Clinical Policy Bulletin:
Bone-Anchored Hearing Aids

Number: 0403

Policy

*Please see amendment for Pennsylvania Medicaid at the end of this CPB.

I. Aetna considers fully or partially implantable bone-anchored hearing aids (BAHAs) or temporal bone stimulators medically necessary prosthetics for persons aged 5 years and older with a unilateral or bilateral conductive or mixed conductive and sensorineural hearing loss who have any of the following conditions, where the condition prevents restoration of hearing using a conventional air-conductive hearing aid and who meet the audiologic criteria below:

   A. Congenital or surgically induced malformations of the external ear canal or middle ear (such as aural atresia); or
   B. Dermatitis of the external ear, including hypersensitivity reactions to ear moulds used in air conduction hearing aids; or
   C. Hearing loss secondary to otosclerosis in persons who can not undergo stapedectomy; or
   D. Severe chronic external otitis or otitis media; or
   E. Tumors of the external ear canal and/or tympanic cavity; or
   F. Other conditions in which an air-conduction hearing aid is contraindicated. Audiologic criteria:

       A. Unilateral implant: Conductive or mixed (conductive and sensorineural) hearing loss with pure tone average bone conduction threshold values measured at 0.5, 1, 2, and 3 kHz less than or equal to 45 dB HL (BAHA Attract, BAHA Divino, BAHA BP100, Baha 4 and Sophono Alpha System), 55 dB HL (BAHA 5 Power, BAHA Intenso, Ponto Plus Power) or 65 dB HL (BAHA Cordelle II).
       B. Bilateral implant: Moderate-to-severe bilateral symmetric conductive or mixed (conductive and sensorineural) hearing loss, meeting above-listed bone conduction thresholds in both ears. Symmetric bone conduction threshold is defined as less than:

           1. 10 dB average difference between ears (measured at 0.5, 1, 2 and 4 kHz) or less than 15 dB difference at individual frequencies (BAHA Divino, Ponto Plus, Ponto Pro, Sophono Alpha System); or
           2. 10 dB average difference between ears (measured at 0.5, 1, 2, and 3 kHz), or less than a 15 dB difference at individual frequencies (BAHA Attract, BAHA BP100, BAHA 4, BAHA 5 Power, BAHA Cordelle II, BAHA Intenso).

II. Aetna considers an implantable BAHA for conductive or mixed hearing loss experimental and investigational when criteria are not met because of insufficient evidence in the peer-reviewed

Policy History

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> Review History
> Definitions

Additional Information

> Clinical Policy Bulletin Notes
published medical literature.

III. Aetna considers the use of an implantable BAHA medically necessary in persons with unilateral sensorineural hearing loss (single-sided deafness, i.e., deafness in one ear while the other ear has normal hearing).

Aetna considers the use of an implantable BAHA experimental and investigational for bilateral pure sensorineural hearing loss, and for all other indications because its effectiveness for indications other than the ones listed above has not been established.

IV. Aetna considers intra-oral bone conduction hearing aids (e.g., the SoundBite hearing system) for the treatment of hearing loss experimental and investigational because their effectiveness has not been established.

Note: Aetna follows Medicare rules in considering osseointegrated implants, such as implantable BAHAs and temporal bone stimulators, as prosthetics. Medicare considers as prosthetics "osseointegrated implants, i.e., devices implanted in the skull that replace the function of the middle ear and provide mechanical energy to the cochlea via a mechanical transducer." Non-osseointegrated hearing devices (e.g., BAHA Soft Band, SoundBite) are not covered under plans that exclude coverage of hearing aids. Please check benefit plan descriptions.

See also

- [CPB 0013 - Cochlear Implants and Auditory Brainstem Implants](#);
- and [CPB 0612 - Hearing Aids](#).

Background

A bone-anchored hearing aid (BAHA) also known as an osseointegrated mastoid implant, is an implantable bone-conduction hearing aid that allows direct bone-conduction of sound through a titanium implant. BAHA has become available as an acceptable alternative if an air-conduction hearing aid is contraindicated. The BAHA transmits sound vibrations through the skull bone via a skin-penetrating titanium implant, and then are further transmitted to the cochlea, bypassing the middle ear. A titanium post is surgically embedded into the skull with a small section exposed outside of the skin. A sound processor sits on the exposed section and transmits sound vibrations via the titanium post. The vibrations to the skull and inner ear stimulate the nerve fibers of the inner ear, allowing hearing. Examples of bone anchored hearing aids include, but may not be limited to, BAHA and Ponto hearing systems, both of which have several different sound processor models.

Several clinical trials have shown its efficacy in patients with a conductive or mixed hearing loss. Indications for the BAHA include hearing loss from congenital ear problems, chronic suppurative otitis media, and in some cases otosclerosis as a third treatment option in those who can not or will not undergo stapedectomy. A second group of potential candidates are patients who suffer from an almost instantaneous skin reaction to any kind of ear mold. In some patients, the benefits are not necessarily those in hearing ability but relate to cosmetic or comfort improvements. Pre-operative assessment of the size of the air-bone gap is of some help to predict whether speech recognition may improve or deteriorate with the BAHA compared with the air-conduction hearing aid.

There is evidence in the peer-reviewed published medical literature to support the use of BAHAs over air conduction hearing aids, however, most of the studies have focused on individuals who suffer from single sided deafness, with unilateral sensorineural deafness in one ear while the other ear has normal hearing. The Food and Drug Administration (FDA) has cleared for marketing the bone anchored
Bone-Anchored Hearing Aids

A hearing aid for individuals aged 5 years and older who have conductive or mixed hearing loss and for patients with sensorineural deafness in one ear and normal hearing in the other based on a 510(k) application. Such clearance was granted based on a determination that the BAHA was substantially equivalent to a contralateral routing of sound (CROS) air conduction hearing aid. A unilateral implant is used for individuals with unilateral conductive or mixed hearing loss and for unilateral sensorineural hearing loss. According to the FDA-approved indications, a bilateral implant is intended for patients with bilaterally symmetric moderate to severe conductive or mixed hearing loss.

