

ORIGINAL ARTICLE

Preliminary Results of Adult Patients with Digisonic SP Cochlear Implant System

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Objective; The aim of this study was to investigate fifteen cochlear adult implant patients with different Digisonic SP implant experience who were implanted at Red Cross Hospital in Athens, Greece. Each participant took part in a series of speech recognition tasks while wearing their fitted Digisonic SP processor. Furthermore, patient's evaluations of the Digisonic SP implant were also recorded.

Materials & Methods; The assessments included open-set tests of Greek bisyllabic word recognition and sentence recognition. The choice of bisyllabic word testing was selected to increase degree of difficulty for implanted patients as when, words containing two syllables are used, there is less information for patients to recognize and thus speech recognition falls. For sentence testing, to increase the level of difficulty we included 2- and 3- word sentences. Perception of life was investigated by using fifteen closed questions and one open question.

Results; Despite the high degree of difficulty included within bisyllabic word perception, results demonstrate that by 6 months of use of the implant, the mean bisyllabic word perception is 20/38 words. Between 1-1.5 yrs of use of the implant, the mean bisyllabic word perception rises to 25/38 words while by 2.5-3 yrs the mean bisyllabic word perception reaches 32/38 words. For sentence recognition, by 1 year of use, patients can recognize short utterances containing only two words. Patients' answers to closed questions reveal that patients have developed a confidence to converse with their partners requiring few, if any, repetitions from their conversational partners. Patients' answers to open questions support the improved life change in all everyday life domains.

Conclusion; By 3 years of use, patients reach a high discrimination score even with short in length words, and by 1 year they recognize short sentences containing two words. Most important though, they appear to feel competent enough to participate in any social event.

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Many studies have examined speech recognition in words and sentences after cochlear implantation ^[1,2]. The majority of studies report findings from closed-set vowel and consonant tests, open set tests of monosyllabic word recognition and sentence recognition as well as consonant-vowel-consonant structure word testing. It is known that for cochlear implant patients, short words in length, are more difficult to recognize in comparison with the words containing three syllables and more. Similarly, two-word sentences are more difficult to perceive, as there is less information compared to 3- word sentences. Thus

as the Greek language contains few monosyllabic words, we used 38 bisyllabic words from Greek audiometry assessments ^[3], and chose 10 sentences ranging from 2 to 3- words per utterance. Patients' performance in both words and sentences was compared across patients with different implant experience.

Questionnaires are a common assessment tool for adult cochlear implant recipients and provide valuable qualitative information in regards to quality of hearing received from the implant or even from the combination of hearing aids and cochlear implants ^[4].

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The questions chosen for this study contain a combination of closed questions in order to record specific profits in communication from implantation, as well as open questioning in order to allow the patients to report their personal perceptions of life change following implantation.

Materials & Methods

Fifteen patients took part in the study. Patients were selected using the following criteria:

1. Severe-to-profound sensorineural hearing loss.
2. Pre and postlingually deafened adults between the ages of 21 and 60 years.
3. All fifteen patients were regular users of hearing aids before implantation.
4. All patients had developed sufficient language skills through lip reading, intensive speech and language therapy and oral education instead of signing or total communication.
5. Patients ranged in experience of the implant. Patients were categorized into three groups. The minimum Digisonic SP implant experience was less than six months (two patients). Seven patients had been using the Digisonic SP implant from one year to one and a half years. Maximum SP implant experience was from two and a half years to three years (six patients).
6. Six of the fifteen patients had speech and language therapy for 6 months to one year once a week.
7. All fifteen patients had no other disabilities other than hearing impairment.
8. All fifteen patients spoke Greek as their first and primary language.

Procedure and Test Materials

Speech stimuli were presented live from microphone. Sound was delivered via a single loudspeaker placed at 1.5 m on the side of the implanted ear. Test items were presented at an average level of 65 dB. Testing took place in a sound-treated booth. Both word and sentence tests were presented in quiet.

Speech perception measures included:

1. Thirty-eight Greek bisyllabic words with phonotactic structures CVCV (consonant-vowel-consonant-vowel), CVCCV (consonant-vowel-consonant-consonant-vowel) and CCVCV (consonant-consonant-vowel-consonant-vowel)^[1]. Patients had to repeat the words they heard. Calculation of words perceived out of the 38 was done across patients with different implant experience.
2. Ten Greek everyday sentences ranging from two to six words were used with six sentences containing two words only and the rest four sentences containing three, four, five and six words. Patients had to repeat the sentences they heard. Results were recorded across types of sentences (2-6 words) and across patients with different implant experience.

