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ABSTRACT

The preschool teacher is in the unique position of being able to identify children who have developed language and speech problems during their early years. This paper is a detailed resource for preschool teachers on hearing and speech problems. Its purpose is two-fold: to emphasize the important role the preschool teacher plays in the lives of children in their care, and to inform the teacher of the important role the sense of hearing plays in the total development of the child. It argues that chronic ear infections do not receive the necessary attention they deserve and can have serious negative educational, emotional, and social consequences in preschool children. Topics discussed include normal development of speech and language; anatomy of the ear; causes of ear-infections; why these ear infections are not identified and/or taken seriously; how the mild hearing loss often associated with the presence of fluid in the middle ear affects the child's perception of speech; treatment; who needs tubes; educational problems associated with chronic infections in the middle ear; problems parents have when a child has ear infections; what parents need to do; and what the preschool teacher needs to do for these children and parents. (SD)

CHRONIC EAR INFECTIONS:

THE SILENT DETERRENT TO ACADEMIC AND SOCIAL SUCCESS

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A hundred years from now, it will not have mattered how big a house I lived in, what kind of a car I drove, or how big my bank account was. The world may, however, be a better place because my actions resulted in the early identification of a child with a problem.

The purpose of this paper is two-fold: to emphasize the important role the pre-school teacher plays in the lives of children in their care, and to inform the teacher of the important role the sense of hearing plays in the total development of the child. Most of the information presented in this paper will pertain to frequent infections in the middle ear in pre-school children. This is the most common reason why children are taken to their primary-care physicians. Because this is such a common condition in children, chronic middle ear infections do not receive the attention they deserve. Public education is not available to inform the parents of the negative educational, emotional, and social consequences and problems for later employment that can result when a pre-school child has chronic infections in the middle ear.

The pre-school teacher is in a position to identify problems of which parents are unaware or that they are reluctant to admit. By being aware of the important role hearing plays in the development of children and of what constitutes normal development of language and speech, and by understanding the basic medical factors relating to chronic disease in the middle ear, the pre-school teacher can advise parents more effectively. The topics discussed in this paper will be normal development of speech and language; anatomy of the ear; causes of ear-infections; why these ear-infections are not identified and/or taken seriously; how the mild hearing loss often associated with the presence of fluid in the middle ear affects the child's perception of speech; treatment; who needs tubes; educational problems associated with chronic

infections in the middle ear; problems parents have when a child has ear-infections; what parents need to do; and what the pre-school teacher needs to do for these children and parents.

According to a study done by the U.S. Department of Health, there has been a 150% increase in the number of ear-infections identified in pre-school children since 1975. Not surprisingly, there has also been an increase in the number of children in school who have learning disabilities. There are approximately 41 million children in school in the United States. Ten percent, or 4,100,000 of these children, will have some type of disability. Seventy-one percent of this number will be in L.D. classes (classes for learning disabilities) and/or in therapy for speech and language. Many of these children have a similar history. They have a history of chronic ear-infections in early childhood. There is no longer any question that frequent ear-infections during the first two years of life can have a detrimental effect on the development of language and speech skills and/or on the ability to achieve in the classroom years later. Research continues to support a close relationship between educational difficulties and early, chronic episodes of fluid in the middle ear.

Hearing plays a major role in determining which child will succeed and which child will fail. It is through the process of hearing that the child learns the language and speech skills that will carry him or her through the rest of life. Of these two terms, language is the most important. Language is utilized in every aspect of the child's life. Language is the ability to learn the meaning of words and then be able to use these words in a meaningful manner, both orally and in written form. Language is involved in reading,

reading comprehension, writing, math, spelling, the ability to follow directions, short-term memory, and interpretation of the inflections of speech and the nuances of speech. Language is also utilized in the ability to learn new concepts and then incorporate these new concepts into an existing linguistic structure and use them appropriately.

Speech is the ability to say the word. If the child says the word "wabbit" for "rabbit," it is a problem of articulation. If, however, the child does not know a rabbit from a horse and she should, the problem is now one of language. If the child does not acquire normal skills in language and speech, every aspect of his life will be adversely affected. The importance of early stimulation of language cannot be over-stated. Parents cannot give too much language-stimulation to their child. When parents talk to their infant, the child does not understand what is being said. How he or she reacts will be based on the parents' tone of voice and facial expression. Over the months and years of being exposed to constant language-stimulation, the child will begin to develop skills in language and speech.

The most important time-period for learning the basis for future development of language and speech is during the first two years of life. The first year is of special critical importance. If the framework for future language-concepts and grammatical rules is not formed at the appropriate time, it is difficult, if not impossible, to go back and create this framework and incorporate it into the linguistic system. If the child does not develop a firm foundation for language during the first two years of life, he will not be able to learn new concepts, or they will not be learned as well as they could

have been. This results in a delay in linguistic skills that will ultimately affect the child's future.

Ninety percent of learning of language is incidental. Parents and pre-school teachers do not teach the child every sound or every word that she will eventually learn and use as language. Children learn these words and concepts by overhearing what is going on around them. Children who have a hearing impairment do not overhear well, and as a result their linguistic system often does not develop as completely as it should. This is why it is so important for the pre-school teacher to be aware of what constitutes normal development of language and speech and what to look for that might suggest that the child may not be hearing normally.

Because this is crucial for the child's future development, the pre-school teacher should be aware of the following:

1) The pre-school teacher should know the family history. If they had a previous child who had a history of chronic middle ear infections and now they have a sibling of this child, there is a very good chance that this child will have the same problem. This condition appears to be hereditary.

2) Does a child have to be called several times before responding? There is no question that children will "tune out" teachers at any given time, but if this is a consistent behavior, there is reason to question the child's hearing.

3) Is the child talking well for his or her age? Figure 1 gives a general outline of normal development of language and speech. The older the child is, the more significant the delay in language becomes. If an 18-month-old is saying nothing as language, there is reason to question the child's development of language. A normal 18-month-old should have approximately 50 common words he or she is able to use as language. It does not count if the parents ask the child to repeat a word and the child is able to repeat it. Language is the ability to have these words in the child's repertoire and be able to use them by himself or herself in a meaningful fashion. If a two-year-old is still in the single-word stage and has a limited vocabulary, this child is probably delayed in the acquisition of language-skills.

4) Is the child able to stay with group activities? If he or she is not able to do this, and this is a constant behavior, maybe the child does not have the linguistic skills needed to stay with the group, or the child is not able to hear the directions.

5) Does the child observe others before he or she begins a task? Perhaps the child did not hear the directions, or the language was too complex for this child to follow.

6) Some children, because they cannot communicate with their peers, become shy or aggressive.

