WHITEPAPER
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The Oticon VAC+ fitting rationale

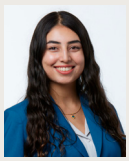
ABSTRACT

Voice Aligned Compression (VAC+) is Oticon's proprietary hearing aid fitting rationale, developed alongside Oticon's hearing aid hardware and signal processing technologies. VAC+ is a living, breathing fitting rationale that continues to grow with the latest technological advancements. This allows for seamless integration with key features related to noise suppression, feedback prevention, open sound processing, and handling of transient sounds. Designed to prioritize natural sound quality, comfort, and ease of adaptation, VAC+ maximizes audibility while minimizing the risk of distortion or discomfort. It supports a wide range of audiometric profiles, including steeply sloping and asymmetrical losses, and is compatible with modern acoustic coupling solutions such as open fittings.

As the default fitting rationale in Oticon's Genie 2 software, VAC+ is a modern, flexible and clinically effective fitting rationale designed for an optimal first fit. Despite its clinical relevance, information about VAC+ (its history, development, and benefits) has not been widely disseminated. Further, there is a common belief that generic fitting rationales may allow for better fittings for various reasons including standardization across devices, validation independent of manufacturers, and widespread use in audiology education.

This white paper provides a detailed overview of VAC+ as well as a recent clinical investigation conducted on eight new hearing aid users, each fit with both VAC+ and a widely used generic fitting rationale, NAL-NL2, to make comparisons between the qualitative and quantitative outcomes. The findings support the fact that there is no significant difference between VAC+ and NAL-NL2, with regard to access to speech cues. VAC+ even outperformed NAL-NL2 when it comes to overall subjective hearing experience.

AUTHOR



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Introduction

What is the right amount of amplification for an average hearing aid user? How much gain is appropriate as a starting place for their specific hearing loss, daily listening environments, and speech understanding? These are important questions in audiology and fitting rationales in hearing aids provide answers. Fitting rationales are scientifically derived algorithms used to guide the gain and output characteristics of a hearing aid, based on the hearing aid user's audiogram, individual characteristics, and other auditory needs. Though different rationales prioritize varying aspects, they all – in some form or another – aim to restore audibility of speech and environmental sounds, provide comfort in loud settings, preserve sound quality and speech intelligibility, and protect residual hearing by avoiding over-amplification (Powers et al., 2014).

When conducting a hearing aid fitting, hearing care professionals (HCPs) have the autonomy to select a generic fitting rationale (one that is not specific to a hearing aid manufacturer) or a proprietary fitting rationale (one that is developed by a hearing aid manufacturer for their specific technology).

Generic fitting rationales, such as NAL-NL2 (Keidser et al., 2011), NAL-NL1 (Byrne et al., 2001), and DSL v5.0 (Scollie et al., 2005) have benefits in that they offer a standardized approach to fittings, typically being available in most manufacturers fitting software. However, Kitterick and Edwards (2025) have described some limitations to the use of generic formulas, including the length of time from development to revision. Such lags mean that the validation of generic formulas is generally performed on non-contemporary hearing aid technology. For example, in the case of NAL-NL2, the formula was reported to have been validated on hearing aid technology from 2010 and was designed to optimize speech in quiet (as opposed to optimizing for speech in noise, the most common complaint of hearing aid users (Hearing Industries Association, 2022)).

The proprietary fitting rationale from Oticon is called Voice Aligned Compression (VAC+). Throughout its 20-year history, it has been adjusted to maximize benefit from developments in Oticon hearing aid hardware, signal processing strategies, and added features. VAC+ is supported by continuous development and is synergistic with Oticon's advancing hearing aid innovations.

This paper presents an overview of Oticon's proprietary VAC+ to ensure that professionals are aware of its potential advantages. This overview will include the theoretical foundations, prescriptive strategies, and clinical applications of VAC+. In particular, the unique approach of VAC+ to address gain prescription, loudness management, and speech intelligibility will be addressed. Additionally, results from a pilot study are presented, examining audibility (aided SII calculated from real-ear measurements), user performance, and preference of VAC+ compared to a generic fitting algorithm (NAL-NL2). Findings suggest that VAC+ demonstrated audibility comparable to NAL-NL2 and, for some patients, shows superior outcomes in user satisfaction and real-world benefit. These results support the potential for broader clinical adoption of VAC+ for adults by hearing care professionals.

Advantages of VAC+

Co-development and a holistic approach

VAC+ is unique in that it has been developed alongside Oticon's hearing aid hardware and signal processing technologies. This co-development ensures seamless integration with advanced features such as feedback prevention, sudden sound balancing, open sound processing, and noise suppression. This allows VAC+ to effectively manage complex acoustic environments, enhancing the user's ability to focus on relevant sounds while minimizing unwanted and non-meaningful sound.

