

# Effectiveness For Older Infants To Start Cranial Remodeling Treatment With Cranial Molding Helmet In Positional Plagiocephaly

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# Positional Plagiocephaly

- Asymmetric condition of the head without craniosynostosis
- Deformational Plagiocephaly
- Plagiocephaly without synostosis

Head shape measurement standards and cranial orthoses in the treatment of infants with deformational plagiocephaly

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Review



# Incidence

- Since 1992, dramatic rise of the incidence in the US
  - **“Back to sleep” campaign** (the American Academy of pediatrics)
    - Up to **15%** of otherwise healthy infants
- The most commonly reported incidence:
  - 1 in 300 births**

# Treatment

- **Helmet therapy; 4 mos. ~ 18 mos.**

Prominent area: passive retaining

Flattened area: growing to empty space

- Position Change; less than 4–6 months
- Surgery; rare

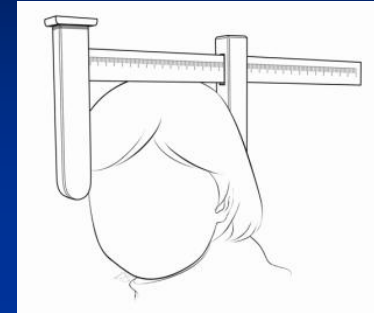


# Patients and Method

- ❖ Positional Plagiocephaly without Synostosis by 3D CT scan
  - ❖ Start age of Helmet therapy : **over 18 month**
  - ❖ Completion of helmet therapy or regular follow-up over one year during therapy and complete documentation.
- 
- **Patient No.; 27 (M:F=15:12)**
  - **Mean Age; 29.7 months (17~75 mos.)**
  - **Duration of Helmet Tx. ; 16.4 mos.**

# Patients and Method

- Method : Spreading caliper



- Cranial vault asymmetry (CVA)

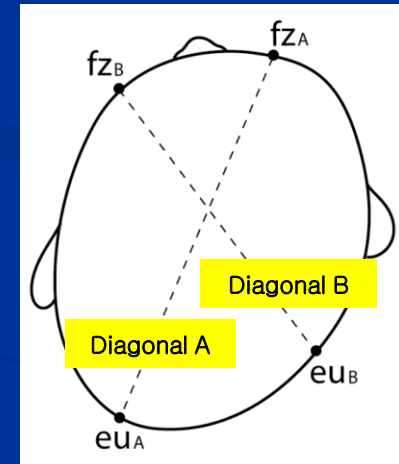
= diagonal A – diagonal B

- Cranial vault asymmetry index (CVAI)

= (diagonal A – diagonal B) / diagonal A x 100

\*\*\* (diagonal A: fz A to eu A (longer one), diagonal B: fz B to eu B)

- Goal of Treatment :  $CVA \leq 5 \text{ mm}$



# Patients and Method

|                           | <b>Value</b>   | <b>Standard deviation</b> |
|---------------------------|----------------|---------------------------|
| <b>Initial CVA</b>        | 15.6mm         | $\pm 7$ mm                |
| <b>Initial CVAI</b>       | 9.42%          | $\pm 4.16\%$              |
| <b>Compliance</b>         | 17.5 hours/day | $\pm 2.6$                 |
| <b>Helmeting Duration</b> | 16.4 months    | $\pm 7.2$                 |

# Results

| Initial CVA<br>(mean) | Final CVA<br>(mean) |
|-----------------------|---------------------|
| 15.6mm                | 8mm                 |
| <b>7.6mm</b>          |                     |

