

An international study reveals the benefits of Oticon Medical's bone anchored sound processor Ponto™

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Oticon Medical introduced a bone anchored sound processor called Ponto in 2009. Following its international release, it was evaluated in a qualitative clinical study by 31 patients who are users of the device and 10 audiologists who fitted the device. The patients were new as well as experienced users of a bone anchored hearing device. The performance (speech understanding, listening effort, sound quality and acoustic feedback), form factors (design and usability), usage, satisfaction and overall performance of Ponto were rated via questionnaires. Patients who are experienced users of a bone anchored device compared Ponto with their own devices along the before mentioned outcome attributes. Results indicated better ratings by patients and audiologists with Ponto than with patients' own devices.

Introduction

In 2009, Oticon Medical introduced a bone anchored hearing solution called Ponto. The Ponto sound processor is powered by the latest generation chip with advanced features designed to meet patient needs.

In an earlier internal evaluation of Ponto, patients compared the performance of Ponto with their own bone anchored device. Their own devices were technically verified to ensure that they were functioning in accordance with manufacturer's specifications. Following evaluation of the devices in their daily listening environments patients rated speech understanding to be better with Ponto than with their own devices in easy as well as in difficult listening environments. The speech in noise test further supported the findings of the real world evaluation. An improvement of 2.7 dB in the signal to noise ratio (SNR) was noted when comparing Ponto in the omni-directional setting with patients' own devices. With Ponto in the directional setting, there was a 2.8 dB SNR advantage over its performance in the omni-directional setting.¹

The purpose of the present study was to gain deep insights into initial clinical experiences with Ponto from the perspective of both the patients and audiologists. The performance, sound quality, form factors, satisfaction and overall preference were investigated.

Method

Participants

A total of 31 patients (5 new patients and 26 patients who have had previous experience with bone anchored devices) from 6 countries (Denmark, Netherlands, Norway, Sweden, United Kingdom, and the United States) and 10 audiologists participated in the study.

Patients ranged in age from 13 to 78 years (mean of 55 years). 20 patients had a conductive or mixed hearing loss and 11 patients had a profound unilateral sensorineural hearing loss. With an exception of 3 patients, all were monaurally fitted with a bone anchored device. The average AC and BC hearing thresholds for the conductive/mixed patients' implanted side are shown in figure 1. The average air conduction thresholds of the good ear of the patients with profound unilateral sensorineural hearing losses (all Single-Sided Deafness) are shown in figure 2.

Participants were selected for this study for a variety of reasons. Some were selected because they were good at reporting their experiences with bone anchored devices, or their audiologists wanted to try Ponto in order to drive it to its maximum gain level. There were also patients who participated in the study because they needed a new bone anchored device.

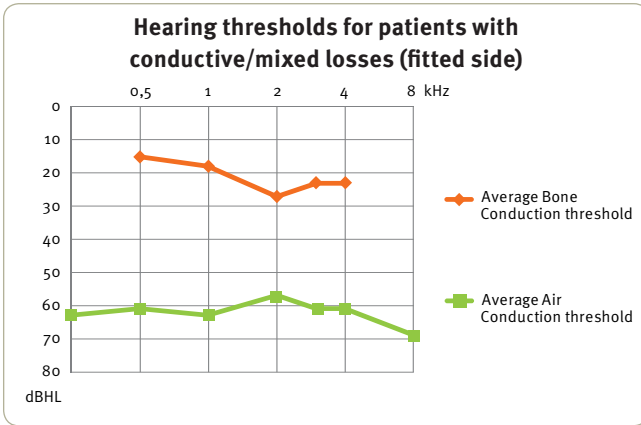


Figure 1. Average AC and BC thresholds for the group of patients with conductive/mixed hearing losses. Thresholds for fitting side is illustrated.

