Assessment of impact of chronic otitis media with effusion on auditory skills development using A to Z program in preschool children

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Abstract

Key wards: Otitis media- Effusion- auditory skills- preschool children- A to Z – hearing intervention program.

Background: otitis media is with effusion one of the commonest childhood diseases, and it gains the attention among phoniatricians and speech and language pathologists out of its impact on language development, and phonological awareness.

Objectives: the purpose of the study is to assess the impact of chronic otitis media with effusion on the auditory skills development in the preschool children using A to Z program.

Methods: This study was carried on 70 children, divided into 2 groups, subjected to the designed auditory assessment sheet, including: screening of language development and phonology, medical history of previous medications, and previous surgeries, recent audiological assessment, and tympanometry and auditory skills assessment and scoring using A to Z program.

Results: The main presenting symptom is multiple phonological errors. All of the auditory skills are affected with variant degrees; the least affected is auditory detection, and the mostly affected is psychoacoustic features. The phonological awareness, word discrimination, and identification are also highly affected. The factor of increasing distance in general, has a great impact on the patients' performance.

Conclusion: OME during early childhood has a strong impact on auditory skills development, mainly presenting as phonological awareness disorders, and learning disabilities. Early diagnosis, intervention and speech rehabilitation is highly recommended.

Introduction:

Hearing is one of the major senses, and it is important for auditory warning and communication. It is a conscious process of vibrations perceived as sounds. In order to do this, the appropriate signal must reach, and be processed in the higher parts of the brain (**Alberti, 2001)**.

The middle ear in many circumstances is a remarkable organ where tympanic membrane (TM), ossicular chain and inner ear represent a highly complex sound pressure wave receiver, whose dynamics are unmatched by any other sensory organ **(Luers and Hüttenbrink, 2015). Bluestone** said that, despite the great advances in public health, and medical care, chronic otitis media is still prevalent around the world. It is most common in developing countries, and in certain high risk populations in developed nations.

There has been much concern over studying the possible effects of middle ear disease on learning in general, and language development in particular. It is important to mention that, the number and duration of attacks, the severity of the hearing loss, and the distinction between unilateral and bilateral disease have a great role **(Hall and Hill, 1990)**.

Patients and methods:

The aim of this study is to assess the effect of chronic otitis media with effusion with duration of 3 months or more on the development of auditory skills in preschool children aged from 3 to 6 years old, which will be reflected latterly on their language development, and their educational performance to highlight the importance of treatment, and resolving of this condition as early as possible. All of the 70 children, divided on 2 groups, were subjected to the designed auditory assessment sheet including, assessment of language development and phonology, history of previous medications and surgeries, recent audiological assessment, and auditory skills assessment and scoring at different distances.

Results:

Table (1): Frequency of referral complaint among cases.

Variables (n=35)	Medical history	
	Number	%
Type of complaint		
Phonological error and poor speech intelligibility	24	68.6%
Poor scholastic achievement	3	8.6%

Mixed	8	22.9%
Onset of complaint		
Gradual	35	100%
Sudden	0	0%
Course of complaint		
Stationary	12	34.3%
Progressive	23	65.7%
Duration of complaint (mean /SD)		
Duration in months	19.3	8.3

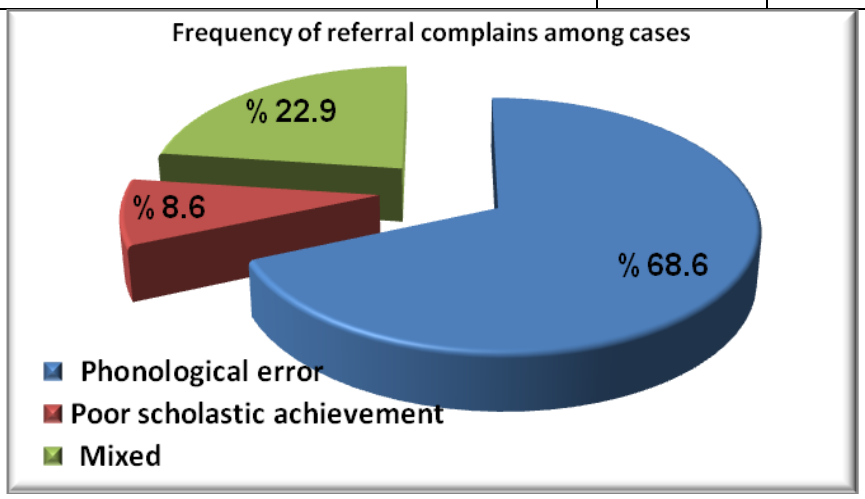

Fig. (1) Frequency of referral complaint among cases

Table (2): Comparisons of the sound localization score in different study groups.

