


*  **The benefits of chiropractic intervention for babies with sleep deprivation resulting from birth trauma**

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Information collated from the babies who attended a chiropractic clinic in England suffering from sleep problems.

Study objectives: 1. To ascertain how many of the babies attending clinic with sleep problems had suffered trauma at birth; 2. To evaluate whether chiropractic intervention improves sleep in babies/children who are suffering pain resulting from birth trauma.

Design: Babies and children (0–12 years) were considered eligible for inclusion in the study if the initial referral appeared to be linked to sleep disturbance and/or birth trauma. The treatment included gentle releases to reduce the cranial, skeletal torsion with the aim of restoring bilateral regularity and improving cranial pulses.

Using pre- and post-treatment questionnaires, the effect of the chiropractic treatment on the sleep and feeding patterns of these babies was assessed.

Setting: Abacus Chiropractic Clinic, Stratford-upon-Avon, UK.

Participants: The 220 subjects in the study were all children with a mean age 2.9 years (the majority were

infants). Of these, 54 presented with sleep problems, 90 presented with pain or discomfort, 62 presented with feeding problems and the remaining 14 subjects with non-specific problems.

Interventions: The parents of all subjects completed a questionnaire prior to the first consultation. At that consultation, a full assessment was carried out and a chiropractic treatment plan explained. The treatment given included gentle releases to reduce the cranial, skeletal torsion with the aim of restoring bilateral regularity and improving cranial pulses.

Measurements and results: 25% of the participants reported sleep problems in the pre-treatment questionnaire and, following chiropractic treatment, all participants reported improved sleep. Furthermore, another 30% of participants, who initially presented with other difficulties, noted an improvement in the duration of sleep, as well as improvements in the baby's ability to settle.

Conclusions: The results show a correlation between chiropractic intervention at the infant stage and improvements in sleep, reduction in discomfort and pain, and improved feeding.



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Background

This article presents information about the need for more empathy to be shown to infants who sustain some form of birth trauma and that the current perceptions of trauma require reclassification. Its publication in this journal is because it is also proposed that midwives are in the best position to assist in this vital process, communicating across agencies and disciplines (Hall & Elliman 2003). The evidence suggests significant numbers of babies continue to suffer pain as a consequence of birth trauma in spite of

the current electronic screening and sophisticated monitoring procedures during pregnancy (Edwards 2006). Pain resulting from birth trauma has been found to have a significant impact on a baby's ability to settle, sleep and feed and is thought to have an impact on a child's potential development (Kranowitz 2005, Wilson 2010).

Existing documentation does not take into account the different levels of trauma, whether this is minor, medium or severe and, surprisingly, assisted births are not considered traumatic. The current system of monitoring a classified trauma or problem following birth is both outdated and outmoded and is based upon a 'wait and see if the problem resolves itself' rather than a systematic clinical approach. Such an imprecise approach encroaches on infants' valuable health and developmental time. Therefore, 'use it or lose it' is actually a very apt phrase for the infant born in distress with brainstem impingement or cranial nerve dysfunction, but which might not be identified or given consideration with regard to treatment. From the chiropractic viewpoint, this time immediately following birth would be opportune for early assessment and referral for chiropractic treatment where necessary, which would ensure more stable sleeping and feeding patterns and utilising valuable recovery time for both the mother and the developing infant (Hall & Elliman 2003).

Events around labour

There is much investment in maternal and fetal health during pregnancy to maximise the opportunities to ensure a healthy mother and baby. However, despite these preparations, pregnancies can have complications and some labours can cause physical trauma to both the mother and the emerging infant.

Where progress deviates from normal, this may require surgical or pharmaceutical induction to stimulate labour and strengthen contractions, the assistance of ventouse or forceps, or as a final resort, an emergency caesarean section. Circumstances will dictate the type of anaesthesia and additional issues maternal health, a disproportionate size and fetal position may also require surgical assistance

with either an elective or emergency caesarean section.

