Figure 1. Patient with an upper brachial plexus lesion on the right side showing the classical "waiter's tip" posture. The arm is adducted and internally rotated, the elbow is extended, and the wrist is flexed.

Figure 2. Patient with a total brachial plexus lesion on the right side showing a flail arm and Horner sign, which is characterized by miosis, partial ptosis, and enophtalmos. Hemifacial anhidrosis is usually not seen in this context.

Case 6

The Assessment and Treatment

For Children with OBPP

Presenters:

Guo Yuxiao
Li Jianbang
Hu Xiaoqian
Wei Xiaoyu

Introduction

Examination and assessment

Plan

Sensory Training

Reference

Case study Six

患儿，男，**2岁6个月**，因右上肢活动障碍入院。
患儿2012年10月10日于外院出生，生产时出现**“肩难产”**，按**“肩难产助产术”**手法助娩出生，出生后Apgar评分1分钟7分，5分钟10分，体格检查发现婴儿右上肢肌张力低下，无主动运动，后转入我院确诊为“右臂丛神经损伤”。曾间断行药物营养神经及物理因子治疗，右上肢肌力较前逐渐恢复。
此次入院体格检查：神清，检查合作，**三角肌肌力2-3级，肱三头肌肌力3-4级，肱二头肌肌力2-3级，肘以下肌群肌力0-I级**。

