IDENTIFICATION OF HYPERMOBILE SCARS ON TYMPANIC MEMBRANE USING AUTOMATIC TYMPANOMETRY

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Abstract

Three subjects exhibited abnormal, atypical tympanographs when tested with electromedics 86 AR Tympanometer. These tympanographs were similar to Ad type, but with a clear notch. Repeated measures yielded similar findings. Ipsilateral reflexes were present in all these ears. Microscopic examination revealed fine, thin, hypermobile scars. Patients with flaccid tympanic membrane yielded Ad type tympanographs without a notch. The notched tympanographs obtained in tympanometer 86 AR seem to help in differential diagnosis.

Introduction

This is a report of our experience in routine audiological clinical work, where we administer impedance test battery on almost every patient. The material for this report emerged due to such an attitude. Probably we were biased by Jerger (1974), who says,

" Do Impedance Audiometry on everybody, no matter what.
Just do it, don't ask Why, just do it on everybody ".

Impedance audiometry has enhanced the horizon of diagnostic abilities of the clinical audiologists, especially where otoscopy reveals no or least clues (Samuel, 1980). Impedance audiometry basically depends upon the following measures:

1. Tympanometry;
2. Static compliance and
3. Acoustic reflex measures.

Tympanometry is an objective procedure which measures the mobility of the tympanic membrane or the compliance change in response to varying air pressures created at the ear drum (Harford, 1980). The tympanic membrane is clamped with air pressure of+ 200 m.m./H_2O in a hermetically sealed ear canal using a probe unit. At this point, the reflected energy of the probe tone is high and is indicated by poor compliance. When the air pressure is gradually released

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through zero into the negative range, the sound pressure level (SPL) in the external canal changes. This change is plotted on a graph known as ' tympanogram' (Northern and Grimes, 1978 and Harford, 1980).

The tympanograms are usually classified into groups and are either given codes (Jerger, 1970), or described based on their pressure peak, amplitude and shape (Feldman, 1978).

Jerger's classification is fairly simple. It classifies tympanograms into A, B and C (Fig. 1); type A indicates normal conductive mechanism and stapes fixation; type B indicates mass filled middle ear system and type C is suggestive of a defective eustachian tube. Under type A we have A deep which is observed in a flaccid or disarticulated middle ear system. Necrotized ossicles may exhibit a still deeper tympanogram known as A double deep. Type A shallow is observed in ears with otosclerosis. This report describes an unusual Ad type tympanogram.

Review of Literature

Liden and associates (1974) report a ' W type tympanogram in patients with scarred ear drums. Harford (1980) speculates these persons, who usually do not complain of any hearing loss to have a loosely coupled incudostapedial joint. Even an atropic scar can yield a ' W' pattern on the D type tympanogram. This D type tympanogram is usually obtained with high frequency probe tone. Liden *et al.,* (1974) have confirmed that the partial decoupling could be one of the causes which give rise to this type of tympanogram.

Ear drum abnormality affects tympanometry and yields such unusual tympanograms. This problem created by ear drum abnormality not only interferes with differentiating stiffening pathology, but also in loosening pathology (Feldman, 1976). Coating collodion on these drums is said to reduce the ear drum effect according to Feldman. Harford (1980) advocates the use of low frequency probe tone to avoid obtaining ' W' pattern in ' D ' type tympanograms. In neonates, this ' W' pattern is observed even if the probe tone is of lower frequency.

Surprisingly, we have obtained similar notched tympanograms in adults, in spite of using a low frequency probe tone. We speculate these unusual tympanograms to have resulted from small, hypermobile scars (one ear drums) **only.**

Method

Subjects : Three subjects aged 21-30 years old were tested, all with hearing in the normal range.

