UCSF Benioff Children's Hospitals

Cranial Remolding Helmets
Understanding the Treatment

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3/29/18

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Cranial Anatomy & Deformation

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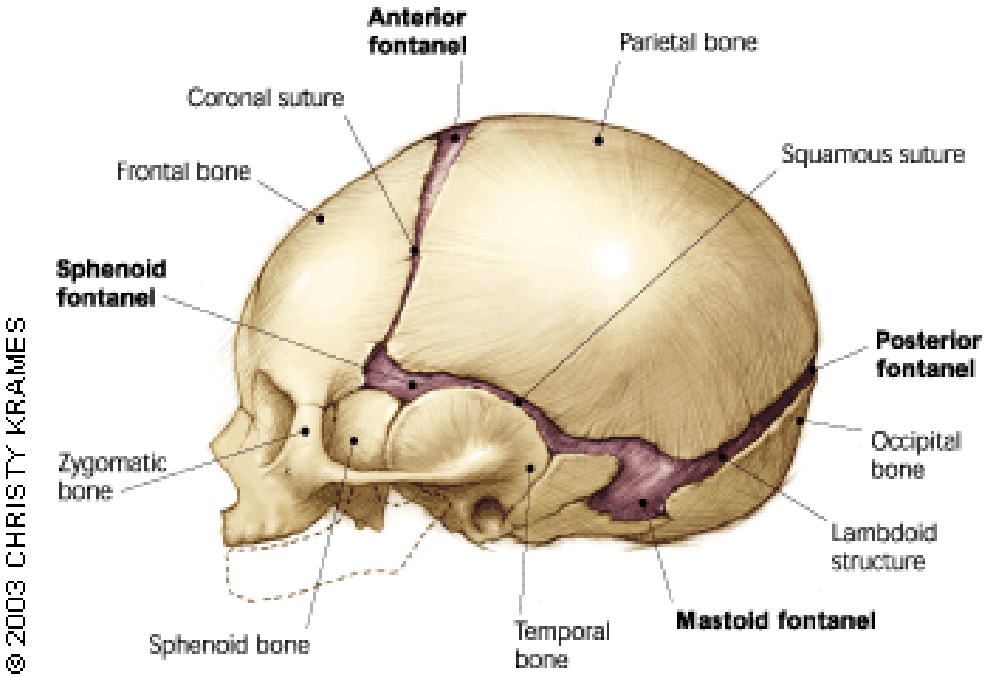
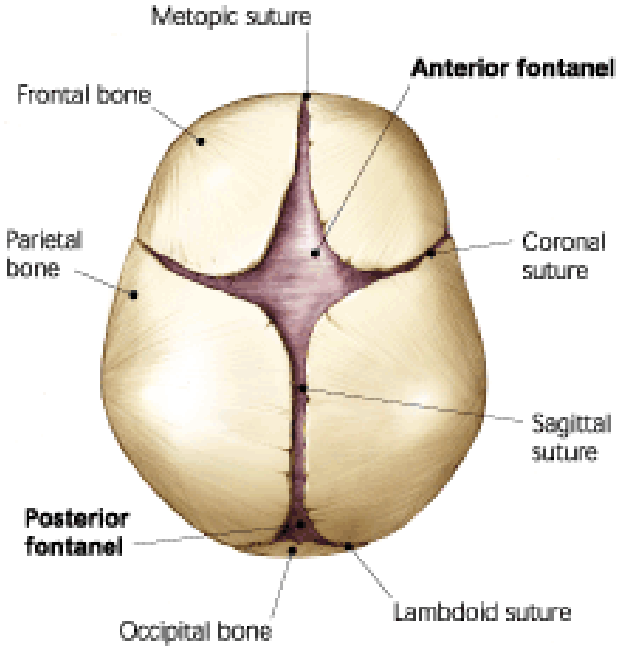
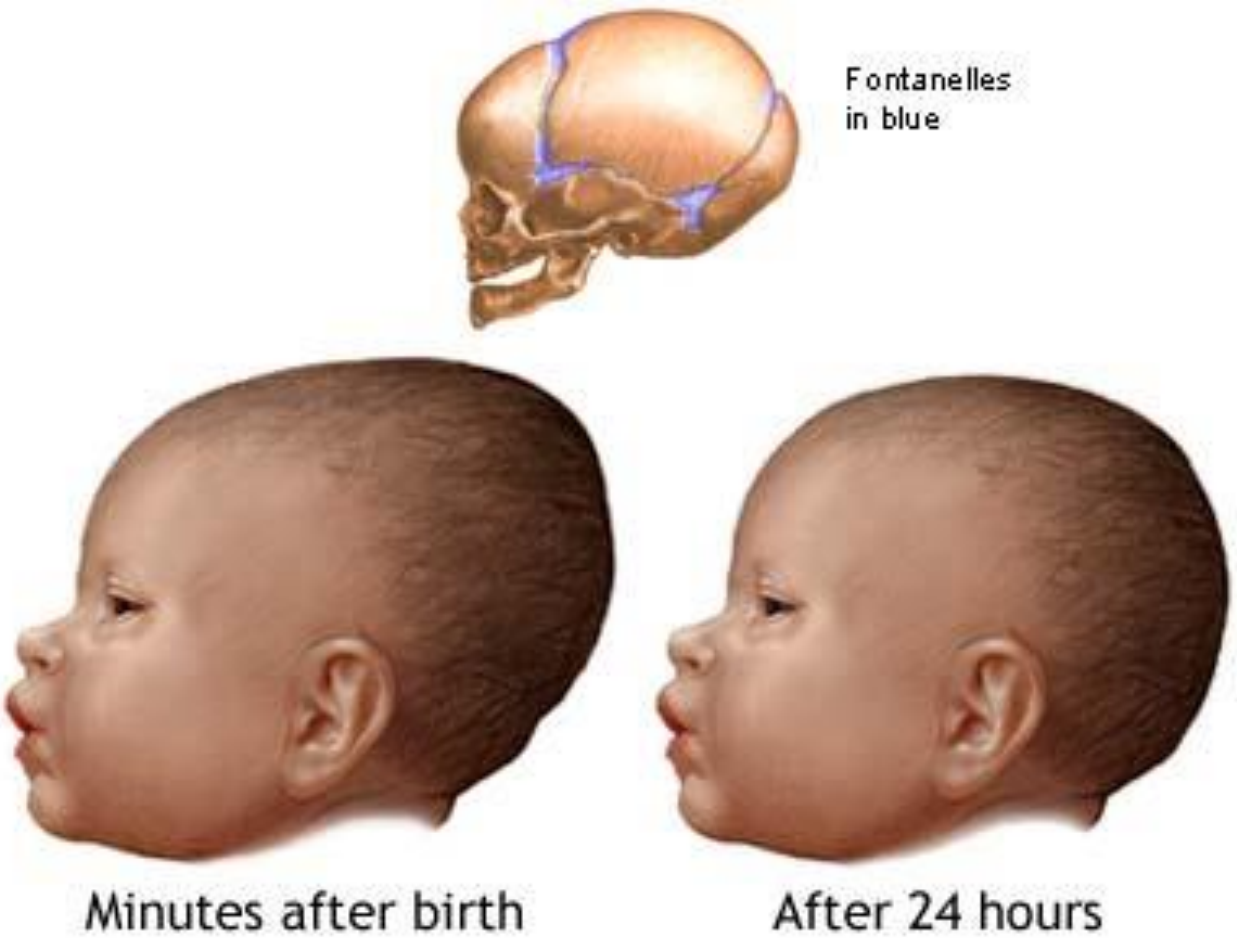
Infant Cranial Anatomy