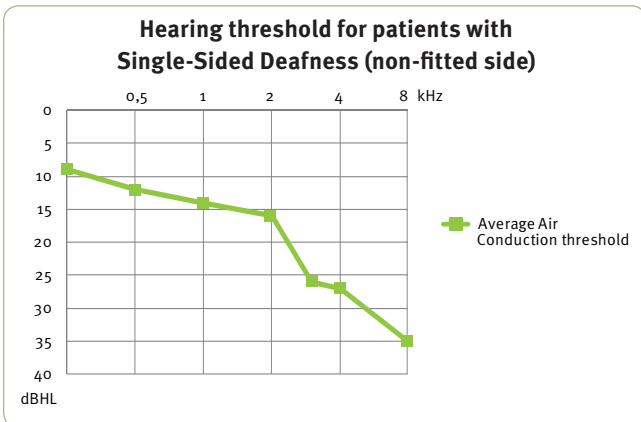


Figure 2. Average AC thresholds for the patient group with profound unilateral sensorineural hearing losses; thresholds are for their good ear.

Bone anchored devices and fitting method

The experienced patients' own devices were from Cochlear and comprised the following: 19 Divino, 4 Compact, 3 Classic and 3 Intenso. 50 % of the experienced patients' own devices were under 1-2 years old; 75 % of the patients had devices which were under 3-4 years old.

All except one patient were fitted with the Ponto Pro sound processor. Devices were fitted in accordance with the recommended fitting procedure using the Oticon Medical Genie Medical 2009.1 fitting software.

After evaluating Ponto for 2-4 weeks in the real world, patients filled out a questionnaire.

Questionnaire

Qualitative ratings of Ponto by patients and audiologists were obtained via a questionnaire consisting of both closed and open set questions. The descriptors used in the rating scales completed by new patients were different from those completed by experienced patients although both groups used a 5-point rating scale.

Experienced patients were required to compare Ponto with their own bone anchored device by selecting one of the following descriptors: 1) much better with old device; 2) somewhat better with old device; 3) cannot tell a difference; 4) somewhat better with new device, or 5) much better with new device. New patients were asked to rate Ponto with one of the following descriptors: 1) very difficult; 2) difficult; 3) somewhat easy; 4) easy; 5) very easy. In the open-set questions, patients were asked to list 3 reasons for preferring one device over the other.

The 10 audiologists who participated in the study rated their patients' performance and the fitting process of Ponto using a questionnaire that contained the following 5 point rating scale: 1) poor; 2) below average; 3) average; 4) above average; 5) excellent. The ratings for the patients' performance were separate for conductive/mixed and Single-Sided Deafness.

Results

1. Results of Ponto's performance

1.1 Ratings of speech understanding

More than 85 % of all patients report that overall speech understanding is 'much better/very easy' or 'better/easy' with Ponto compared to their own devices. The perceived improvements in speech understanding is reported by the majority of the patients in all of the following listening situations: 'in quiet', '(general) in noise', 'in noise with speaker on implant side', 'in noise with speaker on non-implant side' and 'understanding at a distance'. 60 - 80 % report speech understanding to be 'much better/very easy' or 'better/easy' with Ponto compared to their own devices in each of the above-mentioned listening situations (see figure 3).

Similar results were noted in the internal evaluation of Ponto, in the omni-directional mode speech intelligibility improved by 2.7 dB (or by 27 %) with Ponto over their own devices.¹

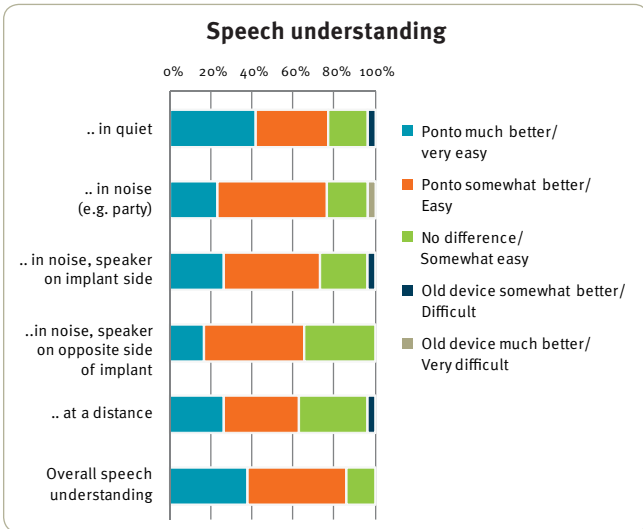


Figure 3. All patients' report on understanding speech in a variety of listening situations and overall (N=31).

