NUROTRON

诺尔康文摘

NUROTRON DIGEST

2020年第1期

单侧聋人工耳蜗植入专题（2）

2017-2020

浙江诺尔康神经电子科技股份有限公司
NUROTRON BIOTECHNOLOGY., Ltd.

诺尔康文摘

目录

诺尔康文摘
NUROTRON DIGEST
2020年第1期 总第8期
出版日期：2020年10月12日

主办单位：
浙江诺尔康神经电子科技股份有限公司

编辑委员会：
诺尔康科学委员会和技术委员会

主编：银力
编辑：彭惠融 高珊仙
翻译：苏珍 吴限
排版：章佳棋 董乐乐

地址：
浙江省杭州市余杭区龙潭路17号
邮编：311121
电话：4006 222 571
传真：0571-88179905
邮箱：service@nurotron.com
网址：http://www.nurotron.com

单侧聋患者人工耳蜗植入的进展

银力[1]；高珊仙[1]；屠文河[2]；曹永茂[3]；平利川[4]；龙墨[5]； 综述 傅前杰[6]；高志强[7]；审校

1 浙江诺尔康神经电子科技股份有限公司（杭州310000）；
2 英国曼彻斯特大学M139PL；
3 武汉大学人民医院耳鼻咽喉头颈外科；
4 NurotronBiotechnologyIn；
5 中国聋儿康复研究中心；
6 UniversityofCalifornia，LosAngeles（UCLA）；
7 中国医学科学院中国协和医科大学北京协和医院

既往未将双耳非对称性听力损失（asymmetrichearingloss，AHL）的极端案例－单侧听力损失（unilateralhearin-gloss，UHL）或单侧聋（singlesidedeafness，SSD）纳入人工耳蜗植入的适应症。近年来有人开始尝试为单侧聋伴有严重耳鸣的患者患耳植入人工耳蜗，结果发现不但可以有效地减轻甚至消除耳鸣，而且还发现适应后可以与健耳听力很好地整合，从而达到双耳聆听的效果。

非对称性听力损失（AHL）是指双耳间听力存在差距，泛指双耳听敏度存在一定程度的不对称，极端例子是差耳为全聋，而对侧耳听力正常或仅有轻度听力损失，一般将这种极端例子称为单侧听力损失（UHL）或单侧聋（SSD），此时，双耳0.5、1、2、4kHz频率的平均纯音阈值（PTA4）差值（差耳PTA4－好耳PTA4）达到30dB或更多，同时差耳听阈为重度到极重度听力损失，达到传统的人工耳蜗植入标准。另一个得到公认的UHL还需满足的附加条件是好耳平均听阈值应好于60dBHL，这样就明确了好耳不适合植入人工耳蜗[1]。表1是以上定义的总结。

表 1 基于纯音平均听阈的 SSD、AHL、双耳听力不对称的差耳及好耳听阈

听力损失特征	差耳听阈	好耳听阈
SSD	重度到极重度听力损失	≤ 3 0 dB H L
A H L	重度到极重度听力损失	≥ 3 0 dB H L
双耳听力不对称	差耳 PTA 4 －好耳 PTA 4	≥ 3 0 dB

根据普遍新生儿听力筛查数据估算，儿童单侧聋的发病率为1%～3%[1]，成人单侧聋发病率较高，特别是老年人的发病率可以高达18%[2]。现在一些国家的医疗机构和医生已将单侧聋纳入人工耳蜗植入的适应症。虽然单侧聋植入人工耳蜗效果满意，但中国同类案例较少，而且尚未正式纳入人工耳蜗植入的适应症，也未得到广大单侧聋患者的接受，因此，应当谨慎推荐。本文总结近年来对单侧聋的干预，特别是单侧聋人工耳蜗植入的情况，对单侧聋的病因、危害、干预及效果进行综述。

1单侧聋的病因

造成单侧聋的原因可以是遗传性、先天性和获得性，如：单侧蜗神经发育异常（cochlearnervedefi-ciencyCND）、先天性小耳畸形、大前庭水管综合征、听神经病、病毒或细菌感染性耳聋、单侧突发性聋、噪声性聋、梅尼埃病、头部外伤、单侧听神经瘤等[3,4]。

2单侧聋的危害

非对称性听力损失和单侧聋患者对听到的言语信号中的语音线索，如：音调等的辨别能力弱[5,6]，造成言语识别率低[7]，但一般不会严重影响患者的言语和语言发育，且由于部分患者学习成绩没有受到直接影响，因此，许多单侧聋患者终生没有接受任何干预[8]。有研究（LeeDS1，2001；Sharmaetal，2005）表明，如果在言语发育关键期发生耳聋，由于此时听觉功能未能建立，会导致中枢功能重塑，而这种重塑会降低植入人工耳蜗的预期效果。患者在人工耳蜗植入前，由于缺乏声刺激，其大脑易于发生交叉知觉模式重组（补偿）[9]（CROSS－MODALre-cruitment），即大脑通过视觉和体感系统补充缺失的声信号刺激[10~12]。发生单侧聋时，大脑会牺牲双侧声源定位能力，以强化单侧听力，这种效应导致高级听觉处理过程中获取语言的通路及听觉定位出现问题，即：这种中枢适应性的优化改变会对以后恢复聋侧听力和双耳声源定位功能不利[13]。单侧聋患者常常会反映其聋耳难以听懂谈话声，无法辨别声音来源以及在有背景噪声时难以理解语言（GiolasT，1994）。有文献报道[14,15]，患有永久性单侧聋的儿童中有35%患儿无法跟上班级课程；单侧聋患者与他人交流或参加会议时往往要选择好耳朝向声源，从而造成尴尬和不便；单侧聋患者择业时也会受到一定限制，他们很难选择那些对听力要求高的职业；单侧聋的另一个危害是耳聋往往伴有严重的耳鸣。据估算突发性单侧聋的发病率为1/10000，其中40%患者伴有严重耳鸣，且每年每百万人口会新发20~25例[1]。

3单侧聋的干预

建议对非对称性听力损失和单侧聋进行干预。目前对单侧聋一般不治疗，可验配环绕信号（contralateralroutingofsignal，CROS）助听器（通过患侧耳放置的麦克风接收声音并无线传送到对侧耳助听设备）和应用骨导助听系统（BCHS），即：在患侧通过佩戴软带（softband）固定骨导助听器或通过手术植入钛钉（BAHA）或磁力钛板（sophono等）外佩体外机，利用双耳骨导衰减小的原理获得“双耳”听力，但收效不大[16,17]。这些干预方式并不能给患者带来真正的双侧听力，因为大脑仅接收和处理了来自单侧的声输入，因此，人工耳蜗植入是唯一能帮助单侧极重度聋患者恢复听力的选择[18]。另外有研究表明在某些情形下，个体可以将一耳的声刺激与另一耳的电刺激相结合从而获得双侧听力的益处[19,20]。根据已知的人类言语发育关键期（3.5岁）推算，应该在3.5岁前对单侧聋患者进行干预；因为3.5岁时聋耳与皮层间尚保持有残存的连接，也只能通过对弱势耳（weakerear）的输入刺激才能加以补偿。确诊单侧聋后即便只是对弱势耳进行短期的训练，如：聆听睡前故事，都有可能进一步帮助患耳克服已经存在的对侧优势耳的趋势[21]。

4单侧聋患者选择人工耳蜗植入的原因

为了解决单侧聋患者的难治性耳鸣症状，比利时的Heyning等为患有单侧聋合并耳鸣、而对侧耳听力正常或轻度听力损失的患者植入了人工耳蜗，尝试是否可以用电刺激的方式来抑制耳鸣，初步结果非常满意[22]。此后，不断有医生尝试为伴有严重耳鸣的单侧聋患者植入人工耳蜗并逐渐将人工耳蜗植入适应症拓展到那些没有（严重）耳鸣的单侧聋患者，其后的研究结果表明[23~25]，单侧聋人工耳蜗植入者在使用人工耳蜗一段时间后可以整合双耳不同的刺激源（声和电）并获得了双耳听力的益处，比如：可以定位声音来源、听声“音量”变大、噪声环境下不必努力寻求健耳朝向发声源等。有单侧聋患者在发现其健侧耳听力开始下降，即将或已经成为双侧聋时，为了避免因双侧耳聋造成的听觉剥夺，而在原耳聋侧植入人工耳蜗，同期或之后又在新发耳聋侧植入人工耳蜗[26]；单侧聋患者选择植入人工耳蜗的原因还包括医患达成共识，给患耳植入人工耳蜗没有“失去”什么[27]。现在有更多的单侧聋患者意识到了双耳听力在社会交往中所发挥的作用，因此，开始寻求对患耳进行干预[28]。此外，尚有由于工伤导致单侧聋得到赔偿而植入诺尔康人工耳蜗的案例。

5单侧聋患者人工耳蜗植入前后的测试方法

5.1术前试用设备 除非有禁忌症，否则在评估方案中应包括其它干预方式（如传统的CROS及BI-CROS和骨导设备），对单侧聋患者试用软带骨导助听装置时应注意不要故意堵塞健耳，这样虽然会得到较好的试用效果，但与骨导助听设备植入后实际情况相差较大，会造成植入者的失望。

5.2术前和术后测试手段 日常生活中需要通过双耳聆听进行声源定位，无法定位声源是非对称性听力损失患者术前的最大缺陷，而可以定位声源是单侧聋患者植入人工耳蜗后比较显著的收益。由于声源定位试验需要高度的认知能力的发育，所以年幼儿童特别是4~6岁以下的儿童不易配合；对头影效应的评估可能是一种相关的替代方法，该法可以显示双耳刺激的益处。目前尚无一种理想的疾病相关生活质量问卷表，推荐采用测试声源定位和疾病特定的生活质量问卷，例如言语、空间和听觉质量量表（speech，spatialandqualitiesofhearing，SSQ）[29,30]，该量表可以反映非对称性听力损失或单侧聋患者日常听觉能力和遇到困难的情境。由于无双侧听力的患者在噪声下听声比较困难，因此，也应将噪声下测听纳入评估项目[1]。目前对非对称性听力损失的常用的言语测听方法包括：言语理解阈（speechreceptionthreshold，SRT）测试、三维空间构型（threespatialspeech－in－noiseconfigura-tions）测试等。单侧聋患者人工耳蜗植入后，另外一个比较显著的收益是电刺激对耳鸣的抑制；评估耳鸣程度及对耳鸣抑制效果的测试量表包括：耳鸣残疾评估量表（tinnitushandicapinventory，THI）、耳鸣问卷（tinnitusquestionnaire，TQ）和视觉比拟量表（visualanaloguescale，VAS）[21~34]。

5.3测试方法细节 ①三维空间构型测试方法为：言语和噪声均自前方（0°方位）给出（S_0N_0），以测试双耳整合（binauralsummation）效应；言语自前方（0°方位）给出而噪声从人工耳蜗植入侧（90°方位）给出（S_0N_{CI}），以测试双耳抑噪（binauralsquelch）效应；言语在人工耳蜗植入侧（90°方位）给出而噪声自正常听力侧（270°方位）给出（$S_{CI}N_{NH}$），以测试头影和噪声抑制的结合效应。测试时采用关闭人工耳蜗（CI_{off}）和开启人工耳蜗（CI_{on}）两种测试条件。平常佩戴助听器的患者在接受测试时应继续佩戴原有助听器。②SSQ包含有50个问题，分为三组题，分别为言语、空间和声音质量评分；SSQ得分有助于判断听障者每日生活的表现。测试要求受试者分别于术前及人工耳蜗术后12和36个月完成问卷[35]。另外单侧聋患者人工耳蜗植入后的效益还可以采用工作表现问卷表（表2），评估时间可以选取植入后的一定阶段，如：开机6个月、12个月、24个月等[32]。除了上述主观测试方法外，还有客观测试方法，如：测试双侧皮层反应[33]以及磁共振弥散张量成像（diffusiontensorimaging，DTI）以评估双侧听中枢功能及形态[24]。

表 2 工作表现问卷表

1．人工耳蜗对你的工作帮助有多大？ H ow m uch has the CIhelped you to do your work？
（a）很大 （b）中等 （c）不大 （d）无变化 （e）变差
2．人工耳蜗对你的职业生涯发展帮助有多大？ H ow m uch has the CIpositively influenced yourcareerdevelopm entorplanning？
（a）很大 （b）中等 （c）不大 （d）无变化 （e）变差
3．植入人工耳蜗后你工作的主动性变化有多大？ H ow m uch m ore active have you been in yourworking environm entafterthe CI？
（a）很大 （b）中等 （c）不大 （d）无变化 （e）变差
4．佩戴人工耳蜗工作后是否会降低你的疲劳感？ H as the CIdecreased yourfatigue afterthe working day？
（a）很大 （b）中等 （c）不大 （d）无变化 （e）变差
5．佩戴人工耳蜗是否有助于你与客户的交流？ Isiteasierto com m unicate with yourco －workers afterthe CI？
（a）很大 （b）中等 （c）不大 （d）无变化 （e）变差
6．人工耳蜗是否有助于你通过电话交流？ Isiteasierto speak on the phone afterthe CI？
（a）很大 （b）中等 （c）不大 （d）无变化 （e）变差

6单侧聋患者人工耳蜗植入的手术指征

设立单侧聋人工耳蜗植入手术指征的初衷是尽可能地缩短由单侧聋造成的听觉剥夺时间，从而避免听觉中枢重组。当非对称性听力损失达到单侧聋的程度，即单侧耳听力损失达到重度或极重度感音神经性聋且助听效果不佳时，就可以考虑在听力较差耳植入人工耳蜗。儿童和成人单侧聋人工耳蜗植入指征不同，单侧聋儿童的人工耳蜗植入应在耳聋后尽早实施。目前虽然对于先天性或早发的单侧聋患者人工耳蜗植入时机尚无定论，但如果听觉剥夺时长超过4年则需谨慎考虑。对于大龄儿童和成人确诊单侧聋后也应推荐尽早人工耳蜗植入，这对于那些好耳有发展成显著性听力下降风险的患者尤为重要[1]。术前对所有潜在适应症患者均应进行头部MRI检查以排除听神经异常，因为有超过50%的单侧聋儿童耳蜗神经发育不良，而蜗神经异常往往是人工耳蜗植入的禁忌症[4]。对于人工耳蜗植入目的主要是为了缓解耳鸣的患者，要求他们术前THI得分至少要达到38分和／或耳鸣问卷（TQ）得分至少要达到42分，视觉比拟量表（VAS）至少达到7.0分[31，32]。

7单侧聋患者人工耳蜗植入的效果分析

多项研究表明人工耳蜗植入可以改善单侧聋患者的生活质量，提高其言语识别率[15]和声源定位能力[38-41]，且较传统的单侧聋干预方法（如使用骨导助听设备和CROS）效果好[40]。单侧聋患者人工耳蜗植入后可以获得双耳听力，双耳聆听可以利用头影效应、双侧抑噪效应和双侧整合效应改善听力和提高声源辨别能力。头影效应是由头颅对声波造成衍射的物理效应（DillonCM，2001），对于空间分割源而言，每侧耳的信噪比由于头影效应而不同，如果通过信噪比较好一侧耳聆听，可改善言语理解力；如果单侧聋患者有功能的一侧耳朝向信噪比较差的方向时，言语理解力会降低（DillonCM，2001；BronkhorstAW，1988）。双侧抑噪效应（binauralsquelcheffect）是通过在信噪比较差的对侧耳增加额外的声音输入改善噪声下的言语理解力。空间分割信号（spatiallyseparatedsignals）是指在双耳间声信号的时间和强度差，有利于改善言语理解力[42]。双侧整合效应（binauralsummation）是言语和噪声均来自同一方位以及同一信号同步抵达双耳，双侧整合可以改善正常听力者言语理解阈（SRT）0.5~2dB[43]。需要双耳输入信号的中枢神经整合才能达到双耳整合与双耳抑噪效应同时发挥作用。Horkonen等[35]研究单侧聋患者人工耳蜗植入后对工作效率的影响发现，单侧聋人工耳蜗植入者较易应对工作，工作一天后较少产生疲劳感；而且由于与同事或客户的沟通变得容易，其工作时变得更主动；双耳聆听降低了植入者产生倦怠或从事对听力要求较高职业时常请病假的风险。

1976年首次有作者提出人工耳蜗植入对抑制耳鸣有帮助（HouseWF，1976），其后不断有人工耳蜗植入抑制耳鸣的文章发表[44]，近来的研究依然支持既往的观点[45,46]，发现且伴有无法忍受的耳鸣的单侧聋患者通过在患耳植入人工耳蜗不但恢复了听力，而且有90%的患者耳鸣的响度和严重程度显著降低[35,47,48]。研究者对耳鸣成因的共识是耳鸣是由于听觉剥夺导致中枢听觉通路的不良适应塑形（maladaptiveplasticity）导致的[49]。对耳鸣抑制是基于对假定的神经不良适应塑形反转或通过引入环境声转移对耳鸣的注意力，从而减轻人工耳蜗植入者对耳鸣的感知，可以通过圈内电刺激（loopede-lectricalstimulation）甚至有时可以采用非听性刺激减轻耳鸣。因此，推测可能不需要引入外界声音信号而仅通过蜗（圈）内电刺激治疗耳鸣，这种不依赖于外部声信号的蜗内电刺激法是潜在的耳鸣治疗手段。既往研究未发现手术自身可以造成耳鸣，长期使用人工耳蜗可以进一步优化对耳鸣的抑制作用[47~53]；要设置对耳鸣抑制理想的刺激参数，中等及大的刺激量较小刺激量抑制耳鸣的效果更明显，这与掩蔽效应有关[53]；与耳鸣音调相匹配的电极发出的刺激其耳鸣抑制效果与所有可用电极发出刺激产生的效果无显著差异[53]；刺激幅度调制对耳鸣抑制没有显著效果[54]，不同的刺激率对耳鸣的抑制作用没有显著差异[52,55]。虽然单侧聋患者使用人工耳蜗可以显著受益，然而与双侧人工耳蜗植入者相比他们的双耳整合效应发展缓慢，这与单侧聋植入人工耳蜗植入者较难整合电和声刺激有关[56]。为此，术前应调整好他们的期望值，并鼓励他们坚持使用人工耳蜗设备。

8结论

由于非对称性听力损失特别是单侧聋会造成患者声源定位能力缺失、噪声下言语理解能力下降，并往往伴有严重耳鸣，从而对患者的学习和生活均造成困扰。如果不及时干预，大脑听中枢的不良重塑会造成不可逆的损害，因此，对非对称性听力损失特别是单侧聋患者应积极干预。迄今为止，人工耳蜗植入是可以恢复单侧聋患者功能性听力并可能恢复双侧听力的唯一方法，如果没有禁忌症应积极考虑尽早在患耳植入人工耳蜗；一侧已经植入人工耳蜗的双侧聋患者经过评估符合植入标准的也要积极考虑尽早在对侧耳植入人工耳蜗。但必须说明的是，中国尚未正式将单侧聋纳入人工耳蜗植入适应症，故应谨慎实施。（致谢：感谢浙江大学童丹阳博士对本文所做出的贡献。）

9参考文献

1Christophe V，Susan A，Jill B，et al．Identification and evaluation of cochlear implant candidates with asymmetrical hearing loss［J］．Audiol Neurotol，2015,20:87.

2Agrawal Y，Platz EA，Niparko JK．Prevalence of hearing loss and differences by demographic characteristics among US adults［J］．Arch Intern Med，2008,168:1522.

3Tharpe AM，Sladen DP．Causation of permanent unilateral and mild bilateral hearing loss in children［J］．Trends Amplif，2008,12:17.

