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INDIVIDUAL FOLLOW-UP OF HEARING AID FITTING

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ABSTRACT

Fifty new hearing aid users were summoned to individual follow-ups about one year after they had completed their hearing aid fitting.

A large percentage (about 30%) of the hearing impaired seldom used their hearing aid (<1h/day). The hearing aid was used only under certain circumstances when the subject had a great need for the hearing aid. The hearing impaired who had a steep hearing loss used the aid to a lesser extent. There is a strong need of follow-up visits. Reliability of the subject's own judgement was good.

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INTRODUCTION

Studies which examine different characteristics and the benefits of hearing aids have been carried out throughout the world for quite some time, e.g. Ringdahl & Leijon (1984), Eriksson-Mangold et al. (1980), Brooks (1979), Byrne & Fifield (1974), Jerlvall et al. (1983), Hagerman & Gabrielsson (1984).

The Department of Audiology at Danderyd hospital has independently and together with other clinics and institutions carried out several projects to evaluate different characteristics and benefits of hearing aids and hearing rehabilitation. Änggård et al. (1979) studied the utilization of hearing aids after the first and fourth year after finishing the fittings. In the "in-the-ear hearing aid project" the clinic evaluated, together with the clinics in Lund, Malmö and Linköping, characteristics of the in-the-ear aids compared with conventional behind-the-ear aids (Jerlvall et al., 1983). Ovegård et al. (1987) and Arlinger et al. (1988) studied in a mutual project between the clinics in Linköping and Danderyd a method for adapting hearing aids to a prescribed gain (POGO-method, McCandless & Lyregaard, 1983). The project also aimed at introducing insertion gain measurements at the clinics. In a purely acoustic study the four audiological departments in Stockholm have tried to find hearing aids with a high degree of predictability of insertion gain (Berninger et al., 1992).

The methods, which we and others have used in projects studying the characteristics of hearing aids and the benefits of hearing rehabilitation,

can be divided into objective respective subjective methods. The most common objective methods are:

- a. Measurements of the hearing aid's gain on the hearing impaired; insertion gain respective functional gain, e.g. Ringdahl & Leijon (1984), Larsby & Arlinger (1988), Arlinger & Jerlvall (1987), Walker et al. (1984).
- b. Speech tests with and without the hearing aid; e.g. phonetically balanced word lists (Lidén, 1954) with and without noise, Hagerman's sentences with noise (Hagerman, 1982).
- c. Measurements of the amount of daily use of the aid; e.g. data storage (Ringdahl et al., 1990), modification of the aid with time circuits (Brooks, 1979).

In the subjective methods one allows the hearing impaired or someone else to rate different characteristics. Among the subjective methods used the following can be mentioned:

- d. Rating of handicap before and after hearing rehabilitation; e.g. social hearing handicap index (Ewertsen & Birk-Nielsen, 1973) and hearing performance inventory (Giolas et al., 1979).
- e. Assessment of benefits and different characteristics of the hearing aid, e.g. Ovegård et al. (1987), Jerlvall et al. (1983).
- f. Rating of the amount of daily use, e.g. Brooks (1989), Jerlvall et al. (1983), Arlinger et al. (1988).
- g. Assessment of the hearing impaired's knowledge regarding for example care of the hearing aid, capability of using the controls on the aid when

it is placed in the ear, and knowledge about what the tele coil can be used for, e.g. Ovegård et al. (1987), Jerlvall et al. (1979, 1983). The assessments can be made by the hearing impaired themselves or for example by the audiology technician.

The hearing clinic at Danderyd hospital has during many years summoned the hearing aid patients to a follow-up visit together in groups 6 to 12 months after finishing their hearing aid fitting. Despite this we felt a need to recall the patients for an individual follow-up visit. This should give both the patient and the audiology technician valuable information. The technician should get a good understanding of how the final result of the hearing rehabilitation turned out. The patient should have the possibility to ask questions about things that are not clear, to get help with adjusting the aid, and to get a prescription of complementing assistive listening devices that are needed.

