

Efficacy of the Sert-A-Plug® Foam Earplug Fitting Tool: Preliminary Findings from Fit-Testing Studies

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SERT-A-PLUG®

J3 GROUP LLC

INTRODUCTION

In a January 2025 science policy update, the National Institute for Occupational Safety and Health (NIOSH) recommended that employers use individual, quantitative fit testing to evaluate the attenuation received by workers from their hearing protection devices. Currently, no national standard exists for earplug insertion. This study evaluated an innovative, patented insertion tool designed to mechanically place foam earplugs directly into the ear canal. We aimed to determine if this tool might improve Personal Attenuation Ratings (PAR) and mitigate the uncertainty of foam earplug fittings. A reliable tool that can provide consistent results might be an impetus to standardize foam earplug fittings in the occupational workplace.

METHODS

PAR data collection was conducted in two phases. First, under a research permit with the Confederated Tribes of Siletz Indians (CTSI), 54 tribal members (30 females, 24 males) were tested at the CTSI medical clinic in Oregon. All participants were tested twice for PAR, allowing for comparison of the two conditions. The initial fit test followed manual self-insertion of the earplugs with no instruction, and the second test was performed after using the insertion tool to place the earplugs in the ear canal, with brief guidance from the instructor.

The second phase was a collaboration with Dr. Kirsten McCall, certified Course Director through the Council of Accreditation in Occupational Hearing Conservation (CAOHC), to test 44 current CAOHC Occupational Hearing Conservationist (OHC) students (37 females and 7 males), across five major West Coast cities. Each subject completed one fit test, following instructor demonstration of the proper use of the insertion tool.

An ear inspection was performed on all potential subjects; those with an unobstructed ear canal were cleared to participate with fit testing.

TRAINING

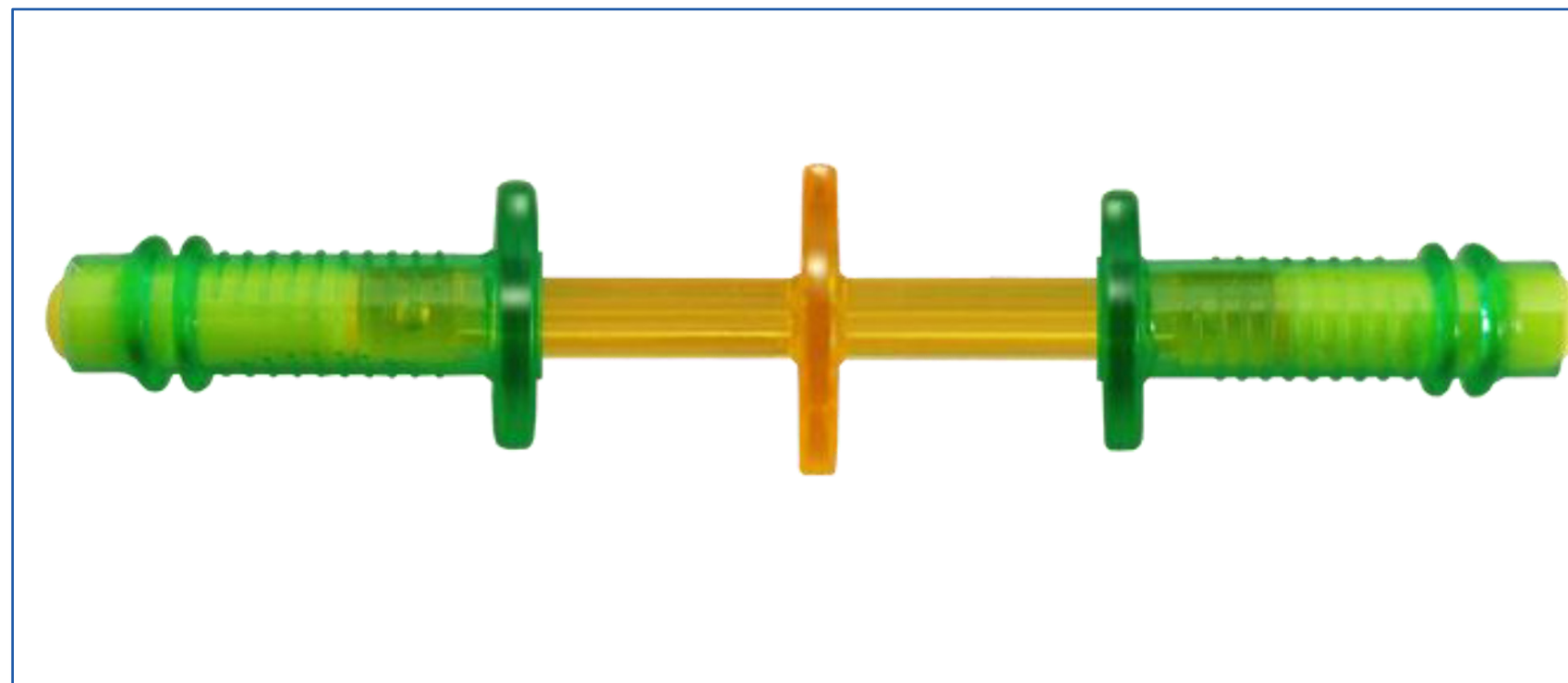
CTSI participants completed a total of three fit tests for PAR. For the initial, 'Naive' test, subjects followed the manufacturer instructions and manually inserted the earplugs themselves. The second, 'Experimenter' fit test was performed after instructor demonstration of the proper manual insertion technique. Prior to the third fit test using the Sert-A-Plug (SAP) tool, subjects either watched a brief instructional video on SAP or the onsite instructor demonstrated the proper hand-hold technique of the tool and ear canal alignment.