We are constantly evaluating the entire signal processing package and adjusting where needed to optimize the capabilities of the technology, to continue providing the best experience for the user.

Precision in output limiting

A key strength of VAC+ is its use of Loudness Discomfort Levels (LDLs) and Uncomfortable Loudness Levels (UCLs) to set precise output limit levels. VAC+ has its own approach that allows us to utilize the full capability of Oticon hearing aids in the most suitable way, considering both user perception and the technical capabilities of the platform. We prevent discomfort from excessively loud sounds while preserving sound quality, even near the threshold of discomfort, ensuring that the user benefits from both comfort and sound clarity.

Customizable to individual needs
VAC+ offers a range of customizable options that allow clinicians to tailor the hearing experience to each user's unique preferences. The Soft Speech Booster enhances the audibility of softly spoken speech and subtle environmental sounds, while the Brightness Adjustment feature provides fine control over high-frequency gain. These tools enable a more personalized and natural listening experience, designed to improve user satisfaction and speech understanding in quiet environments.

Summary of VAC+ benefits

- Philosophy: VAC+ emphasizes natural sound processing, preserves spatial cues, and aims to ease listening effort
- Gain prescription: VAC+ prescribes less gain than some generic fitting rationales, particularly in higher frequencies, to maintain sound quality and comfort, but without compromising access to speech cues. This allows for a more natural listening experience, particularly in complex sound environments
- Signal processing integration: VAC+ is tailored to Oticon products and optimized for the brand's technologies and product-specific features. It works seamlessly alongside MoreSound Intelligence™, open sound processing, and feedback prevention systems
- Clinical application: VAC+ is the default fitting rationale in Oticon Genie 2 and provides a first-fit experience that utilizes platform-specific features. It is a living, breathing rationale that, over time, ensures the best possible first fit with our products
- User experience: VAC+ is designed to be an easy rationale to adjust to due to its softer gain prescription and integration with Oticon's real-time processing strategies

Support for complex audiograms
VAC+ is engineered to accommodate a wide variety of audiometric profiles, including minimal hearing losses, steeply sloping and reverse slope losses, asymmetrical hearing losses, and mixed conductive losses. This versatility ensures that users with complex hearing needs receive appropriate amplification and processing, allowing for better outcomes in real-world listening situations.

Compatibility with modern acoustic coupling
VAC+ supports a range of modern acoustic coupling options, including open fittings. This flexibility allows for more comfortable and cosmetically appealing solutions, particularly for users with mild to moderate hearing loss.

Continuous validation of VAC+

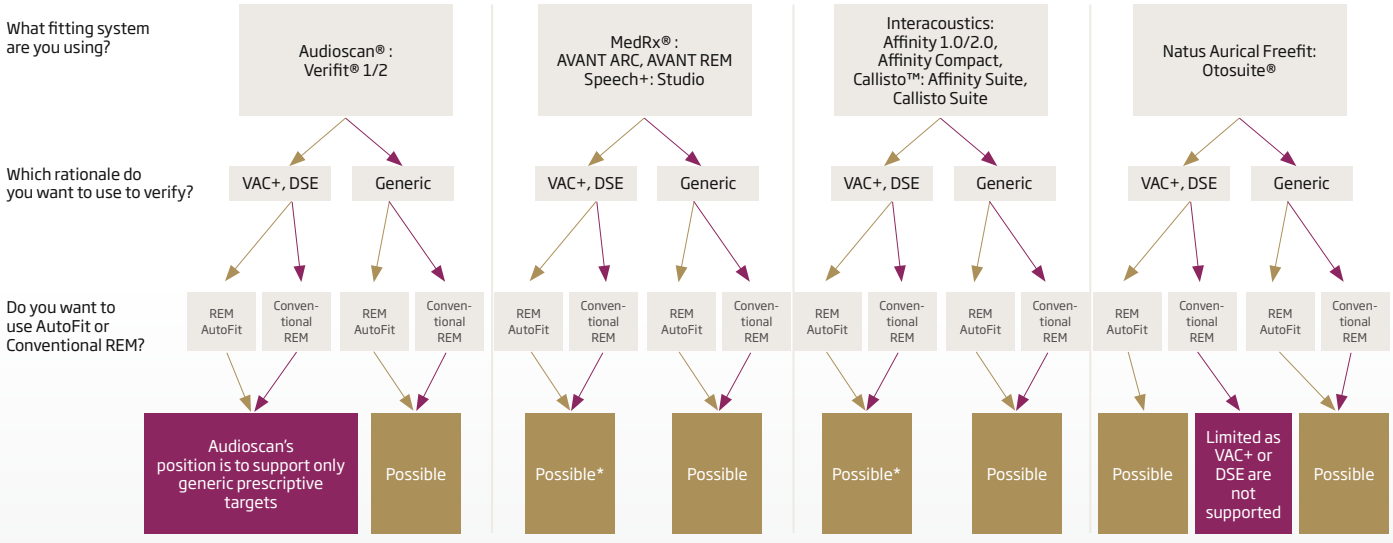
Generic fitting rationales are often validated on hearing aids that are quickly outdated, and being generic in nature, the rationales are not necessarily designed to take full advantage of the unique processing strategies of specific hearing aids. In contrast, VAC+ undergoes continuous and rigorous internal testing across different Oticon hearing aid platforms and different user groups as new technologies are developed. This ongoing validation ensures that VAC+ remains relevant, effective, and finely tuned to the capabilities of modern Oticon hearing aid technologies.