In a recently published meta-analysis of the evidence for BAHA for single-sided deafness, Baguley and colleagues (2006) explained that acquired unilateral sensorineural hearing loss reduces the ability to localize sounds and to discriminate in background noise (BN). Four controlled trials have been conducted to determine the benefit of contralateral BAHAs over CROS hearing aids and over the unaided condition. Speech discrimination in noise and subjective questionnaire measures of auditory abilities showed an advantage for BAHA over CROS and over unaided conditions. However, these studies did not find significant improvements in auditory localization with either aid. The investigators noted that these conclusions should be interpreted with caution because these studies have material shortfalls:

I. the BAHA was always trialled after the CROS aid;
II. CROS aids were only trialled for 4 weeks;
III. none used any measure of hearing handicap when selecting subjects;
IV. 2 studies have a bias in terms of patient selection;
V. all studies were under-powered; and
VI. double reporting of patients occurred (Baguley et al, 2006).

Priwin et al (2007) investigated

I. whether bilateral BAHAs in children with conductive bilateral hearing loss provided additional hearing benefits,
II. the effects of unilateral hearing aids in children with conductive unilateral hearing loss, and
III. the auditory problems of children with conductive unilateral or bilateral hearing loss.

This prospective case series included 22 children with either conductive unilateral hearing loss (unaided or with unilateral hearing aid) or conductive bilateral hearing loss (with unilateral or bilateral BAHAs) and 15 controls. The investigators tested baseline audiometry, tone thresholds in a sound field, and speech recognition in noise and sound localization with and without unilateral and bilateral hearing aids. Two self-assessment questionnaires were completed. The investigators reported 2 problem areas in the children with hearing impairment:

I. reactions to sounds, and
II. intelligibility of speech.

An additional BAHA in the children with bilateral hearing loss resulted in a tendency to have improved hearing in terms of better sound localization and speech recognition in noise. Fitting of unilateral hearing aids in the children with unilateral hearing loss gave some supplementary benefit in terms of better speech recognition in noise but no positive effect on ability to localize sound could be detected. Even so, all children fitted with hearing aids, either unilaterally or bilaterally, reported a positive outcome with their devices in the self-assessment questionnaire. The investigators concluded that the fitting of bilateral BAHAs in children with bilateral hearing loss and of a single-sided hearing aid in children with unilateral hearing loss appears to have some supplementary audiological benefits and also renders high patient satisfaction.

When suggested indications for treatment with the BAHA system are followed, the success rate is very high. The improved quality of life reported by the patients is a combination of improved quality of sound (warble tone threshold, speech reception threshold, and discrimination in noise), improved
Bone-Anchor Medical Devices

comfort, and relief from middle ear and ear canal disease occasioned by conventional hearing aids.

An assessment of the BAHA device by the Institute for Clinical Effectiveness and Health Policy (Pichon-Rivere et al, 2009) concluded that there is evidence that BAHA is useful for people with conductive-type hearing loss who can not undergo surgery or who have contraindications or adverse effects to hearing aids. If implantation is used, it should be implanted to patients over 5 years old and by specially trained staff in an operating room. Evidence comes, however, from observational studies, many of which include a few participants.

Although no longer marketed, the Audiant (Medtronic Xomed, Inc., Jacksonville, FL) Bone Conductor, also known as the temporal bone stimulator, is an FDA-approved implanted device with an external processor that uses transcutaneous inductive electromagnetic energy to cause vibration of an implanted titanium magnet screwed into the temporal bone. Like the currently marketed BAHA device, the Audiant Bone Conductor is also based on a bone conduction concept, and is also indicated for persons with conductive or mixed conductive and sensorineural hearing loss who have conditions that prevent restoration of hearing using a conventional air-conductive hearing aid.

Hol et al (2010) evaluated the effectiveness of 3 CROS hearing aids in adults (n = 10 with unilateral inner ear deafness and normal hearing in the contralateral ear:

I. the CROS hearing aid,
II. the completely in the canal hearing aid, and
III. the BAHA CROS (BAHA).

Each of the 3 hearing aids was tried in a random order for a period of 8 weeks. Audiometric performance, including speech-in-noise, directional hearing and subjective benefit were measured after each trial period, using the Abbreviated Profile of Hearing Aid Benefit (APHAB), Speech, Spatial and Qualities of Hearing Scale (SSQ) and single-sided deafness (SSD) questionnaire. Sound localization performance was essentially at chance level in all 4 conditions. Mixed results were seen on the other patient outcome measures that alternated in favor of one of the 3 CROS devices. After the trial, 3 patients chose to be fitted with the BAHA CROS and 1 with the conventional CROS. The authors concluded that most of the patients experienced some degree of benefit with each of the 3 hearing aids. Preference for one of the 3 hearing aids was independent of the order in which they were tried. It would be worthwhile to formulate selection criteria; still, the authors recommended that all patients with unilateral inner ear deafness should be offered a trial with at least the BAHA CROS.

de Wolf and colleagues (2011a) stated that a study performed in the 1990s with analog linear hearing aids showed that in patients with mixed hearing loss and an air-bone gap that exceeded 25 to 30 dB, speech perception was better with a BAHA than with a conventional behind-the-ear (BTE) device. The objective of the present study was to examine if this conclusion applies to today's digital BTEs with feedback cancellation and whether the cross-over point still occurs at an air-bone gap of 25 to 30 dB. Experienced unilateral BAHA users with the latest digital Baha processors were fitted with a powerful BTE with feedback cancellation. After an acclimatization period of 4 weeks, aided thresholds and speech recognition scores were determined and compared to those recorded previously with the BAHA. To obtain patients' opinions, a disability-specific questionnaire was used. Participants comprised 16 subjects with bilateral mixed hearing loss. Audiometric and speech recognition data showed similar trends to those described previously, but the cross-over point had shifted to an air-bone gap of 30 to 35 dB. In the questionnaire, the BTE was rated higher than the BaHA, except by the patients with an air-bone gap that exceeded an average of 45 dB. The authors concluded that in patients with mixed hearing loss whose air-bone gap exceeded 35 dB, speech recognition is likely to be better with a BAHA than with a BTE. Thus, the BAHA should receive greater consideration when mixed hearing loss is combined with a significant air-bone gap, even when there are no contraindications for BTEs.

