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Transmitting Sound Waves through Cranial Bones by Vibrating Transducers Using Bone Conduction.

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Abstract

Bone conduction is known as to sound conducted due to vibrations along the bones to the cochlea housing the organs of hearing and balance. The vibration is carried through entire skeletal structure. Due to physical vibrations along the bones, bone conducted sound has more influence on nervous system than normal air conducted sound. Bone conduction is why one perceives own sound different when he listens to recorded voice. Because bone conducts sound of lower frequency better than air, people perceive their own voice to be fuller and lower than other do, while in recording of one's voice frequency is higher than one expects. Despite of many uses bone conduction head gears industry is still evolving slowly. The electromechanical transducers converts' electric signal to mechanical vibrations and sends sound to internal ears through cranial bones. Bone conduction head gears bypasses eardrum and do actual work of eardrums. Most cases of hear loss are due to damage to eardrums. Since bone conduction does not uses eardrums, people with hearing difficulties may be able to hear clearly again with the help of bone conduction provided their cochlea is in normal condition. Other uses for bone conduction head gears can be for visually impaired people for navigation while also maintaining situational awareness.

Keywords*: - Bone conduction, cranial, cochlea, transducers, head gears*

I. INTRODUCTION

According to definition of deafness by WHO, deafness can be classified in 3 types which are Sensorineural deafness, conductive deafness, mixed deafness. Hearing loss is usually result of inner ear or nerve damage. Approximately 466 million people around the world are disabled by hearing loss, and 34 million of them are children. It is estimated that by 2050 more than 900 million people will be disabled by hearing loss. From these people with moderate hearing loss can benefit from hearing aids. Many different hearing aids are available in market to improve patient's hearing ability. Bone conducted sound is referred to the phenomenon of transmission of soundby vibrations of bones instead of air conducted sound. Bone conduction use mechanical vibrations to covert sound into different frequencies which are transmitted through human skull. Cranial bones which form top portion of skull protecting brain transmit the vibration to cochlea. Cochlea is a part of inner ear receives the sound in the form of vibration causing stereocilia to move. Vibrations are then converted into nerve impulses which are taken up to brain to be interpreted. In bone conduction we completely bypass outer ear and middle ear to sense sound. Therefore, patients with problem or damage at outer ear or middle ear can be helped with bone conduction. Bone conduction transmits to the inner ear without plugging anything in ear. This is one of the most important feature of bone conduction. These headgears with transducers will vibrate around the tragus, the mandibular condyle, or the cheek bone for transmission.

II. LITERATURE SURVEY

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In order to verify the transmission of sound through bone conduction and its efficiency it is important to study its effect on cranial nerves. According to study of proposed method it is possible to have high voice transmission efficiency by bone conduction than air conduction due to monitoring even small vibrations. As compared to air conduction bone conduction also effectively performs external auditory stimuli[1].

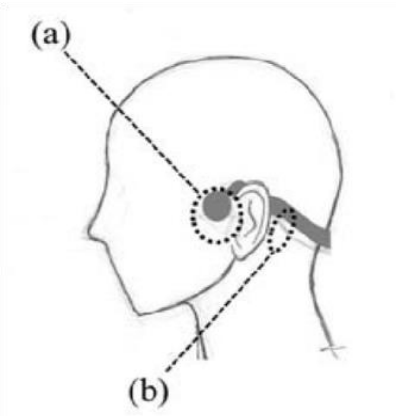

Fig.1 Bone conduction hearing aids

Mastoid is the point wheretransducer is connected (2).Numerical data i.e. parametric values are calculated or can be referenced from cited paper. The force applied to the excitation point which is head is measured by this method and output is considered which is then used to calculate equivalent sound pressure at a reference point i.e. eardrums [3].

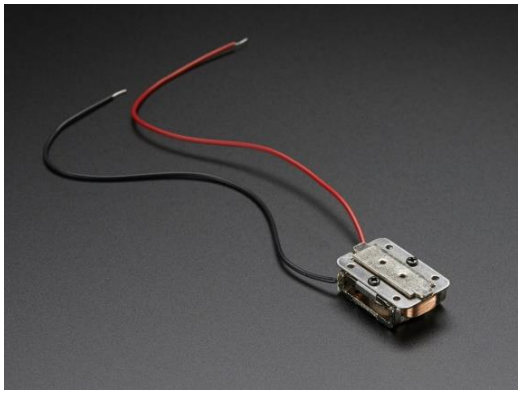

Fig.2 Bone Conductor Transducer

It is important to consider head gear fitting while using bone conduction. It should be tight enough to read vibrations while not being uncomfortable. It is practical study of head related transfer function. While using bone conduction headgears if they used as bone conduction headphones it is equally important to distinguishsurrounding noises. Therefore it is important to calibrate them accordingly [4].

Few studies also have proved that bone conduction is really helpful for people with sensitive sensory that is mostly people with autism. It shows that bone conduction supports stress reduction and helps achieve state of calm. Two modes of listening that is bone conduction and air conduction succours to develop vocal awareness [5].

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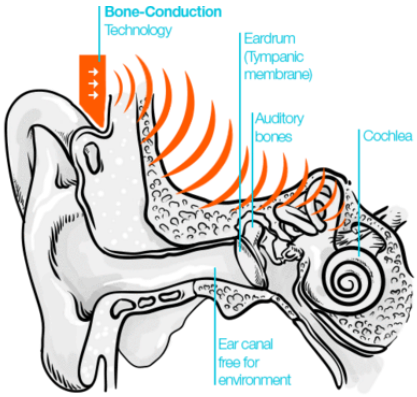

Fig.3 Bone Conduction Working

Fig.4 Head Gear

III. PROPOSED ARCHITECTURE:

Since different uses and functions of bone conduction proposed device will act as a head gear for normal use as well as for people with sensory disability. For normal use this head gear can be used while working in surrounding with people. Where sounds can be played on head gear while being aware of surrounding as well. This system will act as dual mode of sound transmission. People with hearing disabilities will be aided with these gears if their cochlea is healthy. Visually impaired can be helped with use of these gears [6]. Using navigation system a software can be developed programmed with transducers which will vibrate with a specified frequency for each respective command. Head gear will consist a gps and array of sensors to navigate through obstacles.

IV. CONCLUSION:

Bone conduction compared to air conduction had many advantages in terms of efficiency as influence of ambient noise is removed. To solve this problem study of bone conduction is conducted. Implementing these models will aid many patients with different disabilities. It is hoped that through this study we can implement more methods for bone conduction and it performance in aiding patients. It will thus further explore the benefits of bone conduction.

V. FUTURE WORK:

For future work head gears can be implemented with voice recognition to amplify its use in aiding patients for faster response. Bone conduction head gear connected with VR glasses will enhance gaming experience.

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