Apparatus and Environment

For pure-tone audiometry and speech audiometry a Beltone 200-C audiometer was used. Testing for middle ear function was done using a tympanometer (Electromedics 86AR) and an impedance bridge Madsen ZO 73 with its associated X-Y plotter (Hewlett and Packard, 7010 B). All tests were performed in the custom made sound treated rooms of the All India Institute of Speech and Hearing. Microscopic and Otological examinations were done at the ENT section of the Institute by a competent otologist.

Procedure

Pure-tone hearing test was done using the procedure recommended by Hughson and Westlake and Speech Audiometry was done using monitored — live voice procedure. Impedance measurements were carried out as instructed in the manual of each instrument. While using Madsen ZO 73 impedance bridge, the tympanograms were plotted using the associated X-Y plotter (Hewlett and Packard, 7010 B).

Results and Discussion

The results are restricted to only impedance findings (Fig. 2). When tested with electromedics 86 AR, all subjects were tested using adult size (Grey) Rock ear tips. Initially the instrument showed green light indicating an air-tight seal. The tympanometer then automatically recorded the compliance changes. The pressure is reduced from +200 mm H_2O to negative range. The tympanograms resembled Ad type but with a notch around O mm H_2O. While testing, the tester observed a flicker of the red light (indicating loss of air seal) fora fraction of a second. At this time, the green light went off. Initially, we were puzzled. So we repeated the measures. All the testers obtained similar findings. Therefore the instrument was tested using different subjects, with normal middle ear function. Such an abnormal finding did not appear on others. To check this again, we subjected these individuals for impedance measures in another instrument (Madsen ZO 73). To avoid the effect of automatic tympanometry, we used X-Y plotter for ZO 73 also. But, the tympanograms showed only Ad type and did not differentiate these ears from ears with flaccid tympanic membranes. Both instruments have provision to use only a single low frequency (220 Hz) probe tone. Then, how do we explain this difference? We have no definite answers. One possibility could be, the time for releasing the + 200 mm H_2O to negative range. Obviously the electromedics takes a shorter time. Whatever it may be the fact is that one instrument identifies, differentiates it from other similar middle ear differences, while the other does not.

How do we benefit from such a finding ? Ear drum abnormality and its undesirable effects on tympanograms are well known. Thin scars on the drum

introduce a notch, and make the interpretation difficult according to some, and help to clarify the picture according to some others (Feldman, 1977). A flaccid tympanic membrane which is said to be a major problem in iympanometry could be differentiated if only one uses this particular tracing. This might reduce the time in checking whether it is really a scar or an ossicular discontinuity. It is mainly because 86 AR tympanometers administer immediately an ipsilateral reflex test, which clarifies the doubt. If one obtains these notched tympanograms and an ipsilateral reflex, one can easily say, there is no middle ear lesion, and it is only a scar.

We are looking for some more subjects with this type of problem. More data is required to understand how this happens.

Acknowledgement

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REFERENCES

Feldman, A. S., (1976) Tympanometry—-Procedure, Interpretations and Variables, in Acoustic Impedance and Admittance'—The measurement of middle ear function-—A. S. Feldman and Wilber (Ed) Williams and Wilkins, Baltimore.

Feldman, A. S., (1977) Diagnostic Application and Interpretation of Tympanic and Acoustic Reflexes, *Audiology,* 16, 294.

Harford, E. R., (1980) Tympanometry,in clinical impedance audiometry, J. F, Jergerand J. L. Northern (Ed)—American Electromedics Corporation, Massachussets.

Jerger, J. F., (1973) Clinical experience with impedance audiometry, Arch. Otolnryngol, 92, 311.

Jerger, J. F., (1974) Second International Symposium on Impedance Measurement, Houston, TX, *Audiology,* 13, 271.

Jerger, J.' F., and Hayes, D. (1980) Diagnostic Applicaticns of impedance audicmetry: Middle ear disorder, sensorineural disorder in clinical; impedance audiometry, J. 1". Jirgerand J. L. Northern (Ed)., American Electromedics Corporation. Massachussets.