de Wolf and colleagues (2011b) evaluated the benefits of a BAHA in the daily lives of hearing-impaired
children. A total of 38 BAHA users with a minimum age of 4 years at BAHA fitting and 1 to 4 years of use were divided into groups with bilateral conductive or mixed hearing loss and either normal cognition or mental disability and a group with unilateral conductive hearing loss. Main outcome measures included scores on the Glasgow Children's Benefit Inventory, APHAB, and Health Utilities Index Mark 3. The Glasgow Children's Benefit Inventory showed a subjective overall benefit of +32, +16, and +26 in the 3 groups (on a scale of -100 to +100). The APHAB also showed an overall mean benefit in the groups. On an individual level, a clinically significant benefit was reported by more children in the group with bilateral hearing loss and normal cognition (7 patients [70 %]) than in the unilateral hearing loss group (4 patients [27 %]). Overall mean health utility scores and disability index scores on the Health Utility Index Mark 3 were comparable among the 3 groups. The authors concluded that overall, BAHA fitting can be considered effective and beneficial in children with bilateral or unilateral hearing loss.

**The SoundBite Hearing System:**

The SoundBite Hearing System (Sonitus Medical, San Mateo, CA), a bone conduction oral appliance, is classified as a bone conduction hearing aid, but unlike the semi-implantable devices discussed above, is a nonsurgical external device. The SoundBite was developed for individuals with single-sided deafness and purportedly transmits sound through the teeth. The SoundBite has been taken of the market and is no longer available.

The SoundBite Hearing System allows people with SSD to wear an intra-oral device and a small microphone in the deaf ear to regain lost hearing. It consists of a behind the ear device (which houses the receiver, wireless transmitter and microphone) and a removable, custom-fit, retainer-like device. The piezoelectric activator in a small removable unilateral oral appliance conducts sound through the bone via the teeth to the good ear. Currently, there is insufficient evidence to support the use of an intra-oral bone conduction hearing aid for the treatment of hearing loss. The quality of the studies was low due to small study populations, short follow-up, and the lack of randomization and appropriate control groups. Future studies with larger populations of patients wearing the device for longer periods are needed to evaluate hearing benefits and device safety.

Popelka et al (2010) stated that a new approach for SSD has been proposed that optimizes microphone location and delivers sound by bone conduction through a removable oral appliance. Measures in the laboratory using normal-hearing subjects indicated that the device provides useful gain and output for SSD patients, is comfortable, does not seem to have detrimental effects on oral function or oral health, and has several advantages over existing devices. Specifically, microphone placement is optimized for reducing the auditory deficit caused by SSD, frequency bandwidth is much greater, and the system does not require surgical placement. Auditory performance in a small sample of SSD subjects indicated a substantial advantage compared with not wearing the device. The authors noted that future studies will involve performance measures on SSD patients wearing the device for longer periods.

Murray et al (2011a) determine the benefit, safety and effectiveness, of a new intra-oral conduction device (SoundBite Hearing System) for SSD. Adults (aged between greater than 18 and less than 80 years) with acquired, permanent SSD (n = 28) and no current use of any SSD device were included in this study. Intervention was continual daily wear of the new device over a 30-day trial period. Main outcome measures included the Hearing in Noise Test (HINT), the Abbreviated Profile of Hearing Aid Benefit (APHAB), comprehensive pre-trial and post-trial medical, audiologic, and dental examinations and an SSD questionnaire. The Hearing in Noise Test scores improved an average of -2.5 dB after 30 days, compared with wearing no device (p < 0.001). The APHAB scores improved (p < 0.05) for all subjects for the Global and Background Noise subscales and for all but 1 subject for the Reverberation (RV) and Ease of Communication (EC) subscales. There were no medical, audiologic, or dental complications. The authors concluded that the SoundBite system is safe and effective and provided substantial benefit for SSD patients with continual daily use over a 30-day period.
Murray et al (2011b) determined the long-term safety and benefit of the SoundBite Hearing System for SSD. Adults (n = 22) with acquired, permanent SSD and no current use of any other SSD device were included in this study. Main outcome measures included comprehensive medical, audiologic, and dental measures; aided thresholds; APHAB scores, and an SSD questionnaire. There were no related adverse events or changes in the medical or audiologic findings at the end of the trial compared with the beginning. There were no significant changes in the mean aided thresholds (p > 0.01) or the mean dental measures (p > 0.05) at 3 or 6 months compared with pre-trial measures. The mean APHAB scores showed improvement (p < 0.01) for the BN, RV, and EC subscales and the Global scale at 3 and 6 months. The results of the SSD questionnaire indicated that the vast majority (greater than 90%) of the subjects reported satisfaction and improvement in a variety of areas after wearing the device long-term. The authors concluded that the SoundBite system is safe and continues to provide substantial benefit for SSD patients with continual daily use over a 6-month period.

In a prospective, multi-site, non-randomized study, Gurgel and Shelton (2013) determined the safety and effectiveness of the SoundBite for patients over a 6-month period of use. Patients with single-sided deafness were eligible for the study. Patients were fit with the standard SoundBite sound transducer and were asked to wear the device regularly for 6 months. At the end of the trial period, patients completed both a self-assessment and the APHAB questionnaires. A total of 34 subjects completed the study. Mean APHAB scores improved significantly for EC (p < 0.001), BN (p < 0.001), RV (p < 0.001), and global benefit (p < 0.001). Patients reported high rates of auditory benefit in a variety of listening situations and high rates of overall satisfaction with the device. One adverse event with a superficial mouth sore was reported and resolved after appropriate dental care. Twelve patients (35%) reported acoustic feedback. In 6 of these patients, the feedback resolved after device adjustment. The authors concluded that the SoundBite is a new hearing prosthesis that delivers bone conduction energy. It offers advantages over traditional osseo-integrated devices that require surgical placement. Patient satisfaction with the device after 6 months of regular use is high. The SoundBite provided improvement in EC, hearing in BN, sound RV, and an overall global hearing benefit. Acoustic feedback is the most commonly reported problem with the SoundBite, and this is minimized with proper fitting.