Current birth assessments

Following a birth, universal maternal and infant observations are made to identify and reduce complications. The assessment of the newborn includes a range of observations and tests to evaluate the health and well-being of the baby. These apply parameters of normality for birth weight, height, head circumference, skin colour, infant reflexes (including sucking), hip checks and blood screening tests. It would appear that there are no routine tests for cranial or skeletal assessments except the fontanelles.

A discussion of birth trauma

While the initial assessments are designed to verify physical normality, there is an argument that each infant should be viewed holistically. There are aspects that mean the baby is pre-programmed to a certain extent by its genetic make-up, gestational growth and development, gender, experience of birth, birth weight and health, and all play a role in the newborn's first experiences of life. A normal healthy infant from a natural birth will have experienced a cascade of physiological events which include oxygenation, respiration with response breathing and cardio-vascular heartbeat, and initiating cerebrospinal fluid flow (CSFF). These interrelated events all create their own individual interplay and affect the infant's health status and their initial condition at birth, assessed by the Apgar score.

As part of birthing there is a natural process that affects the folding of the cervical spine and the moulding of the cranial bones. This physiological process has a time period specific to each baby and is considered to be most effective when the fetus is in the optimal position to go through the bony pelvis and the mother's cervix is fully dilated. When this process is underway, the natural hormones of the mother help her manage the birth pain efficiently and effectively, supported by professional guidance as necessary. The birthing process also initiates the physiological responses required to initiate independent life and a key chain of events enables the infant to kick-start homeostasis and cellular regeneration from birth, along with

the necessary assimilation and information-processing.

However, the descriptions of what appears to be even the most straightforward birth, can hold some significant dangers for the baby who may suffer micro-trauma of the brain stem tissues in the periventricular areas (Valk *et al* 1991). This trauma can arise where there is some degree of torsion of the cranial and dura matter, the under- or over-moulding of the cranial bones, or the tightening of the cord around the infant at delivery where these result in impeded oxygen flow and a delay with oxygenation. The crucial role of the midwife and birthing team is to not only offer support and guidance but to undertake screening procedures to monitor fetal condition and progress of labour, with a range of interventions being available where necessary.

Following the birth of a baby in a reasonable condition, unless there is an obvious injury, little importance is given to the specific events of the labour and whether these might have put the baby at risk of cranial trauma. Laroia (2006) concluded that '*recognition of trauma necessitates careful physical and neurologic evaluation of the infant to establish whether additional injuries exist. Symmetry of structure and function should be assessed as well as specifics such as cranial nerve examination, individual joint range of motion, and scalp/skull integrity*'.

The birth process for some may positionally compromise the hind brain – the brainstem relay system to the higher cortex which impacts on learning. The brainstem surrounding the top of the spinal cord regulates basic life functions like breathing and the metabolism of the organs. It is from the brainstem (which is near maturation at full gestation) that the higher-functioning emotional centres emerge. All midwives should recognise the concept that acquired or learned knowledge begins from the first day of birth; therefore, even a minor 10% dysfunction at the first assessment may trigger cascading events. This may manifest itself in inappropriate messaging. As a consequence, basic needs are not met and one can conclude that learned behaviour or acquired knowledge is restricted,

misconstrued or, at worse, halted at a very early age.

Recognising cranial trauma

Currently, the health care system in the UK advocates prevention, early detection and referral of problems that arise during the peri- and postnatal period, continuing until school age (DH 2004). However, current screening procedures endorse the wait-and-see approach to many birth injuries with the consequence that many of these will be missed (Gottlieb 1993). Gottlieb (1993) also states that '*birth trauma remains an underpublicized and therefore an undertreated problem*'. He recommends further documentation and studies directed towards prevention. In the meantime, he suggests that manual treatment of birth trauma injuries to the neuro-musculo-skeletal system could be beneficial and this is well within the means of current practice in chiropractic and manual medicine.

