Pediatric Physical Therapy

Torticollis and Plagiocephaly Update

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### Congenital Muscular Torticollis

- Birth or up to 2 months
- Child keeps head to one side and often tipped towards opposite shoulder
- W/or w/o associated mass
- Third congenital deformation after congenital dislocated hip and club foot
- Estimated b/t .3% to 2.0% in newborns

Must differentiate from postural torticollis (no tightness) 80 entities that can cause torticollis

Congenital Muscular Torticollis

- Left Torticollis Most Common
- Slight Increased incidence in males
- That relaxing hormones affect female connective tissue makes them more susceptible to dev. dysplasia of hip and less for CMT
- Testosterone may accentuate m. action
- Increased incidence of Congenital dislocation of hips (20%)

Causes

- Restrictive uterine environment, leading cause
- Very large fetuses/head multiple fetuses, small maternal pelvis, small uterus, increased uterine or abdominal muscle tone, increased or decreased amniotic fluid, breech, (head wedged under the ribs mothers w/pain into the leg)
- Prematurity – w/long periods on respirator or on back.
- Birth trauma
- 1996 studies documented cause and effect relationship of supine lying/sleeping - Back to sleep program

CMT - 3 Classifications In Literature

1- SCM tightness with Pseudo tumor (28% - 47%) soft non tender in sternal portion of SCM palpated in first few weeks of life, gets larger over next few months and resolves by 5 to 21 mos.

2- SCM tightness no mass

3- Features of CMT but No SCM tightness *** = Postural Torticollis not CMT

8% to 20% reported have dislocated hip

Group 3 - less obvious DX. more worrisome need further work up if not resolved with positional changes

Group 3- When It Is NOT Caused By Tight SCM

- Esophageal reflux
- Ocular conditions
- Otitis media, vestibular dysfunction
- Tightness resolved but Weakness in SCM remains....

- Spina Bifida, hemi vertebrae, Arnold-Chiari syndrome
- CNS Tumors
- Cervical anomalies, subluxation/odontoid fractures
- CNS dysfunction - CP severe hypotonia, hemi paresis, movement disorders = dystonia


Types of Torticollis

Osseous types
- Occipitocervical dysfunction
- Cervical vertebral dysfunction
  - Klippel-Feil syndrome
  - Congenital scoliosis
  - Hemivertebrae
Nonosseous types
- Congenital muscular torticollis
- Sandifer syndrome
Neurogenic types
- Central nervous system tumors
- Arnold Chiari malformation
- Ocular torticollis
- Paroxysmal torticollis

Early Treatment

- If noticed by 2 to 3 mos of age and less than 10 degrees difference between sides in rotation most babies respond to positional changes and gentle stretching given by pediatrician - need proper instruction not just telling them lying on side, or turning head to opposite side

- If has more than 10 Degrees of difference between sides in rotational component refer after two weeks of positional changes and still limited ROM - REFER - Best results if referred for PT by 3 mos of age shown in many studies

- 4 to 8 mos is considered a Late Referral - baby develops habit, and fearful of PT, resistant to therapy exercises and positional changes, mm not as flexible, - parent more concerned as baby tilts head often worsens as baby moves up against Gravity or in sitting

Freed, S, Coulter-O.Berry, C. Identification and Treatment of CMT in infants, American Academy of Orthotist and Prosthetists 2004

Early Really Means Early

- Many studies show PT is safe and effective treatment and success is well documented.
- Study of 311 infants with PROM exercises, mean age was 2.3 months, 95% had total resolution. Study concluded that the success rate of conservative treatment is primarily dependent on the patients’ age at the initiation of exercise program.
- Study of 20 infants showed infants with PT gained full ROM and symmetry two months sooner than infants without referral.