Therefore, we have set up a limited investigation to find out if there is a need for individual follow-up visits besides the follow-up visit in a group situation at the clinic. We also wanted to compare the result of the fitting with earlier studies concerning the amount of daily use, which gain the aid is adjusted to, in which situations the aid is used, how much knowledge the subjects have about caring for the aid etc. How well does the subject's rating of his own knowledge correspond with the view of the audiology technician? Another purpose of the investigation was to find out how the patient rates his or her own participation during the fitting.

MATERIAL AND METHODS

Subjects

Patients born between 1909 and 1924, who completed their hearing aid fittings from July through December 1988, participated in the investigation. None of the subjects had previously had hearing aids. Both behind- and in-the-ear aids were included in the study.

There were 50 participants, 28 men and 22 women. The average age of the subjects was 75 (standard deviation = 4.3) in the interval 66 to 85 years old.

Besides the subjects who participated in the investigation we also contacted 15 others. These subjects were not willing to participate because they had already had follow-up visits at the clinic, because of personal reasons such as illness, or that they were not at home during the actual time of the follow-up visit.

Methods

We have used a combination of objective and subjective methods to determine the benefits of the hearing rehabilitation.

Subjects' evaluation form

The form started off with a number of questions concerning living conditions, amount of daily use and under which circumstances the aid was used.

The aim of the following questions was to find out what knowledge they have about caring for their hearing aid etc.

Changes in hearing since completing the fitting, their own participation during the fitting and how pleased the subject was with his or her hearing aid was rated on three continuous scales graded from 0 to 5. "Much worse", "not at all active" and "not at all pleased" corresponded to zero (0), and five (5) corresponded to "much better", "very active" and "very pleased".

The form finished with three open questions. With the first two questions the subject was to describe what he or she liked the best respective disliked the most with the hearing aid. Finally the subjects were asked if they were in need of any assistance from the hearing clinic.

Audiology technician's evaluation form

The form began with information which was compiled from the patient file: information about the hearing aid, data concerning hearing and the number of visits to the audiology technician. After there was a section where the audiology technician gave an account of what knowledge he or she considered the subject to have. Finally, the steps were documented which were taken by the technician to help the subject.

Insertion gain measurement

Insertion gain was measured with a Rastronics CCI 10/3. Before the insertion gain was measured the subject adjusted the gain of the aid to a comfortable level while talking with the technician. The soft probe tube microphone was placed 5 mm in front of the tip of the ear mould.

Procedure

The subjects were summoned to a follow-up visit by telephone during December 1989 and January 1990. The form about the hearing aid etc. was filled out in advance and was then taken to the clinic at the time of the visit. The audiology technician and the subject went through the form together during the visit at the clinic. The technician filled out the evaluation form for each subject in conjunction with the visit at the clinic. At the follow-up visit insertion gain measurement was performed with the hearing aid adjusted to a comfortable level for each patient. A new audiogram was performed if the subject felt that his or her hearing had deteriorated since the fitting. For the remaining subjects data about their hearing was taken from the patient files. Also, information concerning the number of visits made to the audiology technician was obtained from the patient files.

RESULTS

Statistical treatment of the results concerning the hearing aid fitting is related to the hearing aid ear or the best hearing aid ear.

Hearing

Average tone audiogram are shown in figure 1. The average value of the speech recognition score via headphones was 89% (standard deviation = 13).