Moore and Popelka (2013) compared the effectiveness of 2 types of treatment for unilateral hearing loss (UHL), bone-anchored hearing instruments (BAHI) and a dental device (SoundBite). Either BAHI or SoundBite was worn for 30 days, and then the devices were swapped and the second device was worn for 30 days. Measures included unaided and aided sound-field thresholds, sound localization, and perception of speech in babble. The APHAB questionnaire was administered for each trial period. A total of 9 adult BAHI wearers with UHL were included in this study. Mid-frequency aided thresholds were lower for SoundBite than for BAHI. Both devices gave benefits for localization after 30 days, but there was no difference between devices. Speech perception was better for both devices than for unaided listening when the target speech came from the poorer hearing side or in front, and the interfering babble came from the better-hearing side. There was no consistent difference between devices. APHAB scores were better for SoundBite than for BAHI. The authors concluded that speech perception and sound localization were similar for the 2 types of device, but the SoundBite led to lower aided thresholds and better APHAB scores than the BAHI.

The results of these 2 trials were encouraging. However, these studies were small (n = 34 and n = 9, respectively), non-randomized, and had only short-term follow-ups (6 months and 30 days, respectively), their findings need to be validated by well-designed studies. Furthermore, UpToDate reviews on “Sudden sensorineural hearing loss” (Weber, 2014) and “Treatment of hearing impairment in children” (Smith and Gooi, 2014) do not mention the use of SoundBite/dental device/non-osseous anchored hearing aid as a therapeutic option.

The Otomag Bone Conduction Hearing System:

The Otomag bone conduction hearing system (Sophono, Inc., Boulder, CO) is a partially implantable bone conduction hearing aid without a percutaneous abutment. The Otomag sound processor is
Bone-Anchored Hearing Aids

attached magnetically to an implanted magnet assembly. The magnetic field holds the sound processor against the head and vibration is transduced through direct contact with the patient's skin and the bone below. The principle of these bone conduction hearing aids is a magnetic coupling and acoustic transmission between implanted and external magnets. Currently, there is insufficient evidence that the Otomag bone conduction hearing system is beneficial for patients with hearing loss. Further investigation with larger populations and long-term follow-up are needed to evaluate improvement of hearing with this device.

Siegert (2011) developed new partially implantable bone conduction hearing aid without a percutaneous abutment and have been using them clinically for 4 years. The goal of this study was to evaluate clinical and audiological results. Magnets were implanted into shallow bone beds in a 1-step procedure. The skin area above the magnets was also reduced to a thickness of 4 to 5 mm, which reduces the attenuation to less than 10 dB compared to direct bone stimulation. Over 100 patients have been implanted in the last 5 years. Except for temporary pressure marks in 4 %, which healed after careful shimming of the external base plate, there were no other complications. The author concluded that the holding strength of the external components is equivalent to partially implantable hearing aids and cochlea implants and the hearing improvement is similar to other bone conduction hearing aids. The author noted that the comfort and safety of this system is significantly improved compared to conventional or percutaneous bone conduction hearing aids. The main drawback of this study was the lack of a control group. These preliminary findings need to be validated by well-designed studies.

The BAHA Attract System:

The Baha Attract consists of a percutaneously placed implant magnet and an external sound processor magnet forming a magnetic connection across healed skin. A Baha sound processor is then attached to the sound processor magnet. The advantage of the Attract system is that it does not have a percutaneous abutment (a screw that penetrates the skin) and therefore does not require the attention to local hygiene needed for fully-implantable BAHAs. Available evidence suggests that the improvements in hearing with the Attract system are similar to those of a fully-implantable bone conduction (bone-anchored) hearing aid and result in meaningful improvement in select individuals with conductive or mixed (conductive and sensorineural) hearing loss.

Baker and colleagues (2015) noted that bone-anchored hearing devices are an accepted treatment option for hearing restoration in various types of hearing loss. Traditional devices have a percutaneous abutment for attachment of the sound processor that contributes to a high complication rate. Previously, the authors’ institution reported on the Sophono (Boulder, CO) abutment-free system that produced similar audiolgic results to devices with abutments. Recently, Cochlear Americas (Centennial, CO) released an abutment-free bone-anchored hearing device, the BAHA Attract. In contrast to the Sophono implant, the BAHA Attract utilizes an osseointegrated implant. This study aimed to demonstrate patient benefit abutment-free devices, compared the results of the 2 abutment-free devices, and examined complication rates. A retrospective chart review was conducted for the first 11 Sophono implanted patients and for the first 6 patients implanted with the BAHA Attract at the authors’ institution. Subsequently, they analyzed patient demographics, audiometric data, clinical course and outcomes. Average improvement for the BAHA Attract in pure-tone average (PTA) and speech reception threshold (SRT) was 41 dB hearing level (dBHL) and 56 dBHL, respectively. Considering all frequencies, the BAHA Attract mean improvement was 39 dBHL (range of 32 to 45 dBHL). The Sophono average improvement in PTA and SRT was 38 dBHL and 39 dBHL, respectively. The mean improvement with Sophono for all frequencies was 34 dBHL (range of 24 to 43 dBHL). The authors concluded that significant improvements in both pure-tone averages and speech reception threshold for both devices were achieved. In direct comparison of the 2 separate devices using the Chi-square test, the PTA and SRT data between the 2 devices did not show a statistically significant difference (p-value of 0.68 and 0.56, respectively). They stated that the complication rate for these abutment-free devices is lower than that of those featuring the transcutaneous abutment, although more studies are needed to further evaluate this potential advantage.
Iseri et al (2014) reported their experience with a new transcutaneous bone conduction hearing device, the Baha Attract System (Cochlear Bone Anchored Solutions AB, Molnlycke, Sweden). This multi-center clinical study included the first 12 patients (8 females, 4 males; mean age of 27.6 years; range of 5 to 65 years) in whom a new transcutaneous bone conduction system was implanted in Turkey. The mean air-bone gap was 41 dB. Bone smoothing around the implant was needed in 5 patients. These researchers placed a sound processor in the 4th post-operative week for all patients. The authors concluded that these findings suggested that the new bone conduction implant is promising for the patients with conductive or mixed hearing loss who are unable to wear conventional air conduction hearing aid and comparable to percutaneous systems. The main drawback of this study was that it was a retrospective study, thus providing only low level of evidence.