4Susan A，Susanne P，Roland L，et al．Cochlear implantation in children with single－sided deafness：does aetiology and dura-tionofdeafnessmatte［J］．Audiol Neurotol，2015,20:21.

5KerberS．Soundlocalizationinnoisebynormal－hearinglistenersandcochlearimplantusers［J］．EarHear，2012,33:445.

6Loizou PC．Speech processing in vocoder－centric cochlear implants［J］．Adv Otorhinolaryngol，2006,64:109.

7Lieu JE 1，Tye－Murray N，Karzon RK，et al．Unilateral hearing loss is associated with worse speech－language cores in children［J］．Pediatrics，2010,125:1348.

8Weaver J．Single－sided deafness：causes，and solutions，take many forms［J］．Hearing Journal，2015,3:22.

9Bavelier D 1，Dye MW，Hauser PC．Do deaf individuals see better［J］．Trends Cogn Sci，2006,10:512.

10Lomber SG，Meredith MA，Kral A．Cross－modal plasticity in specific auditory cortices underlies visual compensations in the deaf［J］．Nat Neurosci，2010,13:1421.

11Meredith MA 1，Lomber SG．Somatosensory and visual cross-modal plasticity in the anterior auditory field of early－deaf cats［J］．Hear Res，2011,280:38.

12Kral A，Heid S，Hubka P，et al．Unilateral hearing during development：hemispheric specificity in plastic reorganizations［J］．Front Syst Neurosci，2013,7:93.

13Andrej K，Peter H，Jochen T．Strengthening of hearing ear representation reduces binaural sensitivity in early single－sided deafness［J］．Audiol Neurotol，2015,20:7.

14Thorpe AM．Unilateral and mild bilateral hearing loss in children：past and current perspectives［J］．Trends Amplif，2008,12:7.

15Vermeire K，Vande H．Binaural hearing after cochlear implantation in subjects with unilateral sensorineural deafnessandtinnitus［J］．Audiol Neurootol，2009,14:163.

16Gordon K，Henkin Y，Kral A．Asymmetric hearing during development：the aural preference syndrome and treatment options［J］．Pediatrics，2015,136:141.

17Hol MK，Kunst SJ，Snik AF，et al．Pilot study on the effectiveness of the conventional CROS，the transcranial CROS and the BAHA transcranial CROS in adults with unilateral inner ear deafness［J］．Eur Arch Otorhinolaryngol，2010,267:889.

18Griet M，Andrea KP，Marc DB，et al．Binaural auditory outcomes in patients with postlingual profound unilateralhearing loss：3 years after cochlear implantation［J］．Audiol Neurotol，2015,20:67.

19Ching TY，Incerti P，Hill M，et al．An overview of binaural advantages for children and adults who use binaural／bimodal hearing devices［J］．Audiol Neurootol，2006,11:6.

20Dunn CC，Tyler R，Witt SA．Benefit of wearing a hearing aid on the unimplanted ear in adult users of a cochlear implant．［J］．Ann Otol Rhinol Laryngol，2008,117:645.

21Andrej K，Peter H，Jochen T．Strengthening of hearing ear representation reduces binaural sensitivity in early single－sided deafness［J］．Audiol Neurotol，2015,20:7.

22Heyning P，Vermeire K，Diebl M，et al．Incapacitating unilateral tinnitus in single－sided deafness treated by co－chlear implantation［J］．Ann Otol Rhinol Laryngol，2008,117:645.

23Dorman MF，Zeitler D，Cook SJ，et al．Interaural level difference cues determine sound source localization by single－sided deaf patients fit with a cochlear implant［J］．Audiolo-gy&Neurotology，2015,20:183.

24Mertens G，KleinePunte A，DeBodt M，et al．Binaural Auditory Outcomes in Patients with Postlingual ProfoundUnilateral Hearing Loss：3 Years after Cochlear Implantation［J］．Audiology&Neurotology，2015,20:67.

25Kamal SM，Robinson AD，Diaz RC．Cochlear implantation in single－sided deafness for enhancement of soundlocalization and speech perception［J］．Current Opinion in Otolaryngology&Head&Neck Surgery，2012,20:393.

26Boisvert I，Mcmahon CM，Dowell DC．Long－term monaural auditory deprivation and bilateral cochlear implants［J］．Neuroreport，2012,23:195.

27Husseini ST 1，Guida M，Negri M，et al．Bilateral cochlear implantation in a patient with petrous bone cholesteatoma in the only hearing ear：casereport［J］．J Laryngol Otol，2011,125:1272.

28Wie OB 1，Pripp AH，Tvete O．Unilateral deafness in adults：effects on communication and social interaction［J］．Ann Otol Rhinol Laryngol，2010,119:772.

29Demeester KV，Topsakal JJ，Hendric KX，et al．Hearing disability measured by the speech，spatial，and qualities of hearing scale in clinically normal－hearing and hearing－impaired middle－aged persons，and disability screeningby means of a reduced SSQ（theSSQ 5）［J］．Ear Hear，2012,33:615.

30Mertens G，Punte AK，Van DH．Self－assessment of hearing disabilities in cochlear implant users using the SSQ and the reduced SSQ 5 version［J］．Otol Neurotol，2013,34：1622.

31Zeman F，Koller M，Schecklmann M，et al．TRI database study group：tinnitus assessment by means of standardized self－report questionnaires：psychometric properties of the Tinnitus Questionnaire（TQ），the Tinnitus HandicapInventory（THI），and their short versions in an international and multilingual sample［J］．Health Qual Life Outcomes，2012,10:128.

32Meeus O，Blaivie C，Van de Heyning P．Validation of the dutch and the French version of the Tinnitus Questionnaire［J］．B－ENT，2007,7:11.

33孟照莉，郑芸，王恺．推荐一种耳鸣主观评估量表［J］．听力学及言语疾病杂志，2007,15:325.

34王培，邱泽恒，陈玲，等．突发性聋伴耳鸣患者治疗前后耳鸣残疾量表和视觉模拟量表比较及相关性［J］．临床耳鼻咽喉头颈外科杂志，2014,22:294.

35Horkonen K，Kivekas I，Rautiainen M，et al．Single－sided deafness：the effect of cochlear implantation on quality of life，quality of hearing，and working performance［J］．ORL J Oto-rhinolaryngol Relat Spec，2015,77:339.

36Chang JE，Zeng FG．Tinnitus suppression by electric stimulation of the auditory nerve［J］．Front Syst Neurosci，2012,6:19.

37Vos SB，Haakma W，Versnel H，et al．Diffusion tensor imaging of the auditory nerve in patients with long－term single－sided deafness［J］．Hear Res，2015,323:1.

38Firszt JB，Holden LK，Reeder RM，et al．Auditory abilities after cochlear implantation in adults with unilateral deafness：a pilot study［J］．Otol Neurotol，2012,33：1339.

39Hassepass F，Aschendorff A，Wesarg T，et al．Unilateral deafness in children：audio logic and subjective assessment of hearing ability after cochlear implantation［J］．Otol Neurotol，2013,34:53.

40Arndt S，Aschendorff A，Laszig R，et al．Comparison of pseudobinaural hearing to real binaural hearing rehabilitation after cochlear implantation inpatients with unilateral deafness and tinnitus［J］．Otol Neurotol，2011,32:39.

41Tavora－Vieira DG，Ceulaer D，Govaerts PJ，et al．Cochlear implantation improves localization ability in patients with unilateral deafness［J］．Ear Hear，2015,36:93.

42Dubno JR，Ahlstrom JB，Horwitz AR．Binaural advantage for younger and older adults with normal hearing［J］．J Speech Lang Hear Res，2008,51:539.

43Cox RM 1，Schwartz KS，Noe CM，et al．Preference for one or two hearing AID S among adult patients［J］．Ear Hear，2011,32；181.

44Baguley DM，Atlas MD．Cochlear implants and tinnitus［J］．Prog Brain Res，2007,166:347.

45Quaranta N，Fernandez－Vega S，D′eliaC，et al．The effect of unilateral multichannel cochlear implant on bilaterally perceived tinnitus［J］．Acta Otolaryngol，2008,128:159.

46Di Nardo W，Cantore I，Cianfrone F，et al．Tinnitus modifications after cochlear implantation［J］．Eur Arch Oto-rhinolaryn-gol，2007,264:1145.

47Heyning P，Vermeire K，Diebl M，et al．Incapacitating unilateral tinnitus in single－sided deafness treated by co－chlear implantation［J］．Ann Otol Rhinol Laryngol，2008,117:645.

48Amoodi HA，Mick PT，Shipp DB，et al．The effects of unilateral cochlear implantation on the tinnitus handicap inventory and the influence on quality of life［J］．Laryngoscope，2011,121;1536.

49Engineer ND，Riley JR，Seale JD，et al．Reversing pathological neural activity using targeted plasticity［J］．Nature，2011,470:101.

50Arndt S，Aschendorff A，Laszig R，et al．Comparison of pseudobinaural hearing to real binaural hearing reha－bilitation after cochlear implantation in patients with unilateral deafness and tinnitus［J］．Otol Neurotol，2011,32:39.

51Zeng FG，Tang Q，Dimitrijevic A，et al．Tinnitus suppression by low－rate electric stimulation and its electrophysiological mechanisms［J］．Hear Res，2011,277:61.

52Chang JE，Zeng FG．Tinnitus suppression by electric stimulation of the auditory nerve［J］．Front Syst Neurosci，2012,6:19.

53Arts RA，George EL，Chenault MN，et al．Optimizing intracochlear electrical stimulation to suppress tinnitus［J］．Ear Hear，2015,36:125.

54Bahmer A，Baumann U．New parallel stimulation strategies revisited：effect of synchronous multi electrode stimulation on rate discrimination in cochlear implant users［J］．Cochlear Implants Int，2013,14:142.

55Remo AGJ，Erwin LJ，George A，et al．Tinnitus suppression by intracochlear electrical stimulation in single－sided-deafness：a prospective clinical trial－part I［J］．Audiol Neurotol，2015,20:294.

56Aronoff JM，Shay manC，Prasad A，et al．Unilateral spectral and temporal compression reduces binaural fusion fornormal hearing listeners with cochlear implant simulations［J］．Hear Res，2015,320:24.

文献摘要

单侧聋的听觉原理、临床表现及干预策略

夏清清[1,2,3,4,5] 李佳楠[1,2,3,4] 杨仕明[1,2,3,4]

1中国人民解放军总医院耳鼻咽喉头颈外科医学部(北京100853)
2国家耳鼻咽喉疾病临床医学研究中心(北京100853)
3聋病教育部重点实验室(北京100853)
4聋病防治北京市重点实验室(北京100853)
5南开大学医学院(天津300071)

【摘要】

目前全球受听力损失困扰的群体较为庞大，单侧聋是听力损失其中的一类。单侧聋是指一侧耳为重 度及以上的感音神经性听力损失，而对侧耳保持正常或轻度听力损失。这类患者会出现声源定位困难、噪声下言 语辨别困难以及生活质量下降。单侧聋的患儿长期只用单侧听力，容易出现疲劳，并影响其学习及智力发育。对 侧听力的相对完好使得该类型听力损失没有引起足够重视，导致相当多的单侧聋患者终生都没有得到治疗干 预。本文系统地阐述了单侧聋的听觉原理、临床表现及不同干预治疗的特点，旨在帮助单侧聋患者及早认识到疾 病的危害性并能尽快了解不同干预方式的优势与不足，有利于单侧聋患者尽早选择并接受针对性治疗。

【节录】

当患耳听力损失达重度及以上感音神经性聋时，就达到人工耳蜗的植入标准。目前CI 是唯一一种能保留双侧听觉刺激传入的干预方式。

研究表明患侧植入人工耳蜗不会影响健侧耳的言语理解，大脑能够同时整合接收的电刺激和听觉刺激信号，改善患侧听力、噪声下言语识别及声源定位能力。人工耳蜗能够改善声源定位，表明在听觉系统中，与处理声源定位相关的脑部结构具有可塑性和适应性。声源定位的改善和双耳时间差及强度差的平衡，能避免SSD 患者听觉中枢的不良重塑。SSD 患者多伴有严重耳鸣。在人工耳蜗开机后，耳鸣都能得到不同程度的缓解，即使是难治性耳鸣。一项跟踪十年的研究发现，在耳蜗开机后的前三个月，耳鸣的抑制效果最为明显。

语前或语后聋是成人及儿童选择CI 治疗的重要影响因素。语后SSD儿童和成人在行CI 后，声源定位和噪声下言语辨别能力都得到改善。研究表明，只要好耳能获得有效的声刺激，那么双侧听觉传导通路就可以保留，表明耳聋时间的长短可能不是语后聋患者听觉效果的决定因素。但先天性或早发性SSD患者行CI 治疗的时机尚不明确。语前SSD 儿童因存在听觉剥夺，CI 效果欠佳；而语前SSD 成人，由于单侧听力损失时间较长，CI 的效果也较差。

对CI 治疗后的SSD 患者问卷调查显示，促使其选择人工耳蜗进行治疗的四个主要因素是声源定位的需求、耳鸣及噪声敏感性、好耳听力下降的担忧以及改善生活质量。

【关键词】单侧聋；干预治疗.

Hearing principle,clinical manifestations and intervention strategies of unilateral deafness

Xia Qingqing [1,2,3,4,5], Li Jianan [1,2,3,4], Yang Shiming [1,2,3,4]
1 Department of Otolaryngology Head and Neck Surgery Medicine, Chinese People's Liberation Army General Hospital (Beijing 100853)
2National Otolaryngology Clinical Medicine Research Center (Beijing 100853)
3 Key Laboratory of Deafness Ministry of Education (Beijing 100853)
4 Beijing Key Laboratory of Deafness Prevention (Beijing 100853)
5 School of Medicine, Nankai University (Tianjin 300071)

Abstract

At present, there is a relatively large group of hearing loss population in the world, and single-sided deafness (SSD) is considered as a type of hearing loss. Single-sided deafness refers to severe to profound sensorineural hearing loss in one ear with normal or mild hearing loss in the opposite ear. These patients may experience difficulties in sound localization, speech recognition in noise, and poorer quality of life. Children with single-sided deafness get fatigue easily, and their learning and intellectual development can be affected due to long-term use of unilateral hearing. Due to relatively intact hearing in the opposite ear, this type of hearing loss does not raise much concern, resulting in a considerable number of patients not receiving intervention in lifetime. This article systematically introduces the hearing principle, clinical manifestations and the characteristics of different intervention methods. It aims to help patients with single-sided deafness to recognize the downsides of this type of hearing loss and to understand the advantages and disadvantages of different intervention methods, and assist these patients to choose and receive specific interventions as soon as possible.

Excerpt

"When the hearing loss of the affected ear reaches severe to profound sensorineural hearing loss, cochlear implantation criteria is met. At present, cochlear implant (CI) is the only intervention method that can retain bilateral auditory stimulation."

"Studies have shown that cochlear implantation of the affected side will not affect the speech understanding of the normal hearing ear. The brain can integrate the received electrical stimulation and auditory stimulus signals simultaneously, and improves hearing of the affected ear, speech recognition in noise and localization ability. Cochlear implantation can improve localization, indicating brain plasticity and adaptation ability of the auditory system. The improvement of sound source localization and the balance of the interaural time difference and interaural intensity difference can avoid poor remodeling of the auditory system of SSD patients. Moreover, most patients with SSD experience severe tinnitus. After cochlear implant switch-on, tinnitus can be relieved to varying degrees, even for refractory tinnitus. A longitudinal 10-years study found that tinnitus suppression was most obvious during the first three months after cochlear implant switch-on.

"Prelingual or postlingual deafness is an important influencing factor for adults and children to choose CI. Postlinggual SSD children and adults show improvement in sound localization and speech recognition in noise after cochlear implantation. Studies have shown that as long as the good ears can obtain effective acoustic stimulation, the bilateral auditory pathways can be preserved, which indicating that the duration of deafness may not be a determinant factor in postlingually deafened SSD patients. However, the suggested timing of receiving CI in patients with congenital or early-onset SSD is unclear. Overall, children and adults with prelingual SSD have poorer CI performance due to hearing deprivation.

"A questionnaire survey of SSD CI recipients showed that the four main factors that prompted them to choose cochlear implants were the need of sound source localization, tinnitus and noise sensitivity, hearing concerns of the good ear, and improvement of life quality."

Key Words: Single-sided deafness; Intervention; Treatment.

Etiology and therapy indication for cochlear implantation in children with single-sided deafness

S.L.Cushing[1,2,3],K.A.Gordon[2,3,4],M.Sokolov[1,2,3] ,V.Papaioannou[4] ,M.Polonenko[3,5,6] ,B.C.Papsin[1,2,3]

1 Department of Otolaryngology, Head and Neck Surgery, Hospital for Sick Children, Toronto, Canada
2 Department of Otolaryngology, Head and Neck Surgery, University of Toronto, Toronto, Canada
3 Archie's Cochlear Implant Laboratory, Hospital for Sick Children, Toronto, Canada
4 Department of Communication Disorders, Hospital for Sick Children, Toronto, Canada
5 Department of Neurosciences & Mental Health, Hospital for Sick Children, Toronto, Canada 6 Institute of Medical Science, University of Toronto, Toronto, Canada

Abstract

Objective: The characteristics of children with single-sided deafness (SSD) who become candidates for unilateral cochlear implantation (uCI) were identified.

Study design: In all, 118 children with SSD presenting from 2013–2019 to a tertiary pediatric children's hospital were retrospectively assessed regarding candidacy for uCI.

Results: Of the 118 children, 103 had completed uCI candidacy assessment, while 15 were undergoing this assessment at the time of review. More than half of children did not go on to implantation Unilateral deafness · Cochlear nerve aplasia · Cochlear nerve hypoplasia · Cytomegalovirus · Pediatrics · Hearing lossUnilateral deafness · Cochlear nerve aplasia · Cochlear nerve hypoplasia · Cytomegalovirus · Pediatrics · Hearing loss(63/103, 61%), with the 2 main reasons being (1) half (31/63) did not meet candidacy criteria for implantation, most commonly due to cochlear nerve aplasia/hypoplasia (31/82 who were assessed with MRI, 38%) and (2) families (30/103; 29%) declined participation in the surgical arm of the trial. The most common etiologies of SSD in the 37/103 (36%) children who both met candidacy and consented to implantation were congenital cytomegalovirus (cCMV; 16/37, 43%), unknown (6/37, 16%), cochleovestibular anomaly and trauma (each 5/37, 14%).

Conclusions: Many children with SSD who present for implant candidacy assessment do not ultimately receive uCI. Major factors contributing to noncandidacy are cochlear nerve aplasia and parental acceptance of the intervention. While approximately half of children with SSD in our cohort were candidates for implantation, only 1/3 of the total cohort proceeded with implantation with the main predictors of acceptability of this intervention being an etiology (i.e., cCMV) that carries risk of progressive deterioration in the better hearing ear or SSD that was sudden in onset. These findings provide important insight into this new population of cochlear implant users and the emerging acceptance of intervention in children with SSD.

Key Words: Unilateral deafness • Cochlear nerve aplasia • Cochlear nerve hypoplasia • Cytomegalovirus • Pediatrics • Hearing loss.