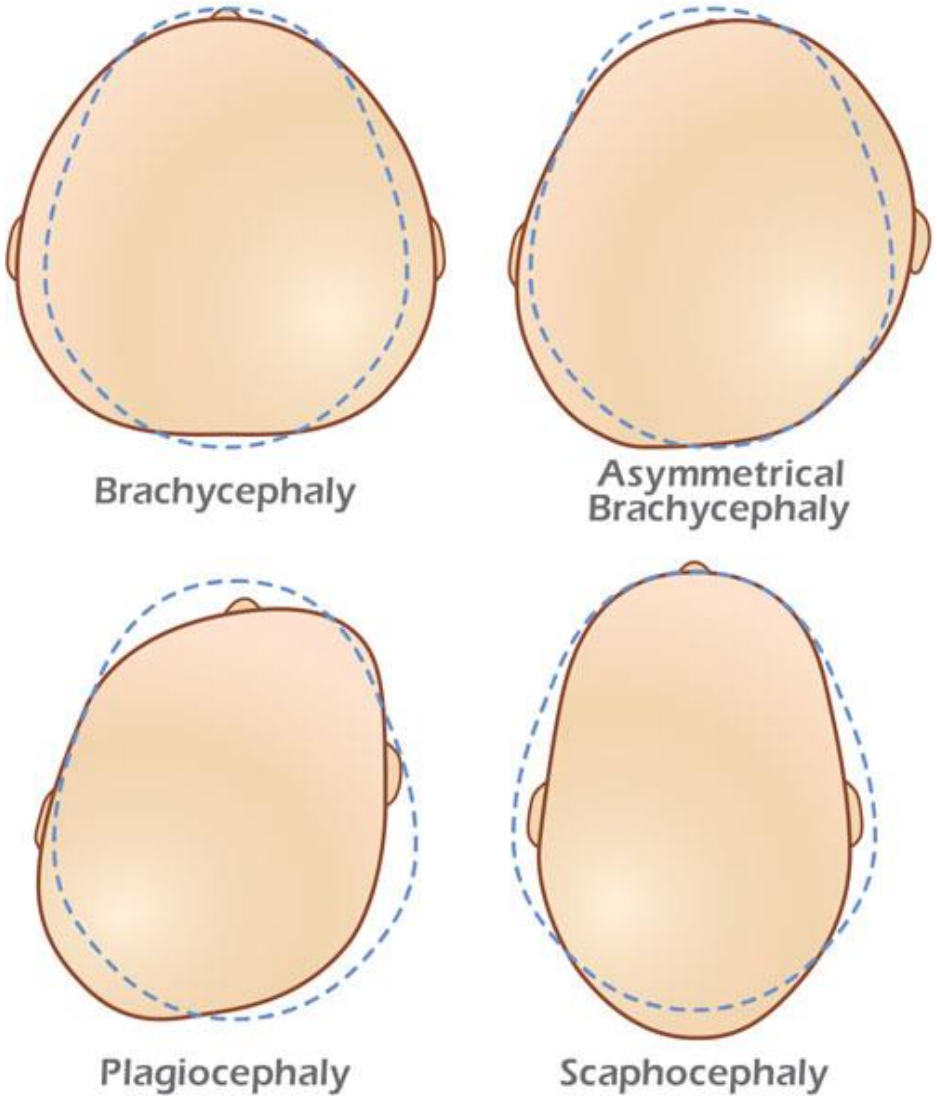




Netter FH. Atlas of human anatomy. Summit, N.J.: Ciba-Geigy, 1994.

Newborn Cranial Anatomy





Types

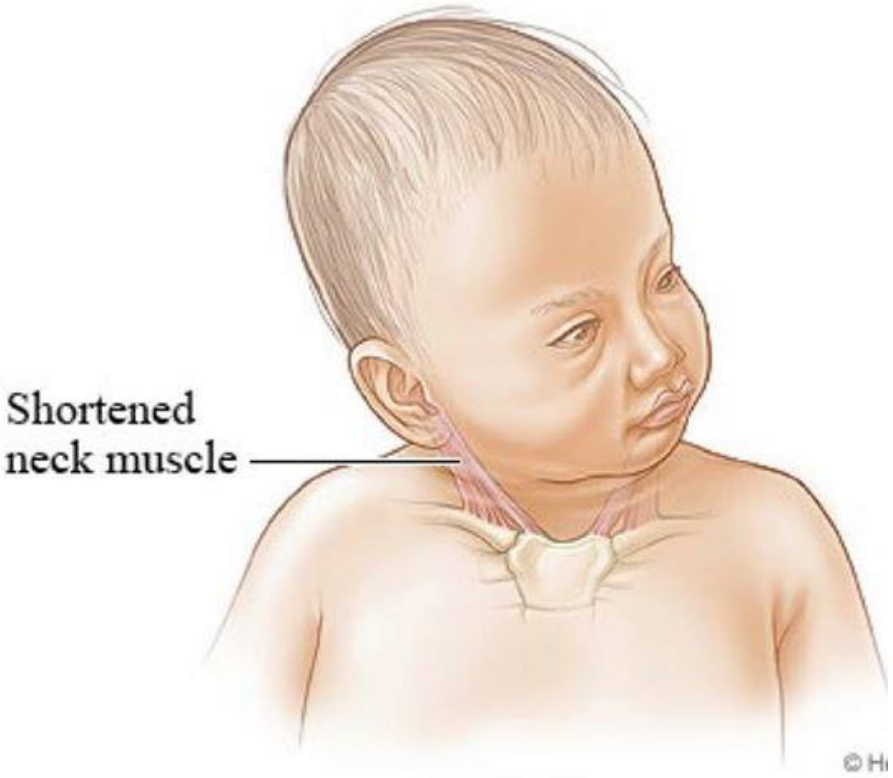
- **Plagiocephaly**:
  - Trapezoidal shape
  - Positional or Unicornal/Unilamdoidal Synostosis
- **Brachycephaly**:
  - Wide head shape
  - Positional or Coronal Synostosis
- **Scaphocephaly**:
  - Narrow head shape
  - Positional or Sagittal Synostosis

Etiology

- Unknown
- Intrauterine positioning
- Environmental positioning
- Pre-natal/neonatal Factors:
  - Premie
  - Torticollis
  - Hypotonia
  - Low birth weight
  - First born
  - Multiple births
  - Prolonged labor