With every major release of a new Oticon hearing aid platform, VAC+ is subjected to a structured testing process. This begins with small-scale development tests designed to assess how VAC+ performs in conjunction with the new platform hardware and signal processing capabilities. These early evaluations help identify necessary adjustments to maintain optimal performance. Initial testing phases often include controlled field tests simulating real-world listening environments and providing valuable insights into user experiences. Additionally, participants may engage in at-home testing over the course of a week, offering feedback on their experiences with the hearing aids in their daily lives. Once the platform has matured, a larger-scale field test is conducted to validate the audiological performance of VAC+. These studies typically involves a cohort of users in real-world settings, complemented by laboratory-based testing with users. This comprehensive approach ensures that VAC+ is not only theoretically sound, but also practically effective for a wide range of users and listening environments on a continuous basis.

Clinical verification of VAC+: Measuring hearing aid output

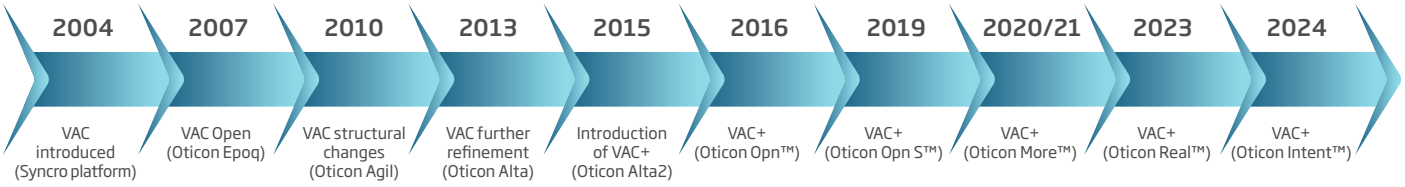
Achieving the best possible first fit is crucial to optimize the user experience and overall outcomes. Real-ear measurements (REMs) are the best practice for ensuring that hearing aids can provide the gain and output prescribed by fitting rationales (Schmidt et al., 2017). This is also the case for proprietary rationales. There are many ways for HCPs to verify VAC+ gain targets using REM. An overview of current manual and automated VAC+ target options for hearing aid fitting diagnostic eqiupment as shown in Table 1.

As an alternative or complementary to matching frequency-specific targets, hearing care professionals may consider using a metric focused on estimating audibility for speech, such as the aided Speech Intelligibility Index (SII), (ANSI, R2020) to guide verification (Wiseman et. al., 2025). By presenting a calibrated speech signal, modern real-ear measurement systems can provide a calculation of speech intelligibility via the SII. The SII estimates how much speech information is accessible to the patient, and research supports its utility in assessing hearing aid benefit across different fitting rationales (Dao, et al, 2021; Scollie, 2018; Scollie et al., 2016). By focusing on audibility outcomes, clinicians can verify speech access and support evidence-based patient care, even if the rationale gain targets are unavailable in the verification system.



**To perform conventional REM with VAC+ or DSE, the latest version of the REM module needs to be launched from the REM tool in Oticon Genie 2. The Dynamic Speech Enhancement (DSE) rationale is available with Oticon Xceed and Oticon Xceed Play.*

Figure 1. Overview of current manual and automated VAC+ target options for diagnostic verification of hearing aid gain



The Evolution of VAC+

The evolution of VAC+ demonstrates a consistent commitment to preserving speech intelligibility, user comfort, and restoring loudness (particularly in the lower-mid frequencies). Over the course of many years, the rationale has maintained a stable prescriptive philosophy, with notable innovations along the way. The following summary of the history of VAC+, from 2004 to 2024 shows how ongoing adjustments of an algorithm can be optimized to take the greatest advantage of developments in hearing aid processing and physical form.

2004: VAC introduced (Syncro platform)

The Syncro platform marked the first application of the VAC rationale. Derived from an existing prescription used by Oticon at the time and with a strong foundation based on the loudness growth model by Buus & Florentine (2001) , and in collaboration with the Eriksholm Research Centre, this was the foundation for Oticon's unique fitting rationale. It was designed with the objective of restoring natural loudness perception while ensuring the preservation of high sound quality (SQ) and speech intelligibility (SI).