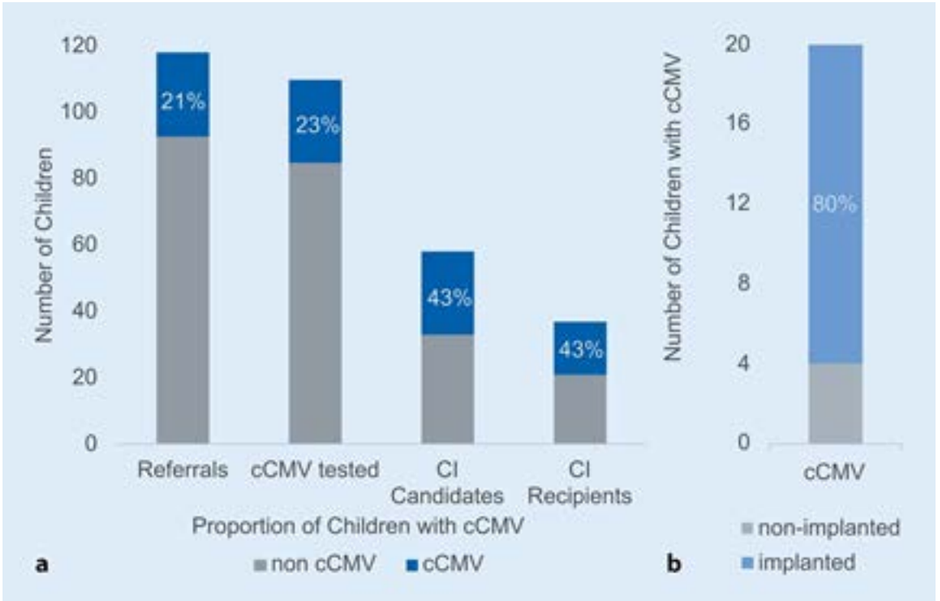


Fig. 3 8 a Increasing proportion of children with congenital cytomegalovirus (cCMV) in the cohort as candidacy assessment progresses toward cochlear implantation (CI). b Proportion of children with cCMV who agree to CI.

参考译文：

单侧耳聋儿童人工耳蜗植入的病因和治疗适应症

S.L.Cushing[1,2,3] •K.A.Gordon[2,3,4]•M.Sokolov[1,2,3] •V.Papaioannou[4] • M.Polonenko[3,5,6] •B.C.Papsin[1,2,3]

1加拿大多伦多儿童医院耳鼻咽喉头颈外科
2加拿大多伦多大学耳鼻咽喉头颈外科
3加拿大多伦多儿童医院Archie的人工耳蜗实验室
4加拿大多伦多儿童医院沟通障碍科
5加拿大多伦多儿童医院神经科学与心理健康系
6加拿大多伦多大学医学科学研究所

【摘要】
目的：
识别单侧耳聋（SSD）儿童作为人工耳蜗（uCI）候选者的特征。
研究设计：
对2013年至2019年在一家三级儿科儿童医院就诊的118名SSD儿童进行了回顾性评估，以确定是否具备uCI的候选资格。
结果：
在118名儿童中，有103名已完成uCI候选资格评估，而15名在审查时正在接受此评估。超过一半的儿童没有进行植入（63/103，61%），其中两个主要原因是（1）一半（31/63）不符合植入的候选标准，最常见的原因是耳蜗神经缺如/发育不全（31/82，经MRI评估，38%）和（2）家庭（30/103；29%）拒绝参加试验的外科手术。在37/103（36%）符合候选资格并同意植入的儿童中，SSD最常见的病因有先天性巨细胞病毒（cCMV；16/37,43%），未知（6/37,16%），耳蜗前庭异常和创伤（每个5/37,14%）。
结论：
许多参加植入候选资格评估的SSD儿童最终没有接受uCI。不符合候选资格的主要原因是耳蜗神经发育不全和父母不接受干预。虽然有超过一半的SSD患儿是植入候选者，但所有参与评估的儿童中只有1/3进行了植入。接受干预的主要预测指标为导致好耳听力逐渐恶化的耳聋病因（如：cCMV）或突发性SSD。这些发现对于了解新的人工耳蜗使用者群体以及接受新兴干预的SSD儿童提供了重要见解。

【关键词】单侧耳聋，耳蜗神经发育不全，巨细胞病毒，儿童听力损失.

Usefulness of cochlear implantation in children with single sided deafness

Désirée Ehrmann-Mueller[a*] , Anja Kurz[a] , Heike Kuehn[a] , Kristen Rak[a] , Robert Mlynski[b] , Rudolf Hagen[a] , Wafaa Shehata-Dieler[a]

[a] Department of Otorhinolaryngology, Plastic, Esthetic and Reconstructive Head and Neck Surgery, University of Wuerzburg, Josef-Schneider-Strasse 11, 97080, Wuerzburg, Germany
[b] Department of Otorhinolaryngology, Head and Neck Surgery, "Otto-Koerner", University of Rostock, Doberaner Strasse 137-139, 18057, Rostock, Germany

Abstract

Objectives: Children with single sided deafness (SSD) show a poorer performance at school, which is attributable to reduced speech discrimination in noise, to reduced localization ability, and to a decreased power of concentration due to faster hearing exhaustion. Therefore, it is important to provide children with SSD with adequate hearing amplification to restore binaural hearing. This can only be achieved by provision with a cochlear implant (CI). But these treatment option in children with SSD is still under discussion.

The aim of the present study is to evaluate audiological and clinical results in children with SSD following cochlear implantation. A special focus was placed on the duration of deafness before implantation and on the frequency of CI-use in everyday life.

Methods: Seven children with SSD of different etiologies who were provided with a CI between 3 and 16 years of age were evaluated. Every child underwent multiple audiological tests before and after cochlear implantation. After cochlear implantation speech recognition tests in noise using the HSM (Hochmair, Schulz and Moser 1997) test and localization tests were performed. Furthermore, the frequency of implant use was evaluated.

Results: Speech recognition in noise with CI compared to the unaided condition significantly improved in all children in different settings. Improvement of the localization ability measured by the root mean square error (RMSE) was shown in all children. All children are very satisfied with the decision to have undergone cochlear implantation and are all full-time users.

Conclusions: Cochlear implantation benefits speech recognition in noise and sound localization ability in children with SSD at different ages. All implanted children are full-time users regardless of age or duration of deafness before implantation.

Key Words: Single sided deafness,Cochlear implantation,Speech recognition,Use of device.

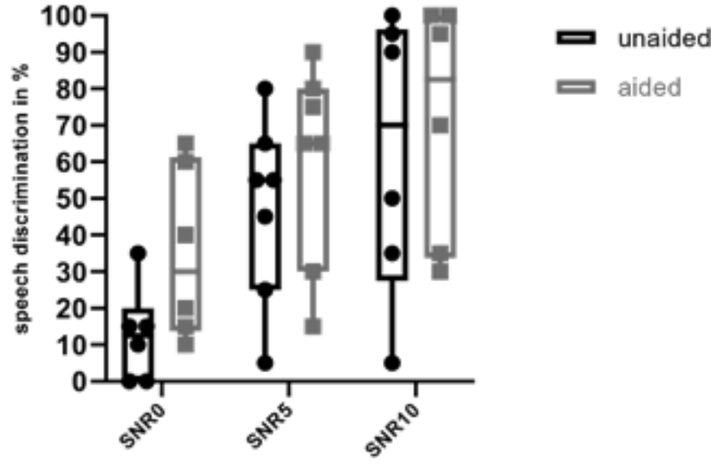


Fig. 3. Speech perception in noise (Wuerzburger). Speech perception in noise with the Wuerzburger two syllables test in different signal to noise conditions (SNR_{60}, S_0N_{90}NH, SN 0, 5, 10), unaided vs. aided, best over time (the number of children is marked in points). SNR = signal to noise ratio.

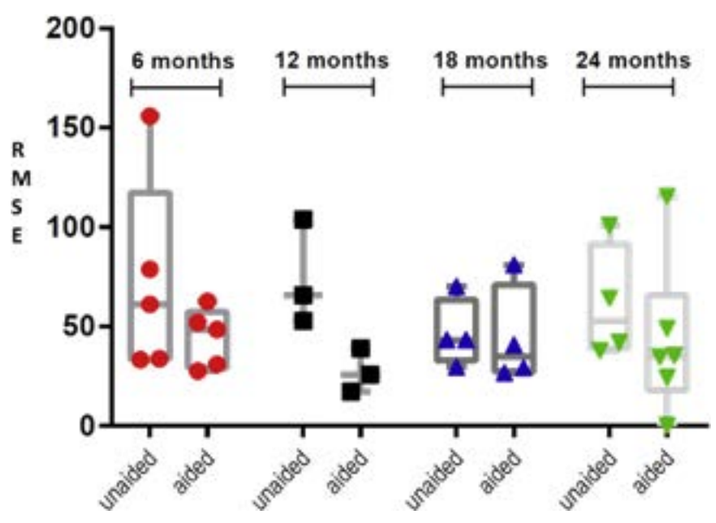


Fig. 4. RMSE over time. Localization results shown as the root mean square error (RMSE) over time (6, 12, 18, 24 months after first fitting) (the number of children is marked as points).

参考译文：

单侧耳聋儿童人工耳蜗植入的有效性

Désirée Ehrmann-Muellera, Anja Kurza , Heike Kuehna , Kristen Raka , Robert Mlynskib , Rudolf Hagena , Wafaa Shehata-Dielera

a德国维尔茨堡大学耳鼻喉科，整形，美容和重建头颈外科，德国伍尔茨堡，约瑟夫·施奈德·斯特拉斯11号，97080
B德国罗斯托克大学耳鼻喉科，头颈外科，德国罗斯托克“奥托·科恩纳”多伯纳街 137-139, 18057

【摘要】

目的：患有单侧耳聋（SSD）的儿童在学校表现较差，这可归因于噪声中的语音辨别力降低，定位能力降低以及由于更快的听力衰竭而导致注意力下降。因此，为患有SSD的儿童提供足够的听力放大以恢复双耳听力十分重要。这只能通过人工耳蜗（CI）来实现。但这些SSD患儿的治疗方案仍在讨论中。

本研究的目的是评估儿童植入人工耳蜗后SSD的听力学和临床结果。特别关注的是植入前耳聋的持续时间以及日常生活中使用CI的频率。

方法：对7例3～16岁不同病因的SSD患儿进行CI的评估。每个孩子在人工耳蜗植入前后都接受了多次听力学测试。人工耳蜗植入后，进行了HSM（Hochmair，Schulz和Moser 1997）在噪声中进行语音识别测试和定位测试。此外，还评估植入设备的使用频率。

结果：在不同环境下，所有儿童的CI噪声中的语音识别与独立状态相比均显着改善。在所有儿童中均显示了通过均方根误差（RMSE）测量的定位能力的提高。所有儿童对接受人工耳蜗植入的决定都非常满意，并且都是全天候使用的用户。

结论：人工耳蜗植入有利于不同年龄SSD儿童噪声和声音定位能力的语音识别。所有植入的儿童在植入前无论年龄或植入前耳聋的持续时间如何，都是全天候使用者。

【关键词】单侧耳聋，人工耳蜗植入，言语识别，设备使用.

Multifactorial Positive Influence of Cochlear Implantation on Patients With Single-Sided Deafness

Sophia M. Häußler, MD, PhD ; Vanessa Köpke, MD, PhD; Steffen Knopke, MD, PhD; Stefan Gräbel, MD, PhD; Heidi Olze, MD, PhD

Abstract

Objectives: Single-sided deafness (SSD) is an extreme case with profound unilateral hearing loss in the poorer ear and regular hearing in the other ear. The aim of this study is to investigate the impairment in the daily life of SSD patients and the influence of cochlear implants (CI) on their health-related quality of life (HRQoL), the impact on existing tinnitus distress and psychological comorbidities, and audiometric parameters.

Methods: In total, 21 patients (8 male and 13 female) were included, and the Charité Test Battery was applied for all patients. Data on HRQoL were collected with the Nijmegen Cochlear Implant Questionnaire and the Medical Outcome Study Short Form 36 (SF-36) Survey. Tinnitus distress was assessed with the Tinnitus Questionnaire (TQ). Data with regard to psychological comorbidities were collected using four validated questionnaires. Speech perception was assessed with the Freiburg Monosyllable Test (FMS), the Oldenburg Sentence Test (OLSA), and the Oldenburg Inventory (OI).

Results:HRQoL improved in the subdomain social interactions. Tinnitus distress dropped significantly 6 months postoperatively. SSD patients preoperatively showed elevated levels of stress, depressive symptoms, and anxiety. Postoperatively, these psychological symptoms improved with regard to stress, tension, and demands. The audiometry tools revealed a significant improvement in directional hearing (OI), speech perception in silence, and in the speech intelligibility threshold (OLSA).

Conclusion: There was an improvement in HRQoL and a reduction of tinnitus and cognitive distress. The preoperatively elevated stress level decreased significantly, and psychological comorbidities such as depressive symptoms and anxiety all improved postimplantation.

Key Words: Cochlear implantation, single-sided deafness, quality of life, stress, tinnitus.

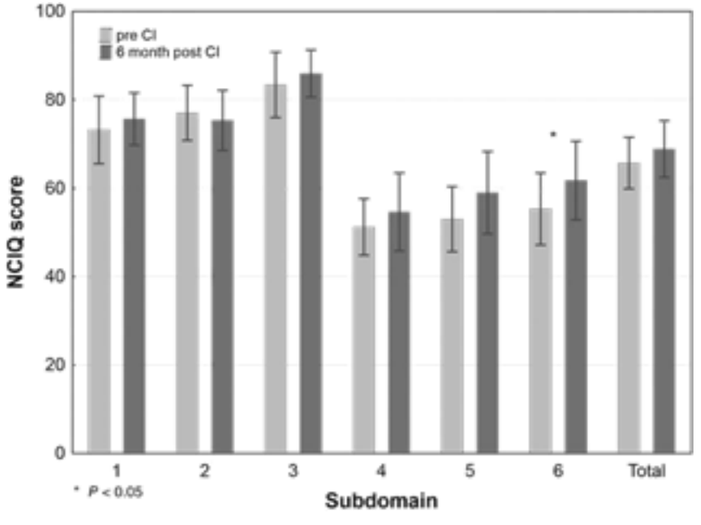


Fig. 3. Results of the Nijmegen Cochlear Implant Questionnaire. The lighter bars show the preoperative results; the darker bars show the postoperative results. 1 = basic sound perception; 2 = advanced sound perception; 3 = speech production; 4 = self-esteem; 5 = activity limitations; 6 = social interactions; CI = cochlear implant; NCIQ = Nijmegen Cochlear Implant Questionnaire.

参考译文：

人工耳蜗植入对单侧耳聋患者的多因素积极影响

Sophia M. Häußler, MD, PhD ; Vanessa Köpke, MD, PhD; Steffen Knopke, MD, PhD; Stefan Gräbel, MD, PhD; Heidi Olze, MD, PhD

【摘要】

目的：

单侧耳聋（SSD）是一种极端情况，差耳有极重度单侧听力损失，另一只耳朵为正常听力。本研究的目的是调查SSD患者日常生活中的损害以及人工耳蜗（CI）对其健康相关生活质量（HRQoL）的影响，对现有耳鸣困扰和心理合并症的影响，以及听力状况。

方法：

共纳入21例患者（男8例，女13例），所有患者均应用Charit é 测试组合。采用Nijmegen人工耳蜗问卷和医学成果研究简表（简称SF-36）调查收集HRQoL数据。用耳鸣问卷（TQ）评估耳鸣困扰。通过四份有效的问卷收集有关心理合并症的数据。通过弗莱堡单音节测验（FMS），奥登堡句子测验（OLSA）和奥登堡量表（OI）进行评估言语感知。

结果：

HRQoL在社交互动方面有所改善。术后6个月耳鸣干扰明显下降。SSD患者术前表现出较高的压力水平，抑郁症状和焦虑。术后，这些心理症状在压力，紧张和需求方面有所改善。听力测试显示，方向性听力（OI），安静下的语言感知和语音可懂阈值（OLSA）有了显着改善。

结论：

治疗前后HRQoL有所改善，耳鸣和认知障碍减少。术前较高的压力水平显着下降，抑郁症状和焦虑等心理合并症均在植入后得到改善。

【关键词】人工耳蜗植入，单侧耳聋，生活质量，压力，耳鸣.

Cochlear Implantation for Single-Sided Deafness: Observations in Poor Performers

Philipp Mittmann[1],A. Ernst[1],S. Scholz[1],R. D. Battmer[1],I. Todt[1]

1 Department of Otolaryngology, Head and Neck Surgery, Unfallkrankenhaus Berlin, Germany

Abstract

Objectives: Patients with single-sided deafness can nowadays receive a cochlear implant. A majority of these patients are well adapted and benefit from the implant. The aim of this study was to evaluate the reasons for poor performance in a group of patients with single-sided deafness, who received a cochlear implant.

Design:A total of 65 patients were enrolled into a retrospective case series. Seven poor performers were present in the group. Freiburger monosyllabics, localization testing, and radiologic images were evaluated.

Results: Localization testing showed the absence of lateralization ability in three patients, whereas the Freiburger monosyllabic word scores improved in three patients. One patient had no speech perception after 1 year of rehabilitation. Findings of magnetic resonance imaging (MRI) revealed cerebral involvement in five patients.

Conclusion: Various factors influence the outcome in unilateral cochlear implantation in patients with single-sided deafness. These reasons may be preoperative, operative, or postoperative. Nevertheless, the majority of patients benefit from these implants.

Key Words:single-sided deafness,cochlear implant,sound localization.

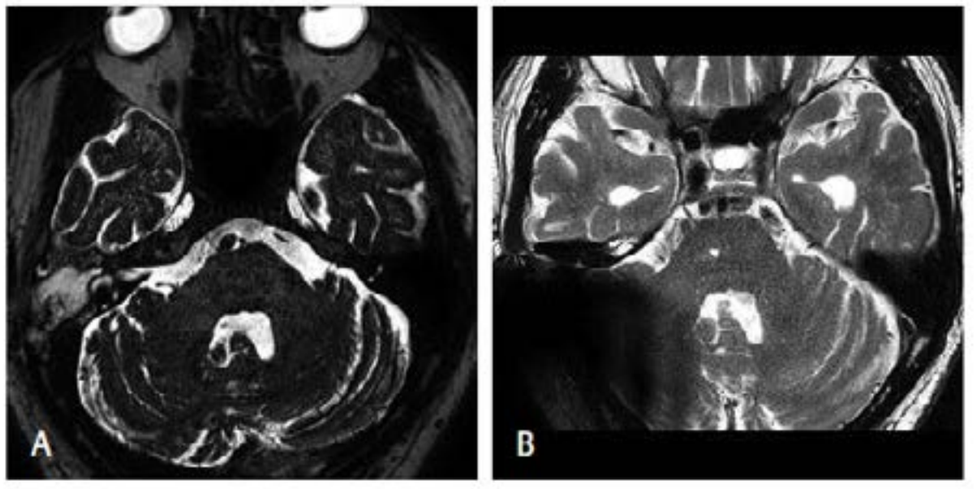


Fig. 2 MRI scan before (A) and after (B) cochlear implantation on the right side. T2-weighted images after cochlear implantation include the artifact caused by the magnet. The lacunar infarct is seen in the pontine area.