临床诊断：1. 肩难产助产术后；2.右臂丛神经损伤

Shoulder dystocia

t requires additional
he fetus after the head
has failed

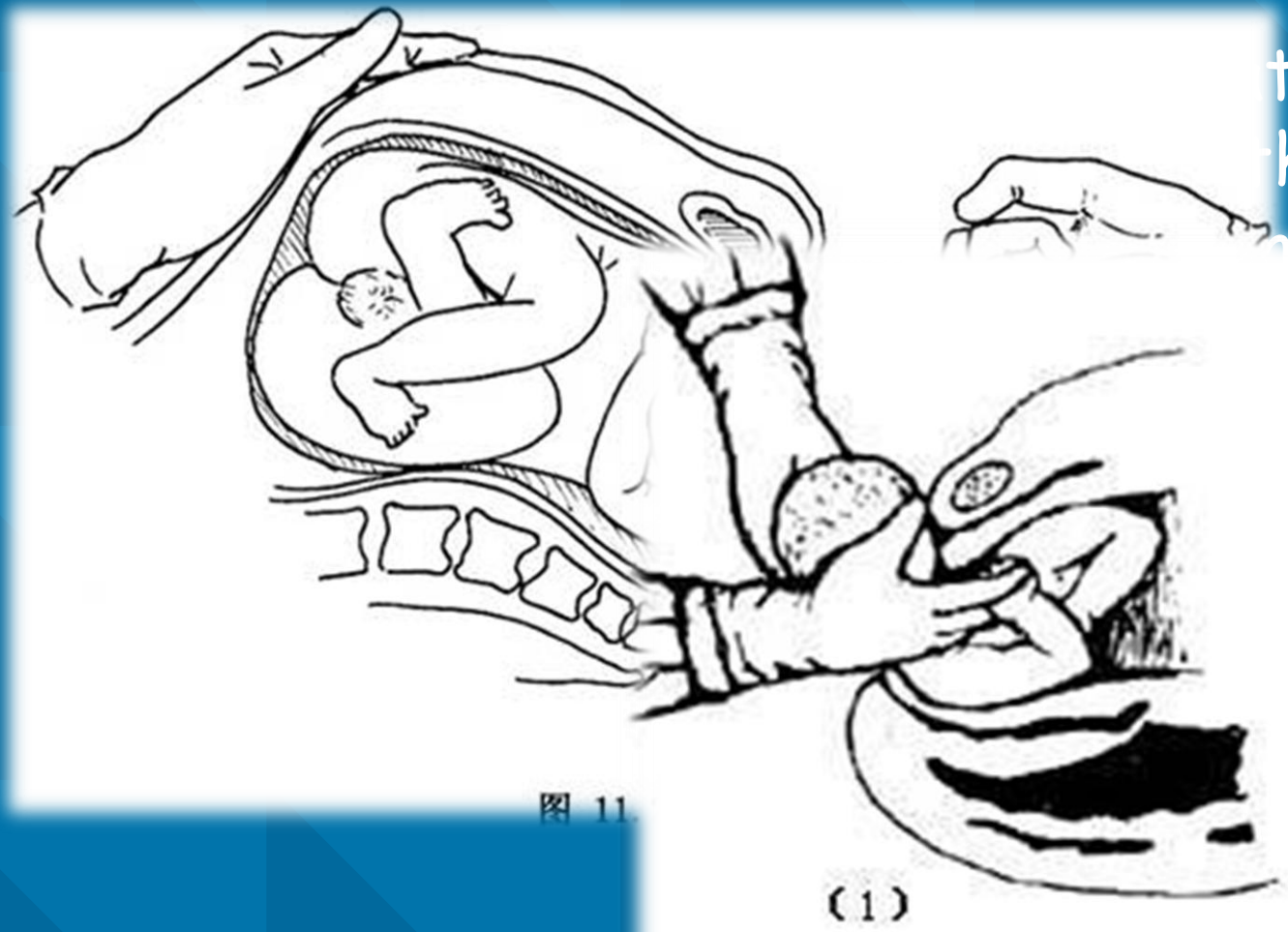


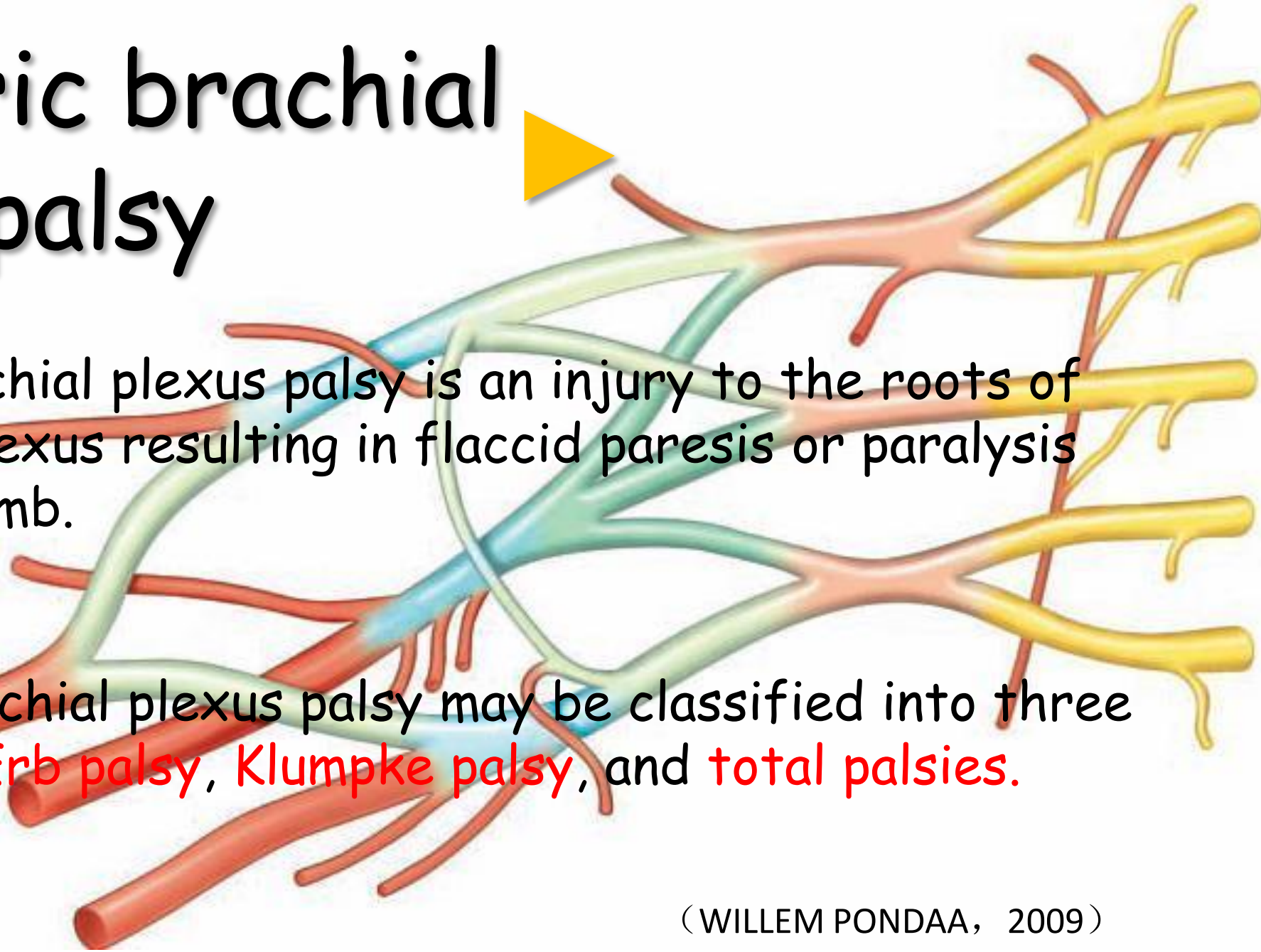
图 11

(1)

(2)

（Nafisa K. Dajani， 2014）

Obstetric brachial plexus palsy



- Obstetric brachial plexus palsy is an injury to the roots of the brachial plexus resulting in flaccid paresis or paralysis of the upper limb.

- Obstetric brachial plexus palsy may be classified into three main groups: Erb palsy, Klumpke palsy, and total palsies.

（WILLEM PONDAA，2009）

Classification

- Erb palsy :involves the upper two roots C5~6 resulting in paralysis of the shoulder and elbow
- Klumpke palsy :isolated involvement of the lower roots C8~T1
- Total palsy, all roots of the brachial plexus C5~T1 are injured, resulting in flaccid paralysis of the entire upper limb, including the hand

三角肌肌力2-3级，肱三头肌肌力3-4级，肱二头肌肌力2-3级，肘以下肌群肌力0-I级

（Amel A. F. El-Sayed，2014）

Examination and Assessment

- Physical Examination 体格检查
- Assessment Scales 量表评估
- Auxiliary examinations 辅助检查

Examination and Assessment

- Physical Examination 体格检查
- Assessment Scales 量表评估
- Auxiliary examinations 辅助检查

1 Physical Examination　体格检查

Area of ex[illegible]ination	Procedure
Obs[illegible]	Informal and formal observation of posture, muscle bulk and tone, soft tissues, gait [illegible]atient's attitude
Joint tests	[illegible]tive and passive physiological movements Joint effusion [illegible]ccessory movement
Muscle tests	Muscle [illegible]ometric muscle tests Muscle bulk a[illegible] muscle tests
Neurological tests	Integrity of the nervous s[illegible] [illegible]us system Diagnostic tests
Special tests	Vascular tests; Measurement of bon[illegible] [illegible]tests
Functional ability	As appropriate
Palpation	Superficial and deep soft tissues, bone, joint, ligament, [illegible]on and nervous tissue
Accessory Movements	Including natural apophyseal glides, sustained natural apophyseal glides and mobilizations with movement

Based on the normal development of the infant.

Different strategies

Grieve, G. P. (2014). Neuromusculoskeletal examination and assessment a handbook for therapists. *Physiotherapy*

1 Physical Examination　体格检查

Special Considerations 特殊考量

- Ptosis And Meiosis Consistent With Horner's Syndrome
- Skeletal Injuries or Bony Fractures
- Expansion of The Chest Cavity
- Classic Postures (E.G., Waiter's Tip)
- Spontaneous Movements And Normal Reflexes
- Neurologic Examination

Fig. 1 – Waiter's-tip posture of the right arm.

Yang, L. J. (2014). Neonatal brachial plexus palsy--management and prognostic factors. *Seminars in Perinatology*

1 Physical Examination 体格检查

Special Considerations 特殊考量

- Ptosis And Meiosis Consistent With Horner's Syndrome
- Skeletal Injuries or Bony Fractures
- Expansion of The Chest Cavity
- Spontaneous Movements And Normal Reflexes
- C

- Motor Function

  PROM and AROM
- Sensory function
- Response to particular stimuli in the respective dermatomes 相应皮节对特定刺激的反应

  (e.g., pinprick, pinch, heat, or cold)
- Sensory alterations 感觉的改变
  - Chewing or biting of the arm or the hand imply in the affected area.
  - Presence of skin rashes in dermatomal distributions can also indicate sensory alterations. 皮疹

Pondaag, W., & Malessy, M. J. A. (2014). Neonatal brachial plexus palsy. *Journal of Neurosurgery Pediatrics*

Examination and Assessment

- Physical Examination 体格检查
- **Assessment Scales 量表评估**
- Auxiliary examinations 辅助检查

Examination and Assessment

Physical assessment measures	The Active Movement scale (AMS)
	The Mallet scale for **shoulder** function
	The Gilbert scale for **elbow** function
	The Gilbert–Raimondi scale for **hand** function
Functional outcome measures	Pediatric Evaluation of Disability Inventory-Computer Adaptive Test

2 Assessment Scales 量表评估

Physical assessment measures

—The Active Movement scale (AMS)

Observation	Muscle grade
Gravity eliminated	
No contraction	0
Contraction, no motion	1
Motion ≤1/2 range	2
Motion >1/2 range	3
Full motion	4
Against gravity	
Motion ≤1/2 range	5
Motion >1/2 range	6
Full motion	7

Curtis, C.(2002). The active movement scale: an evaluative tool for infants with obstetrical brachial plexus palsy.