Variables	**Cases** (n=35)		**Control** (n=35)		**P-value** [a]	**Sig.**
	Mean	**SD**	**Mean**	**SD**		
Localization (0.5 m)	14	1.3	14.9	0.5	**<0.001**	**HS**
Localization (0.75 m)	13.5	2.6	14.9	0.5	**0.002**	**HS**
Localization (1.5 m)	**12.9**	**2.1**	14.9	0.5	**<0.001**	**HS**
P-value [b] **(sig.)**	**0.01(S)**		1(NS)			

This table illustrates that, there was statistically significant difference between study groups, as regards sound localization score at 0.5, 0.75, and 1.5 meter with **low** mean among cases. Also, there was statistically significant **decrease** in localization score with increasing distance among cases, but no statistical significance change in control group.

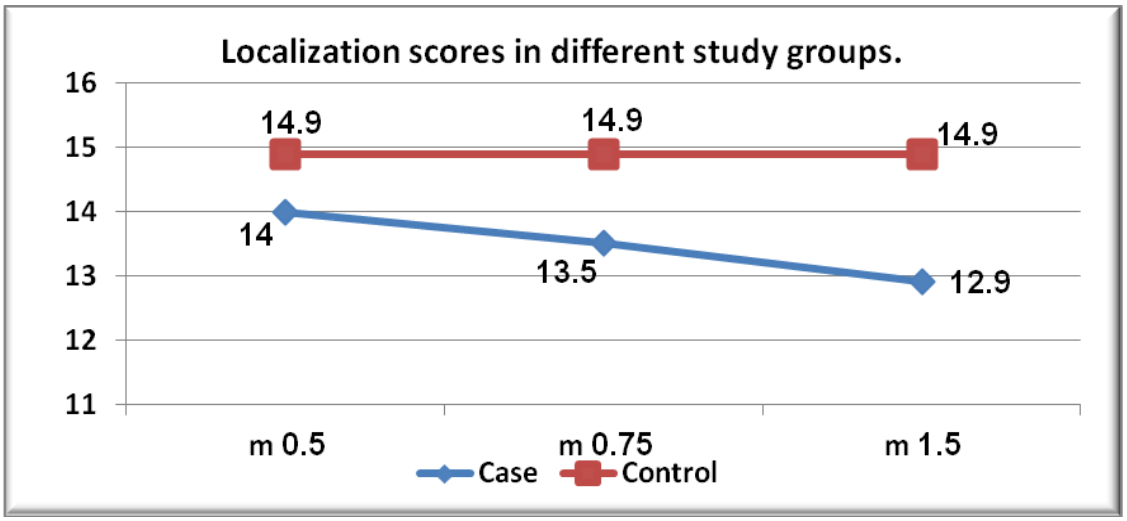

Fig. (2) Comparison of localization score at different distances among groups

Table (3): Comparison of "level 3" discrimination of speech "Ling" sounds among study groups.

Level 3 speech discrimination	Cases (n=35)		Control (n=35)		p-value [a]	Sig.
	Mean	SD	Mean	SD		
/ʃ /-/s/ & /s/-/s/						
0.75 m	3.5	0.6	4.7	0.5	**<0.001**	**HS**

1.5 m	3.3	0.7	4.9	0.2	**<0.001**	**HS**
p-value [b] (sig.)	**0.02(S)**		**0.03(S)**			
/ʃ /-/s/ & /ʃ/-/ʃ/						
0.75 m	3.2	0.7	4.9	0.2	**<0.001**	**HS**
1.5 m	3	0.7	5	0	**<0.001**	**HS**
P-value b (sig.)	**0.02(S)**		**0.8(NS)**			

Table (3) illustrates that, there was statistically significant difference with **low** mean speech sounds discrimination score among cases with p-value < 0.05 at 0.75 meter.

Table (4): Comparison of discrimination of speech sounds at different distances among cases.

Variables	At 0.75 m		At 1.5 m		p-value	Sig.
	Mean	SD	Mean	SD		
/m/-/t/ & /t/-/t/	4.4	0.6	4.2	0.6	**0.03**	**S**
/b/-/w/ & /w/-/w/	4	0.6	3.7	0.7	**0.002**	**HS**
/t/-/d/ & /t/-/t/	3.2	0.7	2.9	0.8	**0.02**	**S**
/s/-/z/ & /z/-/z/	3.1	0.7	2.7	0.9	**0.006**	**HS**
/l/-/r/ & /l/-/l/	3.5	0.8	3.3	0.8	0.07	NS
/k/-/k/ & /k/-/g/	3.1	0.8	2.7	1	**0.004**	**HS**
/x/-/ɣ/ & / ɣ/-/ ɣ/	2.9	0.8	2.6	0.9	**0.001**	**HS**
/k/-/q/ & /q/-/q/	2.9	0.9	2.9	0.9	0.5	NS
/b/-/d/ & /d/-/d/	3.5	0.7	3.2	0.6	**0.003**	**HS**
/m/-/n/ & /m/-/m/	3.9	0.8	3.7	0.8	**0.01**	**S**
/k/-/t/ & /t/-/t/	3.1	0.8	2.9	0.8	**0.01**	**S**

Table (4) illustrates that, there was statistically significant **decrease** in mean speech sounds discrimination score with increaseing distance as (**/m/-/t/) & (/b/-/w/) &** (**/t/-/d/) &** (**/s/-/z/)** & (**/k/-/g/)** & **(/x/-/ɣ/)** & (**b/-/d/)** & **(m/-/n/)** among cases with p-value < 0.05.