Torticollis

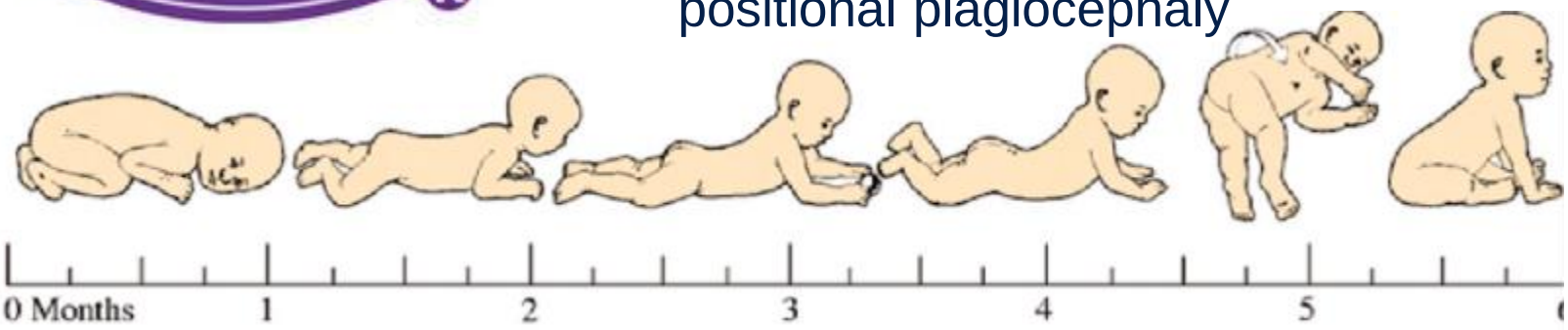
Torticollis Repositioning



http://ossekeag.ca/family-matters-benefits-pediatric-massage/

Incidence and Prevalence:

- Back to Sleep Program (1992) for SIDS
- Age dependent with deformation occurring primarily from **0-6 months of age**
- 2:1 (Males: Females)
- 2x more common to have right side flattening
- 80-90% of torticollis patients have positional plagiocephaly



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Cranial Helmet Treatment

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Effectiveness

- Does helmet therapy really work?
  - Objective: hold prominent sides of the head and allow room for flattened region to grow
  - Only works if patient **GROWS**
- Orthomerica STARband
  - Compliance
  - Age
  - Circumference Percentile
  - Fit

Relationship between starting age of cranial-remolding-orthosi therapy and effectiveness of treatment in children with deformational plagiocephaly

Mi-hyang Han [1] · Jin Young Kang [2] · Hye Young Han [1] · Yun-hwa Cho [3] · Dae-Hyun Jang [1]

Table 2 Analysis of treatment effectiveness

	Duration of therapy (days)	Initial mean CVAI (%)	Final mean CVAI (%)	Mean change of CVAI (%)	Mean rate of improvement (%)	Rate of success % (CVAI ≤3.5%)
Group 3M	124.4 ± 46.9* (77.5~171.3)	10.4 ± 4.1 (6.3~14.5)	3.5 ± 2.1 (1.4~5.6)	6.9 ± 2.5‡ (1.4~9.4)	67.9 ± 12.4† (55.5~80.3)	55
Group 4M	148.0 ± 51.6** (96.4~199.6)	10.1 ± 2.6 (7.5~12.7)	3.8 ± 1.6 (2.2~5.4)	6.3 ± 2.0‡‡ (4.3~8.3)	62.3 ± 12.1†† (50.2~74.4)	44
Group 5M	156.0 ± 59.6** (96.4~215.6)	9.4 ± 2.4 (7.0~11.8)	3.5 ± 1.5 (2.0~5.0)	5.9 ± 1.7‡‡‡ (4.2~7.6)	63.0 ± 12.2†† (50.8~75.2)	48
Group 6M	183.4 ± 81.9 (101.5~265.3)	8.8 ± 2.4 (6.4~11.2)	3.5 ± 1.4 (2.1~4.9)	5.3 ± 1.8 (3.5~7.1)	60.0 ± 11.4††† (48.6~71.4)	48
Group 7M	190.8 ± 60.3 (130.5~251.1)	9.9 ± 2.7 (7.2~12.6)	4.5 ± 2.1 (2.4~6.6)	5.4 ± 1.6 (3.8~7.0)	55.7 ± 11.5††† (44.2~67.2)	44
Group 8M	222.0 ± 68.1 (153.9~290.1)	10.0 ± 2.1 (7.9~12.1)	4.8 ± 1.0 (3.8~5.8)	5.2 ± 1.4 (3.8~6.6)	51.3 ± 7.0 (44.3~58.3)	14
Group 9M	179.5 ± 51.0 (128.5~230.5)	9.8 ± 2.5 (7.3~12.3)	5.7 ± 2.6 (3.1~8.3)	4.1 ± 1.5 (2.6~5.6)	43.4 ± 15.2 (28.2~58.6)	21
Total	165.3 ± 65.9 (99.4~231.2)	9.7 ± 2.8 (6.9~12.5)	4.0 ± 1.9 (2.1~5.9)	5.7 ± 2.0 (3.7~7.7)	59.6 ± 13.6 (46.0~73.2)	43

Group 3M, <120 days; group 4M, 120~149 days; group 5M, 150~179 days; group 6M, 180~209 days; group 7M, 210~239 days; group 8M, 240~269 days; group 9M, ≥270 days. Index; mean ± standard deviation

CVAI cranial vault asymmetry index, *M* months

*p value <0.01, significant difference compared with the 6, 7, 8, and 9M groups; **p value <0.01, significant difference compared with the 8M group; ‡ p value <0.05, significant difference compared with the 6, 7, 8, and 9M groups; ‡‡ p value <0.05, significant difference compared with the 6 and 9M groups; ‡‡‡ p value <0.05, significant difference compared with the 9M group; † p value <0.01, significant difference compared with the 6, 7, 8, and 9M groups; †† p value <0.05, significant difference compared with the 8 and 9M groups; ††† p value <0.05, significant difference compared with the 9M group

Effectiveness

Helmet therapy in infants with positional skull deformation: randomised controlled trial


OPEN ACCESS

84 patient's comparing a helmet group to a no helmet group beginning at 5 months and ending at 12 months of age.

"No conclusive evidence that a significant or clinically meaningful difference in improvement of skull shape was found at the 24-month follow-up between the two groups"

MD Assessment

- Changes with repositioning & PT
- Developmental milestones
- Preferential positioning
- Gestational age
- Birth complications

Treatment Timeline

- 0-3 months:
  - Observation
  - Repositioning - “Tummy Time”
  - Physical Therapy for Torticollis
  - Surgery if necessary
- 4-12 months: Cranial Remolding Helmet
- > 12 months: treatment is less effective
- 18 months: end of treatment

 http://ossekeag.ca/family-matters-benefits-pediatric-massage/

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Cranial Helmet Initial Evaluation