Briggs et al (2015) prospectively evaluated, in a multi-center setting, the clinical performance of a new magnetic bone conduction hearing implant system. The test device was the Cochlear Baha Attract System. Instead of the skin-penetrating abutment of traditional bone conduction hearing implants, the test device uses an implantable and an external magnet to transmit sound from the sound processor (SP) through intact skin to the skull bone. A total of 27 adult patients with a conductive or mild mixed hearing loss or single-sided sensorineural deafness were included in the clinical investigation across 4 investigational sites. Patients were followed for 9 months after implantation. The study evaluated efficacy in terms of hearing performance compared with unaided hearing and with hearing with the SP on a Softband. Patient benefit, soft tissue status, device retention, and safety parameters were monitored continuously throughout the investigation. Surgery and healing was uneventful. Statistically significant improvements in audibility and speech understanding in noise and quiet were recorded for the test device compared with pre-operative unaided hearing. Speech recognition was similar or better than tests performed with the same SP on a Softband. Good soft tissue outcomes were reported, without major pressure-related complications. At the end of the investigation, all patients continued to use and benefit from the device. The authors concluded that the test device provided good hearing performance in patients with a conductive hearing loss or single-sided sensorineural deafness, with good wearing comfort and minimal soft tissue complications. The finding of this small study (n = 27) need to be validated by well-designed studies.

Kurz et al (2014) compared hearing and speech understanding between a new, non-skin penetrating Baha system (Baha Attract) to the current Baha system using a skin-penetrating abutment. Hearing and speech understanding were measured in 16 experienced Baha users. The transmission path via the abutment was compared to a simulated Baha Attract transmission path by attaching the implantable magnet to the abutment and then by adding a sample of artificial skin and the external parts of the Baha Attract system. Four different measurements were performed:

1. bone conduction thresholds directly through the sound processor (BC Direct),
2. aided sound field thresholds,
3. aided speech understanding in quiet, and
4. aided speech understanding in noise.

The simulated Baha Attract transmission path introduced an attenuation starting from approximately 5 dB at 1,000 Hz, increasing to 20 to 25 dB above 6,000 Hz. However, aided sound field threshold showed smaller differences and aided speech understanding in quiet and in noise did not differ significantly between the 2 transmission paths. The authors concluded that the Baha Attract system transmission path introduced predominately high frequency attenuation. This attenuation can be partially compensated by adequate fitting of the speech processor. No significant decrease in speech understanding in either quiet or in noise was found. The main drawbacks of this study were its small sample size (n = 160 and the lack of follow-up.

In a retrospective, multi-center study, Iseri and colleagues (2015) compared the clinical audiological outcomes as well as patient satisfaction of bone-anchored, hearing aid surgery between the percutaneous Dermalock and the transcutaneous Attract systems. Patients who underwent Baha...
Dermalock and Baha Attract surgery were analyzed for hearing results, surgical complications, and post-operative follow-up specifications for both systems. Speech reception thresholds and bone conduction thresholds with and without aided conditions were evaluated. Patient satisfactions were also determined for both groups by Glasgow Benefit Inventory questionnaire. Both of the groups had some minor complications such as skin irritations around the abutment and skin erythema over the magnet. Both of the groups benefit from the devices audiologically; however, when the groups were compared, better results were observed in the percutaneous, bone-conduction group. The authors concluded that both transcutaneous and percutaneous techniques are effective in the rehabilitation of conductive hearing loss when conventional hearing aids cannot be used. However, both of the systems have some advantages and limitations in terms of audiological and surgical perspectives. The main drawback of this study was its retrospective design, which provided low level of evidence.

Clamp and Briggs (2015) stated that bone conduction implant systems utilize osseointegrated fixtures to transmit sound through the bones of the skull. They allow patients with hearing loss to receive acoustic signals directly to the inner ear, bypassing the outer and middle ear. The new Cochlear Baha Attract System (Cochlear Bone Anchored Solutions AB, Molnlycke, Sweden) has been designed as a non-skin penetration hearing implant. The system uses magnetic coupling to hold the external sound processor in place and transmit acoustic energy. An implantable magnet is anchored to the skull via a single osseointegrated fixture, maximizing the efficiency of energy sound transfer. The interposed soft tissue is protected by a SoftWear pad that evenly distributes pressure in order to minimize the risk of pressure necrosis. The main drawback of this study was that it reported on the design features and very early clinical results; not on long-term outcomes.

Furthermore, Dimitriadis et al (2016) presented a systematic review of the indications, surgical technique and audiological, clinical and functional outcomes of the BAHA Attract device reported so far. A systematic computer-based literature search was performed on the PubMed database as well as Scopus, Cochrane and Google Scholar. Out of 497 articles, 10 studies and 89 reported cases were finally included in this review. The vast majority of implanted patients were satisfied with the aesthetics of the device scoring highly at the Abbreviated Profile of Hearing Aid Benefit, Glasgow Benefit Inventory and Client Oriented Scale of Improvement. Overall, hearing outcomes, tested by various means including speech in noise, free field hearing testing and word discrimination scores showed a significant improvement. Complications included seroma or hematoma formation, numbness around the area of the flap, swelling and detachment of the sound processor from the external magnet. The authors concluded that the functional and audiological results presented so far in the literature have been satisfactory and the complication rate is low compared to the skin penetrating Bone Conduction Devices. Moreover, they stated that further robust trials are needed to study the long-term outcomes and any adverse effects (AEs).