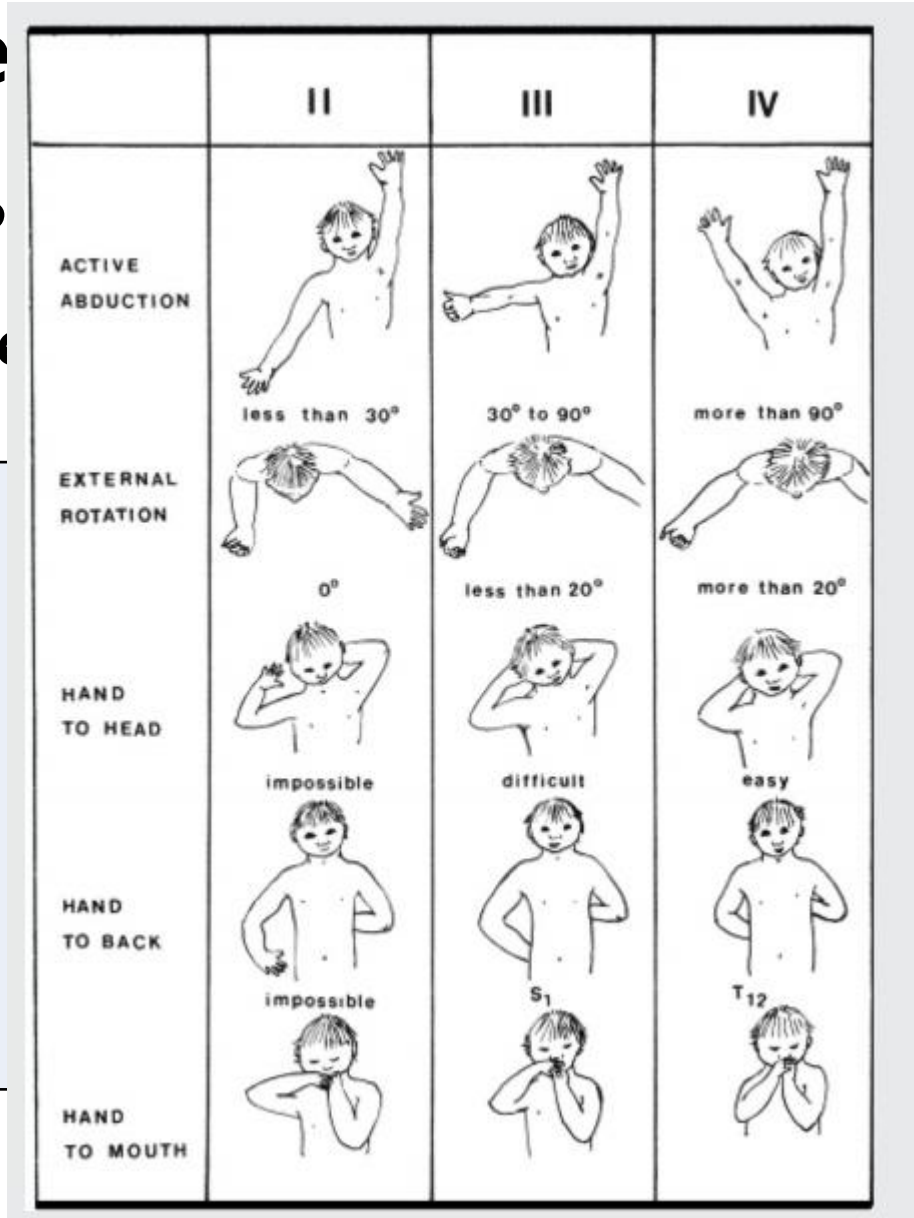
2 Assessme

P

—The Mall

er function

肩外展	4度
肩外旋	>90°
手到颈后	>20°
手到脊柱	容易
手到嘴	T12水平
	外展<40°



Chang, K. W. (2013). A systematic review of evaluation methods for neonatal brachial plexus palsy: a review. *Journal of Neurosurgery Pediatrics*

2 Assessment Scales 量表评估

Physical assessment measures

—The Gilbert-Raimondi scale for assessing elbow function

Elbow function	Score
Flexion	
Nil or some contraction	1
Incomplete flexion	2
Complete flexion	3
Extension	
No extension	0
Weak extension	1
Good extension	2
Extension deficit	
0°–30°	0
30°–50°	−1
>50°	−2

屈曲	
无主动屈曲或伴挛缩	1分
不完全屈曲	2分
完全屈曲	3分
伸展	
无主动伸肘	0分
微弱伸肘	1分
完全伸肘	2分
伸肘缺陷(欠伸)	
0-30°	0分
30-50°	-1分
>50°	-2分

Chang, K. W. (2013). A systematic review of evaluation methods for neonatal brachial plexus palsy: a review. *Journal of Neurosurgery Pediatrics*

2 Assessment Scales 量表评估

Physical assessment measures

—The Raimondi scale for assessing hand function

Description	Grade
Complete paralysis or slight finger flexion of no use; useless thumb—no pinch; and some or no sensation	0
Limited active flexion of the fingers; no extension of the wrist or the fingers; and possibility of thumb lateral pinch	I
Active flexion of the wrist, with passive flexion of the fingers (tenodesis), and passive lateral pinch of the thumb	II
Active complete flexion of the wrist and the fingers and mobile thumb with partial abduction—opposition. Intrinsic balance; no active supination; and good possibilities for palliative surgery	III
Active complete flexion of the wrist and the fingers; active wrist extension; and weak or absent finger extension. Good thumb opposition, with active ulnar intrinsics, and partial pronation/supination	IV
Hand IV, with finger extension and almost complete pronation/supination	V

手瘫痪或有手指轻微屈曲，可有一些知觉；	0级
有限的主动屈指，可有拇指对捏；	Ⅰ级
主动伸腕伴被动屈指（腱固定作用）；	Ⅱ级
主动完全屈腕屈指并完成对掌，手内肌平衡；	Ⅲ级
主动完全屈腕屈指及伸腕，但无伸指，对掌功能佳（尺侧手内肌有力），有部分前臂旋转功能；	Ⅳ级
上述4级+主动伸指及完全的前臂旋转功能。	Ⅴ级

Chang, K. W. (2013). A systematic review of evaluation methods for neonatal brachial plexus palsy: a review. *Journal of Neurosurgery Pediatrics*

2 Assessment Scales 量表评估

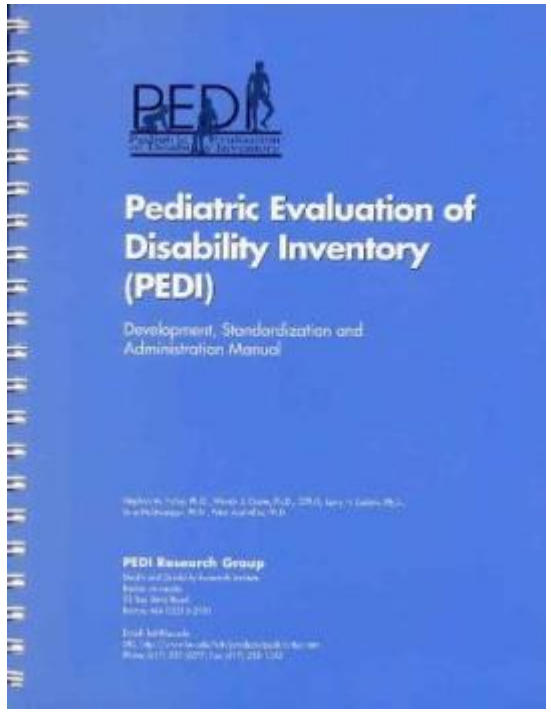
Functional Outcome Measures

TABLE 11: Summary of selected functional outcome measures for NBPP as reported in the literature*

Functional Outcome Instrument	Measurement Focus	Age Range	ICF Domain	Validated for NBPP
Parent and Patient Satisfaction	satisfaction	0–18 yrs	activity & participation	no
Cosmetic Survey	satisfaction	0–18 yrs	participation	no
ADLs (includes WeeFIM)	daily activities	0–18 yrs	activity	no
Cookie Test[9]	daily activities	6–9 mos	activity	no (widely accepted)
Hand-to-Mouth Test	daily activities	0–18 yrs	activity	no
Towel Test[7]	daily activities	2–6 mos	activity	no (widely accepted)
Assisting Hand Assessment[32]	coordination	18 mos–12 yrs	activity	yes[28]
Nine-Hole Peg Test[49]	coordination	≥4 yrs	activity	not for NBPP
Toddler and Infant Motor Evaluation[44]	coordination	4 mos–3.5 yrs	activity & participation	not for NBPP
Pediatric Outcomes Data Collection Instrument[29]	quality of life	2–18 yrs	activity & participation	yes[2]
Pediatric Evaluation of Disability Inventory[6]	quality of life	6 mos–7.5 yrs	activity & participation	no, but applied to NBPP[27]
ICF	global	0–18 yrs	ICF	no

Chang, K. W. (2013). A systematic review of evaluation methods for neonatal brachial plexus palsy: a review. *Journal of Neurosurgery Pediatrics*

2 Assessment Scales 量表评估



Functional Outcome Measures

—Pediatric Evaluation of Disability Inventory

能力低下儿童评定量表

- Published in 1992
- First pediatric measure to assess function rather than development
- Translated into multiple languages and validated for multiple cultures
- Applications:
  1) Document functional delay
  2) Document changes in functional abilities over time in response to therapeutic intervention

Mruzek, D., & Szymanski, C. (2013). *Pediatric Evaluation of Disability Inventory (PEDI)*. *Encyclopedia of Autism Spectrum Disorders*.

