Orthotics

**Plagiocephaly and head binding**

S J Bridges, T L Chambers, I K Pople

Orthotics do not improve plagiocephaly

The practice of head deformation by pressure to an infant’s skull dates back to 2000 BC when the Ancient Egyptians used head binding to produce a cosmetically pleasing and fashionable skull shape. With an increasing incidence of plagiocephaly (asymmetric skull) this practice, with a modern slant, is re-emerging. A simple web search resulted in five paediatric offices offering such a service. If an Ancient Egyptian walked into clinic today with their child’s head bound between two planks of wood, we would be informing social services. Should we, as paediatricians, be advocating modern orthotic devices for plagiocephaly or condemning them?

Plagiocephaly can be subdivided into synostotic, where one or more sutures are fused, and nonsynostotic, or deformational, plagiocephaly. Surgical treatment of the synostotic variety is undisputed as the deformity is likely to progress and there is a significant risk of raised intracranial pressure. However, the treatment of deformational plagiocephaly is more controversial.

There are no population based studies to establish the precise incidence or prevalence of deformational plagiocephaly, but the number of referrals to both paediatric and surgical units is increasing.  

Posterior deformational plagiocephaly occurs more commonly on the right and there is a notable male predominance. The laterality may be in part a result of intrauterine position with 85% of vertex presentations lying on the left occipital anterior position. If the baby descends into the pelvis (fig 1), this may limit the growth of the right occiput and left frontal areas. The asymmetry may be further exacerbated postnatally—when the child is laid supine, the head will automatically roll to the flattened side, which then becomes the preferred side for sleeping.

This hypothesis also explains the increase in incidence of posterior deformational plagiocephaly since the “Back to Sleep” recommendations for prevention of sudden infant death syndrome. Mulliken et al showed that over a four year period from 1992 to 1996, the incidence of frontal plagiocephaly (attributed to prone sleeping) decreased and almost disappeared, with a concomitant rise in posterior plagiocephaly.
thought to be beneficial in the majority of cases if the child is aged less than 12 months, as 85% of postnatal head growth occurs in the first year of life.\(^1\) There has been a concern from some centres regarding stigmatisation of helmet wearers; however, this is not a factor that has been recognised locally.

A range of clinical studies\(^1\) have charted the change in anthropometric measurements with orthotic treatment. They show what would appear to be an impressive asymmetrical resolution with a mean change in asymmetry of about 5 mm. The main problem with each of these studies is the lack of controls. Without a set of control data there is no way of knowing whether the intervention is actually beneficial.

There is only one study that compares the outcome in more than one treatment group. Mullikan and colleagues\(^7\) provide control data on patients that chose not to have the orthotic intervention—in this case a helmet. Despite its failings this study does provide the best evidence and appears to show a significant reduction of asymmetry (p < 0.001) in the treatment group. However, the lack of randomisation and obvious physician bias, with two of three parents opting for the helmet, makes interpretation of the results difficult.

There does not appear to be any definite evidence for improved outcome with orthoses—so are there any disadvantages? The factors that immediately spring to mind are cost and inconvenience. In the USA it has been estimated that orthoses cause any discomfort to these babies can only be guessed at and probably differs on an individual basis. Should we be risking a child’s discomfort, family inconvenience, and NHS funding on a treatment that has no clear benefit?

In summary, there is no clear evidence as yet that orthotic devices improve plagiocephaly in the long term. Craniosynostoses should be excluded by clinical and radiological means, before advice is given regarding sleep position and physiotherapy. Neurosurgical or plastic surgery referrals should be reserved for progressive or severe cases. Population based studies are required; these should investigate the natural history of plagiocephaly with qualitative and quantitative measurements. Unless it is found that children have a detrimental outcome as a result of conservatively managed plagiocephaly, modern head binding cannot be recommended as a routine treatment. Without a set of control data there is no evidence for improved outcome in more than one treatment group. However, the lack of controls in these studies is the case with many treatments for cosmetic deformity, category 1 evidence for efficacy of any intervention is lacking and it is often the parents or consumers who drive the treatment trends. If the infant were asked, he might opt for wait and see.

Arch Dis Child 2002;86:144–145

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...COMMENTARY...

The debates related to true synostotic plagiocephaly (unicoronal synostosis or rarely lambdoid synostosis) as opposed to deformational plagiocephaly have raged over the last decade. A number of articles highlight the clinical features that distinguish these conditions.\(^5\) Various terms are applied to non-synostotic calvarial asymmetry, including “deformational plagiocephaly”. Plagiocephaly without synostosis (PWS) is the preferred term in our unit. It is generally accepted that plagiocephaly without any evidence of synostosis usually needs no surgical intervention.

The exact association between PWS and the “Back to Sleep” campaign is difficult to quantify. A number of obstetric factors appear to predispose to a child being born with an initially asymmetric head, including multiple pregnancy, fetal malposition or malrotation, and prematurity.

In addition, in our unit we have documented a 54% incidence of wormian bones in PWS (versus a 17% incidence in age matched controls). This raises the potential contributing factor of a slightly more malleable head. Interestingly Mayan headbinding cultures have been shown via archaeological skull findings to have increased numbers of wormian bones.\(^5\) Whether this represents evidence of increased malleability or whether the response to an initial restrictive force is a compensatory division of the sutures is unfortunately impossible to prove.

Important in PWS is the fact that whatever the degree of asymmetry present at birth, flattening frequently progresses over approximately the first six months as pressure is maintained on the back of the head due to the sleeping position (even more so in children with developmental delay and poor tone). The unwar may class this initial...
progression as evidence of a synostotic process.

Bridges et al have indicated the difficulty of scientifically assessing outcomes and producing statistical significance, as opposed to assessing clinically relevant effectiveness. The following points need to be taken into account.

1. There is a form of susceptibility which makes some children flatten more significantly than others; thus not all children nursed on their backs will develop occipital flattening.

2. Initial early progression usually precedes resolution.

3. In the vast majority of mild cases, resolution to the point of deformity is the “norm”. Asymmetry is the “norm”.

4. In more severe cases resolution is slower and may be incomplete, but in the majority of cases proceeds without active intervention to a point where the end result is entirely socially acceptable.

5. Literature evidence and personal discussion with groups using orthotic devices indicate that their use may slightly speed up the resolution phase but does not conclusively improve the results over patients treated by observation alone.

6. No studies currently available comment on anything other than the visible “architectural changes”. Significant questions need to be raised as to the overall psychosocial effects of placing a child in a helmet unless we believe the interaction between parents and child, and more particularly between the child and non-family members, will be changed by the presence of a helmet, which is frequently viewed by the uninformed as a protective device essentially for a child at risk.

7. The discomfort of wearing a helmet, particularly in hot weather, and risks associated with general anaesthetic frequently required for adequate fitting of a device, are under emphasised.

It is certainly our feeling that simple observation and allowing nature to take its course is the best option in the vast majority of cases. The authors of the article should be congratulated on their honest reporting of their local experience of these devices and I would definitely support the conclusions drawn in Bridges et al’s final paragraph.

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Arch Dis Child 2002 86: 144-145
doi: 10.1136/adc.86.3.144

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