But, there was no statistically significant difference in discrimination of (**/l/-/r/) & (/k/-/q/)** speech sounds scores among cases with p-value> 0.05.

Table (5): Comparison of Arabic words discrimination at different distances among cases.

Variables	At 0.75 m		At 1.5 m		p-value	Sig.
	Mean	SD	Mean	SD		
شط – بط & بط – بط	4.9	0.3	4.7	0.6	**0.03**	**S**
توت – توت & توت – بوت	3.6	1	3.4	0.9	0.1	NS
نار – جار & جار – جار	4.2	0.7	3.9	0.9	**0.02**	**S**
نحلة – نخلة & نخلة – نخلة	4.5	0.7	4.2	0.7	**0.004**	**HS**
خس – خط & خس – خس	4.5	0.7	4.2	0.8	**0.008**	**HS**
عش – عيش & عش عش	3.6	0.8	3.5	0.9	0.1	NS
شطة – شطة & شنطة – شطة	3.2	0.9	2.9	1	**0.03**	**S**
بطن – بطن & بط – بطن	2.9	1	2.8	1.1	0.3	NS

Table (5) illustrates that, there was statistically significant **decrease** in mean word discrimination scores with increasing distance

Table (6): Comparison of word identification (minimal pairs) at different distances among cases.

Variables	At 0.75 m		At 1.5 m		p-value	Sig.
	Mean	SD	Mean	SD		

نار- فار	4.9	0.4	4.8	0.4	0.4	NS
زيت – بيت	4.8	0.5	4.7	0.6	0.1	NS
برج – درج	3.4	0.7	3.1	0.7	**0.006**	**HS**
توكة – شوكة	4.5	0.7	4.2	0.8	**0.001**	**HS**
شماعة – سماعة	3.7	0.9	3.4	1	**0.01**	**S**
مراية – ملاية	3.2	0.8	2.8	0.6	**<0.001**	**HS**
بيت – بيض	3	0.9	2.6	0.9	**<0.001**	**HS**

Table (6) illustrates that, there was statistically significant **decrease** in the mean of minimal pairs word identification score with **increasing** distance.

Disscussion

The phonological development in patients with OME is the most affected aspect of language and speech, receptively and expressively. In this study, (94.3%) of the cases were with phonological errors.

Only 22.9% of cases complained of previous AOM attacks, also, all of cases were not affected on the level of auditory detection with perfect response to any auditory stimulus with different frequencies. Those results may explain the silent nature of the disease, and its late discovery.

The psychoacoustic features of sound included in this study, were loudness, duration, continuity, segmentation. All are negatively affected. They help in the development of the supra-segmental features, such as; stress, tone, rate or word juncture, extending over syllables, words and phrases, which is related to the prosody of speech to make it more meaningful and effective, clarifying the para-verbal aspects of the context, Also, it helps in the development of intact phonological production.

Shetty & Koonoor in (2016) held a study on Sensory deprivation, due to otitis media episodes in early childhood, which concluded that, finer aspect of speech processing skills are affected in children who had a history of OME at an earlier age and its effect

persists at later age even though the audibility was within normal limit.

It is also noticed that, the most significant changes in speech sounds discrimination between cases and controls, were especially found in the sounds sharing in characters, as sounds with same frequencies, place of articulation, resonance and voicing, etc. These results were in accordance with the results of **Margolis & nelson (1993)** study on patients had AOM followed by conductive hearing loss. They assessed the hearing after the acute attack was resolved, and found that, the conductive element resulting in mild to moderate hearing with sloping curve towards the region of high frequency sounds. They also documented that; this effect may recover slowly, in up to six months duration.

Regarding Arabic words minimal pairs identification, 71.4 % of them was negatively affected, especially with the pairs, which had phonemes within the same frequency range on the level of near distance, and all of the minimal pairs were affected on the level of further distance. This gives an idea about learning and lexical difficulties, and poor performance of the child against noisy background.

Conclusion:

- All of the auditory functions are found to be affected, yet to variant degrees, nevertheless, the distance variable was found to be a very powerful variable.

- Phonemic perception, word discrimination and word identification were affected to a great extent, and they can accordingly have a negative influence on the learning and lexical abilities.

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