Jilt male New Zealand white rabbits weighing 3500-4000 g were
repaired and placed immediately into warm (37°C) oxygenized Krebs
solution of the above composition. The vessel rings were mounted
horizontally on two small L-shaped glass hooks of which one was
connected to a force transducer for measurement of isometric tension.
The rings were then exposed to the fluid of the cochleae in which the
rabbit was kept. The results of the above study were as follows:

1. Aortic rings precontracted with 10^{-6} M norepinephrine
exhibited monophasic relaxation in response to cochlear FS. 
N'-
ethyl-L-arginine methyl ester (L-NAME, 30 μM), an inhibitor of
nitric oxide synthase but not sodium meclofenamate (0.1-100 μM), an
inhibitor of prostaglandin synthesis blocked cochlear FS-induced
vasorelaxation when added to the organ chamber of the vascular
preparations. Nevertheless, L-NAME added to the organ chamber of 
the cochleae failed to significantly influence FS-induced relaxation of 
the vessel rings. Removal of the vascular endothelium also blocked 
the relaxation response. Tetrodotoxin (10^{-6} M), a fast sodium channel
blocker added to the cochlear fluid also was found to block the effect
of FS. Tetrodotoxin added to the vessel rings was without effect.

2. Gilbenclamide (GLIB), a selective blocker of KATP channels
attenuated vasorelaxation due exposure to the fluid medium of the
stimulated cochleae, the K_{ATP} blocker, however, failed to completely
block the relaxation response.

Conclusion: Electrical activation of isolated cochleae of the guinea
pig results in the release of endothelium-dependent vasorelaxant(s) the 
mechanism of action of which involves activation of K_{ATP} channels. 
The results also suggest that K_{ATP} opening is coupled to
nitric oxide synthesis. We think that these results might help to
understand baseline events due to intracochlear stimulation i.e. the
use of cochlear implants.

**FP146**

3D RECONSTRUCTION OF MAGNETIC RESONANCE IMAGES OF THE COCHLEA - 
A NEW TECHNIQUE AND CLINICAL APPLICATIONS.
C.R. Hans, P. Jackson, A. & Ramsden, R.T
Manchester Royal Infirmary & Computer Graphics Unit, University
Manchester, Manchester, United Kingdom

In preparation for cochlear implantation, the evaluation of cochlear pathology is one of the most widely used modalities. MR has definite advantages in assessing the degree of osteoneogenesis. However, a new technique of obtaining an advanced high resolution cochlear scanning protocol has been developed. This new scanning protocol uses a 3D computer modelling provided by Advanced Visual System (AV3) software, the use of which developed by P.H. & A.J., has been excellent in images of the cochlear fluid compartments. In particular it may be possible to image differences in new bone formation in the scala tympani and scala vestibuli. This information helps the surgeon in deciding between a scala tympani or vestibular fistula. Images of other cochlear abnormalities will be shown.

**FP150**

THE HISTOLOGICAL AND PHYSIOLOGICAL EFFECTS OF THE AUDITORY BRAINSTEM PROSTHESIS OF THE AUDITORY PATHWAY
Xuguang Liu, Greg McPhee, H. Lee Seldon and Graeme Clark
Dept.of Otalaryngology, The University of Melbourne and the Bionic Ear Institute, Melbourne, Australia

The cochlear implant can successfully rehabilitate the majority of profoundly deaf patients. However, some of them cannot benefit from the cochlear implant due to bilateral interruption of the auditory nerve, particularly from neurofibromatosis II. These patients can be stimulated directly with an auditory brainstem prosthesis on the cochlear nucleus. To examine the safety and the efficacy of this prosthesis, the cochlear nuclei of guinea pigs were implanted unilaterally with bipolar surface electrodes, and stimulated acutely using charge-balanced, biphasic current pulses at rates of 250, 500 and 1000 Hz and charge intensities of 1.8, 2.8, 3.5 or 7.1 μC/phasedcm². The electrophysiological effects of the prosthesis on the auditory pathway were examined with the electrically evoked auditory brainstem response (EABR), which was used to monitor neuronal excitability of the auditory brainstem during and following six hours of continuous electrical stimulation. The amplitudes and latencies of the EABR waves were measured and compared before, during and after stimulation. The results showed that no significant change was found in the EABR's waveform, amplitudes and latencies pre- and post-stimulation, indicating no change in the responsive capability of the auditory brainstem. The activation of the central auditory pathway by the prosthesis was demonstrated with the 2-deoxyglucose (2-DG) technique, which was also used to double check the EABR.
results. There was broad 2-DG labelling in ipsilateral cochlear nucleus and bilaterally in the inferior colliculi, indicating unusual stimulation of the ipsilateral ascending pathway. Histological analysis was performed on all cochlear nuclei with 3-dimensional reconstruction techniques. The volumes of cochlear nuclei and the neuron sizes in the cochlear nuclei were compared between the stimulated and unstimulated sides. No histological difference was observed between the stimulated cochlear nuclei and the control sides. These results suggest that the auditory brainstem prostheses can safely and effectively activate the auditory pathway with the parameters from the cochlear speech processor in guinea pigs. More work on the effects of chronic implantation and stimulation is in progress.

