

Modern Management of Brachial Plexus Injuries

Occupational/Physical Therapy Approach and
Management.

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Assessment Measurement Tools

Therapy Evaluations/OBPI eval form

- General Management Protocol in OBPI
- Initial Assessment
- Inpatient vs Outpatient Evaluation

- Inpatient Evaluation: Family education; positioning; PROM exercises; precautions; splinting needs; recommendations

- Outpatient Evaluation: OBPI Evaluation form, family education, expectations, precautions, developmental assessment

Therapy Evaluations

- Subjective

- Can be very insightful on family dynamics

Emotional state, coping abilities

Family perception/goals/expectations for the child.

- Availability of the family to assist with rehab process

Therapy Evaluations; History/Subjective

- Pertinent medical history
- To include gestational age, birth weight, presentation, delivery history, maneuvers if used, shoulder dystocia present?
- Complications after birth
- Developmental history, feeding abilities
- Adaptive equipment, previous therapies
- Special diagnostic tests
- Pictorial documentation

4 month old infant with L OBPI



Therapy Evaluations

- Objective Findings
- Precautions
- ID which limb is affected
- ID resting posture in all appropriate developmental positions including: supine, prone, sidelying.
(age dependent)
- Reflex testing in infants
- Must test both arms to get baseline

6 Week old infant with R OBPI



Therapy Evaluations

- Objective:
- Passive ROM: In infants 3 months or less, be sure to take into account physiological flexion and its effects on PROM
- **Precautions:** Be aware of potential shoulder subluxation/or radial head dislocation to prevent injury during PROM exercises



Therapy Evaluations

- Active ROM
- Details, Details, Details
- Effects of gravity on AROM
- Substitutional compensatory patterns of movement
- Mallet Scale of active movement







Therapy Evaluations

- Strength
- How to assess in infant?
- 1. Observation
- 2. Palpation – test in different ranges and in different relationships to gravity



Therapy Evaluations/strength

AMS (active movement scale) Score

Gravity Eliminated

0-No contraction

1-Contraction. No motion

2-<50%, motion

3->50% motion

Against Gravity

5-<50% motion

6->50% motion

7-Full motion

SAT Scale

- 0 – No contraction felt in the muscle
- 1 – Contraction felt but no visible movement observed
- 2 – Motion too difficult to perform against gravity; must be done in horizontal plane
- 3 – Motion up to 50% of full ROM held less than 1 minute; AROM repeated 5 times with noticeable decrease in ROM as reps 2-5 are performed
- 4 – Motion 50-100% of full motion held for one second; AROM repeated 5 times with noticeable decrease in motion as reps 2-5 are performed
- 5 – Maximum AROM held 2 seconds and repeated 5 times with noticeable decrease in ROM as reps 2-5 are performed

SAT Scale

- 6 - Maximum AROM held 2 seconds and repeated 5 times with no decrease in in ROM as repetitions continue
- 7 – Maximum AROM held 2 seconds and repeated 10 times using 1 lbs weight with no decrease of ROM as reps continue
- 8 - Maximum AROM held 2 seconds and repeated 10 times using 2 lbs weight with no decrease of ROM as reps continue
- 9 - Maximum AROM held 2 seconds and repeated 10 times using 3 lbs weight with no decrease of ROM as reps continue



Therapy Evaluation

- Sensation:

Light touch

Painful stimuli

Temperature

How do we objectively measure in infants?

Observation, parent report

Therapy Evaluations

- Primitive Reflexes

Palmar grasp reflex

Plantar grasp reflex

Moro Reflex

Traction

ATNR

Therapy Evaluation

- Muscle Tone

Assess entire body

Newborn physiological flexion

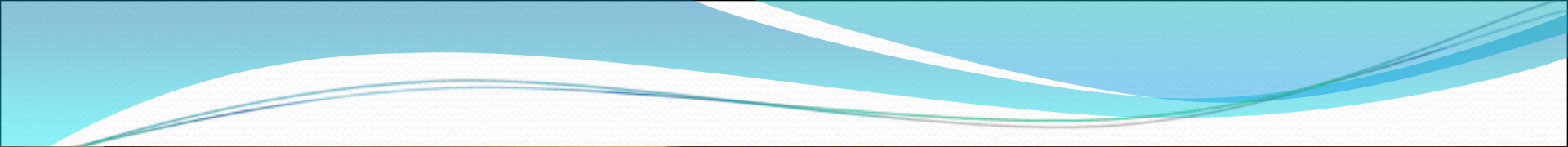
When does this diminish?