2007: VAC Open (Oticon Epoq)

With the introduction of the RISE platform, Oticon Epoq extended the VAC rationale with two updates. The first was to provide a gain adjustment for minimal hearing loss, providing a bit more gain to ensure audibility. The second was to accommodate open dome fittings through the development of VAC Open. In contrast to the standard VAC, VAC Open provided less gain for mild losses and imposed a limitation of the gain for severe losses to balance delivering audibility without the risk of feedback due to the open fit. The fitting rationale was automatically applied when open domes were selected in a fitting and includes acoustic transparency at frequencies below 1kHz; that is, the fitting is acoustically transparent to maximize natural sound quality.

2010: Structural changes (Oticon Agil)

The RISE 2 platform retained the core VAC rationale, with structural changes to streamline gain estimation. These adjustments were primarily technical and did not alter the underlying prescriptive intent of VAC.

2013: Further refinement (Oticon Alta)

Oticon's Inium platform continued the use of VAC with minor modifications tailored to new hearing aid styles. While the core rationale remained unchanged, these changes ensured compatibility with updated form factors and user interface designs.

2015: VAC+ (Oticon Alta2)

With Oticon's Inium Sense platform came the updated VAC+ fitting rationale, leveraging a more powerful anti-feedback system than VAC. This allowed for lowering the high-frequency knee points, which were previously raised to prevent feedback, while still increasing gain at medium input levels to maintain speech clarity. An existing earlier system of five sub-rationales based on 'listening distance' was simplified into this singular rationale, with distance-related adjustments now handled through a Soft Sound Perception trimmer. Additionally, the existing specially formulated VAC+ prescription for precipitously sloping hearing loss configurations (known as "ski slope hearing losses") was refined to prevent large gain shifts from minor changes in hearing thresholds, resulting in more stable and consistent fittings.

2016: VAC+ (Oticon Opn)

With the release of Oticon Opn, the VAC+ rationale was updated to align with the new Velox™ platform and the open sound experience with open sound processing. A key improvement was the introduction of a unified, style-independent VAC+ target display in the Genie 2 fitting software, which replaced the previous system where each hearing aid style had its own correction factors. The new approach removed the influence of acoustic leakage and ventilation effects from the target display, simplifying fittings and improving consistency. Additionally, VAC+ was made available across all premium-tier Oticon Opn hearing aids.

2019: VAC+ (Oticon Opn S)
VAC+ was updated to support the fitting flexibility that was added with the introduction of Oticon's feedback prevention technology, OpenSound Optimizer™. Furthermore, the special VAC+ prescription for steeply sloping high-frequency hearing losses was updated to improve fitting consistency; that is, the categorization of said steeply sloping high-frequency loss would now be required for both ears when fitting binaurally, making corrections on one ear dependent on the other. This was to support more balanced, predictable fittings.

2020-2021: VAC+ (Oticon More)
The VAC+ rationale was optimized to support the Polaris™ platform's advanced processing features, namely hybrid compression as part of the MoreSound Amplifier™ technology, and an expanded 24-band fitting system. It was also aligned with the AI/DNN technology in MoreSound Intelligence, Neural Noise Suppression, to enhance performance in complex listening environments.

In 2021, the conductive component in hearing losses was addressed through the implementation of a new compensation strategy for conductive hearing losses to improve fitting accuracy and clinical reliability.

2023: VAC+ (Oticon Real)
VAC+ (and all other rationales) were updated to have speech-shaped knee-points to improve the fitting experience. The speech-shaped knee-points introduced greater alignment between simulated graphs (for insertion gain) and gain control values, as well as a more intuitive gain adjustment experience .

2024: VAC+ (Oticon Intent)
The VAC+ rationale was updated for the Sirius™ platform to fully leverage the capabilities of the new miniRITE hardware platform. This included alignment with improvements to the speech enhancement system, Neural Noise Suppression, 4D Sensor technology, and extended the low-frequency bandwidth down to 80 Hz to improve bass performance.

Clinical evidence

To better understand the potential to demonstrate benefits of VAC+ comparatively, a pilot study was conducted on new hearing aid users to compare both quantitative and qualitative results of hearing aid fittings with VAC+, to a generic fitting rationale (NAL-NL2). The details of this clinical investigation can be found below.

Methods

Participants

A total of ten adult individuals (two female, eight male) met the inclusion criteria and participated in this study. However, only eight (two female, six male) completed the study in full due to scheduling conflicts. Hence, only the outcomes of these eight participants were included in the results of this study. Participants were required to be at least eighteen years of age and either have a confirmed or suspected hearing loss, which was verified through pure tone audiometry as part of the study protocol. Participants had no prior experience with hearing aids to eliminate any potential preferential bias towards either fitting rationale. Additionally, all participants were required to have bilateral symmetrical sensorineural hearing loss and no known (self-reported) cognitive impairment . Each participant was suitable for fitting with an Oticon miniRITE hearing aid, with no contraindications to its use. Proficiency in English was a mandatory requirement for all participants.

