Background & Market Research

The headset market is comprised mainly of devices that allow individuals to listen to audio from an external source. Common devices include over the ear headphones, earbuds, and wireless bluetooth ear pieces. Most of these are not tailored towards those with irregular head or ear shape. In addition, many of these devices do not implement an existing telephone into the device, but rather include their own microphones and speakers that are wired to redirect sound from a phone. Although these devices can help solve other problems, they do not solve the client's specific problem.

The client is in need of a device that will allow him to write and talk on the phone simultaneously, without him having to use his shoulder or outside assistance to hold the phone. He has limited use of his hand, which prevents him from being able to hold a phone and write at the same time. The device will need to accomodate for a larger head and smaller ears, something many current options do not accommodate for. The device will need to be comfortable and flexible to fit his unique head shape. Time and cost were also considered

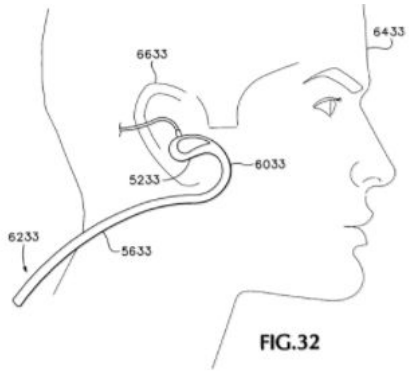

Figure 1: Headset device with inner ear speakers (White, 1997)

Figure 1 depicts one current option. It includes two inner ear speakers connected by a wire that are inserted into the ear in order to hear the audio. Although this device would be

suitable for those with hearing impairments, it is not suitable for the current client because his ear size is too small for anything to comfortably fit inside them and work efficiently. Also, this existing design does not incorporate a microphone which would be necessary for the client to talk to other people on the phone. This device also is a separate external device that would wirely connect to a phone set. This increased complexity is not ideal for the current time and cost constraints (White, 1997).

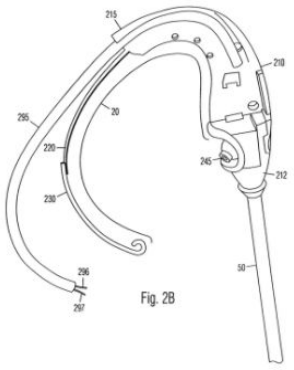

Figure 2: Two separate earpiece device (Lathrop, 1998)

Figure 2 depicts another existing headset design with two small earpieces, attached with a cord, that can be inserted into the user's ears, and it is plugged into an audio source. The earpieces are designed to rest over the ears of the user to better stabilize the earpiece. The device is not customizable to different head and ear shapes. Since the client has non conventional ears, this would not necessarily work for him. The device also allows a microphone to be attached to the headphones, so that the user can talk to the person on the other line, if they are making a phone call. This device uses wires to redirect the sound from an external device into this device. This technology is not ideal to model in the given time constraints or with the predetermined budget (Lathrop, 1998).

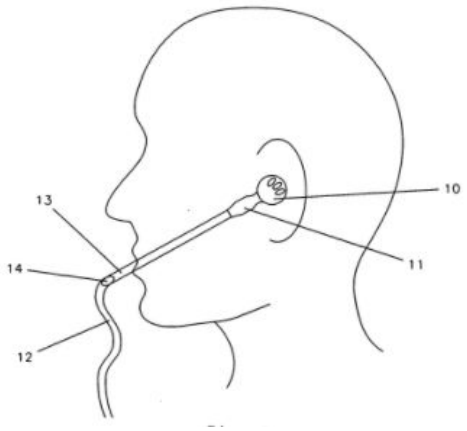

Figure 3: Earpiece and Microphone device (Kimm, 2004)

Another existing device, shown in Figure 3, is a flexible headset, which can change the distance between the earpieces and the microphone. The microphone is the only differentiator between this device and "off-the-shelf" headphones. This headset works for any type of phone or computer. While the use of a microphone is something that can be considered for this project, the wiring technology used it may be too complicated to integrate into the prototype within the given time and with the given cost constraints. Additionally, the earpiece may be too large for the client's ears, as his ear canals are smaller than the average person's ears.(Kimm, 2004).

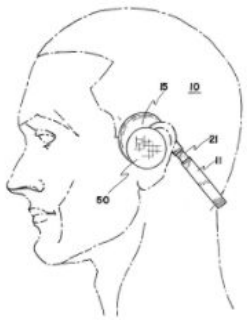

Figure 4: Back of the head headset (Such, 1992)

An additional existing design, as seen in Figure 4, was engineered to fit around the back of the user's head and rest on the backs of their ears. Earpieces extend out from the base of the headset and hover over the ear canals of the user so they can hear the audio. The earpieces do not rest in the ear canals. A microphone can be attached to the base of the headset so the user can talk to the device it is attached to. This device is not ideal for our client because the size of their ear lobes may not allow the device to comfortably rest behind them, and the device is not adjustable to different head sizes. The device does not use wires to redirect sound from the phone to the device, but it does use Bluetooth. This complex technology would be difficult to implement into the potential solution within the time allotted and the given budget (Such, 1992).