DEVELOPMENT OF A TYPANIC MEMBRANE SENSOR FOR A TOTALLY IMPLANTABLE COCHLEAR IMPLANT OR HEARING AID

Zhang, Andy
The University of Melbourne Dept of Otolaryngology, Royal Melbourne Institute of Technology, Dept of Electrical Engineering, Melbourne Victoria, Australia

Cochlear implants (CI) use an external microphone and speech processor which are prone to damage and aesthetically undesirable. Children, in particular, often have trouble taking care of them. To eliminate problems with external components, it is necessary to implant a microphone with other parts of the CI. There are also advantages in having an implantable hearing aid where all the components are totally concealed. As air borne sound cannot efficiently penetrate the skin, one solution is to implant an acoustic sensor inside the middle ear cavity to directly pick up the vibrations of the ossicular chain. The prototype design of such a middle ear sensor consists of a coupling element, a fixation shaft and a bio-compatible sensor cartridge. Concealed in the sensor cartridge, a sensitive diaphragm and an optical fiber probe form an optical lever displacement sensor which is capable of detecting vibrations down to the order of nanometres. The coupling element conducts the vibrations of the tympanic membrane to the sensor diaphragm, and the fixation shaft secures the sensor cartridge WITHIN the middle ear. Since the electronic circuitry of the sensor is linked via an optical fiber bundle and placed outside the cartridge, the sensor implant in the middle ear is simple to construct, electrically passive and immune to external electromagnetic interferences. To develop the implantable fiber-optic microphone, the fiber optic displacement sensor was constructed first and tested in cats (postmortem). In addition, theoretical analysis was carried out to investigate the sensor characteristics such as sensitivity, frequency response, and dynamic range. These studies show that such a sensing technique is adequate for the sound pick-up from the ossicles. Moreover, the sensor cartridge and its coupling and fixation components were designed in conjunction with the study of the implantation procedure. Several placement, coupling and fixation arrangements for the sensor implant in the middle ear have been proposed and evaluated with respect to the standard posterior tympanotomy on normal human temporal bones. Surgical feasibility was studied using models of individual parts of the sensor implant prior to the prototype design and construction. The performance, bio-compatibility, robustness and implantation procedure are currently being tested in both cats and human temporal bones in order to produce the first operating prototype for future in-vivo studies.

NEOGLOTTIC ADJUSTMENT IN TRACHEOESOPHAGEAL SPEECH

M.Kinishi M.Amatsu, M.Mohri
Dept. of Otorhinolaryngology, Kobe Univ. Sch. of Med., Japan

During the past 20 years we have been performing tracheoesophageal (TE) fistulization for voice restoration following total laryngectomy. Radiographical examinations during phonation revealed that the thyropharyngeal muscle forms retropharyngeal prominence on which the neoglottis was located. Electromyographical study of the thyropharyngeal muscle during phonation with TE fistula showed the muscular activity pattern. Regular voice production during TE phonation at various pitch and intensity of voice requires the regulatory mechanism of pulmonary power and neoglottis. Simultaneous record of the electromyogram of the thyropharyngeal muscle, tracheal pressure during sustained phonation with an increase of pitch or intensity of voice demonstrated that both tracheal pressure and activity of the thyropharyngeal muscle increased as pitch or intensity of voice increased. This indicates that the thyropharyngeal muscle and the closure of neoglottis against an increase of pulmonary power in laryngeal speech, voicing distinction for consonants is achieved in coordination between the larynx and the vocal tract. Allophonic speakers lost the larynx, voiced/voiceless distinction of consonants established in TE speakers. Simultaneous recordings of the electromyogram of the thyropharyngeal muscle, supraneoglottal pressure, which followed the reduction of muscular activity. Fibroptic examination showed that the retropharyngeal prominence was relaxed and the neoglottis was open. Production of voiceless consonants was well established in TE speech.

BLOM - SINGER LOW PRESSURE PROSTHESIS IN THE VOICE REHABILITATION AFTER TOTAL LARYNGECTOMY

Pichl G.P.; Innocenti M.; Bari P.; Franceschi L.; Crelente.
ENT Division San Bortolo Hospital, Vicenza, Italy

From 1982 to 1995 in the ENT Department of San Bortolo Hospital in Vicenza we performed 469 patients with supraglottic laryngectomy and esophageal prosthesis. We analyzed the complications and the voice results. Eighty subjects belonging to the first group (3,4%) were compared. Both the 80,8% of the first group and the second one were still using the prosthesis with a high level of voice. In four cases of the second group (3,4%) the prosthesis were removed because of a sanitary choice. Eighty subjects belonging to the first group were tested and 21 of them abandoned the prosthesis.
Author/s:
Lui, Xuguang; McPhee, Greg.; Seldon, H. Lee; Clark, Graeme M.

Title:
The histological and physiological effects of the auditory brainstem prosthesis of the auditory pathway [Abstract]

Date:
1997

Citation:

Persistent Link:
http://hdl.handle.net/11343/26994

File Description:
The histological and physiological effects of the auditory brainstem prosthesis of the auditory pathway [Abstract]