Cochlear®
Hear now. And always

Connect and protect

Promoting long term cochlea health

Start strong with Slim Modiolar

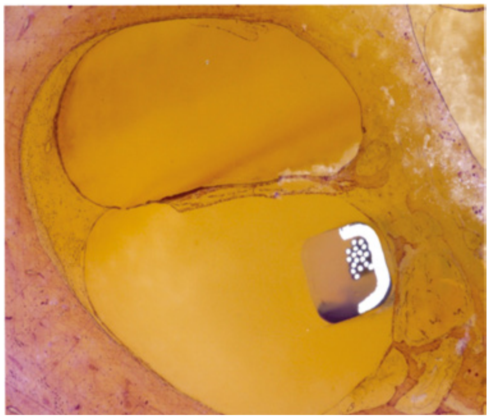
Decisions at the time of implantation establish the foundation for long-term outcomes. In particular, electrode design and placement play a critical role in shaping the electrode-neural interface (ENI), which underpins hearing performance.

Two main goals for an electrode

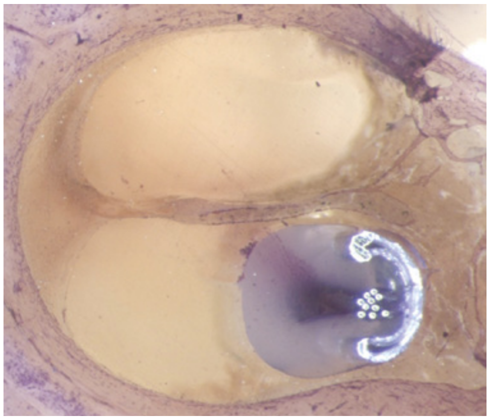
Cochlear's Slim Modiolar electrode is intentionally designed to have the closest connection to the spiral ganglion cells while protecting delicate structures in the cochlea.

Evolution of perimodiolar electrodes

Modern perimodiolar (Slim Modiolar) arrays are not the same as legacy perimodiolar arrays (Contour Advance). Slim Modiolar has **60% less volume** than Contour Advance.



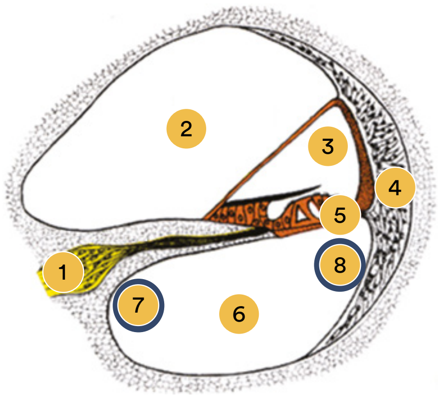
Slim Modiolar electrode



Contour Advance® electrode

Connect to the hearing nerve

1. Spiral ganglion cells: **Electrode-neuron interface** site for electrical stimulation[1–7]
2. Scala vestibuli
3. Scala media
4. Spiral ligament
5. Basilar membrane
6. Scala tympani
7. **Perimodiolar electrode**
8. **Lateral wall electrode**



Focused stimulation and electrode discrimination

Cochlear is the only company to offer **22 electrode contacts**—supporting detailed frequency representation and perimodiolar placement designed to bring electrodes closer to the modiolus.[7]

Perimodiolar placement is associated with significantly improved electrode discrimination success **(77% versus 47%)** and reduced channel interaction.[8]

22 electrode contacts and perimodiolar positioning enhance spectral resolution and maximize speech performance[7]

22 electrode contacts

16 electrode contacts

12 electrode contacts

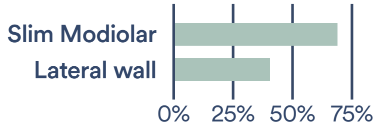
Superior speech perception outcomes

Clinical outcomes support electrode design as a significant contributor to post-operative speech perception. In a cross-manufacturer study, perimodiolar electrodes demonstrate an average **CNC word score advantage** of approximately **16.9% at 6 months** and **19.9% at 24 months** compared with lateral wall arrays.[9]