2 Assessment Scales 量表评估

Functional Outcome Measures

—Pediatric Evaluation of Disability Inventory-Computer Adaptive Test

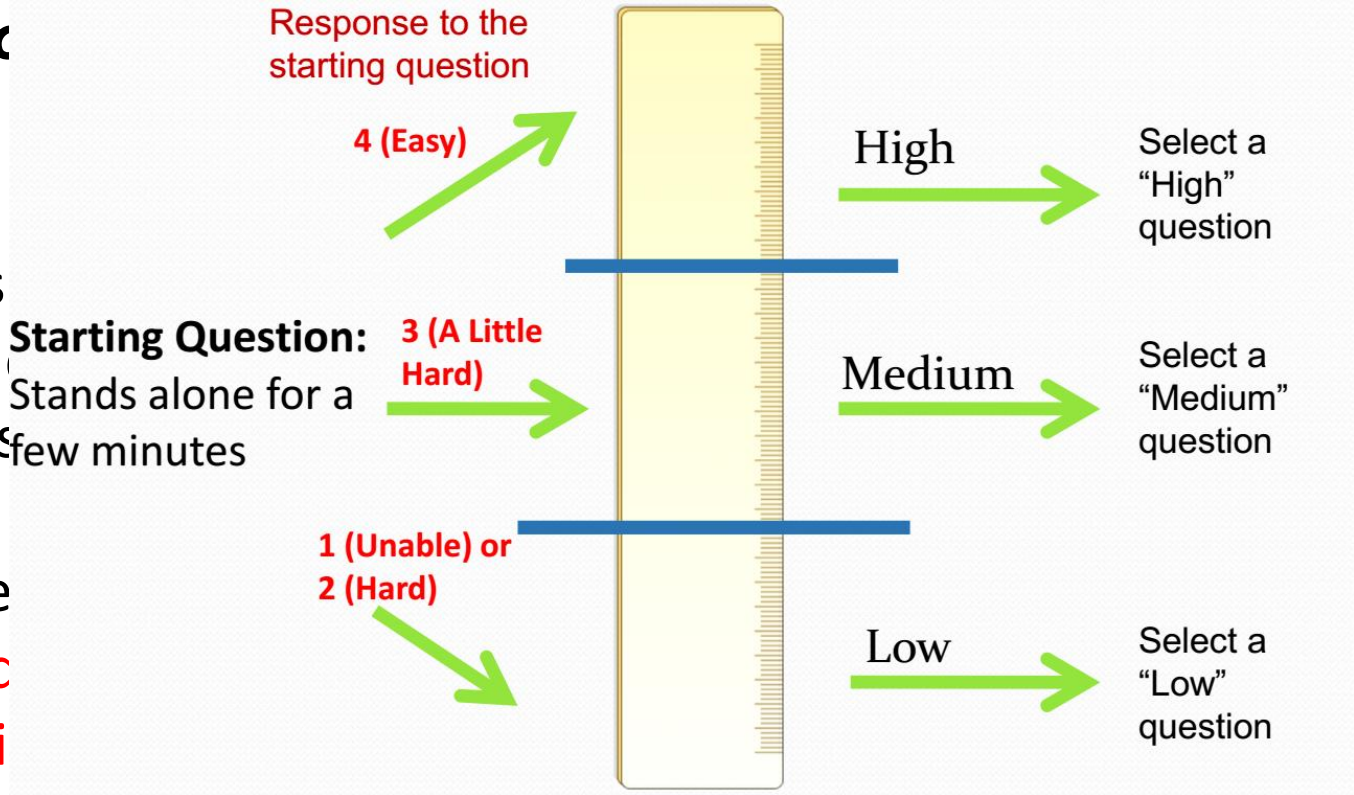
能力低下儿童评定量表-电脑自动适配测试

Dumas, H. M. (2016). Construct validity of the pediatric evaluation of disability inventory computer adaptive test (pedi-cat) in children with medical complexity. *Disability & Rehabilitation*,

2 Assessment Scales 量表评估

Functional Outcome Measures

—Pediatric Eva daptive Test



- Today's
- For chil
- Focuses
- Can be
- Brief ye
- Depenc easier item wi

Dumas, H. M. (2016). Construct validity of the pediatric evaluation of disability inventory computer adaptive test (pedi-cat) in children with medical complexity. *Disability & Rehabilitation*,

2 A

—Pedia Test

Stay calm when I don’t get what I want.

Skip

Hard

A little hard

A little easy

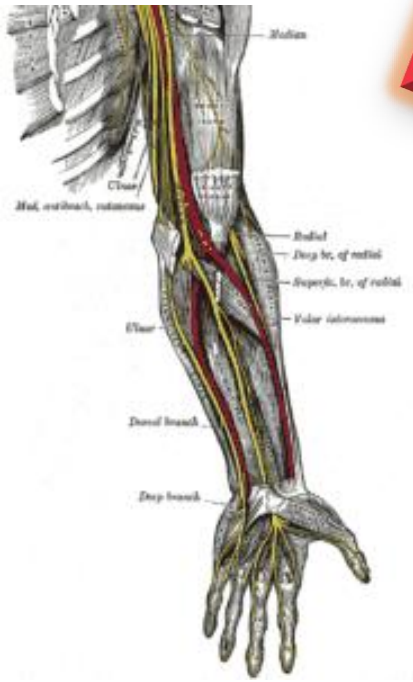
Easy

Next

Examination and Assessment

- Physical Examination 体格检查
- Assessment Scales 量表评估
- **Auxiliary examinations 辅助检查**

3 Auxiliary Examinations 辅助检查



Nerve conduction studies (NCS)

Invasive test 有创检查

- I[illegible] nerve action potential (SNAP)
  - The pres[illegible] absence of SNAPs distinguish rupture and avulsion
- The compound motor action poten[illegible]
  - The ratio of the amplitude of the CMAP o[illegible] involved side to that of the unaffected limb distinguish children's outcomes
- The motor unit action potential (MUAP)

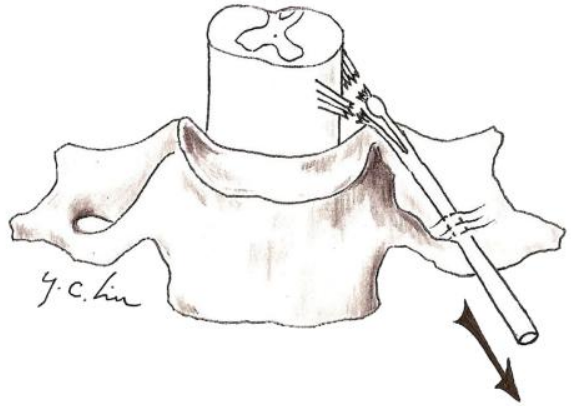


Fig. 2 – Avulsion (preganglionic) lesion.

