A. Kawano, H.L. Seldon, G.M. Clark, R. Ramsden and C. Raine
The University of Melbourne, Dept. of Otolaryngology, Melbourne, Australia

Variations of performance of cochlear implant patients may be related to several factors. In this anatomical study we focus on determining how intracochlear factors affect postoperative psychophysical percepts of the 22-channel cochlear implant system. We have used 3-dimensional (3D) computer reconstructions of cochleas of former Nucleus 22-channel implant patients to quantitatively map intracochlear pathology relative to electrode positions, and relate the type and quantity of pathology to the T and C levels and dynamic ranges of individual electrodes. Preliminary results of this study were presented at the International Symposium on Cochlear Implants, Speech and Hearing Research in Melbourne, October, 1994.

Using the system described by Seldon (2), temporal bone sections were reviewed and analysed on a computer monitor via a Data Translation DT2851 frame-grabber card. We made 3D computer reconstructions from five temporal bones of cochlear implant patients and measured the following factors: distance between electrode ring's center and Rosenthals canals center ("dis"), the cross-sectional areas of fibrous tissue ("ft") and new bone ("nb") as intracochlear pathology along the electrode array, and there was considerable interrelationship and two of those had much new bone formation. The histological changes tended to be greater in the lower basal turn, and there was a high correlation between histological changes and "dis", i.e., a longer distance contributed to a higher DR in three cases, and a longer distance contributed to a higher DR in two cases. A lower T level with a wider DR was considered to be related to sensitivity and function of the inner ear and speech recognition ability (3). So a shorter "dis" and a higher residual "sgc" (or, in the other cases, lower intracochlear changes) contribute to good speech recognition ability.

2) Seldon HL: Three-dimensional reconstruction of temporal bone from CT scans on a personal computer. Arch Otolaryngol Head Neck Surgery 1991; 117:1158-1161

COCHLEAR IMPLANT - BIOMEDICINE

INTRACOCHLEAR FACTORS CONTRIBUTING TO PSYCHOPHYSICAL PERCEPTS FOLLOWING COCHLEAR IMPLANTATION

A. Kawano, H.L. Seldon, G.M. Clark, R. Ramsden and C. Raine
The University of Melbourne, Dept. of Otolaryngology, Melbourne, Australia

Variations of performance of cochlear implant patients may be related to several factors. In this anatomical study we focus on determining how intracochlear factors affect postoperative psychophysical percepts of the 22-channel cochlear implant system. We have used 3-dimensional (3D) computer reconstruction of cochleas of former Nucleus 22-channel implant patients to quantitatively map intracochlear pathology relative to electrode positions, and relate the type and quantity of pathology to the T and C levels and dynamic ranges of individual electrodes. Preliminary results of this study were presented at the International Symposium on Cochlear Implants, Speech and Hearing Research in Melbourne, October, 1994 (1).

Using the system described by Seldon (2), temporal bone sections were reviewed and analysed on a computer monitor via a Data Translation DT2851 frame-grabber card. We made 3D computer reconstructions from five temporal bones of cochlear implant patients and measured the following factors: distance between electrode ring's center and Rosenthal's canals center ("dis"), the cross-sectional areas of fibrous tissue ("ft") and new bone ("nb") as intracochlear histopathological changes, and the density of residual spiral ganglion cells ("sgc") at each electrode ring position. The interrelationship between the postoperative psychophysical parameters (T and C levels, DR) and these factors were analyzed. To correlate the psychophysical percepts with the anatomical factors, Pearson's correlation coefficients were calculated. Multiple regression analysis was also performed to find the combination of factors that contribute to the performance. In the multiple regression analysis, T and C levels and DR were used as dependent variables, and the anatomical factors as independent variables.

Values for 'dis' were 1.1-2.2 mm and tended to be shorter toward the apex of the cochlea. All cochleas had several histological changes ('ft' and 'nb') along the electrode array, and there was considerable individual variation. Four had notable changes (more than 10 mm3), and two of those had much new bone formation. The histological changes tended to be greater in the lower basal turn, and there was a high correlation between histological changes and 'dis'. The total number of residual spiral ganglion cells was 5591-11001, with one exception (21 158).

Are Mondini's patients with profound sensorineural hearing impairment candidates for a cochlear implant? There is no preoperative test to determine a sufficient number of cochlear neural elements for stimulation. Based on results of examinations of successfully implanted non-Mondini temporal bones, it is believed that the spiral ganglion cells are most probably neural elements stimulated by cochlear implant. Therefore, it is attempted to determine if Mondini's bones may have enough spiral ganglion cells for cochlear implant stimulation. We counted population of spiral ganglion cells in the mid-modiolar sections of bones from four patients with Mondini's malformation and five cochlear implant and in sections from five bones from four patients without Mondini's but with two-to-ten-years history of successful implant use. Five bones with normal anatomy from three patients with normal hearing served as controls. The six Mondini's had an average of 390 spiral ganglion cells, with a range of 354 to 459. The five implant ears had 384, with a range from 291 to 504. Numbers are almost the same. Both are about 45% of the population of the control bones, which averaged 846.

Results of this limited sample of Mondini's bones indicate that they may have enough spiral ganglion cells for auditory response to cochlear implant stimulation.

THE ROLE OF ENDOTHELIUM IN VASOREGULATION BY COCHLEAR NEUROTRANSMITTERS IN GUINEA PIGS. THE INVOLVEMENT OF ATP-SENSITIVE POTASSIUM CHANNELS.

Judith Schloesser, Józef Géza Kiss, József Jóri, John Mieszkowski*, Jenő Czigner
Dept. Oto-Rhino-Laryngology, Albert Szent-Györgyi University Szeged H-6725 Szeged, Tisza Lajos kr. 111, H-1
*Cochlear AG Basel, Switzerland

Background: Acetylcholine, calcitonine gene-related (CGRP) and nitric oxide (NO) have been found to have a neuromodulatory role in cochlear function. These neurotransmitters release from cochlear nerves, due to electric signals, might contribute to an increase in blood flow through vasodilation. Aim: Since the vasodilation mediated by these mediators is believed to be underlain at least in part by activation of ATP-sensitive potassium (KATP) channels, we aimed to study whether KATP channel opening is involved in the vascular effect of electrical activation of cochlear neurons. Methods: Cochleas prepared from adult male guinea pigs were placed in an organ chamber (5 ml) filled with temperature- and PH (7.2)-controlled oxygenized Krebs solution. They were then mounted on small plastic hooks. Stimulation (FS) was applied with 50 Hz, 40 V square impulses of 10 ms duration for 10 s. Two-channel programmable stimulator, Thoracic...

2) Seldon HL: Three-dimensional reconstruction of temporal bone from CT scans on a personal computer. Arch Otolaryngol Head Neck Surgery 1991; 117:1158-1161
Author/s:
Kawano, A.; Seldon, H. Lee; Clark, Graeme M.; Ramsden, R.; Raine, C.

Title:
Intracochlear factors contributing to psychophysical percepts following cochlear implantation

Date:
1997

Citation:

Persistent Link:
http://hdl.handle.net/11343/26993