参考译文：

单侧耳聋的人工耳蜗植入：表现不佳的观察

Philipp Mittmann[1] A. Ernst[1] S. Scholz[1] R. D. Battmer[1] I. Todt[1]

1德国柏林Unfallkrankenhaus耳鼻咽喉头颈外科

【摘要】

目的：

目前，单侧耳聋患者可以接受人工耳蜗植入。这些患者中的大多数都能很好地适应并人工耳蜗中受益。这项研究的目的是评估一组接受人工耳蜗植入的单侧耳聋患者表现不佳的原因。

设计：

共有65名患者被纳入回顾性病例系列。该小组有七名表现不佳的人。对弗赖堡单音节词，定位测试和影像学进行了评估。

结果：

定位测试显示三名患者缺乏方向感知能力，而弗莱堡单音节单词得分在三名患者中有所改善。一例患者康复1年后没有言语感知。磁共振成像（MRI）结果显示五名患者的脑部受累。

结论：

各种因素影响单侧耳聋患者单侧人工耳蜗植入的疗效。这些原因可能是术前，手术或术后。尽管如此，大多数患者受益于人工耳蜗植入。

【关键词】单侧耳聋，人工耳蜗，声音定位.

Single-Sided Deafness and cochlear implantation in congenital and acquired hearing loss in children

Ángel Ramos Macías*, Silvia A Borkoski-Barreiro*, Juan C Falcón González*, Isabel de Miguel Martínez **, Ángel Ramos de Miguel*

*Hearing Loss Unit. Otorhinolaryngology, Head and Neck Department. Complejo Hospitalario Universitario Insular Materno Infantil, Las Palmas of Gran Canaria, Spain.
**Microbiology Department. Complejo Hospitalario Universitario Insular Materno Infantil, Las Palmas of Gran Canaria, Spain.

Abstract

Background: While CI provision is a well-established and beneficial therapy in an increasing number of countries for adults with acquired SSD, there is less experience with this therapeutic option in children.

Objective of review:determine the audiological and clinical results of cochlear implantation in children below the age of 12 years old with congenital and acquired single-sided deafness.

Evaluation method: Observational, descriptive, transversal study, in children <12 implanted for congenital or acquired SSD. Speech reception thresholds, Cortical responses, Auditory Lateralization Test and SSQ questionnaire.

Results: All the children with congenital SSD showed positive cortical responses. Positive results were obtained in the Auditory Lateralization Test for the following modalities: 0º, 45º and 90º.

With respect to the Speech Test, the children with acquired SSD showed the following results: 92% and 100% in recognition and 48% and 68% (Azimuth modalities), Signal CI side 52% and 68% and Signal normal hearing side 44% - 60% ($p < 0.05$).

In both group the processor was used for 6-12 hours.

With respect to the SSQ questionnaire results, the parents were more satisfied within the postoperative period than within the preoperative period ($P<0.001$).

Conclusions: Cochlear implant provides children with congenital SSD with significant audiological and subjective benefits. Children with congenital SSD and implanted after a longer period may not have an important benefit (binaural) although other bilateral effects can be achieved. Children with post-lingual unilateral deafness and after a short period of hearing deprivation probably integrated the normal acoustic hearing with the cochlear implant electrical signal and showed binaural benefits.

参考译文：

先天性和后天性单侧聋儿童及人工耳蜗植入的临床观察

Ángel Ramos Macías*, Silvia A Borkoski-Barreiro*, Juan C Falcón González*, Isabel de Miguel Martínez **, Ángel Ramos de Miguel*

*听力损失科。耳鼻咽喉头颈科。西班牙大加那利岛帕尔马斯岛妇孺大学综合医院
**微生物系。西班牙大加那利岛帕尔马斯岛妇孺大学综合医院

【摘要】

背景：

在越来越多的国家，对于患有后天SSD的成年人，CI是一种公认的有益的治疗方法，但在儿童中使用这种治疗方法的经验却很少。

目的：

探讨12岁以下先天性和后天性单侧聋儿童植入人工耳蜗后的听力学和临床效果。

评价方法：

对12岁以下儿童先天性或后天性SSD进行观察、描述、横向研究。言语识别阈、皮层反应、听力方向性试验和SSQ问卷。

结果：

先天性SSD患儿均表现为皮质反应阳性。在听力方向性测试试验中获得以下良好的结果：0°、45°、90°。在语音测试方面，获得性SSD儿童的识别率为92%和100%，方位模式为48%和68%，信号CI侧52%和68%，听力正常侧44%-60%（p<0.05）。

在两组中，处理器均使用了6-12小时。

从SSQ问卷结果来看，术后家长满意度高于术前（P<0.001）。

结论：

人工耳蜗植入术对先天性SSD患儿的听力学和主观方面有明显的益处。先天性SSD患儿经较长时间植入后可能没有重要的益处（双耳），尽管其他双边效果可以实现。语后聋单侧耳聋患儿在短时间听力剥夺后，可能将正常听觉与人工耳蜗植入电信号结合，表现出双耳优势。

Cochlear Implantation for Single-Sided Deafness: A Multicenter Study

Douglas P. Sladen, PhD; Christopher D. Frisch, MD; Matthew L. Carlson, MD; Colin L.W. Driscoll, MD; Jennifer H. Torres, MA, CCC-A2; Daniel M. Zeitler, MD

Abstract

Objectives/Hypothesis: To report the preliminary outcomes of patients with single-sided deafness and asymmetric hearing loss undergoing cochlear implantation at two centers.

Study Design: Retrospective review and prospective data collection

Methods: Patients with single-sided deafness who underwent cochlear implantation at two centers were included. Pre and postoperative measures included monosyllabic word and sentence recognition in quiet for the ear implanted, and sentence recognition in noise in the best-aided bilateral condition.

Results: Average monosyllabic word recognition scores in quiet improved significantly from 11.3% (standard deviation [SD] 15.6%) preoperatively to 48.7% (SD 24.2%) at the 3-month postactivation interval, although they did not increase significantly between the 3-month and 6-month intervals. Sentence recognition scores in quiet increased significantly from 18.4% (SD 28.5%) preoperatively to 65.9% (SD 17.9%) at the 3-month postactivation interval, but not between the 3-month and 6month intervals. Sentence recognition in noise in the best-aided bilateral condition increased from 59% (SD 16.3%) preoperatively to 72% (SD 16.0%) at 6-months postactivation, though the difference was not statistically significant. Thirteen of the participants reported tinnitus prior to surgery. Of those, 12 reported that tinnitus was improved after implantation, and one reported that tinnitus was unchanged.

Conclusion: Preliminary results suggest that speech recognition in a singly deafened ear is significantly improved after cochlear implantation, although speech recognition in noise measured in the bilateral condition remains the same at 6months postactivation.

Key Words: Cochlear implant, single-sided deafness, signal-to-noise ratio, tinnitus, speech understanding in noise, sudden sensorineural hearing loss.

参考译文：

单侧耳聋的人工耳蜗植入：一项多中心研究

Douglas P. Sladen, PhD; Christopher D. Frisch, MD; Matthew L. Carlson, MD; Colin L.W. Driscoll, MD; Jennifer H. Torres, MA, CCC-A2; Daniel M. Zeitler, MD

【摘要】

目标/假设：

报道在两个中心接受人工耳蜗植入的单侧耳聋和不对称听力损失患者的初步结果。

研究设计：

回顾性研究和前瞻性数据收集。

方法：

纳入在两个中心接受人工耳蜗植入的单侧耳聋患者。术前和术后措施包括安静下的单音节单词和句子识别，以及在双耳最佳辅助下进行噪声下的句子识别。

结果：

安静组平均单音节单词识别分数从术前的11.3%（标准差[SD]15.6%）显着提高到植入后3个月的48.7%（SD 24.2%），但在3-6个月的间隔期间没有显着增加。安静组的句子识别分数从术前的18.4%（标准差28.5%）显着增加到植入后3个月的65.9%（标准差17.9%），但在3个月和6个月之间的时间间隔内没有显著的提高。在最佳双侧辅助的条件下，噪声环境下的句子识别从术前的59%（SD 16.3%）增加到植入后6个月的72%（SD 16.0%），尽管差异无统计学意义。13名参与者在手术前报告耳鸣，其中12例报告植入后耳鸣改善，1例报告耳鸣未改变。

结论：

初步结果表明，尽管在双侧条件下的噪声语音识别在激活后6个月仍保持不变，单耳聋的语音识别在人工耳蜗植入后得到了显著的改善。

【关键词】人工耳蜗，单侧耳聋，信噪比，耳鸣，噪声语音理解，突发感音神经性听力损失.

Long-term Audiologic Outcomes After Cochlear Implantation for Single-Sided Deafness

Douglas P. Sladen, PhD; Christopher D. Frisch, MD; Matthew L. Carlson, MD; Colin L.W. Driscoll, MD; Jennifer H. Torres, MA, CCC-A2; Daniel M. Zeitler, MD

*From the Department of Otolaryngology–Head and Neck Surgery (C.B.S., Z.A-Q., V.Z., A.L., C.D., B.J.G., M.R.H.); and Department of Neurosurgery (C.B.S., Z.A.-Q., V.Z., A.L., C.D., B.J.G., M.R.H.), University of Iowa Hospitals and Clinics, Iowa City, Iowa, U.S.A.

Abstract

Objectives: To evaluate the long-term audiometric outcomes, sound localization abilities, binaural benefits, and tinnitus assessment of subjects with cochlear implant (CI) after a diagnosis of unilateral severe-to-profound hearing loss.

Method: The study group consisted of 60 (mean age 52 years, range 19–84) subjects with profound hearing loss in one ear and normal to near-normal hearing in the other ear who underwent CI. Data analysis included pre- and postoperative Consonant-Nucleus-Consonant (CNC) Word scores, AzBio Sentence scores, pure tone thresholds, sound localization, and Iowa Tinnitus Handicap Questionnaire scores.

Results: Preoperative average duration of deafness was 3.69 years (standard deviation 4.31), with an average follow-up time of 37.9 months (range 1–87). CNC and AzBio scores significantly improved (both $P < 0.001$) postoperatively among the entire cohort, and there was much heterogeneity in outcomes with respect to deafness etiology subgroup analysis. Sound localization abilities tended to improve longitudinally in the entire cohort. Binaural benefits using an adaptive Hearing in Noise Test test showed a significant ($P < 0.001$) improvement with head shadow effect. Utilizing the Iowa Tinnitus Handicap Questionnaire, there was significant improvement in social, physical, and emotional well-being ($P = 0.011$), along with hearing abilities ($P = 0.001$).

Conclusions: This case series is the largest cohort of CI SSD subjects to date and systematically analyzes their functional outcomes.Subjects have meaningful improvement in word understanding, and sound localization tends to gradually improve over time. Binaural benefit analysis showed significant improvement with head shadow effect, which likely provides ease of listening.

Key Words: Cochlear implants, sensorineural hearing loss, quality of life.

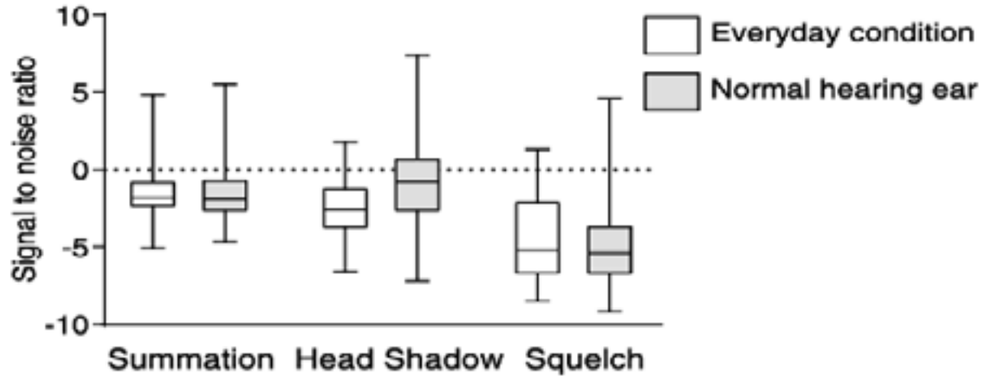


Fig. 5. Average of binaural benefits seen after CI for SSD. When noise was introduced to the listener in in the NH ear with the CI turned on (everyday condition), there was a significant ($P < 0.001$) improvement with the head shadow effect. No significant differences were seen with respect to binaural summation or the squelch effect. Nonimplanted is when sound is introduced with the CI turned off. CI = cochlear implant; NH = normal to good audiometric profile; SSD = single-sided deafness is right.

参考译文：

单侧耳聋人工耳蜗植入后的长期听力学结果

Christopher Blake Sullivan, MD ; Zaid Al-Qurayshi, MD, MPH; Vivian Zhu, BS ; Andrew Liu, MD, PHD; Camille Dunn, PhD ; Bruce J. Gantz, MD; Marlan R. Hansen, MD

*来自耳鼻咽喉-头颈外科（C.B.S.，Z.A-Q.，V.Z.，A.L.，C.D.，B.J.G.，M.R.H。）；和神经外科（C.B.S.，Z.A.-Q.，V.Z.，A.L.，C.D.，B.J.G.，M.R.H。），爱荷华州爱荷华市爱荷华大学医院和诊所

【摘要】

目的：

评估单侧重度至重度听力损失诊断后人工耳蜗（CI）患者的长期听力测定结果，声音定位能力，双耳益处和耳鸣评估。

方法：

研究组由60名（平均年龄52岁，范围19-84）接受CI的受试者组成，其中一只耳朵有严重的听力损失，另一只耳朵的听力正常至接近正常。数据分析包括术前和术后辅音-核-辅音(CNC)单词得分，AzBio句子评分，纯音阈值，声音定位和爱荷华州耳鸣障碍问卷评分。

结果：

术前平均耳聋病程为3.69年（标准差4.31），平均随访时间为37.9个月（范围1-87）。在整个队列中，CNC和AzBio评分在术后均显着改善（均P<0.001），并且在耳聋病因亚组分析方面，结果存在很大的异质性。在整个队列中，声音定位能力纵向上趋于提高。在噪声测试中使用自适应听力测试显示头部阴影效应显着（P<0.001）改善。利用爱荷华州耳鸣障碍问卷，社交，身体和情绪健康状况以及听力能力得到了显着改善（P=0.001）（P=0.011）。

结论：

该病例系列是迄今为止最大的CI SSD受试者队列，系统地分析了他们的功能结果。受试者在单词理解方面具有有意义的改进，并且声音定位倾向于随着时间的推移逐渐改善。双耳效益分析显示，头影效应显著改善，可能提供了轻松的听力。

【关键词】人工耳蜗，感音神经性听力损失，生活质量.

Speech Recognition in Noise in Single-Sided Deaf Cochlear Implant Recipients Using Digital Remote Wireless Microphone Technology

Thomas Wesarg* Susan Arndt* Konstantin Wiebe* Frauke Schmid*† Annika Huber*† Hans E. M¨ulder‡ Roland Laszig* Antje Aschendorff* Iva Speck*

*Department of Otorhinolaryngology—Head and Neck Surgery, Medical Center—University of Freiburg, Faculty of Medicine, Freiburg, Germany; †University of Applied Sciences Offenburg, Offenburg, Germany; ‡Phonak Communications AG, Murten, Switzerland

Abstract

Background: Previous research in cochlear implant (CI) recipients with bilateral severe-to-profound sensorineural hearing loss showed improvements in speech recognition in noise using remote wireless microphone systems. However, to our knowledge, no previous studies have addressed the benefit of these systems in CI recipients with single-sided deafness.

Purpose: The objective of this study was to evaluate the potential improvement in speech recognition in noise for distant speakers in single-sided deaf (SSD) CI recipients obtained using the digital remote wireless microphone system, Roger. In addition, we evaluated the potential benefit in normal hearing (NH) participants gained by applying this system.

Research Design: Speech recognition in noise for a distant speaker in different conditions with and without Roger was evaluated with a two-way repeated-measures design in each group, SSD CI recipients, and NH participants. Post hoc analyses were conducted using pairwise comparison t-tests with Bonferoni correction.

Study Sample: Eleven adult SSD participants aided with CIs and eleven adult NH participants were included in this study.

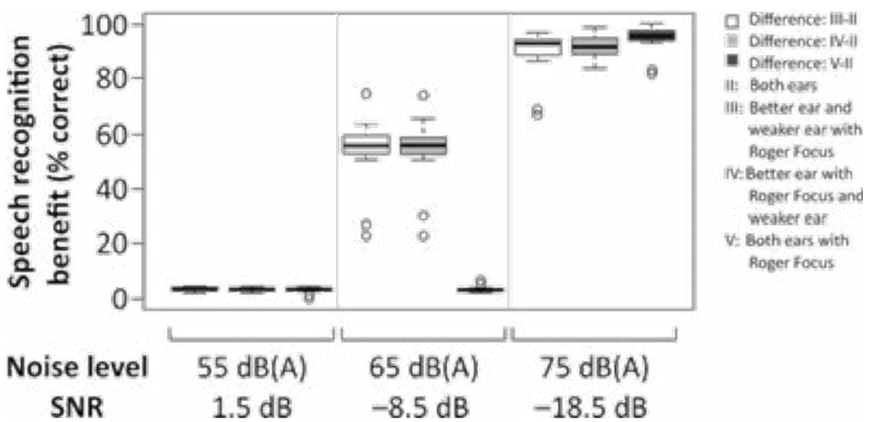
Data Collection and Analysis: All participants were assessed in 15 test conditions (5 listening conditions ×3 noise levels) each. The listening conditions for SSD CI recipients included the following:(I)only NH ear and CI turned off, (II)NH ear and CI (turned on),(III) NH ear and CI with Roger 14,(IV)NH ear with Roger Focus and CI, and (V) NH ear with Roger Focus and CI with Roger 14.For the NH participants, five corresponding listening conditions were chosen:(I)only better ear and weaker ear masked,(II)both ears, (III) better ear and weaker ear with Roger Focus, (IV) better ear with Roger Focus and weaker ear, and (V) both ears with Roger Focus. The speech level was fixed at 65 dB(A) at 1 meter from the speech presenting loudspeaker, yielding a speech level of 56.5 dB(A) at the recipient's head. Noise levels were 55, 65, and 75 dB(A). Digitally altered noise recorded in school classrooms was used as competing noise. Speech recognition was measured in percent correct using the Oldenburg sentence test.

Results: In SSD CI recipients, a significant improvement in speech recognition was found for all listening conditions with Roger (III, IV, and V) versus all no-Roger conditions (I and II)at the higher noise levels (65 and 75 dB[A]). NH participants significantly benefited from the application of Roger in noise for higher levels, too. In both groups, no significant difference was detected between any of the different listening conditions at 55 dB(A) competing noise. There was also no significant difference between any of the Roger conditions III, IV, and V across all noise levels.

Conclusions: The application of the advanced remote wireless microphone system, Roger, in SSD CI recipients provided significant benefits in speech recognition for distant speakers at higher noise levels. In NH participants, the application of Roger also produced a significant benefit in speech recognition in noise.

Key Words:cochlear implant, remote wireless microphone system, single-sided deafness, speech recognition in noise.

Abbreviations:ADRO=5 Adaptive Dynamic Range Optimization; ASC=5 Autosensitivity control; CI 5 cochlear implant; FM=5 frequency modulation; HA=5 hearing aid; NH=5 normal hearing; NHbe=5 better normal hearing ear; NHwe=5 weaker normal hearing ear; OLSA=5 Oldenburg sentence test; SSD=5 single-sided deafness.



Difference: III-II
Difference: IV-II
Difference: V-II
II: Both ears
III: Better ear and weaker ear with Roger Focus
IV: Better ear with Roger Focus and weaker ear
V: Both ears with Roger Focus

Figure5.Box-and-whiskerplotsofspeechrecognitionbenefitof11NHparticipantsatthreenoiselevelsforeachofthreedifferent comparisons of listening conditions.