The well-established neonatal screening process in the UK could be utilised further to include a cranial assessment. Such a robust system could be more finely tuned to identify cranial and skeletal anomalies at birth and address them without delay, so that there is less risk of these hindering the baby's development. No studies identified birth-associated trauma, such as hypoxia or longevity of hypoxia (interruption or reduction of oxygen during birth), bruising, flat or tired babies, puffiness around the eyes, forceps marks, and misshapen or asymmetric heads, and it is these kinds of trauma that often go undocumented. Terrett (1993) discussed cerebral dysfunction theory and how decreased circulation to the brain can lead to loss of cell function and decreased cerebral blood flow, hypoxia, hibernation, and eventually cell death. However, there appears little correlation to hypoxia and associated repercussions at birth, including reduced cerebral blood flow. Cranial nerve injuries include unilateral branches of the facial and vagus nerves, specifically the recurrent laryngeal nerve, which is most commonly involved in cranial nerve injuries and can result in temporary or permanent paralysis. Laroia (2006) writes '*resolution may take several months*'. Laryngeal nerve injury may affect swallowing and breathing, cause

a hoarse cry or respiratory stridor and improvement can take up to six to 12 months. Infants who present in a paediatric chiropractic clinic often struggle with sleep and feeding problems, failure to thrive, show reflux, and gag. All are symptoms related to nerve dysfunction and minimal cranial chiropractic intervention is consistently effective.

Localised lateral or occipital cranial flattening result more often from forceps or vacuum-assisted deliveries, leaving infants born bruised with a cephalo-haematoma or torticollis which is left untreated (Peitsch *et al* 2002). There has also been a significant increase in plagiocephaly, especially since it was recommended to place babies on their backs as they are then inclined to lie their head to the flattened side, which increases the risk of progression to full deformational plagiocephaly. Several studies have looked at the long term developmental outcomes in children with deformational plagiocephaly. Miller and Clarren (2000) identified that 40% of children had received special help in primary school including special educational assistance, physical therapy, occupational and speech therapy. Panchal *et al* (2001) found that 43% of the children studied were within normal limits, 48% showed mild delay and 9% had significant delay. These findings were supported by Kordestani *et al* (2006) who found significant delays in both mental and physical development and no children with accelerated learning. No references, however, were made to sleep patterns or sleep from birth.

The potential impact of birth trauma on the developing child

There appears a paucity of literature regarding infant birth trauma linked to pain and sleep disruption, as well as a disregard for parental stress and feelings of inadequacy (Wolfson *et al* 1992, Twycross *et al* 1998). Each baby responds very differently to birth and trauma surrounding birth and this response ranges from requiring special hospital care to being calm and content from the outset. However, there are many cases where babies display seemingly minor ailments as a result of birth trauma which present as having trouble settling and sleeping, difficulty feeding or winding,

irritability, and suffering with colic, reflux, constipation and discomfort. These babies often cry persistently as a result of discomfort or pain, which has a significant impact on sleep patterns (Sadeh 1996).

Left unresolved, problems stemming from a birth trauma, particularly sleep disruption, can have significant impact on the nervous system, leading to behavioural problems and academic underachievement. Affected children can present like a swinging pendulum, moving continually from one extreme to the other (Giedd *et al* 1999, Wilson 2010). Children present with multidimensional delay and are consequently assigned a myriad of labels, including sensory integration dysfunction (SID), sensory processing disorder (SPD), attention deficit disorder (ADD), attention deficit hyperactivity disorder (ADHD) and autistic spectrum disorder (ASD). Stores and Wiggs (1998) discussed abnormal sleep patterns associated with autism and related syndromes, yet little evidence is available regarding which comes first: the sleep disruption or the symptoms of the syndrome.

The relationship between pain and sleep loss and the consequent impact on normal development is also often overlooked. Sleep is necessary for cellular health, regeneration, development and a cascade of inter-related physiological events. Pain disturbs sleep and sleep loss reduces the pain threshold, as well as concentration span and the ability to learn. Some levels of developmental delay are a direct result of that negative interplay.

