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## ABSTRACT

Infants in the Neonatal Intensive Care Unit (NICU) experience many cranial forces that make them more susceptible to significant cranial shape changes throughout their hospitalization that may persist even once home. Prone and side lying positioning for early respiratory support can result in significant dolichocephaly. In a study by McArty et al.(2017), 54% of infants developed dolichocephaly during hospitalization with infants 32-34 weeks being at highest risk. Prolonged positioning for medical purposes can lead to deformational head shape changes during hospitalization, and early “back to sleep” protocol can then reinforce asymmetric cranial weight bearing resulting in plagiocephaly as well. It has been shown that deformational plagiocephaly can have overall developmental impacts that continue to affect the baby well after their discharge from the NICU (Martiniuk, 2017).

## BACKGROUND

The developmental team at Banner University Medical Center-Tucson has implemented the use of the positional aid, Crown Cradle by Dandle-LION, to assist with cranial shape remodeling efforts once infants are medically stable and their sleep environment is conducive to use of the device. The Crown Cradle is now being utilized as a specific therapeutic intervention to address the identified cranial molding concerns and is used adjunctively with therapies during hospitalization. Overall, we have had successful results with returning head shape to within normal limits quickly and without significant negative sequelae.



Baby Head Shape Assessment for Plagiocephaly/Flat Head Diagnosis - Cranial Technologies

### Crown Cradle™ by Dandle•LION



Crown Cradle | Dandle•LION Medical



Shared with written consent from parent

## OBJECTIVES

- The learner will interpret cranial measurements in order to identify the need for the implementation of the crown cradle positioning aide.
- The learner will list inclusion/exclusion criteria for use of the Crown Cradle Positioning Aide.

## METHODS

- Developmental care team or bedside nursing identifies head shape concerns
- PT completes cranial measurements with calipers, if infant outside of normal range the Crown Cradle Protocol is utilized to determine placement on positioning aid
- Infant placed on appropriately sized mattress with correct size foam insert
- Signage placed at bedside with precautions and protocol
- If able, infant's cranial shape measured weekly and documented in chart
- Infant is removed from mattress when cranial shape within normal limits for 2 measurements OR if within 1 week of discharge and/or NG tube has been removed
  - Infants included in primary results were assessed and measured from 11/2019-2/2021
  - The 11 babies included in results were able to be consistently measured

### Crown Cradle Protocol

Complete cranial measurements, if outside of normal range initiate use of Crown Cradle Specialty Mattress

Assess medical stability of infant and determine if appropriate

Inclusion:

- On nasal canula or less
- Able to tolerate supine for at least 50% of the day (discuss with nurse)
- Head shape is outside bounds of normal limits

Exclusion:

- HOB elevated
- Ventilator
- Multiple IV's/lines
- Within 1 week of homegoing (or NG tube is out)

Obtain consent from family for pictures (if appropriate).

Assess weight for appropriate size mattress and foam insert

Provide mattress for infant, place dandle pals, and hang signage at bedside

- Assess fit, ensure foam insert is appropriate size for infant (ie not hyperextended)
- Educate family and bedside nurse on use and skin checks
- Document cranial measurements in Tests/Procedures section of Situation page in documentation, add date
- Take pictures: front, side, back, and top down (if consent has been obtained)

Re-assess head shape each week

- Change out foam insert, and mattress size based on infant growth
- Take new measurements and document in same place, add new date.
- Take pictures to show progress (if consent has been obtained)
- Assess skin

Removal of mattress

- When infant demonstrates cranial measurements WFL
- Measurements remain stable for 2 consecutive measurements
- Decline in medical status (will reassess need as medical status improves)