Position at rest



Therapy Evaluations

- Atrophy-
Circumferential Measurements
- Size
 - ID limb discrepancy in length or circumference
Landmarks: humeral head to lat epicondyle
Ulnar or radial head to styloid process.
Limb length discrepancy could be related to shear deformity.
 - In infants, measure in metric system



Therapy Evaluation

- Developmental progression
- Dependent on age
- Look for symmetry



Infant Development Review

- **One month old:** Physiological flexion, Grasp reflex
- **Two month old:** holds head upright when trunk supported
- **Three month old:** + head control, voluntary swiping & reaching
- **Four month old:** props on forearms, rolling, bilateral reaching
- **Five month old:** sits with min support, hand to mouth pattern
- **Six month old:** increased postural control, weight shifting

Reference: Normal Development of Functional Motor Skills

Rona, Alexander; Regi Boehme, Barbara Cupps.

Motor Skills acquisition in the first year: Lois Bly (therapy skill builders)

Infant Development Review

- **Seven month old:** equilibrium reactions emerging
- **Eight month old:** rocks forward and backwards in quadruped.
- **Nine month old:** Crawling, increase in transitional movements
- **Ten month old:** Pulls to standing, cruising, pinch emerging
- **Eleven month old:** stands with less support, pincer grasp
- **Twelve month old:** independent walking

Therapy Evaluations

- Joint Integrity
- Check for subluxations or dislocations
- Check for joint capsule tightness
- Check for glenohumeral changes



Therapy Evaluations

- **Scapulohumeral relationship**

Changes with passive and active abduction

In order to access 180 deg of shd abduction, you need a mobile scapula.

Scapula moves – 30° of active abduction and 70° of passive abduction

- **To assess for shear deformity:** Palpation of the clavicle with the thumb and the spine of the scapula with the index finger.
(scapular elevation grading scale)



Therapy Evaluations

- Questions to ask to assist in setting goals:
 - Are problems related to
nerve dysfunction?
biomechanical issues?
muscle imbalance?
sensory loss?

Therapy Evaluations

- Associated problems
 - Visual neglect of involved side
 - Torticollis
 - Hemidiaphragm paralysis

Therapy Evaluations

- **Special considerations for older children**
 - Tone of uninvolved UE
 - Subluxation of opposite shoulder
 - Trunk stability



Therapy Evaluations

- **Long Term Considerations**
 - Arthritic changes
 - Bone density/bone health
 - Limb length discrepancy/deformity
 - Muscle contractures
 - Sensory deficits
 - Apraxia: limb neglect and sensorimotor skills



Therapy Evaluations

- **Long Term Considerations**
 - Posture
 - Self-injury
 - Developmental skills
 - ADL's

Pre-Surgical Interventions

Therapeutic Management

OBPI Treatment-Infant

- Need to determine frequency of OT/PT session
- Why it is important to treat infants more often?
- When should treatment begin?

BPI Treatment

Essential Beginnings

Teach parent ROM exercises

If they are not comfortable doing them, show them
hand

over hand to show the exact range available

Treatment/Infants

- PROM

Should be performed through full comfortable range but should be gentle and pain free

If clavicular fracture present avoid ROM for ten to fourteen days as per MD's orders

Treatment-Positioning

Infants:

No longer pinning arm to chest unless fracture present

Older infants (4 month +)

Supine and Prone

Shoulder abducted to 90 degrees
with external rotation



Treatment Goals

- 1st priority
- **FAMILY EDUCATION**
including traditional treatment: ROM, scapular;
gleno-humeral stabilization

Precautions/plans

Carrying and feeding the infant with OBPI

Car seat position

Diagnostic work-up, specialists

Treatment Goals

- Maintain PROM/prevent contractures
- Obtain AROM
- Preserve joint integrity
- Promote age appropriate developmental skills acquisition

Treatment Goals

- Promote sensory awareness of involved UE in hopes of reducing apraxia
- Promote visual awareness of involved UE (midline)
- Prevent/minimize compensatory patterns of movement
- Monitor potential associated problems
medial rotation posture/deformity related to muscle imbalances





Treatment/Infants

- PROM points to remember
 - radial head dislocation
 - support normal scapulohumeral rhythm