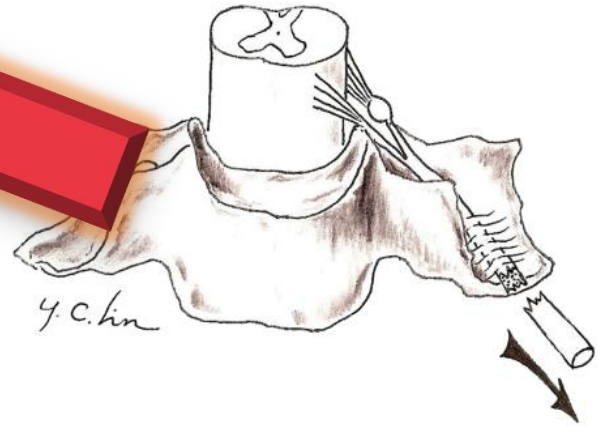


Fig. 3 – Rupture (postganglionic) lesion.

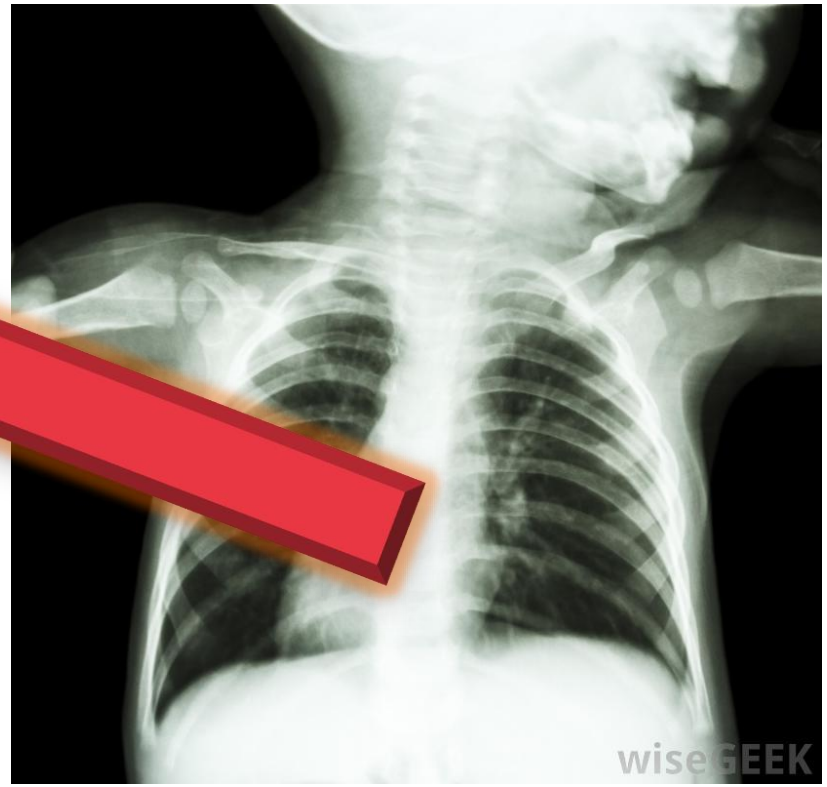
Pondaag, W. (2014). The evidence for nerve repair in obstetric brachial plexus palsy revisited. *Biomed Res Int, 2014*(1).

3 Auxiliary Examinations 辅助检查

Plain radiographs

Rough 粗略

- X-ray examinat… how fractures of the cervical spine, humerus, o… the newborn.
- Assess for diaphragmatic paralysis consequent to … phrenic nerve lesion.



Pondaag, W. (2014). The evidence for nerve repair in obstetric brachial plexus palsy revisited. *Biomed Res Int, 2014*(1).

3 Auxiliary Examinations 辅助检查

Computed tomography/myelography

Invasive test 有创检查

- High sensiti[illegible]assessment of intradural root avulsion[illegible]
- The absence of hypodense root sha[illegible] with or without a pseudomeningocele is suggestive for nerve root avulsion /preganglionic injury 一旦CTM检查发现假性脊膜膨出且膨出脊膜中神经根缺失，则强烈提示神经根已发生撕脱

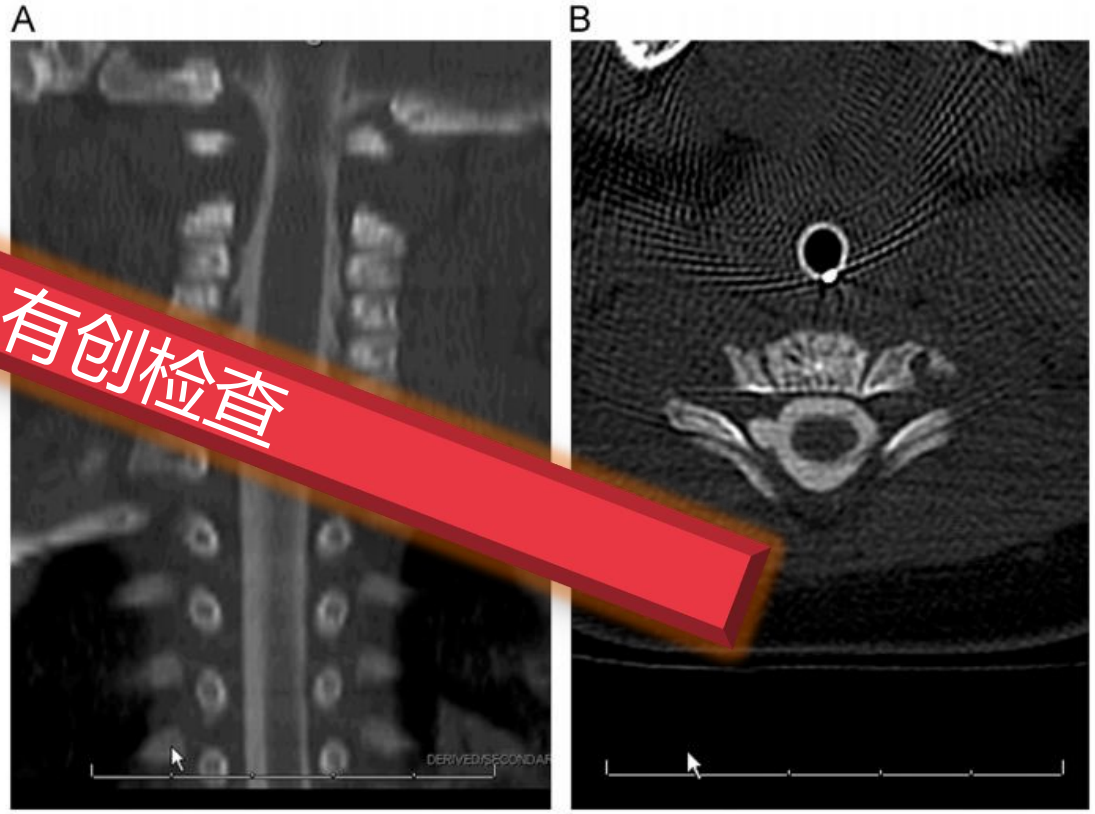


Fig. 4 – A CTM image of an avulsion lesion (A) coronal (B) axial.

Pondaag, W. (2014). The evidence for nerve repair in obstetric brachial plexus palsy revisited. *Biomed Res Int, 2014*(1).