Ohman, A, Staffan, N, Beckung, E * Stretching treatment for Infants with CMT; PT or Parents?* PM and R 2010
Length of PT treatment

- If referred early (study of 980 infants)
  - < less than 1 month of age = 1.5 mos
  - 1 to 3 mos of age = 5.9 mos
  - 3 to 6 mos of age = 7.2 mos
  - 6 to 12 mos of age = 9.8 mos
  - 12 mos of age = 10.3 mos

_Eur J Phys Rehabil Med 2010_
Treatment

- Physical Therapy referral to skilled pediatric PT - necessary if does not respond to suggestions from pediatrician of supervised tummy time and other positional changes within a few weeks and younger than 3 months of age

- **Strengthening** of weak alternate SCM, as well as several different **stretching** exercises and positioning techniques

- Often difficult for parent to do exercises without assistance/guidance of therapist
Usually Two Components

Left torticollis

- Head is tipped to child’s left and face is rotated to the right
- Must work on rotating to left but also tilting head to the right in all positions (including prone) Actively and Passively
- Massage to trapezius
Home Programs
Treatment

- Active and Passive Range of Motion often throughout day
- Re-Positioning throughout day
- Most parents need help with exercise program

- If not addressed by 3 months and seen for PT at 4 mos. or later babies often have decreased head control, residual head tilt, preference towards one side throughout achieving milestones
- Plagiocephaly
Hates Tummy

- Often trapezius also affected
- Often head tilt worsens as child moves up against G
- Torticollis can return as child learns new gross motor skill
Frequency and Treatment

- Varies by clinician and facility - usually covered by insurance
- One prospective study of 45 infants had 100% resolution of torticollis - (mean age 15 to 120 days)
- Concluded early and more frequent therapy can lead to shorter duration of therapy - especially if exercises carried over at home every three hours.

Celayuir A.C. Congenital muscular torticollis; early and intensive treatment is critical. Pediatric Int. 2002 Oct.
M. is now 8 mos old and was born full term and has a history of g.i. reflux and asthma. He also wears a cranial orthosis/ helmet since the age of 4 mos. due to dx of right plagiocephaly and brachiocephaly. He also has a dx. of left torticollis and has been doing exercises shown to her by her pediatrician at home since he was 2 mos. Of age. However, his mother reports that she feels M’s head tilt is worsening since he began sitting one month ago.
Frequency of Treatment

- Varies from 3/day
- 15 times a day - 10 seconds - 6 reps
- Every time you can think of it or diaper, position/feed the baby

- Gentle – just to the point of resistance tendon can “snap”
- Include active exercise as soon as possible
- Keep child off back/when not asleep and out of car seat/bouncers – lots of tummy and side lying time when awake
- Home Exercises need to continue as moves to next motor milestone
Torticollis Not Improving

- If Congenital Torticollis does not show improvement after several sessions of PT and home carry over, revise and increase frequency of home program, increase frequency of PT and if still no progress......

- Referral to a specialist should be considered for follow up and to rule out other causes...
Large Prospective Study

- 821 patients also concluded that stretching is safe and effective.
- Most important factors that predict good outcome, the initial deficit in rotation in neck.
- 8% needed surgical treatment which was recommended if child had residual head tilt or LROM of rotation lateral flexion of >30 degrees after at least 6 months of conservative RX.

Larger Prospective Study

- 1086 cases studied over 12 year period
- Three subgroups -
  - 1) SMT - SCM Tumor found to present earlier with higher incidence of breech presentation (19.5%), difficult labor (56%) and hip dysplasia (6.81%)
  - 2) MT - muscular torticollis
  - 3) POST - postural torticollis

- Severity of passive neck rotation was found to correlate significantly with CMT, bigger tumor size, hip dysplasia, degree of head tilt and cranial facial asymmetry.
- 91% had excellent results with therapy, 5% required surgery. Most important prognostic factors for surgery were severity of limitation of range of motion and age at presentation.

Persistent Torticollis

- Banding of clavicular portion of SCM
- Lateral and posterior Skin folds
- Outcome scale – poor after 7 months of conservative treatment
  Surgery had good results

Persistent Torticollis

- Can have persistent tightness of involved side
- +/- or weakness on opposing side
  - Can be intermittent tilt especially when tired.