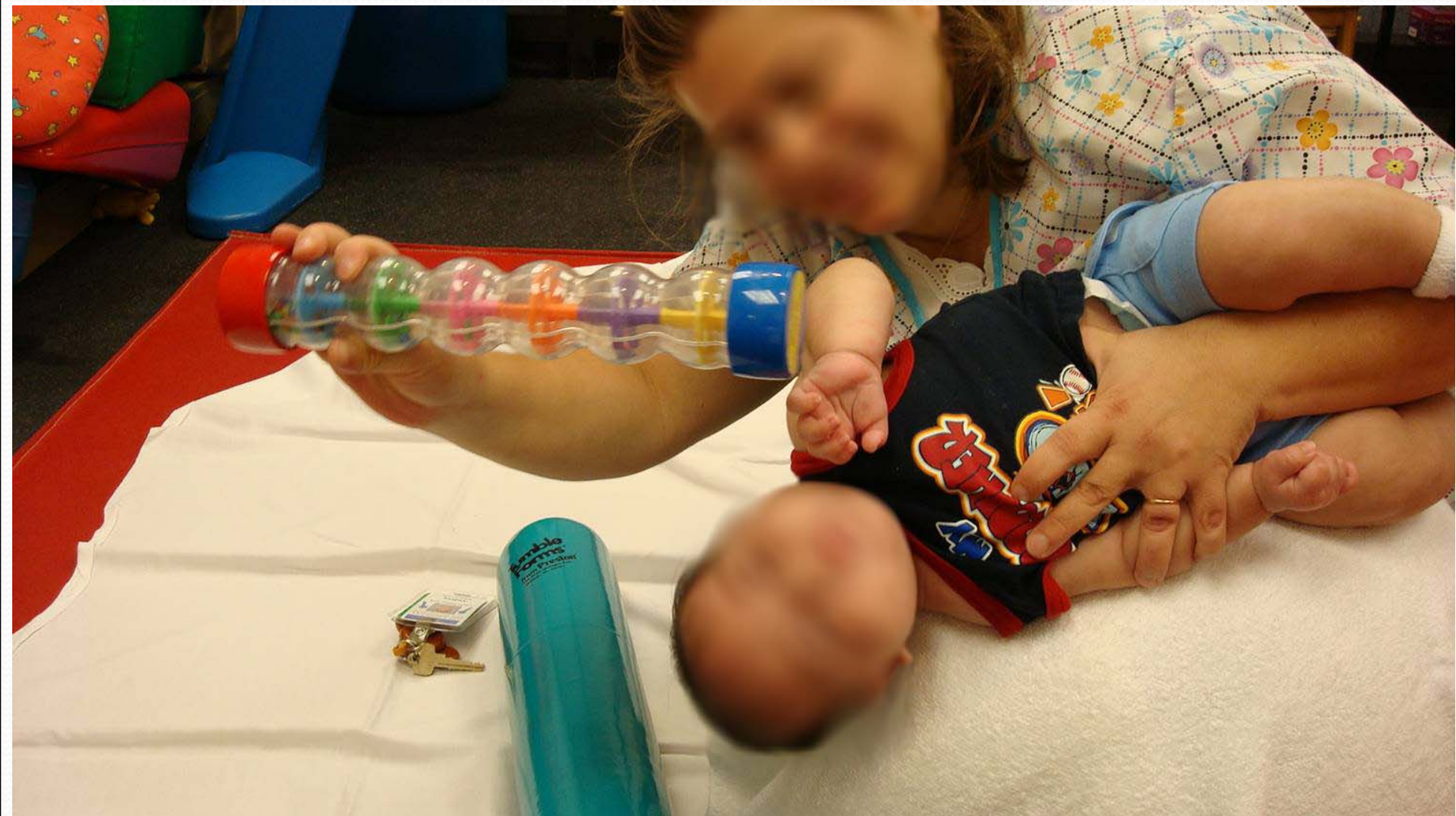


Treatment-AROM

- Early facilitation of AROM is critical for the prevention of learned nonuse

General Guidelines

- Start in gravity eliminated or gravity reduced position when eliciting concentric contraction
- Reflexes can be helpful to elicit muscle contraction
- Weakness can develop in muscles not directly affected by the lesion



Treatment-AROM

- Facilitation of shoulder stability is the foundation for controlled arm and hand function
- Weight bearing and weight shift in prone
- Assisted reach while in prone
 - Vibration/tapping to rhomboids
- Promote scapular weightbearing facilitates co-contraction both with scapular movers and stabilizers
- Activation of abdominals





Facilitation of Reach

- Gentle humeral compression during reach
- Humeral guidance while facilitating humeral flexion and ER (inhibit excessive humeral abduction)
- Stabilizing and mobilizing scapula
- Facilitate reach without grasp, but reach to touch easier