1.2 Ratings of listening in complex listening situations and effort

About 67 % of all patients reported that it was 'much easier' or 'easier' with Ponto to ignore other sounds when trying to listen to somebody, and it was 'much easier' or 'easier' to follow both a conversation as well as to watch TV at the same time. The majority of all patients (83 %) reported that it took less effort to listen with Ponto.

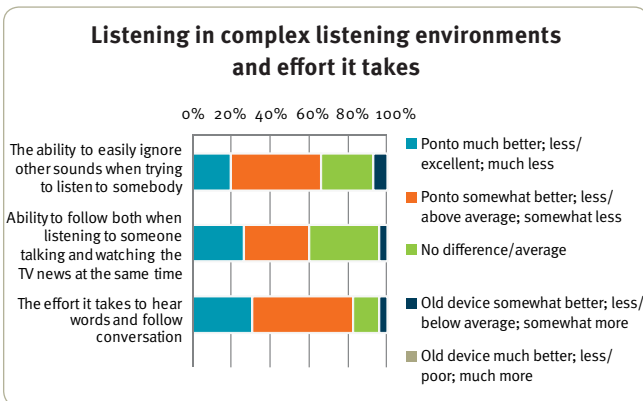


Figure 4. All patients' report on listening in complex listening environments and the effort it takes (N=31).

1.3 Ratings of sound quality and listening to music

Another noteworthy finding besides speech understanding is the perceived sound quality of the device. All experienced

patients (with one exception) report that the sound quality is 'much better' (64%) or 'better' (32 %) with Ponto. Listening to music is also 'much better' or 'better' for the vast majority of the patients (80 %).

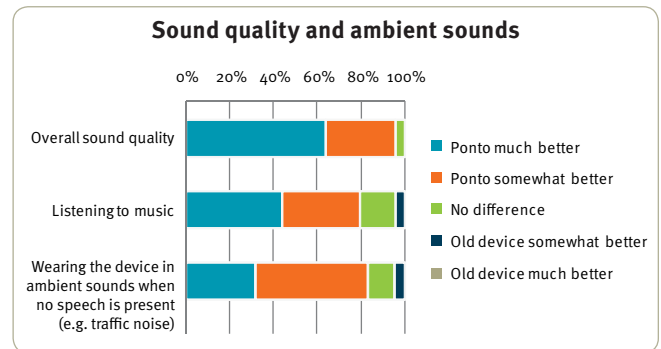


Figure 5. All experienced patients' report on sound quality, listening to music and ambient sounds (N=25).

Sound quality is a key consideration to the acceptance and user satisfaction.² To a large extent it is determined by the sophistication of the chip in the sound processor. Ponto is building on the RISE platform which also is used in the advanced Oticon hearing instruments Epoq and Dual. The Epoq product test also revealed high ratings on sound quality, amongst the 58 test subjects the most often mentioned reason for choosing Epoq was related to better sound quality.³

1.4 Ratings of listening in ambient noise

84% of all experienced patients reported that Ponto was 'much better' or 'better' when wearing it in ambient noise when no speech is present (e.g. in traffic noise), and 4 out of 5 new patients report Ponto to be 'very comfortable' or 'comfortable' in these situations.

These situations cover both situations with and without wind noise, and therefore Ponto's Tri-state noise reduction system as well as the wind noise reduction system comes into play. In situations where there is no wind, the Tri-state noise reduction system is active; if wind is present then Ponto's wind noise reduction system takes over. The wind noise reduction system can apply more attenuation than the Tri-state noise reduction system can. The amount of attenuation applied depends upon the amount of wind noise; the more wind noise the more attenuation.

