



人工耳蜗术后康复效果影响因素的研究
The Influential Factors on the
Rehabilitation for Hearing-impaired
Children with Cochlear Implant

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提要 Summary

从康复效果评估探讨科学的听觉言语康复方法.对国内使用的三种康复方法（听觉口语训练法、综合感官训练法、音素辨听训练法）效果进行了比较分析

Investigate the appropriate approach for CI children by analysis the effect of three therapy model used in China: AV therapy, multiple sensory therapy and phonematic recognizing therapy.

听觉口语训练法（方法一） AV Therapy (method one)

强调听觉、言语和认知依照自然发展之程序结合起来，在有意义的情境中透过会话式的互动学习说话。注重残余听力的运用和口语表达能力的培养。强调在训练中应先将听觉加以发展。注重家长在康复中的深度参与。

Focus on the combination of hearing, speech and cognization according the natural developmental process. Learning speech through communication in significative context. Emphasizing exploit hearing remained and

综合感官学习法（方法二） Multiple Sensory Therapy (method two)

强调从初始阶段，在整个训练期及各个环节中
都应应将视觉、听觉、触觉等多种感官相结合，来帮助
助听障儿童感受声音、学习语言。

Advocate integrating visual, auditory and tactile to help CI recognizing phonetics and learning language from beginning and through whole therapy.

音素辨听训练法（方法三）

Phonematic Recognizing Therapy (method three)

注重术后听觉功能的培建和语音细致听辨的学习，以拼音音素为核心，组织相应的词汇、儿歌和故事等作为主要的辨听学习内容。从训练初期即强调语音清晰度的矫正。

Focus on phoneticize discrimination and learning, select vocabularies, nursery rhymes and stories around them. Stress on articulation intervention from beginning.

材料和方法

Materials and Methods

- ❖ **观察对象(Sample): 124人 (2-7岁)**
- ❖ **分组(Grouping):依据不同教学方法分为三组(Divided in three groups according different intervention methods):**
 - 一组(Group 1)(听觉口语法-AVT):54人
 - 二组(Group 2)(综合感官训练法-MST):34人
 - 三组(Group 3)(音素辨听训练法-PRT):36人

控制因素 Control Factors

- ❖ 术前听力水平(**Hearing Level Preoperation**)
所有样本双耳裸耳纯音气导听阈均大于**90dBHL**，
ABR大于100dB SPL

佩带助听器后，多数听障儿童对**2000HZ**以下语音可查知，
或不能做出反馈。所有样本均不能听辨词语。

控制因素

Control Factors

- ❖ **术前语言水平(Speech and Language Level Preoperation)**
组一中10人、组二中9人、组三中11人术前有一定词汇水平。其余人没有任何口语基础。
- ❖ **智力水平(Intelligence Level)**
所有样本均经过希内学习能力测试，智力水平均在正常范围内。

三组样本手术年龄和开机时间分布情况

Contrast Implanted Age and Hearing age In Three Groups

方法	手术年龄 (岁)	开机时间 (月)				合计 (个)
		4-6	7-12	13-24	25-30	
方法一	2-3	5	5	4	3	17
	4-5	5	5	4	5	19
	6-7	5	5	4	4	18
方法二	2-3	3	3	2	2	10
	4-5	3	3	3	3	12
	6-7	3	3	3	3	12
方法三	2-3	3	3	3	3	12
	4-5	3	3	3	3	12
	6-7	3	3	3	3	12

材料和方法

Materials and Methods

- ❖ 本研究采用全国统一的《听障儿童听觉言语康复评估标准及方法》对三组听障儿童进行评估测试。
- ❖ **Evaluate by “Hearing and Speech Assessment Standard and Methods for Hearing Impaired Children”**
- ❖ 实验者采用**SPSS16.0**软件对评估数据进行统计分析。用**General Linear Model** 中的**Multivariate**进行统计。
- ❖ **Statistics and Analysis by General Linear Model.**

研究与分析

不同训练方法对听障儿童听觉和语言能力的影

Effect of Different Approaches on Hearing Impaired Children's Hearing and Speech Abilities

	听觉能力评估				语言能力评估		
	双音节 词识别 (%)	韵母识 别(%)	声母识 别(%)	短句辨 听(%)	模仿句 长(级)	主题对话 (级)	清晰度 (%)
方法 1	98.1	92.4	88.4	80.1	3.0	3.0	75.0
方法 2	89.9	81.0	76.2	38.4	2.7	2.8	75.9
方法 3	98.9	93.1	88.5	58.7	2.5	2.2	77.1



听觉能力评估分析

Analysis on hearing ability assessment

- ❖ 在听觉能力评估的双音节词识别、韵母识别、声母识别这三项词汇水平的辨听测试项上：方法一、方法三与方法二存在显著差异 ($p < 0.01$)，方法一与方法三差异不显著；但是在“短句辨听”项上，三者的成绩都有显著差异。
- ❖ **Achievement on identification of double syllables, vowels and consonants: Method one and three have obvious difference with method two ($p < 0.01$); method one is similar with three.**
Achievement on “identification of short sentences”: There are obvious difference in all the three methods.