When different electrode array types are implanted in the same patient, performance differences can be attributed to the electrode design. In an intrapatient comparison, **perimodiolar electrodes averaged 66% CNC word scores compared to a 42% average with lateral wall electrodes**.[10]

When controlling for cochlea health, wrapping factor, angular insertion depth, and programming strategy, perimodiolar electrodes with **tighter modiolar proximity** outperform lateral wall electrodes at 6 months **(53.3% versus 45.1%)**, emphasizing the importance of these factors in optimizing cochlear implant outcomes.[11]

CNC word scores[10]



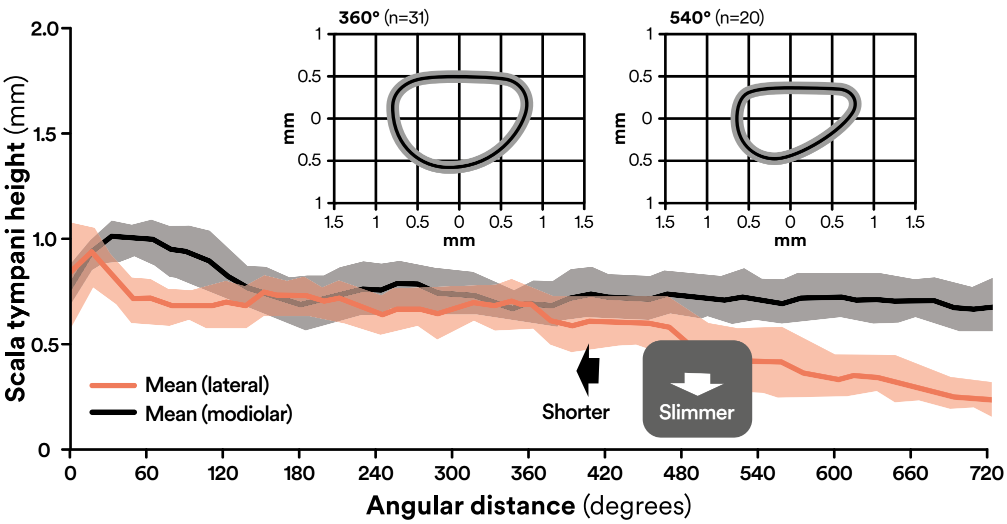
Pediatric clinical evidence

Pediatric data indicate that closer modiolar proximity is associated with **lower impedances** and **reduced neural thresholds**, **reduced energy consumption**, and **more consistent early auditory access**. These factors translated to significantly **improved speech and language** outcomes in children implanted at three years of age or younger.[12]

Protect the cochlea

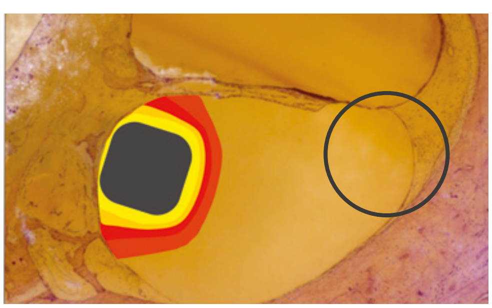
Cochlear anatomy and insertion trauma

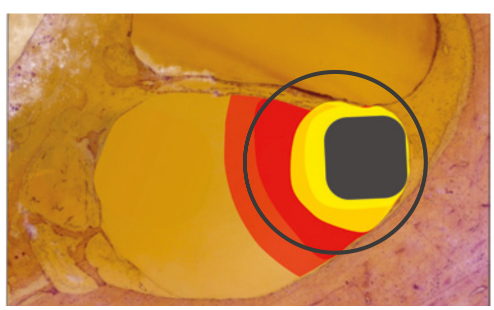
Anatomical studies show that the scala tympani narrows asymmetrically with increasing insertion depth, with lateral wall height decreasing more rapidly than modiolar height beyond approximately 360 degrees. This anatomic change **increases the risk of basilar membrane contact and trauma with deep lateral wall insertions.**[13,14]