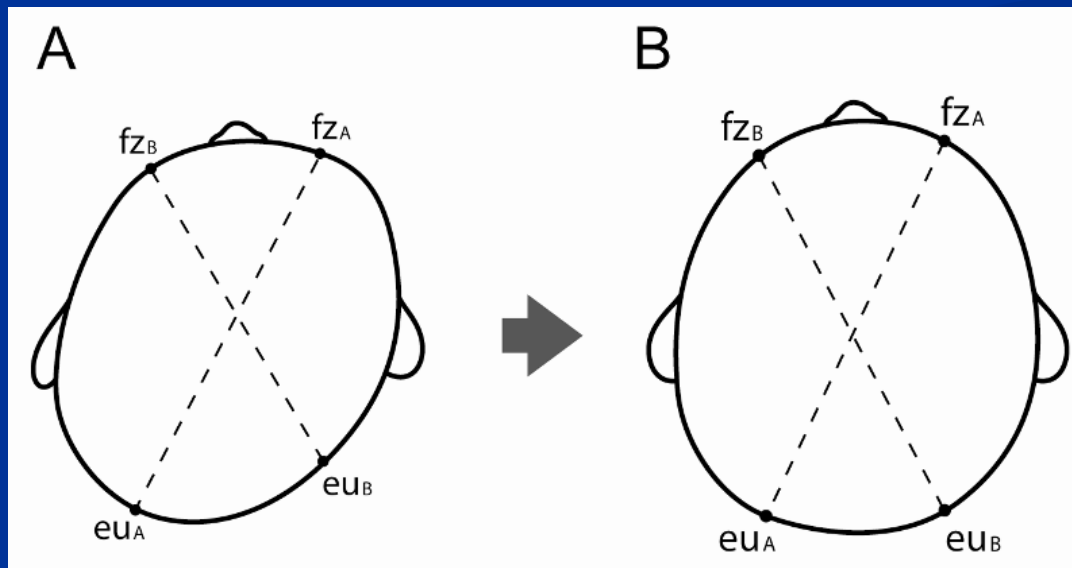
| Initial CVAI<br>(mean) | Final CVAI<br>(mean) |
|------------------------|----------------------|
| 9.42%                  | 4.91%                |
| <b>4.51%</b>           |                      |

50% Improvement in Average



# Results

- Successful outcome :  $CVA \leq 5 \text{ mm}$   
→ 6 patients among 27 (22%)



# Results of Successful Outcome

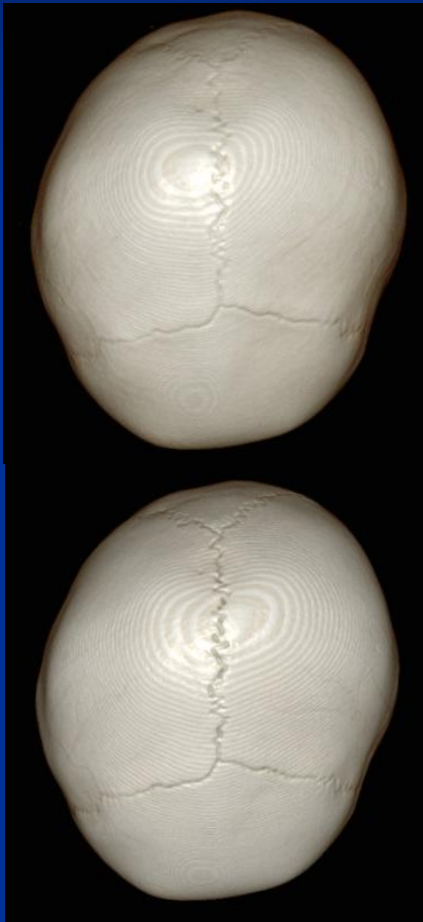
| No.         | Age of start helmet therapy | Initial CVA (mm) | Final CVA (mm) | Initial CVAI (%) | Final CVAI (%) | Helmeting Duration (months) | compliance (hour/day) |
|-------------|-----------------------------|------------------|----------------|------------------|----------------|-----------------------------|-----------------------|
| 1           | 31.3                        | 9                | 1              | 5.36             | 0.61           | 12.2                        | 21.3                  |
| 2           | 17.1                        | 12               | 1              | 7.14             | 0.59           | 7.8                         | 19.2                  |
| 3           | 26.9                        | 22               | 3              | 4.07             | 1.18           | 5.9                         | 19.5                  |
| 4           | 33.7                        | 7                | 2              | 2.94             | 1.78           | 13.4                        | 20                    |
| 5           | 28.8                        | 19               | 4              | 11.18            | 2.48           | 19.4                        | 21                    |
| 6           | 25.6                        | 6                | 4              | 3.53             | 2.38           | 12.2                        | 20.3                  |
| <b>Mean</b> | 27.2                        | 12.5             | 2.5            | 6.56             | 1.51           | 10.84                       | <b>20.2</b>           |