Participants ranged from 52 to 82 years old; the mean age was 68 years old. Prior to hearing aid use, the average Hearing Handicap Inventory for the Elderly (HHIE) (Ventry & Weinstein, 1982) score was 21 (out of a total of 30). Of the eight participants, seven had self-reported non-bothersome tinnitus. Hearing severity ranged from normal to profound hearing loss. The average pure tone average (PTA, measured across 500Hz, 1kHz, 2kHz and 4kHz) for the right ear across test participants was 28 dB HL. The average PTA for the left ear across test participants was 29 dB HL. Therefore, the average hearing loss across both ears for all test participants was a mild hearing loss.

Equipment

Test participants underwent a series of audiological tests before undergoing the hearing aid fittings, all conducted using the Interacoustics Affinity Compact. This system includes modules for audiometry, real-ear measurement (REM), and the Audible Contrast Threshold (ACT™) test for an assessment of hearing-in-noise abilities.

Participants were fit with pairs of Oticon Intent™ hearing aids, the latest miniRITE model in the Oticon portfolio, featuring user-intent sensors and powered by the Sirius™ platform. The receiver power level and domes were selected to match each participant's hearing loss. The fitting software used was Oticon Genie 2, version 24.1.

Procedure
The study took place over a period of five months and required each test participant to attend three in-clinic appointments. For study consistency and reliability, the same hearing care professional attended to all test participants and all appointments.

Appointment one
Each test participant attended an initial appointment with a hearing care professional, where they completed a case history and confirmed that they met the inclusion criteria. Following an explanation of the study's objectives and procedures, informed consent was obtained. Otoscopy was performed to inspect the condition of the external auditory canal and tympanic membrane, ensuring the absence of contraindications prior to the audiometric evaluation. Subsequent assessments included pure-tone audiometry (air- and bone-conduction thresholds), tympanometry, and the ACT test to evaluate hearing-in-noise performance.

Participants who met the audiological criteria for inclusion were randomly assigned to one of two groups: Group N (five participants; one female, four male) received hearing aids programmed with the NAL-NL2 fitting rationale, while Group V (three participants; one female, two male) received hearing aids programmed with Oticon's VAC+ rationale. All fittings were performed using real-ear measurement (REM) for verification with an automated protocol (REM Autofit) on the Interacoustics Affinity Compact, fit to adaptation manager 3, with no manual adjustments made post-fitting. The participant's ACT value was automatically integrated into the fitting through Oticon Genie 2. To ensure consistency, user-accessible features such as volume control and wireless connectivity were disabled. Participants were instructed to wear the hearing aids in their daily environments for a minimum of 8 hours per day, for a period of 2 to 4 weeks, depending on individual scheduling availability. Their second appointment was booked at the end of this session.

Appointment two
At the second appointment, participants completed a structured questionnaire designed to evaluate their auditory experience with hearing aids. Instructions emphasized that responses should focus exclusively on the acoustic performance of the hearing aids, excluding considerations related to physical fit or comfort. The questionnaire incorporated validated items from the International Outcome Inventory for Hearing Aids (IOI-HA) (Cox et al., 2000) and the HHIE , alongside questions developed specifically for this study focusing on sound quality, clarity, comfort, and more.

Participants responded on 5-point Likert scales to rate various aspects of hearing aid performance, including: overall experience, sound quality, clarity of speech, speech understanding in quiet and noisy environments, localization, noise handling, battery life, and the perceived naturalness of sound. Additional items assessed user sentiment, such as willingness to wear hearing aids in daily life, perceived benefit over unaided hearing, and likelihood of recommending the hearing aid to others.
To complement the quantitative data, the questionnaire also included open-ended questions allowing participants to elaborate on their experiences. These prompts explored topics such as perceived sound quality, the adaptation period required to become accustomed to the hearing aids, and overall listening comfort.

Before leaving, participants were fit with the second fitting rationale (the alternative fitting rationale to the one they had previously been fit with; that is, Group N was now fit with VAC+, and Group V was fit with NAL-NL2) and instructed once again to wear the hearing aids in their daily environments for a minimum of 8 hours a day, over a period of 2 to 4 weeks.

Appointment three
At the third and final appointment, participants completed a follow-up questionnaire with the same questions as the first questionnaire, with the addition of more questions designed to assess and compare their auditory experiences with the two different hearing aid fitting rationales. The questionnaire included a series of comparative items, prompting participants to evaluate which fitting – NAL-NL2 or VAC+ – provided superior subjective performance across a range of auditory aspects. These included perceived sound comfort, sound quality, clarity, access to speech in noisy environments, loudness levels, presence of artifacts or unwanted noise, and overall preference. Participants were also asked to indicate which fitting they would be more likely to recommend to others, which one they felt worked best for their individual hearing needs, and which provided better access to high-frequency sounds or sounded sharper; whether beneficial or not.

