

## Excess Cerumen : Failure Rate of Black and Indian Preschool Children from Durban on the Middle Ear Screening Protocol (MESP)

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### ABSTRACT

*The aim of the study was to examine the failure rate of Black and Indian subjects within the excessive cerumen category of the Middle Ear Screening Protocol (MESP). The subjects included four to five year old Black and Indian children attending pre-schools in the Durban Central Region. Thus, a sample of 728 subjects (average age = 4.6 years), 312 Black (135 male and 180 female) and 413 Indian (223 male and 190 female) was screened using referral criteria based on a Middle Ear Screening Protocol (MESP). The results of the study indicated that a significant percentage of Black (38,4%) and Indian (49,9%) subjects failed, due to excessive cerumen. These results are discussed with reference to the literature. A cerumen management program has been outlined and recommended to be implemented in preschools in South Africa.*

### OPSOMMING

*Die doel van die studie was om ondersoek in te stel na die invloed van oormatige was op die faalkategorieë van 'n middeloorsiftingsprotokol. Die proefpersone het bestaan uit vier- en vyfjarige Swart- en Indiërkinders verbonde aan primêre skole in die Durban Sentraalstreek. 'n Totale groep van 728 proefpersone (gemiddelde ouderdom = 4.6 jaar), waarvan 312 Swart (135 manlik en 180 vroulik) en 413 Indiër (223 manlik en 190 vroulik) kleuters was, het 'n Middeloorsiftingsprotokol ondergaan. Die resultate van die studie dui daarop dat 'n betekenisvolle groot groep van die proefpersone -38.4% Swart en 49.9% Indiër - die sifting gefaal het as gevolg van oormatige was. Hierdie resultate is bespreek aan die hand van relevante literatuur en opgevolg deur 'n voorgestelde was-hanteringsprogram wat moontlik sinvol in Suid-Afrikaanse kleuterskole geïmplementeer kan word.*

**KEY WORDS:** Black and Indian children, 4-5 years, Cerumen Management program, excessive cerumen, Middle Ear Screening Protocol.

### INTRODUCTION

The SANCD (1990) classifies auditory dysfunction that occurs when the site is the external ear or middle ear, as conductive hearing loss. One of the commonest causes of conductive hearing impairment is the accumulation of cerumen in the External Auditory Meatus (EAM) (Northern & Downs, 1984; Martin, 1981; Newby, 1979).

Total occlusion of the EAM due to excessive or impacted cerumen is said to cause a threshold shift of about 45 - 70 dB (Chandler, 1964). In fact, Bricco (1985) pointed out that impacted cerumen is regarded as an ear disease - it can cause otitis externa, hearing loss, pain, itching and tinnitus (Ballachanda & Peers, 1992; Roeser & Crandell, 1991). Furthermore, Bricco (1985) stated that if cerumen impinges on the eardrum, a chronic cough may be triggered and persist until the cerumen is removed. Myers and Fueschel (1987) even related impacted cerumen to major psychiatric changes. Bricco's (1985:241) investigation suggested "an association between the presence of impacted ear wax (cerumen) and subsequent middle ear or hearing problems, but a causal relationship is not inferred from the study". However, Garber (1986) found that in some 30% of children, accurate diagnosis of acute otitis media

(AOM) requires cerumen removal. He stated that "you cannot assume that the heat of the middle ear infection will melt earwax : Ceruminosis and acute otitis media can coexist". (Garber 1986:151).

The reasons for cerumen impaction are many. It may be due to increased secretory function of ceruminous glands, leading to more than normal production (Mandour, El-Ghazzawi, Topozoda & Malaty, 1974) or failure of keratinocyte separation that occurs normally in the ear-canal (Robinson & Hawke, 1990). Anatomical abnormalities of the ear-canal, the improper use of cotton swabs, hearing aids, or a collapsed ear-canal have also been reported to obstruct extrusion of cerumen from the canal (Ballachanda & Peers, 1992).

Furthermore, the aggressive cleaning of soft wax by well-meaning parents can result in the wax becoming impacted against the tympanic membrane (Bricco, 1985; Newby, 1979; Martin, 1981). In addition, Ballachanda and Peers (1992) stated that cerumen enlarges when it becomes soaked with water (e.g., after bathing, swimming) and can completely occlude the EAM. Thus, even the presence of excessive amounts of soft cerumen, poses a significant audiological problem since it can result in a mild conductive loss.

It has been proven in studies on recurrent otitis media that mild and fluctuating conductive losses have negative effects on language and auditory function and on later educational achievements (Gravel & Wallace, 1992; Boothroyd, 1982; Northern & Downs, 1984). This is equally true of excess cerumen and the negative consequences can be prevented through routine otoscopic examination of preschool children. In fact, the American Food and Drug Administration (1977), cited by Alpiner and McCarthy (1987), as well as ASHA (1990), identified excessive accumulation of cerumen as a condition that needed medical intervention. Furthermore, American physicians are said to perform cerumen extraction on approximately 44 000 ears per year (Sharp, Wilson, Ross & Barr-Hamilton 1990). According to Burgess (1977), wax removal is done more than 40 000 times a week in the United Kingdom. Thus, otoscopic examination can "improve the timeliness of medical management for those in most urgent need." (Roush, 1990:367).