7) Is the child a mouth-breather? When napping on his or her back, is the child a restless sleeper and/or does the child snore? If so, this is a good indication that the child may have large adenoids obstructing the

airway. If this is the case, the child is at risk for having repeated episodes of fluid in the middle ear. This child may also have chronic drainage from the nose or may have bad breath.

8) Does the mother frequently bring in medication? If the mother of an eight- or nine-month-old is already bringing in medication, this child is at risk. Children who begin having problems in the middle ear before they are a year old tend to keep on getting them.

9) Is the child walking but not talking? If so, he is at risk.

10) Does the infant not respond to sound, or respond inconsistently?

If any of these situations apply to a given child in the classroom, especially if the child is showing evidence of not developing normal language skills, the pre-school teacher should discuss what she is observing with the parents. The parents should be encouraged to have the child's hearing evaluated by an audiologist and then be seen by an ear, nose, and throat physician to be evaluated medically. The hearing should be evaluated even though the parents and pre-school teachers may not be questioning the child's hearing. As will be seen later on in this paper, a child can have a very significant impairment in hearing and still not have his or her hearing questioned. After the status of the hearing has been determined and the medical problems evaluated, the pre-school teacher should encourage the parents to have the child evaluated by a speeech pathologist. Most public school systems have an "early intervention program" that can evaluate the child to determine whether there is a significant delay in development of these all-important skills.

Delays in speech and language and/or educational problems can be caused by early, chronic infections in the middle ear, pre- and post-birth injury, hereditary factors, sickness, developmental factors, environmental agents, neurochemical factors, abuse of drugs by a father or mother, or a combination of all of the above. The most common cause, however, for a delay in language and speech and/or educational problems is re-occurrent ear-infections during the first two years of life. The other factors cannot be controlled. For example, if a child is going to be delayed because of a genetic factor, we can prevent chronic ear-infections from adding to a pre-existing condition by identifying them early and obtaining aggressive treatment.

There are several causes for frequent episodes of fluid in the middle ear in children. They are: large tonsils and adenoids, allergies, sinus infections, immature muscle system, smoked-filled environment, and genetics. Figure 2 shows a diagram of the auditory system. The outer ear is on the side of the head. The ear-canal directs the sound down to the eardrum. The middle ear, a small space behind the eardrum, contains the three smallest bones in the body. The middle ear is where fluid collects when a child has an ear-infection. The eustachian tube extends from the middle ear to the back of the throat; this is a very important structure. The cochlea is the end-organ of hearing; this is where the acoustic information is changed to electrical impulses and carried to the brain via the auditory nerve.

A hearing loss can occur at any place along this chain. Impacted wax in the ear-canal can have the same effect as fluid in the middle ear. When the doctor looks into the ear-canal, all he sees is the eardrum. In some cases, the drum can look red and

infected, and it is obvious that an infection is present. In other children, it can be difficult to determine by looking at the eardrum whether fluid is present.

A child's having chronic fluid in the middle ear does not necessarily mean he will have a delay in language and speech or educational problems, but it is not possible to determine which child will have difficulties and which child will not. Unfortunately, if the parents adopt a "wait-and-see" attitude, and the child does not develop normal communicative skills, irreparable damage has been done. This is why any child who is not developing these skills normally must have their hearing evaluated and have a medical evaluation by an ear, nose, and throat physician. If a loss is present and is caused by fluid in the middle ear or wax in the canal, it can be corrected. If, however, the loss is in the cochlea, it is much more serious than that loss caused by fluid in the middle ear. Hearing loss that occurs in the cochlea is called sensorineural hearing loss. This loss cannot be identified by looking at the eardrum.

Losses in the cochlea cannot be treated medically or surgically. In addition to being permanent, the loss that occurs in the cochlea produces distortions to the sounds that are heard. For example, an "s" may sound like an "f." Because of the distortions, children who are developing skills in language and speech do not learn the meaning of words and other aspects of language. The child also does not learn to speak clearly; a word will be said as the child hears it. Consequently, this loss will cause a delay in language and speech, if it is present at birth or occurs in early infancy. If the loss is present at birth, the child must be fit with hearing aids no later than six months

of age. Modern technology such as oto-acoustic emissions and auditory brainstem testing allows the hearing to be evaluated in a child as young as several days old.

Figure 3 demonstrates how large adenoids and tonsils can cause fluid in the middle ear. Large adenoids are the most common cause of recurrent episodes of fluid in the middle ear in young children. The adenoids are more related to hearing than the tonsils because of their location relative to the eustachian tube. If the tonsils are large, the adenoids are probably also enlarged. The eustachian tube is a very important structure in the ear. It is through this tube that air is exchanged in the middle ear.

Part A of Figure 3 shows a normal structure. The adenoids and tonsils are small. There is a large airway so that the child can breathe easily through the nose, which allows air to pass freely up the eustachian tube and ventilate the middle ear. These areas are marked "1" and "2" respectively. Part B illustrates large adenoids blocking the eustachian tube, and large tonsils. When this occurs, air cannot enter the middle ear system and fluid collects behind the eardrum. The area marked "3" demonstrates a restricted airway. This restriction can cause a child to breathe through the mouth, cause restless sleep, and cause snoring or a noisy sleep when the child is sleeping on his or her back.

As long as the eustachian tube is obstructed, the young child will have frequent episodes of fluid in the middle ear. The child frequently does not have symptoms such as fever or an earache that would tell parents that fluid is present. The hearing loss that usually accompanies this fluid is so mild that the hearing is often not questioned.

In some children, the fluid does not cause a hearing impairment at any given time, but the fact that it is present subjects the child to a fluctuating hearing loss.

Figure 4 shows the relationship of the eustachian tube in an adult to that in a child. In an adult, the tube is angled toward the back of the throat. When fluid does collect in the middle ear, it has a tendency to drain into the throat. In children, because the tube is flat, the fluid has a tendency to remain in the middle ear. The eustachian tube reaches the adult angle at around the age of 12.

The most common age for ear-infections to occur is during the first 18 months of life. This, as far as the child is concerned, could not happen at a worse time. This is during the critical language-forming years. The audiologist and the speech pathologist would not be concerned about this if the language system could be fixed. Unfortunately, once the language system is impaired, it usually cannot be returned to normal. Children with impaired language can be helped through proper speech and language therapy, but residual problems frequently remain. Therefore, if the problem cannot be remedied, it must be prevented. This is done through awareness on the part of parents and pre-school teachers, early identification, and aggressive treatment.

If impairment of the language system cannot be prevented, for example in the case of sickness, accident, and so on, the delay must be identified at the earliest possible age so that the child can be placed in a proper program of therapy. Fluid in the middle ear is usually treated with medication first. The child must be seen by the physician after the course of treatment has been completed. Parents must never assume the

condition has cleared, just because the child has been put on medication. The infection can clear but the fluid still remain. Even though the fluid is no longer infected, it can still impair the hearing. The problem has not been solved.

