Appendix 2

Cranial treatment and the infant

APPENDIX CONTENTS

This text has deliberately concentrated attention on the adult skull. The skull of the infant, and more so in the neonate by necessity, is immensely malleable, with the pliability of a milk carton. As a mainly cartilaginous structure at birth, the infant skull is ultraresponsive to direct molding pressures.

The evolution of the neurocranium, through different growth centers, as well as the main sutural features of the skull and face are shown in Figure A2.1.

The cranial bones are unconnected by sutures at birth and some of the cranial bones, known as composite bones (e.g. occiput, sphenoid, temporal) comprise several parts, allowing scope for the rapid growth of the brain (Carreiro 2003). The neonatal cranium is remarkably soft and unstructured, to allow folding of the cranium as it passes through the birth canal, where it is particularly vulnerable to deformation during the birth process (see Figs A2.2 and A2.3).

Cranial distortion can be created by prebirth influences, via trauma (seat-belt compression during an automobile accident, for example) or if the womb is crowded (perhaps by a twin) or if chemical influences distort development (drugs, toxins and/or nutritional deficits). Far more likely to produce damage, however, are the influences of the powerful forces acting upon the supple skull during the birth process.

Among the factors which can produce cranial damage during birth are (Biedermann 1992, 2001):

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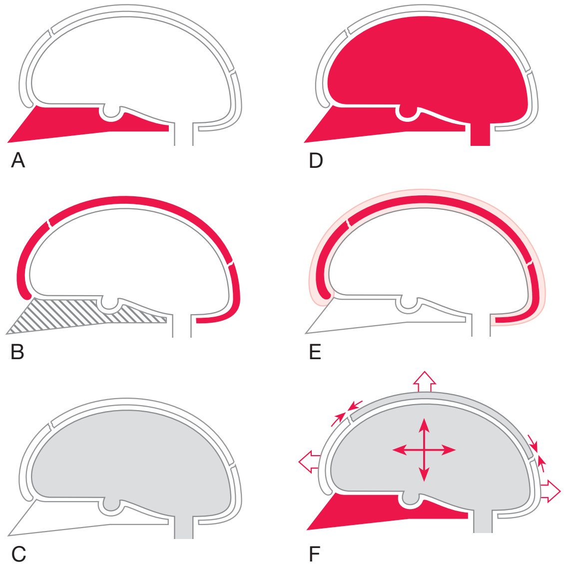

Figure A2.1 The neurocranium increases through various growth centers: (A) the synchondroses in the skull base; (B) the sutures in the cranium. The growing brain (C) is a mechanical entity with a stable skull base. (D) The sutures in the cranium allow movement of the dura mater (E). (F) The brain growth is buffered by the skull base and makes the cranium reform at the sutures. (Redrawn from von Piekartz & Bryden (2001) with permission from Elsevier.)

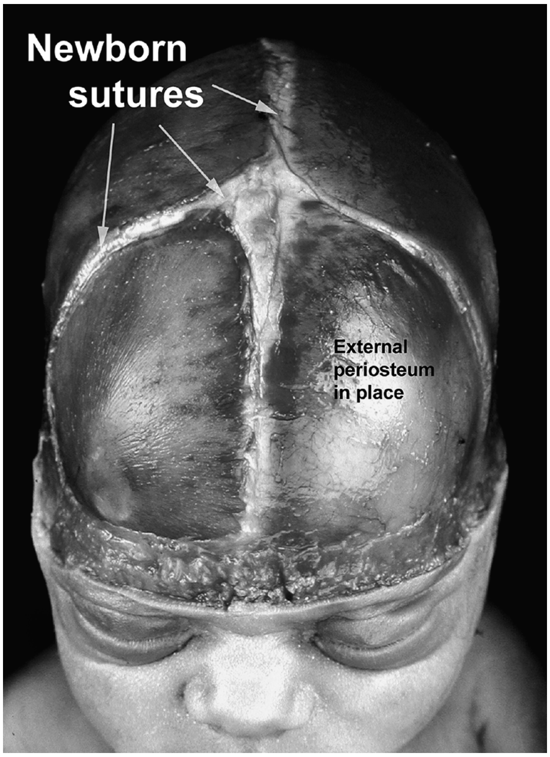

Figure A2.2 Anteroposterior view of the neonatal cranium. The periosteum has been removed from the right frontal bone but is still in place on the left. The sutures can be seen to comprise thickened connective tissue. (Reproduced with permission from the Willard & Carreiro Collection.)

