

DESIGN OF GSM BASED VOICE DATA PROCESSING THROUGH BONE CONDUCTION

Jenifa mary.S, Brintha.R, Sruthi.S.U & Revathy. A

Department of ECE,
Loyola Institute of Technology,
Palanchoor, Chennai, TamilNadu.

Abstract-In this study, we measure d the GSM based sound Bite hearing system allows people to hear the sound via bone conduction to wear an intraoral device and a small microphone in the deaf ear to regain lost hearing. The device consist of GSM modem , PIC controller and audio amplifier unit. GSM modem will receive incoming calls and automatically answer the call via Attention commands. Then incoming voice signal is converted into low frequency vibration signal that fed through the teeth of cochlea.

Keyword-bone conduction; hearing aid; GSM modem

1.INTRODUCTION

Bone conduction devices are used in wide range of applications such as communication system, language development approach, audiometric investigation and finally most importantly in hearing rehabilitation. This review is focused on hearing rehabilitation, where the common indications are mixed hearing loss and also single sided deafness. These bone conduction devices can be semi- implantable, where some part of the devices is implanted.

In the beginning of the 20th century with a sound processor attached with spectacles, steel spring headband or soft headbands. The vibration that are produced and then transmitted through the skin to the skull bone and then passes to the cochlea in the inner ear, bypassing a conductive impairment in the external or middle ear. The development of the conventional bone conduction device was a big step forward in the rehabilitation of these patients; however, the devices have some drawbacks. The static pressure on the skin needs to be high enough to transmit the vibrations to the cochlea leaving the skin compressed, which might lead to discomfort and skin problem in the attachment area. The primary issue with conventional bone conduction device applied a headband as well as with frames of a pair of glasses, is related to the static pressure of approximately 2N towards the skin and soft tissues.

Then introduced the bone conduction headphone because it is perceived that bone conduction headphone are inferior to general air-conduction headphones in terms of sound quality and volume as a result of vibration damping by the skin ,we are concerned with an implanted bone conduction hearing and worn in the crown of a dental implant.[1]we have compared the word intelligibility of air-conducted and bone-conducted sound when wearing ear pugs in both ears.[2]In this study we measured the threshold bone conduction hearing via teeth while wearing a mouthpiece with a bone-conductive actuator and determining the correct

responses of word intelligibility when using bone conduction devices.

2. AIM OF STUDY

In this paper, all present Bone conduction devices for hearing rehabilitation known to the authors to be available on the market or being in clinical trials will be described. The author will be described the middle ear implant and direct acoustic cochlear implant do not use bone conduction and therefore excluded from this review.

3. BONE CONDUCTION DEVICES

To categorize all existing bone conduction device for hearing rehabilitation, the three division are made into “direct device “BCD, ”skin drive” BCD, and “ in the mouth devices” BCD. In direct drive bone conduction devices transmit vibration directly skull bone, not through the skin. In skin-d rive bone conduction devices transmit vibration through the skin. They are divided into conventional and passive transcutaneous bone conduction devices. A similar division could be made to direct drive BCDs which are divided the percutaneous BAHA and active transcutaneous devices.

In third category of bone conduction devices called “in – the- mouth “devices as they stimulate the ear by transmitting vibration via a tooth and its relatively stiff root connected to the skulls.

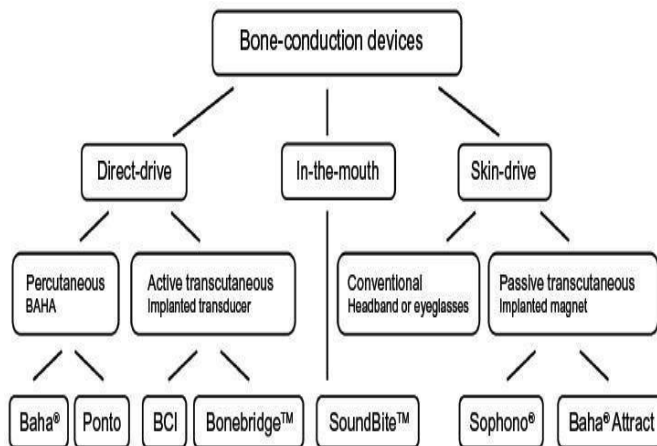


Fig 1 categorization of bone-conduction device

4. PROPOSED SYSTEM

This hearing device is designed to use the natural amplification of your ear. Any sound in that that coming from GSM Mode m. It uses a digital processor (PIC16F877A) to transmit to the sound to a piezoelectric actuator which needs very little power to generate the vibrations that travel through bone, which in turn sends those sound vibrations into your cochlea through your teeth. This way, the sound is transported from your impaired ear directly to your hearing ear. This hearing device will be fitted to the upper left or right teeth in the back of your mouth. This doesn't require any of your teeth to be altered, and the device can be inserted and removed easily. This hearing device is a flat piece (in Real-Time Product) that contains a sealed rechargeable battery, and electronics and wireless capabilities that can pick up sound transmissions from the behind-the-ear microphone.