In addition to the comparative ratings, participants responded to a set of open-ended questions aimed at capturing broader reflections on their experiences with hearing aids, independent of the specific fitting rationale. These qualitative responses provided insight into long-term perceptions of benefit, adaptation, and satisfaction, contributing to a more comprehensive understanding of user outcomes across both fitting strategies.

By administering separate questionnaires immediately at the end of each test phase (after each appointment following a fitting), participants were able to evaluate the sound quality, overall satisfaction, and comfort in daily communication with each hearing aid fitting. This methodology minimized recall bias, as ratings were based on more immediate listening experiences rather than longer retrospective comparisons. Phase-specific surveys, designed to reduce the recency effect, included temporally independent evaluations for each fitting rationale. This allowed us to directly compare individual responses across the two fitting rationales with the same participant.

Aided Speech Intelligibility Index (SII) values were measured for each fitting to provide an objective estimate of the audibility of speech cues across the frequency (using ANSI S3.5 (IRCA Stationary). These values were used to support interpretation of participant preferences and to quantify the potential benefit of each fitting rationale in terms of speech accessibility.

Data analysis

Quantitative analysis:

To evaluate the relative objective performance of the two fitting rationales, a comparative analysis was conducted based on aided SII measurements following REM AutoFit adjustments. These data were evaluated in two ways.

1) Aided SII was determined for each participant across three different sound input levels (50 dB, 65 dB, and 80 dB SPL), collapsed across right and left ears.

2) For visualization only, aided SII values were averaged across ears and input levels, yielding a single mean value per participant and rationale; these collapsed values were displayed graphically but were not included in any statistical tests. Differences between the two rationales were statistically evaluated separately for each input level using paired Wilcoxon signed-rank tests. This non-parametric approach was particularly appropriate due to the small sample size and the lack of sufficient evidence supporting normality assumptions required by paired t-tests. A Bonferroni correction was applied to control for multiple comparisons where appropriate. Statistical analyses were carried out in Python, using pandas and SciPy.

Qualitative analysis:

To evaluate the relative subjective performance of the two fitting rationales, we conducted a comparative analysis based on user responses. Differences in ratings for the same questions across fitting rationales were assessed using paired t-tests, which could help determine whether the observed differences in ratings were statistically significant. Given the small sample size and non-normal distribution of the paired differences, the Wilcoxon signed-rank test was used as an additional validation method. This approach was appropriate due to the paired nature of the data and ordinal scale of the responses. The combination of both tests strengthens the robustness of the findings. Statistical analyses were carried out in the R programming language, using RStudio.

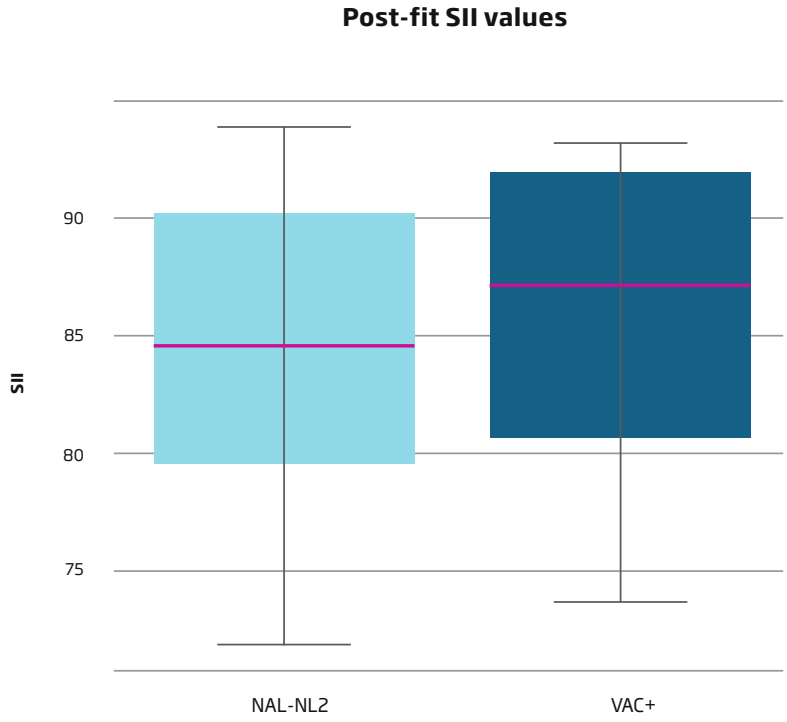
Results

Quantitative findings (SII values)