The findings of the internal evaluation of Ponto with respect to wind noise were similar to that of the present study. Most patients were reported to have removed their own bone anchored devices (or turned it off) when they encounter wind noise but not with Ponto; wind noise was less of an annoyance when wearing Ponto.¹

1.5 Ratings of feedback tendency compared to patients' own devices

76 % of experienced patients reported that Ponto was 'much better' or 'better' when it came to acoustic feedback. In other words they experienced less feedback problems with Ponto. Bearing in mind that half of the patients' previous devices were under 2 years old, one might therefore expect that the previous devices' coupling are not worn out. If the coupling was worn out it would be loose and increase the feedback tendency.

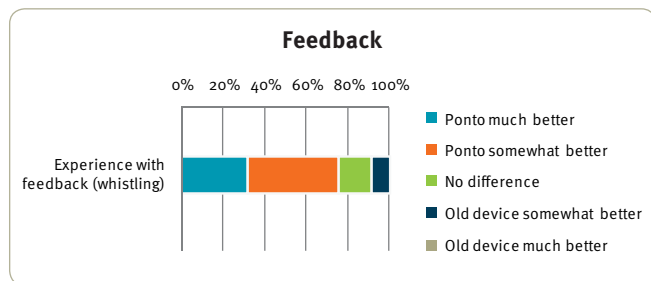


Figure 6. Experienced patients' report about feedback (N=25).

With Ponto the patients with profound unilateral sensorineural hearing losses (Single-Sided Deafness) have significantly more high frequency gain than they got from their own devices that provided limited fitting flexibility. One could therefore expect feedback problems to occur more frequently for this particular patient group when wearing Ponto. However, this does not seem to be the case. The vast majority (76 %) of the experienced patients with profound unilateral hearing loss reported Ponto to be 'much better' or 'better' with regard to feedback.

2. Results of Ponto's usage and form factors

2.1. Usage

More than 80 % of all patients reported using Ponto more than 8 hours per day. 62 % of experienced patients reported using Ponto more than their own device. 31 % reported using Ponto just as much as their own device.

2.2 Handling and connecting / disconnecting the device

10 of the 26 experienced patients (38 %) reported it was 'much easier' or 'easier' to handle and operate Ponto; 7 reported no difference and the remaining 9 found it 'easier' or 'much easier' to operate the old device.

Ponto connects on the outside of the abutment while the patients' own devices connect on the inside. The majority (54%) reported Ponto was 'easier' to connect to and disconnect from the abutment. Even though the patients were used to connecting on the inside of the abutment with their own devices, most patients found it easier to connect on the outside. However there were 35% of patients who still found it 'much easier' or 'easier' to connect their own device to the abutment.

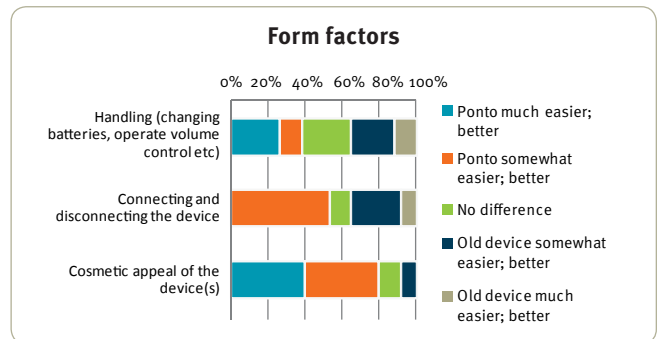


Figure 7. Experienced patients' report on handling, connecting/ disconnecting the devices and cosmetic appeal (N=26).

2.3 Cosmetic appeal

The vast majority (80 %) of the experienced patients found Ponto to be more cosmetically appealing than their own device. 3 out of the 5 new patients reported Ponto as being cosmetically 'attractive' while 2 reported the cosmetic appeal to be 'average' (neither attractive nor unattractive).