Questionnaires were sent to the fifteen adult cochlear implant recipients who were implanted at Red Cross Hospital. The questionnaire included 15 closed questions and one open question. The first set of four closed questions asked included as to whether patients can have a conversation in shops, whether they cannot understand fast speech, whether loud noises annoy them, whether they cannot understand speech at home. The second set of three closed questions asked included as to whether they cannot understand the news on television, whether at dinner with more than two people they cannot perceive one's speech, whether street noises annoy them. The third set of four questions asked included as to whether patients can understand speech from a distance in a large room, whether they cannot understand questions posed in a small room, whether they cannot perceive their friend's speech and whether they cannot perceive their doctor's speech. The last set of four closed questions asked included as to whether patients can understand the priest's speech, whether they can have a conversation even when there are a lot of people, whether they frequently ask people to repeat what they've said to them and whether the sound of siren

and sound of brakes of a car annoy them. For the closed questions patients could only choose one of seven choices (always, almost always, in many cases, half the time, sometimes, rarely, never).

The questionnaire ended with one open question where patients could report the life changes that followed implantation.

Results

Greek Bisyllabic Word Perception

Scores for bisyllabic word perception across patients with different implant experience (three groups) are shown in Figure 1. Two patients with less than 6 months experience perceive 21/38 and 22/38 words. Seven patients with one year to one and a half years of implantation experience, hadve scores ranging from 23/38 to 26/38 words. Six patients with two and a half years to three years of implantation experience, have scores ranging from 31/38 to 33/38 words.

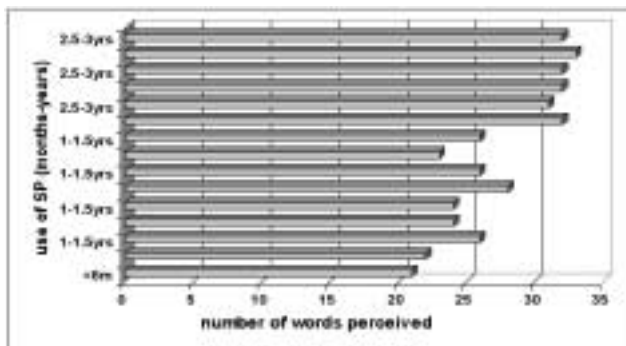


Figure 1. Number of words perceived in bisyllabic word perception test for patients with different experience of Digisonic SP implant.

Types of Greek Consonants affecting bisyllabic word perception

It is worth noting that during open-set testing of bisyllabic words, certain words appeared to be easier to repeat than others. All fifteen patients had ease in repeating words containing the consonant clusters ps,ks,sk,sp,st and consonants r,p,s,z,t,k,f. More difficulty was noted in words containing _m,l,b,v,n (Figure 2).

Greek Sentence Perception

Scores across different types of sentences (2 to 3 words) across patients with different implant experience are shown in Figure 3. Two patients with less than six months experience of the implant did not perceive two-word sentences but perceived 3 word sentences. Patients with 1 year to 3 years (thirteen patients) of implant experience were able to perceive 2 and 3 word sentences.



Figure 2. Greek Consonant clusters and consonants affecting bisyllabic word perception.

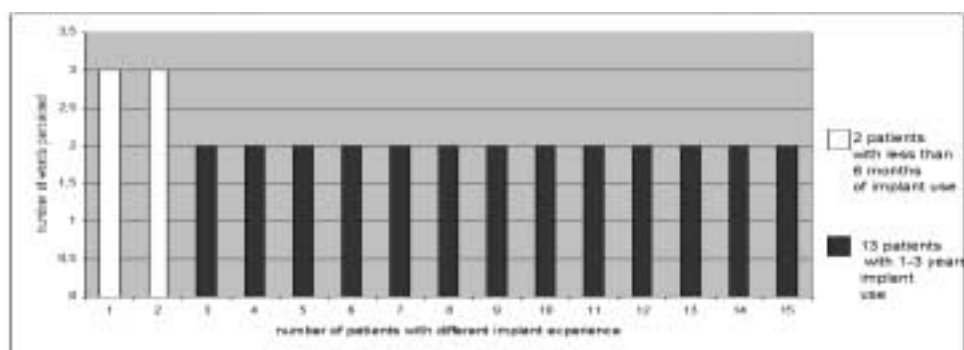


Figure 3. Sentence perception (2-3 words) for patients with different experience of Digisonic SP implant