The research design of the present study used a modified version of the revised ASHA (1990) protocol, referred to as the Middle Ear Screening Protocol (MESP). Disorders of the outer and middle ear contribute to the conductive component of a hearing loss, which in many cases can be remediated with medical attention. It is possible that disease in the outer ear may spread to the middle ear and vice-versa (Martin, 1981). Therefore it is logical to include examination of the outer ear when considering middle ear disorders. It is for the above reasons, that the protocol used in this study, although being a middle ear screening protocol, is included in the examination of the outer ear. The MESP consists of three components; history, visual inspection and tympanometry. (Refer to Appendix A, Table 1.) Excess cerumen was identified using this protocol.

Martin (1991) stated that the problem of ear wax is a complex one and that no one wants to take the responsibility for the managing of it. In this regard two important questions needed to be answered:

- (i) "Why haven't audiologists assumed the responsibility for cerumen management?" According to Roeser and Crandell (1991:52) a likely reason is that audiology's roots are in nonmedical institutions of higher education, where the philosophy is to avoid procedures that might be interpreted as "medical". Moreover, in the early years of the profession, routine audiological protocols did not require placing objects in the ear-canal. In fact, otoscopy was not performed or encouraged routinely. However, standard audiology protocols now require placing objects in the ear-canal and audiologists are familiar with the proper protocols to follow, as well as the possible contra-indications. The ear-canal is irrigated similarly to that of cerumen removal for caloric testing during electronystagmography. In addition, otoscopy is a mandatory prerequisite for proper audiological screening, evaluation and management. Visual inspection of the ear-canal (otoscopy) is required in the ASHA screening guidelines (ASHA, 1989); moreover, the Standard Procedures in Audiology manual developed by the Veterans Health Services and Research Administration (VHSRA, 1990) includes visual inspection of the ear as an audiological procedure. It is apparent that the above reasons are valid and that cerumen management should be the responsibility of the audiologist

in view of the new standard audiology protocols and the high frequency of occurrence in the population under study.

- (ii) Should cerumen management be a part of audiology practice? ASHA (1990) defined the scope of practice in audiology to include: facilitating and conservation of auditory system function; preventing auditory system dysfunction; and selecting, fitting and dispensing amplification. In addition, ASHA (1996) included the following in the audiologist's scope of practice "Otoscopy examination and **external ear canal management for removal of cerumen** in order to evaluate hearing or balance, make ear impressions, fit hearing protection or prosthetic devices, and monitor the continuous use of hearing aids". (ASHA, 1996:14). Furthermore, the American Academy of Audiology (AAA) (1989:1), adopted a scope of practice statement that defines an audiologist as "a person who, by virtue of academic and clinical training and appropriate certification and/or licensure, is uniquely qualified to provide a comprehensive array of professional services related to the prevention, assessment and rehabilitation of auditory and vestibular impairments". In addition, "the audiologist is an independent practitioner, and may practice in a hospital, clinic, school, private practice or any other setting in which audiological services are relevant".

In view of the limitations in providing comprehensive audiological services when excessive/impacted cerumen is present, both ASHA and AAA scope of practice statements give strong support and rationale for audiologists to engage in cerumen management. Furthermore, considering the results of the present study on excessive cerumen in both race groups, it is time to recognize that audiologists can and should manage cerumen.

It is evident from the results of the present study and the literature review presented above on the problem of excessive cerumen, that this is a serious problem in many countries, including South Africa, and which needs urgent attention. The writer, therefore recommends a cerumen management programme which could be implemented in pre-schools and primary schools in South Africa.

## METHOD

### RESEARCH DESIGN

In order to realise the aim of the study, the methodology of research design used was the analytical (quantitative) survey method (Leedy, 1989).

### AIM

The aim of the study was to examine the failure of Black and Indian preschool children within each category of the Middle Ear Screening Protocol (MESP).

### SUBJECTS

A total of 728 randomly selected subjects (mean age 4,6 years), comprising 315 Blacks (135 males, 180 females) and 413 Indians (223 males, 190 females) contributed relevant data for the purpose of this study. Available literature has indicated a paucity of information of middle ear

disorders within the Indian and Black ethnic groups in South Africa, which motivated the criterion of race. All subjects attended preschools located in the magisterial district of Durban Central. According to Bess and Humes (1990), children who reside in the inner city and attend day care centres are prone to suffer from outer and middle ear disorders. Table 1 presents the subject characteristics of this study. All subjects were required to fall within the age range of 48-60 months inclusive (4-5 years) as a literature review has shown an increased prevalence of middle ear infection in this age range worldwide (Davidson et al., 1988).

