The Sound of a Solution: An Affordable, Self-Calibrating Hearing Aid Via Semi-Porous Nitinol Compression and Optimization of a Novel Concave Amplification Technique

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Over 80% of people suffering from hearing loss cannot access hearing aids due to the high price. This project develops an affordable hearing device that solves the manual calibration and feedback issues seen in modern hearing aids. The engineered hearing aid was constructed by covering an amplifier with five layers of varying aluminum alloys, five layers of nitinol, and one layer of lacquer-acrylic surrounded by a programmed gripping tool with sound sensors. The novel design created a new method of sound amplification through a controlled expansion of sound waves across increasingly sound-conductive metal mediums to optimize sound expansion and conduction. Using elastic material mediums increased sound propagation speed to further reduce acoustic leakage and consequent feedback. The pressure of the gripping tool altered the surface area of the nitinol layer, increasing the sound amplified by compression of the nitinol into a compacted form and the converse through expanding the nitinol pores. Testing demonstrated the engineered hearing aid had a 34.6% greater adjusted amplification power compared to a traditional hearing aid, despite costing only $72 to produce. There was a significant change in sound amplification depending on the compression setting and sound input, demonstrating successful self-calibration. Future directions include 3D printing, new pore shapes, and incorporation of patient data to increase the effectiveness and usability of future prototypes. The sound amplification techniques in this project are applicable in virtually any acoustic application, including architecture, general speakers, and sonar. Ultimately, the engineered hearing aid will offer affordable and effective treatment to individuals across the globe who suffer from hearing loss.