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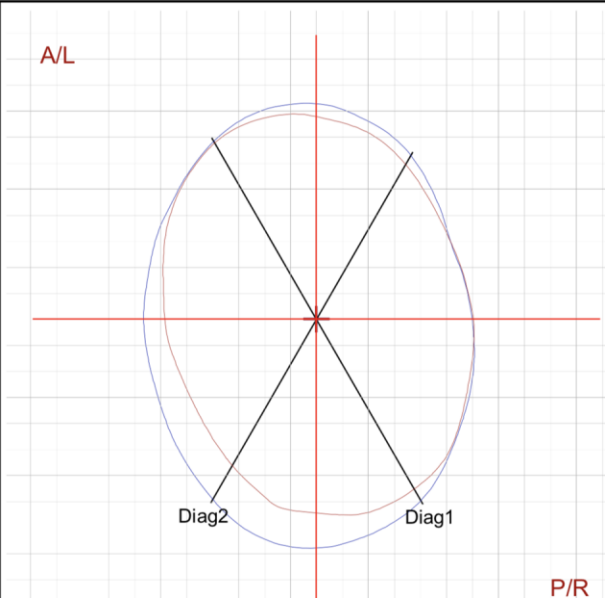
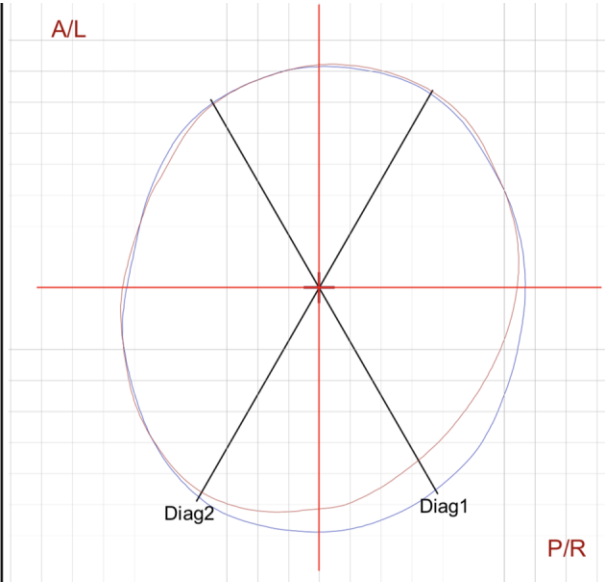
Initial Evaluation

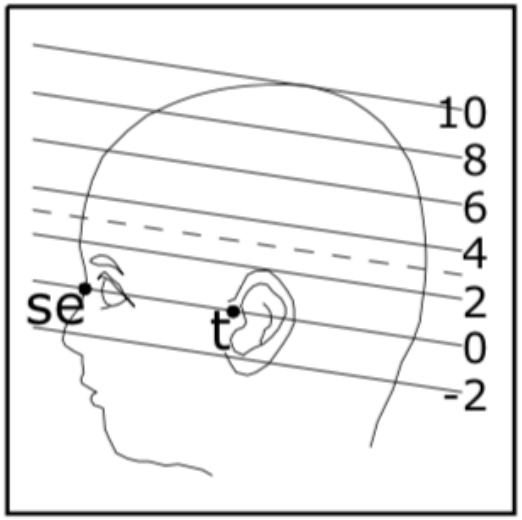
- History
  - Repositioning
  - Physical therapy
  - Delivery/pregnancy complications
- Visual assessment of head shape
- Shape Capture:
  - Laser scan to create 3-D image for measurements
  - Hand Measurements
  - Casting
- Educate family on treatment process (~6-8 appointments)
- Submit for insurance authorization



Plagiocephaly Signs

- Parallelogram Shape
- Frontal protuberance & ipsilateral occipital flattening
- Facial asymmetry
- Ear Position
- Unilateral bald spot





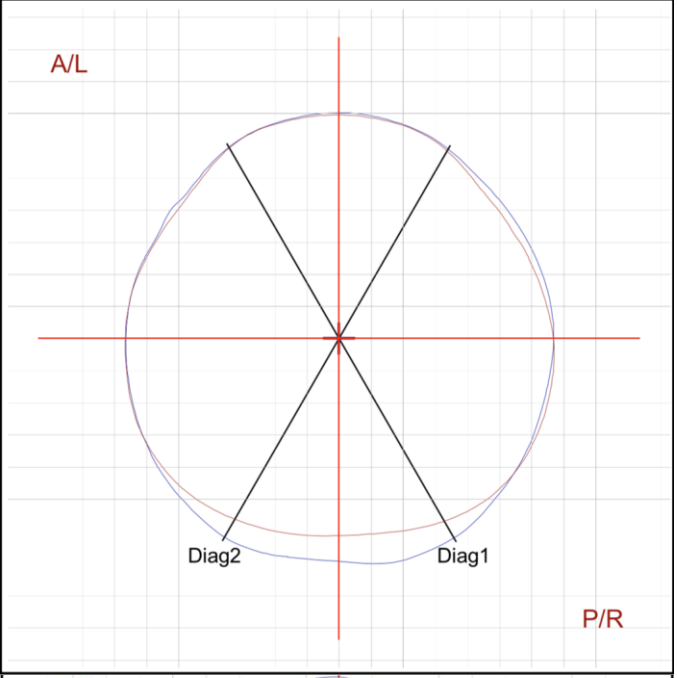
Deformational Plagiocephaly Severity

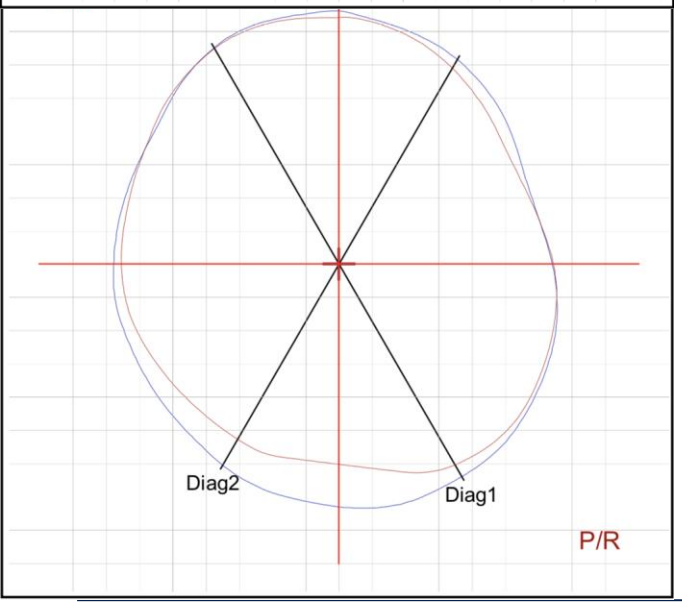
Mild DP.

Moderate DP.

Severe DP.

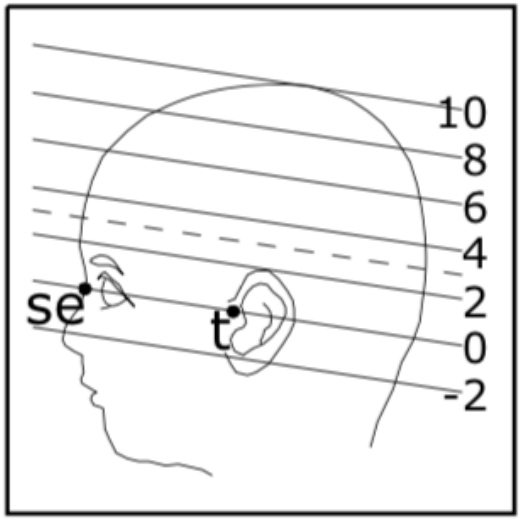
Severity scale developed by Plank is 2004 is primarily based upon clinical presentation of deformity rather than linear measurements.