Ear-infections are considered to be chronic when: (a) the fluid goes away when the child is on medication but returns when the child goes off medication; (b) several medications are tried, but the fluid still persists; (c) the fluid persists for three months, with or without treatment; (d) the child is placed on long-term medication but has another episode of fluid, even though he or she is on medication. Long-term medication is not good for the child. The organisms causing the ear-infection become desensitized to the antibiotic, making it less effective. When fluid in the middle ear is chronic and medication does not solve the problem, tubes should be inserted. Adenoids should also be removed if they are obstructive and the child is old enough to have them removed. Parents may need to seek a second opinion, if the physician refuses to provide surgical management when the condition warrants it.

Ventilating tubes can be inserted before the child is one year old, if the condition is chronic. A ventilating tube is a tiny tube that is surgically inserted through the eardrum. This provides an air-passage between the ear-canal and the middle ear. Figure 5 demonstrates a ventilating tube in the eardrum. The ventilating tubes serve as an artificial eustachian tube. The middle ear system is then being ventilated through the tube rather than through the child's own eustachian tube. The tubes also keep the child hearing normally as long as they are in and functioning properly. These tubes will stay in for six to 12 months, and then they will fall out on their own.

If the fluid returns after the tubes fall out, they can be put back in with no harm being done to the eardrum. Often, by the time this happens the child is now old enough to have the adenoids removed. This almost always solves the problem. The general criteria for having adenoids removed are that the child should be at least 18 months old, have a history of repeated episodes of fluid in the middle ear, and have nasal symptoms such as difficulty breathing through the nose, nasal discharge, and snoring when sleeping on his or her back.

For some children it takes a period of time for their own eustachian tube to begin functioning on its own after the adenoids have been removed. This is why the adenoids are generally not removed without putting in ventilating tubes. When the tubes are inserted, they need to be checked periodically to assure that they remain open. If they become plugged, they are no longer serving their purpose, and the fluid will probably return. The tubes can be plugged with drainage or with wax. A tympanogram can easily tell whether the tube is open or closed. The ventilating tube can appear to be open but can be plugged on the inside where the blockage cannot easily be seen by looking into the ear.

When parents are going to have tubes inserted in the child's ear and the child is 18 months or older, they need to be aware that enlarged adenoids may be causing the problem. This may not be mentioned to the parents by the physician. If it isn't, the parents need to request that the adenoids be carefully evaluated. A lateral x-ray is often needed to determine whether the adenoids are obstructive. If they are not, this problem has been ruled out for the present time. If they are enlarged, and the child is

old enough to have them removed, but they are not removed, the fluid will no doubt return after the tubes fall out. This will result in another set of tubes that may not have been necessary.

This is why it is important for the pre-school teacher to have a basic understanding of the anatomy, so that they can properly inform parents. Parents need to be educated consumers when it comes to medical care for their child. There are some children who will require multiple sets of tubes, even though the adenoids have been removed or are not obstructive. For these children, the muscular system that opens and closes the eustachian tube may be immature or not functioning for some other reason. There may also be a structural problem that is preventing the eustachian tube from functioning properly.

Tonsils, because of their location, are not as related to problems in the middle ear as are the adenoids, but they can be a contributing factor if they are chronically infected. The criteria for removing tonsils are that the child should be three years old, weigh 30 pounds, and have had strep throat and/or tonsillitis three times in two years or five times in one year. Some physicians will remove the tonsils at an earlier age if the medical history warrants it. Frequent episodes of strep throat can cause serious problems with the heart.

Infected sinuses can also contribute to problems in the middle ear. The sinuses drain down over the opening of the eustachian tube. This can cause the infection to travel up the eustachian tube into the middle ear. Sinuses are usually developed around the

age of four to five. One symptom of infected sinuses is chronic drainage from the nose and/or facial tenderness.

Parents and teachers cannot rely on the child's behavior to tell them that the child may have fluid in the middle ear. As previously indicated, many children do not have symptoms to alert the parents that a problem is present. Because of this, the fluid can remain undetected for a long period of time. When this occurs, the child is at risk for developing some rather complicated medical problems.

The child can develop what is known as a cholesteatoma or a tumor behind the eardrum. This medical problem can erode the three little bones in the middle ear, as well as erode the eardrum. The child can develop a "glue-ear." This is when the fluid takes on the consistency of gel. This can also erode the structures in the middle ear, as well as the eardrum. In some cases, the child can get meningitis. Chronic fluid in the middle ear can also cause permanent sensorineural hearing loss. Even though fluid in the middle ear is a very common childhood problem, it has to be taken seriously. Not only is a child at risk for long-term, permanent educational problems, but the medical ramifications can also be quite serious.

The hearing loss caused by the fluid is generally mild. It can occur in only one ear, or it can be mild in one ear and quite pronounced in the other ear. Because of the mild nature of the hearing loss, the child's hearing may never be questioned. Figure 6 is an audiogram depicting the average loss caused by fluid. Between 0 and 20 is the range of normal hearing across the frequencies of 250 through 4000 Hz. It is noted on this

Figure that the mild hearing loss occurs between 25 and 35 dB (in loudness). This child's hearing loss will never be questioned. Also depicted on this audiogram is a sampling of where (at what loudness and what frequencies) the various speech-sounds occur. Sounds above the line, e.g. the "s" sound, are not heard with this mild loss.

The vowel-sounds are located in lower frequencies (250 to 1000 Hz). These sounds carry the loudness of speech. This is also where most environmental sounds occur. The consonants, such as the "s," "t," "f," "th," "sh," and "p" sounds, occur between the frequencies of 1500 and 4000 Hz. These sounds are the most important, because they carry the words' meanings: Was the word "fan," or "tan"? The consonantal sounds are very soft and occur very quickly in ongoing speech. The vowel-sounds tend to be prolonged and are much louder. When a child has a loss in the high frequencies, he or she will not hear these all-important consonantal sounds at all and/or accurately. For example, if the word was "fan," a child with a mild loss in the high frequencies may only hear "an." As a result, the child only hears parts of words.

To compound the problem, the fluid can cause hearing to fluctuate. Some days the child hears the word "fan," and on some days he only hears "an." This causes an inconsistent input to the language system. If this occurs often during the years when learning of language should occur (0 to two years of age), the child is at risk for not developing normal skills in language and speech. For some children, this inconsistent input is more detrimental to the language system than a consistent hearing loss caused by fluid.