3 Auxiliary Examinations 辅助检查

Magnetic Resonance Imaging

- Avoids the use of ionizing radiation, does not require lumbar puncture, can be performed with mild sedation in babies
- MRI拥有无创、无电离辐射、少量镇静剂使用及强大后期图像处理能力等众多优势。

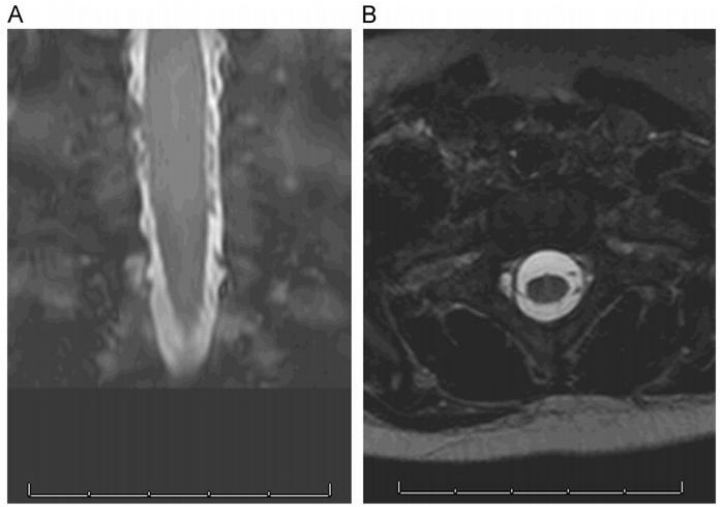


Fig. 5 – A MR image of an avulsion lesion (A) coronal (B) axial.

Pondaag, W. (2014). The evidence for nerve repair in obstetric brachial plexus palsy revisited. *Biomed Res Int, 2014*(1).

Case study Six

患儿，男，**2岁6个月**，因右上肢活动障碍入院。
患儿2012年10月10日于外院出生，生产时出现“肩难产”，按“肩难产助产术”手法助娩出生，出生后Apgary评分1分钟7分，5分钟10分，体格检查发现婴儿右上肢肌张力低下，无主动运动，后转入我院确诊为“右臂丛神经损伤”。曾间断行药物营养神经及物理因子治疗，右上肢肌力较前逐渐恢复。此次入院体格检查：神清，检查合作，**三角肌肌力2-3级，肱三头肌肌力3-4级，肱二头肌肌力2-3级，肘以下肌群肌力0-I级**。

临床诊断：1. 肩难产助产术后；2.右臂丛神经损伤

GOAL

- Short-term Goal : Relieve pain, neural restoration, promote muscle strength and prevent contracture
- Long-term Goal : Promote muscle strength and prevent malformation

Treatment

- Pain
- Amyotrophia and Contracture

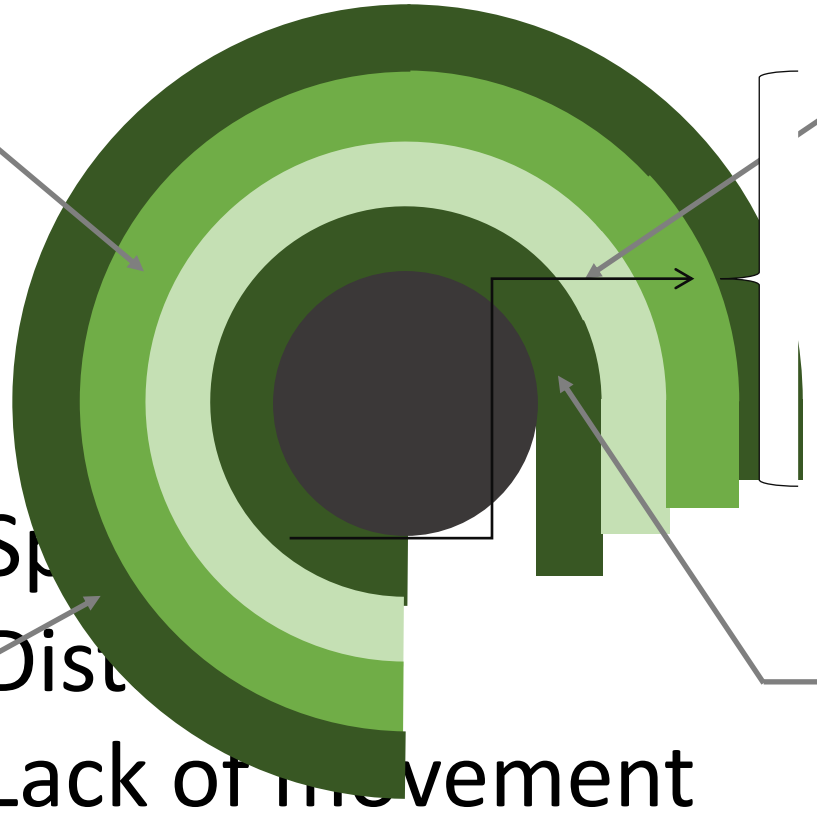
Korak KJ, Tam SL, Gordon T, et al. Changes in spinal cord architecture after brachial plexus injury in the newborn [J]. Brain,2004,127(Pt 7):1488—1495.

Pain

- Intractable
- TENS
- Brace

陆廷仁. 骨科康复学[M].北京：人民卫生出版社，2007. 693.

Amyotrophia and Contracture



Physiotherapy

Contract

Vein and lymphatic return

Cause:

Sp

Dist

Lack of movement

Manipulation

Electric stimulus

Plastic of brain

Orthotics

Maintain ROM

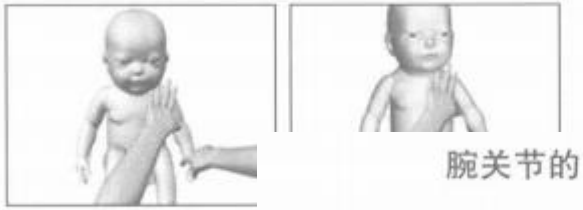
Active and passive training

Blood circulation

周俊明，徐文东，张丽银，等.上肢神经损伤的康复[M]. 复旦大学出版社，2008.36—37.