**TABLE 1 : Subject Characteristics**

	N%	Mean age in years	Mean age in years
Black	315 (43)		
Males	135 (43)	4,7	4,0-4,9
Females	180 (57)	4,6	4,1-4,9
Indian	413 (57)		
Males	223 (54)	4,6	4,2-5,0
Females	190 (46)	4,6	4,0-4,8
Total	728		

**DATA COLLECTION PROCEDURE**

All procedures for middle ear screening were completed on the same day, i.e., history, visual inspection and tympanometry for each subject. The screening was conducted on the school premises during school hours (08h00-12h30). Screening was scheduled for Fall, i.e., between February and April 1992, to control for seasonal variations, since otitis media has its highest prevalence during the winter months (Roush, 1990; Sorensen, 1981). All subjects who met the subject selection criteria were included. The criteria included: race (Black and Indian), age (4-5 years old), and area of school (Durban Central Region).

- \* The teacher provided the biographical details as well as information pertaining to observable history of pain and ear drainage, which was recorded on the record form (Appendix B).
- \* Following the collection of the above information, a visual inspection of the ear, head and neck was performed, using a Welch-Allen battery operated otoscope. Otoloscopic examination of each ear was conducted to identify, earcanal abnormalities, blood effusion, occlusion, inflammation, excessive cerumen, tumour or foreign material. Each ear was then examined for eardrum abnormalities, and specifically for obvious inflammations, and severe retractions.
- \* After visual inspection, typanometry was performed except when the earcanal was occluded with cerumen, or any other foreign material which prevented visual inspection of the tympanic membrane. According to ASHA (1990), excess cerumen is classified as soft or hard cerumen that totally occludes the ear canal and impacted wax. Tympanometric measures were obtained using the Grason-Stadler 28A (Grason-Stadler, 1990), which was calibrated in January 1992, i.e., prior to

- screening.
- \* Immediate medical referral was made in cases of abnormally large canal volume (>1.0ml) estimates accompanied by low static admittance (<0.2ml) (when there was a reason to suspect a perforation of the tympanic membrane) (ASHA, 1990).
- \* When tympanometric results were abnormal, (low static admittance (<0.2ml) and abnormal tympanometric peak pressure (< -200daPa)) rescreening was scheduled in 4-6 weeks from the date of the first screening. If the results were again abnormal, a medical referral was made.
- \* Normative data (Table 2 of Appendix A) based on the work of Margolis and Heller (1987) and ASHA (1978) were used for analysis of results in the procedures above. The pass-fail criteria are indicated in Appendix A.
- \* When a subject failed the first or second screening, the parents and school officials were informed by letter/report, of the test results and informed of a need for further evaluation. When medical review was indicated, parents were advised to consult with a general practitioner or their family doctor. A medical follow-up was requested from the attending doctor specifying his/her findings and treatment procedures for school records.

**DATA ANALYSIS PROCEDURES**

Failure rate was computed in terms of percentages and numbers, and reflected in tables and graphs. The specific criteria for evaluation were as follows:

- (i) Middle Ear Screening Protocol (MESP) included history, visual inspection and tympanometry. The MESP consisted of two elements:
  - Outer ear tests and Middle ear tests.
- (ii) Failure on Outer ear tests included:
  - structural defects of the ear, head and neck
  - ear-canal abnormalities. (i.e., B<sub>1</sub> to B<sub>5</sub>, refer to Appendix B).
- (iii) Failure on Middle ear tests included:
  - eardrum abnormalities
  - tympanometry
- (iv) Failure of a subject on any one of the categories, under outer ear and middle ear tests independently, was regarded as a fail.
- (v) Failure of a subject on either ear on each category independently was regarded as a fail.
- (vi) Both ears of a subject had to pass the three screening procedures in order for that subject to be regarded as a pass.

The data were analysed in terms of failure rate of Black and Indian subjects within each category of the MESP. Results were calculated using one subject as the statistical unit and classifying each subject according to the poorest result obtained in either ear.

**RESULTS**

The failure rate of Black and Indian subjects was computed within each category of the Middle Ear Screening Protocol.

Results in Table 2 and Figure 1 reflect the following failure rates for Black and Indian subjects, within each category of the Middle Ear Screening Protocol (MESP).

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(i) **History**

On history 0,3% (1) Black and 0,5% (2) Indian failed on otalgia, whereas 0,3% (1) Black and 0,2% (1) Indian failed on otorrhea.

(ii) **Visual Inspection**

Visual inspection is divided into three subcategories, i.e., structural defects, earcanal abnormalities (ECA) and eardrum abnormalities (EDA). The results are as follows:

\* **Structural Defects**

Only one Black (0,3%) failed on structural defects of the head. There were no failures in the Indian group.