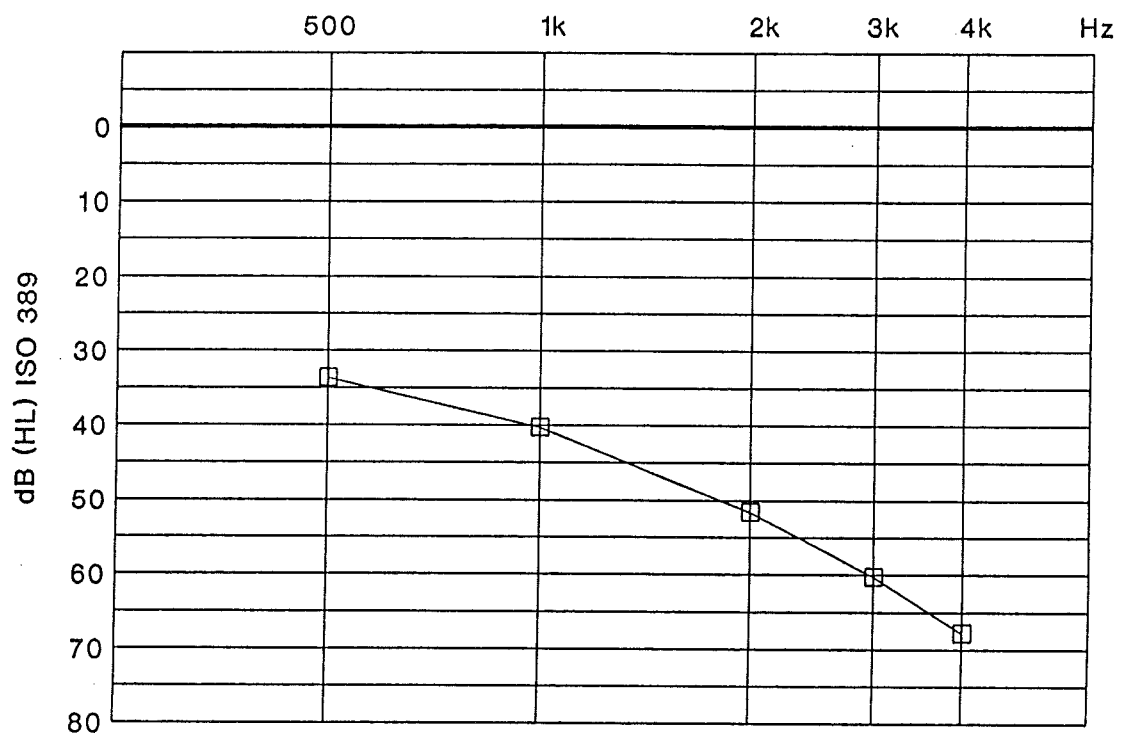


Fig. 1. The subjects' average tone audiogram.

Insertion gain

Average insertion gain (lower curve) and prescribed gain by the NAL method (Byrne & Dillon, 1986) (upper curve) are shown in figure 2. In the calculation of the prescribed gain by the NAL method was no compensation for the conductive part of the subjects hearing loss included. The

insertion gain for the subjects was about 3 dB lower than prescribed by the NAL method for 1 kHz and the difference increases successively to about 12 dB at 4 kHz.