Liden, G., *e t al* (1974) Tympanometry for the d iagnosis of oss'cular disruptions *Arch. Otolaryngol.* 99, 23.

Northern, J. L., and Grimes, A. M., (1978) Introduction to Acoustic impedance in. Handbook of Clinical Audiology, J. Katz (2nd Ed.) Williams and Wilkins, Baltimore.

Samuel, J. D., (1980) Recent Advances in Audiology— Impedance Auidometry, Second South Zone ENT Conference, Hyderabad, 6th and 7th Sept., 1980.

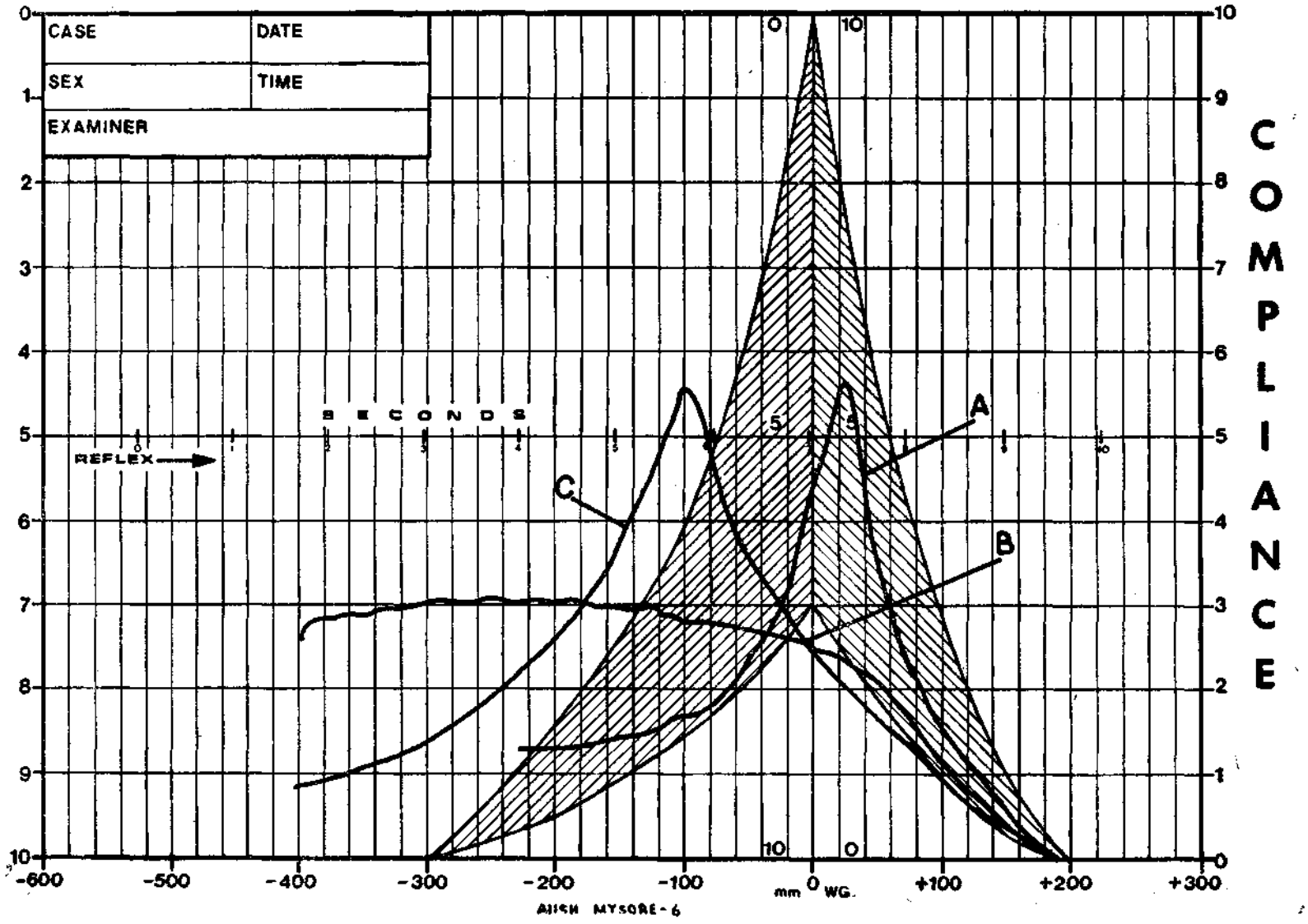
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Fig. 1