Persistent Torticollis
When Conservative Treatment Is Not Enough

- Usually late referral and child has developed contracture, weakness of opposing musculature and habit
- Tot Collar - limited success, only used after 4 months of age, and while child is awake
- Kineso Taping - helps some
- Botox - varied success, needs to be followed with PT.
- Study of 27 children with Botox injections 75% showed improvement avoided surgery and 7% had adverse effects of dysphagia and neck weakness.

Collin, Janovic, J. Botulinum toxin injection for congenital torticollis Neurology, 2006
Persistent Torticollis Cont

- Surgery - The lengthening can improve the ROM but not the corresponding weakness. Controversy as to when to do surgical correction.

- Most successful if postponed until patient can comply successfully with post-op bracing and exercise program.

- Recommended surgery most successful if torticollis does not improve after one year of therapy. Delay causes more fibrous contracture to develop and habit which does not lead to best cosmetic or functional result.

- Scarring a cosmetic issue - endoscopic surgery successful cases reported.

Dutta S, Albanese, CT. "Transaxillary endoscopic release of the SCM for persistent torticollis" Pediatric Surg. 2008
Torticollis and Plagiocephaly

- Many children with Torticollis develop Non Synostosis Plagiocephaly on opposing side because of continuous asymmetrical weight bearing on malleable skull.
- Once relatively rare now cases have increase dramatically.
- “Back to Sleep Program” 1992
- Some studies state dx 3 to 5 times increase
  - 1974-1/300
  - 1996-1/60

Graham Gomex, m et. Al “Management of Plagio: Repositioning vs. Orthotic Therapy” / Pediatrics, 2005
Incidence of Cranial Facial Asymmetries and/or CMT

- Asymmetries of the head and neck are very common in normal newborns - one study of 174 newborns at University of California - 73% had one or more asymmetry which resolved w/o Rx.
- Torticollis - 16%, asymmetry of mandible 13%, facial 42%, head 61%.
- Infants with head asymmetry and Torticollis are at the most risk for developing posterior plagiocephaly.
- Important to identify them early for positioning and PT to prevent secondary craniofacial deformations that are part of increasingly common phenomenon.

Diagnose Early

- Important to look at baby from vertex one side of occiput flattened
- (usually R) frontal region bulge, R ear (smaller and moved forward and down, uplifted lower helix, R cheek puffier, prominent mandible sulcus with mandibular tilt, unilateral epicanthal fold often.
- Almost all have a contralateral torticollis
Nonsynostotic Occipital Positional Plagiocephaly vs...... Craniosynostosis
Cosmetic/ Benign?  vs...... Serious

Rhomboid Shape with forward ear vs....... trapezoid shape and posterior ear
Right Torticollis
Left Plagiocephaly
Risk Factors for Plagiocephaly

- Moderate Facial Asymmetry - Longer second stage labor, forceps delivery, larger babies, multiples and birth trauma. These often resolve by position changes only.
- Males, first borns, breech, transverse presentations, premature,
- Torticollis - maternal report of the fetus being “stuck” in one position more than 6 weeks before delivery

Joganic et. Al * Risk Factors Associated With D.P. Pediatrics, 2009
Other Factors Impacting Onset of Plagiocephaly

- Although previous studies have stated underlying biological and environmental factors associated with DP Joganic et al found in largest study so far of 20,000 children that single greatest predictor was sleep position

- Advent and increased use of multifunction infant carriers/seats/stroller

- ? less active, more content babies, bottle fed, higher SES?, lower SES ? had more plagio

- Chart review, phone survey by CHOP found most significant factor for moderate to severe plagio after 6mos of age was unresolved _torticollis_

Joganic et al "Risk Factors Associated With Deformational Plagio" Pediatrics, 2009
Archives of Pediatrics & Adolescent Med. 2011
No Treatment?

- Natural progression of plagio left untreated has been studied (2004 - Hutchinson et al.) found deformity tends to increase by four months of age found 19.5% infants had plagio, and by two years only 3.3% had plagio.

