

## **Auditory Threshold Shift and the Factor of Age in Deaf Children**

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**Objective:** To study the effect of age on auditory threshold shift among children in two schools for the deaf.

**Design:** Prospective.

**Setting:** Two schools for the hearing impaired children, one in a non-metropolitan and another in a metropolitan area.

**Method:** Three hundred and eight-five children with hearing level of 75 dB were audologically tested within three years. The study was performed from January 2005 to June 2007.

**Result:** Pure tone audiogram showed 6-8 dB threshold shift in the metropolitan group of 234 children and 4 dB in the non-metropolitan group of 151 children. In metropolitan school one hundred and forty-seven (62.8%) were found to be hearing aid users and 42 (28%) were in non-metropolitan school.

**Conclusion:** Threshold shift of 6-8 dB in the metropolitan group of 234 children and 4 dB threshold shift in the non-metropolitan group of 151 children was found.

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Hearing impairment has become a subject of remarkable interest in the medical-rehabilitative field, although many are yet to come to terms with the reality of its impact on the afflicted.

It is no longer a contestable fact that some of the consequences of unattended hearing impairment are long lasting communication difficulty, psychosocial and educational deficits<sup>1</sup>.

In many normal hearing children, the hearing threshold have been found to take an upward swing with age especially in those with normal middle ear function<sup>2-5</sup>. In a study on hearing impaired children, about 89% of the studied group showed a threshold shift (downward/better) of 10 dB between the initial and final auditory tests<sup>6</sup>.

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As age advances, many unattended hearing impaired children lose the potential of auditory attention and consequently the prevalent channel of communication with the outside world, oral-verbal communication is lost.

It is vital to assess regularly the auditory threshold shift in hearing impaired children to plan appropriate clinico-therapeutic program for the benefit of the child.

The aim of this study is to assess the hearing threshold shift in severely deaf children.

## **METHOD**

The researcher designed questionnaire which was administered to parents by a social worker to ascertain consanguineous or non-consanguineous marriage.

Otoscopic examination was performed on the children to eliminate factors that could invalidate the study.

Two schools for the hearing impaired, in two different locations were selected for the study; one in Riyadh as Metropolitan, the second was in Al-Kharj dubbed as non-metropolitan.

Three hundred and eighty-five hearing impaired children aged 6-17 years (all boys) were selected from both schools, the study was performed from January 2005 to June 2007.

Two hundred and thirty-four children were from metropolitan school and 151 children from non-metropolitan school. All the children had an initial pure tone average (PTA) threshold of 75 dB.

Annual, regular pure tone audiometric test was performed on the children from January 2005 to June 2007. Audiometric test was carried out using a calibrated Madsen O.B.8-22 audiometer. Pure tone frequencies 0.5, 1, 2 and 4 KHz were tested. The hearing and speech center of the ministry of education, which is acoustically insulated, was used as a venue for testing the children.

Middle ear evaluation was conducted on children with Standard Grason Stadler (GSI 36) tympanometer.

A standard criteria for participation in the study was an average hearing threshold of 75 dB, bilateral sensorineural hearing loss, normal otoscopic examination and normal middle ear function (Type A tympanogram).

## **RESULT**

Compared to the threshold recorded at the inception of the study, 6-8 dB threshold shift improvement in the hearing of 234 children in the metropolitan school was found, while only 4 dB threshold shift improvement was found among 151 children in the non-metropolitan school.

One hundred and forty-seven (62.8%) children were hearing aid users in the metropolitan school and 42 (28%) in the non-metropolitan school.

Out of 385 children, 17 (4.42%) were found to have come from a consanguineous marriage (1<sup>st</sup> cousins) while 29 (7.53%) came from 2<sup>nd</sup> cousin or other relative marriage. A total of 339 (88.05%) were found not to be family related. (See tables 1, 2 and 3).