参考译文：

单侧耳蜗植入者噪声语言识别中的数字遥控无线麦克风技术

Thomas Wesarg* Susan Arndt* Konstantin Wiebe* Frauke Schmid*† Annika Huber*† Hans E. M¨ulder‡ Roland Laszig* Antje Aschendorff* Iva Speck*

*弗莱堡医学中心耳鼻咽喉头颈外科，德国弗莱堡医学院；†德国奥芬堡奥芬堡应用科学大学，奥芬堡，德国；曾在瑞士Murten峰力通信公司

【摘要】

背景：先前的研究表明，在人工耳蜗植入者中，双侧重度至重度感音神经性耳聋患者在使用远程无线麦克风系统时，语音识别能力有所提高。然而，据我们所知，以前没有研究说明这些系统对单侧耳聋的CI受者的好处。

目的：本研究的目的是评估单侧聋（SSD）CI接受者在使用数字远程无线麦克风系统Roger对远距离噪声下的语音识别潜在改善。此外，我们评估了应用此系统对正常听力（NH）参与者的潜在收益。

研究设计：在有和没有Roger的不同条件下，使用双向重复测量设计来评估SSD CI接受者和NH参与者中在远距离噪声中的语音识别。事后分析使用成对比较t检验和Bonferoni校正进行。

研究样本：本研究纳入了11名成年SSD参与者辅助CI和11名成年NH参与者。

数据收集和分析：所有参与者均在15种测试条件（5种听力条件×3种噪音水平）下进行评估。SSD CI接收收者的听力条件包括：（I）仅NH耳和CI关闭，（II）NH耳和CI（打开），（III）NH耳和CI与Roger 14，（I V）NH耳与Roger Focus和CI，以及（V）NH耳与Roger Focus和CI与Roger 14.对于NH参与者，选择了五个相应的听力条件：（I）只有更好的听力耳朵和较弱的耳朵被掩盖，（II）双耳，（III）更好的耳朵和较弱的耳朵与Roger Focus，（IV）更好的耳朵与Roger Focus和较弱的耳朵，以及（V）双耳与Roger Focus。语音水平在距语音扬声器1米处固定为65 dB（A），在接收者的头部产生56.5 dB（A）的语音水平。噪音声级分别为55、65和75 dB（A）。在学校教室记录的数字改变的噪音被用作竞争噪音。使用Oldenburg句子测试语音识别的正确率。

结果：在SSD CI接受者中，在较高噪声水平（65和75 dB）下，Roger（III，IV和V）与所有非Roger（I和II）的所有听力条件下，语音识别都有显著改善。NH参与者也从Roger中收益，在噪声中获得更高。在两组中，在55 dB（A）竞争噪声下，任何不同的听力条件之间均未检测到显着差异。在所有噪音水平上，任何Roger条件III，IV和V之间也没有显着差异。

结论：先进的远程无线麦克风系统Roger在SSD CI接受者中的应用在较高噪声水平的远距离扬声器的语音识别提供了显着优势。在NH参与者中，Roger的应用也为噪声中的语音识别带来了显著的益处。

【关键词】人工耳蜗，远程无线麦克风系统，单侧耳聋，噪声语音识别.

缩写：ADRO=5自适应动态范围优化；ASC=5自动敏感度控制；CI 5人工耳蜗；FM=5频率调制；HA=5助听器；NH=5正常听力；NHbe=5更好的正常听力耳朵；NHwe=5弱正常听力耳朵；OLSA=5 Oldenburg句子测试；SSD=5单侧耳聋.

Cochlear implantation as a long-term treatment for ipsilateral incapacitating tinnitus in subjects with unilateral hearing loss up to 10 years

Griet Mertens [a, b, *], Marc De Bodt [a, b], Paul Van de Heyning [a, b]

[a] Univ. Dept. Otorhinolaryngology, Head and Neck Surgery, Antwerp University Hospital, Belgium
[b] University of Antwerp, Belgium

Abstract

Introduction: The authors previously demonstrated that tinnitus resulting from unilateral hearing loss (UHL) can be treated with electrical stimulation via a Cochlear Implant (CI). The study aimed to do a longterm (LT) evaluation of CI in subjects suffering from UHL and accompanied incapacitating tinnitus up to 10 years. The primary focus of the study is on LT tinnitus reduction.

Subjects:LT evaluation was derived from 23 subjects suffering from UHL and accompanied incapacitating tinnitus (Pre-operative Tinnitus Loudness Visual Analogue Scale (VAS) score >6/10). They were cochlear implanted at a median age of 55 years (22-71 yr) and had 8 years (3-10 yr) experience with their CI at the LT testing. The subjects were categorized into two groups: a Single-Sided Deaf Group (SSD) and an Asymmetric Hearing Loss Group (AHL). The SSD group comprises subjects with contralateral normal hearing (i.e. air conduction pure tone average (PTA0.5, 1, 2 and 4 kHz) ≤30 dB HL) and the AHL group subjects with contralateral mild to moderate hearing loss (i.e. air conduction PTA0.5, 1, 2 and 4 kHz > 30 dB HL).

Methods: In order to obtain a LT structural overview of the CI use in UHL subjects, a structured interview was conducted including questions about daily amount of CI use, residual inhibition of the tinnitus after switch off, tinnitus type, etc. The $VAS_{tinnitus\ loudness}$ and the Tinnitus Questionnaire were obtained preoperatively, one, three, six, 12, and 36-months post-operatively and at the long-term test interval (8 (3 e10 years) post-operative). The Hyperacusis Questionnaire was administered in the CI_{ON} and the CI_{OFF} condition.

Results: The structural interview revealed that all patients (23/23) still wear their CI seven days a week, eight (3e10) years after cochlear implantation. It appeared that in all subjects but one CI switch-on is the first act when rising and CI switch-off is the last act before bedtime. In the SSD group, tinnitus suppression is still the primary benefit reported (83%), whereas in the AHL the majority of the subjects (55%) report that the primary benefit shifted to improved hearing. In the majority of the subjects the tinnitus reduction starts within 1 min (in 70% of the cases) and the residual inhibition after CI switch-off is less than a minute (in 65% of the cases). The VAS and TQ scores significantly improved up to three months after the first-fitting and remain stable up to the LT test interval. The median score on the Hyperacusis Questionnaire was 17 (7-36) in the CI_{OFF} condition and improved to 23,5 (12-39) in the CI_{ON} condition in the SSD group.

Conclusion: This is the first study to report on LT results in a large number of UHL CI users, up to 10 years. Structured interviews shows that 100% of the subjects wears their CI seven days a week. The tinnitus reduces significantly up to three months after the first-fitting and the tinnitus reduction remain stable up to the LT test interval. The SSD group report tinnitus reduction as the primary benefit, whereas the majority of the AHL group report improved hearing as the primary benefit, eight (3-10) years after implantation. In addition to the tinnitus reduction, the CI provides also a benefit regarding reported.

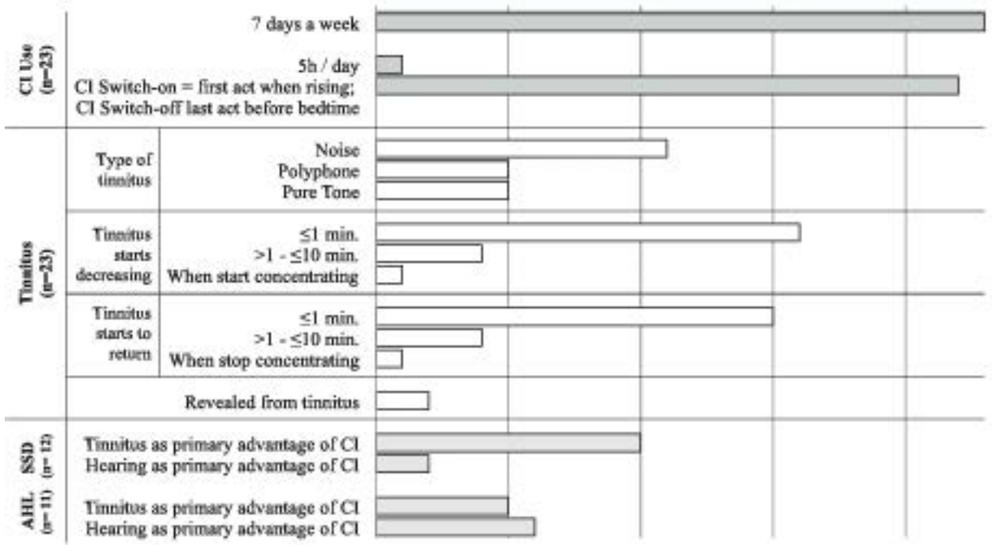


Fig. 3. Overview structured interview, including questions related to CI use, experienced tinnitus and primary experienced advantages after CI in the SSD and the AHL group.

参考译文：

人工耳蜗植入可作为单侧听力损失长达10年的同侧失能性耳鸣的长期治疗方法

Griet Mertens a, b, * , Marc De Bodt a, b , Paul Van de Heyning a, b

a比利时安特卫普大学医院耳鼻咽喉头颈外科大学
b比利时安特卫普大学

【摘要】

简介：作者先前证实，单侧听力损失（UHL）引起的耳鸣可以通过人工耳蜗（CI）进行电刺激治疗。该研究旨在对患有UHL及伴有失能性耳鸣长达10年的受试者进行CI的长期（LT）评估。该研究的主要重点是LT耳鸣的治疗。

受试者：LT评估来自23名患有UHL并伴有失能性耳鸣的受试者（术前耳鸣响度视觉模拟评分（VAS）评分>6/10）。他们的人工耳蜗植入平均年龄为55岁（22-71岁），并且在LT测试中具有8年（3-10岁）的CI经验。受试者分为两组：单侧聋组（SSD）和非对称性听力损失组（AHL）。SSD组是对侧正常听力（即空气传导纯音平均（PTA0.5,1,2和4kHz）≤30dB HL）的受试者、AHL组是对侧轻度至中度听力损失（即空气传导PTA0.5,1,2和4kHz>30dB HL）的受试者。

方法：为了获得UHL受试者CI使用的LT结构概述，采用结构化访谈，包括每日CI使用频率，关闭后耳鸣残余抑制率，耳鸣类型等问题。分别于术前、术后1个月、术后3个月、术后6个月、术后12个月和术后36个月以及术后8（3 -10年）长期试验时进行VAStinnitus响度及耳鸣问卷调查。在CION和CIOFF两种情况下进行听觉障碍调查。

结果：结构访谈显示，所有患者（23/23）在人工耳蜗植入后8（3-10）年，每周7天仍然佩戴CI。结果显示，除了一个CI是起床后就开机，而另一个CI睡觉前的关机外，其他所有被试都是如此。在SSD组中，抑制耳鸣仍然是报告的主要好处（83%），而在AHL组中，大多数受试者（55%）报告主要好处转向改善听力。在大多数受试者中，耳鸣在1分钟内开始减轻（在70%的情况下），在CI关闭后的残余抑制作用不到一分钟（在65%的情况下）。第一次拟合后三个月内VAS和TQ评分显着改善，并在LT测试间隔内保持稳定。Hyperacusis问卷的中位数得分在CIOFF条件下为17（7-36），在SSD组的CION条件下改善至23,5（12-39）。

结论：这是第一项报告大量UHL CI用户长达10年的LT结果的研究。结构化访谈显示，100%的受试者每周7天都佩戴CI。耳鸣在第一次拟合后最多三个月明显减轻，并且耳鸣减少在LT测试间隔之前保持稳定。SSD组报告以耳鸣减少为主要益处，然而大多数AHL组报告在植入后8年(3-10年)，改善听力是主要好处。而大多数AHL组报告在植入后八（3-10）年将听力提高为主要益处。除了减少耳鸣外，CI还提供了有关报道的益处。

The Influence of Cochlear Implantation on Tinnitus in Patients with Single-Sided Deafness: A Systematic Review

Nicole Peter, MD[1,2*], Nuwan Liyanage, MSc[1,2*], Flurin Pfiffner, PhD[1,2], Alexander Huber, MD[1,2], and Tobias Kleinjung, MD[1,2]

1 Department of Otorhinolaryngology, Head & Neck Surgery, University Hospital Zurich, Zurich, Switzerland
2 University of Zurich, Zurich, Switzerland
* These authors contributed equally to this work and share first authorship.

Abstract

Objectives: This systematic review provides an overview of the available studies (published by January 29, 2018) with descriptive data analysis about the influence of cochlear implantation on tinnitus in patients with single-sided deafness (SSD).

Data Sources: PubMed, EMBASE, Web of Science, Cochrane Library, and Google Scholar.

Review Methods: Original studies about the influence of cochlear implantation on tinnitus, measured with different tinnitus questionnaires or visual analog scale, in patients with SSD were included. The pre- and postimplantation tinnitus scores of the included studies were extracted for the further systematic review.

Results: The systematic search yielded 1028 studies. After evaluating titles, abstracts, and full texts, 1011 of these were dismissed. From the remaining 17 studies, 4 showed a low directness of evidence or high risk of bias and were therefore excluded. Due to the nature of cochlear implantation in SSD, only cohort studies and no randomized trials exist, which limits the evaluation in a systematic review. Generally, the mean tinnitus questionnaire scores decreased after cochlear implantation in these 13 studies with a total of 153 patients. The most widely used tinnitus questionnaire was the Tinnitus Handicap Inventory. In these studies, 34.2% of patients demonstrated complete suppression, 53.7% an improvement, 7.3% a stable value, and 4.9% an increase of tinnitus, and none of the patients reported an induction of tinnitus.

Conclusions: This review shows a clear improvement of tinnitus complaints after cochlear implantation in patients with SSD. Therefore, tinnitus might be considered as an additional indication for cochlear implantation in SSD.

Key Words:unilateral hearing loss, cochlear implant, CI, tinnitus, singlesided deafness, cochlear implantation, review

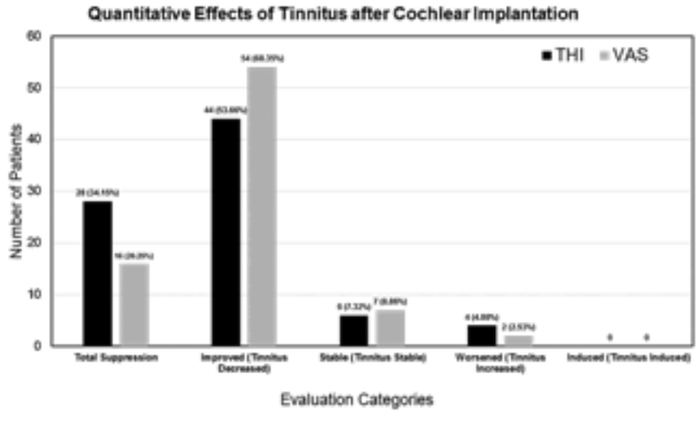


Figure 4. Number of patients from all the studies categorized into different outcome classes. The calculation was based on the studies, which used the Tinnitus Handicap Inventory (THI) and/or visual analog scale (VAS) questionnaires.

参考译文：

人工耳蜗植入对单侧耳聋患者耳鸣的影响：系统评价综述

Nicole Peter, MD1,2*, Nuwan Liyanage, MSc1,2*, Flurin Pfiffner, PhD1,2, Alexander Huber, MD1,2, and Tobias Kleinjung, MD1,2

1瑞士苏黎世苏黎世大学医院耳鼻咽喉头颈外科
2苏黎世大学，瑞士苏黎世
*这些作者对这项工作做出了同样的贡献，并分享了第一作者身份

【摘要】

目的：

本综述评价概述了现有研究（2018年1月29日前发表），人工耳蜗植入对单侧耳聋（SSD）患者耳鸣的影响进行了描述性数据分析。

数据来源：

PubMed，EMBASE，Web of Science，Cochrane图书馆和Google Scholar。

回顾方法：

采用不同耳鸣问卷或视觉模拟量表测量SSD患者人工耳蜗植入对耳鸣影响的原始研究。所纳入研究的植入前和植入后耳鸣评分被提取用于进一步的系统评价。

结果：

系统搜索产生了1028项研究。在评估标题，摘要和全文后，其中1011人被剔除。从其余的17项研究中，4项显示证据的直接性较低或偏倚风险较高，因此被排除在外。由于SSD中人工耳蜗的性质，仅存在队列研究且没有随机试验，这限制了系统评价的评估。总体而言，在这13项研究中共153例患者植入人工耳蜗植入后平均耳鸣问卷得分降低。使用最广泛的耳鸣问卷是耳鸣障碍量表。在这些研究中，34.2%的患者表现出完全抑制，53.7%的患者出现好转，7.3%的患者出现稳定值，4.9%的患者出现耳鸣增加，无一例患者出现耳鸣诱导。

结论：

本综述显示SSD患者人工耳蜗植入后耳鸣症状明显改善。因此，耳鸣可能被认为是SSD中人工耳蜗植入的另一个指征。

【关键词】单侧听力损失，人工耳蜗，CI，耳鸣，单侧耳聋，人工耳蜗植入，综述.

Mechanisms of Localization and Speech Perception with Colocated and Spatially Separated Noise and Speech Maskers Under Single-Sided Deafness with a Cochlear Implant

Coral Dirks1,2, Peggy B. Nelson1, Douglas P. Sladen3, and Andrew J. Oxenham2

1Department of Speech-Language-Hearing Sciences, University of Minnesota, Minneapolis, MN, USA
2Department of Psychology, University of Minnesota, Minneapolis, MN, USA
3Department of Communication Sciences and Disorders, Western Washington University, Bellingham, WA, USA

Abstract

Objectives: This study tested participants with a cochlear implant (CI) in one ear and acoustic hearing in the other ear, to assess their ability to localize sound and to understand speech in collocated or spatially separated noise or speech maskers.

Design: Eight CI users with contralateral acoustic hearing ranging from normal hearing to moderate sensorineural hearing loss were tested. Localization accuracy was measured in five of the participants using stimuli that emphasized the separate contributions of interaural level differences (ILD) and interaural time differences (ITD) in the temporal envelope and/or fine structure. Sentence recognition was tested in all eight CI users, using collocated and spatially separated speech-shaped Gaussian noise and two-talker babble. Performance was compared with that of age-matched normal-hearing (NH) listeners via loudspeakers or via headphones with vocoder simulations of CI processing.

Results: Localization improved with the CI, but only when high-frequency ILDs were available. Participants experienced no additional benefit via ITDs in the stimulus envelope or fine structure using real or vocoder-simulated CIs. Speech recognition in two-talker babble improved with a CI in 7 of 8 participants when the target was located at the front and the babble was presented on the side of the acoustic-hearing ear, but otherwise showed little or no benefit of a CI.

Conclusion: Sound localization can be improved with a CI in cases of significant residual hearing in the contralateral ear, but only for sounds with high-frequency content, and only based on ILDs. In speech understanding, the CI contributed most when it was in the ear with the better signal-to-noise ratio with a speech masker.