Passive movement

肩关节屈曲运动

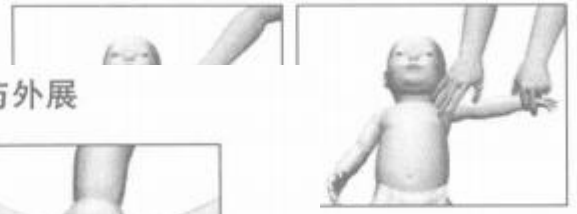


婴儿取仰卧位，双
举患儿手臂与肩平齐，

肘关节屈曲及外展运动

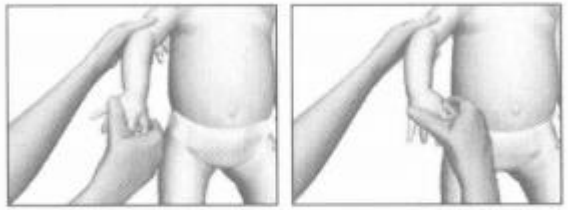
一手固
伸展。

肩外展运动



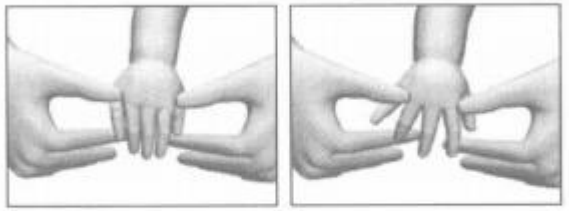
定肩，一手牵前臂向体

腕关节的内收与外展运动



婴儿取仰卧位，双手分别固定患儿前臂和手，然后左右移动腕关节。

手指的内收与外展

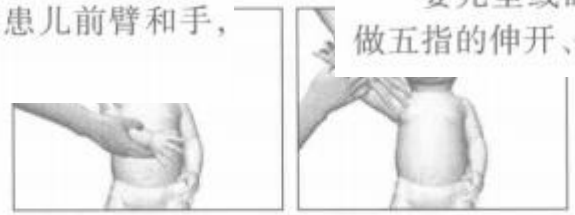


婴儿坐或卧，掰开婴儿手掌，保持手指伸直，做五指的伸开、合拢动作。

前臂

婴儿取仰卧位，一只手固定前臂上部并握肘，一手托腕，进行前臂与手的上下活动。

旋转运



婴儿取仰卧位，一只手握住近上臂肩部，另一只手握住前臂。前臂向下，并屈肘至身体中线，再将前臂向外上方伸展。

外展

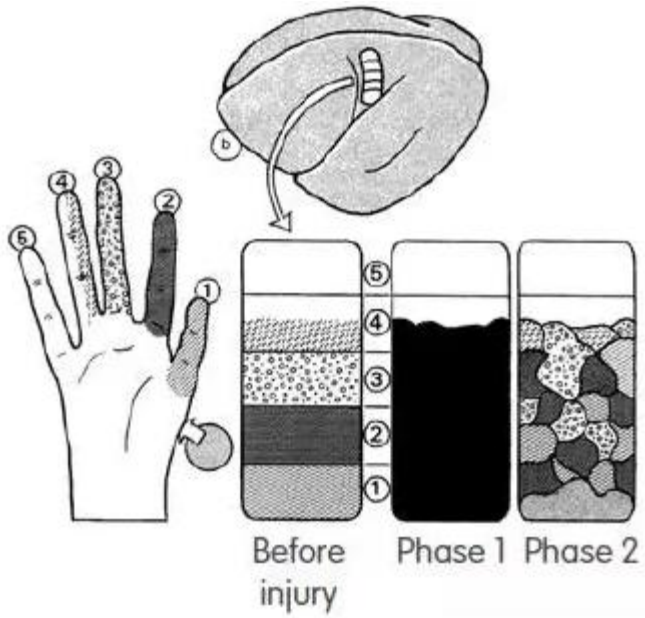
婴儿坐或卧，一只手固定腕，一只手握住手指，进行手指的屈伸运动。

Part 3

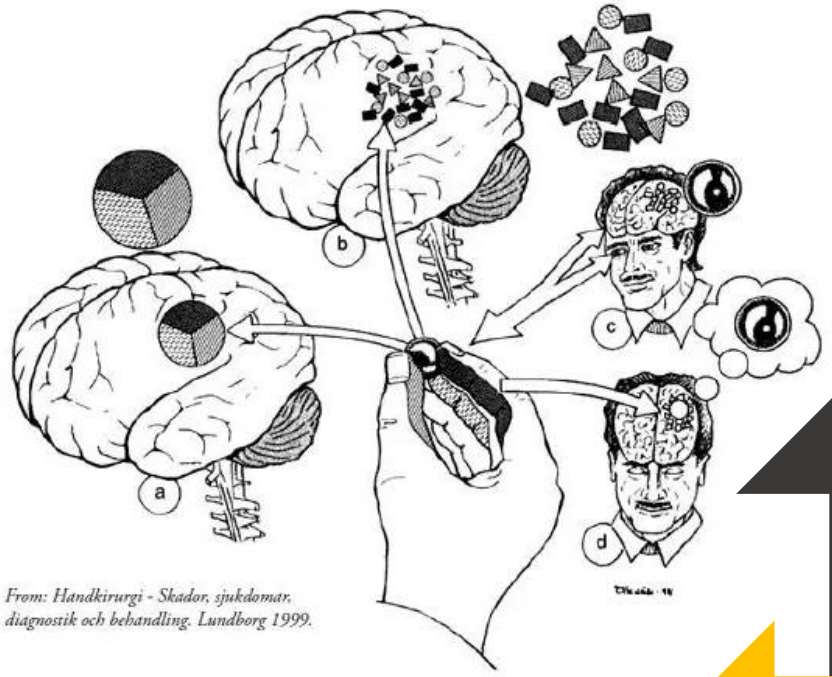
Sensory Re-education

Sensory re-education:Maximizes the full sensory potential (Existing receptors and somatosensory spinal tracts).

Normal and Injury



Re-education



Alon Kalrona ,Effects of a new sensory re-education training tool on hand sensibility and manual dexterity in people with multiple sclerosis ,NeuroRehabilitation 32 (2013) 943–948