Questionnaire - First set of four closed questions

Answers to the first set of four questions are shown in Figure 4. For question 1 fourteen patients replied that after implantation, they could always have a conversation in shops and only one patient replied that almost always he could not have a conversation in shops. For question 2, eight patients replied that they never had a problem understanding fast speech, while the remaining six patients replied “between answers of always having a problem with fast speech” (3 patients), “almost always having problems with fast speech” (1 patient), “many times” (1 patient) and “half the time” (1 patient). For question 3, thirteen patients replied that after implantation they had never been annoyed by loud noises, and two patients replied

always and almost always. For question 4, all fifteen patients had never had a problem with understanding fast speech at home.

Second set of three closed questions

Answers to the second set of three questions are shown in Figure 5. For question 1, six patients replied that they rarely had problems with understanding the news on television, while the remaining patients replied between the answers of “never having problems with understanding the news on television” (3 patients);, three patients reported “sometimes having problem with understanding the news”, two patients “half the time they have had problems with understanding” and one patient “many times has had a problem with understanding the news on television”. For question 2,

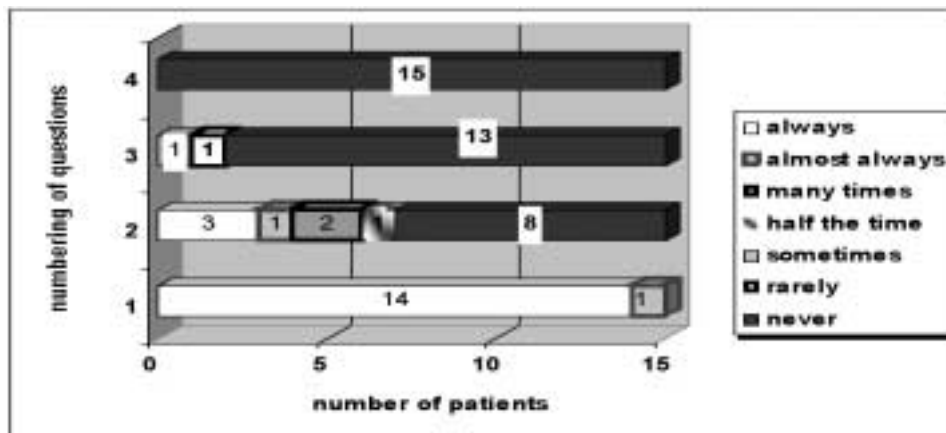


Figure 4. Answers to first set of four closed questions regarding communication with the Digisonic SP implant.

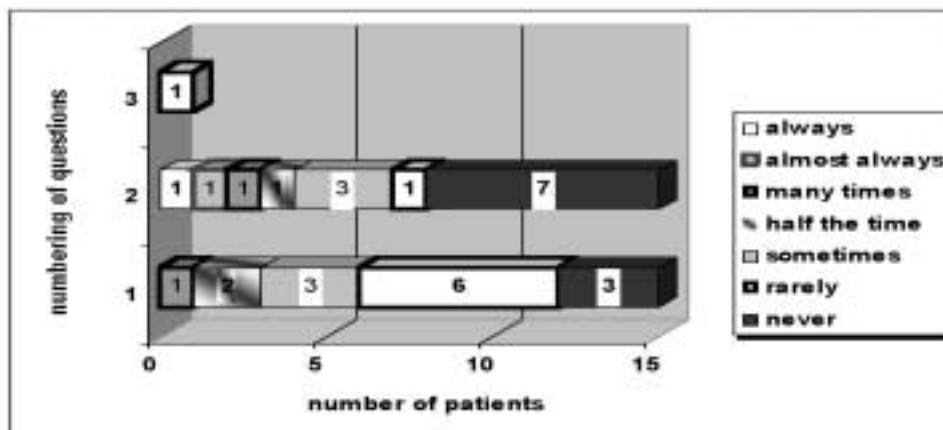


Figure 5. Answers to second set of three closed questions regarding communication with the Digisonic SP implant.

seven patients replied that they never have had problems with perceiving one's speech at dinner with more than two people, three patients replied "sometimes having problems with understanding speech at dinner with more than two people", while the remaining patients replied "half the time having problems" (1 patient), "many times having problems" (1 patient), "almost always having problems" (1 patient) and "always having problems with understanding speech at dinner with more than two people" (1 patient). For question 3, only one patient reported that street noises annoys him.