3. Results of user satisfaction and overall preference

3.1 Ratings of satisfaction

The overall satisfaction with Ponto was indeed high. 89 % of all patients reported as being 'very satisfied' or 'satisfied' with Ponto. 96 % of the experienced patients preferred Ponto over their previous device, 1 of the 3 patients fitted with Intenso preferred the Intenso over Ponto.

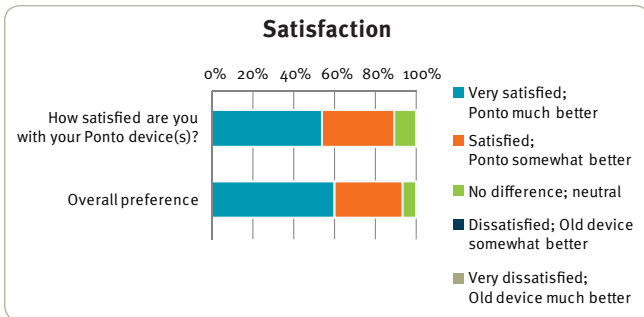


Figure 8. All patients' reported satisfaction and overall preference.

3.2 Reasons for preferring Ponto

The last two questions dealt with patients' preference and the reasons for their preferences. The answers to the open-set question on the 3 main reasons for preferring one device over the other can be broadly categorized into 7 areas; improved speech understanding, better sound quality, easier to handle, less noise, less problem in wind, cosmetic appeal and others.

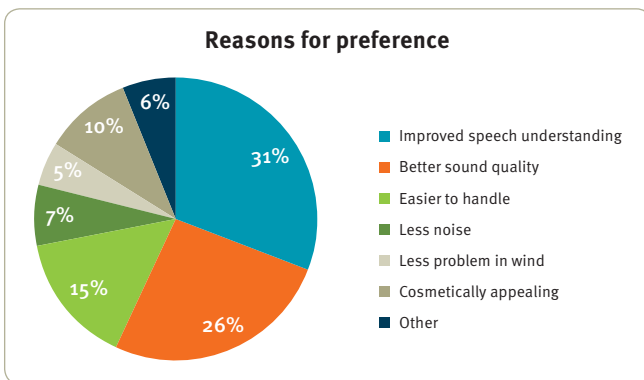


Figure 9. Distribution of factors which impact the patients' reasons for preferring Ponto (N=30). Each patient could list up to 3 reasons.

The main reasons for preferring Ponto are 'Improved speech understanding' and 'Better sound quality' regardless of the type of hearing loss. 23 patients (74 %) cited improved speech understanding as the reason. Some of the reasons given were as follows: "I can more easily follow speakers and be social – compared to previously"; "(My) hearing (is) improved in group, (I'm) able to follow conversations much better"; "Able to hear people on my left side"; "Listening to people speaking (is) much improved". Better sound quality as the main reason was cited by 20 patients (65 %); some were quoted as saying:

"The sound is clearer", "The sound is more natural", "The sound is more nuanced now", and "Sound quality improved much on all settings".

The third frequent reasons to preferring Ponto over own device relate to operating the Ponto device. For instance, patients reported that Ponto was "Easy to use", "Easier to change volume (i.e. just one touch)" and "Easier to put it on".

7 % of the reasons are related to experiencing less noise with Ponto in general. Patients reported the following: "Reduced background noise", "More comfortable", "Filters out undesired sounds/noise". These statements could be attributed to the advanced features (Tri-state noise reduction and Automatic multiband adaptive directionality) that work seamlessly in Ponto. 5 % of reported reasons for preferring Ponto were related to fewer problems with wind noise. Wind noise is a big problem for many patients with bone anchored devices; they often turn off the device when in windy weather as they find the noise generated in the device to be bothersome and annoying.¹ Patients were noted to say: "Better outdoors", "Doesn't cause so much feedback and noise when out in the wind", "Less problems in wind" with Ponto.

10 % of the reported reasons relate to the cosmetic of the device. 7 patients reported cosmetic appeal as the third most important reason for preferring Ponto. According to them Ponto was "Cosmetically pleasing", had "Nicer design and color", and was "Closer to skin and less prominent".