Biological response and fibrosis

Post-implant foreign body response results in new tissue and fibrotic growth regardless of electrode design. Lateral wall electrodes sit closer to the basilar membrane and vascular supply, whereas **perimodiolar electrodes are positioned farther from these vulnerable structures**, potentially reducing long-term impact.[20-21]





Perimodiolar electrode

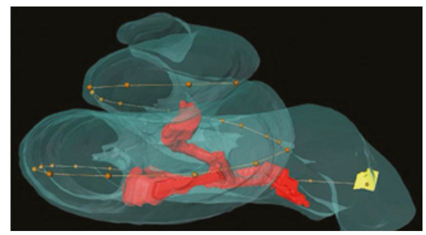
By avoiding contact with the lateral wall of the cochlea, you could potentially **avoid injuring the rich blood supply** which can lead to intracochlear bleeding and inflammation.[20]

Lateral wall electrode

Even if contact between a straight electrode and basilar membrane can be avoided, the fibrous tissue formed around the electrode array may **impede basilar membrane function** after surgery.[21]

Cochlear duct length ≠ spiral ganglion coverage

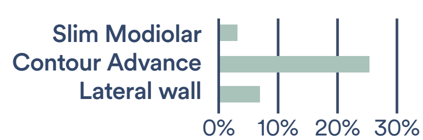
Spiral ganglion neurons terminate before the full length of the cochlear duct (average 695 degrees)[15], meaning **deeper insertions may not provide additional neural benefit.**



Slim Modiolar electrodes have **lower translocation rates** compared to legacy perimodiolar electrodes and translocate less than lateral wall electrodes.[19,*]

Shaul, 2020[16]
0.0% vs. 17%
CI532 vs. CI512
Beck, 2023[17]
2.7%
CI532 or CI632
Liebscher, 2021[18]
5.1% vs. 32.3%
CI532 vs. CI512

Translocation rate*



Hearing preservation and long-term stability

A meta-analysis published by Geng et al. concluded that slim modiolar electrodes (SME) and slim straight electrodes (SSE) have similar hearing preservation abilities in the short term. However, a prominent decline in hearing preservation over time was observed in the SSE compared with SME. This indicates SME may offer better durability in HP over time.[22]

Summary

Global insights on the electrode-neural interface

An international group of CI surgeons each with more than 30,000 patients in their care provide a collective expert opinion narrative summarizing the identified influencing factors upon long-term CI outcomes.[23]

Connect

"The proximity of the electrode contacts to the auditory nerve seems to be beneficial in terms of resolution and ultimately CI performance."

Protect

"Perimodiolar positioning causes a much lower risk of disrupting lateral wall structures, thus better preserving long-term cochlear health."

Clinical takeaway

The Slim Modiolar electrode is engineered to achieve consistent perimodiolar positioning while minimizing intracochlear trauma, thereby optimizing the relationship between electrode contacts and spiral ganglion neurons. Current literature supports the position that electrodes achieving closer modiolar proximity and avoiding delicate cochlear structures establish more favorable conditions for neural stimulation and support both structural preservation and functional outcomes. These findings underscore the importance of electrode choice at the time of implantation.

To learn more about our Slim Modiolar electrode, visit **cochlear.us/connectandprotect**

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* Cross study comparisons are limited by differences in study design, populations, and endpoints.

This material is intended for health professionals. If you are a consumer, please seek advice from your health professional about treatments for hearing loss. Outcomes may vary, and your health professional will advise you about the factors which could affect your outcome. Always read the instructions for use. Not all products are available in all countries. Please contact your local Cochlear representative for product information.

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