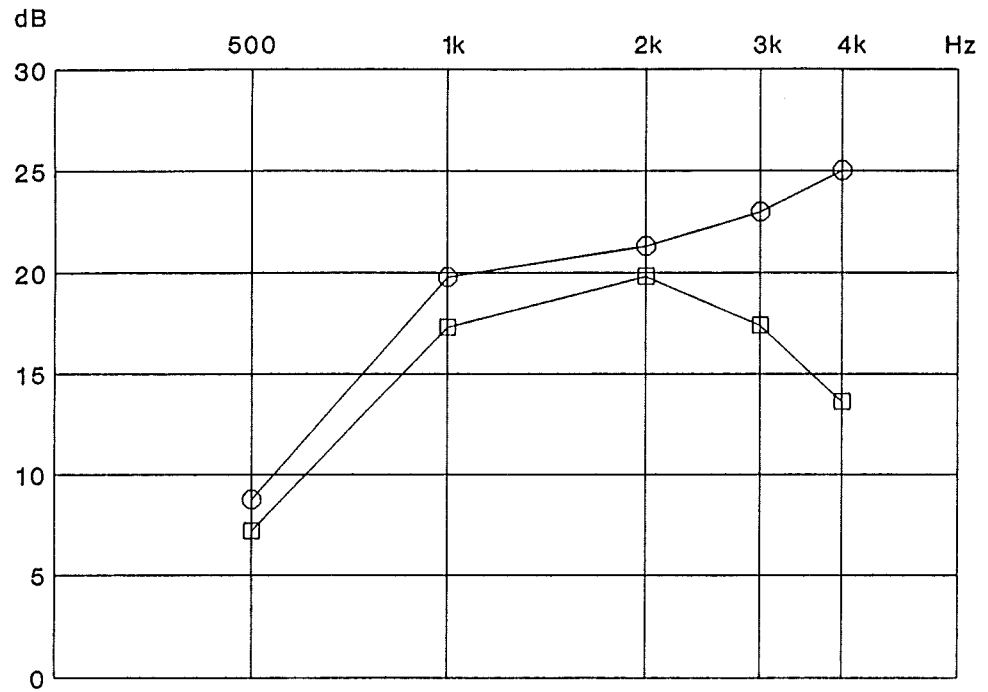


Fig. 2. The subjects' insertion gain (lower curve) and prescribed gain by the NAL method (upper curve).

Number of visits to the audiology technician

The subjects had on an average visited the audiology technician 4.0 times during the fitting period (standard deviation = 2.0).

Hearing aid ear and types of hearing aids

In the investigation 52% of the subjects had a hearing aid in the right ear, 44% in the left ear and 4% had binaural fittings. A behind-the-ear hearing aid was used for 88% of the subjects and 12% used an in-the-ear aid.

Housing

Sixtyfour percent (64%) of the subjects lived in multi-unit housing and the rest lived in single-unit housing. Seventytwo percent (72%) of the subjects lived with other adults and the remaining 28% lived alone. None of the subjects lived with small children.

Daily hearing aid use

The amount of daily hearing aid use is shown in Table I.

Table I: Amount of daily hearing aid use.

<1	1-2	2-4	4-8	>8	hours
34	14	32	6	14	%

As shown in the table 1/5 of the subjects used their hearing aids more than 4 hours per day and about 1/3 of the subjects used their aids less than 1 hour per day.

Occasions of use

Table II shows on which occasions the subjects used their hearing aids.

Table II: Occasions of use.

Alone	16%
Conversation between two	68%
Conversation in groups	52%
TV/radio	72%
Outdoors	20%
Lectures, theatre, church etc.	62%

As shown in the table the subjects primarily used their hearing aids during favorable acoustical circumstances such as in one to one conversations, TV/radio etc.

The subjects' and the audiology technician's assessment

Table III shows the subjects' assessment of their own knowledge and the audiology technician's assessments of the subjects' knowledge.

Table III: The subjects' assessment of their knowledge (left column) and the audiology technician's assessments of the subjects' knowledge (right column).

	Subject	Technician
Can change battery	96%	92%
Can place ear mould in their ear	96%	98%
Can turn on and off the aid, while it is attached to the ear	90%	88%
Can change the volume while the hearing aid is attached to the ear	82%	86%
Can change the plastic tube between the ear mould and the hearing aid	68%	62%
Know where they can buy batteries	84%	-
Know how to clean the ear mould	72%	-
Know where to get the aid repaired	66%	-
Know where the tele coil can be used	50%	-

A comparison of the results in Table III show a very good correspondence between the audiology technician's assessment and that of the subjects. The results do not differ significantly for the assessments that coincide for the technicians and the subjects ($z < 0.83$, $df = 98$).

Activity during fitting period

The subjects assess their own activities during the fitting period to 2.2 (standard deviation = 1.3). The subjects' assessments divided into five intervals are shown to the left in figure 3.

Changes in hearing

On an average the subjects generally assess their hearing as unchanged since the fitting of the hearing aid, mean = 2.3 (standard deviation = 0.7). The subjects assessments divided into five intervals are shown in the middle of figure 3.