- 2010 study by Hutchinson 129 children at 3 & 4 yrs. 61% reverted to normal range, 4% remained severe plagio. Brachycephaly improved more than plagio. Facial and frontal asymmetry reduced to almost nil. Most had good improvement but 13% were categorized as having poor improvement. Parental somewhat or very concerned initially decreased from 85% to 13% - 41% had motor delay initially reduced to 11%.

- Dutch study of 7609 infants plagio was 8.2% -screened before 6 mos of age and brachycephaly noted in 10% and it persisted in nearly 1/3 when reexamined at 2 to 3 years. 

Hutchinson, Stewart, and Mitchell, .” Deformational Plagio: a follow-up of head shape, parental concern and neurodevelopment at ages 3 and 4 yrs.” Arch Dis Child 2011
Plagio Treatment Options

- Rx and Dx early = best outcomes
- 80% of growth occurs before 12mos.
- Repositioning often works - if begun in first few months
- Parents need help to understand and follow through on repositioning
- Understand effect of prolonged positioning in Car seats, swings, bouncer seats, stroller
- Supervised tummy time
- P.T. for the torticollis
- Moderate to Severe plagiocephaly or one that does not improve by repositioning and PT should have Neurosurgical/Cranial facial consult for helmet most prefer to see by 3 to 5 months.
- ? Remain when to refer for PT and/or helmet
Repositioning

- Most infants with mild - moderate plagio will improve with repositioning and early referral to PT - parents often need assistance by therapist as report baby cries with tummy time and or exercises - and don't comply

- 298 cases cranial symmetry was significantly better in infants treated w/ helmets than just repositioning (61% decrease in DD vs. 52% decrease at one yr. of age). More severe cases need helmets to change plagio

- Study of 400 infants with a control group determined that # of infants with CMT with severe plagio who had PT by 2 mos. of age decreased from 53% to 30% compared to 63% to 56% in control group by 6mos of age.


Vargish, l, Mendonz, m, Ewigman, b “Use of PT to head off this deformity in infants” Journal of Family Practice 2009
Specialists Don’t Always Agree When to Use Helmet

- Surgeons have yet to agree on ideal therapy and no definable standards exist for initiating treatment with helmets
- Survey of 71 neurosurgeons 64 plastic surgeons shown computer images
  Responses showed N.S. less likely to prescribe Helmets than P.S. in moderate to severe cases and showed differences between specialties with respect to the perception of DP severity

J Neurosurg Pediatrics 5:368-374, 2010
Helmet or No Helmet??

- Parents faced with a costly decision that may be influenced more strongly by referral and physician bias than medical evidence
DD is more than 1.0 cm
At 6mos of age
Normal = .3 +/- .1cm
Different centers use different Criteria and no standard tool to quantify assessment of progress or efficacy
Graham et al., J Neurosurg Pediatrics 5:368-374 2010
Mild, Moderate or Severe???
What is Mild, Moderate, or Severe Plagio??

- Study showed inter-rater agreement between 2 dysmorphologist was only 65% in independent blinded ratings of 3-D images using a numerical rating scale.
- Developed standardized indexes thru 3-D measurements of DP that did not depend on landmark selection (0-4%, 4-7%, >7% asymmetry (CVAI)).
- New 3D severity indexes offered better definition of cranial asymmetry than the 2D histograms or OCLR measurement and higher accuracy of classification and 3D used presently for research.

Measurements of Plagio

- 2-D measurements provided by a close approximation of the OCLR. (2005 - Hutchinson’s Heads UP technique) w or w/o parental and clinician ratings and classifications.

- Newer 3D indices provided better sensitivity and specificity in the discrimination of plagiocephaly and typical head shapes than the present methods stated by some studies.

- Other study that easy-less expensive caliper measurements were reliable and this SD measurement highly reproducible if staff well trained.

