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Clinical Study

Use of external orthotic helmet therapy in positional plagiocephaly

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ABSTRACT

Positional plagiocephaly is the most common type of cranial asymmetry affecting infants. We aimed to investigate the effectiveness of helmet therapy compared to no helmet therapy in treating positional plagiocephaly in infants under the age of 1 year. This retrospective review was conducted in an Australian paediatric hospital and included 171 patients recruited from outpatient clinics. Only 30 patients had positional plagiocephaly scores recorded at first and final consultations while 39 patients had diagonal measurements recorded at both visits. The mean age was 7.38 months at initial consultation with a mean follow-up duration of 5.85 months. Those who had helmet therapy had a significantly greater reduction in diagonal difference than those who did not use helmets ($p = 0.011$). Therefore, there may be a role for helmet therapy in the treatment of severe positional plagiocephaly.

1. Introduction

Positional plagiocephaly is the most common type of cranial asymmetry in infants and is characterised by a flattening of one side of the occiput. The asymmetrical head shape can lead to craniofacial changes such as an anterior shift of the ipsilateral ear and cheek, ipsilateral frontal bossing, and contralateral occipital bossing [1].

Orthotic devices such as passive or dynamic helmets can be used to remodel the skull shape by allowing the head to grow into a symmetrical mould. Dynamic helmets limit further growth of prominent areas of the head by exerting pressure [2]. Studies have shown a trend demonstrating the effectiveness of helmet therapy as well as the superiority of this intervention over active repositioning or no treatment [3–9] with a few exceptions [10,11]. However, only a few studies described the intervention in detail and many lacked a comparison group. Due to the presence of such biases, a systematic review published in 2008 was unable to provide conclusions on the effectiveness of head moulding therapy and repositioning therapy and instead emphasised the need for further research [12].

At the time of writing, there have been no Australian clinical studies on positional plagiocephaly. Furthermore, the helmets that are used at the Sydney Children's Hospital are dynamic but non-banded, unlike the dynamic orthotic cranioplasty bands that have been used in American studies. Our aim was to investigate the effectiveness of helmet therapy compared to no therapy in an Australian sample of infants with positional plagiocephaly.

2. Methods

Ethics approval was obtained from the Hunter New England Human Research Ethics Committee. Inclusion criteria were as follows: clinically diagnosed with positional plagiocephaly, between 6 weeks and 1 year of age at the first visit, and attended at least one follow-up visit. Patients were excluded from the study if they had clinical signs of craniosynostosis or congenital craniofacial abnormalities.

A retrospective review was performed on data collected between 2009 and 2012 from the Sydney Children's Hospital. Patients with positional plagiocephaly who were referred to the helmet clinic, craniofacial clinic, or neurosurgical outpatient clinic were identified. Patients were examined by a neurosurgical consultant or registrar and five standard anthropometric measurements were obtained using metal sliding callipers (Fig. 1): head circumference, lateral diameter, anteroposterior diameter, long diagonal, and short diagonal.

Asymmetry of the forehead and ears was noted as well as the presence of occipital bumps. An overall plagiocephaly score out of 8 was given to each child to allow for measurement of individual progress (Table 1).

The decision on whether to initiate helmet therapy was made by the clinician based on the examination, parents' wishes, and

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Fig. 1. Metal sliding callipers used to measure the deformity. This figure is available in colour at http://www.sciencedirect.com/.

Table 1
Positional plagiocephaly clinical scoring used at the Sydney Children's Hospital, Australia

Forehead asymmetry	0 – No asymmetrical protrusion on superior view 1 – Asymmetrical protrusion on superior view 2 – Asymmetrical protrusion on anterior view
Ear asymmetry	0 – Symmetrical 1 – Asymmetrical with no obvious gap 2 – Asymmetrical with an obvious gap
Occipital bumps	0 – Present 1 – Absent
Diagonal difference	0 – No difference 1 – ⩽1 cm difference 2 – >1 cm and <2 cm difference 3 – ⩾2 cm difference
Overall score	Forehead asymmetry score + ear asymmetry score + occipital bumps score + diagonal difference score

recommendation of the orthotist. Those receiving a helmet were asked to wear it for at least 18 hours a day. All families were given general advice such as keeping their child in a prone position when awake. Physiotherapy was not routinely recommended unless torticollis was present.

Follow-up visits organised with each infant ranged from 6 weeks to 3 months following the previous consultation. At each visit, the infants were re-examined for measurements and scores. Infants were followed-up at the clinics until satisfactory results were achieved or the child was no longer tolerating the helmet.

2.1. Helmet manufacturing

All helmets were custom-manufactured at the Sydney Children's Hospital by an orthotics team.

Plaster slabs were used to acquire a mould of the head shape, which was then filled with potter plaster and allowed to set to a solid unit (Fig. 2). Softened Thermofoam (Polyform, Québec, Canada) was placed over the plaster cast and the void areas were covered with up to four layers (Fig. 3). A firmer material called Bock-Lite (Otto Bock Othopedic, Minneapolis, MN, USA) was then stretched over the cast and formed into the shape of the helmet (Fig. 4). This dense material applied compression to the prominences of the head and limited further growth in these areas.

Fig. 2. Cast of head shape. This figure is available in colour at http://www.sciencedirect.com/.

Fig. 3. Cast with Thermofoam (Polyform, Québec, Canada) over void areas. This figure is available in colour at http://www.sciencedirect.com/.

Fig. 4. Cast with Bock-Lite Lite (Otto Bock Othopedic, Minneapolis, MN, USA) material. This figure is available in colour at http://www.sciencedirect.com/.

Semi-molten polypropylene was placed over the cast while on a vacuum (Fig. 5). The hardened plaster cast was split down the side and a hook and loop fastener (Velcro, Curaçao, Netherlands Antilles) strap was attached to allow for expansion (Fig. 6). As