To further illustrate this important concept of not hearing all of the speech sounds in ongoing conversation, the following nursery rhyme, "Mary Had a Little Lamb," will illustrate this quite dramatically:

> *Mar ad a lile am ose* ee *as ite a ow, nd eve ere Mar en he am wa ure o go. i ollowed er o ool ne da, i as again the rle; all he ildren began o lau, because i agan th ul.*

This may be what a child with a mild hearing loss hears when parents are talking to him or her, or when the child is engaged in "overhearing." Is it any wonder that some of these children do not acquire normal skills in language and speech, if this is what they hear during those all-important language-learning years? An analogy that could be used would be to say that this is similar to an adult trying to learn a foreign language and only hearing parts of what is being said. This is not a good analogy, because the adult has an existing language system on which he or she can fall back to help fill in what was not heard. The child who is still developing the language system does not have a system on which to fall back to help fill in what is not heard.

Figure 7 depicts the hearing of a four-year-old child who has a mild to profound sensorineural hearing loss. He has normal hearing for the low frequencies and a severe loss in the high frequencies. Because of the normal hearing in the low frequencies which allowed him to hear environmental sounds and some of speech, the mother never questioned his hearing. This child has the same problem as the child with fluid in the middle ear; he was unable to hear those all-important consonantal sounds, short words, word-endings, plurals, and inflectional patterns. This child would also hear the nursery rhyme as it is portrayed above. As previously indicated, this child's hearing loss cannot be corrected. At the age of four, this child is permanently

handicapped. This child should have been questioned at 18 months when he was not developing the appropriate skills in language and speech.

This emphasizes the point that if a child does not appear to be developing normal skills in language and speech, his or her hearing must be evaluated to rule out or identify this type of hearing impairment. It is always assumed that because a child responds to sound, the hearing is normal. It is easily seen how this can be very misleading. Children who have a unilateral hearing loss (a hearing loss in one ear) have a similar problem. Even though they have one good ear, these children do not overhear well. Approximately 50% of children who have unilateral hearing impairments have difficulty with their academic program.

The following children are at risk for having recurring episodes of fluid in the middle ear. This emphasizes the importance of having pre-school teachers know the child's history as well as the child's family's history. Factors to recognize include:

1) premature babies; these are babies who have exceedingly small birth-weights of two to three pounds. Most of these children will have recurrent episodes of fluid in the middle ear because the muscular system that supports the eustachian tube just does not function properly.
2) children whose parents have a history of early and frequent upper respiratory infection or who have older siblings with the same history.
3) retarded children; children with Down's syndrome are going to have repeated episodes of fluid in the middle ear.

4) children who have facial anomalies such as a cleft palate.

5) children who attend day-care centers during the first three years of life. It does not matter how clean the day-care center is; children tend to pass around colds and upper respiratory infections very easily.

6) children whose parents smoke in the house. Smoke is an extreme irritant to a child's upper respiratory system. Children of parents who smoke in the house are at very high risk for having repeated infections in the middle ear and upper respiratory system.

7) children who consistently breathe through the mouth, or are restless sleepers, or snore when they sleep on their back.

The age of onset is very important. Children who have their first episode of fluid in the middle ear before they are 12 months of age are at risk for having recurrent problems in the middle ear. These children need to be watched very carefully to determine whether they are appropriately developing normal skills in language and speech. If parents are already bringing in medication and the child is not yet 12 months of age, the pre-school teacher should make them aware of what the possibilities are.

Children's ear-infections should be treated very aggressively at this young age. If the condition is chronic, children as young as eight to ten months of age can safely have ventilating tubes inserted. The anesthesia is very light, and it takes a matter of minutes to place the tube in the ear. Some parents have a great fear of having tubes put in their child's ears. Granted, there are risks to everything that is done to a child medically, whether it is having tubes inserted or having the child receive childhood

vaccinations. If parents really understood the devastating consequences that can occur if a child does not develop normal communicative skills, they might not be so reluctant to have tubes put in. The informed pre-school teacher can help the parents make this important decision.

Because of the total absence of public education on this, parents do not realize when they are being given wrong information. As a result, many children are needlessly handicapped. The parents need to be educated consumers so they will know when they are being given wrong information. The following is a list of some mis-information which parents have been told:

1) "All children have episodes of fluid in the middle ear; this is nothing to worry about." If parents are told this, they are not going to be concerned if their child is having chronic episodes of fluid in the middle ear.
2) "He will outgrow the infections." This is generally true; most children will tend to outgrow the problems with fluid in the middle ear. The concern, however, lies in <u>what is happening to the language system while he or she is outgrowing the problem.</u> If the child does not outgrow it until the age of three or four years, there is a good chance the child has not heard well during those critical two years of life where the basis of the language system is being developed. People who tell parents "don't worry; he will outgrow it" do not understand the nature of the language system or the serious consequences that can develop later in the child's life.

3) "It is only a mild hearing loss, so it will not cause any problems." The reader is referred back to the nursery rhyme which demonstrates what speech may sound like when a child does not hear all of the speech-sounds.

4) "As long as he has one good ear, he will be able to hear okay." Children who have only one good ear do not hear well, especially in the presence of background noise.

5) "The infection is gone, but the fluid is still there." To most parents, the infection is the main problem. If the infection is gone, they assume the problem has been solved. The antibiotics can clear an infection, but as long as fluid remains in the middle ear, the hearing is subject to fluctuation, thereby causing an inconsistent input to the language system.

6) "Adenoids are not related to hearing." The reader is referred to Figure 3, where it can be seen that the adenoids, because of their relationship to the eustachian tube, are directly related to the function of the middle ear system.

7) "If the adenoids are taken out, they will grow right back." When parents hear this, they do not want them taken out and then have to go through the surgery again. When removed properly, only a very small percentage of adenoids grow back.

8) "If we put tubes in the eardrum, this will cause scar-tissue." If this is not explained to the parents, they will assume that scar-tissue will cause a hearing loss. Tubes can be put in repeatedly with little or no effect on the child's ability to hear. There are some children who do need to have

multiple sets of tubes. The problem comes in when the eardrum is ruptured by the fluid in the middle ear. This rupturing can cause ragged scarring of the eardrum, which can cause a degree of hearing impairment.

9) "A lot of children do not talk until the age of three; he will be okay." If parents decide to wait to see whether their child is going to talk, and he or she does not, valuable time has been lost that the child cannot make up.

10) "Your child is too young to test." No child is too young to test. Testing procedures such as the auditory brainstem test and the oto-acoustic emissions test can evaluate the hearing-sensitivity of children as young as several days old.

11) "Mouth-breathing and snoring do not mean a thing." If parents do not understand the relationship of the adenoids to the functioning of the middle ear system, they will not investigate having them removed.

12) "Your child's tympanogram has always been flat; this does not mean a thing." If a tympanogram is done properly, and it has what is known as a "flat configuration," the chances of fluid being present in the middle ear are very high. If, however, the tympanogram is not taken properly, incorrect results can be obtained.