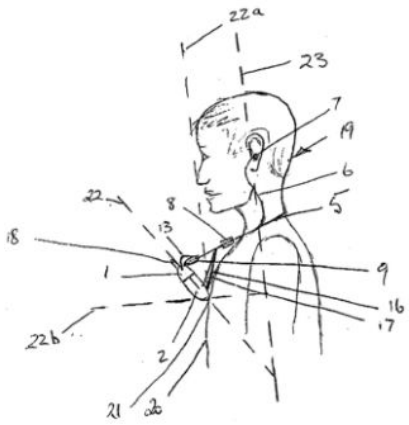

Figure 5: Chest Microphone (Kim, 2003)

The product shown in Figure 5 implements an existing phone into its design. The phone is held with straps from the users neck. The user has the option to either talk to the caller on speaker or use earbuds attached to the device. With the client's nonconventional ears, it would be difficult for the client to wear the earbuds, which are not customizable to his ear shape. It is also not ideal for the client to use speaker phone because callers may prefer to keep their calls private. This device is also engineered for a specific smartphone, rather than a desk phone, which the client will be using. Additionally, this device may be difficult for the client to put on without assistance (Kim, 2003).

Figure 6: Suction cup (Keliikipi, 2009)

Figure 6 depicts a headset which does not use the user's earchambers. Instead a suction cup is attached to an external cell-phone that can be placed right next to the ear, so that it can be held up without the use of any hands. Its function is similar to that of the future prototype. Though the cost of to build a similar device would fit in the budget, this design does not necessarily suit the situation. Foreseen problems are that it may not have the strength to hold a desk phone, since it was designed for flip cell phones (Keliikipi, 2009).

Figure 7: Phone holding headpiece (Cellfy, 2017)

Another method for mounting an existing phone onto a headpiece could be using a plastic clip and a strap, as seen in Figure 7. The device mounts a smartphone using an adjustable strap and a plastic clip to keep it in position. Perhaps this design can be adapted to hold a desk phone in place near the client's ear on the prototype. It is able to be adjusted to fit other phone shapes, and the entire device itself is relatively inexpensive. Therefore, it would be inexpensive to adapt to the prototype (Cellfy, 2017).

Another piece of existing technology includes a pair of conventional headphones that cover the user's ears. There are speakers on both ends of a plastic bar that goes over the user's head, and the speakers are large enough to fit over the ears of the user. For the client this project is working with, his ears may not fit the measurements of the existing headphone cuffs, making them uncomfortable for him. Also, the plastic bar that goes across the user's head is not extremely adjustable, so it may not be able to be modified to be large enough for the client's head.

Figure 7: Over-the ear headphones

It was evident that none of the current available devices would suit the needs of the specific client. One important aspect that many of the above devices did not explicitly address was comfort. Comfort is a major factor considered for the prototype design, as the client would be wearing the device during his shift, for at least a few hours. According to an article written in 2016, there are five important aspects of a headset that contribute to comfort. Firstly in regards to the ear cup extension, headphones are deemed to be comfortable if the center of the ear cup can be placed over the user's ears without much extension. It is important that the headphones are not too big without any extension. Secondly, the clamping force of the headset can add more pressure, which should be avoided, or not enough, which may cause the headset to slide off the person's head. Thirdly, ear cup rotation, which relates to clamping force, allows for even pressure with the ear pieces, to maximize comfort. Then, ear cup depth and size are important because user feels maximum comfort generally when the cups are not deep enough to be right against the ear. Circle cups shapes align with ears the best, according to this article. Lastly, cushioning is important because too little cushioning causes the ears to come in contact with the hardware, yet too much cushioning causes too much stress on the ears. All of these factors are important to consider in the brainstorming and prototyping process (Goodner, 2016).

Other factors considered for the device were how the device would be tightened to fit the client's head. Since the head measurements of the client are unknown, the device will be made to be adjustable. The client has limited motion in one hand, so the device will need to be able to be tightened via one hand.

Figure 9: ratcheting (Replacement)

Figure 10: Velcro strap (Ordinary)

Figure 11: Plastic latch clamp (One)

Options for one handed tightening mechanisms include a ratcheting clamp, as seen in Figure 8, a velcro strap as seen in Figure 9, and a plastic latch as seen in Figure 10. Ratcheting clamps can be difficult to loosen at times, which could put excessive pressure on the client's head. Although velcro is relatively flexible, its flimsy nature may require a second hand to tighten the device to a comfortable size. The plastic latch can be tightened simply by pulling the plastic strap to a comfortable length and loosened by pressing the latch down and pushing the latch back out. Currently no problems are foreseen for the plastic latch, so long as the strap never fully comes out of the latch.

Additionally, the use of the existing desk phone technology was considered for this device. If the entire existing phone was to be used, weight of the phone would be taken into account, which could cause pressure on the client's head. However, that may not be necessary if the parts of the desk phone are extracted from its outside shell. The handset is simply made of a

speaker and a microphone, both of which are connected to an RJ11 connector, where the phone cord is attached. The phone cord consists of four wires, which connect to the speaker and microphone. The hard shell of the handset only serves to allow the user to hold this technology to their head to speak and hear (Brain, 2000).

The device needs to be tailored mainly towards this specific client, and their specific need, to have assistance holding a phone, taking into account their abnormally shaped ears and head and limited mobility in one hand. Many of the devices seen on the market are made either for the general public or for those who are hard of hearing, but do not have physical deformities. Often the devices are not customizable and do not accomplish the task of holding an existing phone. In fact, many use complex wiring technology that would not be feasible to incorporate in the given time frame for this project. Other factors that the prototype design will account for are comfort an ability to use and tighten with one hand. Although there are certainly many different approaches currently available to redirect audio signals from phones to a person's ears, none of the devices found were suitable for this specific client.

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