**The Ponto Pro:**

Oeding and Valente (2013) determined if statistically significant differences existed in the mean Reception Threshold for Sentences (RTS in dB) in diffuse uncorrelated restaurant noise between unaided, an omnidirectional microphone (OM), split DM (SDM), and full DM (FDM) in the Oticon Medical Ponto Pro. A second goal was to assess subjective benefit using the APHAB comparing the Ponto Pro to the participant's current bone anchored hearing solutions (BAHSs), and the Ponto Pro and participant's own BAHS to unaided. The third goal was to compare RTS data of the Ponto Pro to data from an identical study examining Cochlear Americas' Divino. A total of 15 BAHS users with unilateral sensori-neural hearing loss (USNHL) were recruited for this study. The Ponto Pro was fit by measuring in-situ bone conduction thresholds and was worn for 4 weeks. An RTS was obtained utilizing HINT sentences in uncorrelated restaurant noise from an 8 -loudspeaker array, and subjective benefit was determined utilizing the APHAB. Analysis of variance (ANOVA) was used to analyze the results of the Ponto Pro HINT and APHAB data, and comparisons between the Ponto Pro and previous Divino data. No statistically significant differences existed in mean RTS between unaided, the Ponto Pro's OM, SDM, or FDM (p = 0.10). The Ponto Pro provided statistically significant benefit for the BN (p < 0.01) and RV (p < 0.05) subscales compared to the participant's own BAHS. The Ponto Pro (EC
Bone-Anchored Hearing Aids

[p < 0.01], BN [p < 0.001], and RV [p < 0.01] subscales) and participant's own BAHS (BN [p < 0.01] and RV [p < 0.01] subscales) overall provided statistically significant benefit compared to unaided. Clinically significant benefit of 5% was present for the Ponto Pro compared to the participant's own BAHS and 10% for the Ponto Pro and the participant's own BAHS compared to unaided. The Ponto Pro's OM (p = 0.05), SDM (p = 0.05), and FDM (p < 0.01) were statistically significantly better than the Divino's OM. No significant differences existed between the Ponto Pro's OM, SDM, and FDM compared to the Divino's DM. The authors concluded that no statistically significant differences existed between unaided, OM, SDM, or FDM. Participants preferred the Ponto Pro compared to the participant's own BAHS and the Ponto Pro and participant's own BAHS compared to unaided. The RTS of the Ponto Pro's adaptive multi-channel DM was similar to the Divino's fixed hyper-cardioid DM, but the Ponto Pro's OM was statistically significantly better than the Divino's OM.

Bosman et al (2013) compared performance of a recently released sound processor for bone-anchored implants, the Ponto Pro Power from Oticon Medical (bone-conduction device 2 [BCD2]) with that of the BAHA Intenso from Cochlear (bone-conduction device 1 [BCD1]). Direct comparison of the subject's own device (BCD1) with the new device (BCD2) was examined in a non-randomized design. Subjects were initially tested with BCD1; BCD2 was tested after a 4-week acclimatization period. A total of 18 subjects with mixed hearing loss and with at least 4-month experience with BCD1 completed the study. Mean air-conduction and bone-conduction thresholds averaged across the frequencies of 500, 1,000, 2,000, and 4,000 Hz were 73.9 and 34.2 dB HL, respectively. Performance of the 2 devices was evaluated objectively by measuring aided free-field thresholds, speech perception in quiet, and speech perception in noise. A subjective evaluation was carried out with APHAB and the SSQ questionnaire. In addition, user experiences, user satisfaction, and device preference were obtained via proprietary questionnaires. Statistical significance was established with ANOVA and paired t-statistics with Bonferroni correction. Aided free-field thresholds and speech reception thresholds (SRTs) in quiet were not statistically significantly different for either device (p > 0.05). In contrast, SRTs in noise were 2.0 dB lower (p < 0.001) for BCD2 than for BCD1. APHAB questionnaire scores on all subscales provided statistically significantly greater benefit (p < 0.05) for BCD2 than for BCD1. Also, with the SSQ most items in the speech and sound quality domain were significantly more favorable (p < 0.05) for BCD2 than for BCD1. Finally, all subjects preferred BCD2 over BCD1 with 14 subjects reporting a strong preference and 4 subjects an average preference for the digital signal processing provided by BCD2 over previous technology provided by BCD1.

Hill-Feltham et al (2014) compared the performance of 2 new BAHAs with older BAHAs that were not fully digital. A total of 14 experienced BAHA users participated in this cross-over study. Performance of their existing BAHA was assessed using speech-in-noise testing and questionnaires. Participants were then fitted with either a Ponto Pro or a BP100 device. After 4 weeks of use with each new device, the same assessments were repeated. Speech-in-noise testing for the 50% signal-to-noise ratio (the ratio at which 50% of responses were correct) showed no significant differences between the Ponto Pro and the BP100 device (p = 0.1). However, both devices showed significant improvement compared with the participants' previous BAHA devices (p < 0.001). There were no significant differences between the 2 new devices in the questionnaire data. The authors concluded that both fully digital BAHAs demonstrated superior speech processing compared with the previous generation of devices. There were no substantial differences between the 2 digital devices in either objective or subjective tests.

Miscellaneous Information:

Kiringoda and Lustig (2013) summarized available peer-reviewed literature to describe the range and rate of complications related to osseo-integrated hearing aids in adult and pediatric patients. These investigators searched PubMed using the terms bone-anchored hearing aid for articles published in English between 2000 and 2011. They included all articles reporting complications rates, except those that were case reports, general review (not systematic review), or commentary, as well as those that did not include patient outcomes, that reported outcomes associated with non-standard implantation (e.g., 8.5-mm abutment) or were of poor study or reporting quality. After excluding articles that did not
meet criteria, a total of 20 articles were identified, comprising 2,134 patients who underwent a total of 2,310 osseo-implants. Complications reported in the literature were typically minor in nature. Skin reactions from Holgers Grade 2 to 4 ranged from 2.4 % to 38.1 %. Failure of osseo-integration ranged from 0 % to 18 % in adult and mixed populations, and 0 % to 14.3 % in pediatric populations. The rate of revision surgery ranges from 1.7 % to 34.5 % in adult and mixed populations and 0.0 % to 44.4 % in pediatric patients, whereas the total rate of implant loss ranged from 1.6 % to 17.4 % in adult and mixed populations and from 0.0 % to 25 % in pediatric patients. The authors concluded that overall, the quality of large scale and/or prospective studies reporting the incidence of complications after osseo-integrated hearing aid surgery is poor and lacks uniformity. However, based on available data, which shows a lack of major complications, osseo-integrated implantation is a safe procedure in both adult and pediatric populations. Moreover, they stated that well-designed, prospective studies with uniform reporting standards would allow greater comparison between techniques and more reliable analysis of complications of osseo-integration surgery of the temporal bone for cochlear stimulation.