5. Block Diagram:

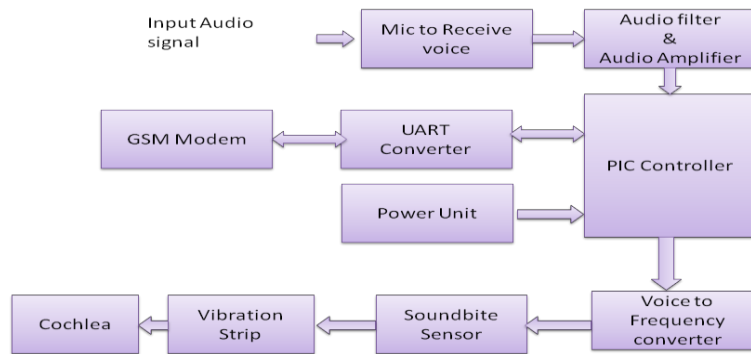


Fig 2 Block diagram of bone conduction.

6. PRELIMINARY EXPERIMENT

We measured the thresholds of bone conduction hearing of a subject using the methods of limits. Twenty –one types of sine waves (125-8000 Hz) were used in this experiment. Each sine wave had a sound pressure of -90dB that was increased in intervals of 5 dB. The maximum sound pressure (1.7v RMS output) was taken as the 0-dB reference.

A. EXPERIMENTAL PROCEDURE

A subject wore ear plugs and a mouthpiece. This experiment proceeded using 21 waves as follows:

- 1: A bone-conduction actuator was fixed to the mouthpiece, as in Fig.1
- 2: A subject listens for a sine wave at the minimum sound pressure of -90 dB
- 3: If this sound is heard, the sound pressure is recorded.
- 4: If this sound is not heard, the sound pressure is increased by 5 dB, and the subject listens for the sine wave again.

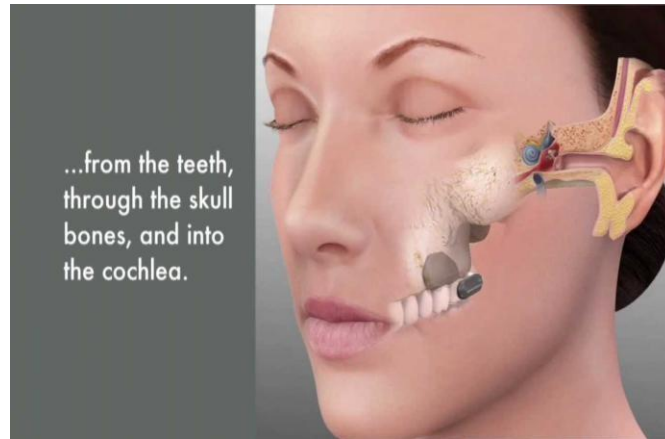


Fig3 Photograph of a bone actuator fixed to a mouthpiece

This measurement was carried out once per day. Moreover, two measurement methods were utilized. One that increases the sound pressure by 5 dB from -90 dB and another decreases the sound pressure 5 dB from 0 dB. Both methods were carried out three times. This experiment was also performed while the subject wore ear plugs.

B.RES ULTS

Fig. 3 shows the average and standard deviation (SD) of the thresholds of hearing while wearing and not wearing ear plugs. The thresholds of bone-conduction hearing are better by about 15 dB in the range of 500–1500 Hz when ear plugs are worn. No changes were observed for other frequencies. Therefore, we found the range at which hearing improves when wearing earplugs with the thresholds of bone-conduction hearing via teeth. With this measurement method, wearing ear plugs and not wearing ear plugs differed in the assay date. Therefore, a comparison of whether to use ear plugs was difficult because hearing depends on the body conditions. Because the subject's hearing was tested on different days with and without ear plugs, we decided to utilize two measurement methods that increase and decrease the sound pressure on same day to measure the thresholds of hearing exactly by taking the average of two measuring methods.

7.MAIN EXPERIMENT

The subjects of the experiment were four Japanese men with no hearing loss (A–D, 20–24 years old) and one Japanese man with hearing loss in the right ear (E, 22 years old). In this experiment, the same sine waves used in the preliminary experiment were also used for this experiment.