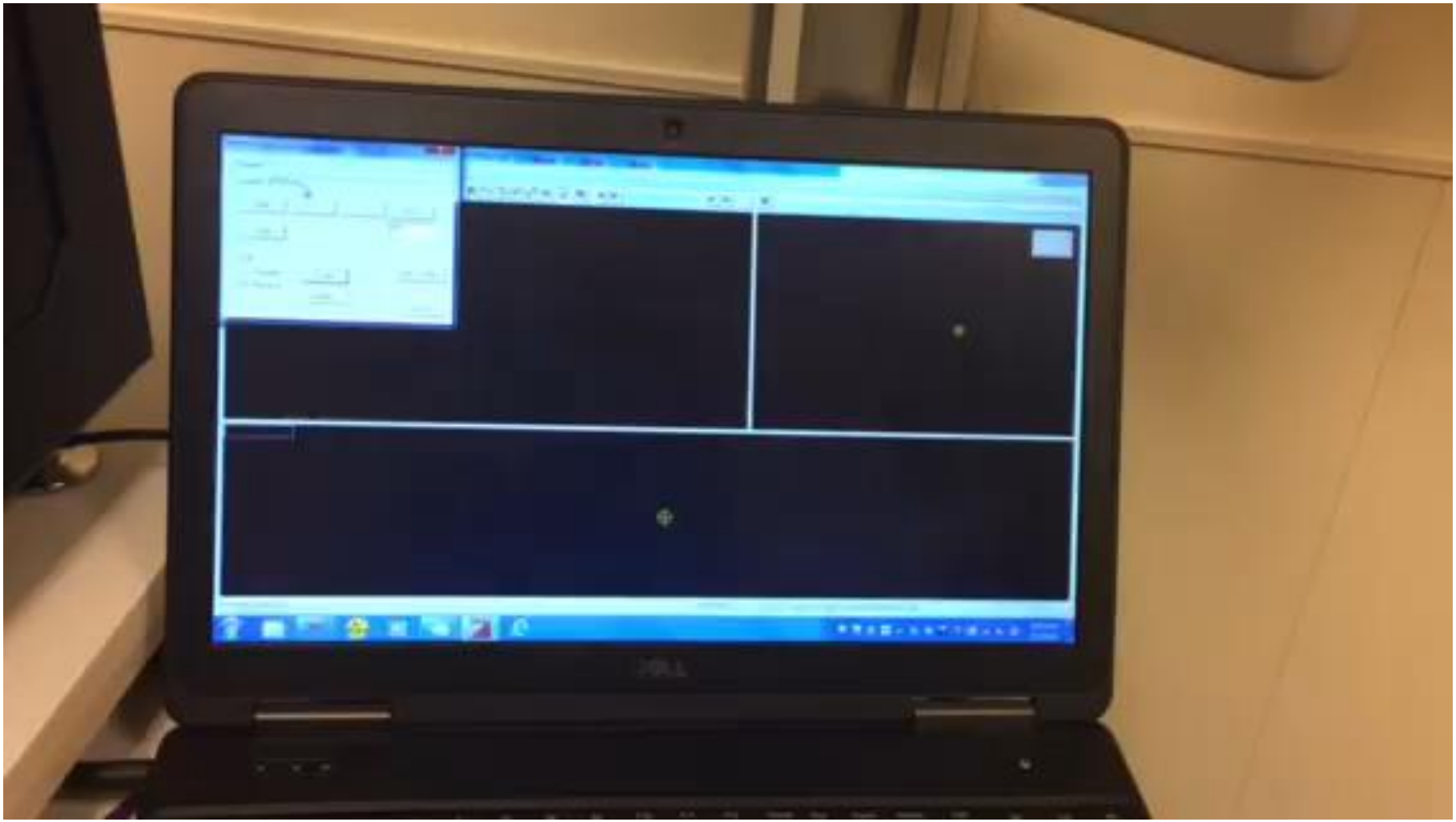


Brachycephaly Signs

- Wide width
- Symmetric posterior flattening
- Frontal bossing
- Midline bald spot
- Increased cranial vault