\* **Earcanal Abnormalities (ECA)**

There were no Black or Indian failures on occlusion B<sub>5</sub> categories. In the blood effusion category, 0,3% (1) Blacks failed whereas no Indians failed (B<sub>4</sub>). Four point eight percent (15) Blacks 2,2% (9) Indians failed to inflammation (B<sub>6</sub>).

Of the 103 Blacks, 32,7% and of the 188 Indians, 45,5% failed due to excessive cerumen (B<sub>7</sub>) and 1,0% (3) Blacks and 2,2% (9) Indians failed to foreign material (B<sub>9</sub>).

It is evident that a large percentage of Indians (45,5%) and Blacks (32,7%) failed due to excessive cerumen as compared to failure on any other category of earcanal abnormalities. Furthermore, more Indians (45,5) failed than Blacks (32,7%) on excessive cerumen only.

\* **Eardrum Abnormalities (EDA)**

There were no Black or Indian subjects failing due to

severe retractions (B<sub>11</sub>). However, 1,0% (3) Blacks and 0,5% (2) Indians failed due to obvious perforations (B<sub>10</sub>) and 1,6% (5) Blacks and 1,0% (4) Indians failed due to obvious inflammation (B<sub>11</sub>).

(iii) **Tympanometry**

On tympanometry measures, 1,0% (3) Blacks and 0,5% (2) Indians failed due to flat tympanogram (C<sub>1</sub>) and equivalent earcanal volume outside normal range (C<sub>2</sub>) i.e. >1,0cm<sup>3</sup>; 5,4% (17) Blacks and 4,8% (20) Indians failed due to low static admittance (C<sub>3</sub>), i.e. <0,2cm<sup>3</sup> and 8,3% (26) Blacks and 10,4% (43) Indians failed tympanometric peak pressure (C<sub>4</sub>) i.e. <-200 daPa.

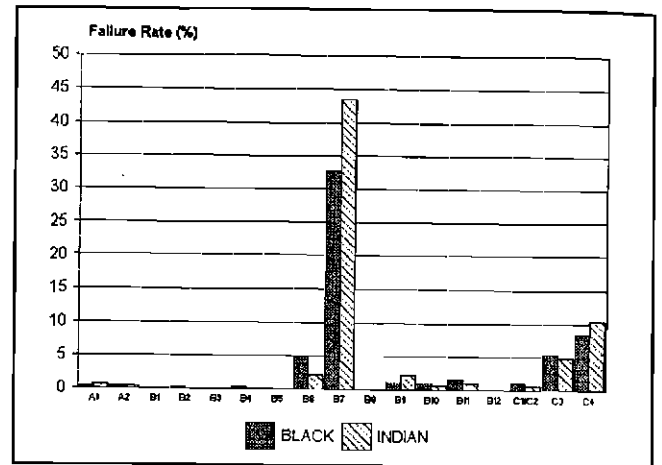


FIGURE 1 : Failure rate (percentage) of Black and Indian subjects within each category of the MESP

TABLE 2 : Failure rate (percentage and numbers) of Black and Indian subjects within each category of the Middle Ear Screening Protocol (MESP)

Middle Ear Screening Protocol (MESP)																		
Subject	History		Outer Ear Tests									Middle Ear Tests						
			Visual Inspection															Tympanometry
			Structural Defects			Ear-Canal Abnormalities						Ear-Drum Abnormalities						
A <sub>1</sub>	A <sub>2</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	B <sub>5</sub>	B <sub>6</sub>	B <sub>7</sub>	B <sub>8</sub>	B <sub>9</sub>	B <sub>10</sub>	B <sub>11</sub>	B <sub>12</sub>	C <sub>1</sub> /C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>		
Black	0,3 (1)	0,3 (1)	0	0,3 (1)	0	0,3 (1)	0	4.8 (15)	32.7 (0.3)	0	1.0 (3)	1.0 (3)	1.6 (5)	0	1.0 (3)	5.4 (17)	8.3 (26)	
Indian	0,5 (2)	0,2 (1)	0	0	0	0	0	2.2 (9)	45.5 (188)	0	2.2 (9)	0.5 (2)	1.0 (4)	0	0.5 (2)	4.8 (20)	10.4 (43)	

NOTE: Figures in parenthesis denote number of subjects failed.