One to three days prior to fit testing, CAOHC OHC students had received didactic training on hearing protection as part of their course but had not yet completed the hearing protection practicum. Subjects completed a single fit test, following the above, instructor guidance on use of the SAP tool.

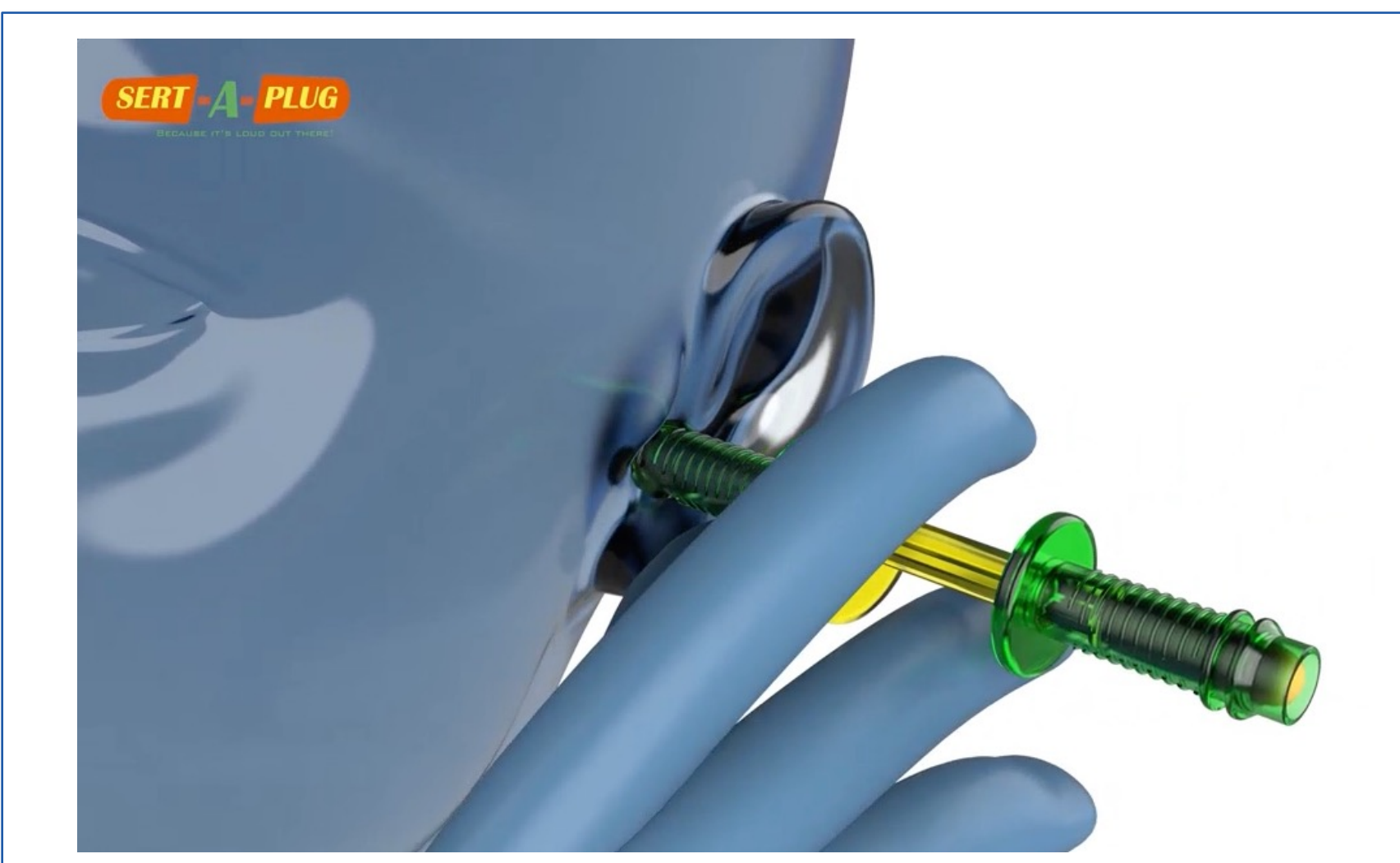
CAOHC STUDENT TRAINING



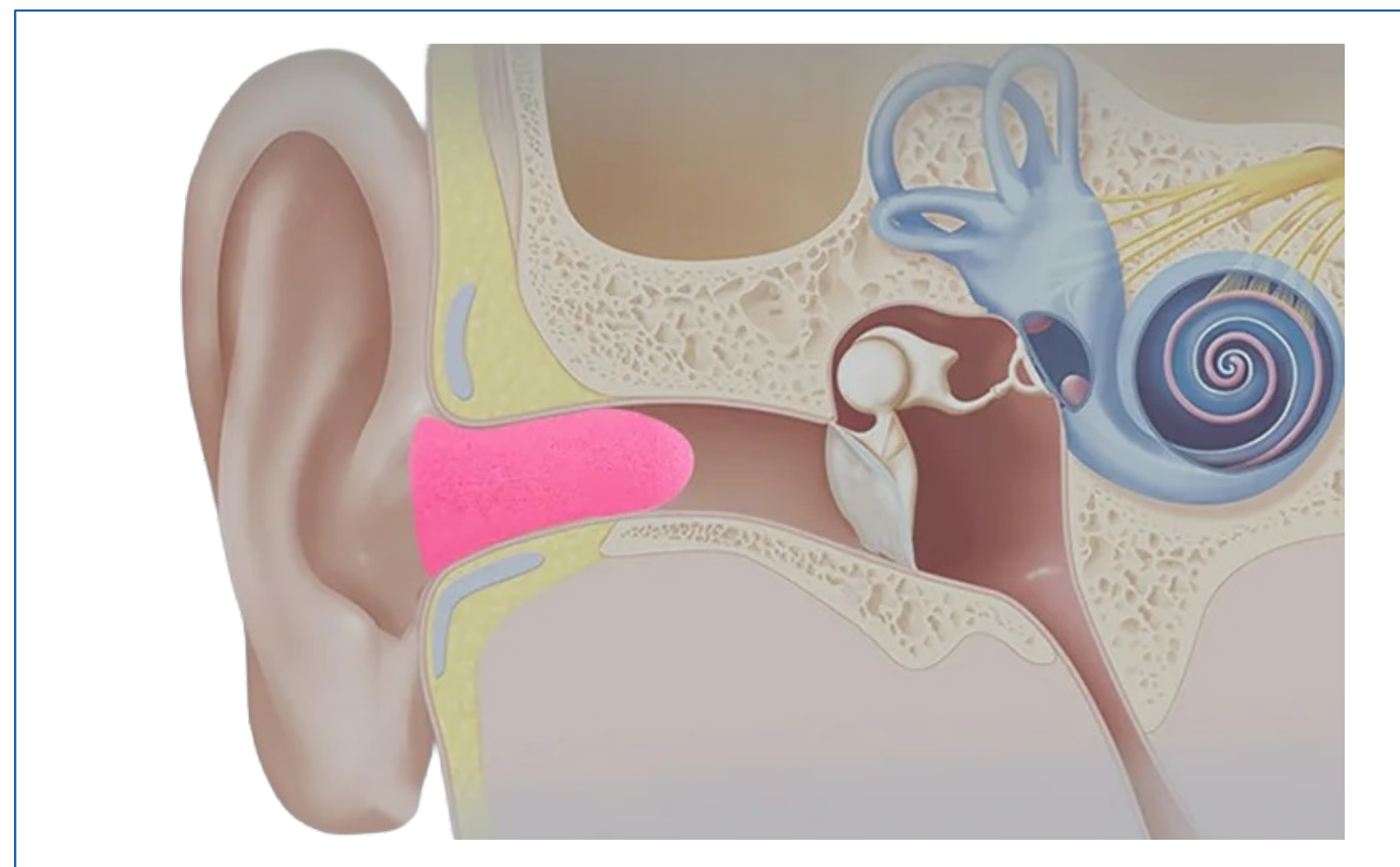
SAP FOAM EARPLUG INSERTION TOOL



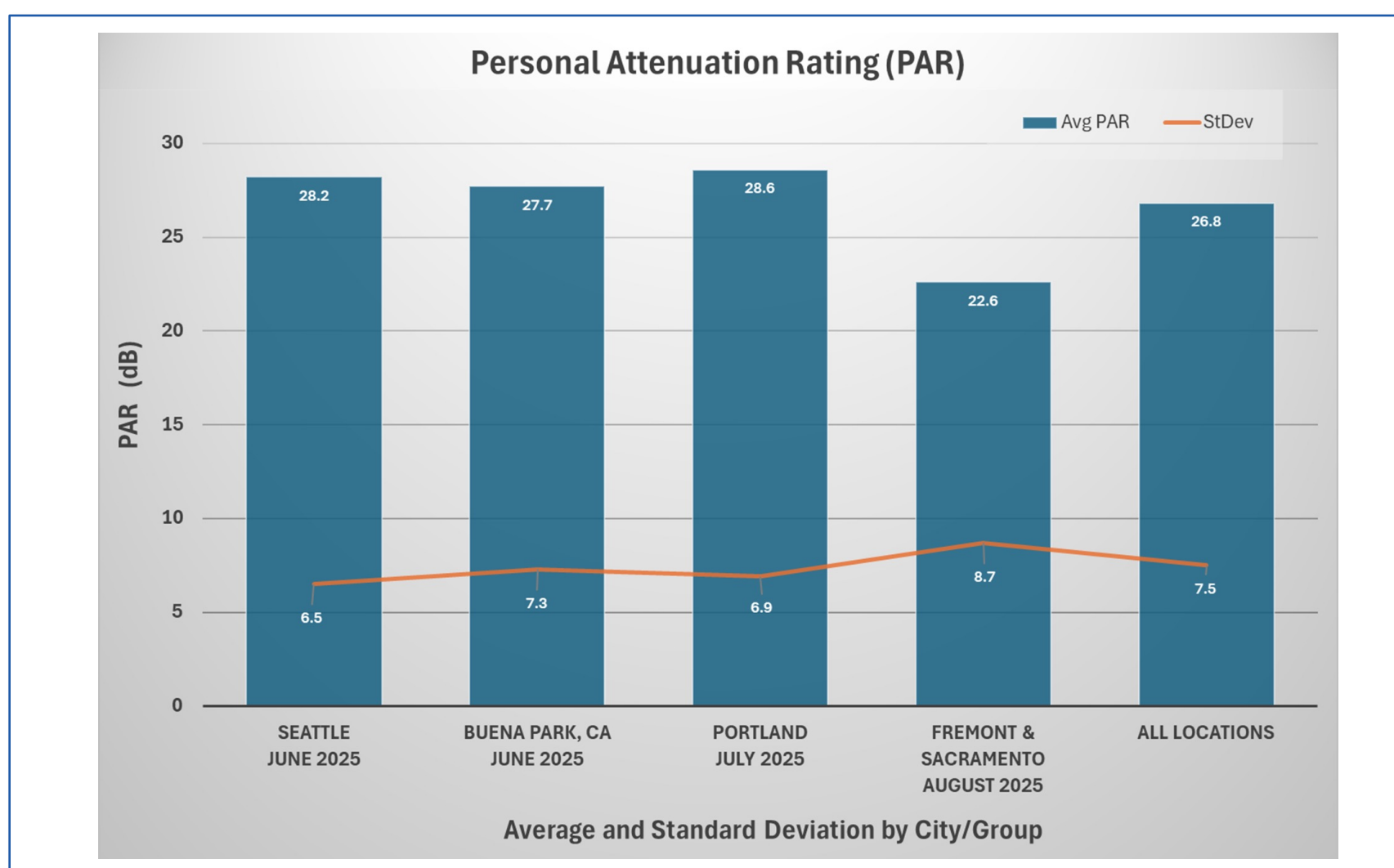
INSERTION ANGLES VARY



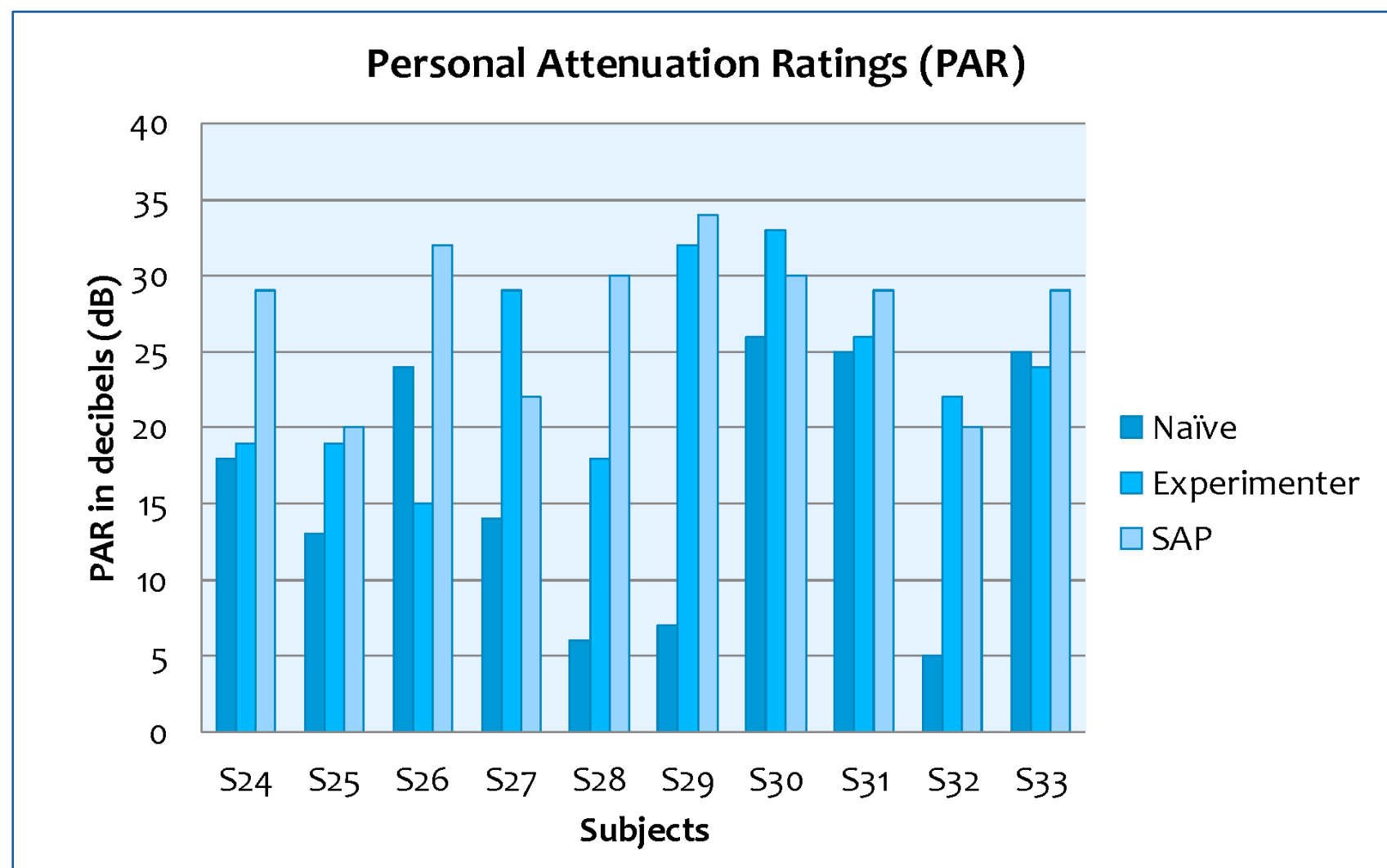
PROPER FIT