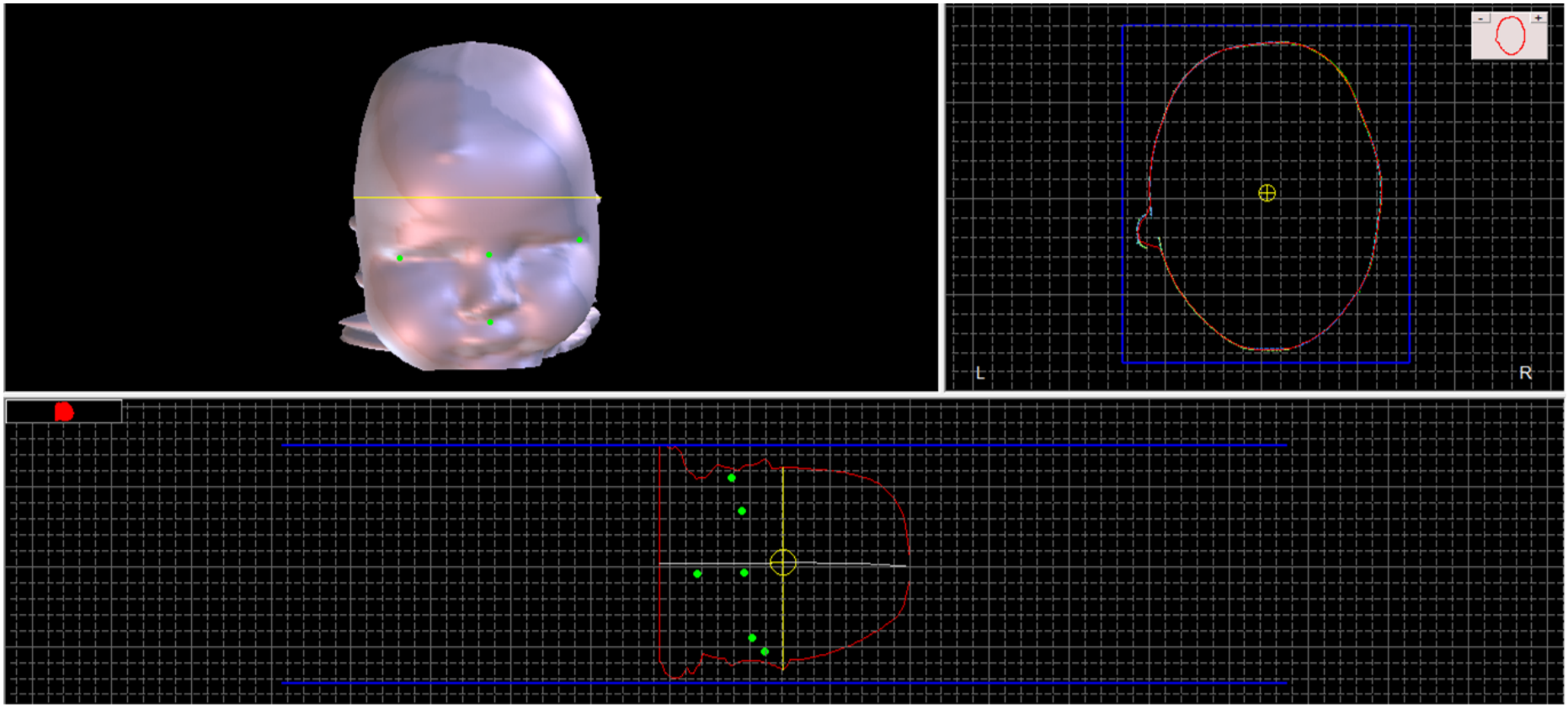


Preparing the Scan



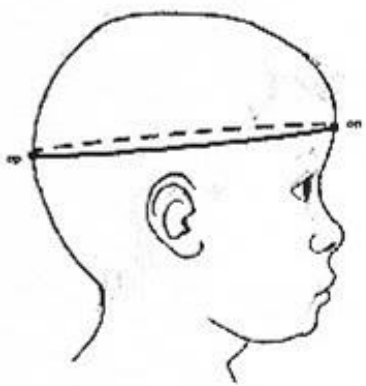
Process of Scanning

Initial Evaluation Scan

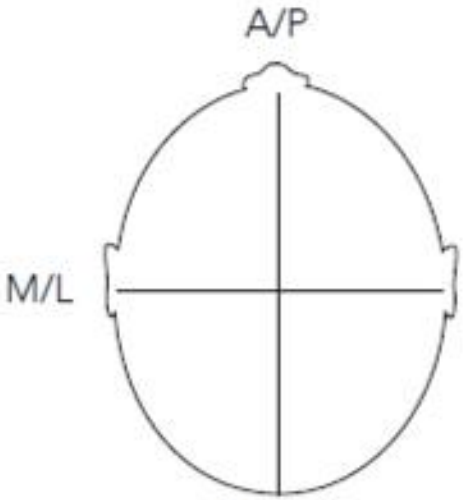


Measurements

Head Circumference



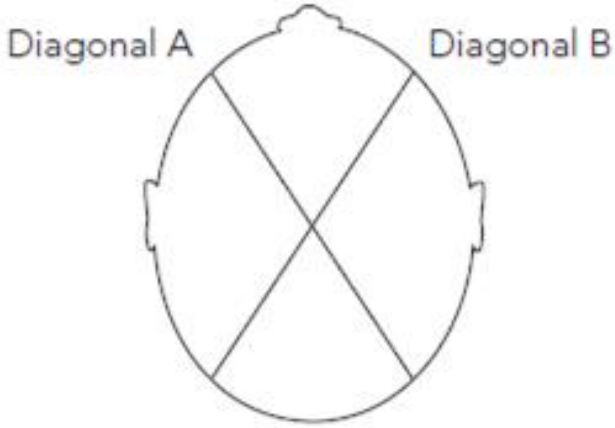
Cephalic Ratio (CR)



$$CR = \frac{M/L}{A/P} \times 100$$

Cranial Vault Asymmetry Index (CVAI)

- Measure in millimeters (mm) at 30° fro
  center of nose (outer edge of eyebrow

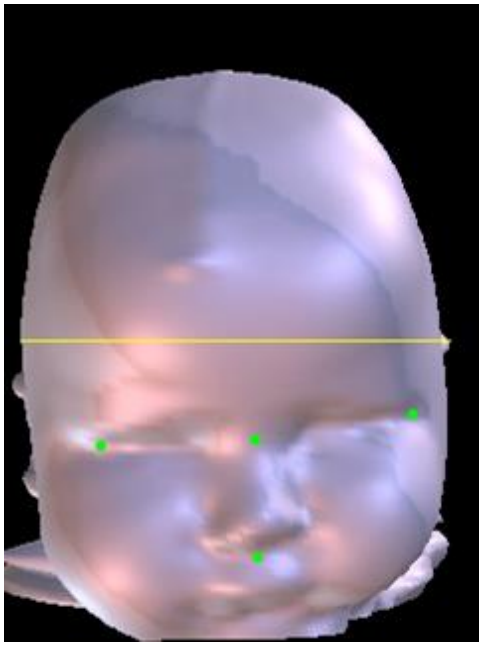


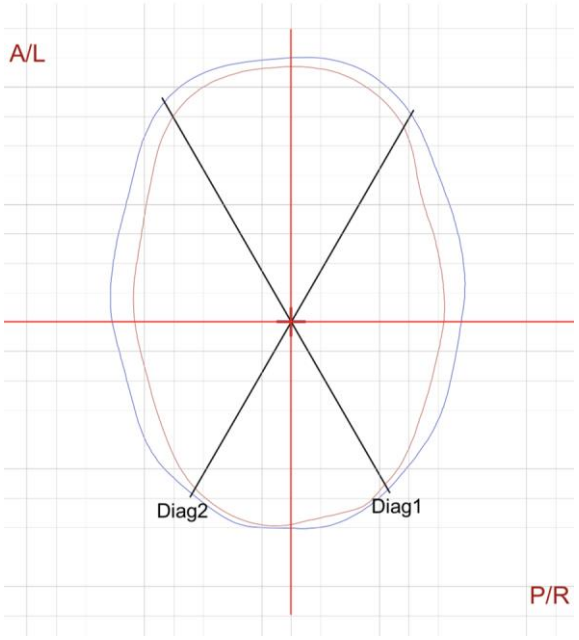
$$CVAI = \frac{|A-B| \times 100}{A \text{ or } B}$$

(whichever is greater)

Level	Clinical Presentation	Recommendation*	CVAI
1	All symmetry within normal limits	No treatment required	< 3.5
2	• Minimal asymmetry in one posterior quadrant • No secondary changes	Repositioning program	3.5 to 6.25
3	• Two quadrant involvement • Moderate to severe posterior quadrant flattening • Minimal ear shift and/or anterior involvement	Conservative treatment: • Repositioning • Cranial remolding orthosis (based on age and history)	6.25 to 8.75
4	• Two or three quadrant involvement • Severe posterior quadrant flattening • Moderate ear shift • Anterior involvement including noticeable orbit asymmetry	Conservative treatment: • Cranial remolding orthosis	8.75 to 11.0
5	• Three or four quadrant involvement • Severe posterior quadrant flattening • Severe ear shift • Anterior involvement including orbit and cheek asymmetry	Conservative treatment: • Cranial remolding orthosis	> 11.0