Satisfaction with hearing aid

On an average the subjects assess their satisfaction with the hearing aid to 2.7 (standard deviation = 1.0). Their assessments divided into five intervals are shown to the right in figure 3.

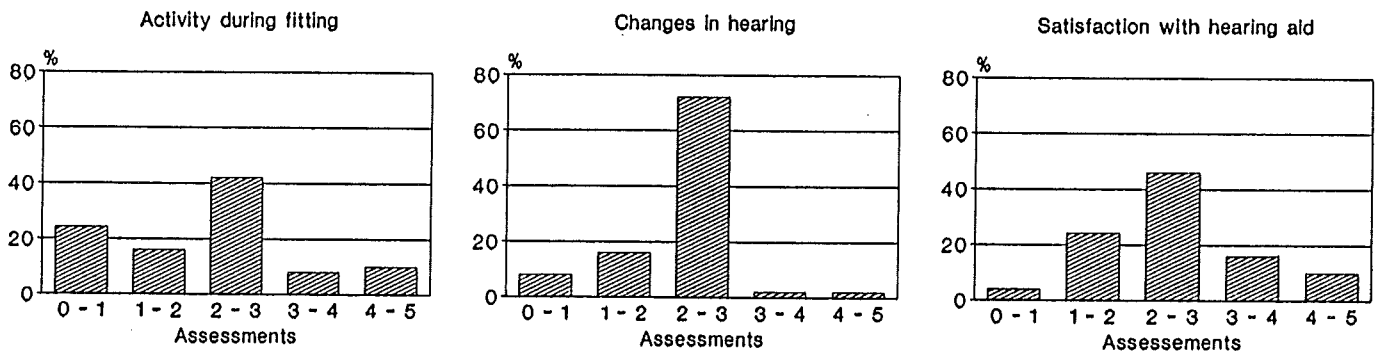


Fig. 3. The subjects' assessments: Assessments of their own activity during fitting (left). Assessments of changes in hearing since completing the fitting (middle). Assessments of satisfaction with the own hearing aid (right).

Need of help at the follow-up visit

Table IV shows the need of help at the follow-up visit.

Table IV: Need of help at the follow-up visit.

Adjusting the hearing aid	24%
Adjusting the ear mould	14%
Changing the tube	36%
Prescription of assistive listening devices	26%
New care plan or new return visit	8%
Other types of help	34%

After an examination of all subjects there were 14% who were not in need of any help. Table IV shows that many of the subjects were in need of help with more than one thing.

During more in-depth studies of the examining material we have tried to find the reasons why a large percentage of the subjects use their hearing aid less than one hour per day.

Among other things we investigated if the low percentage of use was due to reduced speech recognition, own activities during the fitting and living alone versus living together with others. The only statistically significant correlation which explains the use is the steepness of the hearing threshold. As a measure of the steepness we have used the difference between the hearing thresholds at 1 kHz and 4 kHz. Comparing the group which uses their hearing aids less than 1 hour per day to the group which uses their hearing aids more than 4 hours per day, we found a statistically significant difference (Student's t-test, 1%) in the steepness of the hearing loss. The subjects with a low usage of the hearing aid have a steeper loss.

DISCUSSION

The subjects in the investigation are typical hearing aid users who have recently received hearing aids through a Swedish hearing clinic. Age, housing, degree of hearing impairment, speech recognition score, and number of visits to the audiology technician during the fitting of the hearing aid agree well with the investigations

performed by Ovegård et al. (1987) and Jerlvall et al. (1983).

Compared with the investigation performed by Ovegård et al. (1987) the subjects in the present investigation have a higher insertion gain (about 5 dB) at 1, 2 and 3 kHz and the same gain at 4 kHz. The higher insertion gain at the lower frequencies is a result of a better utilization of insertion gain measurements during the fitting. The technicians have become very skillful using the insertion gain measurements when adjusting the hearing aid gain to the desired response. A corresponding increase of the insertion gain does not exist at 4 kHz. The reason for this is that the hearing aids are not capable to give sufficient gain at the higher frequencies.