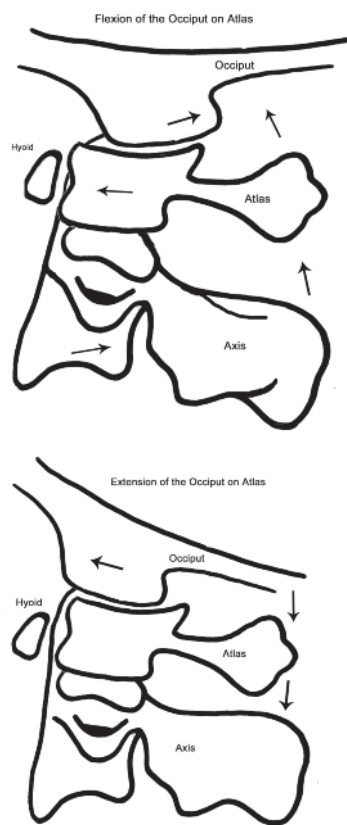
Benefits of chiropractic use in these circumstances

The brainstem, whilst protected by ligaments, cranial bones and cervical bones, can be compromised by trauma to those supportive elements and structures. The occipital bone, with the foramen magnum protecting the spinal cord and meningeal dura, geographically rests or sits on the atlas (C1), which in turn sits on the axis bone (C2) and so on. There are seven such interrelated cervical (neck) vertebrae shaped to intercept with the next, so enabling full movement. The interconnected shape, structure, strength, and function are all critical for the remaining spinal vertebra.

Within the cranial vault, there is a system of divisions and reinforcing struts protecting the brain. The delicate balance and function of the duras, falx and tentorium (reciprocal tension membrane) form a fine web to create the unique tension required. The meningeal dura, with the arachnoid membrane and pia mater, form the dural tube enveloping the spinal cord. The dural tube is attached firmly at the foramen magnum, with insertions to the second and third vertebra, where it becomes free of attachments through to the sacral periosteum. CSF bathes the brain and cord in what can be simply described as a 'slow-wave connectedness' to respiratory and vascular rhythm. The incoming arterial pulse affects CSF by altering and displacing venous blood into the sinuses and promoting cerebral circulation.

A venous backpressure and volume of blood in the head can affect CSF dynamics and flow. The meningeal and cranial dura with its 5% elasticity permits a small degree of movement between the bones it attaches to.

Fig 1. Position induced dysfunction of the atlanto-occipital interplay



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If trauma was sustained at a crucial area unique to each baby, this trauma would progress, escalate and compound in the first few days of life. What may have started as a micro-trauma may then lead to more serious trauma. Post-birth handling and intervention also impacts on the traumatised baby and midwives play a key role with detection of this and guidance as to its cause and management. A baby will react to positions that threaten their survival, such as increased pressure on the occiput and atlanto occipital junction which causes a CSF flow pressure change which is unacceptable to them. This would trigger heightened pain awareness and a survival response of crying. The cranial, cervical and spinal bones protect the brain, vascularity, cerebral spinal fluid flow, vital nervous system and neural circuitry. The movement of bones alters the pressure on the spinal cord and hindbrain, altering physiological orchestration, cranial nerve function and vascular regularity. This bone movement can impact both in a positive or negative way, depending on existing tension and torsion, as shown in the side view in Fig 1.

The importance of the interconnectivity of the cranial and cervical bones can be seen and reflected in an efficient sucking mechanism, through the synchronicity of the atlanto-axial and atlanto-occipital joints, and the stability and motion of the tempomandibular joint. The position adopted by an infant for sleep impacts further on the positional interplay of the cranial and cervical bones and function. The head position, coupled with respiration, result in the back of the head moving towards the neck. The occiput moves and the tension and torsion increase. The baby's survival mechanism (the amygdala) kicks in and leads to the baby waking and crying until it is picked up. Once picked up, the negative chain of events is halted and reversed, the occiput alters position, and tension releases which results in a cerebral spinal fluid flow pressure change. The triggered amygdala stops and the baby calms.