Key for Table 2 and Figure 1

- A<sub>1</sub> - Otagia
- A<sub>2</sub> - Otorrhea
- B<sub>1</sub> - Structural Defect of the Ear
- B<sub>2</sub> - Structural Defect of the Head
- B<sub>3</sub> - Structural Defect of the Neck
- B<sub>4</sub> - Blood Effusion
- B<sub>5</sub> - Occlusion
- B<sub>6</sub> - Inflammation
- B<sub>7</sub> - Excessive Cerumen
- B<sub>8</sub> - Tumor
- B<sub>9</sub> - Foreign Material
- B<sub>10</sub> - Obvious Perforation
- B<sub>11</sub> - Obvious Inflammation
- B<sub>11</sub> - Severe Retraction
- C<sub>1</sub> - Flat Tympanogram (Type B)
- C<sub>2</sub> - Equivalent Ear-Canal Volume (> 1.0 cm<sup>3</sup>)
- C<sub>3</sub> - Static Admittance (<0.2cm<sup>3</sup>)
- C<sub>4</sub> - Tympanometric Peak pressure (<-200 daPa)

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## DISCUSSION

With reference to Table 2 and Figure 1, it is evident that a large percentage of both Indians (45,5%) and Blacks (32,7%) failed due to excessive cerumen as compared to failure on any other category of earcanal abnormalities. Furthermore, more Indians (45,5%) than Blacks (32,7%) failed on excessive cerumen. Ruben and Fishman (1981) also found that the problem of impacted cerumen was common in their study of American infants. Six of the 21 hearing impaired infants examined, presented with cerumen, this being a significant finding (Rubin & Fishman, 1981). Bricco (1985), in her study of children younger than 7 years of age, found that 10 percent (35) of the subjects failed the screening because of impacted cerumen. However, 4,63% of the school children screened by audiologists Watkins, Moore and Phillips (1984) failed their screening because of excessive cerumen in the EAM. Roeser and Crandell (1991) emphasised that the incidence of excessive or impacted cerumen in children aged 6-17 years, is approximately 10%. In a pilot study conducted on Indian children, (House of Delegates, 1990) 87,8% of the subjects failed the hearing and immittance screening protocol. They concluded that "the majority of pupils failed one or all three subtests due to the presence of impacted wax unilaterally or bilaterally (House of Delegates, 1990:3)".

Comparisons between the results of this study and the studies cited above must be drawn with caution due to the differences in age range of subjects in each study. However, in a study conducted by Mandour, El-Ghazzawi, Topozada and Malaty (1974) on histological and histochemical study of the activity of ceruminous glands in normal and excessive wax accumulation in subjects aged one to thirty years, they showed no difference in the normal control groups either in the two sexes or at different ages. There appears to be no available information on the relationship between race and excessive accumulation of cerumen.

Comparatively, results on all other categories of the MESP was found to be not significant for both Black and Indian subjects. The striking results on the excessive cerumen category therefore indicate an urgent need for cerumen management.

## CONCLUSION AND RECOMMENDATIONS

The study revealed a high prevalence of excessive cerumen in both race groups. Several studies in the literature have noted a high prevalence. As discussed in the Introduction, excessive cerumen can cause a mild to moderate (fluctuating) conductive hearing loss. Furthermore, medical consequences of impacted cerumen include tinnitus, pain, fullness in the ear and loss of hearing.

The implication of this result is that there is an urgent need for cerumen management programs to be implemented and established with preschool children. The desired result of any screening program is the proper referral and care of individuals with identified problems. Furthermore, universities can actively promote training and participation by students in cerumen extraction processes as part of their course requirements. Unless audiologists manage cerumen they will be unable to provide comprehensive services to as many as 25-30% of certain populations (ASHA, 1990). A strong case is put forward for the audiologist's responsibility in cerumen manage-

ment. Further research in this respect is suggested.

It is further suggested that teacher-parent education and general public awareness on the harmful effects of excessive cerumen, prevention and treatment of cerumen through organized programs need to be developed.

Although audiologists currently receive some theoretical training and clinical experience that qualifies them to manage cerumen, specific training in cerumen removal should be conducted before they engage in this activity (Roeser & Crandell, 1991). According to ASHA (1991), each audiologist who intends to perform cerumen removal procedures must ensure that he/she has acquired the knowledge and skills necessary to do each task necessary to the procedure. ASHA (1991) has outlined the tasks to be performed, the necessary proficiencies and the knowledge and skills necessary to do each task are summarised in Appendix C.

ASHA (1991) also stressed that the training should take place through direct supervision by a qualified professional in a setting allowing the trainee adequate clinical experience. The writer is in agreement with ASHA (1991) and recommends that ASHA's suggestions be followed in the South African pre-schools. However, each practitioner should consider the following precautions or circumstances prior to undertaking these procedures:

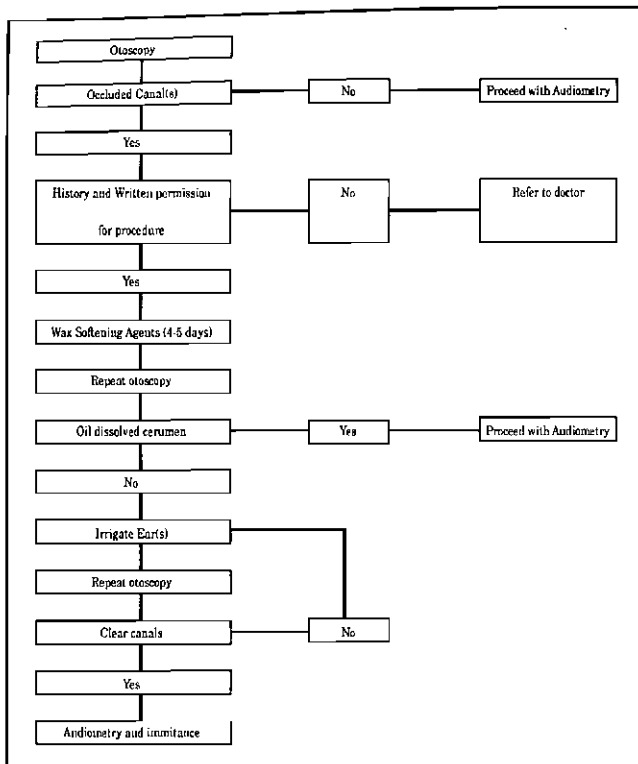
- (a) Obtain a ruling from the appropriate professional board(s) to determine whether there are any limitations on the scope of audiology practice which restrict the performance of these procedures.
- (b) Check professional liability insurance to ensure that there is no exclusion applicable to cerumen management.
- (c) Check medical policy, institution insurance coverage and delineation of practice privileges for the specific institution to ensure that there are no restrictions applicable to an audiologist performing these procedures.
- (d) Know whom to contact if emergency medical assistance is needed.
- (e) Obtain informed consent from parents/guardian/caregiver to proceed with cerumen management and maintain complete and adequate documentation.

The program that follows, is extracted and modified from the Dallas (Texas) Independent School District Program (DISD) (Roeser, Adam & Watkins, 1991). The program has been modified to suit the preschools in the South African context.

## PROGRAM PROCEDURES

Figure 2 presents a flow chart outlining the program. Otoscopy should be performed by an audiologist prior to audiometric screening. Audiometric screening should only be performed if both earcanals are unoccluded. If either or both canals are occluded, written permission from the parents/guardian is obtained for earcanal irrigation. If the child has no previous otologic history and permission is obtained, the audiologist must then instill wax softening agents into the earcanal twice daily for four to five days and the ears must be checked otoscopically. If cerumen is removed by the wax softening agent, audiometric and immittances screenings should be done.

Ears that remain occluded, must be irrigated until clean by the audiologist with a Water Pik using lukewarm wa-



**FIGURE 2: Flow chart of procedures for Cerumen Management Preschool Program**  
Reference: Roeser, Adam & Watkins (1991: 47)

ter (35 -39°C, 96 -100°F). Care must be taken to avoid extreme temperatures which may cause nausea and vomiting. A low pressure setting, no higher than 2 on a scale of 0-10 on the Water Pik, should be used to dislodge the cerumen. Audiometric and immittance screening should be performed once the ears are clear. These procedures are in accordance with Roeser, Adam and Watkins, (1991).

The audiologist must consider the contraindication of irrigation when implementing the programme. Garber (1986) suggested that irrigation is contraindicated:

- in young children or infants, because perforations are more likely in this age group;
- in patients with tympanostomy tubes;
- when tympanic membrane is perforated;
- when surgery of middle ear has been recent.

The program offers several significant advantages:

- Each child with impacted cerumen receives treatment necessary to ameliorate the problem. At present, patients with impacted cerumen are referred to ENT specialists or doctors. Often, these referrals are not completed and audiometric status remains unchanged, which may affect academic, psychoeducational and psychosocial development (Roeser et al., 1991).
- The program will represent a time and monetary saving for parents because completing a referral often means half a day out of class for the child, medical expenses, the loss of parents' working time and salary.
- Reduced case load for ENT specialists and doctors.
- Cerumen management will increase accessibility of the public to audiological practices and widen the use of our services.

The procedure does have some inherent risks. Injury and infection to the external auditory canal, perforation of the tympanic membrane, exacerbation of chronic middle ear disease and damage to the ossicular chain can result (Brooks, 1980). However, if procedures are performed by trained staff and applied judiciously, these risks are minimal to nonexistent (Roeser et al., 1991).

The program represents a modest investment of financial resources by the school system and time of the health care staff. Roeser et al. (1991) reported data on more than 2000 ears that were irrigated without complications. The benefits to patient care and increased professional independence far outweigh the potential risks (Roeser & Crandell, 1991).

It must be stressed that the proposed program is only a guideline and not a protocol that needs strict adherence. The validity and reliability of the program need to be determined.