Facilitation of Supination

- Early supination begins with elbow flexion
- Get shoulder in neutrally rotated position first
- Cylindrically shaped toys presented in vertical fashion
- Facilitates supination
- Present toys to radial side of hand

Facilitation of Supination

- Treatment Strategies

Encourage hand to mouth and toy to mouth play

Finger feeding

Bimanual holding of toys

Banging blocks

Holding bottle at feeds

Stickers on palmer surface or wrist

Weight shifting while in prone





Facilitation of ER

Gentle stretch to pectorals is essential

MFR, strain/counterstrain

Gentle joint mobilization

Massage

Trunk rotation while weight bearing on fixed (involved)
UE

Reaching out to side with humerus fixed against trunk



Facilitation of Grasp

- Treatment Strategies

Toy to mouth

Traction and proprioceptive input through palm

Weight bearing through palm/correction of
weight bearing through dorsal surface

Hold large object requiring two hands

Use velcro strap on hand to maintain hold



BPI Treatment-infant

Teach Parents

Proper positioning

Sensory stimulation

Visual orientation

Proper carrying and picking up techniques

Treatment-Positioning

Sidelying on uninvolved side to promote midline orientation of involved limb as well as spontaneous play

Sidelying on involved side-trunk should be reclined back slightly towards supine to avoid undue pressure (if hemidiaphragmatic, this should be limited but still performed)

BPI Treatment

Tummy time

Essential for preparation for future use



BPI Treatment

Sensory Stimulation

Facilitate involved arm

Exploring other body parts

Provide infant massage over involved limb

Provide vibratory input

Provide joint compression

Provide variety of textures

Alter temperature of toys

Treatment-Visual Input

Involved arm should always be in visual field to reduce chances of developmental apraxia of nonuse

Place bell on small wrist band to encourage child to look
at arm when spontaneous movement occurs



BPI Treatment

- Use of vibration can achieve a lot at young age
- Can activate muscle
- Promote sensory awareness
- Assist with nerve re-generation