There is an awareness that, in babies, the combination of a near-mature amygdala at birth and an immature cortex (acquired knowledge site), which stays underdeveloped, impedes essential physiological orchestration

and therefore outcome. The baby would therefore struggle to progress from one developmental stage to another or may even remain in a state of inertia.

Without treatment, this critical process of physiological interconnectivity may be halted. This can affect specific and general progress, including the development and function of cranial nerves, which prevent even the simplest survival tasks from developing fully. As a result, the physiological response activated by the amygdala in the immature generalised synaptic neural pathways remains in that simple state. If the brainstem were damaged at birth or thereafter, prior to full maturation, the amygdala would continue to have full control over the acquired or learned behaviour response. The interdependent communication system necessary for higher-brain involvement would largely remain underdeveloped, or would be slow to develop, as the necessary interconnecting neural circuitry would not progress and mature as it should. This would mean the baby lacks the necessary interconnectivity required to progress and develop at a normal rate.

The resulting child may display a heightened or lowered sensitivity and utilise only or mostly the innate perpetual fight-flight response, with little intervention from the higher-skilled, slower-processing cortex, which serves to calm and reason (Goldberg 2001). The swinging pendulum child operates in extremes and would be compromised, or possibly incapable of adapting to family values or understanding the difference between right and wrong.

There are recognised techniques for all chiropractors and the McTimoney technique used (a cephalo-caudal route of assessment and care) compliments the development of the infant. The McTimoney Chiropractic College in the UK (www.mctimoney-college.ac.uk) provides a modular programme leading to a Masters in Paediatric Chiropractic, and all chiropractors are regulated by the General Chiropractic Council (www.gcc-uk.org).

As more sophisticated monitoring systems are used, information gathering is more accessible, and evidence-based research is being compiled and implemented by all

practitioners seeking optimum care for their patients. This theoretically should reduce bias and narrow the gap between both conventional and other health care disciplines. Patients are often confused by misinformation, therefore improved interdisciplinary communication, accessibility and accountability through all disciplines should be encouraged to the benefit of all. This paper reflects five years of clinical observation culminating in the results discussed. A barn door obvious solution to an extensive problem.

Methods of the study

We had observed high numbers of children presenting in our clinic with sleep disruption, in pain, and with varying levels of developmental delay. This led to further investigation and evaluation of 145 record cards in 2006 which revealed 95% of the children treated had suffered some form of trauma surrounding their birth.

Based on these findings, a more detailed investigation was proposed which would include all babies treated, irrespective of mode of delivery, the parity of the mother or the referral mechanism. A time period spanning 21 months from June 2007 through to March 2009 was identified. Parents gave consent for collection of information on their child, and agreed to complete pre- and post-treatment questionnaires. The pre-treatment questionnaire provided a full history of the pregnancy, birth and parental concerns. All babies presenting with reduced cranial nerve function or limited range of movement in the neck and head with limb involvement were tested in the same way. These infants had been referred to the clinic either by the birthing or perinatal midwife, general practitioner or hospital staff. The treatment included gentle releases to reduce the cranial, skeletal torsion, ultimately restoring homeostasis and

improving cranial pulses. The parents were sent a post-treatment questionnaire by the resident occupational therapist three months after their final acute phase treatment.

An advisory panel included an occupational therapist, independent assistant and parent advisor. The study was given institutional and ethical approval by the McTimoney Chiropractic College in Abingdon.

Results

The study included 220 children with a mean age of 2.9 years with a range of a two day old baby to a 12 year old. Of these, only 24 (11%) were considered to have had a normal birth. The majority 196 (89%) of the babies attending clinic were reported by their parents to have suffered some sort of trauma at birth, 74/38% of these had suffered multiple traumas (see Tables 1 and 2, and Graph 1).

