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COCHLEAR IMPLANTATION IN IRAN

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ABSTRACT

Cochlear implantation has become an increasingly common procedure in the rehabilitation of selected cases of profound deafness.[1] Patients should have profound total bilateral sensorineural hearing loss. Sound is transformed into small electric currents which stimulate the auditory nerves in the cochlea and generate the hearing sensation.

The nucleus cochlear implant is the result of more than 20 years of research and development and has been used in more than 9000 patients worldwide to date.[2]

After two years of research in order to provide the cochlear implant in the Farsi (Persian) language, three out of 54 post lingual totally deaf patients up to now have undergone the cochlear implant operation with a 22-channel mini-system through a Lehnhardt incision, mastoidectomy, facial recess, and cochleostomy procedure.[3-4]

One month following the implant, these patients were undergoing speech education and auditory training by using innovative rehabilitation techniques for deaf people in the Persian language. This report deals with presenting three cases implanted by a cochlear implantation team in Iran and the results of rehabilitation following implant.

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INTRODUCTION

Auditory sensation as a result of electrical stimulation dates back at least as far as the year 1800, when Volta inserted metal rods in each of his ears and attached them to a circuit containing 30 or 40 of his newly-developed electrolytic cells. Volta did not repeat that experiment.[5]

In the last half of the nineteenth century numerous investigations concerning this phenomenon were performed and by the late nineteenth century, a new field referred to as "electro-otiatrics" had been developed, but by the turn of the century it died out.

The modern history of electrical stimulation of the auditory nerve is generally believed to begin with the reports

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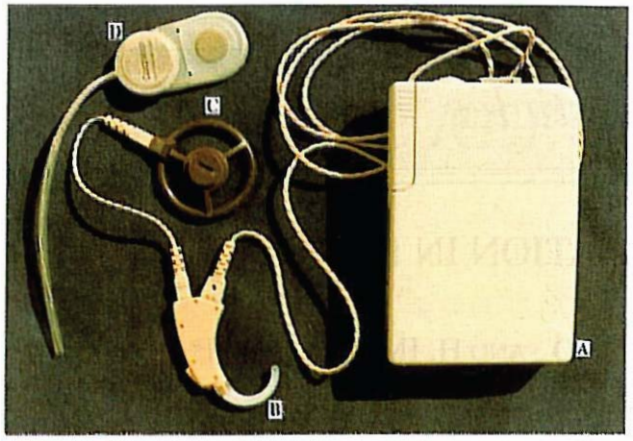


Fig. 1. The mini speech processor (MSP) and microphone headset-the mini-22 cochlear implant.

of Djourno and Eyries (1975) in France.[5] During the 1960s, cochlear implant activity was highly localized to the west coast of the USA, especially California. In Los Angeles, House began with studies of electrical stimulation in patients undergoing middle ear surgery followed by implantation in several deaf patients in 1961. One of his patients received a multi-electrode device. However, this device was removed when redness and swelling developed.

House later teamed up with engineer Jack Urban and implanted three patients in 1969-1970 with a multi-electrode "hard-wired" device.

During the 1970s, complete clinical programs for implatation developed, including development of materials and methods for device fitting, rehabilitation and assessment. The 1970s began with the first wearable devices and long-term human implantations (Michelson, 1971 and House 1973).[5] The 1980s brought with them Food and Drug Administration (FDA) medical regulations, large-scale clinical trials of several different cochlear implant devices in both adults and children, the introduction into the field of commercial manifestations, and numerous national and international meetings on C.I.[5]

The latter part of the 1980s brought acceptance of cochlear implants as a form of rehabilitation for selected profoundly deaf patients.[5]

Considering total deaf children, Dr. House has been providing children with cochlear implants since 1980. He uses a mono-channel device with only one electrode. It is inserted at the round window, or just enside it.[6] Dr. Lehnhardt's consideration was also prompted by technical advancement which has resulted in the so-called Mini system 22. In this system the implant is only 6mm thick with a speech processor 9×6×1/9cm in size, weighing not more than 100g. This implant has good results in small children.[7]

To summarize, a cochlear implant is a device which provides useful hearing and improved communication ability for adults and children with severe or profound bilateral sensorineural hearing loss.[8]

The entire device consists of the following components: /A/ and /B/ are worn externally and /C/ and /D/ are surgically placed in the ear (Fig. 1).

A= Speech processor
B= Direction microphone transmitter
C= Receiver/Stimulator
D= 22 Channel electrode array[9]

PATIENTS AND METHODS

From 54 adult post-lingual totally deaf patients, three patients were chosen to undergo cochlear implantation, based on complete audiological testing, ABR; identifying the cochlear duct through CT-scanning, and performing the promontory test and psychological evaluation.[10] In our opinion, it is important that the patient have a realistic expectation of the outcome of the treatment. We also consider a good social condition and normal intelligence as important criteria.