Huber et al (2013) evaluated the functional performance of the Bonebridge (BB, MED-EL), a newly-designed transcutaneous bone conduction implant that allows the skin to remain intact and to compare it with the current clinical model of choice, a percutaneous bone conduction implant (BAHA BP100, Cochlear Bone Anchored Solutions AG). The devices were compared using 2 methods:

I. Measurements of cochlear promontory acceleration in 5 cadaver heads: Accelerations of the cochlear promontories on both ipsilateral and contralateral sides were measured using a Laser Doppler system, with free-field sound stimuli of 90 dB SPL in the frequency range of 0.3 to 10 kHz, and

II. Measurements of pure-tone sound field thresholds in 5 normally hearing human adult subjects under a condition of simulated hearing loss.

For the latter measurements, the devices were applied to the head using a Softband, and measurements were performed in the frequency range of 0.25 to 8 kHz. Within investigation comparisons (i.e., in cadavers or listeners) and a cross-comparison analysis of the cadaver and human results were done. Results from the cadaver heads showed that the cochlear promontory acceleration with the BB was higher within 10 dB on the ipsilateral side and lower within 5 dB on the contralateral side than the acceleration with the BAHA, in the frequency range of 0.7 to 10 kHz. The transcranial attenuation of the acceleration for the BB was greater than for the BAHA within 20 dB. For the sound-field threshold assessments with human subjects, the BB and BAHA showed similar threshold improvements of more than 10 dB HL for the ipsilateral side. For the contralateral side, the threshold improvement with the BB was less than with the BAHA, indicating better separation between ipsilateral and contralateral sides. The authors concluded that pre-clinical results implied that the BB has functional performance similar to the BAHA and could be beneficial to patients suffering with conductive and mixed hearing losses as well as for those with unilateral impairment. Based on these preliminary results, a carefully designed clinical trial with conservative inclusion criteria can be recommended.

### Appendix

<table>
<thead>
<tr>
<th>Replacement Parts</th>
<th>Life Expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batteries</td>
<td>72 per 6 months</td>
</tr>
<tr>
<td>Headband</td>
<td>1 per year</td>
</tr>
<tr>
<td>Processor</td>
<td>1 per 5 years</td>
</tr>
</tbody>
</table>

Adapted from: Wisconsin Department of Health and Family Services, 2005.
### CPT Codes / HCPCS Codes / ICD-10 Codes

**Information in the [brackets] below has been added for clarification purposes. Codes requiring a 7th character are represented by "+".**

**CPT codes covered if selection criteria are met:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>69710</td>
<td>Implantation or replacement of electromagnetic bone conduction hearing device in temporal bone [temporal bone stimulator] [Audiant Bone Conductor]</td>
</tr>
<tr>
<td>69711</td>
<td>Removal or repair of electromagnetic bone conduction hearing device in temporal bone [temporal bone stimulator] [Audiant Bone Conductor]</td>
</tr>
<tr>
<td>69714</td>
<td>Implantation, osseointegrated implant, temporal bone, with percutaneous attachment to external speech processor/cochlear stimulator; without mastoidectomy [bone-anchored hearing aid (BAHA), Ponto Pro]</td>
</tr>
<tr>
<td>69715</td>
<td>with mastoidectomy [bone-anchored hearing aid (BAHA), Ponto Pro]</td>
</tr>
<tr>
<td>69717</td>
<td>Replacement (including removal of existing device), osseointegrated implant, temporal bone, with percutaneous attachment to external speech processor/cochlear stimulator; without mastoidectomy [bone-anchored hearing aid (BAHA), Ponto Pro]</td>
</tr>
<tr>
<td>69718</td>
<td>with mastoidectomy [bone-anchored hearing aid (BAHA), Ponto Pro]</td>
</tr>
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</table>

**Other CPT codes related to the CPB:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>69550 - 69554</td>
<td>Excision aural glomus tumor</td>
</tr>
<tr>
<td>69660 - 69662</td>
<td>Stapedectomy or stapedotomy</td>
</tr>
<tr>
<td>92521</td>
<td>Evaluation of speech fluency (eg, stuttering, cluttering)</td>
</tr>
<tr>
<td>92522</td>
<td>Evaluation of speech sound production (eg, articulation, phonological process, apraxia, dysarthria)</td>
</tr>
<tr>
<td>92523</td>
<td>Evaluation of speech sound production (eg, articulation, phonological process, apraxia, dysarthria); with evaluation of language comprehension and expression (eg, receptive and expressive language)</td>
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<tr>
<td>92524</td>
<td>Behavioral and qualitative analysis of voice and resonance</td>
</tr>
<tr>
<td>92551 - 92557, 92558, 92567 - 92569, 92579, 92582 - 92587</td>
<td>Audiologic function tests</td>
</tr>
<tr>
<td>92626 - 92627</td>
<td>Evaluation of auditory rehabilitation status</td>
</tr>
<tr>
<td>92630 - 92633</td>
<td>Auditory rehabilitation</td>
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**HCPCS codes covered if selection criteria is met:**

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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>L8690</td>
<td>Auditory osseointegrated device, includes all internal and external components [Otomag Alpha 1(M) bone conduction hearing system]</td>
</tr>
<tr>
<td>L8691</td>
<td>Auditory osseointegrated device, external sound processor, replacement</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>L8693</td>
<td>Auditory osseointegrated device abutment, any length, replacement only [Otomag Alpha 1(M) bone conduction hearing system]</td>
</tr>
<tr>
<td>L8694</td>
<td>Auditory osseointegrated device, transducer/actuator, replacement only, each [Otomag Alpha 1(M) bone conduction hearing system]</td>
</tr>
</tbody>
</table>