BPI Treatment- Developmental Sequence

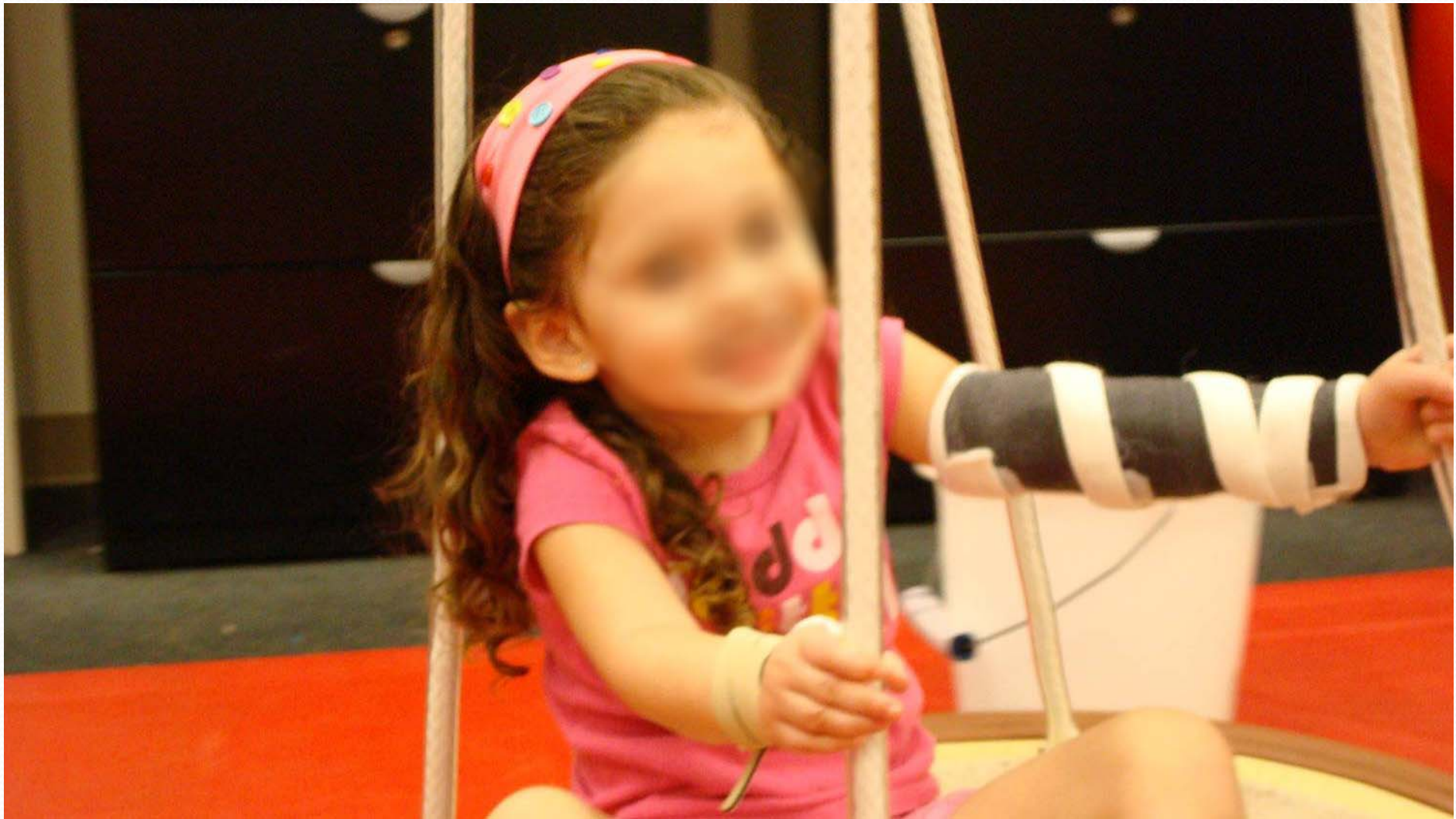
General points of consideration

Utilize age appropriate activities

Keep it fun through variety of stimulation

Insure successful experience

Watch entire body for compensations



BPI treatment-Transitional Movement

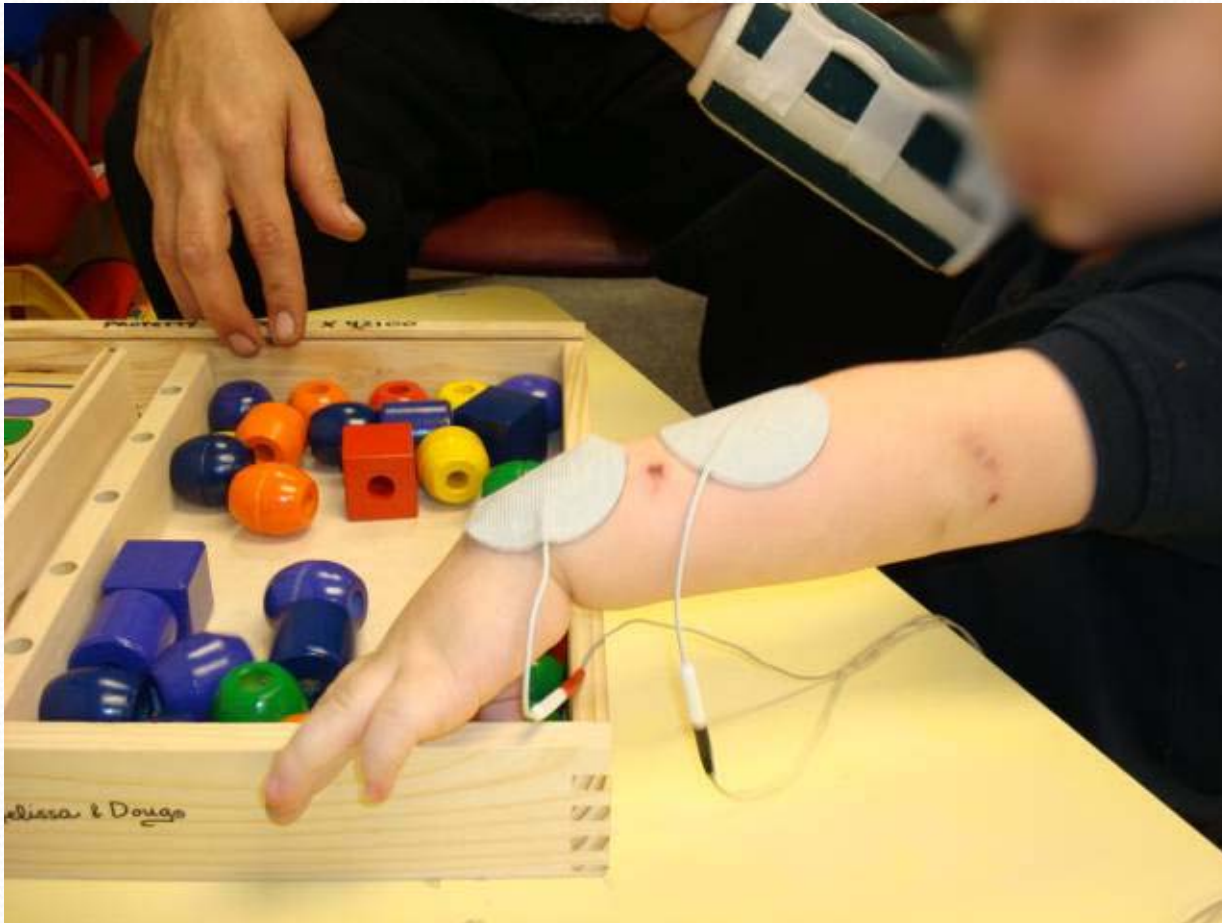
Rolling supine to sidelying to prone (and vice versa)