When a child has chronic ear-infections, it is not just the child who has problems, it is also the parents and other siblings. If a child is sick, the parents do not sleep; they have to juggle their schedules for frequent trips to the doctor. They need to balance

the needs of the ill child with the needs of the well children in the family. There is often strain between the spouses. Oftentimes, one spouse does not believe that all these trips to the doctor are necessary because he has been told that the child is going to outgrow it. There may be financial concerns. Many parents who do not have good insurances cannot afford the cost of the appropriate medications. Some parents may be concerned because a child has been on so much medication, and there are some who will be concerned about "how these early ear-infections will affect their child's development of language and speech." This, because of the lack of public education, probably will not be considered.

The following is a list of educational problems that are often associated with chronic ear-disease in early infancy:

1) The child may not develop normal skills in speech and language. This should become evident at least by the time the child is 18 months of age. It must be stressed, however, that there are many children who have a history of chronic middle ear disease who are able to acquire normal skills in language and speech. The problem does not become present until they enter the school-system. This is why the pre-school teacher and parents cannot ignore early chronic infections in the middle ear, even though the child appears to be developing skills well in language and speech.
2) When they are in the classroom, they may have difficulty with short-term memory.
3) They may be distractable and/or hyperactive.

4) Reading comprehension or reading is often very difficult for them.

5) They may have difficulty in following directions or difficulty hearing when there is background noise. This concept is very important. These children behave as if they do not hear, so the parents take them in to have their hearing evaluated, and the hearing is then found to be well within normal range. Children who have educational difficulties (2) through (5) may well have normal skills in language and speech, but these children have a disorder that is very often overlooked. These children have what is known as a central auditory processing disorder. One aspect of a central auditory processing disorder is that the children are not able to hear easily in the presence of routine classroom noise. If the parents go to a doctor, a nurse, or an audiologist who is not familiar with central auditory processing disorders, they will be told that the hearing is fine, and the child is probably not paying attention. When this happens, the child is often punished for something over which he or she has no control. A central auditory processing disorder cannot be identified from a routine hearing test.

6) These children may also have a problem involving visual processing.

7) The child may not like school.

8) Their attitude and self-esteem is often very poor.

When the attitude and self-esteem become involved, the educational problems now escalate considerably. These two factors are very difficult to correct once they have become ingrained. Should these two factors become involved, the parents often have

feelings of guilt and are very frustrated because no one told them that chronic ear-infections can have long-term, negative educational consequences for their child. The pre-school teacher has an immense responsibility to identify the children who are at risk and bring it to the attention of the parents while the child is still an infant. The teacher should document that the parents were advised. It is hoped that the parents will have the child evaluated to rule out or to identify these problems. Unfortunately, there are some parents who will choose not to heed the advice of the pre-school teacher. When this occurs, it is the child who will suffer the consequences.

In summary, the child's ability to hear plays a major role in determining whether he or she will fail or succeed. The age of onset, severity, and duration of the hearing loss are critical factors in determining the extent and degree of delay in language and speech. The longer a hearing impairment remains undetected and untreated, the greater the risk for significant impairment of language and speech. In our fast-moving, high-tech society, more emphasis is going to be placed on reading, reading comprehension, writing skills, critical thinking, following directions, and so on. Those children who do not have adequate communicative skills will find these tasks difficult. Because of this, their opportunities for employment will be quite limited. When gainful employment is restricted, the emotional and social aspects of the individual's life are often adversely affected.

If the child's skills in language and speech are questioned, they must have their hearing evaluated and be seen by an ear, nose, and throat physician to rule out any medical or hearing problems. After medical problems have been ruled out or treated,

the child must be seen by a speech-language pathologist to rule out or determine the extent of the delay. If the delay in language is not identified and treated, the child's chances for academic success and opportunities in employment are limited.

It is hoped that the information presented in this paper will help prevent or lessen the educational, social, and emotional difficulties associated with chronic infections in the middle ear or permanent sensorineural hearing loss, through awareness, early detection, and aggressive treatment.

> Before a child can develop the skills in speech and language that he or she will use tomorrow, the child must have heard all of yesterday.

FIGURE 1

LANGUAGE AND SPEECH DEVELOPMENT

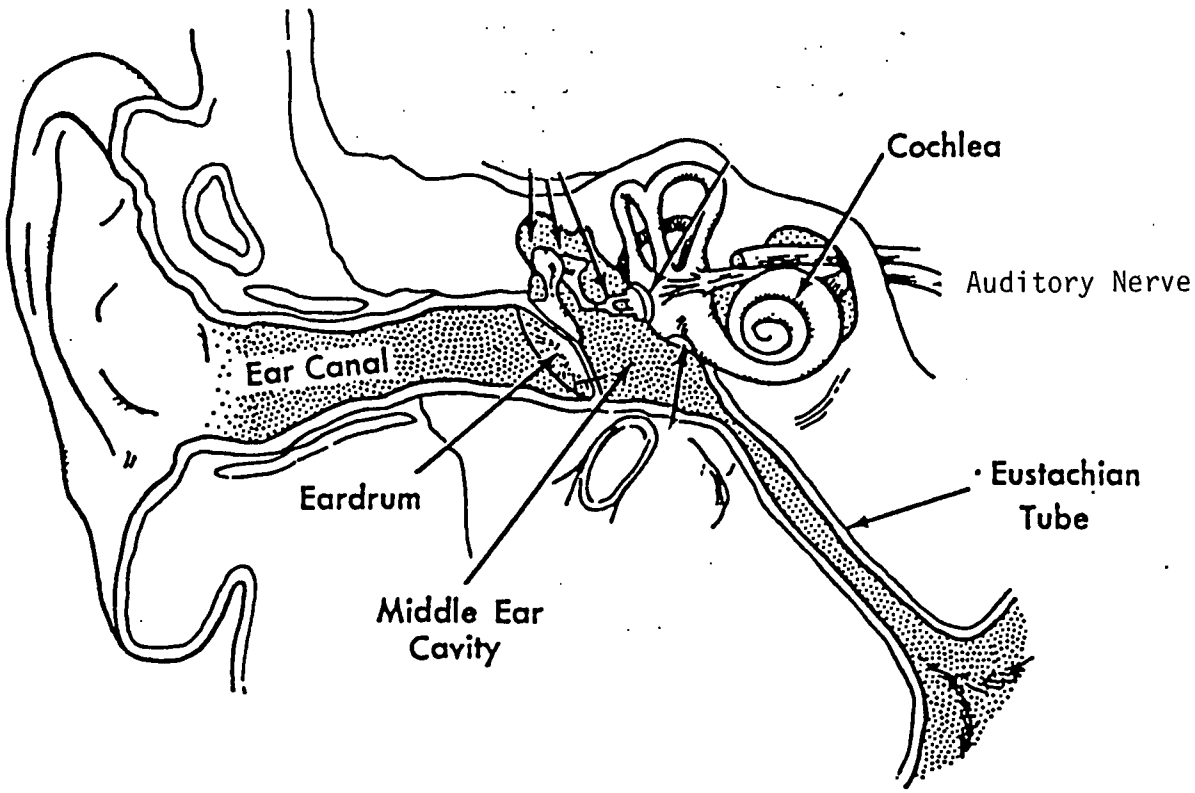
3 years	Has at least 1000 words in vocabulary. Speaks in short sentences. Speech is about 90% intelligible.
2 years	Has about 250 words. Uses two word phrases. Speech is about 60 % intelligible.
1.5 years	Uses up to 50 words. Points to eye, nose etc... Has normal intonation pattern to voice.
1 year	Applies first words to persons and objects. Understands some words.
6 months	Adds consonants to vowels making syllables.
1 month	Alerts to voice, coos.

