

Published: October 31, 2022

Citation: Ahmad Tarmizi NE, Abdullah A, et al., 2022. Bone Anchored Hearing Aid (BAHA®) Implant in Canal Atresia and Microtia: A Single Case Report, Medical Research Archives, [online] 10(10). <https://doi.org/10.18103/mra.v10i10.3155>

Copyright: © 2022 European Society of Medicine. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI
<https://doi.org/10.18103/mra.v10i10.3155>

ISSN: 2375-1924

CASE REPORT

Bone Anchored Hearing Aid (BAHA®) Implant in Canal Atresia and Microtia: A Single Case Report

Nur Eliana Ahmad Tarmizi, Asma Abdullah, Fahrin Zara Mohammad Naseri

¹UKM

*e187eliana@gmail.com or asmappukm@gmail.com

ABSTRACT

Bone anchored hearing aid (BAHA®) implant is a type of hearing rehabilitation for patients with conductive, mixed or unilateral hearing loss. There are various options for BAHA® usage. Two of the most used bone-anchored hearing implant systems are the BAHA® Connect and BAHA® Attract. The BAHA® Connect uses a skin-penetrating titanium abutment. The BAHA® Attract uses an implanted magnet, leaving the overlying skin intact. This case report highlights the particular benefits of BAHA® Attract System in a patient who had previously worn the BAHA® Connect System. It was upgraded to the Attract System following post-surgical infection. The patient showed improved compliance, and thus has a better hearing outcome. BAHA® Attract system gives its patient better compliance and ease of use along with its reduced complications.

Keywords; microtia, conductive hearing loss, bone anchored hearing aid

Introduction

The implantable prosthesis of osseous conduction (BAHA) is an excellent option in the auditory rehabilitation of patients with conductive and mixed hearing loss, unilaterally or bilaterally. It has been a good advantage over the conservative bone conduction apparatus. The osseous-integrated implants were first introduced to clinical practice in Sweden in 1970. The Bone Anchored Hearing Aid (BAHA) system, which was originally used by Tjellstrom and his team in Sweden in 1977, made the prospect of osseous-integrated implants renowned in the area of otology [1]. BAHA® Attract System was introduced in which there is a magnetic transcutaneous bone conduction implant system with intact skin interposed between two magnets [2]. A sound processor with vibrator is attached outside the intact skin. It is attached to a corresponding external magnet. Two magnets are being used: one under the skin connected to the implant and the second is on the outside along with the sound processor [3]. Unlike BAHA® Connect System, this BAHA® Attract System avoids soft tissue reduction at the implant site, therefore, preventing irritation and inflammation of the skin. Apart from that, it improves compliance in the young. However, prior to the surgical procedure, adequate skin thickness between the magnets, must be ensured to avoid skin reaction and thus better audiological outcome [2]. In a study done by Nicholas et al, the study demonstrated significantly lower one-year post-implantation complication rates with the Attract system compared to the Connect system in paediatric patients (20.8% vs. 41.2%), including the need for revision surgery (0% vs. 29.4%). Additionally, the complications seen with the BAHA® Attract were exclusively magnet-related and thus mild in comparison to the wound-related complications seen with BAHA® Connect implantation such as skin overgrowths and infections [4].

Here, we report on a patient in whom a BAHA® Connect System was initially used, however failed the treatment due to infection, and was thus subsequently implanted with the BAHA® Attract System. Our patient had less complications and good hearing outcomes thresholds from the BAHA® Attract.

Case Presentation

A 17-year-old boy, presented to our clinic at age 7 years with reduced hearing bilaterally since childhood. His speech development was good as he had used bone conduction hearing aids previously and attended normal school. He had no history of otalgia, otorrhea or trauma. His antenatal history was uneventful. On examination, he had bilateral microtia Grade III and canal atresia (Figure 1).



Figure 1: shows microtia Grade III (black arrow) with absence of external auditory canal (EAC).