Amongst other reasons for preferring Ponto were "Less feedback", "Better localization".

3.3 The differences between patients with conductive/mixed and profound unilateral sensorineural hearing losses

The hearing pathways for patients with conductive/mixed hearing losses differ from that of patients with profound unilateral sensorineural hearing losses (Single-Sided Deafness). While unilateral deaf patients with a bone anchored device on the deaf side hear signals coming from both sides of the head to one functioning cochlea, patients with conductive/mixed hearing losses would receive signals in both cochlea. In the present study, patients with conductive/mixed hearing loss had significant hearing loss on the non-implanted side; they were monaurally fitted and were therefore monaurally hearing. The different pathways warrant different amplification strategies. These differences could potentially result in vastly

different reports of Ponto's performance in terms of speech understanding and sound quality. However, this did not seem to be the case; the reports on Ponto are very similar for both types of hearing loss. Patients with conductive/mixed hearing loss reported similar improvement with Ponto over their own devices as their Single-Sided Deafness counterparts.

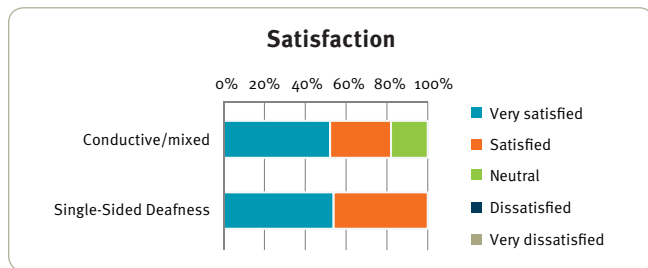


Figure 10. Reports on 'satisfaction' with the two patient groups: Profound unilateral sensorineural hearing loss and conductive/mixed hearing loss.

4. Results of audiologists' perception of Ponto

The audiologists' perception of their patient satisfaction with Ponto concurred with that of patients' perception. All audiologists found that patients with profound unilateral hearing losses fitted with Ponto were either 'very satisfied' or 'satisfied'; and all but one audiologist found that patients with conductive/mixed hearing loss were either 'very satisfied' or 'satisfied' with Ponto.

The 10 audiologists' perception of speech understanding in quiet and noise were consistent with the patients' ratings. A similar agreement was also noted for sound quality.

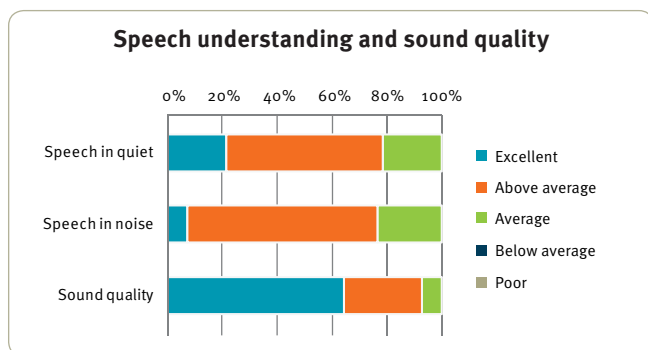


Figure 11. Audiologists' perception of patients' speech understanding and sound quality.

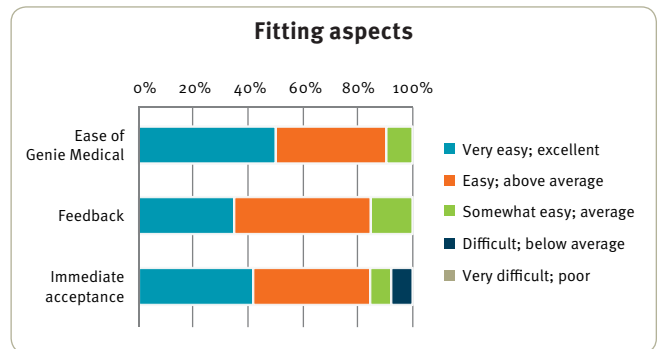


Figure 12. Audiologists' report on ease of fitting, tendency to feedback and patients' immediate acceptance.