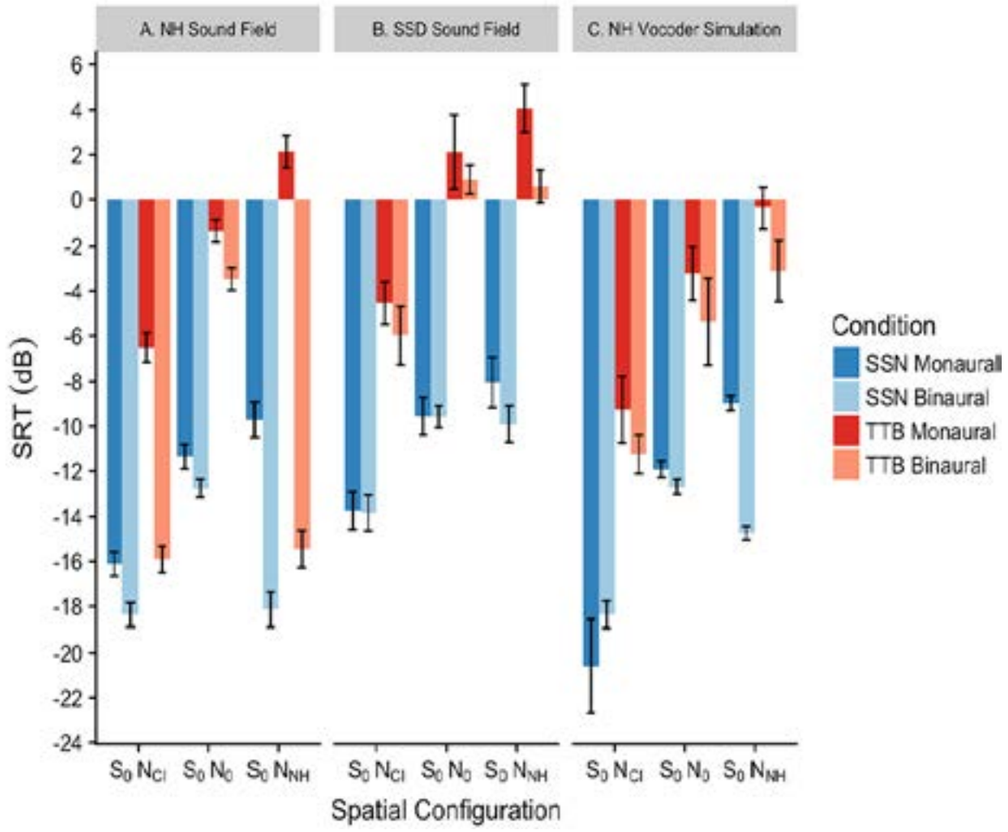


Fig. 8. Speech recognition thresholds for NH listeners in the sound field (first panel), NH listeners in the vocoder simulation (second panel), and SSD+CI in the sound field (third panel),groups, respectively. Speech and noise location appear on the x-axis and SRT in dB appears on the y-axis. Blue bars represent conditions where the masker was speech-shaped noise (SSN). Red bars represent conditions where the masker was time-reversed two-talker babble (TTB). Darker shaded bars represent the monaural condition. Lighter shaded bars represent the binaural condition. Error bars represent ±1 standard error.

参考译文：

单侧耳蜗植入噪声和语音掩蔽器的定位和语音感知机制研究

Coral Dirks1,2, Peggy B. Nelson1, Douglas P. Sladen3, and Andrew J. Oxenham2

1美国明尼苏达州明尼阿波利斯市明尼苏达大学语言听力科学系
2明尼苏达大学心理学系，明尼阿波利斯，明尼苏达州，美国
3通信科学与障碍系，西华盛顿大学，贝林厄姆，华盛顿州，美国

【摘要】

目的：

本研究用人工耳蜗CI植入受试者的一只耳朵和另一只耳朵进行听觉测试，以评估他们在并置或空间分隔的噪音或语音掩蔽物中定位声音和理解语音的能力。

设计：

测试了8名CI用户的对侧听力，从正常听力到中度感音神经性听力损失。在五名参与者中使用刺激来测量定位精度，这些刺激强调了时间包络和/或精细结构中耳间水平差异（ILD）和耳间时间差异（ITD）的各自作用的刺激。在所有八个CI用户中，使用并置且空间分离的语音形状高斯噪声和双说话者语音词，测试了句子识别。通过扬声器或耳机与声码器模拟CI处理的vocoder模拟将性能与年龄匹配的正常听力（NH）听众进行比较。

结果：

使用CI改善了定位，但只有在有高频耳间水平差异可用的情况下。通过使用real或vocode模拟CIs，参与者在刺激包膜或精细结构中的耳间时间差异没有获得额外好处。当目标位于前方,而声音出现在听觉耳朵的一侧时，八名参与者中有七名参与者的语言识别得到了改善，但除此之外，CI几乎没有益处。

结论：

在对侧耳有明显残余听力的情况下，CI可以改善声音定位，但仅适用于高频含量的声音，并且仅基于ILD。在语音理解方面，CI在耳朵中的贡献最大，使用语音屏蔽器具有更好的信噪比。

Binaural Perception in Single-Sided Deaf Cochlear Implant Users with Unrestricted or Restricted Acoustic Hearing in the Non-Implanted Ear

Camille Dorbeau a John Galvin b Qian-Jie Fu c Elsa Legris a Mathieu Marx d David Bakhos a, e

aCHRU de Tours, Service ORL et Chirurgie Cervico-Faciale, Tours, France;
b House Ear Institute, Los Angeles, CA, USA;
cDepartment of Head and Neck Surgery, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, CA, USA;
d CHU Toulouse, Hôpital Purpan, Service d'Otologie-Otoneurologie, Toulouse, France;
e Université François-Rabelais de Tours, CHRU de Tours, UMR-S930, Tours, France

Abstract

Cochlear implantation (CI) can benefit patients with singlesided deafness (SSD) in terms of sound localization, speech understanding in noise, tinnitus severity, and quality of life (QoL). In previous studies, CI outcomes have been largely reported for SSD patients with normal "unrestricted" hearing in the contralateral ear. However, SSD patients may often have some degree of hearing loss in the contralateral ear ("restricted" acoustic hearing). In this study, we report results from a French clinical trial for CI in in SSD patients (NCT02204618). Localization, speech reception thresholds (SRTs) in noise, tinnitus severity, and QoL were evaluated in 18 SSD patients 1 year after CI. Data were analyzed for 2 subject groups according to the pure-tone average thresholds in the non-implanted ear: unrestricted acoustic hearing (UNRES; ≤25 dB HL; n = 10) and restricted acoustic hearing (RES; > 25 dB HL; n = 8). Across all subjects, localization was significantly better with the CI on than off ($p = 0.005$); there was no significant difference between subject groups ($p = 0.301$). When speech and noise were co-located (S0N0), there was no significant difference in SRTs with the CI on or off ($p = 0.480$); SRTs were significantly better for the UNRES than for the RES group ($p = 0.005$). When speech and noise were spatially separated (SCINNH), SRTs were significantly better with the CI on than off ($p < 0.001$). While SRTs were better for the UNRES than for the RES group ($p = 0.024$), the CI benefit was more than 50% greater for the RES group due to the restoration of high-frequency speech cues. Questionnaire data showed that tinnitus severity was significantly reduced ($p = 0.045$) and QoL was significantly improved after one year of experience with the CI ($p < 0.001$). Age at testing was significantly correlated with SRTs for the S0N0 condition; duration of deafness was correlated with SRTs for the SCINNH condition. There were relatively few correlations between behavioral and subjective measures, suggesting that both were valuable when assessing CI benefits for SSD patients. The present data suggest that indications for CI should be expanded to include unilaterally deaf patients who have normal hearing or mild-to-moderate hearing loss in the nonimplanted ear.

Key Words: Unilateral deafness • Single-sided deafness • Cochlear implant • Localization • Speech in noise • Clinical trial

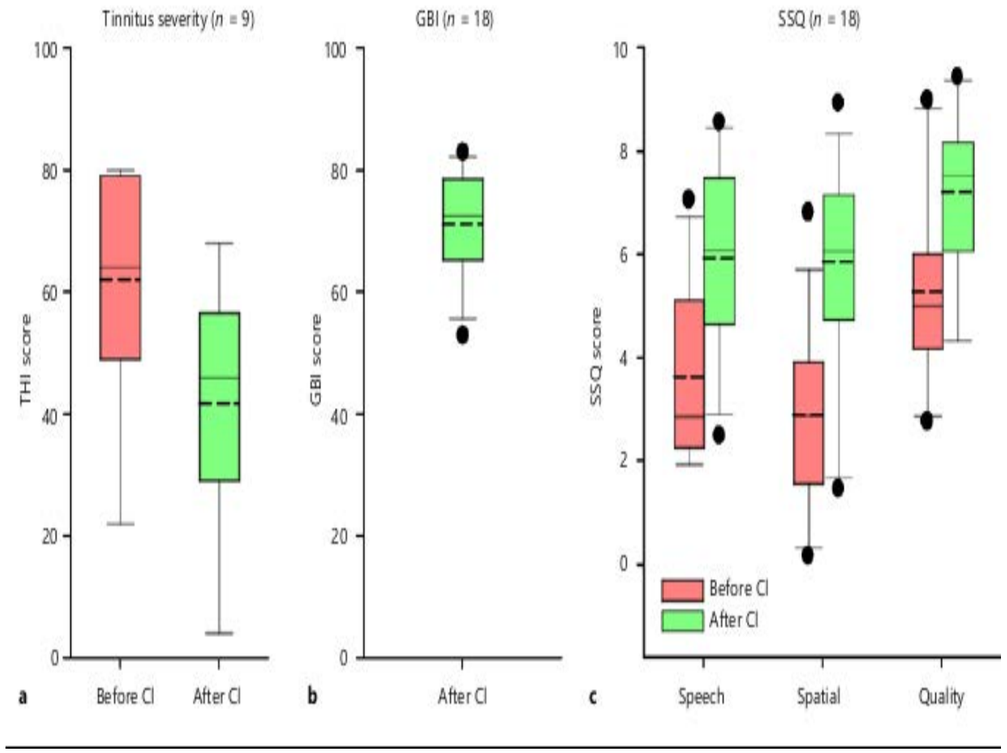


Fig. 4. a Boxplots for THI scores with the CI off (red) and CI on (green); lower scores indicate reduced tinnitus severity. b Boxplot for GBI scores; higher scores indicate better self-perceived outcome. c Boxplots for SSQ scores for the Speech, Spatial, and Quality categories; higher scores indicate better outcomes. In all panels, the red and green boxes show performance before and one year after receiving the CI respectively. The boxes show the 25th and 75th percentiles, the error bars show the 5th and 95th percentiles, the filled circles show outliers, the solid line shows the median, and the dashed line shows the mean.

参考译文：

单侧耳聋人工耳蜗使用者的双耳感知，非植入耳朵的听觉不受限制或受限

Camille Dorbeau a John Galvin b Qian-Jie Fu c Elsa Legris a Mathieu Marx d David Bakhos a, e

a法国的图尔，服务或服务和服务;
b豪斯耳研究所，美国加利福尼亚州洛杉矶;
c美国加州大学洛杉矶分校大卫格芬医学院头颈外科;
d朱图卢兹，啤医院，法国图卢兹耳科医院;
e弗朗索瓦-拉伯雷-图尔大学，图尔大学，UMR-S930，法国图尔

【摘要】

在声音定位，噪声中的语音理解，耳鸣严重程度和生活质量（QoL）方面，人工耳蜗植入（CI）可以使单侧耳聋（SSD）患者受益。在以往的研究中，CI结果主要报道了对侧耳朵正常“无限制”听力的SSD患者。然而，SSD患者可能经常在对侧耳朵有一定程度的听力损失（“受限”听觉障碍）。在这项研究中，我们报告了法国SSD患者CI临床试验的结果（NCT02204618）。18例SSD患者在CI后1年进行了定位，噪声中的语音接收阈值（SRT），耳鸣严重程度和生活质量评估。根据非植入耳的纯音平均阈值对2组受试者进行数据分析：无限制听觉障碍（UNR；≤25 dB HL；n=10）和受限的声音听觉（RES；>25 dB HL；n=8）。在所有受试者中，CI开启时的定位明显优于CI关闭时的定位（p=0.005）；受试者组之间无显着差异（p=0.301）。当语音和噪声并存时（S0N0），SRTs与CI开或关时无显着差异（p=0.480）；UNS的SRTs明显优于RES组（p=0.005）。当语音和噪声在空间上分开（SCINNH）时，CI打开时的SRT明显优于关闭时的SRT（p<0.001）。虽然SRTs对于UNS比RES组更好（p=0.024），但由于高频语音提示的恢复，RES组的CI益处大于50%。问卷调查数据显示，经过一年的CI经验，耳鸣严重程度显著降低（p=0.045），生活质量显著改善（p<0.001）。在S0N0条件下，测试年龄与SRTs显著相关；对于SCINNH条件，耳聋持续时间与SRTs相关。行为和主观测量之间的相关性相对较少，表明在评估SSD患者的CI益处时两者都是有价值的。目前的数据表明，CI的适应症应扩大到包括单侧耳聋患者，这些患者在未植入的耳朵中听力正常或轻度至中度听力下降。

【关键词】单侧耳聋，人工耳蜗，定位，噪声语音，临床试验.

Effect of Cochlear Implantation on Quality of Life in Adults with Unilateral Hearing Loss

Margaret T. Dillona Emily Buss a Meredith A. Rootha English R. Kingb
Ellen J. Deresb Craig A. Buchmanc Harold C. Pillsburya Kevin D. Browna

aDepartment of Otolaryngology/Head and Neck Surgery, University of North Carolina at Chapel Hill
bAudiology Department, UNC Health Care, Chapel Hill, NC
c Department of Otolaryngology/Head and Neck Surgery, Washington University, Saint Louis, MO, USA

Abstract

Objective: Patients with moderate-to-profound sensorineural hearing loss in 1 ear and normal hearing in the contralateral ear, known as unilateral hearing loss (UHL) or single-sided deafness (SSD), may experience improved quality of life with the use of a cochlear implant (CI) in the affected ear. Quality of life assessment before and after implantation may reveal changes to aspects of hearing beyond those explicitly evaluated with behavioral measures.

Methods: The present report completed 2 experiments investigating quality of life outcomes in CI recipients with UHL. The first experiment assessed quality of life during the 1st year of device use with 3 questionnaires: the Speech, Spatial, and Qualities of Hearing Scale (SSQ), the Abbreviated Profile of Hearing Aid Benefit (APHAB), and the Tinnitus Handicap Inventory. Twenty subjects were evaluated preoperatively and 1, 3, 6, 9, and 12 months post-activation. Quality of life results were compared over the study period using traditional scoring methods and the SSQ pragmatic subscales. Subscales specific to localization and speech perception in noise were compared to behavioral measures at the preoperative and 12-month intervals. The 2nd experiment evaluated quality of life preoperatively and at the 12-month interval for CI recipients with UHL and CI recipients with bilateral hearing loss, including conventional CI users and those listening with electricacoustic stimulation (EAS). The 3 cohorts differed in CI candidacy criteria, including the amount of residual hearing in the contralateral ear.

Results: For subjects with moderateto-profound UHL, receipt of a CI significantly improved quality of life, with benefits noted as early as 1 month after initial activation. The UHL cohort reported less perceived difficulty at the pre- and postoperative intervals than the conventional CI and EAS cohorts, which may be due to the presence of the normal-hearing ear. Each group experienced a significant benefit in quality of life on the APHAB with CI use.

Conclusions: Cochlear implantation in cases of substantial UHL may offer significant improvements in quality of life. Quality of life measures revealed a reduction in perceived tinnitus severity and subjective improvements in speech perception in noise, spatial hearing, and listening effort. While self-report of difficulties were lower for the UHL cohort than the conventional CI and EAS cohorts, subjects in all 3 groups reported an improvement in quality of life with CI use.

Key Words: Unilateral hearing loss • Single-sided deafness • Cochlear implant • Quality of life

Tables and figures

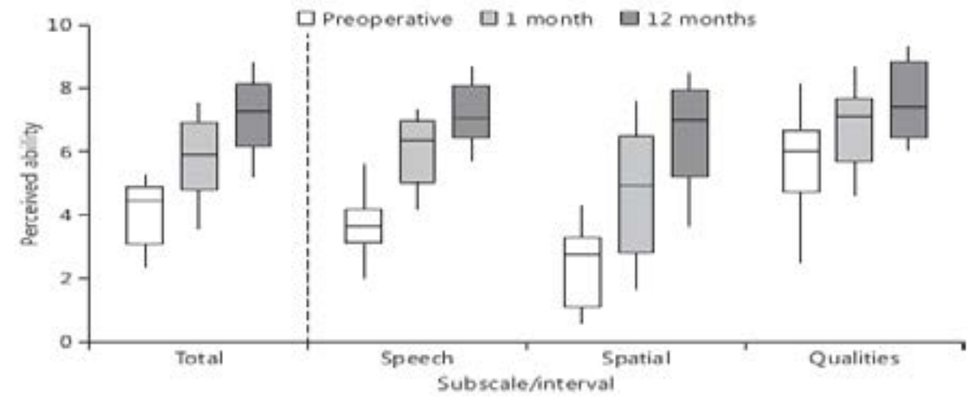


Fig. 3. Subjective responses on the Speech, Spatial, and Qualities of Hearing Scale (SSQ) over the study period. Responses are plotted as the total score on the left side of the vertical dashed line, and scores on the SSQ subscales on the right side of the dashed line. Plotting conventions follow Figure 2 .

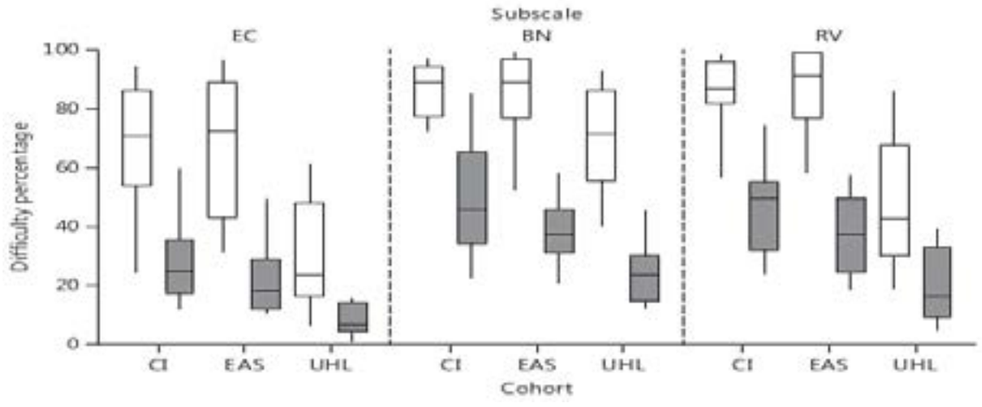


Fig. 8. Results on the Abbreviated Profile of Hearing Aid Benefit in the Ease of Communication (EC), Background Noise (BN), and Reverberation (RV) subscales at the preoperative (white) and 12-month (gray) intervals for the conventional cohorts with cochlear implant (CI), electric-acoustic stimulation (EAS), and unilateral hearing loss (UHL). Plotting conventions follow Figures 2–6.