We performed a promontory stimulation test under local anaesthesia to be sure of the function of the cochlear nerves. Electrical stimulation of the cochlea prior to cochlear implantation has become a routine part of candidate selection protocol at many centers. The promontory test was performed by injecting 2ml of lidocaine in the skin of the external auditory canal inserting the needle through the tympanic membrane near the round window.[11]

The results of rehabilitation were almost the same as the promontory test, and this reveals the importance of the promontory test. In choosing the patients, psychological evaluation was performed and the importance of this evaluation became obvious after surgery and rehabilitation of the patients.[12]

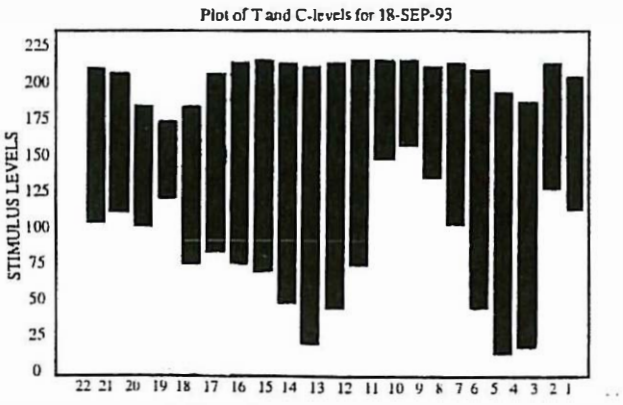


Fig. 2. Plot of T and C-levels for case one.

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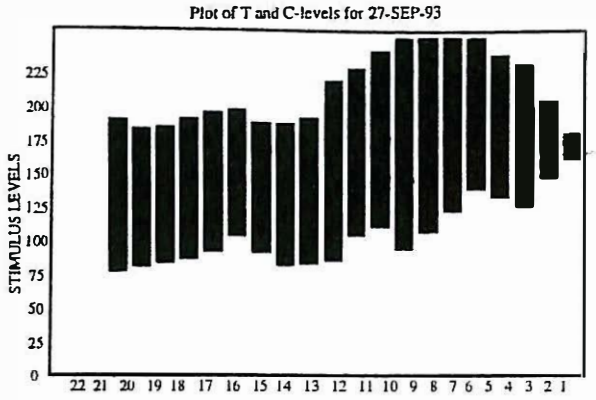


Fig. 3. Plot of T and C-levels for case two.

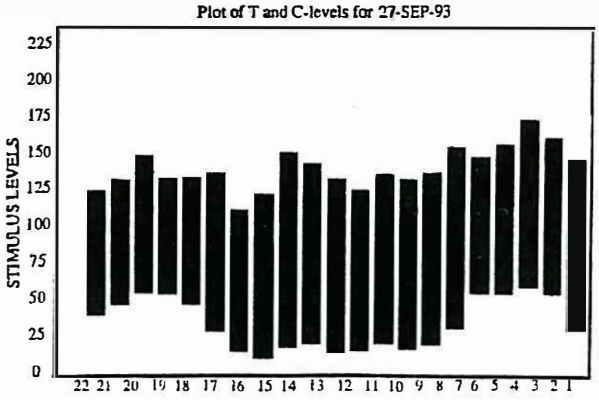


Fig. 4. Plot of T and C-levels for case three.

CASE 1

A 36 year old man suffered from total deafness following an automobile accident. He had been deaf for three years. Audiological examination revealed total deafness, and a CT-scan of the cochlear channels revealed that they were open.

The result of the promontory test confirmed that the function of auditory nerve fibers was intact.

The patient was implanted by Lehnhardt's procedure and after four weeks. hearing evaluation and rehabilitation programs were commenced (Fig. 2).

CASE 2

A 31 year old woman had suffered from hearing loss (>95db) since age ten. The results of her audiological tests, CT-scan, promontory test, and psychological tests suggested her being a suitable candidate for implantation. Therefore, C.I. was performed and 40 days later her rehabilitation program was begun. (Fig. 3).

CASE 3

A 26 year old woman had been totally deaf for five years following meningitis.

The results of her otologic examination, audiological and promontory tests, CT scan of the cochlear ducts, and psychological examination suggested that she was suitable for undergoing C.I.

Therefore, her right ear underwent C.I. and 37 days later rehabilitation programs were initiated (Fig. 4).

DISCUSSION

The most important factor in cochlear implantation is choosing the right patient. Basically, patients being deaf or hard of hearing are among the following six groups:

1- Acquired post lingually deaf adults
2- Acquired post lingually deaf children
3- Acquired prelingually deaf children
4- Congenitally
5- Acquired prelingually deaf adults
6- Congenitally deaf adults

Meningitis, ototoxic drugs, trauma, chronic otitis media, viral infections, congenital syphilis, otosclerosis, and idiopathic causes are the most common factors resulting in deafness.[13]

Many people with profound sensorineural hearing loss have some remaining auditory nerve fibers. Individuals can be tested to find out if these nerve fibers still function. If they do, the individual may benefit from cochlear implantation.

General criteria for C.I. include:

1- A profound to total hearing loss in both ears

2- An inability to hear or recognize speech through hearing aids

3- A feeling that being able to hear will help the individual do more and benefit his/her life

The best candidiates are acquired post lingually totally



Fig. 5. The extended endaural incision.

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deaf adults, with high promontory test dynamics.[14]

There are many methods for performing a correct and precise surgical operation, out of which we chose Professor Lehnhardt's procedure, which includes an extended endaural incision, mastoidectomy, facial recess, and cochleostomy (anterior inferior part of round window niche) (Fig. 5). In our program, patients are evaluated at two four, and six months and one year after the operation.

The test program includes tests to recognize vowels, consonants, monosyllabic and spoondee words, question-statement discrimination, and comprehension. The patients have developed good recognition and discrimination after the training programs.

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