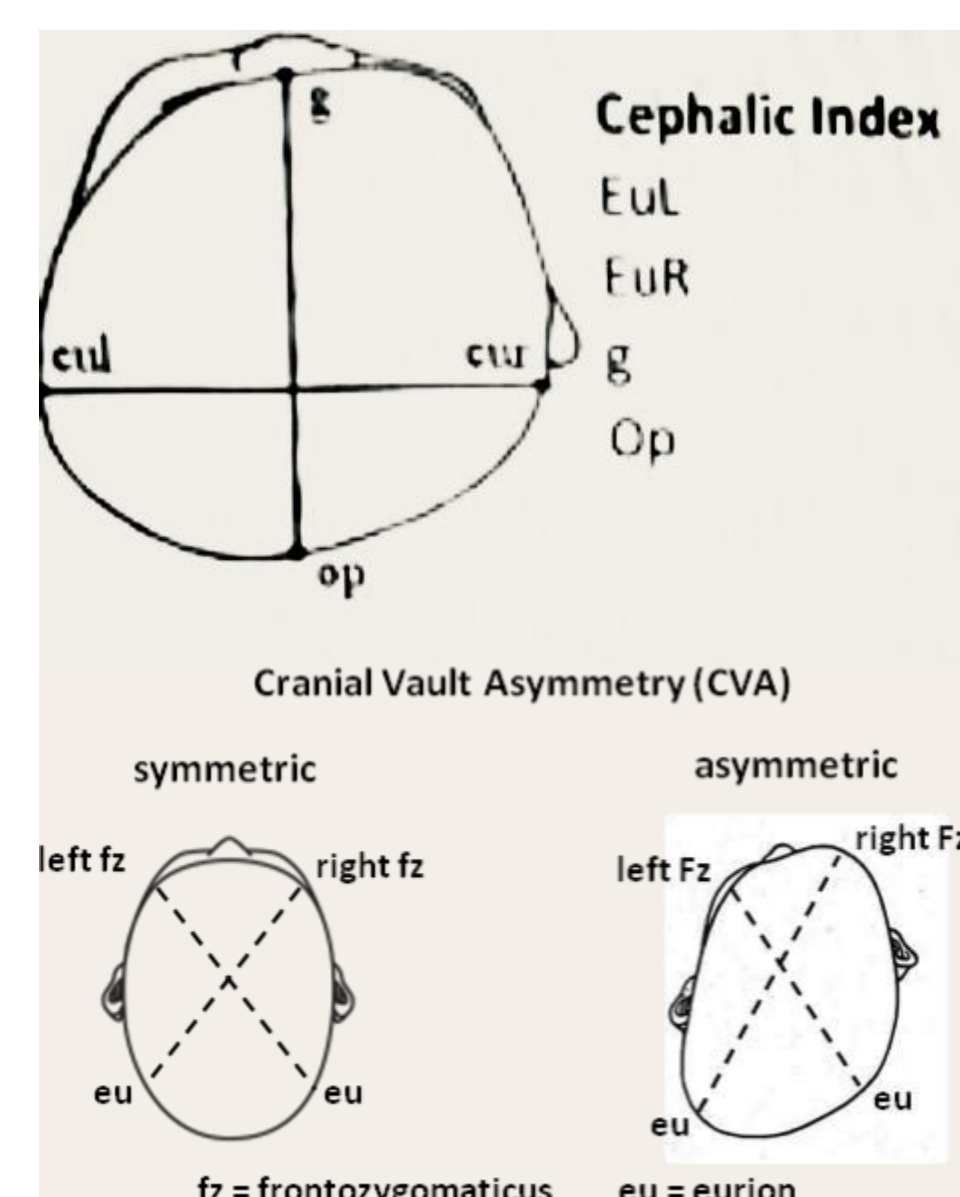
### Cranial Measurements Utilized to Determine Eligibility

#### Scale for Cephalic Index (CI)

Brachycephaly = CI >90%  
Dolichocephaly = CI <76%  
 $CI = \text{width} \div \text{length} \times 100$

#### Scale for Measuring Plagiocephaly

Normal head shape: 0 – 4 mm  
Mild Plagiocephaly: 5 – 9 mm  
Moderate Plagiocephaly: 10 – 15 mm  
Severe Plagiocephaly: >15 mm



<https://www.cappskids.org/cephalic-index-what-do-the-numbers-mean/>

Cranial vault asymmetry also referred to as diagonal difference, oblique diagonal difference, or transcranial difference. CVA is the difference between 2 diagonal measurements. \*\*\* CVA will be symmetric in brachy-, and dolichocephaly.

## RESULTS

	#1		#2		#3		#4		#5	
	CI	CV	CI	CV	CI	CV	CI	CV	CI	CV
week 1	72%	3 mm	71%	8mm	72.80%	6 mm	83%	7.5 mm	84%	10 mm
week 2	72.50%	0 mm	71%	4 mm	missed	missed	84%	5 mm	86%	7 mm
week 3	77%	2mm	72%	2mm	78.50%	7.5 mm	87%	5 mm	88%	6 mm
week 4			80%	2 mm	78%	8 mm	90%	5 mm		
week 5			81%	2 mm						
week 6			77%	1 mm						

CI: Cranial Index. CV: Cranial Vault

	#6		#7		#8		#9		#10	
	CI	CV	CI	CV	CI	CV	CI	CV	CI	CV
week 1	71%	5 mm	83%	5 mm	80%	7.5 mm	75%	2.5 mm	77%	7 mm
week 2	missed	missed	87%	5 mm	87%	7 mm	76%	2.5 mm	79%	3 mm
week 3	82%	0 mm			84%	7.5 mm	78%	0 mm	81%	3 mm
week 4							82%	0 mm	79%	0 mm

Average length of use: 3 weeks



1/12/2021 1/18/2021

Pictures taken by parent and shared with written consent

	#11	
	CI	CV
week 1	71%	0 mm
week 2	*surgery	*surgery
week 3	74%	0 mm
week 4	76%	0 mm

\*Infant removed from mattress week 2 due to surgical procedure, unavailable for measurement

## CONCLUSIONS

Advantages:

- Low-risk intervention that results in markedly improved head shapes
- No adverse effects identified, no skin breakdown, assists with transition to back to sleep, provides containment
- Positive response from RN staff and increased awareness in cranial head shape changes
- Improvements in both Cephalic Index (CI) and Cranial Vault (CV) asymmetry observed
- Worked best for moderate to severe head shape changes
- Easy to use

Disadvantages:

- Head of bed elevation or changes in medical status results in removal of mattress prior to max effect and inconsistencies in measurements and outcomes
- Time spent out of bed increases as babies become older, so less time on mattress overall
- Discharge from hospital prior to last measurement or skipped week due to scheduling
- Consistency of measurement between practitioners, consistency of use between RNs
- CV and CI measurements may change at different rates

Future improvements

- Need to compare outcomes against other products available, including no use of product
  - Exclusion due to medical status does not preclude their need, so should compare measurements with “traditional repositioning” intervention when an infant isn't eligible for product use
- Initiate consistency of measuring head for a week after the mattress removed as well to determine carryover effect
- Need to initiate use earlier
- Increase number of parameters documented for more robust data
- On-going recalibration of inter-rater reliability among practitioners

## BIBLIOGRAPHY

See attached PDF