Protective Sensation：

1)Temperature

2)Sharp/Dull

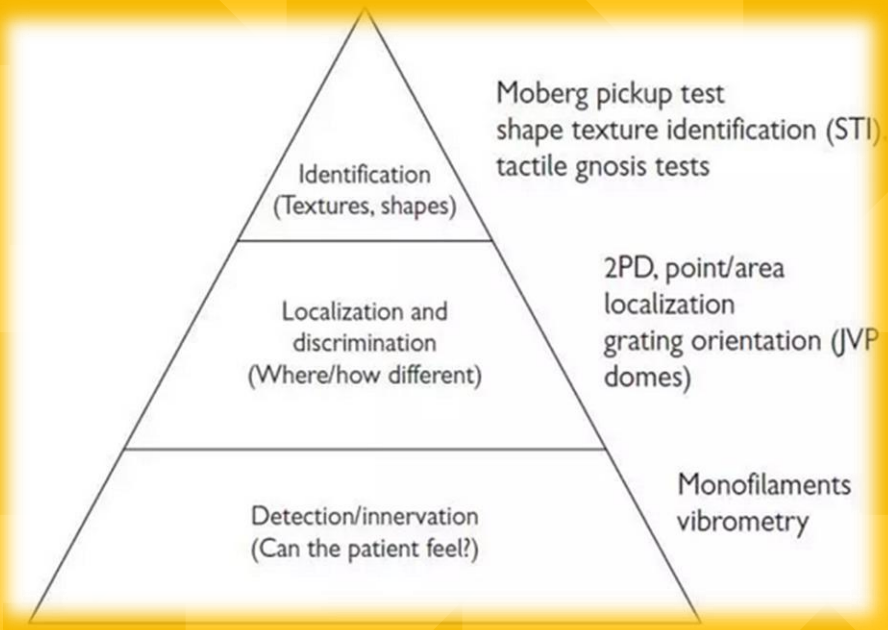
3)Deep Pressure；

Functional Sensation：

1)Fine Discriminative Touch

2)Discrimination of Shape

3)Texture Proprioception



Jerosch-HeroldC ---- Three Levels of Sensory

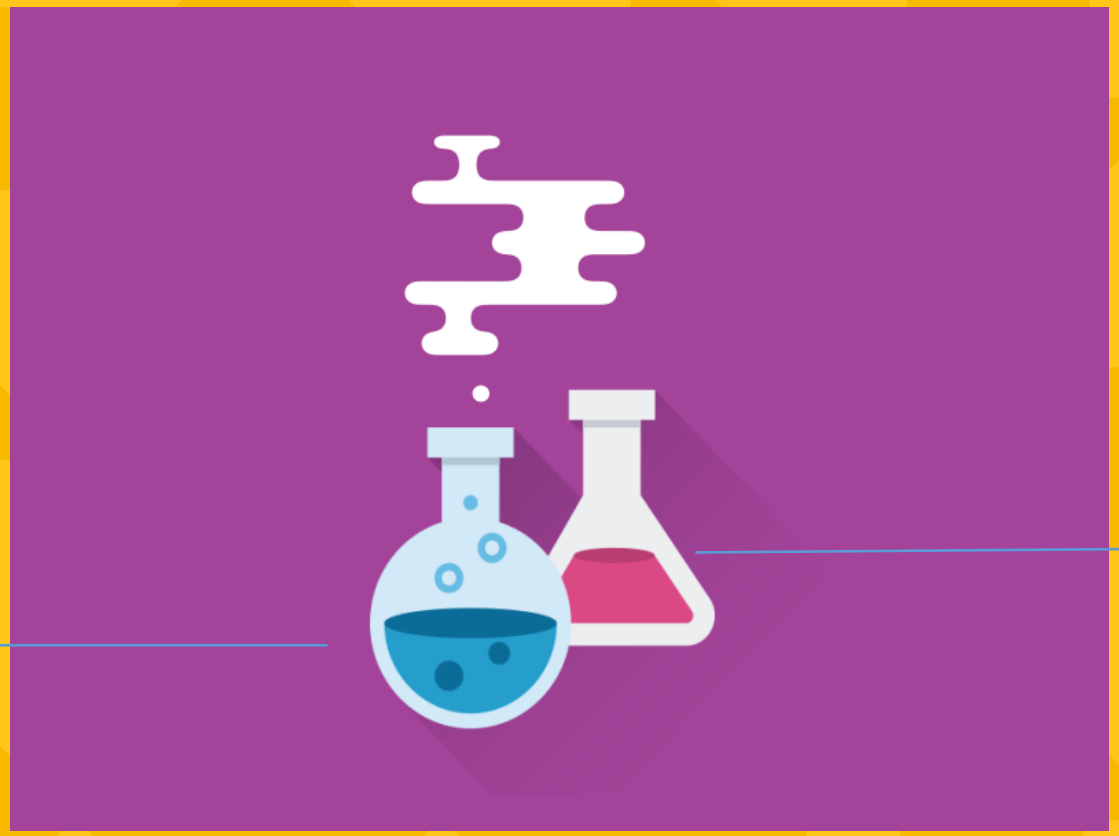
徐晓君,臂丛神经损伤康复治疗研究进展*Chinese Journal of Rehabilitation Medicine, Nov. 2010, Vol. 25, No.11

Occupational therapy session, twice a week,consisting of non-specific repeated exposure to stimuli varying in texture, shape, size, weight, hardness, and temperature, via grasping of common object.

Deconinck FJA, Reflections on mirror therapy:a systematic review of the effect of mirror vis feedback on the brain. Neurorehabil Neural Repair. 2015;29(4):349-61.

Thermal sensation:Put a glass of warm water(about 45℃) another glass of and cold water on the injured hand,to train the thermal sensation.

Attention: Avoid empyrosis!



傅育红，镜像疗法结合感觉再教育训练对足趾移植再造拇指术后复合感觉的效果,中国康复理论与实践2016 .7 .22 卷第7 其

1.The therapist randomly placeda single element into their hand, asking for identification through palpation

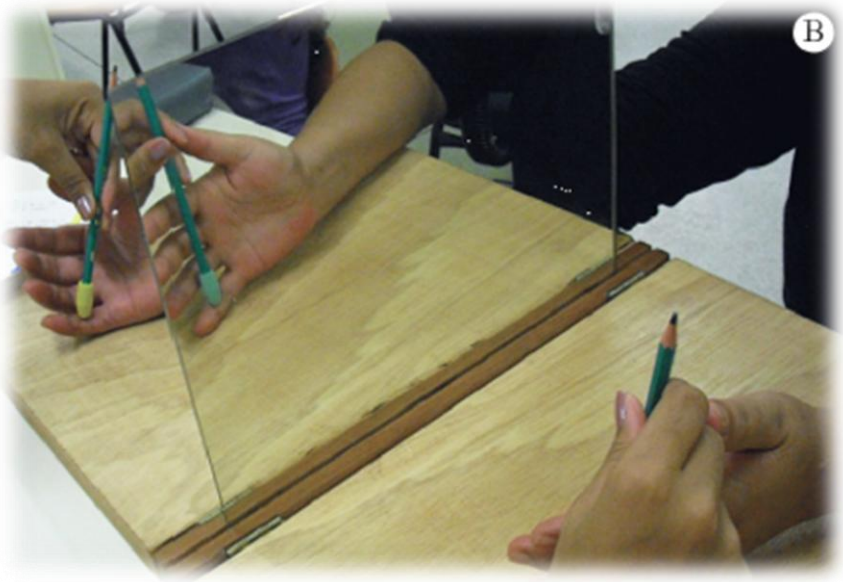
2.All elements were placed in a pouch. Participants were unable to see the tubes. They then placed their affected hand into the pouch picking out a single element described by the therapist, relying solely on palpation.

傅育红，镜像疗法结合感觉再教育训练对足趾移植再造拇指术后复合感觉的效果,中国康复理论与实践2016 .7 .22 卷第7 其

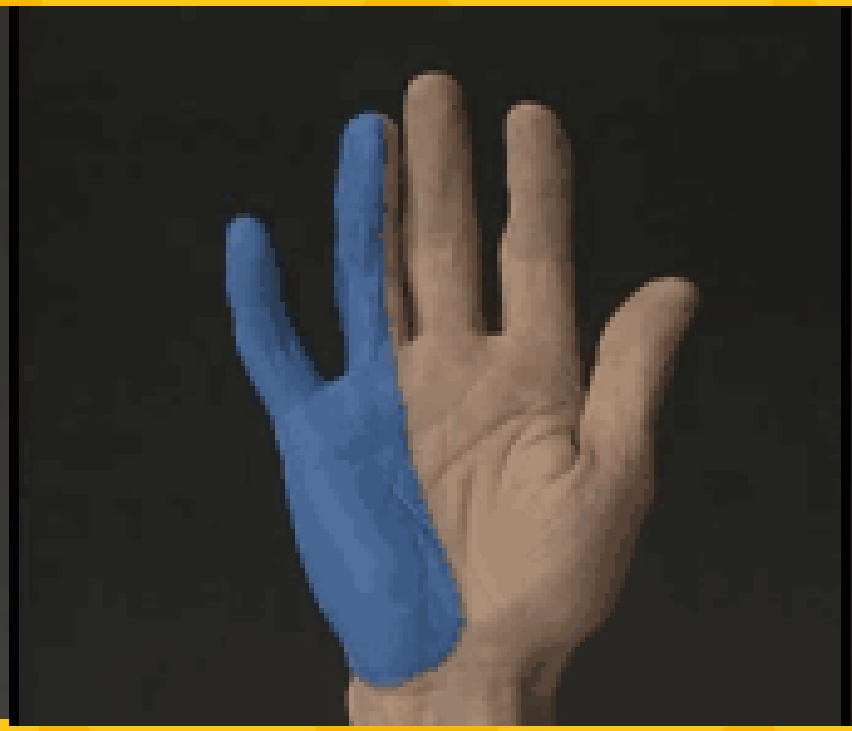
Mirror Therapy: An alternative stimulus to feed the somatosensory cortex to preserve hand cortical representation with better functional results.

Early Phase

Late Phase



Nojima I, Human motor plasticity induced by mirror visual feedback [J]. J Neurosci, 2012, 32 (4): 1293-130


“Make the sensory re-education fulfill the life.”

Miller LK, Effects of sensory reeducation programs on functional hand sensibility after median and ulnar repair: a systematic review. J Hand Ther.2012;25(3):297-07

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END

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Li Jianbang

Hu Xiaoqian

Wei Xiaoyu

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Thank You!