参考译文：

人工耳蜗植入对成人单侧听力损失生活质量

Margaret T. Dillona Emily Buss a Meredith A. Rootha English R. Kingb
Ellen J. Deresb Craig A. Buchmanc Harold C. Pillsburya Kevin D. Browna

a北卡罗来纳大学教堂山分校耳鼻喉科/头颈外科
b北卡罗来纳州教堂山分校UNC医疗保健听觉科
c美国密苏里州圣路易斯华盛顿大学耳鼻喉科/头颈外科

【摘要】

目的：一侧耳中度至极重度感音神经性听力损失和对侧耳正常听力的患者，称为单侧听力损失（UHL）或单侧耳聋（SSD），患耳使用人工耳蜗（CI）可改善其生活质量。植入前后的生活质量评估可显示听力方面的变化，超出了通过行为测量明确评估的变化。

方法：本报告已完成2项实验，调查了单侧聋 CI植入者的生活质量结果。第一项实验通过3个问卷评估设备使用第一年的生活质量：言语，空间和听力质量量表（SSQ），助听器效果评估简表（APHAB）和耳鸣残疾量表。对20名受试者进行术前评估和开机后1,3,6,9和12个月评估。使用传统评分方法和SSQ实用分量表比较研究期间的生活质量结果。比较噪声中的声源定位和言语感知的分量表与术前和间隔12个月的行为测量。第二项实验评估了单侧聋植入者和患双侧听力损失的CI植入者术前和间隔12个月的生活质量，包括传统的CI用户和声电联合刺激（EAS）的用户。这三个队列在CI候选标准上有所不同，包括对侧耳的残余听力量。

结果：对于中度至极重度单侧聋的受试者，植入CI显著改善生活质量，最早在开机后1个月可见受益。与传统的CI和EAS队列相比，单侧聋队列报告术前和术后时间间隔的感知困难较少，这可能是由于听力正常的耳朵所致。使用CI的APHAB显示每组患者的生活质量都有显著受益。

结论：人工耳蜗植入对于严重单侧聋病例可能会带来显著生活质量改善。生活质量指标显示，其感知耳鸣的严重程度降低，且噪声中言语感知，空间听觉和听觉疲劳得到主观改善，虽然单侧聋队列的自我报告困难程度低于常规CI和EAS队列，但所有3组受试者均报告使用CI可改善生活质量。

【关键词】单侧听力损失 单侧耳聋 人工耳蜗 生活质量.

Cochlear implantation in adults with single-sided deafness: generic and disease-specific long-term quality of life

Franz Muigg1,2 • Harald R. Bliem2 • Heike Kühn3 • Josef Seebacher1 • Bernhard Holzner4 • Viktor W. Weichbold1

1 Department for Hearing Speech and Voice Disorders, Medical University of Innsbruck, Anichstraße 35, 6020 Innsbruck, Austria
2 Department of Psychology, University of Innsbruck, Innsbruck, Austria
3 Comprehensive Hearing Center, ENT University Clinic, Würzburg, Germany
4 University Hospital of Psychiatry I, Medical University of Innsbruck, Innsbruck, Austria

Abstract

Purpose: To determine the 2-year outcome of health-related quality of life (HRQoL) in adults who received a cochlear implant (CI) for single-sided deafness (SSD).

Methods: Twenty adults (mean age at implantation: 47 ± 11 years) with SSD (PTA worse ear: 113 dB HL, PTA better ear: 14 dB HL) were administered the Nijmegen Cochlear Implant Questionnaire (NCIQ), and the Health Utility Index 3 (HUI 3). Questionnaire administration occurred before cochlear implantation and 3, 6, 12, and 24 months after implant activation.

Results: Of the 20 patients, 2 discontinued CI use within the observation period due to poor benefit. The NCIQ total score of the sample increased significantly over time (p = 0.003). The largest increase occurred within the first 3 months of CI use. Also, the HUI 3 multi-attribute utility score increased significantly (p = 0.03). The post-treatment increase of this score (+ 0.11 points) indicated that the gain in HRQoL was clinically relevant. Patients with a duration of deafness > 10 years had in all measures an equal HRQoL improvement than had patients with a duration of deafness < 10 years.

Conclusion: Cochlear implantation led to significant improvement of hearing-specific and generic HRQoL in our patients. The improvement was seen after 3 or 6 months but did not increase further at later intervals. Patients with long-lasting SSD may be at higher risk of discontinuing CI use. However, if they adapt to the CI, they can experience an equal increase of HRQoL as patients with a short duration of SSD.

Key Words: Single-sided deafness • Cochlear implant • Health-related quality of life • Duration of deafness.

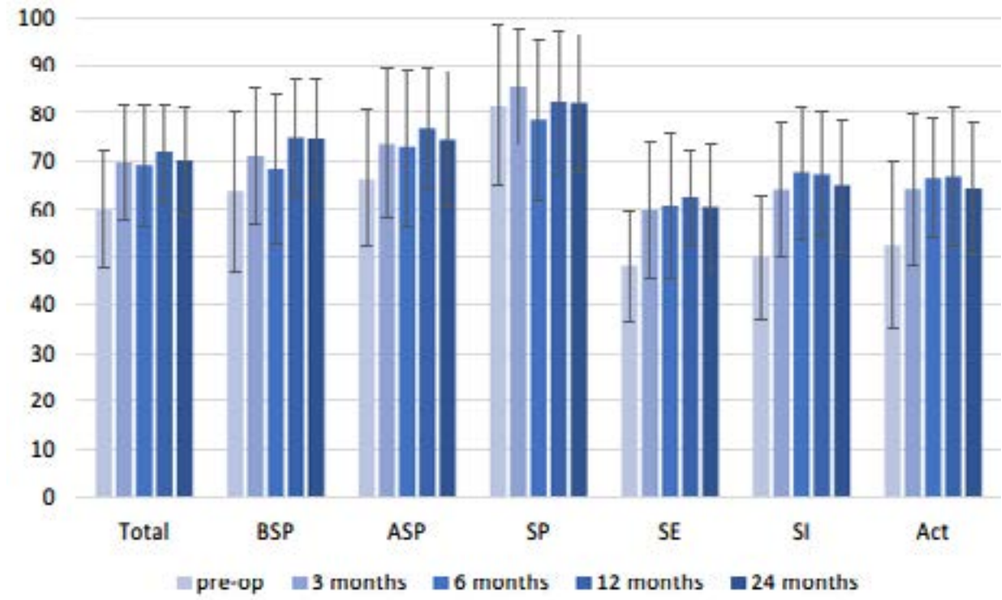


Fig. 1 Mean NCIQ scores (total score and domain-specific scores) at time-points pre-operatively (each first bar of the domains) and 3, 6, 12 and 24 months after implant activation (subsequent bars in this order). Error bars represent SD. BSP basic sound perception, ASP advanced sound perception, SP speech production,SE self-esteem,SI social interaction,Act activities,Total total score.

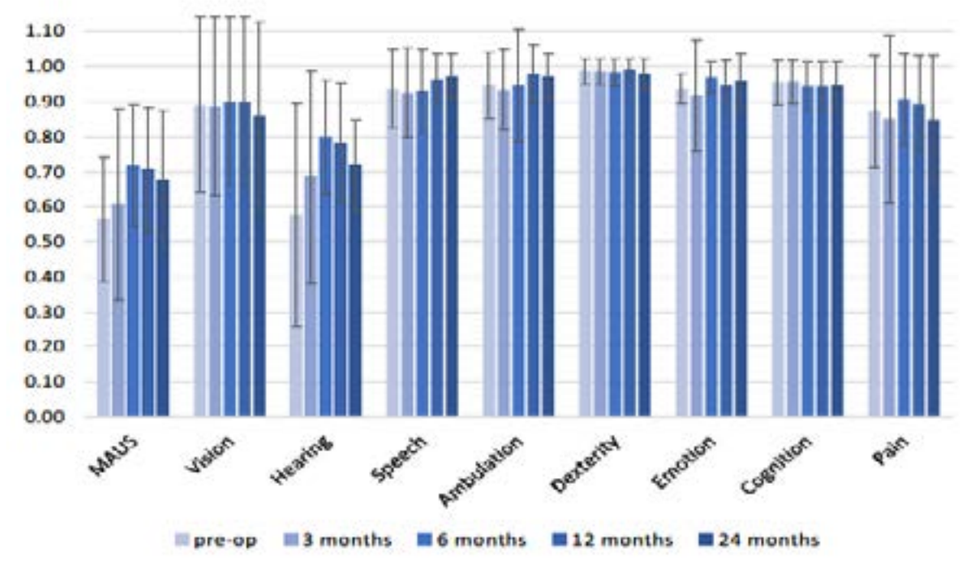


Fig. 2 HUI 3 findings over time: multi-attribute utility score (MAUS) and single-attribute utility scores of the eight single attributes shown as series of bars. Each series represents the time-points pre-operatively,3, 6, 12, and 24 months after implant activation (in this order). Error bars represent SD.

参考译文：

成人单侧聋的人工耳蜗植入：普通和特定疾病患者的长期生活质量

Franz Muigg1,2 • Harald R. Bliem2 • Heike Kühn3 • Josef Seebacher1 • Bernhard Holzner4 • Viktor W. Weichbold1

1奥地利因斯布鲁克市因斯布鲁克医科大学听力、言语及声音障碍学系
2因斯布鲁克大学心理学系，因斯布鲁克，奥地利
3综合听力中心，耳鼻喉科大学诊所，维尔茨堡，德国
4因斯布鲁克医科大学精神病院，因斯布鲁克，奥地利

【摘要】

目的：

探索成人单侧聋植入人工耳蜗（CI）2年内的健康相关生活质量（HRQoL）。

方法：

对20名成人单侧聋（植入时平均年龄：47±11岁，PTA较差耳：113 dB HL，PTA较好耳：14 dB HL）采用Nijmegen人工耳蜗植入量表（NCIQ）和健康效用指数量表3（HUI 3）。在人工耳蜗植入前和开机后3,6,12和24个月进行问卷调查。

结果：在20例患者中，2例在观察期内由于效果不佳停止使用CI。受试者NCIQ总分随时间显著增加（p=0.003）。最大增幅在CI使用的前3个月内。此外，HUI 3多属性效用量表评分显著增加（p=0.03）。治疗后该评分的增加（+0.11分）表明HRQoL的增加与临床相关。耳聋持续时间>10年的患者所有指标的HRQoL改善均与耳聋持续时间<10年的患者均等。

结论：

人工耳蜗植入显著改善患者的听力特异性和通用HRQoL。3或6个月后可见改善，但在以后的时间间隔内没有进一步增加。长期单侧聋患者停止使用CI的风险可能更高。然而，如果他们适应CI，可体验与单侧聋持续时间短的患者均等的HRQoL增加。

【关键词】单侧耳聋 人工耳蜗 健康相关生活质量 耳聋时长.

Consequences of Stimulus Type on Higher-Order Processing in Single-Sided Deaf Cochlear Implant Users

Mareike Finkea, b Pascale Sandmann a, c, e Hanna Bönitz b Andrej Kral a, d Andreas Büchner a, b

a Cluster of Excellence “Hearing4all”, and Departments of
b Otorhinolaryngology
c Neurology
d Institute of AudioNeuro Technology and Department of Experimental Otology, Hannover Medical School Hannover
e Department of Otorhinolaryngology, University Hospital Cologne, Cologne, Germany

Abstract

Single-sided deaf subjects with a cochlear implant (CI) provide the unique opportunity to compare central auditory processing of the electrical input (CI ear) and the acoustic input (normal-hearing, NH, ear) within the same individual. In these individuals, sensory processing differs between their two ears, while cognitive abilities are the same irrespectively of the sensory input. To better understand perceptualcognitive factors modulating speech intelligibility with a CI, this electroencephalography study examined the centralauditory processing of words, the cognitive abilities, and the speech intelligibility in 10 postlingually single-sided deaf CI users. We found lower hit rates and prolonged response times for word classification during an oddball task for the CI ear when compared with the NH ear. Also, event-related potentials reflecting sensory (N1) and higher-order processing (N2/N4) were prolonged for word classification (targets versus non-targets) with the CI ear compared with the NH ear. Our results suggest that speech processing via the CI ear and the NH ear differs both at sensory (N1) and cognitive (N2/N4) processing stages, thereby affecting the behavioral performance for speech discrimination. These results provide objective evidence for cognition to be a key factor for speech perception under adverse listening conditions, such as the degraded speech signal provided from the CI.

Key Words: Cochlear implant • Single-sided deafness • Unilateral hearing loss • Event-related potentials • Speech intelligibility • Listening effort.

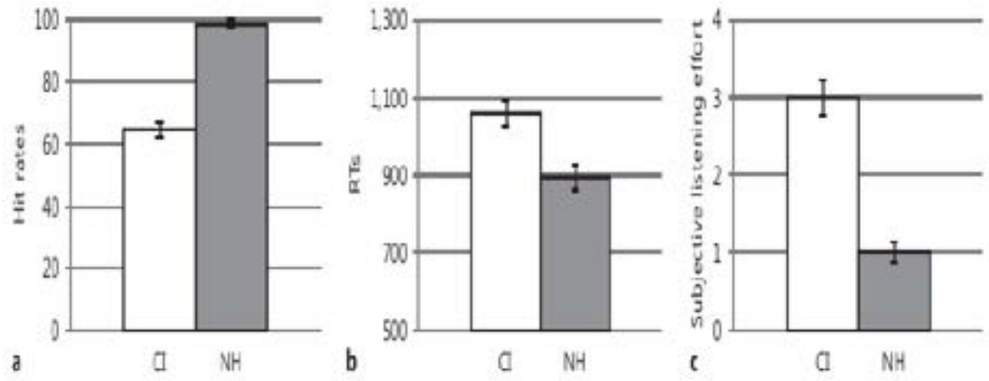


Fig. 2. Decreased hit rates (a) and increased RTs (b) were found for word classification with the CI ear compared to the NH ear. c The subjectively rated listening effort was enhanced when listening via the CI. Error bars denote the standard error of the mean.

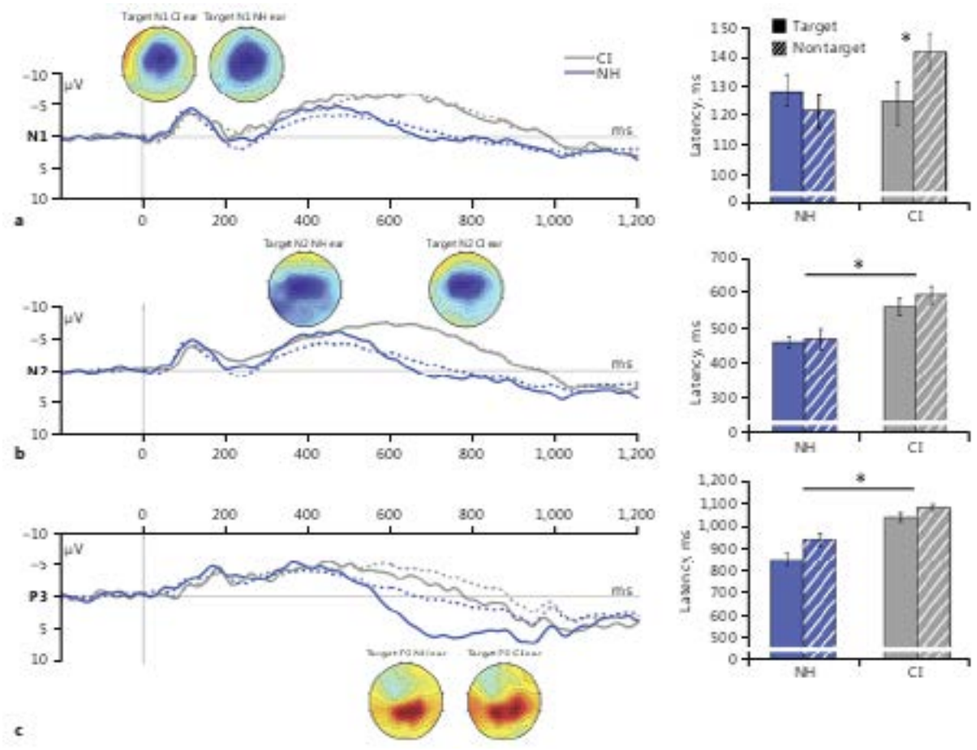


Fig. 3. ERP waveforms for the CI ear (gray; colors in the online version only) and NH ear (blue) for the N1 (a , fronto-central ROI), N2/N4 (b , central ROI), and P3 (c , parietal ROI). ERPs elicited by targets are displayed by solid lines, ERPs elicited by nontarget stimuli by dotted lines. Latencies of the respective ERP components are shown as bar graphs on the right.

参考译文：

刺激类型对单侧聋人工耳蜗使用者高阶处理的影响

Mareike Finkea, b Pascale Sandmann a, c, e Hanna Bönitz b Andrej Kral a, d Andreas Büchner a, b

a德国科隆汉诺威医学院耳鼻喉科
b耳鼻喉科
c耳鼻喉科技术研究所
d实验耳科
e德国科隆大学医院耳鼻喉科

【摘要】
植入人工耳蜗（CI）的单侧聋受试者可有独特机会比较其电输入（CI耳）和声输入（正常听力，NH，耳）的中枢听觉处理。受试者双耳之间的感官处理有所不同，而无论感官输入如何，认知能力都是相同的。为了更好地理解CI调节言语可懂度的感知认知因素，这项脑电图研究检查了10名语后单侧聋CI用户的单词中枢听觉处理，认知能力和言语可懂度。与NH耳相比，我们发现CI耳在oddball任务中的单词分类命中率更低，响应时间更长。此外，在单词分类（目标与非目标）中，CI耳反映感知（N1）和高阶处理（N2/N4）的事件相关电位比NH耳延长。结果表明， CI耳和NH耳的言语处理在感知（N1）和认知（N2/N4）处理阶段都不同，从而影响言语识别的行为表现。这些结果提供了客观证据，显示认知是在不利的听声环境下，如CI的降级言语信号，进行言语感知的关键因素。

【关键词】人工耳蜗 · 单侧耳聋 · 单侧听力损失 · 事件相关电位 · 言语可懂度 · 听觉疲劳.

Comparison of Place-versus-Pitch Mismatch between a Perimodiolar and Lateral Wall Cochlear Implant Electrode Array in Patients with Single-Sided Deafness and a Cochlear Implant

Jeroen P.M. Peters a, b Edwin Bennink c Gijsbert A. van Zanten a, b

aDepartment of Otorhinolaryngology and Head and Neck Surgery, University Medical Center Utrecht, Utrecht, The Netherlands
b UMC Utrecht Brain Center, Utrecht, The Netherlands
c Image Sciences Institute, University Medical Center Utrecht, Utrecht, The Netherlands

Abstract

Background: In electric-acoustic pitch matching experiments in patients with single-sided deafness and a cochlear implant, the observed "mismatch" between perceived pitch and predicted pitch, based on the amended Greenwood frequency map, ranges from –1 to –2 octaves. It is unknown if and how this mismatch differs for perimodiolar versus lateral wall electrode arrays.

Objectives: We aimed to investigate if the type of electrode array design is of influence on the electric-acoustic pitch match.

Method: Fourteen patients (n = 8 with CI422 + lateral wall electrode array, n = 6 with CI512 + perimodiolar electrode array; Cochlear Ltd.) compared the pitch of acoustic stimuli to the pitch of electric stimuli at two test sessions (average interval 4.3 months). We plotted these "pitch matches" per electrode contact against insertion angle, calculated from high-resolution computed tomography scans. The difference between these pitch matches and two references (the spiral ganglion map and the default frequency allocation by Cochlear Ltd.) was defined as "mismatch."

Results: We found average mismatches of –2.2 octaves for the CI422 group and –1.3 octaves for the CI512 group. For any given electrode contact, the mismatch was smaller for the CI512 electrode array than for the CI422 electrode array. For all electrode contacts together, there was a significant difference between the mismatches of the two groups ($p < 0.05$). Results remained stable over time, with no significant difference between the two test sessions considering all electrode contacts. Neither group showed a significant correlation between the mismatch and phoneme recognition scores.

Conclusion: The pitch mismatch was smaller for the perimodiolar electrode array than for the lateral wall electrode array.

Key Words: Electric-acoustic pitch match • Place-versus-pitch • Cochlear implant • Frequency-place map • Single-sided deafness • Hearing loss • Perimodiolar electrode array • Modiolar hugging • Contour advance • Lateral wall electrode.