Of the babies who presented initially with specific difficulties, 54 (25%) were suffering significant sleep disturbance, 90 (41%) were described as unsettled or in pain (affecting sleep) and a further 62 (29%) had problems feeding. Following treatment, all of these babies were reported to have shown improvements in these areas. In addition, parents who had not noted these issues as a specific problem reported improvements following treatments, so sleep disturbance was improved for a further 68 (31%), 44 (20%) babies were not so unsettled or in apparent pain and feeding improved for 57 babies (26%).

There was also a range of other concerns at the initial consultation, all of which appeared to have shown improvement following treatment (see Table 3).

All parents involved in the study stated that they would have liked a cranial and

skeletal assessment alongside the other checks their baby received at birth, and all parents would have liked an early referral by their midwife and chiropractic treatment for infants to be more widely available. Early assessment and intervention resulted in improvements in cranial and CSF flow balance and thus the optimum functioning of the higher cortex.

Discussion

Two of the most notable findings of the study were how many babies and children present in pain, with sleep and/or feeding problems and the frequency with which these babies suffered some form of birth trauma. Significantly, many of the traumas were not officially documented or were understated. As can be seen from Table 1, the traumas included a range of factors, from induction, fetal distress, hypoxia leading to the need for multiple levels of assistance prior to caesarean section. It was notable that many babies were brought to the clinic several weeks after their birth with unresolved bruising, puffy eyes, cone-shaped heads, cephalo-haematomas, cranial asymmetry, tortocollis, and various degrees of plagiocephaly. Parents also reported that their babies had one or more of the following symptoms: poor sucking, bouts of inconsolable crying, difficulties with feeding (both breast and bottle), poor weight gain, an inability to settle or sleep when put down, snuffly noses or breathing noises, sticky eyes, reflux, and colic.

We feel that the results of our research confirm the importance of early referral for babies and the benefits of chiropractic intervention at this stage, especially for those babies who suffered trauma at birth and are

Table 1. Seven key areas of birth trauma* suffered by subjects

Trauma	Number of subjects
Baby became stuck and required some kind of assistance	62
Induced labour	44
Ventouse assistance on the baby's head	38
Forceps assistance	30
Emergency caesarean section	41
Cord wrapped around the neck	37
Infant distress	34

* There are multiple levels of trauma surrounding birth, but seven key areas have been identified for the purposes of this study.

Table 2. Other birth traumas suffered by subjects (including those births considered to be 'normal')

Trauma	Number of subjects
Long labour	73
Short labour	51
Difficult labour	45
Assisted labour	22
Manually-assisted labour (turned)	13
Elective caesarean section	25
Placenta problems	10
Heart problems	7
Breathing problems	15
Infections	3
Abnormal head shape	33
Special care baby unit	33

neonatal & infancy

Table 3. Other problems reported by subjects at first consultation and improvements reported in each area after chiropractic treatment

Problem	Number of subjects reporting problem at first consultation	Number of subjects reporting improvements after treatment (regardless of initial problem)
Reassurance/check-up	30 (14%)	N/A
Developmental challenges	15 (7%)	59 (27%)
Random/clumsy movements	22 (10%)	88 (40%)
Agitated/unhappy/colic	6 (3%)	97 (44%)
Bowel problems	14 (6%)	50 (23%)
Head shape/plagiocephaly	20 (9%)	65 (30%)
Unwellness/illness/immune problems	15 (7%)	38 (17%)
Sensory noise issues	6 (3%)	16 (7%)
Verbal	6 (3%)	39 (18%)
Social interaction	12 (6%)	33 (2%)
Other	4 (2%)	21 (10%)

consequently suffering from pain-related sleep disturbance. Excessive infant crying is often diagnosed as colic (White *et al* 2000) and crying can affect cortisol production. Midwives are in a privileged position with their skill base for early detection. Below is an explanation of the relevance of chiropractic treatment in cases of infant sleep disturbance.

