHNESS

-2	-1	0
Very Harsh	Harsh	Normal

H. RATE

-2	-1	0	1	2
Very Fast	Fast	Normal	Slow	Very Slow

I. STRESS

-1	0
Inappropriate	Appropriate

J. FLUENCY

-2	-1	0
Noticeable repetitions	Occasional repetitions	Normal