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**APPENDIX A**

**TABLE 1 :Referral Criteria : Middle Ear Screening Protocol (MESP)**

<p><b>I History</b></p> <p>(a) Otagia</p> <p>(b) Otorrhea</p>	
<p><b>II Visual Inspection of the Ear</b></p> <p>(a) Structural defect of the ear, head or neck</p> <p>(b) Earcanal abnormalities</p> <p style="padding-left: 20px;">Blood or effusion</p> <p style="padding-left: 20px;">Occlusion</p> <p style="padding-left: 20px;">Inflammation</p> <p style="padding-left: 20px;">Excessive cerumen, tumour, foreign material</p> <p>(c) Eardrum abnormalities</p> <p style="padding-left: 20px;">Obvious perforation</p> <p style="padding-left: 20px;">Obvious inflammation</p> <p style="padding-left: 20px;">Severe retraction</p>	
<p><b>III Tympanometry</b></p> <p>(a) Flat tympanogram and equivalent earcanal volume (<math>V_{ec}</math>) outside normal range.</p> <p>(b) Low static admittance (Peak Y) on two successive occurrences in a 4-6 week interval.</p> <p>(c) Abnormally wide tympanometric peak pressure, i.e., more negative than -200 daPa on two successive occurrences in a 4-6 week interval.</p>	

**Modified from : ASHA (1990) and ASHA (1978)**

**TABLE 2 : Interim Norms (Means and 90% Ranges) for Static Admittance (Peak Y), Equivalent Earcanal Volume ( $V_{ec}$ ) and Tympanometric Peak Pressure (TPP)**

	Peak Y cm <sup>3</sup> /ml*		$V_{ec}$ cm <sup>3</sup> /ml*		TPP daPa	
	Means	90% Range	Means	90% Range	Means	90% Range
Children	0.05	0.2-0.9	0.7	0.4-1.0	100	-200 - +100

The values were extracted from Margolis & Heller (1987) who employed an acoustic immittance screening instrument (226-Hz) probe tone; pump speed -200 daPa/s that automatically compensated for earcanal volume by subtracting the admittance at 200 daPa from all values. Normative values for children were obtained from preschool-aged children (3-5 years).

\*cm<sup>3</sup> and ml are equivalent units (ASHA, 1990).

Modified : Roush (1990)

From ASHA (1978)

## APPENDIX B

### Pupil Record Form

**PERSONAL DETAILS** Reference No: .....

Name: ..... Sex: .....

School ..... D.O.B .....

Date of Test: ..... Age: .....

Date of Retest: ..... Race : .....

Audiologist : Daksha Bhoola

KEY: Red = Right Ear; Blue = Left Ear

A. HISTORY		First Screen		Second Screen	
A.1	OTOLGIA	YES	NO	YES	NO
	OTORRHEA	YES	NO	YES	NO
<b>B. VISUAL INSPECTION</b>					
STRUCTURAL INSPECTION OF THE					
B.1	EAR	YES	NO	YES	NO
B.2	HEAD	YES	NO	YES	NO
B.3	NECK	YES	NO	YES	NO
EAR CANAL ABNORMALITIES					
B.4	BLOOD EFFUSION	YES	NO	YES	NO
B.5	OCCLUSION	YES	NO	YES	NO
B.6	INFLAMMATION	YES	NO	YES	NO
B.7	EXCESSIVE CERUMEN	YES	NO	YES	NO
B.8	TUMOR	YES	NO	YES	NO
B.9	FOREIGN MATERIAL	YES	NO	YES	NO
EARDRUM ABNORMALITIES					
B.10	OBVIOUS PERFORATION	YES	NO	YES	NO
B.11	OBVIOUS INFLAMMATIONS	YES	NO	YES	NO
B.12	SEVERE RETRACTIONS	YES	NO	YES	NO



FIRST SCREEN						Actual Value R L
<b>C. TYMPANOMETRY</b>						
C.1	TYMpanogram	A	As	B	C	Ad
C.2	STATIC ADMITTANCE	<0,2	0,2-0,9		>0.9	
C.3	EARCANAL VOLUME	<0,4	0,4-1,0		>1,0	
C.4	TYMPANOMETRIC PEAK PRESSURE	<-200daPa	-200-+100daPa		+ 100daPa	
<b>D. SUMMARY</b>						
D.1	HISTORY		FAIL		PASS	
D.2	VISUAL INSPECTION		FAIL		PASS	
D.3	TYMPANOMETRY		FAIL		PASS	
D.4	SEND LETTER TO PARENT		YES		NO	
D.5	SEND LETTER TO ENT		YES		NO	
D.6	RETEST		YES		NO	

SECOND SCREEN						Actual Value R L
<b>C. TYMPANOMETRY</b>						
C.1	TYMpanogram	A	As	B	C	Ad
C.2	STATIC ADMITTANCE	<0,2	0,2-0,9		>0.9	
C.3	EARCANAL VOLUME	<0,4	0,4-1,0		>1,0	
C.4	TYMPANOMETRIC PEAK PRESSURE	200daPa	-200-+100daPa		+100daPa	
<b>D. SUMMARY</b>						
D.1	HISTORY		FAIL		PASS	
D.2	VISUAL INSPECTION		FAIL		PASS	
D.3	TYMPANOMETRY		FAIL		PASS	
D.4	SEND LETTER TO PARENT		YES		NO	
D.5	SEND LETTER TO ENT		YES		NO	
D.6	RETEST		YES		NO	