Pure tone audiometry (PTA) was performed prior to BAHA® Connect surgery and showed bilateral moderate conductive hearing loss (CHL) with a range of 50-65 dB HL (Figure 2).

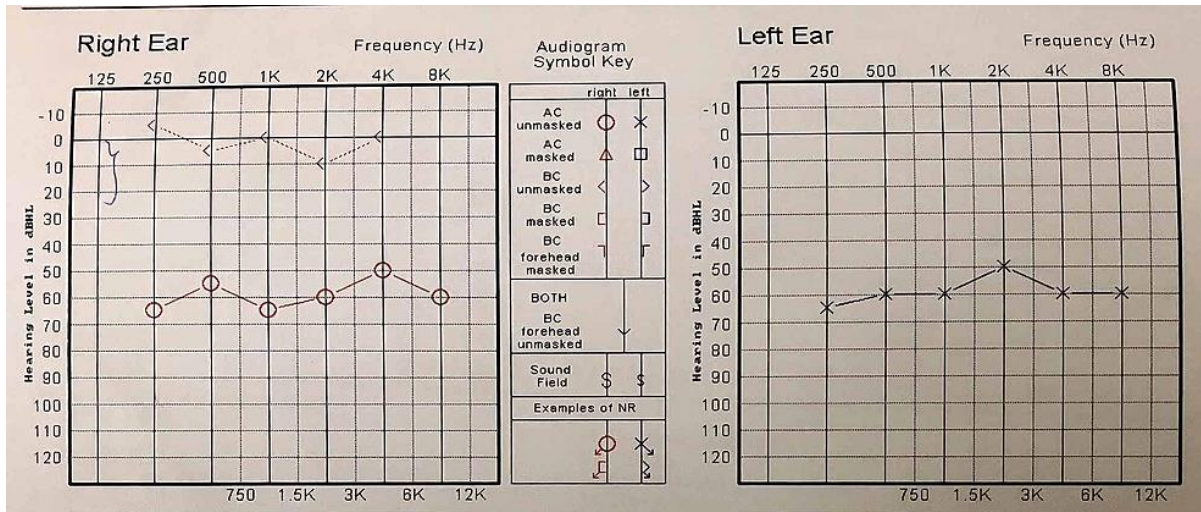


Figure 2: shows bilateral moderate conductive hearing loss.

High resolution computed tomography (HRCT) scan of the temporal bones revealed abnormal EAC, tympanic membrane and ossicles. However, the cochlear, semicircular canal and internal auditory meatus were normal. He was fitted with a right BAHA® Connect System 1st stage in July 2011 and Right BAHA® Connect system 2nd stage in December 2011. However, the surgery was complicated with florid skin overgrowth overlying the abutment and infection. He underwent removal

of scar tissue over the previous incision site and removal of soft tissue in December 2011. He recovered well post-operatively. Unfortunately, he defaulted follow up from 2012 till 2018. He presented with a similar complaint following this long absence with reduced hearing. His PTA shows bilateral moderate CHL ranging from 50-65dB HL which is similar to his initial hearing level prior to the BAHA® Connect System surgery (Figure 3).