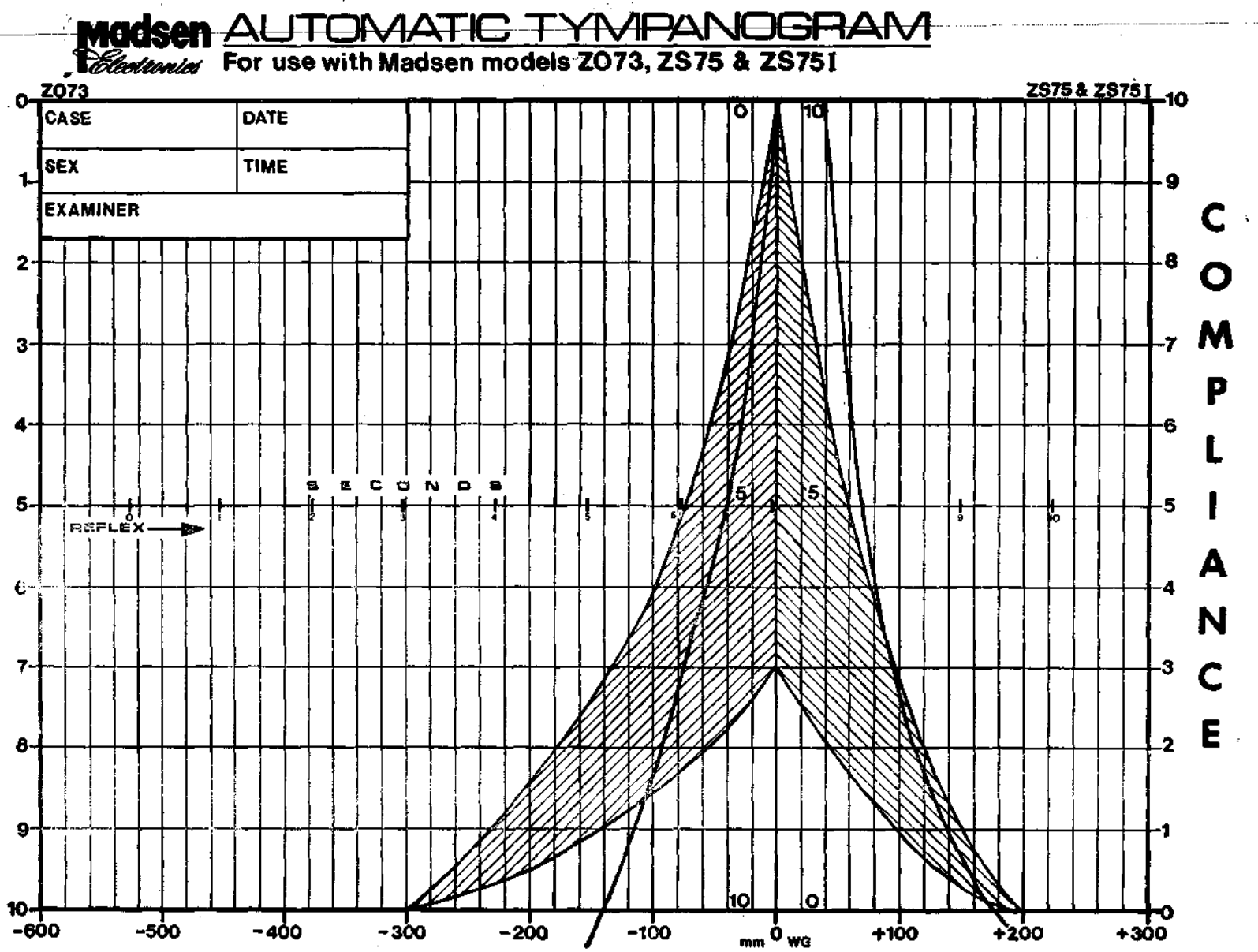
Madsen Electronics
AUTOMATIC TYMPANOGRAM
For use with Madsen models ZO73, ZS75 & ZS75I
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Fig. 2