- too rapid a transit through the birth canal which precludes the opportunities for 'normal' molding to occur
- too extended a period in the birth canal with excessive compression forces operating on the delicate membranes, sometimes for many hours (Magoun 1976)
- anomalous prenatal positioning and/or crowding (as in twins or triplets)
- the application of mechanical force to extract the infant via inappropriate use of forceps or the stress of vacuum suction delivery (Noret 1993).

As Milne (1995) explains:

> *A newborn baby has no sutural interlocking or interdigitation between adjacent cranial bones. The bony plates of the cranial vault are free to float like icebergs in an elastic sea of membranous dura. The mechanism of the fontanells, pliant cartilage, tender membrane, open sutures, cerebrospinal fluid and falx and tentorium has evolved so that what is, evolutionarily, a huge head can pass through a small birth canal intact. This is achieved by progressive and controlled cranial implosion.*

The craniocervical link

Biedermann (2001) suggests that the common denominator in all of these negative influences is undue mechanical stress impinging on vulnerable cerebral tissues and the craniocervical area. The result may include asymmetrical posture, morphology or movement patterns, as well as inappropriate responses to external stimuli.

Under normal conditions any minor distortions imposed during birth will resolve as a result of the influences of the reciprocal tension membranes within a matter of days, greatly assisted by the forces involved in suckling and crying (Frymann

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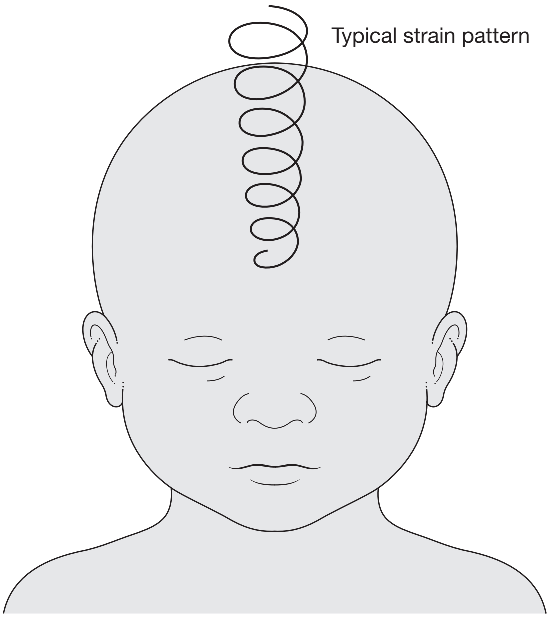


Figure A2.3 Schematic diagram depicting the typical cone-shaped, rotational strain seen at the sight of vacuum placement. The depth of extension into deeper tissues appears to be dependent upon the duration and intensity of application of the device. (Reproduced with permission from Carreiro 2003.)

1966). In many instances, however, such a recovery is not achieved due to the degree of distortion created, with sometimes disastrous consequences in health terms (Arbuckle 1948, Frymann 1976).

Distortions and deformities are often easily noted and may be the reason the parent(s) seek assistance. Behavioral problems such as incessant crying, feeding difficulties, 'head banging' or frank illness might cause parents to attempt to find appropriate professional help. Clearly if the health-care provider consulted is ignorant of the influence of cranial function on health, whatever is offered will be less than satisfactory.

After birth the pliability of the infant cranium continues to allow damage to occur more easily than once ossification has taken place. Falls and blows are obvious possibilities, and indeed probabilities, during the early years of life. If severe enough, these may produce problems similar to those which can occur during childbirth.