CAOHC STUDENT PAR RESULTS BY CITY



SILETZ PAR RESULTS



EQUIPMENT/TOOLS

Test subjects used the patented Sert-A-Plug® (SAP) foam earplug insertion tool to fit foam earplugs directly into their ear canals. The foam earplug options were 3M Taperfit2 and 3M EARSoft Yellow Neon (medium and large). The WAHTS tablet-based, audiometric testing system was utilized to collect binaural PAR data on each subject.

RESULTS

The initial fit test on the CTSI members, following manual self-insertion of the earplugs, resulted in an average PAR of 17.2 dB. Following instructor guidance and use of the SAP tool, the average PAR for participants was 28.8 dB. Comparison of the two sets of PAR results indicates that use of the insertion tool improved PAR results for all subjects.

The PAR average for the CAOHC OHC students was 26.8 dB; the range of average PAR results for each of the student groups in five cities was 22.6 dB* - 28.2 dB. The average PAR for the OHC students and CTSI members revealed similar results when the SAP insertion tool was used, showing consistency between all groups tested. *Note: The PAR for one participant in Sacramento was 6.6 dB; despite full insertion with the tool, a proper earplug seal was not achieved in the subject's larger ear canal, lowering the average PAR for that student group.

CONCLUSIONS

Preliminary results indicate the SAP foam earplug insertion tool provides consistent PAR results with minimal training. The initial findings of this study also suggest that using an insertion tool may raise an individual's PAR compared with manual self-insertion. Test subject feedback on SAP comfort and ease of use was overwhelmingly positive.

This study encourages the continued collection of PAR data within the military, mining, construction, and maritime sectors. Studies involving more extensive comparison of PAR results, for conditions of pre- and post-use of the insertion tool, are indicated. The use of additional foam earplugs in future PAR studies is also recommended to accommodate ear canal size variability. An additional avenue for further research is to evaluate and compare PAR results for subjects based upon their ability to achieve a proper seal of foam earplugs prior to the use of an insertion tool.

ACKNOWLEDGEMENTS

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