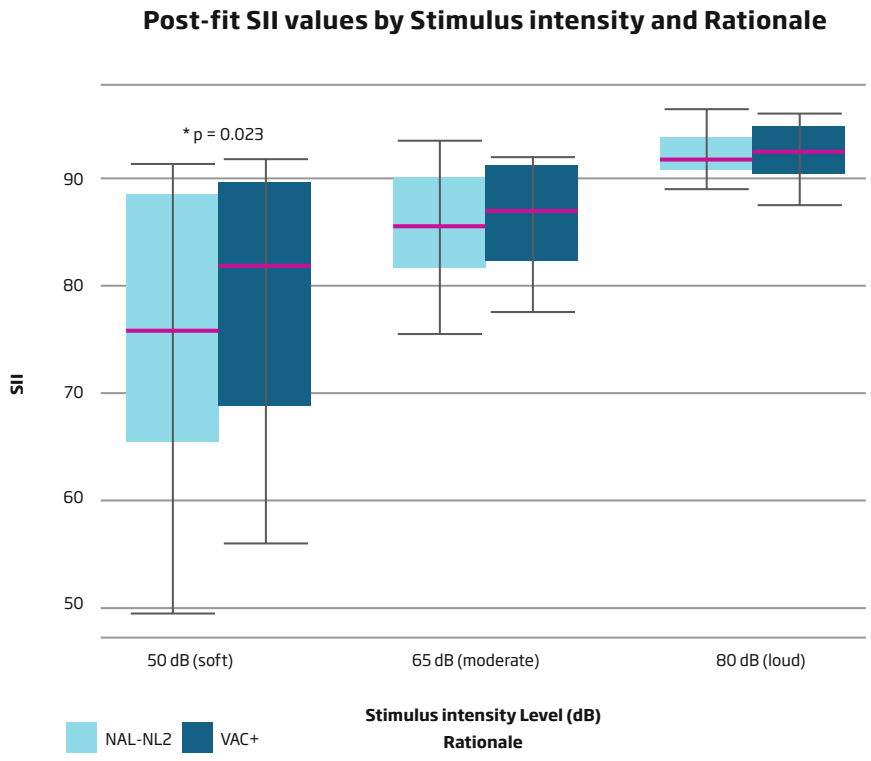
The summary boxplot that collapses aided SII values across input levels (Graph A) shows that the overall aided-SII distributions for VAC+ and NAL-NL2 are very similar.

Analyzing the data at each input level (Graph B) indicated that the two rationales differed only for soft speech. At 50 dB SPL the difference was statistically significant after Bonferroni correction ($p = 0.023$), whereas no significant differences were observed at 65 or 80 dB SPL (both $p > 0.05$).

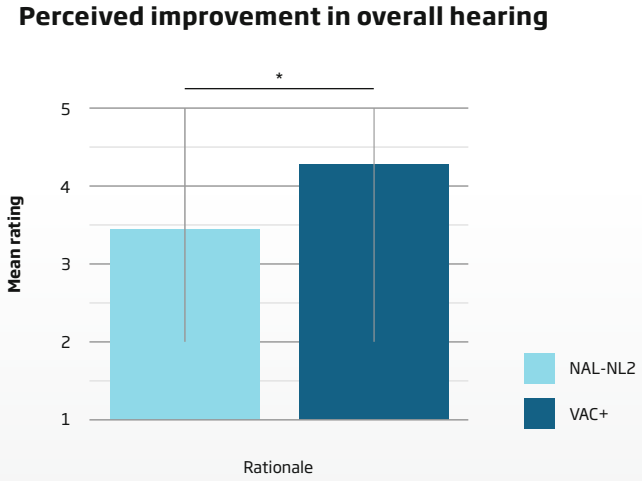
Overall, the results suggest that aided speech intelligibility, as measured by SII, was comparable between the two fitting rationales except at 50 dB SPL where VAC+ showed a statistically significant increase.



Graph A. Aided SII values for all eight test participants with VAC+ vs NAL-NL2, after averaging each listener's values across ears and across the three input levels. These collapsed data are shown for visual comparison only and were not included in the statistical tests.



Graph B. Aided SII values for all eight test participants at each speech input level with VAC+ and NAL-NL2. values are averaged across ears to give each participant a single value per rationale and level, eliminating within-subject ear correlation.



Graph C. Perceived improvement in overall hearing by fitting rationale, rated on a 5-point Likert sale by all eight test participants; with 1 being 'very dissatisfied' and 5 being 'very satisfied'. This graph shows that participants experienced an impressive 25% improvement in their subjective overall hearing experience when fit with the VAC+ fitting rationale, compared to NAL-NL2.

Qualitative findings (questionnaire responses)
For both the paired t-tests and the Wilcoxon tests, we deployed a 95% confidence interval meaning that results with a p-value of <0.05 were considered statistically significant. For the vast majority of questions, there was no significant difference or preference found between VAC+ and NAL-NL2 across questions covering listening comfort, adaptation time, sound quality, help in very loud environments, speech clarity, and more. However, the most significant finding showed that participants experienced an impressive 25% improvement in their subjective overall hearing experience when fit with the VAC+ fitting rationale, compared to NAL-NL2. This was in response to a question asking participants to rate their improvement in hearing by selecting 'very satisfied', 'satisfied', 'neutral', 'dissatisfied' and 'very dissatisfied'. These findings support the fact that VAC+ either performs similarly, or in some cases, better than a generic fitting rationale such as NAL-NL2 (Graph C).