Biedermann (2001) describes what he terms 'KISS' children in whom the main clinical feature is torticollis, often combined with an asymmetrical cranium, postural asymmetry and a range of dysfunctional symptoms (see Fig. A2.4). KISS is an acronym for **k**inematic **i**mbalances due to **s**uboccipital **s**train. Biedermann notes: '(KISS imbalances) can be regarded as one of the main reasons for asymmetry in posture and consequently asymmetry of the osseous structures of the cranium and the spine'.

Among the many symptoms reported by Biedermann in KISS children are torticollis, reduced range of head/neck motion, cervical hypersensitivity, opisthotonos, restlessness, inability to control head movement and one upper limb underused (based on statistical records of 263 babies treated in one calendar year up to June 1995).

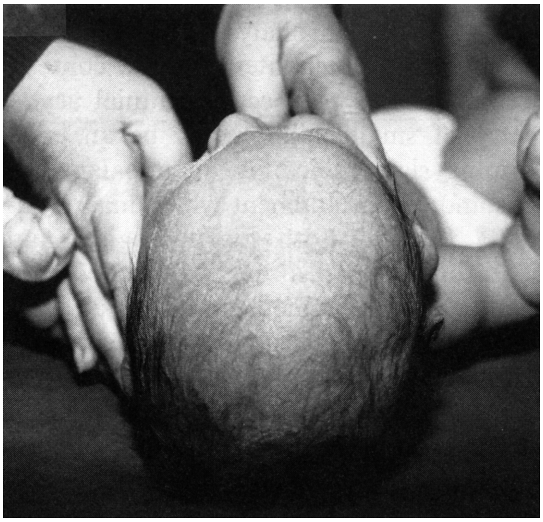
Biedermann (2001) is convinced that the most effective treatment for such infants is removal of suboccipital strain by manual treatment and not direct treatment of cranial asymmetry, as this is considered to be a symptom of the underlying problem (most commonly suboccipital strain). Following appropriate treatment to re-establish full range of upper cervical motion, functional improvement is reported to be common within 2–3 weeks, although normalization of cranial asymmetry takes many months.

How much treatment is required? According to Biedermann, of the 263 babies treated, 213 required only one treatment, 41 were treated twice and the remainder more often, with just two requiring 4–5 treatment sessions.

Sleeping position and cranial deformity

One of the reasons for KISS-like problems seems to relate to infant sleeping position. A research study by plastic and reconstructive surgeons has concluded that the almost universal acceptance of positioning neonates on their backs to avoid SIDS may well increase the incidence of abnormalities of the occipital cranial sutures, causing significant posterior cranial asymmetry, malposition of the ears, distortion of the cranial base, deformation of the forehead and facial structures (Argenta et al 1996).

The study reported that there had been a dramatic increase in the incidence of deformation of the occipital structures, although the patient



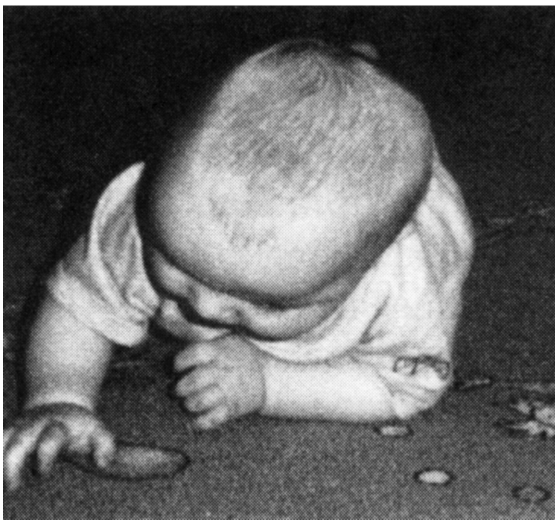


Figure A2.4 Two KISS babies with their cranial asymmetries. Both pictures were taken by the parents and are reproduced here with their kind permission. They show in both cases a right-convex KISS situation with the accompanying cranial scoliosis, microsomy of the left side of the face, flattening of the right occipital region and a seemingly asymmetrical positioning of the ears. All these morphological asymmetries need many months to subside. The important sign at the control 3 weeks after the initial treatment is the free movement of the cervical spine. (Reproduced from von Piekartz & Bryden (2001) with permission from Elsevier.)