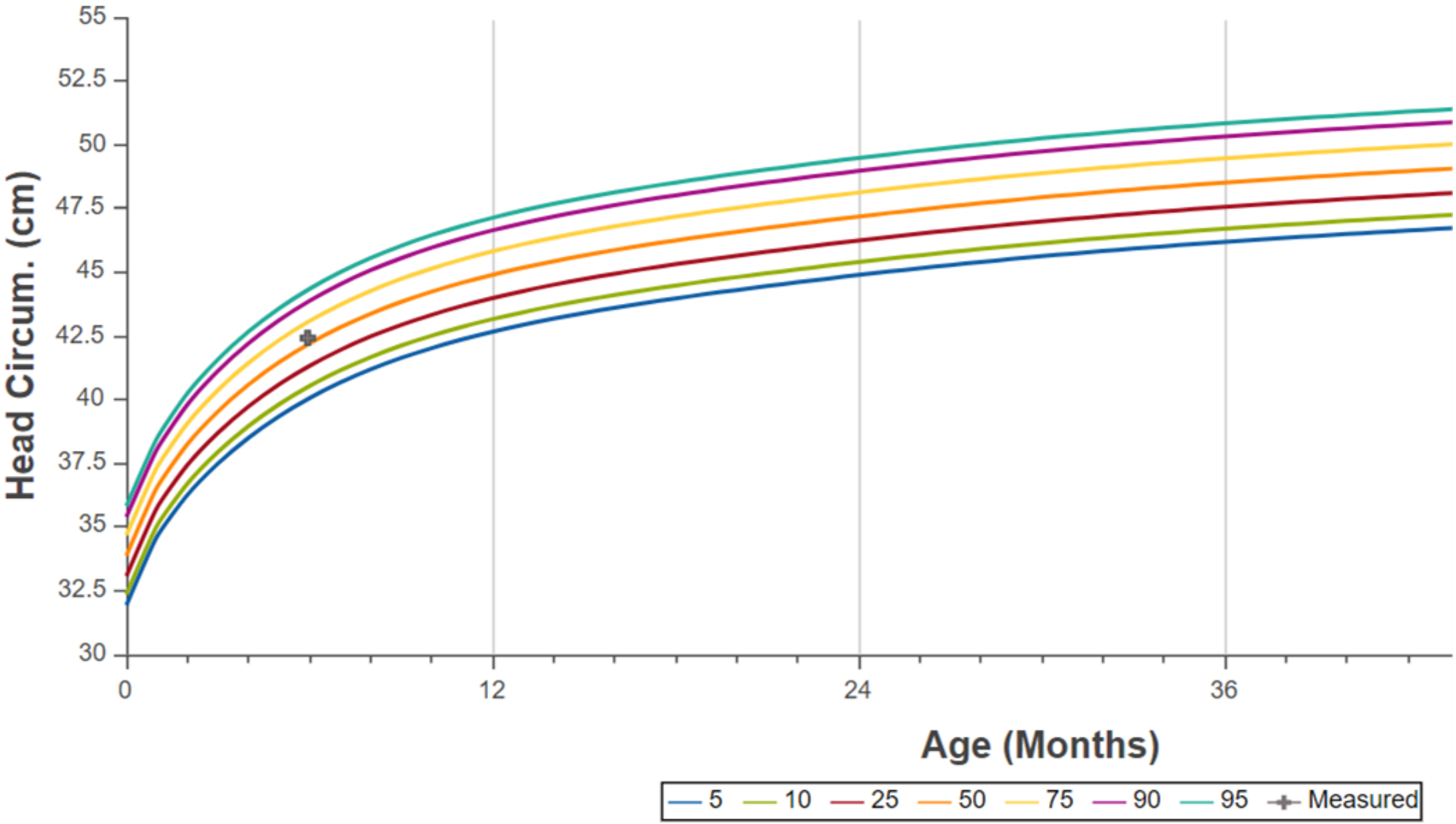
Measurements





Circumference	(mm)	424.2
Cranial Breadth (M-L)	(mm)	105.9
Cranial Length (A-P)	(mm)	156.4
Cephalic Ratio (M-L / A-P)		0.677
Radial Symmetry Index (RSI)		22.6

WHO Cranial Growth Trends:



Helmet Preparation

Cons	Pros
Skin Irritation	It Works!
Sweat	Protective
Smell	Customizable
Sleep Adjustment	

Helmet Types

- Copolymer
  - Bivalved
  - Side Opening
- Surlyn (clear material)
  - Bi-valved
  - Side Opening

Order the Helmet

- Send scan to Orthomerica
- Orthomerica STARband
  - 5/32” copoly shell
  - ½” pelite line
  - Stop gap foam insert

  Velcro Closure
    - Opposite side of flattening
    - Chafe attachment anterior to opening

  Finished trimlines

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Cranial Helmet Fitting

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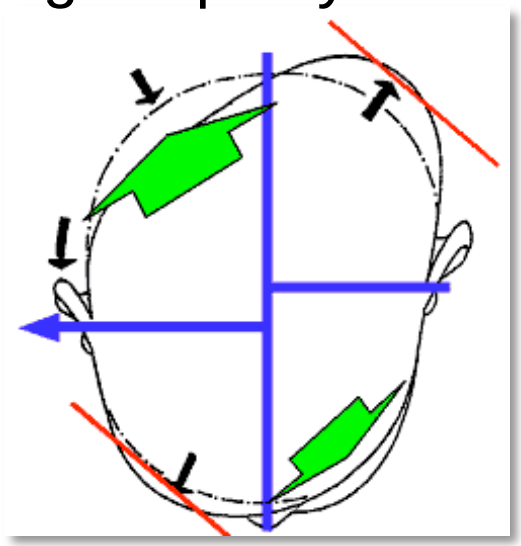
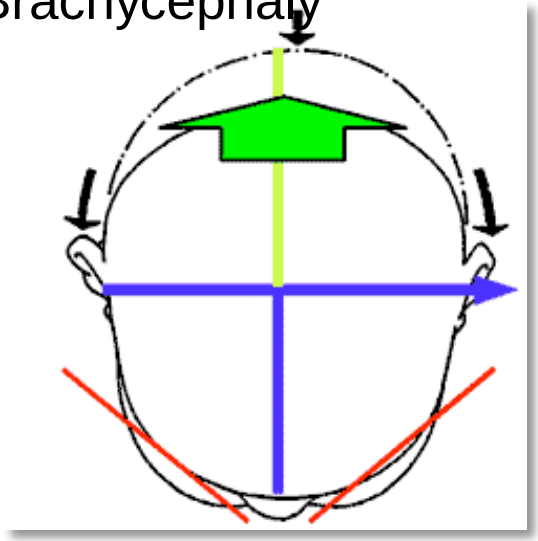
Fitting Appointment

- 1-2 Hour appointment
- Trim lines are adjusted to the proper length:
  - Above the eyebrow
  - Around the ears
- Helmet motion checked
  - Rotation
  - Forward tilt
- Contact areas are confirmed

Plagiocephaly



Brachycephaly



Contact & Relief Areas

- **DP:** Restricting growth in longer diagonal and allowing growth in the flattened regions.
- **Brachycephaly:** Allow posterior growth while restricting anterior and lateral growth
- **Scaphocephaly:** Allow lateral growth while maintaining the anterior and posterior shape
- Rarely correction of ear positioning

Donning the Helmet

Break-in Schedule & Maintenance

DAY	*ON*	*OFF*	*NAP*	*NIGHT*
1	1 hr	1 hr	No	No
2	2 hrs	1 hr	No	No
3	4 hrs	1 hr	Yes	Yes
4	8 hrs	1 hr	Yes	Yes
5	23 hrs	1 hr	Yes	Yes

- Remove for fevers
- Wash daily
- Layer less of clothing for heat adjustment
- All red marks should go away within 1 hour
- If skin irritation discontinue use until an adjustment is made

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Follow-up Appointment

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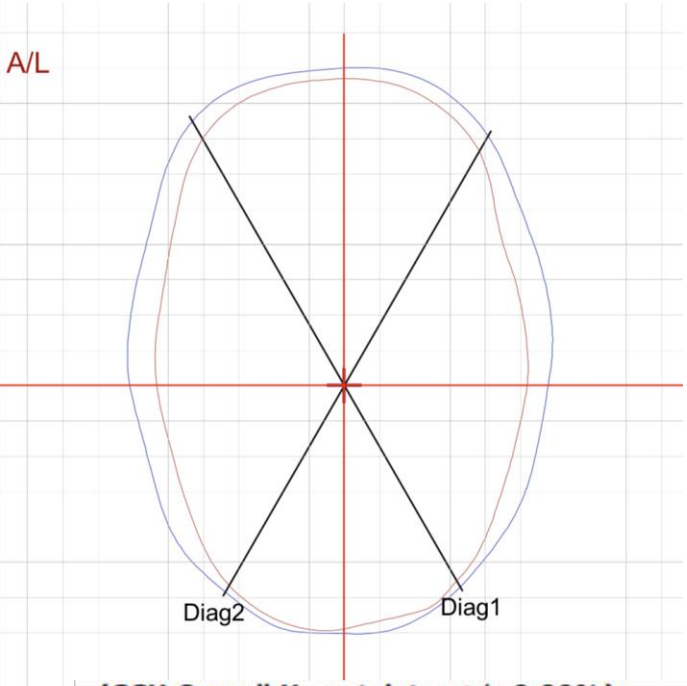
1 Week Follow-up