Always to both sides

Weight shift in sitting

Creeping on hands and knees

BPI Treatment/NMES



BPI Treatment/Constrained induced





BPI Treatment-Splinting

Goals

Prevent contractures

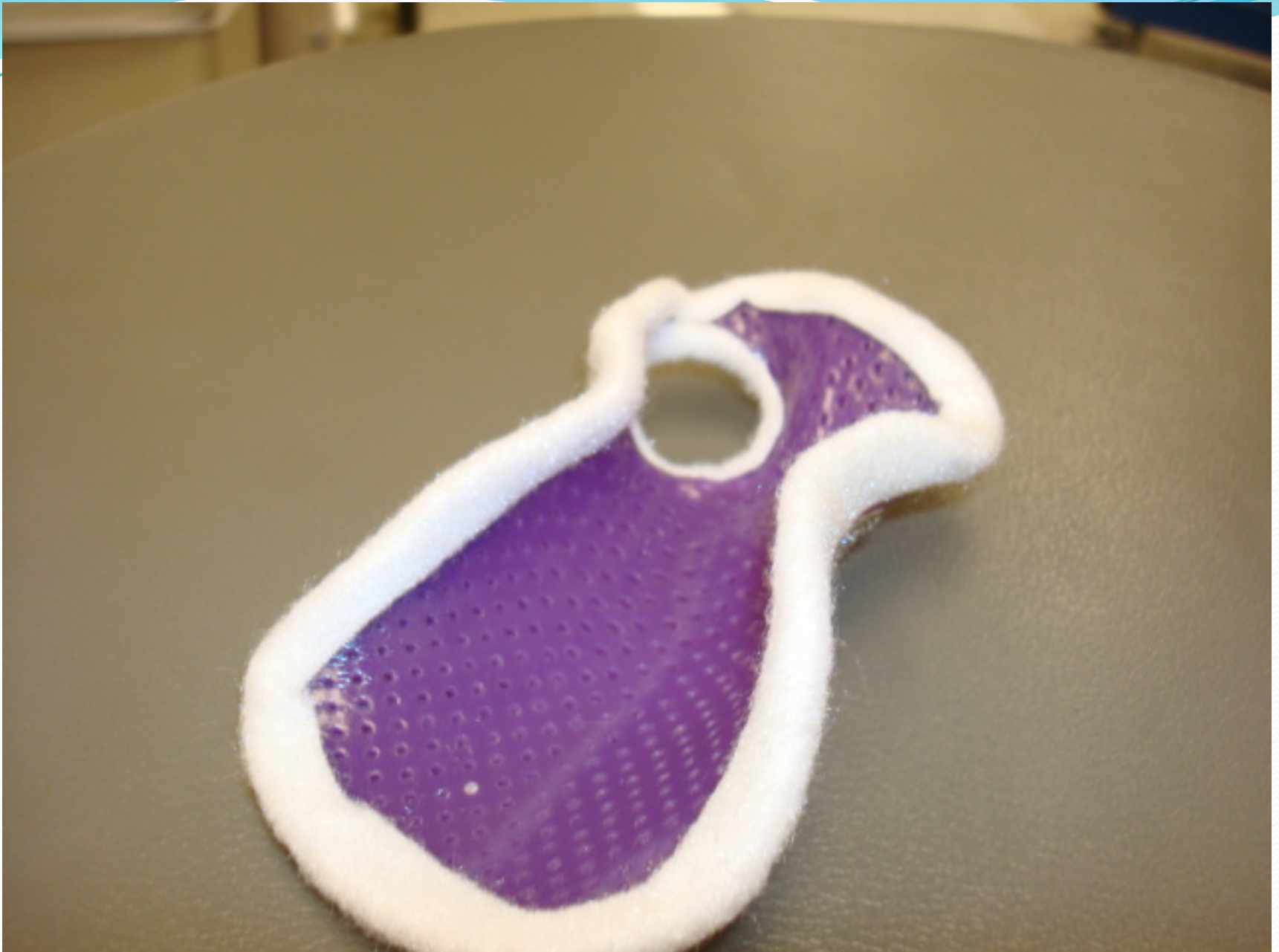
Promote increased function

Protect joint

Deficits determine splinting needs
not all infants need splinting.