referral base has not changed appreciably. Argenta et al note that the timing of this increase correlates closely with the acceptance of recommended changes in sleeping position to supine or side positioning for infants because of the fear of sudden infant death syndrome (SIDS). They report that older infants were treated with continuous positioning by the parent, keeping the infant off the involved side, while younger infants and those with poor head control were treated with a soft-shell helmet. Only three of 51 patients have required surgical intervention and other patients demonstrated spontaneous improvement of all measured parameters.

The researchers report:

> *We believe that most occipital plagiocephaly deformities are deformations rather than true cranio-synostoses. Despite varying amounts of suture abnormality evidenced on computed tomographic scans, most deformities can be corrected without surgery. In cases where progression of the cranial deformity occurs, despite conservative therapy, surgical intervention should be undertaken at approximately 1 year of age. (Argenta et al 1996)*

Other reasons for serious cranial distortion in infants, according to medical authorities

It is reported (Miller & Clarren 2001) that deformational plagiocephaly (cranial distortion or 'crooked head shape') can result from three different etiologic processes.

- Abnormalities in brain shape and subsequent aberrant directions in brain growth
- Premature fusion of a single coronal or lambdoidal suture
- Prenatal or postnatal external constraint.

What are the long-term effects of deformational plagiocephaly?

A study was conducted to determine whether there was an increased rate of later developmental delay in school-aged children who presented as infants with deformational plagiocephaly, without obvious signs of delay at the time of initial evaluation (Miller & Clarren 2001).

A total of 181 families from the medical record review were notified about the study and 63 families agreed to participate in a telephone interview. The sample of participants for the telephone interview was random to, and

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representative of, the group as a whole. The families reported that 25 of the 63 children (39.7%) with persistent deformational plagiocephaly had required special help in primary school including special education assistance, physical therapy, occupational therapy and speech therapy, generally through an Individual Education Plan. Only seven of 91 siblings (7.7%), serving as controls, required similar services. One useful finding was that affected males whose deformity was due to uterine constraint were at the highest risk for subsequent school problems.

It was also noted that the use of helmet therapy to correct the distortion (a standard medical approach) did not seem to affect the rate of developmental delay, almost half of the delayed patients having worn helmets (Miller & Clarren 2001).

Different cranial approaches

This text is not an appropriate place in which to offer precise details of infant cranial care, as the methods needed for application on such delicate structures need to be learned in closely supervised clinical and classroom settings. Suffice it to say that the method of application of cranial manipulation in infants is usually direct rather than indirect, i.e. the barriers of resistance are engaged and molding is applied to normalize distortions, utilizing very gentle and sensitive holding patterns.

Biedermann (a physiotherapist, whose work on KISS children is reported earlier in this appendix) applies a direct approach in cervical treatment of KISS children, using what is described as 'minimal impulse manipulation', commonly in a lateral direction but with a rotational component in some cases.

> *We measured the force used in treatment of babies and adults [and found] the force used for treating babies is 15–20% of that used in adults. In most cases the direction of the impulse is determined by radiological findings (85%). … The manipulation itself consists of a short thrust with minimal force of the proximal phalanx of the medial edge of the second finger.*

The amount of force involved, tested with a calibrated pressure gauge, required no more effort than would be needed to 'push a bell-button energetically'.

Clinical researchers and authors such as Viola Frymann (1976) and John Upledger (Upledger & Vredevoogd 1983) record many instances of success in treating dysfunctional children, some with severe learning and behavioral problems as well as a host of physical complaints, utilizing cranial techniques (Upledger 1978). Some research has been undertaken, notably by these two pioneers but also by others such as Californian osteopathic physician Carlisle Holland (1991), whose video evidence of the benefits of cranial manipulation is well worth study.