**Other HCPCS codes related to the CPB:**

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<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>G0153</td>
<td>Services performed by a qualified speech-language pathologist in the home health or hospice setting, each 15 minutes</td>
</tr>
<tr>
<td>L8692</td>
<td>Auditory osseointegrated device, external sound processor, used without osseointegration, body worn, includes headband or other means of external attachment [excluded under plans that exclude coverage of hearing aids]</td>
</tr>
<tr>
<td>S9128</td>
<td>Speech therapy, in the home, per diem</td>
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<tr>
<td>V5008 - V5299</td>
<td>Hearing services</td>
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**ICD-10 codes covered if selection criteria are met:**

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<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>C30.1</td>
<td>Malignant neoplasm of middle ear</td>
</tr>
<tr>
<td>C44.201 - C44.299</td>
<td>Other and unspecified malignant neoplasm of skin of ear and external auricular canal</td>
</tr>
<tr>
<td>C47.0</td>
<td>Malignant neoplasm of peripheral nerves of head, face and neck</td>
</tr>
<tr>
<td>C49.0</td>
<td>Malignant neoplasm of connective and soft tissue of head, face and neck</td>
</tr>
<tr>
<td>D04.20 - D04.22</td>
<td>Carcinoma in situ of skin of ear and external auricular canal</td>
</tr>
<tr>
<td>D14.0</td>
<td>Benign neoplasm of middle ear, nasal cavity and accessory sinuses</td>
</tr>
<tr>
<td>D21.0</td>
<td>Benign neoplasm of connective and other soft tissue of head, face and neck</td>
</tr>
<tr>
<td>D22.20 - D22.22</td>
<td>Melanocytic nevi of ear and external auricular canal</td>
</tr>
<tr>
<td>D23.20 - D23.22</td>
<td>Other benign neoplasm of skin of ear and external auricular canal</td>
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<tr>
<td>H61.111 - H61.119</td>
<td>Acquired deformity of pinna [surgically induced malformations of external ear canal or middle ear]</td>
</tr>
<tr>
<td>H65.20 - H65.23</td>
<td>Chronic serous otitis media [severe]</td>
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<tr>
<td>H65.30 - H65.33</td>
<td>Chronic mucoid otitis media [severe]</td>
</tr>
<tr>
<td>H65.411 - H65.499</td>
<td>Other chronic nonsuppurative otitis media [severe]</td>
</tr>
<tr>
<td>H66.20 - H66.23</td>
<td>Chronic atticoantral suppurative otitis media [severe]</td>
</tr>
<tr>
<td>H66.3X1 - H66.3X9</td>
<td>Other chronic supplicative otitis media [severe]</td>
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<tr>
<td>H66.90 - H66.93</td>
<td>Otitis media, unspecified [chronic severe]</td>
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<tr>
<td>H80.00 - H80.93</td>
<td>Otosclerosis [causing hearing loss in persons who cannot undergo stapedectomy]</td>
</tr>
<tr>
<td>ICD-10 Code</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>H90.0 - H90.2</td>
<td>Conductive hearing loss</td>
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<tr>
<td>H90.41 - H90.42</td>
<td>Sensorineural hearing loss, unilateral, with unrestricted hearing on the contralateral side</td>
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<tr>
<td>H90.6 - H90.8</td>
<td>Mixed conductive and sensorineural hearing loss</td>
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<tr>
<td>L20.0 - L20.82, L20.84 - L20.9</td>
<td>Atopic dermatitis</td>
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<tr>
<td>L23.0 - L25.9</td>
<td>Allergic, irritant and unspecified contact dermatitis [external ear/hypersensitivity reactions]</td>
</tr>
<tr>
<td>L30.0, L30.2, L30.8 - L30.9</td>
<td>Other and unspecified dermatitis [external ear/hypersensitivity reactions]</td>
</tr>
<tr>
<td>Q16.1</td>
<td>Congenital absence, atresia and stricture of auditory canal (external) [congenital malformations of external ear canal]</td>
</tr>
<tr>
<td>Q16.3</td>
<td>Congenital malformation of ear ossicles [congenital malformations of middle ear]</td>
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<tr>
<td>Q16.4</td>
<td>Other congenital malformations of middle ear [congenital malformations of middle ear]</td>
</tr>
<tr>
<td>Q17.9</td>
<td>Congenital malformation of ear, unspecified [congenital malformations of external ear canal or middle ear]</td>
</tr>
</tbody>
</table>

**ICD-10 codes not covered for indications listed in the CPB:**

- H90.3, H90.5 | Sensorineural hearing loss [other than unilateral] |

*SoundBite Hearing System [e.g., intra-oral bone conduction hearing aids] [excluded under plans that exclude coverage of hearing aids]:*

No specific code

**ICD-10 codes not covered for indications listed in the CPB:**

- H90.0 - H93.93 | Hearing loss |

*Otomag Alpha 1(M) Bone Conduction Hearing System [e.g., partially implantable bone conduction hearing systems]:*

No specific code

**ICD-10 codes not covered for indications listed in the CPB:**

- H90.0 - H93.93 | Hearing loss |

- H90.A21 - H90.A22 | Sensorineural hearing loss, unilateral, with restricted hearing on the contralateral side |

The above policy is based on the following references:

2. Tjellstrom A, Hakansson B. The bone-anchored hearing aid. Design principles, indications, and...
Bone-Anchored Hearing Aids


3. Ontario Ministry of Health and Long-Term Care, Medical Advisory Secretariat. Bone anchored...


Bone-Anchored Hearing Aids

67. Weber PC. Sudden sensorineural hearing loss. Last reviewed February 2014. UpToDate Inc., Waltham, MA.
AETNA BETTER HEALTH® OF PENNSYLVANIA

Amendment to
Aetna Clinical Policy Bulletin Number: 0403 Bone-Anchored Hearing Aids

There are no amendments for Medicaid.