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Treatment of positional plagiocephaly – Helmet or no helmet?

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ABSTRACT

Introduction: Positional plagiocephaly has attained widespread attention. There is a lot of data on helmet therapy available, but the natural course of the deformity has not been investigated in depth. The decision for or against helmet therapy can be controversial. This study examined the outcome of both options.

Methods: 128 infants were enrolled in this prospective, non-randomized, longitudinal study. 62 were treated with and 66 without a helmet. The initial cranial vault asymmetry index (modified CVAI) was determined at 6.3 and 6.2 months of age (SD 1.44/2.14). Follow-up took place at the end of helmet therapy (age: 10.2 months, SD 1.77) or after 1 year (age: 18.5 months, SD 2.28) respectively. The outcome and the correlation of the changes to the initial asymmetry were compared.

Results: All infants showed a significant reduction of their plagiocephaly. Although children with helmet had more severe asymmetry initially, they showed significantly better improvement (68% vs. 31%). Only a weak correlation was found between the initial asymmetry and the amount of improvement in both groups.

Conclusion: Despite concerns against helmet therapy (comfort, finances), it should be the treatment of choice for moderate to severe cases. Only mild cases (modified CVAI $\leq$ 6.5%) can be adequately treated by conservative, i.e. non-helmet, management.

1. Introduction

As a consequence of its increased incidence, positional plagiocephaly has received widespread attention in routine clinical practice as well as in the scientific literature. The aetiology, risk factors and several treatment options are well understood but this does not end the controversy regarding whether an intervention, such as helmet therapy, is necessary. The self-healing effect of head growth over time, financial burdens and comfort aspects are some of the arguments of critics that cannot be ignored. The question: "Helmet or no helmet" is therefore justified for the large group of infants with slight to moderate plagiocephaly ("Can have"-kids). While the use of a helmet in severe cases is, on the whole, agreed ("Must have"-kids), for infants with slight to moderate plagiocephaly, treatment suggestions often differ between clinicians. Different recommendations of other therapists involved in the infants management (paediatrician, physiotherapist, craniofacial specialist) may lead to uncertainty on the parent's side.

There is an evident imbalance between scientific investigations on the natural course of the condition and on helmet therapy. Literature reviews show that the focus is on treatment options such as helmets rather than on the natural course of plagiocephaly (Bialocerkowski et al., 2005; Robinson and Proctor, 2009; Wilbrand et al., 2012b). To help to clarify this issue, this study compares the outcome of helmet therapy with the outcome of the natural course of infants with positional plagiocephaly. The correlation between the change in asymmetry and the severity of the initial asymmetry was investigated simultaneously. The study aimed to offer clinicians and parents criteria for a decision for or against helmet therapy based on objective data. Additionally it intended to derive a numerical limit of asymmetry that can easily be managed by a "watch and wait-policy".

2. Material and methods

128 infants with positional plagiocephaly (Fig. 1) were included in a prospective, non-randomized, longitudinal study. Children with a relevant clinical brachycephaly as well as infants with severe other diseases or severe developmental retardation were excluded. Further inclusion criteria were regular follow-up and complete documentation.

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Fig. 1. Infant with positional plagiocephaly.

62 infants, 40 male and 22 female (group 1) underwent helmet therapy. The helmet was individually made for every child by Cranioform® (Siegen, Germany) on the basis of a three-dimensional surface scan. The parents were instructed to ensure that the child wore the helmet for 23 h per day. Regular reviews took place every 6–8 weeks.

66 children, 34 male and 32 female (group 2) had no helmet and were reviewed after one year.

Parents in both groups were asked to continue regularly with any previously initiated further supportive interventions (physiotherapy, osteopathy, repositioning). As the applied specific methods, their intensity, duration and frequency differed relevantly between the observed children and these data could not be raised in a standardized way, so these influential factors could not be investigated.