9 out of the 10 audiologists reported that it was 'very easy' or 'easy' to fit Ponto with the Genie Medical fitting software. In more than 80 % of the fittings the audiologists reported Ponto to be 'excellent' or 'above average' with respect to feedback and that the immediate acceptance was 'excellent' or 'above average'. All in all, Ponto was an easy device to fit.

Discussion

The results of the present study revealed improvements in speech understanding in a variety of complex listening situations, listening effort, sound quality and in handling aspects for most patients with Ponto compared to their own devices. The clinical nature of the present study provides audiologists with a deep insight into what they can expect when upgrading patients from their own devices to Ponto. There is a risk that the present study may bear an inherent bias; experienced patients may expect the newer Ponto devices to perform and feel better than their older own devices. Reports from audiologists were included in the study to obtain the clinicians' perspective on the benefits Ponto could bring to their patients. The audiologists' perception of Ponto concurred with the ratings provided by patients' on all aspects of the devices' performance, usability and design. This further strengthens the validity and credibility of the improvements noted in performance and form factors by patients wearing Ponto and their own devices.

In a short space of time, bone anchored devices have gone from being simple amplifiers to sophisticated sound processors. The RISE chip used in Ponto allows for Ponto a 10 kHz bandwidth, a 15-channel processing capability and 10-band frequency response flexibility. The advanced signal processing technology of Ponto includes detectors and algorithms that result in improvements in speech intelligibility and in sound quality. Ponto is also designed to reduce listening effort and discomfort from strong background noise and specifically wind noise.

Treatment with bone anchored devices has been proven in numerous studies^{4,7} back when technology and fitting flexibility were very limited. Ponto offers significant improvement to patients who already gain benefit from a bone anchored device. The key questions to ask are: (1) How will Ponto add value and benefit to the treatment of patients who are good candidates for bone anchored solutions, (2) What's the impact of Ponto on patients' performance, (3) How does Ponto positively influence the quality of life of patients who wear them, (4) How does Ponto help patients remain active in their jobs, and, (5) Can more patients benefit from bone anchored devices.

The results of the present study indicated that the gain prescriptions used for the different patient groups were appropriate. The prescription of compression in Ponto is based on the NAL-NL1 formula.⁸ Patients with normal functioning cochlea should be provided with linear gain; hence no compression for patients with conductive hearing losses. Patients with cochlea hearing losses (mixed hearing losses) would benefit from compression as prescribed by the NAL-RP formula for mild sensorineural hearing losses.

Patients with profound unilateral sensorineural hearing losses are – compared to patients with conductive hearing losses – prescribed more high frequency gain and less low frequency gain. On the one hand, the high frequency signals from the bone anchored device are subjected to intracranial damping resulting in considerable attenuation as they reach the contralateral side. This phenomenon is known as transcranial attenuation (TA). For this reason, it is desirable to compensate for TA by providing additional high frequency gain. The low frequency signals, on the other hand, have longer wavelengths, and therefore, are able to bend around the head and reach the contralateral ear without the attenuation typically seen with high frequency sounds due to head shadow effect. Providing as much low frequency gain as for conductive hearing losses is therefore unnecessary.

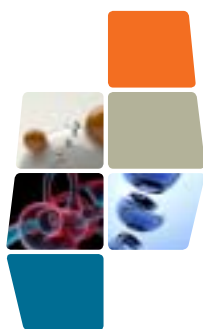
Conclusion

In the present international study a total of 31 patients from 6 countries and 10 audiologists qualitatively rated the Oticon Medical Ponto sound processor in terms of performance, sound quality, form factors, usability, user satisfaction and overall preference. Results showed that Ponto was rated better than patients' own devices in all of the above mentioned categories. Not only did Ponto fare better in terms of speech understanding and sound quality. Ratings of user satisfaction and preference were also highly in favor of Ponto. A survey of the perception of audiologists further supported the performance, design and functional advantage of Ponto over patients' own devices as well as the ease of fitting.

We would like to thank all the audiologists and patients for their participation in this study.

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