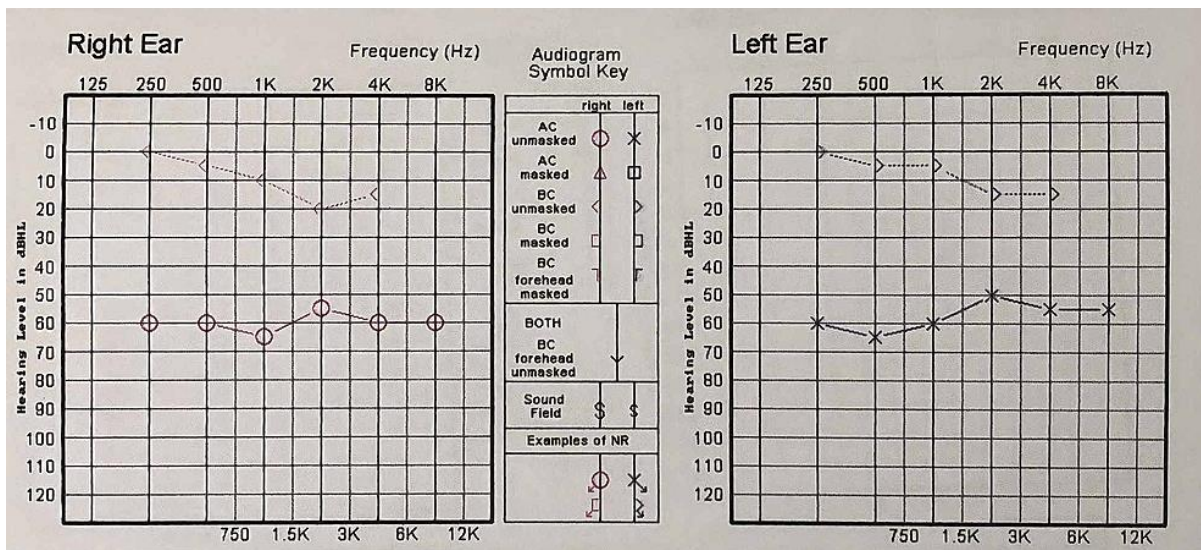


Figure 3: Pure Tone Audiometry Prior BAHA® Attract Surgery.

Right BAHA® Attract surgery was performed in April 2019. This patient only underwent one stage surgery for BAHA® Attract System. One-stage surgery involves placing an implant and an implant magnet in the same procedure.

Post-surgery, he was well and without evidence of infection and he was comfortable with the BAHA® Attract System (Figure 4).



Figure 4: shows Right BAHA® Attract System (yellow arrow) which is the sound processor with vibrator that is attached to a corresponding external magnet.

PTA shows right mild CHL at low frequency 25-35 dB HL and moderate CHL at high frequency 60dBHL, with improvement in his hearing threshold (Figure 5).

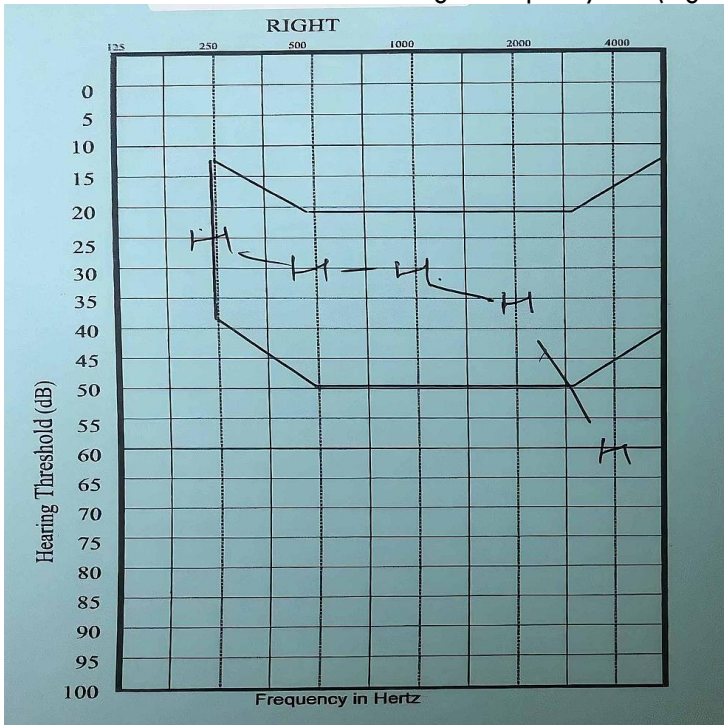


Figure 5: shows right mild CHL at low frequency and moderate CHL at high frequency.

