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## CVAI reduction according to severity and accompanied brachycephaly for deformational plagiocephaly.

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### Introduction

The effect of a cranial molding orthotic device(helmet) for correcting deformational plagiocephaly was well announced these days. In numerous clinical cases, there are deformational brachycephaly accompanied with plagiocephaly. But, there are few studies for relationships between brachycephaly and plagiocephaly. So we investigated the effect of helmet according to severity, starting age and accompanied brachycephaly.

### Methods

A total of 47 pediatric patients diagnosed deformational plagiocephaly and applied helmet were enrolled in this study. The mean duration of the helmet treatment was 5.7±1.9 months. The mean hour of putting on the helmet per day was 19.3±3.3. The mean age at initiation of helmet treatment in the subjects was 8.19±3.1 months. Pre- and post-treatment cranial shape asymmetry was measured according to the Cranial Vault Asymmetry Index (CVAI) using 3D-Photogrammetry. The CVAI is the difference between the lengths of two diagonals measured 30 degrees from midline, divided by the larger of the two diagonals multiplied by 100. Patients were classified by age at which treatment was started: Group 1 was comprised of patients younger than 6 months (n = 22); Group 2, those aged 6-9 months (n =13); Group 3, those aged >9 months (n = 12). Groups were also categorized by severity (mild: CVAI 3-7%; moderate: CVAI 7-12%; severe: CVAI > 12%). Additionally, patients were divided into 2 groups: Group A, those without brachycephaly; Group B, those with brachycephaly. We set up standard that CI(Cranial Index)>90% as brachycephaly. Cranial Index is the ratio of the maximum width divided by maximum length multiplied by 100.

### Results

The mean initial CVAI was 9.77%, which reduced to 5.69% after helmet treatment. Group 1 (<6 months) showed the highest CVAI reduction. But there was no significant difference among the groups. A significant difference in CVAI reduction depending on age was only seen in severe cases of plagiocephaly but not in mild and moderate plagiocephaly[table 1]. Severity correlated positively with CVAI reduction between some groups, but no

significant difference was seen. However, regardless of age, more severe group appeared higher CVAI reduction[table 2]. Although the existence of brachycephaly did not affect on the CVAI reduction, in the severe groups there was a significantly higher CVAI reduction in the group without brachycephaly[table 3].

**Conclusion**

The effect of helmet for patients of deformational plagiocephaly was greater in the case of more severe groups. The existence of brachycephaly did not affect on the effect of helmet. But, in case of severe plagiocephaly, accompanied brachycephaly reduced the CVAI reduction. In case of severe deformational plagiocephaly with brachycephaly, we must consider that CVAI reduction could be poor.

Table 1. CVAI reduction of 47 patients with plagiocephaly treated with helmet. Patients were divided by severity of plagiocephaly according to the CVAI and stratified by age at start of therapy.

|  | CVAI reduction [%] | | | p-value | | |
|---|---|---|---|---|---|---|
|  | Group 1 | Group 2 | Group 3 | 1 vs. 2 | 1 vs. 3 | 2 vs. 3 |
| Mild | 5.88(N=3) | 5.22(N=4) | 5.32(N=3) | 0.205 | 0.192 | 0.211 |
| Moderate | 5.21(N=15) | 4.65(N=4) | 4.89(N=7) | 0.175 | 0.151 | 0.091 |
| Severe | 3.06(N=4) | 4.80(N=5) | 5.10(N=2) | 0.024 | 0.011 | 0.074 |
| Total | 5.25(N=22) | 4.73(N=13) | 2.91(N=12) | 0.124 | 0.085 | 0.093 |

Table 2. CVAI reduction of 47 patients with plagiocephaly treated with helmet. Patients were divided by age at start of therapy and severity.

|  | CVAI reduction [%] | | | p-value | | |
|---|---|---|---|---|---|---|
|  | Mild | Moderate | Severe | Mild vs. Moderate | Mild vs. Severe | Moderate vs. Severe |
| Group 1 | 5.92(N=3) | 5.01(N=15) | 5.64(N=4) | 0.027 | 0.121 | 0.185 |
| Group 2 | 5.05(N=4) | 4.21(N=4) | 4.98(N=5) | 0.160 | 0.063 | 0.032 |
| Group 3 | 3.01(N=3) | 3.14(N=7) | 4.96(N=2) | 0.170 | 0.200 | 0.189 |
| Total | 4.38(N=10) | 4.70(N=26) | 5.00(N=11) | 0.021 | 0.015 | 0.013 |

Table 3. CVAI reduction of 47 patients with plagiocephaly treated with helmet. Patients were divided by severity of plagiocephaly according to the CVAI and stratified by existence of brachycephaly.

| | CVAI reduction [%] | | p-value |
|---|---|---|---|
| | Group A (without brachycephaly) | Group B (with brachycephaly) | A vs. B |
| Mild | 5.15(N=5) | 5.75(N=5) | 0.256 |
| Moderate | 4.87(N=14) | 5.23(N=12) | 0.301 |
| Severe | 5.07(N=6) | 3.20(N=5) | 0.015 |
| Total | 4.97(N=25) | 4.88(N=22) | 0.071 |