The first two years of life, the first year being especially critical, are the most important years of the child's life. It is during this time period that the frame work for the future language and speech skills is formed. This frame work is created almost entirely through the process of hearing. The language and speech skills are used during the all important process of communication. Language is the ability to learn the meaning of words and concepts and use them appropriately. Speech is the ability to say the word correctly. If this frame work is not properly developed, the child will be delayed in the acquisition of these skills. **Because of the severe risk this holds for the future educational achievement of the child, early identification is essential.** The longer this delay remains unidentified and untreated, the greater the risk of this delay becoming permanent.

Even though the most common cause for delayed language and speech skills is repeated episodes of middle ear fluid in infancy, the child must have his/her hearing evaluated by an audiologist to rule out a previously undetected permanent hearing loss and then have the child evaluated by a speech language pathologist if:

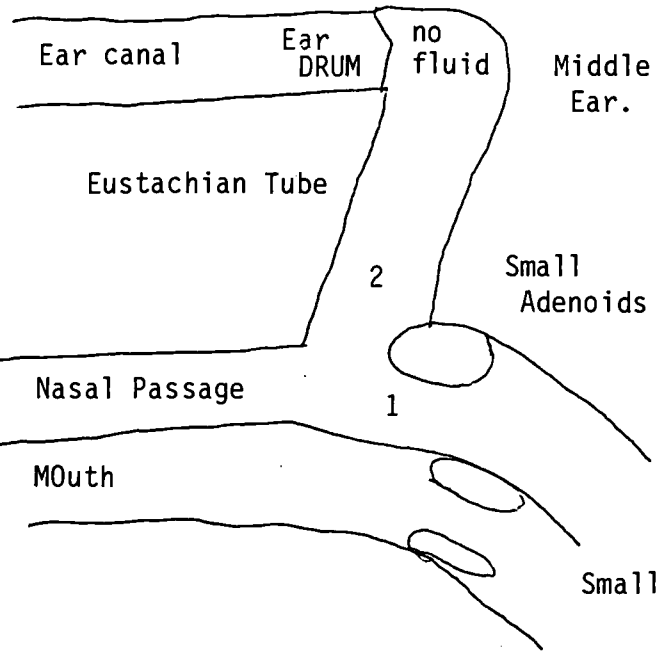
1. The infant does not respond or responds inconsistently to sound.
2. The 18 month-old does not use any words.
3. The two year old has fewer than 100 words is still using single words and/or the words he/she does use are unintelligible.
4. The three year old is not talking in short sentences, has fewer than 700 words, and/or his/her speech is difficult to understand.

Figure 2


Cochlea
Auditory Nerve
Ear Canal
Eardrum
Eustachian Tube
Middle Ear Cavity

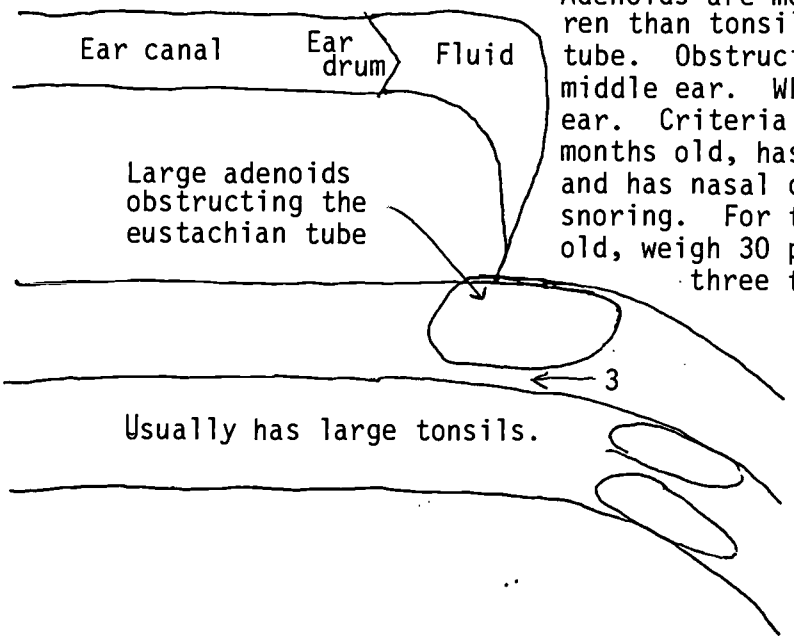
NORMAL SYSTEM (PART A)

Figure 3



The purpose of the eustachian tube is to provide ventilation for the middle ear. Air passes freely through the eustachian tube when it is not obstructed by large adenoids.

IMPAIRED SYSTEM (PART B)



Adenoids are more related to hearing problems in small children than tonsils because of their location to the eustachian tube. Obstructive adenoids prevent air from ventilating the middle ear. When this occurs, fluid collects in the middle ear. Criteria for removing the adenoids is the child be 18 months old, has a history of repeated middle ear infections and has nasal obstruction such as mouth breathing and/or snoring. For tonsil removal, the child should be three years old, weigh 30 pounds and have a history of strep or tonsillitis three times in two years or five times in one year.