言语能力评估分析

Analysis on Speech Ability Assessment

- ❖ 从言语能力三项评估（可唇读）来看：方法一和方法二在“模仿句长”、“主题对话”上与方法三有差异显著；方法一和方法二差异不显著。在“语音清晰度”的成绩上三者没有显著差异($p=0.941$)。
- ❖ **Method one has obvious difference with method three on “sentence imitation” and “topic conversation”, whereas resemble method two. There are no obvious difference on “articulation” in all the three methods.**



不同训练方法对不同手术年龄的听障儿童听觉和语言能力的影晌

Effect of Different Approaches on Hearing Impaired Children's Hearing and Speech Ability with Varied implanted Age

方法	手术 年龄 (岁)	听觉能力评估				语言能力评估		
		双音节 词识别 (%)	韵母 识别 (%)	声母 识别 (%)	短句 辨听 (%)	模仿句长 (级)	主题对 话(级)	清晰度 (%)
方法 1	2-3	98.9	93.9	89.5	80.0	2.8	2.9	76.9
	4-5	98.3	92.9	89.3	82.6	3.1	3.1	76.9
	6-7	97.2	90.6	86.4	77.6	3.2	3.0	71.3
方法 2	2-3	88.9	79.9	75.1	40.2	2.4	2.5	77.0
	4-5	90.5	82.7	77.8	40.9	2.8	2.8	77.6
	6-7	90.2	80.3	75.4	34.5	2.8	3.0	73.3
方法 3	2-3	99.2	94.0	89.2	59.2	2.3	2.2	82.4
	4-5	98.8	94.3	88.9	59.6	2.5	2.2	76.8
	6-7	98.7	91.0	87.3	57.5	2.6	2.2	72.1



手术年龄对听觉能力发展的影响

Effect of implanted Age on Hearing Ability Development

- ❖ 不同手术年龄组在韵母识别、声母识别和短句识别三个分测验上差异达到显著水平，但在双音节词识别上差异不显著($p=0.39$)。
- ❖ **Groups with different implanted age have obvious diversity on identification of vowels, consonants and short sentences; but resemble on identification of double syllables.**
- ❖ 在韵母识别、声母识别和短句识别3个方面，均为2-3岁组与6-7岁组差异显著，4-5岁组与6-7岁组差异显著，而2-3岁组与4-5岁组差异不显著。此结果表明5岁前开机者语言辨听能力发展较好。（亦不能排除评估内容对结果可能有一定影响）
- ❖ Group of 2-3years and 6-7years, 4-5years and 6-7years have obvious difference on identification of vowels, consonants and short sentences; not in group 2-3years and 4-5years. This result documents that children with CI switched on before 5years old have better language identification ability development.



手术年龄对言语能力发展的影响

Effect of Implanted Age on Speech Ability Development

- ❖ 不同手术年龄组对语音清晰度影响显著。手术年龄小则清晰度发展好。2-3岁与6-7岁、4-5岁与6-7岁差异显著，2-3岁与4-5岁差异不显著。
- ❖ **Varied implanted age has obvious effect on articulation. Operated more younger, articulation development more better.**
- ❖ 对主题对话和模仿句长影响不显著。
- ❖ **Varied implanted age has no obvious effect on topic conversation and sentences imitation.**
- ❖ 可能影响评估结果的因素：
- ❖ **Factors those maybe impact the assessment result:**
评估内容和开机时间的局限（最长2年半）
Limited assessment items and there are no sample received CI longer than half and two years.