Third set of four closed questions

Answers to the third set of four closed questions are shown in Figure 6. For question 1, twelve patients

answered that they could always understand speech from a distance in a large room, one patient replied that almost always he understood speech from a distance in a large room and two patients replied that many times they understood speech from distance in a large room. For question 2, all fifteen patients replied that they never had a problem with understanding questions posed in a small room. For question 3, all fifteen patients replied that they never had a problem with understanding their friend's speech. For question 4, all fifteen patients replied "never having problems with understanding their doctor's speech".

Fourth set of four closed questions

Answers to the fourth set of four closed questions are shown in Figure 7. For question 1, ten patients replied

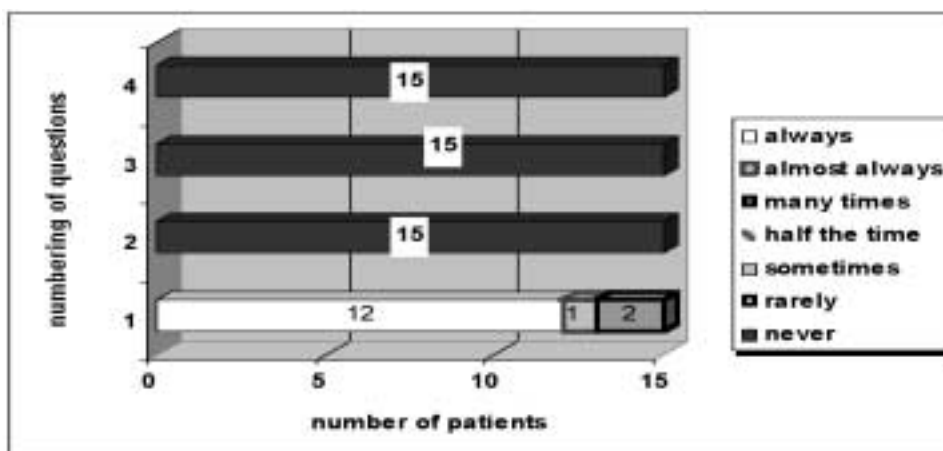


Figure 6. Answers to third set of four closed questions regarding communication with the Digisonic SP implant.

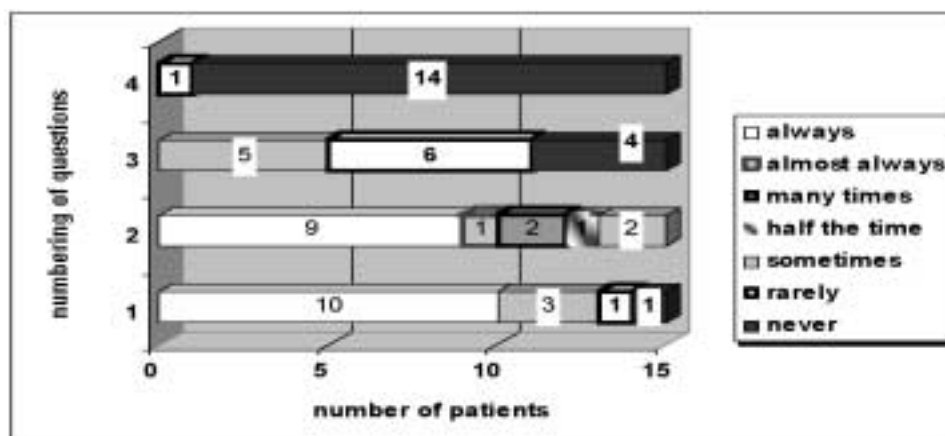


Figure 7. Answers to the fourth set of four closed questions regarding communication with the Digisonic SP implant.