Holland discusses mainstream methods which attempt to address infant cranial distortion (largely from a cosmetic perspective). Some of the methods currently employed by orthopedic surgeons to 'correct' cranial distortions involve surgical removal of plates of bone from the skull, fusion of sutures and the imposition of irreversible damage to the cranial mechanism. An alternative is to inflict growing infants with the wearing, for years, day and night, of a 'helmet' which forcibly molds deviant skulls into cosmetically acceptable shapes, with no regard for functional integrity (and with an enormous degree of discomfort).

Visual evidence is available via videos (such as those produced by physicians such as Carlisle Holland) of the possibility of returning the growing skull to a degree of normality, structurally, with benefits aplenty in terms of symptom relief, from associated wry neck, visual and acoustic problems, as well as behavioral and learning difficulties. The younger a baby's head is treated the better as, once ossification commences, normalization becomes more difficult.

Should cranial distortion occur in infancy and childhood, when plasticity allows for a degree of movement not available in the adult skull, in particular in relation to the sphenobasilar synchondrosis (see especially Chs 1 and 2), the resulting distortion patterns, with their associated soft tissue imbalances of the reciprocal tension membranes in particular, will become 'set' and will be largely impervious to 'corrective' treatment in adult life. Some modification of the associated stress patterns can still be initiated via cranial and

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other therapeutic measures, even in adult life, but restoration of structural 'normality' and symmetry becomes a virtual impossibility after childhood.

Moving away from cranial distortion to far more common patterns of ill health affecting infants leads inevitably to the topic of chronic ear infection.

Ear disease and cranial care

Spermon-Marijnen & Spermon (2001) have treated many children with chronic middle ear disease, using cranial techniques. They report that: '60 children [with otitis media with effusion] were inspected and treated with passive movements of the craniofacial region over the past 6 years; 49 children were treated successfully and 11 showed no change'.

These children had been referred by general physicians because standard treatments such as insertion of grommets, paracentesis, surgery and/or antibiotic usage had failed. Spermon-Marijnen & Spermon (2001) suggest that 'passive movement of the cranium can restore the circulation and motion by which drainage of the middle ear is stimulated'.

It is worth reflecting that this model of care represents one of the therapeutic choices, discussed in Chapter 12, in which the objective is enhancing function so that the adaptation load (inflammation, congestion, etc.) can be better handled via enhanced drainage and circulation, with homeostatic/self-regulating mechanisms effecting the recovery.

As discussed in Chapter 12, these clinicians commence the process of treatment by observation, palpation and motion palpation.

> *Look at symmetry or deformity, paying special attention to asymmetry, the orbital line, the level of ears related to the level of eyes, and the mastoids. Palpate the vault and position of the sutures, noting swelling, overlap and mobility. Test the condylar parts of the occiput and examine the occipito-atlantal mobility.*

As has been repeated throughout this book, palpation and motion palpation merge readily into treatment: 'The techniques of passive motion testing are, in our opinion, also effective as therapeutic movements, with the application of additional or sustained pressure'.

In earlier chapters it has been suggested that treatment of the adult cranium frequently involves indirect methods ('exaggerate distortion'), although direct methods can also be useful (springing methods, decompression, V-spread, etc.). In contrast, when treating infants, direct approaches are most commonly utilized, reflecting the far more pliable nature of the tissues involved.

The following list is a summary of the methods described by Spermon-Marijnen & Spermon (2001) as relevant techniques used for children with chronic ear conditions. Some of these methods, as well as similar but not identical approaches, have been outlined in previous chapters, most notably in Chapters 6 and 7.