Discussion

Branemark introduced the concept of osseous-integrated for craniofacial and dental surgeries [5] in 1965. Superior skin penetration using titanium implants for direct bone conduction was introduced by Tjellstrom [6] in 1995. The BAHA® system bypasses the external and middle ear hearing mechanism and transmits the sounds directly to the cochlea through the skull bone. Thus, patients with external ear deformities such as microtia or anotia can benefit from this system. Furthermore, patients with discharging ears such as chronic otitis media or externa can also benefit from this system as conventional hearing aids may not be suitable for them. The BAHA® system can be used in patients who suffer from conductive, mixed hearing loss or single sided deafness. Due to the skin penetration, previous BAHA® systems have led to skin inflammation, skin overgrowth, pain and may ultimately to infection [2]. This happened to our patient and was complicated with post-surgical infection and skin overgrowth. Apart from that, the BAHA® connect system also requires maintenance as excessive sweating at the implant site can also cause problems. The abutment is clearly seen on the patients' head, thus adding to possible problems with cosmesis and patient compliance in the young population [2]. We suspect our patient's non-compliance played a factor with his usage of the BAHA® Connect system.

In contrast to the BAHA® Connect, BAHA® Attract is non-skin penetrating. It has an implant magnet under the skin that connects with the sound processor externally utilizing magnetic force. The sound processor is attached via a softwear pad to equalize the pressure over the attachment surface. Comparing this to the conventional BAHA®, it gives a more satisfactory audiological outcome to the patient [7]. Baker et al [8] and Powel et [9] al studied the audiological outcome in paediatric populations and it showed greater improvement in mean aided thresholds (41dB HL and 30.6 dB HL). In our patient, he also benefitted from BAHA® Attract compared to his previous surgery and he was also compliant to the BAHA® Attract system. He showed audiological improvement in his mean aided hearing threshold of about 31.6 dB HL. In a previous study done at our centre by Azirah et al [10], 9 patients who have microtia with canal atresia / stenosis, and had undergone BAHA® Attract Surgery showed good audiological performance post-operatively with overall mean functional gain of 53.1 dB. It also has the added advantage in terms of aesthetic and hygienic concerns. It has a single-point transmission for better and efficient sound transmission by focusing the vibration in a single point compared to multiple

screws as in BAHA® Connect Surgery, thus resulting in lower transmission efficiency.

BAHA® Attract System shows less complications too. Dimitriadis et al reported that 78.7 % has no complications followed by other complications such as numbness (8.9%), seroma or hematoma (4.4%), detachment of processor and swelling reported as 1.1% each. There are no major differences comparing complications in the paediatric and adult population. As compared with skin reactions in BAHA® Connect surgery, there are no reports on persistent adverse reactions of the skin due to the magnet [11]. In a study involving 125 patients implanted with the Baha Attract system by Wojciech et al [12], healing was uneventful in 92.8% of cases. However, 7.2% of patients were diagnosed with haematoma post-surgery, which was then successfully treated by aspiration and compression. Our patient recovered well following surgery and subsequent follow up revealed no complications. However, despite uneventful postoperative recovery and skin healing, there are some problems that can occur at the implant site after processor attachment. These can due to the strength of the external magnet. In order to overcome the tenderness, redness or pain at the implant side the magnet strength can be reduced or limited daily usage. Dimitriadis et al [11] reported skin tenderness and redness in 3.8%, Wojciech et al [12] observed mild redness and/or mild pain in 9.6% and Reddy-Kolanu et al [13] observed tenderness at the side of the implant in 17.6%. In most of these studies, the follow-up and observation period were short. Thus, further studies are needed for longer duration of observation so that the long-term effect of magnetic attraction on the soft tissue condition can be evaluated.

In our setting as a tertiary hospital, selecting the best type of hearing rehabilitation modality is of utmost importance. Our patients most often have financial difficulties. Therefore, a second surgery to deal with complications, or to upgrade to a superior system, may not be a viable option given the cost. Given our third world status and limited financial resources, we prefer the BAHA® Attract system given its patient compliance and ease of use along with its reduced complications.

Conclusions

The BAHA® Attract Surgery system is a good hearing rehabilitation intervention and is a step forward in technology that gives patients improved audiological outcome and benefit. It gives the gift of hearing in patients with external ear deformities as well as hearing loss. The functional as well as audiological outcome shows BAHA® Attract System is much superior to the conventional hearing aid.