Caliper Measurements

Take at least 5 measurements
1. Head Circumference
2. Right Oblique Transcranial Distance
3. Left Oblique transcranial Distance
4. Cranial Width
5. Cranial length to calculate Cephalic Index

Repeated measurements at each visit
And photos taken frontal, side, superior
And posterior views to quantify change
Of movement of cranial bones
Two lasers are mounted into each side of a scanner and shine a beam of light on infants head four cameras on 1.5 sec each side of scanner record the laser data where it is interpreted by the scanner’s software, the scans are emailed to orthmerica where they are carved in a 3 d model of infant head a variety of different cranial remolding orthosis can then be fabricated according to the Dr and orthotists specifications. Easier to see change over time, put one scan over the other – challenging doing it manually. Many parents (90%) prefer scanning process - minimize stress to infant and easier to document changes.
28 plus 5 gestational age twin a 1180g strong preference to turn head to right since birth per mom also had facial asymmetry – mother very concerned. Premature more vulnerable thinner skulls more malleable. Treated in PT for left torticollis which resolved – still slept w head to right helmet placed at 7m chron age 4mos corrected age.
Cephalic index is measurement of width to the cranial length – infants with brachycephaly often exhibit ratios greater than 85% for girls and 90% for boys approx 2 SD above the norms. Norm is 78%
Positional Brachycephaly

- Increased since supine lying in last decade CI has moved from normal (76% to 81%) to >81%. In Asia where infants have traditionally slept on their backs >81% is the norm.
- Must introduce tummy time from early infancy or baby may resist. Side lying sleeping should not be done and play must be supervised reassurance for CI < 90% at 5 mos.
- Changing in CI w/ helmet therapy was difficult but resulted in significant change. Helmet may have to be worn longer than cases of plagio and recommended for persistent CI >90% that do not change with positioning changes.

Graham, Kreutzman, j et al “Deformational Brachycephaly in supine sleeping Infants” / Pediatrics 2005 146:253-7
Treatment length for wearing helmet

- 2008 study of 58 children showed that children who finished wearing helmet by 12 mos had shorter time wearing helmet than group that had 50% of wearing time after 12 mos.
- (6.51 m older group vs...... 3.62m ) younger children cranium grow faster which causes the flat areas to fill in faster
- However, both groups had no statistical difference in amount of asymmetry correction
- Results conflict with earlier 2005 study by Graham who stated younger patients needed to wear helmet longer and many other reports in literature little benefit after 12 mos.

Results of Helmet Therapy

- Despite small changes in measurements parents’ perceived significant change
- Many parents stated they became less concerned about babies head shape as child grew hair.
- Brachycephaly showed better improvement as child grew than plagio if no helmet used in study of 980 N.Z. children.
- Reported that 87% of plagio and brachycephaly showed good improvement with only PT and positional changes- 61% fell within normal range and only 4% still in severe range 3.5 years later determine by OCLR of 110 or greater

Figure 13. Cranial remolding orthoses are worn 23 hours per day to obtain optimal results.
Delayed Motor Development

- 27 infants with PP had motor scores similar to that of matched control group.
- Motor development was associated with amount of time spent in prone position while awake for both groups. On average infants with PP and infants and infants w/o PP spent less than 30 min per day in prone.
- Infants who spent less time in prone (supine, swing or infant seat) while awake had lower motor scores on AIMS.
- 5 out of 27 of infants with PP scored (less than 10th percentile)

Delayed Motor Development

- Majnemar and Barr (2005, 2006) lack of exposure to prone delays acquisition of extended arm support, 4 point crawling and transition to sit.
  Parents appear to be not acting on advice of “awake tummy time” by pediatrician

- Larger study 980 children showed early motor delay with babies with PP but by 3 to 4 years motor skills were not statistically different than peers

SCAPHALOCEPHALY

Long narrow “premie head or bean shape” some say too much side lying in nicu and more malleable skull. The cephalic index in these babies is very low and the ratio of the width to length is significantly less than the norm of 78%. Doing studies now on this deformity if helmet helps thru star scanner.
Evidenced Based Research ??

- No research to show that helmets help scaphiocephaly.
- Most opportune time to refer for helmet is 4 to 6 months
- Most opportune time to refer for PT or OT is before 2 mos. of age for best outcome than late referrals or only home exercise programs
THANK YOU !!!