For each child, date of birth and consultation were documented. Cranial diagonal measurements (mm) were taken with an anthropometric metal cranial calliper by one person. Although the measurements were not strictly taken at 30° diagonals as introduced by Loveday and De Chalain, the cranial vault asymmetry index (modified CVAI in %) was calculated according to their proposal. The index considers the variation in infants head size and therefore allows a better interindividual comparison than the nominal difference in diagonal diameters. A CVAI of 0% represents perfect symmetry. Scores larger than 3.5% are classified as significantly asymmetric (Loveday and De Chalain, 2001).

$$\text{CVAI} = \frac{\text{Difference in cranial diagonals}}{\text{shorter cranial diagonal} \times 100}$$

Initial CVAI and CVAI at the end of helmet therapy were used for analysis in group 1. Our clinical experience shows, and is described in literature (Paquereau, 2013), that changes in cranial asymmetry are expected to occur much slower for children without helmet treatment, so we decided to set a different final assessment point for group 2 in order to compensate for the time lag. Unfortunately the extent of the delay is unknown and an arbitrary point had to be set. In the group of children without helmet therapy, initial CVAI and the CVAI at the second consultation after one year were used for the study. A final assessment much later did not seem to be reasonable because the period of the major cranial growth potential is over by then. Any obvious further changes will probably occur over several years.

Data were anonymized. Descriptive and statistical analyses were performed with the program SPSS. The changes of CVAI from the first consultation to the end of helmet therapy (group 1) and to follow-up after 1 year respectively (group 2) were determined as the primary parameter.

The null hypothesis was defined as no difference between the two patient groups concerning the development of the CVAI. The significance level was set at $\alpha = 0.01$.

The Kolmogorov–Smirnov-test was used to test whether all variables followed a normal distribution. As variables in the group without a helmet did not show a normal distribution, statistical analyses were performed with the non-parametric Mann–Whitney-U-test and median values instead of the mean are shown. The correlation between initial asymmetry and the change of CVAI was tested with the Spearman correlation in both groups.

3. Results

3.1. Age and time of observation

The first consultation in our outpatient clinic took place at 6.3 months of age (SD 1.44) in group 1. Therapy ended at a mean age of 10.2 months (SD 1.17). Children in group 2 were seen at an age of 6.2 months of life (SD 2.14) for the first time. As they did not have helmet treatment, the next review took place after 12 months (SD 1.08) at an age of 18.5 months of age (SD 2.28).

3.2. Development of cranial vault asymmetry index (CVAI)

Infants in the helmet group showed a median initial modified CVAI of 13.3% (min.–max.: 9.1–19.4%, SD 2.69). Children without a helmet had a lower median initial modified CVAI of 9.3% (min.–max.: 3.0–18.5%, SD 3.12). The severity of the plagiocephaly between both groups differed significantly ($p < 0.0001$).

In both groups asymmetry decreased significantly ($p < 0.0001$) but normal values according to the description of Loveday and De Chalain ≤3.5% were not reached (Fig. 2). Using other cut-off points,

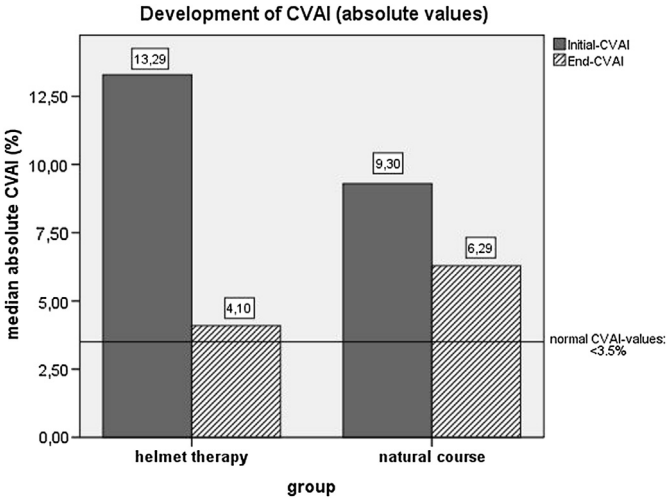

Fig. 2. Comparison of cranial vault asymmetry index (CVAI) initially and at the end of follow-up.