References

1. Pedriali IVG, Buschle M, Mendes RC, Ataíde AL, Pereira R, Vassoler TMF, et al. *Implantable Prosthesis of Osseous Conduction (BAHA): Case Report*. *Int. Arch. Otorhinolaryngol.* 2011;15(2):249-255
2. Hetal Marfatia, Keya Shah, Sheetal Shelke, Kartik Krishnan. *Baha Attract: Our Experience*. *Indian J Otolaryngol Head Neck Surg* (Oct-Dec. 2017, 69:544-548. 10.1007/s12070-017-1192-4
3. Dong Su Jang, Dong Hyo Shin, Woojae Han, Tae Hoon Kong, Yoong Joon Seo: *BAHA Attract implantation Using A Small Incision: Initial Report of Surgical Technique and Surveillance*. *Clinical and Experimental Otorhinolaryngology*. Volu 13, No. 1: 15-22, February. 2020, <https://doi.org/10.21053/ceo.2019.0381>
4. Nicholas R. Oberlies, Johnathan E. Castaño, Monika E. Freiser, Jennifer L. McCoy, Amber D. Shaffer, Noel Jabbour. *Outcomes of BAHA connect vs BAHA attract in paediatric patients*. *International Journal of Paediatric Otorhinolaryngology*, Volume 135,2020,110125,ISSN 0165-5876 <https://doi.org/10.1016/j.ijporl.2020.110125>.
5. Branemark PI, Breine U, Adell R: Hansson BO, Lindstrom J, Ohlsson A (1969) *Intraosseous anchorage of dental prostheses: I. Experimental Studied*. *Scand J Plasst Reconstr Surg*3:81-100. 10.3109/02844316909036699
6. Tjellstrom A, Hakansson B (1995: *The bone-anchored hearind aid. Design principles, indications and lng term clinical results*. *Otolaryngol Clin North Am.* 28:53-72. 10.1016/S0030-6665(20)30566-1
7. Karz A, Flynn M, Caversaccio M, Kompis M (2014: *Speech understanding with a new implant technology: a comparative study with a new nonskin penetrating Baha system*. *Biomed Res Int* 23. 2014, 10.1155/2014/416205
8. Baker S, Centric A, Chennupati SK. *Innovation in abutment free bone anchored hearing devices in children. Updated results and experience*. *Int J Paediatr Otorhinolaryngol.* 2015, 79:1667-72. 10.1016/j.ijporl.2015.07.021
9. Powell HR, Rolfe AM, Birman CS. *A comparative study of audilogic outcomes for two transcutaneous bone anchored hearing devices*. *Otol Neurotol.* 2015, 36:1525-31. 10.1097/MAO.0000000000000842
10. Goh Bee See: Salahuddin Nor Azirah, Abdullah Asma. *Experience of Baha Attract System in Malaysia*. *International Medical Journal*. Dec2019, Vol. 26. 6:498-500.
11. Panagiotis A. Dimitriadis, Matthew R. Farr, Ahmed Allam, Jaydip Ray: *Three-year experience with the cochlear BAHA Attract implant: a systematic review of the literature*. *Dimiatriadis et al. BMC Ear, Nose and Throat Disorders.* 2016:16 12. 10.1186/s12901-016-0033-5
12. Wojciech Gawecki, Andrzej Balcerowiak, Ewelina Kalinowicz, Maciej Wróbel. *Evaluation of surgery and surgical results of Baha Attract system implantations- single centre experience of hundred twenty-five cases*. *Braz J Otorhinolaryngol.* 2019, 85:597-602. 10.1016/j.bjorl.2018.04.011
13. Reddy-Kolanu G, Marshall A. *Implantation of the cochlear BAHA® 4 attract system through a linear incision*. *Ann R Coll Surg Engl.* 2016, 98:437-8. 10.1308/rcsann.2016.0122