**APPENDIX C**

**Summary of Tasks, Proficiency, Knowledge and Skills Required for Cerumen Management**

TASK	PROFICIENCY	KNOWLEDGE/SKILLS NEEDED
Inspect visually via hand-held otoscope or head-light (mirror) and speculum the EAC and TM for presence of obstructing material, evidence of lesions or ongoing infectious process, evidence of anatomical anomalies that may affect the accuracy of immittance or caloric irrigations.	Visual inspection of the EAC and TM.	<ol style="list-style-type: none"> <li>1. Knowledge of anatomy, physiology and pathophysiology of the EAC and TM.</li> <li>2. Knowledge of common medical or post-surgical conditions of the EAC, TM or middle ear that alter the appearance and/or function of the EAC and/or TM.</li> <li>3. Skill in the use of otoscopy.</li> <li>4. Skill in the interpretation of visual inspection of the EAC and TM</li> </ol>
Inspect the EAC and TM visually via hand-held pneumatic otoscope or head light (mirror) and Seigel scope for determining the mobility of the TM.	Determination of appropriateness of TM mobility.	<ol style="list-style-type: none"> <li>1. Knowledge of anatomy, physiology and pathophysiology of the EAC and TM.</li> <li>2. Knowledge of common medical or postsurgical conditions of the EAC, TM or middle ear that alter the appearance and/or function of the EAC and/or TM.</li> </ol>

		<ol style="list-style-type: none"> <li>3. Skill in the use of otoscopy and pneumatic otoscopy.</li> <li>4. Skill in the interpretation of visual inspection of the EAC and TM.</li> </ol>
Inspect the EAC and TM visually prior to and following caloric irrigation, immittance, ear mould impression, real ear acoustic measurements or non-invasive electrocochlegraphy for purpose of documenting status of the EAC and TM after one of these procedures is performed.	Visual inspection of the EAC and TM	<ol style="list-style-type: none"> <li>1. Knowledge of common medical or post surgical conditions of the EAC, TM or middle ear that alter the appearance and/or function of the EAC and/or TM.</li> <li>2. Skill in the use of otoscopy and pneumatic otoscopy.</li> <li>3. Skill in the interpretation of visual inspection of the EAC and TM.</li> </ol>
Determine if occluding material visualized in the EAC is cerumen and if it can be removed comfortably and safely without the use of an operating microscope.	Recognizing cerumen versus other occluding versus other occluding materials, and determining its need for removal and the most effective method of removal	<ol style="list-style-type: none"> <li>1. Skill in the use of otoscopy and pneumatic otoscopy.</li> <li>2. Skill in the interpretation of visual inspection of the EAC and TM.</li> <li>3. Skill in cerumen removal by a variety of techniques and equipment.</li> </ol>
Determine if the procedure to be performed should be deferred, based on EAC and TM inspection, and if referral to an otolaryngologist is indicated.	Determining the status of the EAC and TM relative to the needs of the procedure to be performed.	<ol style="list-style-type: none"> <li>1. Knowledge of anatomy, physiology and pathophysiology of the EAC and TM.</li> <li>2. Knowledge of common medical or postsurgical conditions of the EAC or TM or middle ear that alter the appearance and/or function of the EAC and/or TM.</li> <li>3. Skill in the use of otoscopy and pneumatic otoscopy.</li> <li>4. Skill in the interpretation of visual inspection of the EAC and TM.</li> <li>5. Skill in cerumen removal by, e.g., use of cerumen loop and hand-held otoscopic device; use of cerumen loop, head mirror and hand-held speculum; use of material for softening and gentle water irrigation or a combination of these methods.</li> </ol>
Establish appropriate protocol with medical personnel to handle EAC abrasion or laceration that could result from cerumen removal.	Determining need for other medical service involvement in the care of the EAC and TM.	<ol style="list-style-type: none"> <li>1. Knowledge of anatomy, physiology and pathophysiology of the EAC and TM.</li> <li>2. Knowledge of common medical or postsurgical conditions of the EAC, TM or middle ear that alter the appearance and/or function of the EAC and/or TM.</li> </ol>
Select appropriate method and remove occluding cerumen or refer to an otolaryngologist for removal once determining that: <ol style="list-style-type: none"> <li>a. use of a microscope may be required;</li> <li>b. the cerumen is too close to the TM;</li> <li>c. the occluding material is not cerumen;</li> <li>d. the comfort or safety of the patient may be comprised</li> </ol>	Determining if occluding material is cerumen and, if it is cerumen, determining if it can be removed safely and comfortably without the use of an operating microscope.	<ol style="list-style-type: none"> <li>1. Knowledge of anatomy, physiology, and pathophysiology of the EAC and TM.</li> <li>2. Skill in cerumen removal by a variety of techniques and equipment</li> </ol>

Key : EAC - External auditory Canal. Tympanic membrane Reference : ASHA (1991:66)