Post-Surgical Interventions

Therapy Intervention Following Mod Quad Procedure





Post-Surgical Rehab/Mod Quad

- Statue of Liberty (SOL) splint is removed by OT on post-op day #1 to assess current shoulder AROM
- AROM tested anti-gravity & gravity eliminated planes
- Based on AROM findings decision on splint wearing time is made
- AROM might be restricted by pain and dressings
- Typically infants sleep with SOL for 3 weeks

Post-Surgical Rehab/Mod Quad

- Typically infants under 12-18 months do not need splinting during day-time

Splinting at night time only for 3 weeks

- Children 2 + more aware of pain and discomfort
- Might need splinting 18/7 for 1-3 weeks
- Splint is to promote healing and for pain control
- Important to remove splint 1-2 hours at least 2 x day



Post-Surgical Rehab/Mod Quad

- AROM/AROM begin immediately
- Infant's and younger children restrict AROM on non-affected extremity (elbow splint)
- Children 12+: pillow splint with shoulder at 80/90 degree angle to prevent numbness/tingling
- Protocol for older children varies and AAROM/AROM begin at post-op day #1 and performed every hour

Compensatory patterns big problem for older children

Post Surgical Rehab/Mod Quad

- Formal therapy typically resumes at post-op weeks 2-3
- Encourage active movement and function through play and participation in self-care skills
- Non-resistive activities: balloons, bubbles, magnets
- **Do not encourage internal rotation or adduction at the shoulder**





Post-Surgical Rehab/Mod Quad

- Post-op weeks: 0-3: PROM/AAROM/AROM
To shoulder flexion/abduction/external rotation
- Post-op weeks: 3-6: Therapy might resume
Continue AROM/AAROM
Aquatics might begin
Discourage compensatory patterns of movement

Post-Surgical Rehab/Mod Quad

- Post-op weeks 6 and after

Discontinue night time splint

Scar massage

Assessment of the scapular stabilizers on both sides must be done prior to begin progressive strengthening

Consider kinesio-taping, theratogs, special braces to build and maintain scapular stability

TES/other modalities could be started

Post-Surgical Rehab/Mod Quad

- **Special Considerations**

- Children with shear deformity will continue to exhibit shoulder AROM deficits
- CT scan is ordered at post op week 3 to 6 to assess shear deformity and plan for Triangle Tilt surgery
- TT surgery is typically planed 3-6 months following MQ

Post-Surgical Interventions

Therapy Intervention Following
Triangle Tilt Procedure



Post-Surgical Rehab/Triangle Tilt

- OT perform splint check and family education on TT protocol and post-op day #1
- Saro brace: worn 24/7 without removal for 3 to 6 weeks

This will be pending on severity of shear deformity

- Saro position goal: elbow crease facing upwards
- Clear plastic of splint from axillary area
- Splint should be sitting above hip joint



Post-Surgical Rehab/Triangle Tilt

- Post-op dressings are removed by pediatrician at post-op week #1
- Elbow PROM begins at post-op week #1 to prevent elbow stiffness
- Saro brace is removed at post-op week 3 to 6 at home or therapy clinic
- Heat modalities recommended: hot pack or bath
- Expect loss of ROM at shoulder and elbow
- No Saro brace at night until functional AROM at shoulder and elbow re-gained