Through the investigation we discovered that about 1/3 of the subjects use their hearing aids less than one hour per day. This group is considerably larger in comparison to corresponding groups in the investigations carried out by Ovegård et al. (1987), and Jerlvall et al. (1983). Results comparable with ours were obtained by Änggård et al. (1979). The lower degree of usage with our subjects we believe is due to the fact that the "taking care effect" wears off one year after finishing the fitting and that the subjects therefore only use the hearing aid in those situations where they benefit from the hearing aid. These patients who have a low degree of usage of their hearing aid have previously been classified as patients with their hearing aid in their "chest of drawers". The subjects in our investigation reported that they have great benefit of their hearing aid when they use it. This is supported by the fact that despite their low degree of usage they have quite good knowledge about the hearing

aid, caring for it etc. There is also a very good correspondence between the audiology technician's assessment of the subjects' knowledge and the subjects' own assessment.

Only 1/5 of the subjects in our investigation use their hearing aid more than four hours per day. The reason that this group is smaller than those in earlier studies can be that all of the subjects are retired.

In the in-depth study we have discovered that the subjects with steep hearing impairment use their hearing aid less than those with flatter hearing losses. Hearing impaired people with steep hearing losses often have good hearing at low frequencies. Therefore they manage well in many situations. They catch surrounding noise without the hearing aid but need the aid under more demanding situations and when the source of the sound is at a distance, for example lectures and meetings. Despite this low degree of usage the subjects are as pleased with their hearing aid as those who use their hearing aid often. Hearing impaired people with low degree of usage and a steep hearing loss have accepted that they can not get help from the hearing aid in many situations.

In our investigation the average number of visits to the audiology technician is 4.0. This study shows that an initial visit and three return visits on an average are sufficient in order that the low degree user can receive good and lasting knowledge about the hearing aid etc. In our opinion, despite the long queues for fittings, new hearing aid users should come to the clinic for a number of return visits even if the patient and the audiology technician are pleased with the results of the fitting already after one return visit. New hearing

aid users need support during the adapting process and at the same time more visits facilitate learning how to care for the hearing aid etc.

A relatively large number of the subjects (40 %) estimated their own input during the fitting comparatively low, rating ≤ 2 . We think this is remarkable considering the formulation of the question, "How active were you during the fitting period?". We have reason to believe that a higher degree of activity facilitates and accelerates the hearing aid fitting.

The long queues for hearing aid fittings, many subject's relatively low activity during the fitting and the need for a number of return visits demand improvements in the fitting procedure. An increased usage of different active tasks between the visits is needed. As a test, return visits ought to be done in groups to activate the patients during the fitting and possibly increase the patient flow.

Most of the subjects at the follow-up visits are in need of help with many things which have to do with the hearing aid and prescribed assistive listening devices. This agrees well with our earlier clinical experience. The prescription of assistive listening devices that the hearing impaired can install by themselves is increasing in Sweden. We believe that this further increases the need for follow-up visits.

CONCLUSION

- We have found a large group (about 1/3) of hearing impaired with a low degree of usage of the hearing aid. Despite this the subjects claim that they have great use of the hearing aid. The hearing aid is used only during certain situations. The fact that the subjects more than one year after completing the fitting have good knowledge about the aid and can care for it is proof that they benefit from the aid.
- The subject's own assessments are reliable. Their assessments of their own knowledge coincides with that of the audiology technicians.
- The audiology technicians need to help the subjects with many things at the follow-up visits. This shows that there is a strong need for follow-up visits.
- The degree of steepness of the hearing loss between 1 and 4 kHz determines the usage of the hearing aid. The hearing impaired with a steep hearing loss use the hearing aid to a lesser extent.

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