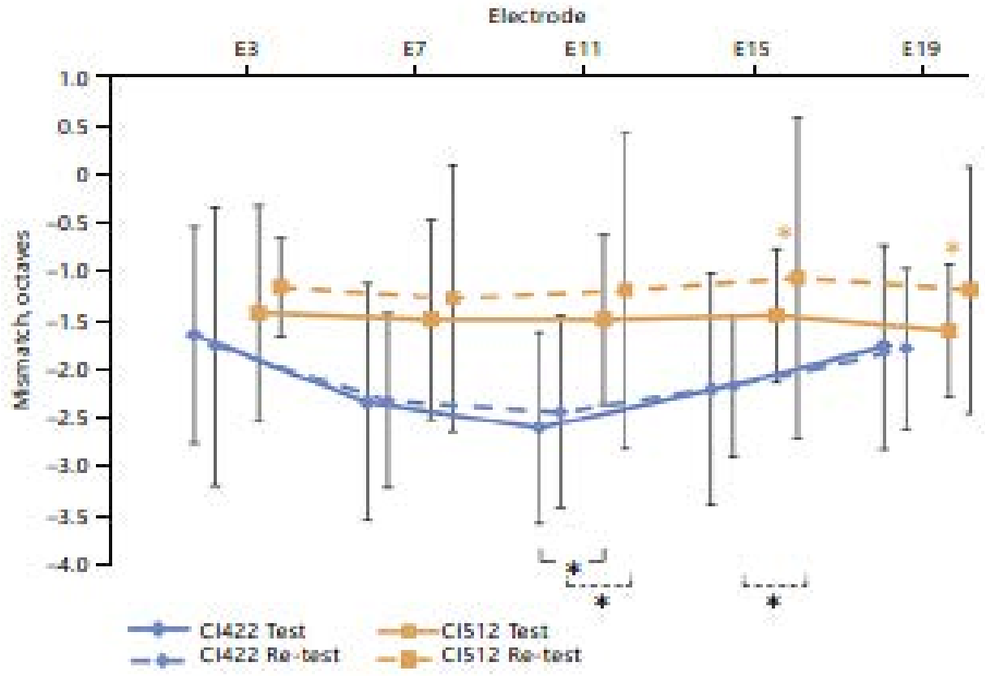


Fig. 4. Mismatch expressed per electrode contact per group and experiment. The mismatch relative to the Stakhovskaya reference is plotted per electrode (data relative to Cochlear reference not shown). Data points are displayed separately for the CI422 and CI512 groups, as well as for the Test and Re-test experiments. For the CI422 group, there is no significant difference between Test and Re-test for any of the electrodes. For the CI512 group, E15 and E19 differ significantly between Test and Re test, indicated with orange asterisks. For E11, there is a significant difference between the two groups for both Test and Re-test, indicated with black asterisks. For E15, the difference between the two groups is statistically significant for Retest, but not statistically significant for Test.

参考译文：

比较单侧耳聋患者和人工耳蜗患者环蜗轴和侧壁耳蜗电极阵列的位置-音高失配

Jeroen P.M. Peters a, b　Edwin Bennink c　Gijsbert A. van Zanten a, b

a荷兰乌得勒支大学医学中心耳鼻咽喉和头颈外科
b乌得勒支大学大脑中心，荷兰乌得勒支
c荷兰乌得勒支大学医学中心图像科学研究所

【摘要】

背景：在单侧耳聋和人工耳蜗患者的电声音高匹配实验中，根据修正后的格林伍德频率图观察到的感知音高与预测音高之间的“失配”范围为－1至－2倍频程。目前尚不清楚环蜗轴（弯电极）与侧壁电极阵列（直电极）的失配是否以及如何不同。

目标：旨在研究电极阵列设计的类型是否会影响电声音高匹配。

方法：比较14例患者（n=8，CI422+侧壁电极阵列，n=6，CI512+环蜗轴电极阵列；Cochlear Ltd.）在两项测试中（平均间隔4.3个月），声刺激的音高和电刺激的音高。通过高分辨率计算机断层扫描计算，绘制每个电极触点相对于插入角度的音高匹配度，。这些音高匹配与两项参考（螺旋神经节图和Cochlear Ltd.的默认频率分配）之间的差异定义为“失配”。

结果：我们发现CI422组的平均失配度为－2.2倍频程，CI512组为－1.3倍频程。对于任何测试电极触点，CI512电极阵列的失配小于CI422电极阵列。对于所有电极触点，两组失配之间存在显著显着差异（$p<0.05$）。结果随时间推移保持稳定，所有电极触点在两个测试阶段之间没有显著差异。两组均未显示失配和音位识别得分之间的显著相关性。

结论：环蜗轴电极阵列的音高失配小于侧壁电极阵列。

【关键词】电声音高匹配 · 位置与音高 · 人工耳蜗 · 频率位置图 · 单侧耳聋 · 听力损失 · 环蜗轴电极阵列 · 蜗轴状环抱 · Contour 进阶 · 侧壁电极.

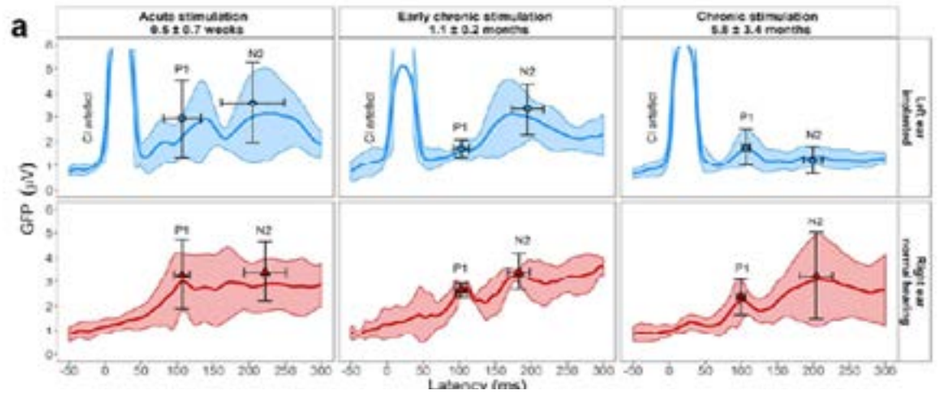
Cortical organization restored by cochlear implantation in young children with single sided deafness

Melissa Jane Polonenko 1,2, Karen Ann Gordon1,2,3,4, Sharon Lynn Cushing1,3,4 & Blake Croll Papsin1,3,4

1 Institute of Medical Sciences, The University of Toronto, Toronto, ON, M5S 1A8, Canada.
2 Neurosciences and Mental Health, The Hospital for Sick Children, Toronto, ON, M5G 1X8, Canada.
3 Department of Otolaryngology – Head & Neck Surgery, The University of Toronto, Toronto, ON, M5G 2N2, Canada.
4 Otolaryngology – Head & Neck Surgery, The Hospital for Sick Children, Toronto, ON, M5G 1X8, Canada.
Melissa Jane Polonenko and Karen Ann Gordon contributed equally to this work.

Abstract

Early treatment of single sided deafness in children has been recommended to protect from neurodevelopmental preference for the better hearing ear and from social and educational deficits. A fairly homogeneous group of five young children (≤3.6 years of age) with normal right sided hearing who received a cochlear implant to treat deafness in their left ears were studied. Etiology of deafness was largely cytomegalovirus (n = 4); one child had an enlarged vestibular aqueduct. Multi-channel electroencephalography of cortical evoked activity was measured repeatedly over time at: 1) acute (0.5 ± 0.7 weeks); 2) early chronic (1.1 ± 0.2 months); and 3) chronic (5.8 ± 3.4 months) cochlear implant stimulation. Results indicated consistent responses from the normal right ear with marked changes in activity from the implanted left ear. Atypical distribution of peak amplitude activity from the implanted ear at acute stimulation marked abnormal lateralization of activity to the ipsilateral left auditory cortex and recruitment of extra-temporal areas including left frontal cortex. These abnormalities resolved with chronic implant use and contralateral aural preference emerged in both auditory cortices. These findings indicate that early implantation in young children with single sided deafness can rapidly restore bilateral auditory input to the cortex needed to improve binaural hearing.



参考译文：

单侧耳聋患儿人工耳蜗植入的大脑皮层神经重建

Melissa Jane Polonenko 1,2, Karen Ann Gordon1,2,3,4, Sharon Lynn Cushing1,3,4 & Blake Croll Papsin1,3,4

1加拿大多伦多大学医学科学研究所
2欧洲科学与心理健康，病童医院，多伦多，安大略省，M5G 1X8，加拿大
3耳鼻喉科-头颈外科，多伦多大学，多伦多，ON，M5G 2N2，加拿大
4耳鼻喉科-头颈外科，病童医院，多伦多，ON，M5G 1X8，加拿大
梅丽莎 · 简 · 波洛内科和凯伦 · 安 · 戈登对这项工作的贡献是一样的

【摘要】

建议单侧聋患儿早期治疗，以防止神经发育倾向好耳及避免社会和教育方面的障碍。研究同类组别的5例患儿（3.6岁以下），该组患儿右耳听力正常，左耳耳聋并植入人工耳蜗。耳聋的病因主要是巨细胞病毒（n=4）及一例患儿为前庭导水管扩大。随着时间的推移，反复测量多通道皮层诱发脑电图：1）短期（0.5±0.7周）；2）中期（1.1±0.2个月）；3）长期（5.8±3.4个月）人工耳蜗刺激。结果显示，正常右耳的反应一致，植入左耳的活动性有明显变化。短期刺激时，植入耳非典型波幅分布表明，同侧左侧听觉皮层活动侧化异常，包括左侧颞外区域的额叶皮层聚集异常。这些异常可通过长期使用植入体解决，且两侧听觉皮层均显示出对侧听觉偏好。这些发现表明，单侧聋患儿早期植入，可以迅速恢复皮层的双侧听觉输入，改善双耳听力。

Cochlear implantation in adults with unilateral deafness: A review of the assessment/evaluation protocols

Dayse Távora-Vieira, Roberta Marino, Aanand Acharya, Gunesh P. Rajan

Otolaryngology, Head & Neck Surgery-School of Surgery, University of Western Australia, Perth, Australia, Fiona Stanley Hospital, Perth, Australia

Abstract

Objectives: Cochlear implantation is becoming widely used outside the tertiary research centers for treatment of unilateral deafness (UD). No consensus exists, however, on the most suitable assessment/evaluation protocols for this group of adult patients. This paper aims to review the assessment and evaluation protocols used by various research groups and to propose a protocol for the use in the clinical setting.

Methods: The PubMed, Embase, and Cochrane Library databases were searched with the keywords 'cochlear', 'implant', 'single-sided', 'deafness', 'adults', 'unilateral', and 'deafness'. The words were either used individually, combined in pairs, or in groups of 5. All articles reporting on prospective studies, retrospective studies, or case studies were included. Results: Sixteen published studies met the inclusion criteria. Measures of hearing performance, tinnitus, subjective quality of hearing, and quality of life varied greatly among studies.

Discussion: Adaptive speech in noise testing, localization, tinnitus measurement questionnaires, and selfrated hearing improvement are widely used among the research groups. These tools in conjunction assess and evaluate the main issues associated with UD.

Conclusion: The test battery most commonly used to assess and evaluate adult cochlea implant users with UD consists of (a) a subjective self-rating of hearing performance, (b) localization testing, and (c) the adaptive speech in noise testing conducted in at least the following three spatial configurations: speech and noise presented from the front (S0/N0), speech presented from the front and noise presented to the good hearing ear (S0/Nhe), and speech presented to the implanted ear and noise presented to the hearing ear (Sci/Nhe).

Key Words: Unilateral deafness, Cochlear implant, Assessment protocol.

参考译文：

成人单侧聋人工耳蜗植入：评价/评估方案综述

Dayse Távora-Vieira, Roberta Marino, Aanand Acharya, Gunesh P. Rajan

耳鼻喉头颈外科-西澳大利亚大学外科学院，珀斯，澳大利亚菲奥娜斯坦利医院，珀斯，澳大利亚

【摘要】

目的：人工耳蜗植入在三级研究中心外广泛应用于治疗单侧聋。然而，关于成人患者最合适的评价/评估方案，还没有达成共识。本文旨在回顾不同研究小组采用的评价和评估方案，并提出一个在临床环境中使用的方案。

方法：在PubMed、Embase和Cochrane图书馆数据库用关键词“耳蜗”、“植入”、“单侧（single-sided）”、“耳聋”、“成人”、“单侧（unilateral)”进行检索。这些关键词可单独使用，或成对使用，或5个关键词合成使用。所有前瞻性研究、回顾性研究或案例研究的文章报告都包括在内。

结果：16项已发表的研究符合纳入标准。各项研究中，听力表现、耳鸣、主观听觉质量和生活质量的指标差异很大。

讨论：自适应噪声下言语识别测试、声源定位、耳鸣测量问卷、自评听力改善等方面在研究领域里得到广泛的应用。这些工具共同测试和评估与单侧聋相关的主要问题。

结论：评估成人单侧聋人工耳蜗植入者最常用的测试方法包括（a）主观听力表现自我评定，（b）声源定位测试，以及（c）至少在以下三种空间配置中进行的自适应噪声下言语测试：前方言语噪声（S0/N0）、前方言语声和好耳噪声（S0/Nhe），植入耳言语声和好耳噪声（Sci/Nhe）。

【关键词】单侧耳聋，人工耳蜗，评估方案.

Re-training the deaf ear: Auditory training for adult cochlear implant users with singlesided deafness

Dayse Távora-Vieira , Roberta Marino

School of Surgery, The University of Western Australia, Fliona Stanley Hospital, Perth, Australia

Abstract

Objective: While cochlear implant (CI) provision for adults with single-sided deafness (SSD) is now an accepted treatment option, auditory training programs specific to this group of CI users have not been described. This paper details the auditory training protocol and critical factors required to rehabilitate CI users with post-lingual SSD.

Outcomes and Results: Several key factors are integral to the success of the rehabilitation program; these include 1) CI users with SSD require a map that is balanced as closely as possible to their normal hearing ear and has optimal mapping levels; 2) the auditory training program needs to be stimulating, rewarding, and directly stimulate the implanted ear via Direct Auditory Input (DAI); 3) CI users need to achieve some success in the early post-implantation stages to maintain or increase their motivation; 4) CI users need to be fully committed to the auditory training; and 5) a well-defined structured auditory training program with immediate feedback and markers of success helps ensure optimal communication outcomes. As an indication of success, from the foundation of the program in 2008 until the present all adults with SSD who have received a CI at our clinic (N=114) only 5 have elected to stop using their device.

Conclusion: The auditory training program described herein has been developed to optimize hearing and quality of life outcomes for adult CI users with SSD.

Key Words: Single-sided Deafness, Rehabilitation, Unilateral deafness, Cochlear implant, Auditory training.

参考译文：

聋耳的重建：成人单侧耳聋人工耳蜗植入者的听觉训练

Dayse Távora-Vieira , Roberta Marino

西澳大利亚大学外科学院，弗利奥娜斯坦利医院，珀斯，澳大利亚

【摘要】

目的：人工耳蜗（CI）是成人单侧耳聋（SSD）患者目前公认的治疗方案，但尚未描述针对这类CI植入者的听觉训练方案。本文详细介绍了语后单侧聋CI植入者的听觉训练方案及康复所需的关键因素。

结果：康复计划成功的几个关键因素是不可或缺的；这些因素包括：1）单侧聋的CI植入者需要一个尽可能接近其正常听力的调试程序，并且具有合适的调试参数；2）听觉训练计划需要有激发性、鼓励性，并通过直接听觉输入（DAI）直接刺激植入耳；3）CI植入者需要在植入后的早期阶段取得一定的成功，以保持或增加其动力；4）CI植入者需要充分投入听觉训练；（5）一个定义明确、结构合理、具有即时反馈和成功标志的听觉训练计划有助于确保最佳的沟通效果。作为成功的证明，计划从2008年启动到目前，所有在我们诊所植入人工耳蜗的单侧聋成人患者（n=114），仅5例选择停止使用设备。

结论：本文所述的听觉训练计划是为了优化成年单侧聋CI患者的听力和生活质量。

【关键词】单侧耳聋；康复；人工耳蜗；听觉训练.

Cortical auditory evoked responses in cochlear implant users with early-onset single-sided deafness: indicators of the development of bilateral auditory pathways

Andre Wedekinda, Dayse Távora-Vieiraa,b and Gunesh P. Rajana,b

aDepartment of Otolaryngology, Head and Neck Surgery, School of Surgery, University of Western Australia, Perth and bFiona Stanley Hospital, Murdoch, Western Australia

Abstract

Cochlear implantation (CI) for early-onset single-sided deafness (SSD) provides a unique insight into the development and cortical reorganization of binaural pathways. This case series aimed to investigate the impact of duration of deafness on CI outcomes as measured by cortical evoked auditory potentials (CAEPs). Four adults with early-onset SSD were studied after CI. The adults had a duration of deafness of 22, 24, 42, and 38 years before implantation. CAEPs and speech perception in noise were used to investigate binaural cortical pathways and function. Our four patients lost their hearing at the ages of 3, 6, 5, and 6 (S1, S2, S3, and S4, respectively). CAEPs were present bilaterally in S2, S3, and S4. S1's, who had the least experience with a CI, cortical responses at 1 month after CI activation showed cortical responses from the CI ipsilateral pathway, but no responses from the CI contralateral pathway. At 3 and 6 months, S1 showed significant cortical responses from the CI contralateral pathway for two speech tokens. An improvement in speech perception in noise testing was observed in all four participants. This case series indicates that long duration of deafness for early-onset SSD is not a contraindication for CI and may not impact the long-term outcomes in this population. The electrical stimulation from the CI integrates with the normal hearing ear to produce bilateral cortical projections and functional improvement in speech perception in noise. These early data provide surprisingly positive results and call for larger scale research to be carried out.

Key Words:binaural hearing, cochlear implant, cortical auditory evoked potentials, single-sided deafness.

参考译文：

早期单侧耳聋人工耳蜗植入者的皮层听觉诱发反应：双侧听觉通路发育的指标

Andre Wedekinda, Dayse Távora-Vieiraa,b and Gunesh P. Rajana,b

西澳大利亚大学外科学院耳鼻喉头颈外科学系和菲奥娜斯坦利医院，默多克，西澳大利亚

【摘要】

早发性单侧耳聋（SSD）的人工耳蜗植入（CI）为研究双耳通路的发育和皮层重组提供了独特的见解。本研究旨在使用皮层诱发听觉电位（CAEPs）测量去探讨耳聋持续时间对于CI效果的影响。对四例有早发性单侧聋成人人工耳蜗植入者进行研究。患者植入前的耳聋时长为22、24、42和38年。用CAEP和噪声下的言语感知研究双耳的皮层通路和功能。四例患者在3、6、5和6岁时失去了听力（分别为S1，S2，S3和S4）。S2，S3和S4双侧能引出CAEPs。S1使用CI经验最短，开机后1个月的皮层反应显示来自CI同侧通路，CI对侧通路无反应。在3个月和6个月时，S1的CI对侧通路对于两种言语样本引出显著显著皮层反应。在所有四名参与者中均观察到噪声下言语感知的改善。此病例系列表明，早发性单侧聋的耳聋时长不是CI的禁忌症，可能不会影响该群体的长期效果。CI的电刺激整合正常听力的耳朵，以产生双侧皮层投射和改善噪声中言语感知的功能。这些早期数据提供了令人惊讶的积极结果，并呼吁进行更大规模的研究。

【关键词】双耳听力，人工耳蜗，皮质听觉诱发电位，单侧耳聋.

杭州总部
地址：浙江省杭州市余杭区龙潭路17号
邮编：311121
电话：4006 222 571
传真：0571-88179905
邮箱：service@nurotron.com
网址：http://www.nurotron.com