Conclusion

Our findings confirm that babies and children who suffer birth trauma are affected by sleep disruption but that where the focus in the first few days following birth is more on feeding and adequate weight gain, little consideration is given to the fact that a baby who does not settle may be in pain. With an appropriate screening process in place, each child suffering trauma and sleep disruption could be adequately treated following birth. It is

recommended that midwives and health visitors and health workers are trained in the early detection of known cranial anomalies and they can then refer the baby to a paediatric chiropractor. Chiropractic intervention would be a simple low-cost application and a solution to the spiralling costs of treating and assisting children with developmental delays later in life.

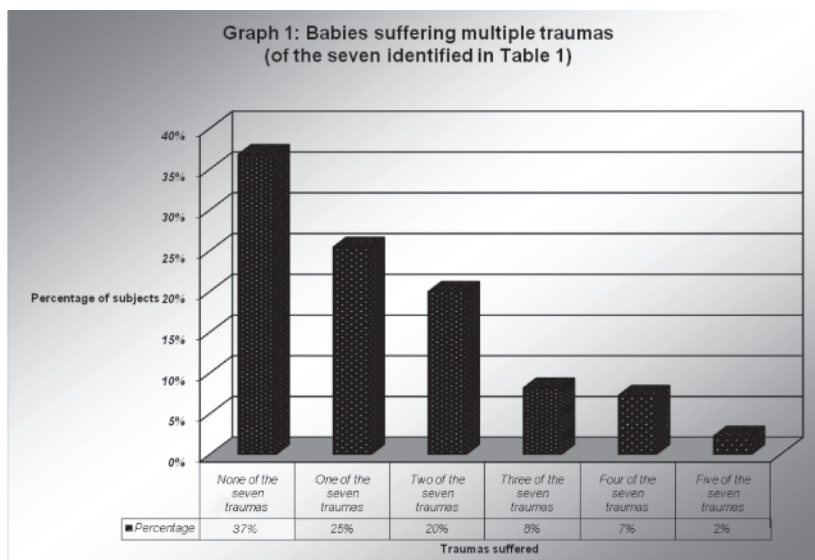
About the Abacus Clinic and the authors

Abacus Chiropractic and Physical Therapy clinic, a double award winning practice based in Shakespeare's Stratford, provides a range of care for the entire family. The team ensures careful assessment and a treatment plan tailored to individual needs. Careful guidelines are given to all patients especially parents of babies and young children (www.abacushealth.co.uk).

Deirdre Edwards, the principal chiropractor (chief investigator of the study) has specialised in child health care since 1971. With a combined paediatric nursing qualification, she joined the first UK based multi-disciplinary and multi-agency paediatric assessment day unit based at the City Hospital in Nottingham. Pursuit of prevention led to health visiting with an extensive caseload, including interdisciplinary involvement, case conferences and referrals of disadvantaged children, prior to further studies as a chiropractor. Involvement at Chair level, a Fellow of professional associations, and founder of the successful Abacus Clinic, fuelled the need to self-fund the research of five years to enable more babies and children achieve their personal optimum best.

Claire Gibb qualified as an occupational therapist 1988 and specialised in adult mental health, children and adults with learning disabilities and special needs. With multi-cultural experience gained in South Africa, Dubai, and Malaysia, this wealth of cultural insight was reflected in the research and assistance in the children's clinic at Abacus. Information collated enabled statistical evidence to monitor outcome.

Jo Cook assisted Abacus in patient communication and refined management systems prior to university where he obtained a first degree in communications media and culture. He initiated computer software systems bespoke to the children's clinic, and assimilated the statistics into a manageable form for interpretation.



* 81 subjects fell into the first category: None of the seven identified traumas. Of these, 57 reported another kind of birth trauma not included in the seven key areas. Furthermore, amongst the remaining 24 subjects who reported a normal birth, there were reports of particularly long or short births, some infant distress, and concerns over the baby's head shape.

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