A.EXPERIMENTAL PROCEDURE

Subjects wore ear plugs and a mouthpiece. This experiment proceeded using 21 sine waves as follows:

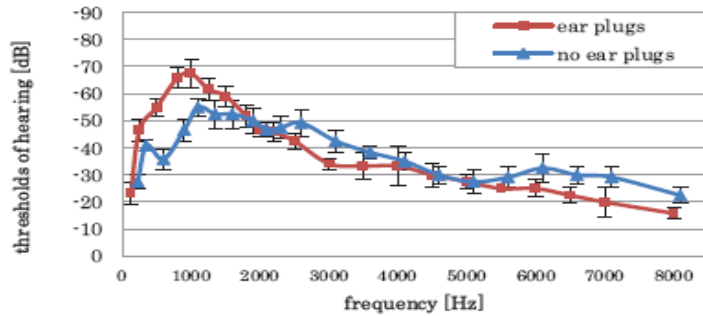


Fig4. Comparison of the thresholds of hearing when wearing/not wearing ear plugs

- I: A bone-conduction actuator was fixed to the mouthpiece, as in Fig. 1.
 - II: A subject listens for a sine wave at the minimum sound pressure of -90 d B.
 - III: If this sound is heard, the sound pressure is recorded.
 - IV: If this sound is not heard, the sound pressure is increased by 5 dB, and the subject listens for the sine wave again.
- This experiment was also carried out while wearing ear p lugs on the same day.

B. Results

Figs. 3-4 show the average and SD of the thresholds of hearing of subjects A, B, C, and E. The thresholds of hearing are better by about 15 dB in the range of 500–1500 Hz when ear plug are worn . Further, we did not observe a difference in the thresholds of hearing when wearing or not wearing ear plugs for subject E.

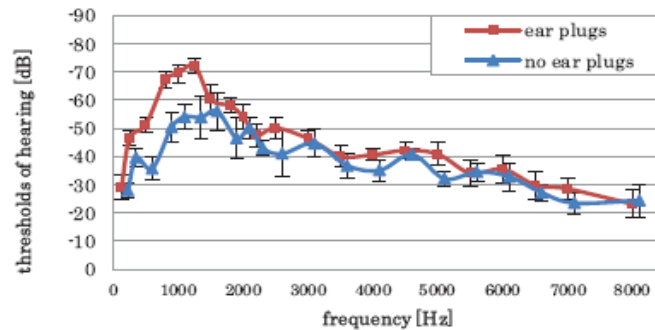


Fig5. Comparison of the thresholds of hearing when wearing/not wearing ear plug subject A

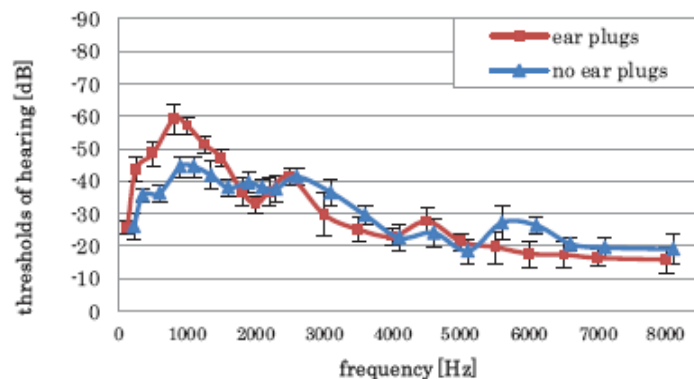


Fig6. Comparison of the thresholds of hearing when wearing/not wearing ear plugs for subject B

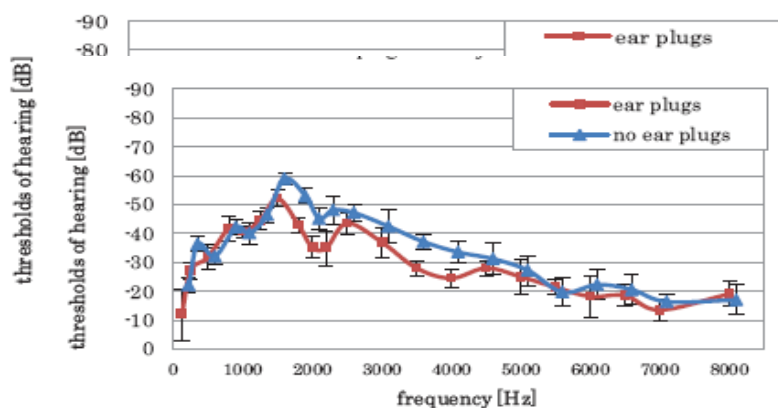


Fig5. Comparison of the thresholds of hearing when wearing/not wearing ear plugs subject C

Fig6. Comparison of the thresholds of hearing when wearing/not wearing ear plugs subject D

8.SUMMARY

We could decrease the error in measurement using a mouthpiece. Moreover, it was found that wearing ear plugs improved in the thresholds of bone-conduction hearing in the case of no hearing loss. This was caused by an air-conduction sound that was generated by bone conduction as it entered the closed external auditory canal while wearing ear plugs. The reason why the thresholds of bone-conduction hearing improved in the range of 500–1500 Hz is related to the inner ear resonant frequency. The middle -ear resonant frequency is about 1000 Hz [3], [4]; therefore, sound in the range of 500–1500 Hz was amplified by resonance in the inner ear.

9.ACKNOWLEDGMENT

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10.REFERENCES

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