- Talk with family
- Assess redness:
  - Duration
  - Intensity
- Make adjustments when:
  - Redness lasts >1 hour after helmet removal
  - Skin is compromised
- Check to make sure there isn't excessive A-P tilt or rotation



Routine Follow-ups

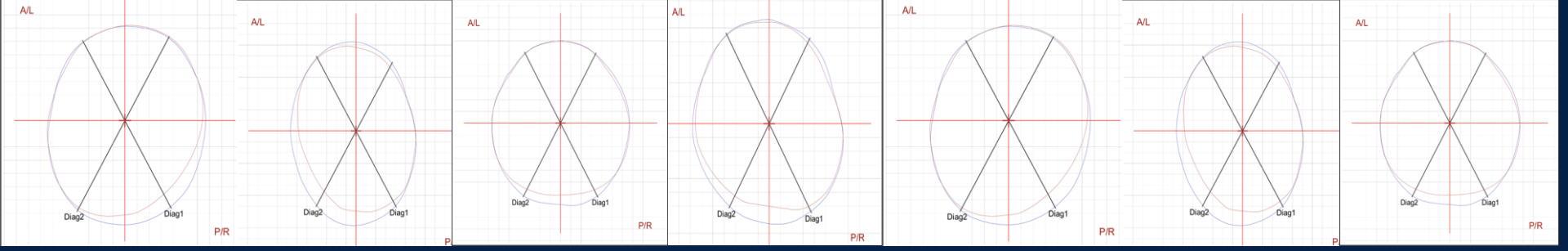
(CCU Overall Uncertainty: +/- 0.09%)		Age: 6 W	Age: 29 W
Section (3) Measurements			
Circumference	(mm)	427.5	476.1
Cranial Breadth (M-L)	(mm)	109.3	129.9
Cranial Length (A-P)	(mm)	153.7	169.8
Cephalic Ratio (M-L / A-P)		0.711	0.765
Radial Symmetry Index (RSI)		20.0	10.5
Oblique - Diagonal 1, at -30.0 deg	(mm)	144.1	157.7
Oblique - Diagonal 2, at 30.0 deg	(mm)	144.6	159.3
Cranial Vault Asymmetry	(mm)	0.5	1.6

End of Treatment

- Clinically
  - DP: Asymmetry is < 5mm
  - Brachycephaly: Cephalic ratio < 87%
- Efficacy of the helmet significantly reduces after 15 months of age
- Parents make the final determination

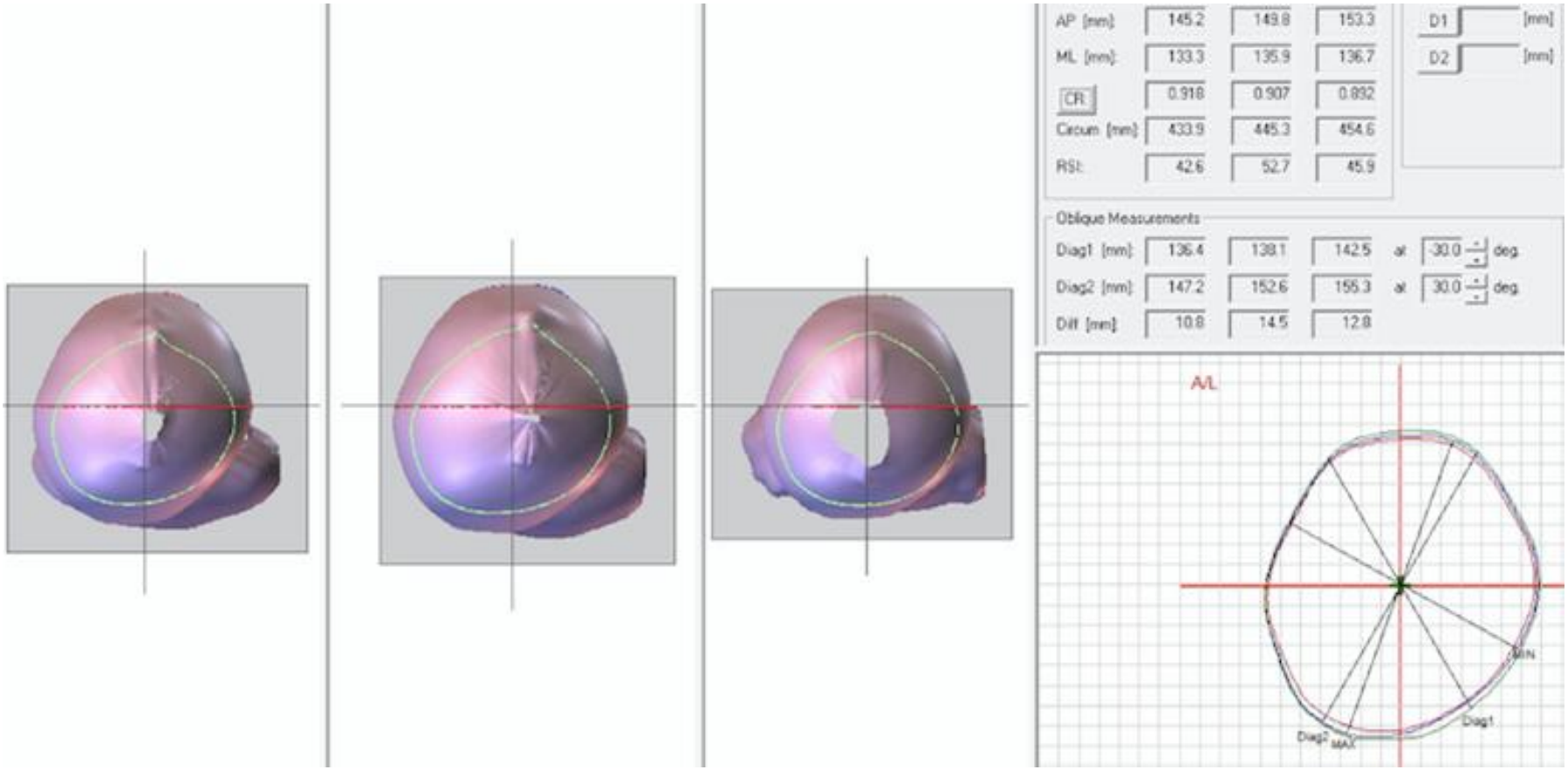
Takeaways

- Helmets are;
  - A commitment
  - Optional for cosmetic correction
    - Quantitative Measurements
    - Qualitative
- Parent decides when treatment ends



QUESTIONS?

Routine Follow-ups



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