**Table 1: Threshold Average in dB (n=385)**

School	No of student	Tested frequencies (Average threshold)			Variability average
		1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	
Metropolit an School (Riyadh)	234	75dB	70dB	68dB	7dB
Non-Metropolit an School (Al-Kharj)	151	75dB	72dB	71dB	4dB

**Table 2: Hearing Aid Use (n=385)**

School	No of student	Hearing Aid Users (%)	Non-Hearing Aid Users (%)
Metropolitan School (Riyadh)	234	147 (62.8)	87 (37.2)
Non-Metropolitan School (Al-Kharj)	151	42 (28)	109 (72)
Total	385	189 (49.1%)	196 (50.91%)

**Table 3: Consanguinity (n=385)**

	(1 <sup>st</sup> cousins)	(2 <sup>nd</sup> cousins/relatives)	No.of Sample	Parentage %
Consanguineous parentage	17 (4.42%)	29 (7.53%)	64	11.95%
Non-Consanguineous parentage	-	-	339	88.05%
Total Sample			385	100%

## DISCUSSION

Many healthcare providers are unaware of the variability in auditory threshold, which could occur in hearing impaired children. Because the degree of impairment is classified according to the loss of hearing sensitivity, that is how loud sounds perceived by a listener. A drop of more than 10 dB in the level of a sound is significant. The difference recorded in this study, is without a doubt is an improvement<sup>6,7</sup>.

In this study, ear wax was commonly noticed in those children from the non-metropolitan school. Impacted wax is one of the most common causes of deafness seen in general practice<sup>8</sup>. The fact that the majority of these children did not have the benefit of better audiological services as their counterpart in the metropolitan school may have accounted for the impacted wax seen in their ear canals. Although, the issue of accumulated wax in the auditory canals of hearing aid users is commonly documented, adequate audiological care makes it less of a problem to the hearing impaired<sup>9</sup>.

Hearing impairment in Saudi Arabia was found in 13% of the children surveyed. Sensorineural hearing loss (SNHL) was (1.5%) of all children surveyed (1-4 in 1000). Whereas mixed hearing loss was (1.1%) and the prevalence of otitis media with effusion was 7.5%, this percentage is high when compared to other developed countries<sup>10</sup>. The majority of the deaf children obtain Hearing Aid (HA) from the institute of the deaf around the age of 6 years, The majority of the children in the present study used manual communication, and this is the teaching procedure in the institutes for the deaf in Saudi Arabia<sup>11</sup>. Complicating matters is the distinction between the need for amplification due to the extent and impact of the auditory deficit versus how much benefit the hearing impaired experiences from the hearing aid<sup>12,13</sup>.

The only feasible explanation in the upward shift of auditory threshold among the studied children can be attributed to natural maturation or aging process, improvement in conscious utilization of residual hearing or enhanced post-amplification listening skills and other clinically structured rehabilitative program.

For a more acceptable validation of this finding, i.e. audiometric improvement of severely hearing impaired hearing aid users, further longitudinal study may be desirable.

In this study, few children are the product of consanguineous marriage. This finding is similar to a previous study performed in the Kingdom on consanguinity and hereditary hearing impairment among Saudi population<sup>14</sup>. Diminishing consanguineous related hearing impairment is therefore a pointer to the fact that the society is aware of the drawbacks of consanguineous marriage.

For many hearing impaired persons, HA provides a re-entry into the hearing world. Hearing aid should be prescribed free of charge or at least with an affordable price at an early age.

## CONCLUSION

**Threshold shift of six to eight dB in the metropolitan group of 234 children and 4 dB in the non-metropolitan group of 151 children was found.**

**This study indicates the need for regular audiological monitoring of hearing impaired school children to maximize the benefits derived from amplification.**

**Adequate provision of hearing health care professionals with proper facilities both in the urban and rural settings are important factors for enhancing the linguistic, educational and psycho-social development of hearing impaired school children in the Kingdom of Saudi Arabia.**

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