不同训练方法对不同开机时间的听障儿童听觉和语言能力的影 Effect of Different Approaches On Hearing Impaired Children's Hearing and Speech Ability with Varied Hearing age

方 法	开机时间	听觉能力评估				语言能力评估		
		双音节 词识别 (%)	韵母 识别 (%)	声母 识别 (%)	短句 辨听 (%)	模仿句长 (级)	主题对 话(级)	清晰度(%)
方 法 1	不足半年	94.4	83.0	76.9	45.5	2.0	2.2	53.1
	半年-1年	99.1	92.5	88.9	85.2	2.7	2.7	70.3
	1年-2年	99.7	97.8	94.2	97.8	3.8	3.6	89.5
	2年-2年半	100.0	98.8	96.3	99.3	4.0	3.9	93.8
方 法 2	不足半年	75.4	69.4	64.3	19.5	1.7	1.8	55.2
	半年-1年	88.4	76.9	71.2	26.3	2.3	2.6	70.3
	1年-2年	97.7	88.0	83.2	47.3	3.3	3.3	88.4
	2年-2年半	100.0	91.6	88.0	64.4	3.8	3.8	93.0
方 法 3	不足半年	97.2	82.6	74.5	40.5	1.7	1.4	56.0
	半年-1年	97.6	93.1	88.8	42.2	2.3	1.9	70.1
	1年-2年	100.0	97.9	94.0	63.2	2.7	2.3	89.2
	2年-2年半	100.0	98.8	96.5	89.0	3.2	3.2	93.0

视觉传达

开机时间对听觉能力发展的影响

Effect of Hearing age on Hearing Ability Development

- ❖ 不同开机时间在听觉能力评估的4个分测验 成绩上的差异均达到显著水平。说明开机时间对聋儿听觉能力的提高作用显著。开机时间越长，听觉水平越高。
- ❖ **Hearing age can effect hearing impaired children's hearing ability enormously.**



开机时间对言语能力发展的影响

Effect of Hearing Age On Speech Ability Development

- ❖ 不同开机时间在言语能力评估3个分测验的成绩上差异均达到显著水平。说明开机和训练时间越长，患者言语水平越高。
- ❖ **There are obvious difference on assessment for speech ability in varied hearing age. The longer after CI, the higher children can get on speech level.**



训练方法与开机时间的交互作用

The Interact of Intervention Approaches and Hearing age

- ❖ 训练方法与开机时间两因素的交互作用在听觉能力评估的4个分测验成绩上均有显著差异:
- ❖ **The interact of intervention approaches and hearing age has obvious difference on all the four items of hearing ability assessment.**

在开机时间较短时，不同训练方法的效果差异较大，而随着开机时间的增加，不同训练方法在听觉能力发展上的差异在逐渐缩小。

The difference of the hearing development in varied approaches get smaller and smaller over time.



训练方法与开机时间的交互作用

The Interact of Intervention Approaches and Hearing age

- ❖ 由于言语发展存在敏感期，所以此结果并不能说明不同训练方法对听障儿童最终的康复水平没有影响。
- ❖ **We can't elicit from the result just mentioned that there's no effect on rehabilitation with varied approaches, because the key period is existed in speech development.**
- ❖ 该结果与本实验的评估内容有关。在后续调查中显示：听觉口语法训练组听障儿童在开放式交流方面的成绩明显优于另两组，而且随开机时间的延长，该差异有增大趋势。
- ❖ **The result was affected by the limited assessment items. The later research shows group one got much better achievement than other two groups on opening communication assessment.**

结论 Result

- ❖ 综合感官训练法能有效地帮助听障儿童提高言语水平，但在听觉能力的发展上效果不够理想。
- ❖ **Multiple sensory therapy can advance the speech level, but not satisfied on hearing ability development.**
- ❖ 音素辨听训练法可以促进听障儿童对语音细致辨听的能力，但对言语能力的发展帮助有限。
- ❖ **Phonetic recognizing therapy can improve the phonetic careful hearing ability, whereas limited in facilitating the speech ability development.**
- ❖ 听觉口语训练法能使听障儿童的听觉和言语两方面能力得到均衡的发展。
- ❖ **AV therapy can enhance both of the hearing and speech ability of deaf children.**

建议 Suggestion

对于有适当听力补偿者，应首先试用听觉口语训练法，以帮助其听、说两方面能力得到全面提高。但它不是唯一的康复方法。在不同阶段、不同活动形式以及对大龄植入者（术前基础差）的训练中，也可灵活综合使用不同方法。

We should try the AV therapy for hearing impaired children first, but it is not the only way for them.

有待进一步探讨的问题

The Problems need more researches

- ❖ **丰富评估内容(Expand the assessment items)**
在今后实验中可加入连贯性言语语音清晰度评估，加大模仿句长难度，扩展对话交流内容
增加开放式听觉评估以及多个关键词复杂句式的辨听评估
Add connected speech assessment, longer and more complex sentences and opening hearing evaluation.
- ❖ **对7岁以上接受手术、术前听力和言语能力较差的大龄患者采用怎样的康复方法还有待进一步研究**
- ❖ **The approaches for cochlear implanted children who older than 7 years needs further research on.**