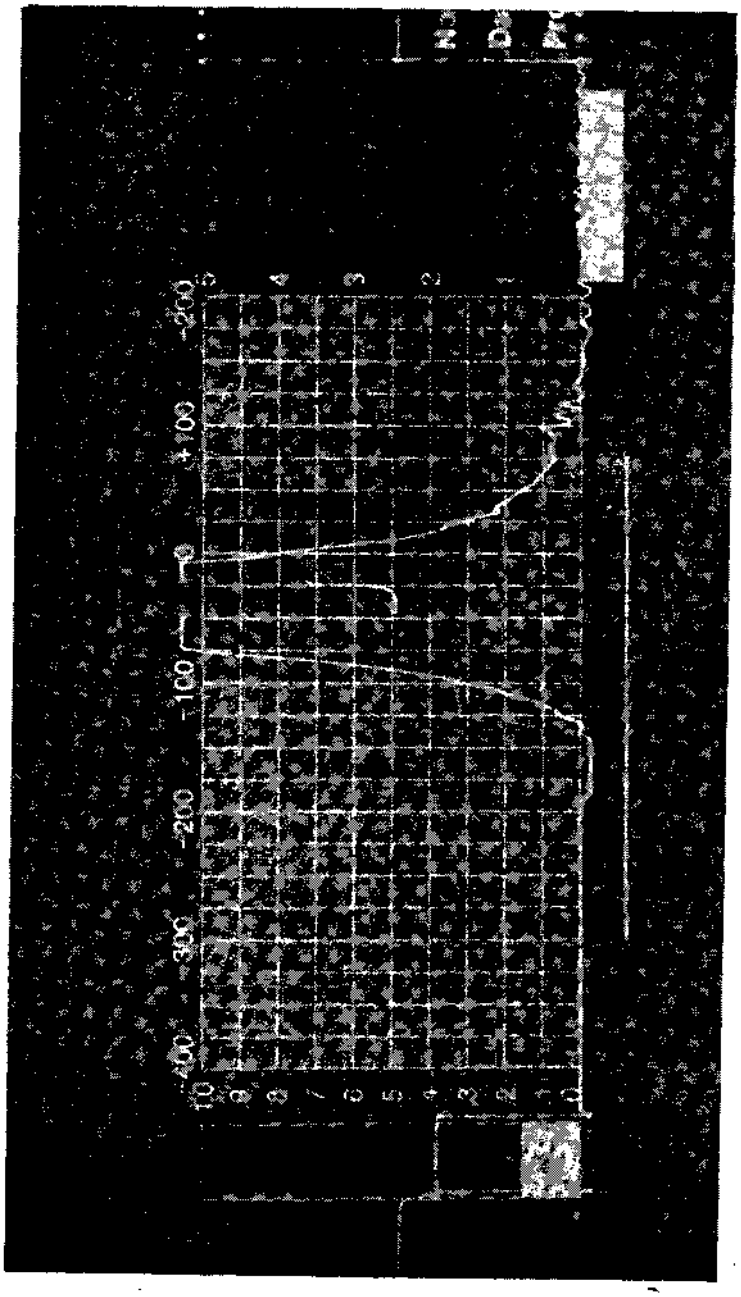

Fig. 2A