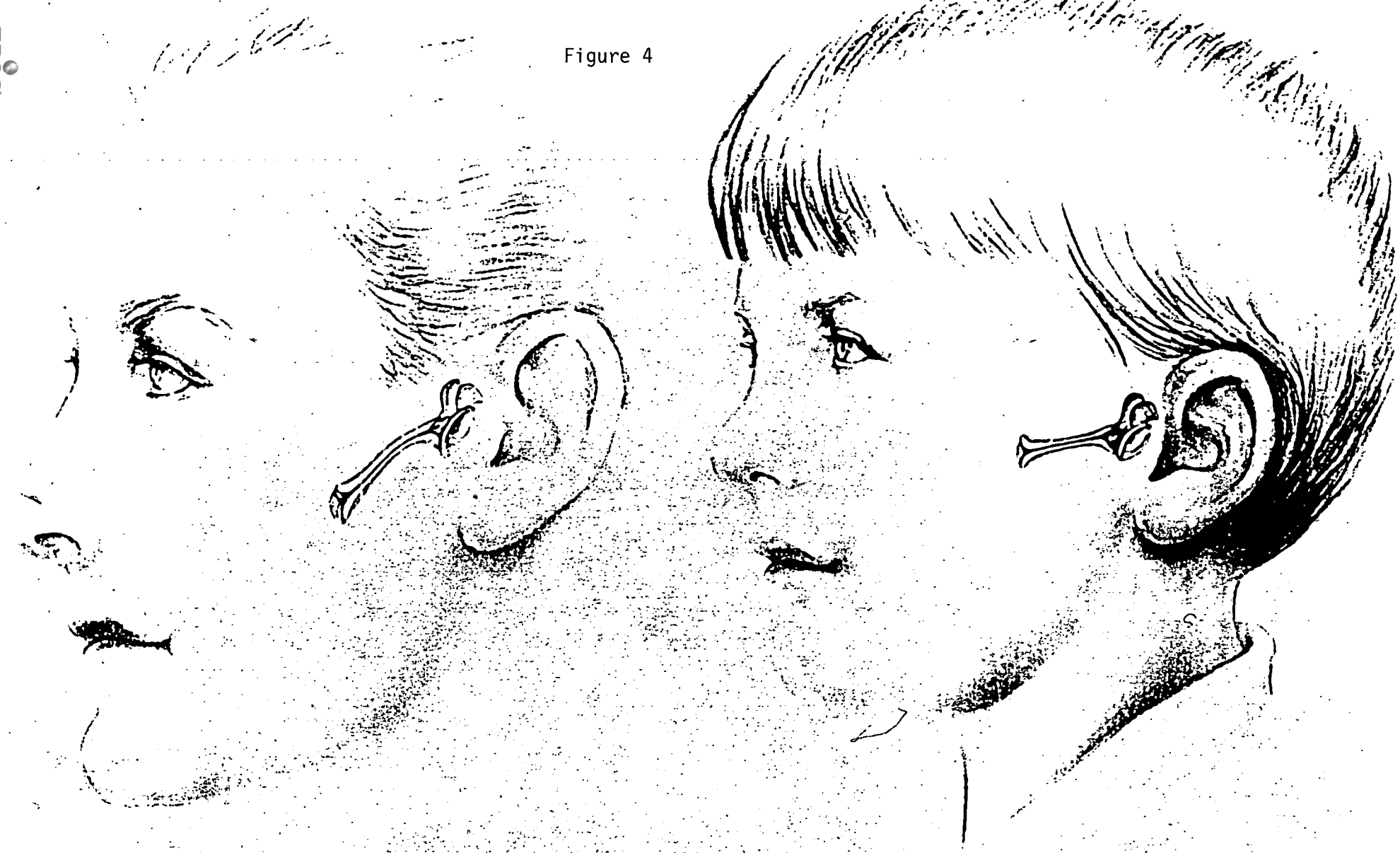
Small airway causes mouth breathing and/ snoring when child sleeps on his back.

Large tonsils may cause difficulty swallowing some foods.

Symptoms that are usually present to inform parents that the tonsils and adenoids may be contributing to chronic middle ear fluid:

1. Mouth breathing. The child may not breathe through the mouth when he standing up, but is a restless sleeper and/or snores when he sleeps on his back. This pattern may not be noticed if he sleeps on his side or stomach.
2. The nose is frequently congested. drainage is often present.
3. Frequent sore or strep throat.
4. It is usually difficult to see the adenoids in small children by looking into the mouth. A lateral x-ray can be helpful in determining if the adenoids are obstructive.