that they always understand the priest's speech in church; three patients replied that they sometimes understand the priest's speech, one patient replied that he rarely understands the priest's speech and one patient reported never understanding the priest's speech in church. For question 2, nine patients reported that they could always have a conversation even when there are a lot of people, one patient almost always could have a conversation with a lot of people, two patients could many times have a conversation with a lot of people, one patient half the time and two patients could sometimes have a conversation with a lot of people. For question 3, four patients reported that they have never asked people to repeat what they had said to them, six patients reported rarely asking people to repeat what they had said, and five patients replied that sometimes they asked people to repeat what they had said to them. For question 4, fourteen patients replied that the sound of siren and brakes of a car never annoyed them and one patient reported rarely being annoyed by the sound of siren and sound of brakes of a car.

One open question

Answers for the open question are shown in Figure 8. For the open question "what life changes followed implantation?", fifteen patients reported that they could hear more environmental and speech sounds

(answer 1), fifteen patients reported that oral communication was easier (answer 2), ten patients reported that they could speak on the phone (answer 3), eight patients reported that they were able to work (answer 4), fifteen patients reported being more sociable (answer 5), fifteen patients reported feeling more confident (answer 6) and fifteen patients reported "feeling alive" with the implant (answer 7).

Discussion

This investigation explored speech audiometry scores in Digisonic SP implant users at both word and sentence level. Comparison of speech audiometry scores across patients with different implant use was also conducted in an attempt to seek whether there are differences between groups of patients who have been using the implant for a short period and for longer periods of time. Finally, as the most reliable information comes from the patients themselves, investigation of their beliefs was conducted through specific and open questioning.

Having chosen 38 Greek bisyllabic words with high degree of difficulty for an implant patient, patients' data support that by 6 months of use of the implant, patients can perceive a mean of 20 words out of the total 38. Patients that had been using the implant for 1 year to 1.5 years achieve a mean of 25 words out of the total 38. By 2.5 years to 3 years of usage, patients rise

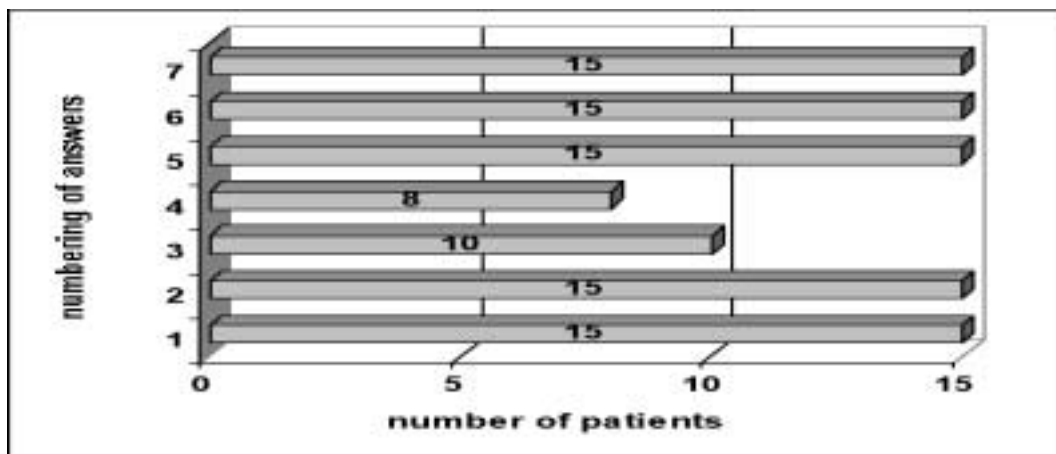


Figure 8. Answers to the open question "what life changes followed implantation?"

in their perception scores with a mean of 32 words perceived out of the total 38. The increase in perception scores indicates that longer use of the Digisonic SP implant increases auditory memory and thus patients are able to perceive a greater number of words. In regards to sentence scores, data supports that there is a need for a year of use of the implant to perceive sentences with a decreased mean length of utterance (2 word sentences).

Conclusion

Closed questioning in regards to communication through the implant reveals that Digisonic SP users have the confidence to converse with their partners always requiring few, if any, repetitions from their conversational partners. Open questioning reveals that there have been positive life changes following implantation especially in their construing of self identities and that they perceive themselves as individuals that can function in every life domain. Given our results both quantitative and qualitative, excellent sound quality from the implant, leads to life improvement in these patients' lives.

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