1. **Transverse movement of the sphenoid.** Sitting at the head of the supine patient, one index finger and middle finger on the sphenoid and the other index and middle finger on the contralateral zygoma and frontal bone, pressure is used to gently shunt the sphenoid into a translation. Hand positions then reverse and translation to the other side is introduced. In this same opposition rotation of the sphenoid is also achievable. Note: this is similar to the method described in Exercises 6.5a and b and 7.8. See also method 10 in Chapter 10, describing Jones's method for treatment of the sphenoid tender point.

2. **Longitudinal movements of the nasofrontal region.** Standing to the side of the supine patient, one hand over the crown of the head, the index finger contacts and stabilizes the supraorbital region on one side, while the other hand uses a pincer contact on the superior aspect of the nose to introduce a distraction force. This may be sustained or can rhythmically 'pump' the area. One side is treated and then the other to 'influence the frontal and maxillary sinuses'. While not identical, the methods described in Exercises 7.10 and 7.11 will achieve similar results.

3. **Transverse movement of the zygomatemporal and zygomamaxilla region.** The patient is supine and the practitioner is seated at the

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Figure A2.5 Movement of the zygomatemporal region. (Reproduced from von Piekartz & Bryden (2001) with permission from Elsevier.)

Figure A2.6 Movement of the zygomamaxilla region. (Reproduced from von Piekartz & Bryden (2001) with permission from Elsevier.)

head. One side is treated at a time. (a) Using finger and thumb contacts of each hand, one contact closer to the zygomamaxilla junction and the other closer to the zygomatemporal junction, a gentle distraction/separation is introduced as the patient's head is rotated contralaterally. (b) Thumb and index finger of one hand is placed on the zygoma and the same contacts of the other hand are placed on the maxilla, allowing distraction that eases the zygoma laterally and cephalad and the maxilla medially and caudad. The distraction is applied and released synchronous with the breathing of the patient several times. Spermon-Marijnen & Spermon suggest that these methods influence the maxillary and frontal sinuses. See Exercises 6.5c and 7.37 for variations on these approaches. See Figures A2.5 and A2.6.

4. **Longitudinal movement of the petrous bone (mastoid lift).** The patient is supine and the practitioner is seated at the head. With finger contact on the petrous portion of the mastoid bone, rhythmic repetitive longitudinal traction is applied cephalad, synchronous with breathing. This decompression approach is thought to influence the craniocervical region. See also Exercises 7.32 and 7.34 for rhythmic approaches utilizing leverage of the mastoid processes.

5. **Rotation of the forehead on hindhead.** The forehead is held with one hand, while the other cradles the occipital region, to act as a stabilizing force. The frontal bone is gently rotated clockwise then anticlockwise several times to influence sinus drainage. See also method 9 in Chapter 10, describing Jones's treatment of the sphenobasilar tender point, which uses similar mechanics (see Fig. 10.10).

6. **Distractions of relevant sutures.** A gapping pressure is applied at right angles across sutures. See Exercise 7.6 for a description of the V-spread technique, as well as method 11 in Chapter 10 describing Jones's treatment of the squamosal tender point, which distracts the parietal bone from the temporal, gapping the suture between them (see Fig. 10.10).

7. **Opening external auditory meatus.** The patient is sidelying, head on a firm pillow. The practitioner places two fingers of one hand on the mastoid process and two fingers of the other hand anterior and superior to the external auditory meatus. A rhythmic separation stretch is introduced, with the patient being asked to either swallow after each stretch, swallow during the stretch or perform a Valsalva maneuver during the stretch (i.e. inhale, hold the nose and attempt to exhale through the nose, creating increased pressure in the nasopharynx, in an attempt to open the Eustachian tubes).

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CONCLUSION

Cranial treatment of infants differs from the methodology applied to adults in that it usually involves direct approaches. Pressures used are even lighter for infants than the gentle methods suggested for adults. Whether problems are developmental or distortional or treatment is aimed at improving drainage (as in otitis or sinusitis), there are a range of effective treatment methods, examples of which have been described in this chapter.

CAUTION

It is essential that appropriate training is undertaken before infants are treated using cranial methods.

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