Over 20 hours application of Helmet per day can achieve the successful outcome

# Results

|          |                               | Age of start helmet therapy (months) | Initial CVA (mm) | Final CVA (mm) | Initial CVAI (%) | Final CVAI (%) | Helmeting Duration (months) | Compliance (hours/day) |
|----------|-------------------------------|--------------------------------------|------------------|----------------|------------------|----------------|-----------------------------|------------------------|
| <b>S</b> | <b>Good compliance (n=5)</b>  | 26.7                                 | 7                | 2              | 6.25             | 1.45           | 10.5                        | 21.1                   |
| <b>S</b> | <b>Poor compliance (n=1)</b>  | 26.9                                 | 22               | 3              | 12.79            | 1.79           | 13.4                        | 16.0                   |
| <b>F</b> | <b>Good compliance (n=15)</b> | 31.9                                 | 19               | 10             | 10.63            | 5.28           | 20.6                        | 17.7                   |
| <b>F</b> | <b>Poor compliance (n=6)</b>  | 28.3                                 | 14               | 11             | 9.23             | 6.27           | 20.6                        | 15.4                   |

# Discussion



**Table 2. Cranial Vault Asymmetry Index and Cranial Diagonal Diameter Values and Differences before and after Helmet Therapy**

|                         | T <sub>i</sub> |          | T <sub>e</sub> |          | Difference CVAI |              |
|-------------------------|----------------|----------|----------------|----------|-----------------|--------------|
|                         | CVAI (%)       | DCD (mm) | CVAI (%)       | DCD (mm) | Absolute (%)    | Relative (%) |
| Group 1 (<6 mo, n = 24) |                |          |                |          |                 |              |
| Median                  | 13.6           | 17       | 3.1            | 4.5      | -11.1           | 75.3         |
| SD                      | 2.5            | 2.98     | 2.5            | 3.2      | 1.97            | 13.9         |
| Minimum                 | 10.7           | 14       | 0              | 0        | -8              | 56.0         |
| Maximum                 | 19.4           | 24       | 7.1            | 10       | -14             | 100          |
| Group 2 (>6 mo, n = 38) |                |          |                |          |                 |              |
| Median                  | 13.1           | 17       | 4.5            | 6.5      | -8.5            | 60.6         |
| SD                      | 2.8            | 3.48     | 2.8            | 3.9      | -2.40           | 15.2         |
| Minimum                 | 9.1            | 12       | 0.7            | 1        | -5              | 29.0         |
| Maximum                 | 19.4           | 26       | 13.8           | 20       | -14             | 95.0         |

T<sub>i</sub>, start of helmet therapy; T<sub>e</sub>, end of helmet therapy; CVAI, Cranial Vault Asymmetry Index; DCD, difference in cranial diagonal diameters.

**Table 1. The effectiveness of helmet therapy according to the starting age**

| Starting age (mo) | No. | Duration (mean) | Compliance (mean) | CVA (mean) |       |         | CVAI (mean) |       |         |
|-------------------|-----|-----------------|-------------------|------------|-------|---------|-------------|-------|---------|
|                   |     |                 |                   | Initial    | Final | P-value | Initial     | Final | P-value |
| Group 1 (≤5)      | 20  | 6.70            | 17.96             | 15.5       | 3.9   | 0.0001  | 10.97       | 2.61  | 0.0001  |
| Group 2 (6-8)     | 38  | 6.12            | 17.40             | 16.3       | 4.8   | 0.0000  | 11.01       | 3.11  | 0.0000  |
| Group 3 (9-11)    | 31  | 6.94            | 16.87             | 15.9       | 4.5   | 0.0000  | 10.35       | 2.84  | 0.0000  |
| Group 4 (≥12)     | 19  | 6.66            | 15.63             | 16.3       | 5.6   | 0.0001  | 10.24       | 3.47  | 0.0001  |
| Total             | 108 | 6.56            | 17.04             | 16.0       | 4.7   | 0.0000  | 10.68       | 3.00  | 0.0000  |

In the total of 108 pediatric patients, the mean treatment period with helmet therapy was 6.56 months, and the initial CVA and CVAI were 16.0 mm and 10.68%, respectively. The final CVA and CVAI were 4.7 mm and 3.00%, respectively. The changes were statistically significant (P<0.0001 and P<0.0001). Among the patient groups based on the initiation age of the treatment (Groups 1, 2, 3, and 4), the initial to final CVA and the initial to final CVAI were greatest in Group 1 and least in Group 4. CVA, cranial vault asymmetry; CVAI, cranial vault asymmetry index.

Mean Age; 29.7 months (17~75)

9.42

4.91

# Conclusion

Even in babies older than 1 & 1/2 year,  
Helmet Therapy can be effective,  
when wearing time is  
more than 18~20 hours/day  
and 11~20 months' duration.

*Thank you  
for your attention !*

The authors have no conflict of interest to declare in relation to the content of this article



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