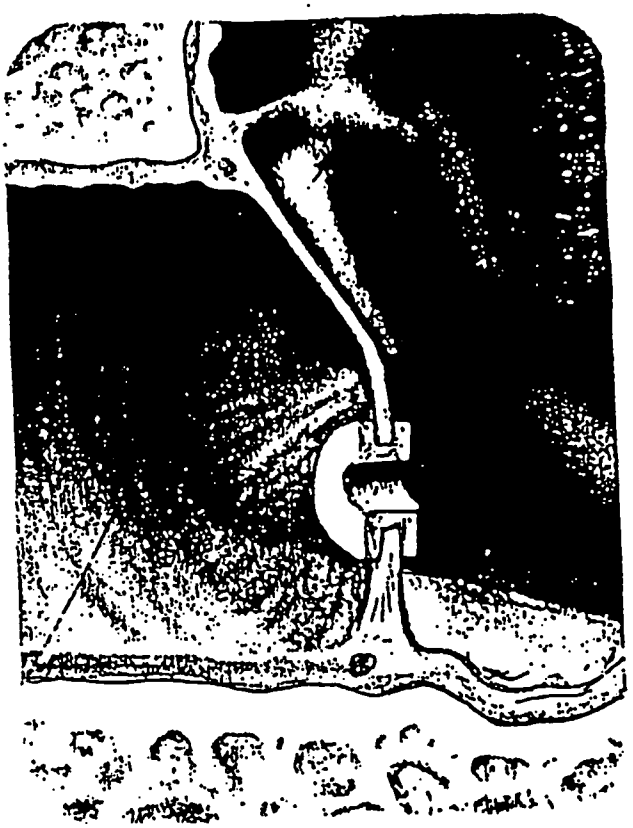
Figure 4



Adult / Child Eustachian Tube Relationship

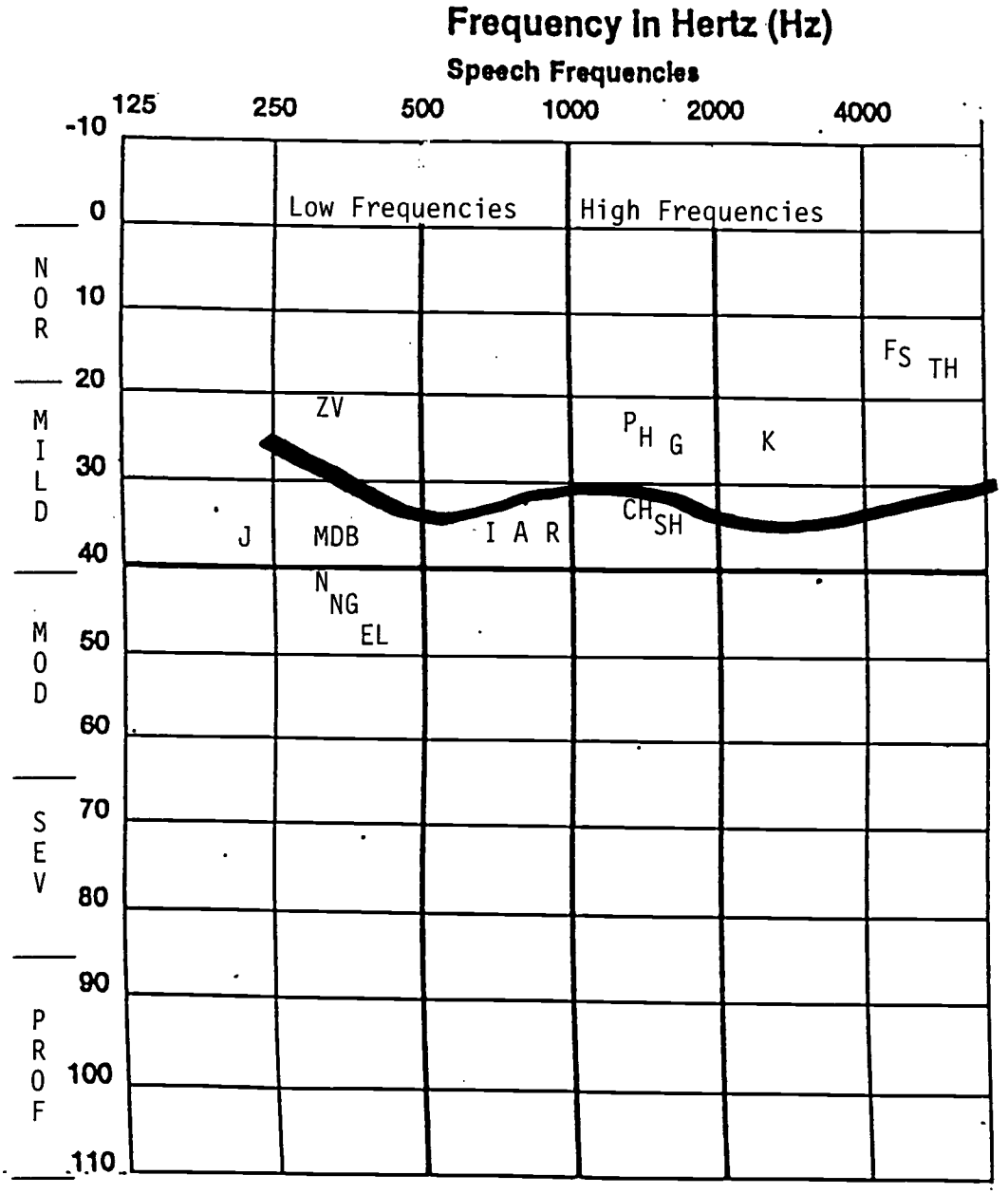
Figure 5

Ear canal side



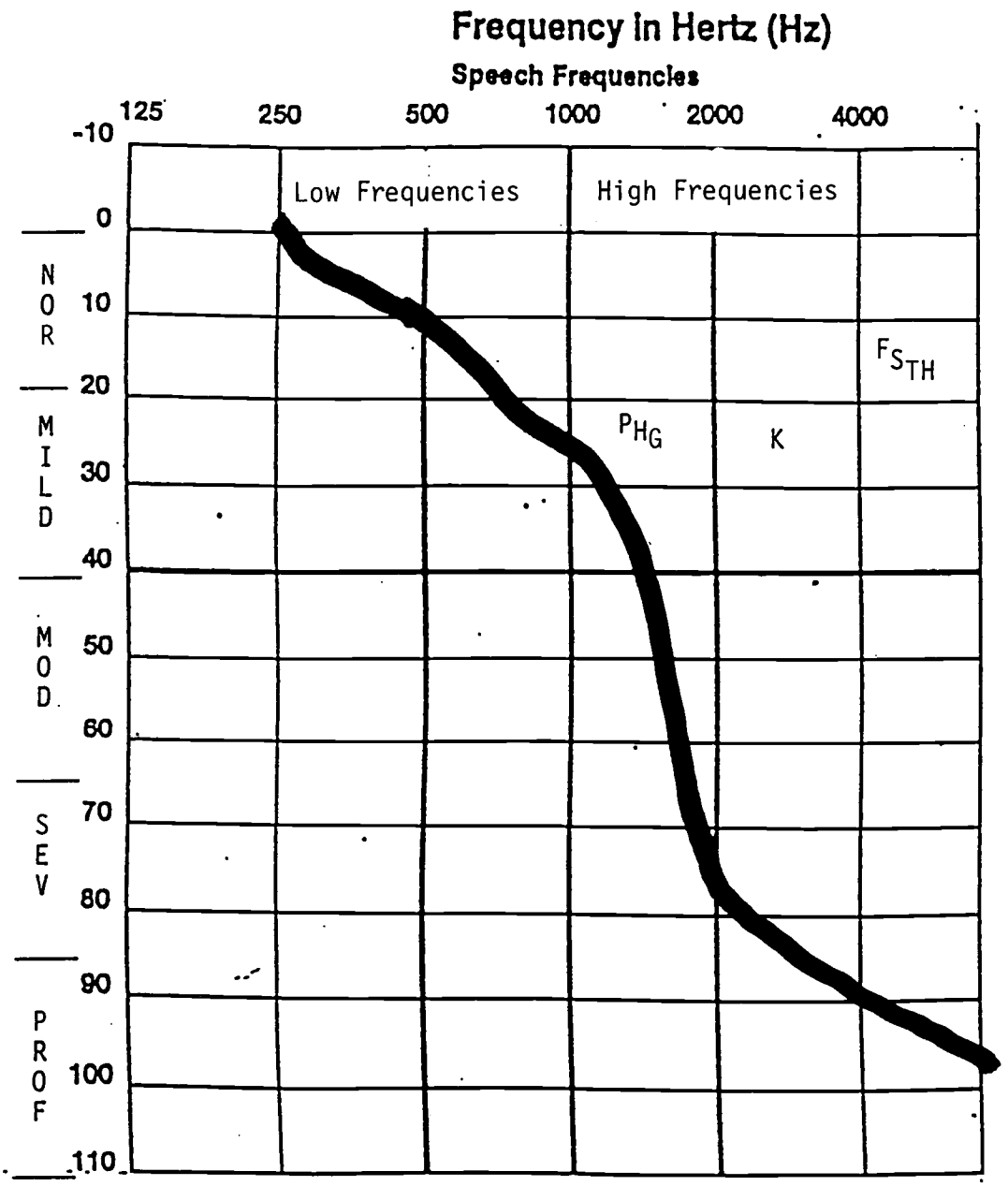
Middle ear side

Figure 6



This audiogram demonstrates the average hearing loss associated with middle ear fluid. Because of the mild nature of the loss, the hearing would not be questioned.

FIGURE 7



This audiogram depicts a mild to profound sensory neural (permanent) hearing loss. Because of the normal hearing in the low frequencies, this child's hearing would not be questioned.

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	Date: December 21, 1996

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