Discussion
The aim of this study was to evaluate and compare user outcomes between two fitting rationales; VAC+ and NAL-NL2. Both qualitative and quantitative data were analyzed to provide an understanding of the user experience (and perceived benefit) and aided performance associated with each fitting rationale.

Quantitative analysis of aided SII values further supported the overall comparability of the two fitting rationales. While VAC+ produced a higher median SII value (Graph A), this difference did not reach statistical significance. This outcome suggests that although VAC+ may offer a marginal acoustic advantage, the difference is not large enough to deem statistically robust within the current sample. Notably, results showed a significantly higher SII value for soft sounds (50 dB SPL input level) with VAC+ (Graph B). This is not surprising, as it confirms results of a 2015 study with 64 test participants investigating the potential benefit of adding the Soft Speech Booster to the VAC+ rationale (Le Goff & Schum, 2015). Here, speech understanding improved on average 7% and results are directly attributable to an increase of 3 dB fixed soft gain above 1.5 kHz. At this time, Oticon VAC took a leap forward and was renamed Oticon VAC+. Increasing fitting flexibility and providing more access to speech while considering a new feature set become attainable goals when platform and fitting rationale development are integrated processes.

Qualitative results from questionnaires filled out by participants revealed no statistically significant differences between VAC+ And NAL-NL2 across most domains. This consistency indicates that for these participants, VAC+ provided a user experience commensurate in many ways with the widely used NAL-NL2 fitting rationale. One notable exception is the 25% improvement that participants reported in their overall hearing experience when fit with VAC+. This finding was statistically significant and highlights a potential user preference for VAC+ in real-world, subjective assessments of benefit.

Overall, the findings of this pilot study suggest that VAC+ performs equally as well as NAL-NL2 or better, in terms of audibility as measured by aided SII, in subjective assessment of sound quality, and other metrics. In some cases, the overall experience of VAC+ was rated as better than NAL-NL2. As a fitting rationale created specifically alongside and for Oticon's technologies, VAC+ can be considered for adults as an evidence-based option for maximizing the benefits and features of Oticon hearing aids.

Limitations and future research
This study presents promising insights into the comparative performance of VAC+ and NAL-NL2. However, it is important to acknowledge the limitations that come with this study and the interpretation of its findings. Firstly, being a pilot study, there was a small sample size ($n = 8$), which limits the generalizability of the results. The primary aim of this pilot was to explore trends and gather preliminary data, rather than to produce definitive conclusions. The limited statistical power associated with a small cohort can increase the likelihood of errors, where true differences may exist but may be missed. Next, relying on retrospective questionnaire data introduces potential memory recall bias. Participants were asked to reflect on their experiences with each fitting rationale, which may have been influenced by the time or environments during which they wore the hearing aids, difficulty distinguishing between the two fittings, and other factors that may have not been considered. Although there was no correlation or difference found between the two groups (N and V), suggesting that the order in which participants tried the fitting rationales does not have an influence, this may have changed with a larger sample size. All of these listed factors could affect the reliability of subjective reports, especially when answering questions on subtle differences in listening environments or with level of comfort.

Future research should address these limitations through larger-scale studies with more diverse participant groups. Blinded conditions could help minimize recall bias and enhance the validity of self-reported outcomes. Furthermore, incorporating objective data logging from the hearing aids could improve the accuracy of the user experience by tracking everyday environments and providing more information on how long fittings with each fitting rationale were worn for. Further, using ecologically momentary assessments for feedback in real time in participants would be beneficial. Longitudinal studies would be valuable to assess how user preferences and performance outcomes evolve over time as individuals adapt to different fitting strategies. Evaluating the interaction between initial preference, long-term satisfaction, and real-world performance would inform more personalized hearing aid fittings and improve outcomes for hearing aids users.

Conclusion

VAC+ is built on a holistic, co-development approach that integrates seamlessly with Oticon's signal processing technologies. Its precise output limiting, personalization features, and compatibility with a wide range of hearing profiles make it versatile and user-friendly. As a living, breathing fitting rationale that grows with Oticon's latest technological advancements, it is made with the intention of providing the best first fit possible for average adult hearing aid users.

This pilot study found that VAC+ performed comparably to NAL-NL2 across both subjective and objective measures, with participants reporting a notable 25% improvement in overall hearing experience with VAC+ compared to NAL-NL2.

These findings support VAC+ as a clinically valid and potentially preferred fitting rationale when fitting Oticon hearing aids, offering natural sound, comfort in loud environments and adaptability in complex listening environments.

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