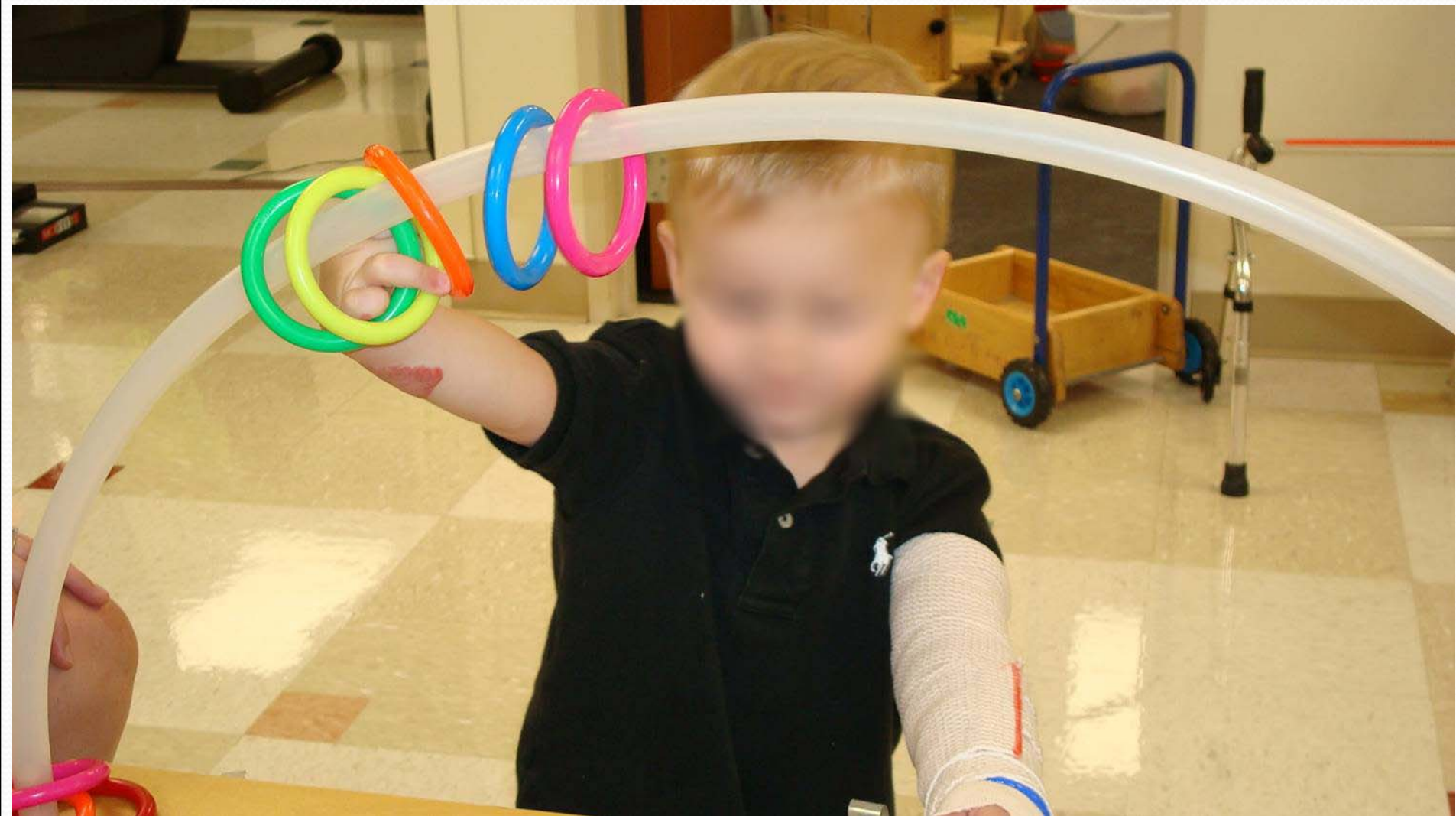






Post-Surgical Rehab/Triangle Tilt

- Send follow up video to Dr. Nath
- Weeks 3-6 to 8: Full PROM and AROM as tolerated
 - Therapy resumes at post-op weeks 3-6 (when saro brace is not longer used)
- Early therapy goals: Increase AROM to shoulder flexion/abduction and elbow flexion



Post-Surgical Rehab/Triangle Tilt

- Weeks 8 to 12:
 - Continue with progressive AROM activities
 - Restricted use of the non-affected UE encouraged
- All compensatory movements to be discouraged such as hiking the hip, rotating or bending body backward
- Serial casting at the elbow might be started if elbow flexion contracture present (*refer to casting protocol*)



Serial Casting Protocol







Post-Surgical Rehab/Triangle Tilt

- Weeks 12+: Begin strengthening program
 - Weight bearing as tolerated
- Assess: alignment of the scapula on the rib cage
- Alignment and mobility of the gleno-humeral joint
- AROM/PROM and strength
- Treatment focus initially on strengthening of the scapular stabilizers to promote scapulo-humeral rhythm



Post-Surgical Rehab/Triangle Tilt

- Therapy after TT protocol begins with a frequency of 2 x per week

Therapy is recommended for at least 6 months following TT surgery

The following modalities are also recommended
TES/Bio-feedback, kinesio-taping, bracing etc.





Discussion, Comments, Questions