

JCCP

JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS



VOLUME 15 • NO. 2 • MAY 2016

PUBLICATION OF THE COUNCIL ON CHIROPRACTIC PEDIATRICS
INTERNATIONAL CHIROPRACTORS ASSOCIATION

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The Journal of Clinical Chiropractic Pediatrics (JCCP) is the official peer-reviewed journal of the Council on Chiropractic Pediatrics, 6400 Arlington Boulevard, Suite 800, Falls Church, Virginia 22042, U.S.A.

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Chiropractic research featured in the *Journal of Evidence-Based Complementary and Alternative Medicine*

By Cheryl Hawk, DC, PhD, CHES

Even though chiropractic care is now used annually by nearly 14% of adults,¹ it is used far less by children. A 2015 analysis of National Health Interview Survey data indicated that 3% of children aged 4-17 used chiropractic, and data were not even reported for those younger than 4-years of age.² The evidence base for chiropractic is primarily built on studies of adults with musculoskeletal complaints.³ As the health care systems of the world increasingly rely on scientific evidence of effectiveness and safety in order to authorize use of healthcare practices and treatment, it is essential that the chiropractic profession conduct high-quality research on special populations, particularly children.

The March 2016 issue of the *Journal of Evidence-Based Complementary and Alternative Medicine* is dedicated to chiropractic research—a first for this journal, and unusual for any medical journal. As guest editor of this issue, part of my responsibility was to encourage submissions, which were of course then rigorously peer-reviewed. Readers of the *Journal of Clinical Chiropractic Pediatrics* should be pleased to see that four of the seven articles included in this special issue were on the topic of chiropractic care for children. The abstracts of these articles are included in this issue of *JCCP*. They covered many aspects of chiropractic pediatrics: breastfeeding counseling in an interdisciplinary clinic which included chiropractic care and midwifery (Miller et al); a survey of obstetricians' opinions on chiropractic (Weis et al); description of a reporting system for Doctors of Chiropractic (Pohlman et al); and description of a consensus-based set of core competencies for chiropractors treating children (Hewitt et al).

All these high-quality articles shared the themes of the importance of interdisciplinary collaboration and communication and the strong emphasis within the chiropractic profession on establishing practices and procedures that optimize patient safety and outcomes.

The publication of these articles in a journal with a primarily non-chiropractic readership is a great benefit to our profession, and to that portion of the profession focusing on pediatric care in particular. These articles are likely to increase other professions' awareness and knowledge of chiropractic pediatrics, and also to enhance the credibility of the profession in general. *JCCP* thanks the authors of these articles for their dedication to research and to the welfare of all children.

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The infant with dysfunctional feeding patterns — The chiropractic assessment

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ABSTRACT

The World Health Organization recommends exclusive breastfeeding for the first 6 months of an infant's life, followed by the introduction of complementary foods while breastfeeding for 2 years and beyond. Early and consistent breastfeeding support can often make the difference in a dyad's ability to establish a functional breastfeeding relationship. While challenged dyads can sometimes accomplish competent breastfeeding given appropriate support, necessary interventions, and an opportunity to learn; timing is critical when a neonate has not been transferring adequate milk volume or is managing feeding in a passive or compensatory manner. Chiropractors should be most familiar with the diagnosis and treatment of musculoskeletal dysfunctions that could result in an inability to feed. They should also recognize and treat the compensatory changes that will develop in a healthy, neurotypical neonate who is challenged by an inability to feed efficiently in order to prevent the evolution of long term physiologic and postural ramifications.

Key words: breastfeeding, dysfunctional feeding, chiropractic, International Board Certified Lactation Consultant, tethered oral tissue, tongue tie, lip tie, neonate, pediatric.

Introduction

The World Health Organization recommends exclusive breastfeeding for the first 6 months of an infant's life, followed by the introduction of complementary foods while breastfeeding for 2 years and beyond.¹

According to the 2014 breastfeeding report card produced by the CDC, breastfeeding rates continue to rise in the United States. In 2011, 79% of newborn infants started to breastfeed, 49% were breastfeeding at 6 months, and 27% at 12 months. (However, it is important to note that this does not represent exclusivity, as another CDC report states that exclusivity rates did not rise between 2002 and 2012).² Additionally, the number of IBCLCs (International Board Certified Lactation Consultants), and others trained to support breastfeeding in various clinical and community settings has also increased.^{3,4} Short-term risks of artificial-feeding have been well-documented across the literature and include increased obesity and incidence of infection – including acute otitis media, respiratory tract and gastrointestinal infection. In the long term, failure to breastfeed is likely a factor in the development of inflammatory bowel disease, celiac disease, and diabetes. Artificial-feeding has also been associated with increased blood pressure and cholesterol levels in adulthood.⁵

Early and consistent breastfeeding support can often make the difference in a dyad's ability to establish a functional breastfeeding relationship.⁶ Despite the fact that challenged

dyads can still accomplish successful breastfeeding given time-appropriate support and interventions, timing is critical when a neonate has not been transferring milk. If released from the hospital without appropriate assessment of latch and transfer, symptoms may not appear until the dyad has gone home and the neonate's status can rapidly decline. Neifert (2001) makes a compelling argument for the importance of recognizing and resolving breastfeeding dysfunction as it affects neonatal health: "Clinicians must overcome the tendency to view the complications of mismanaged breastfeeding as an indictment of the "process". Instead, pediatric practitioners are obligated to confront the reality of breastfeeding failure, identify associated risk factors and implement intervention strategies to prevent infant morbidity."⁷

Once at home, an infant who cannot transfer milk may quickly become a lethargic infant but may be perceived as a well-behaved baby. Even if parents express concern, they are often advised not to wake a sleeping baby by well-intentioned but ill-informed family, friends, or healthcare providers. Without daily weights to observe weight loss (or gain), or taking note of the requisite number of wet diapers or stools produced, this failure to feed may go unnoticed until the situation has become tenuous, or worse, untenable. When the infant is unable to transfer a sufficient amount of milk to sustain normal activity, they will often fall asleep at the breast waking shortly afterward and crying inconsolably until put to breast again. Other signs of inadequate

milk transfer include feeding for short intervals very frequently or the infant who never gets off the breast yet fails to gain weight and meet developmental milestones.⁸ Alternatively, these babies may gain adequately in the short-term if the mother has a robust milk supply and is willing to nurse very frequently, however milk supply is dependent upon milk removal, not only time at breast.⁹

New parents often receive input from a variety of sources including family members, friends, and daycare providers as well as parent support groups and local service organizations like La Leche League¹⁰ or Breastfeeding USA.¹¹

But with all these different sources of information, there is risk of parents being overwhelmed by confusing or conflicting information, as well as myth and bias. Parents need educated support to help them evaluate the available information and resources so they can make informed decisions. Tow and Vallone (2009) assert that this role should ideally fall to the appropriately trained healthcare provider, the International Board Certified Lactation Consultant or IBCLC.

Despite the IBCLC being the most suitable portal of entry for breastfeeding education and support, a mother can potentially receive guidance at a variety of junctures: while still in the hospital by nursing or lactation support staff, incidentally at a routine well-baby follow up with nursing staff, well baby clinic or pediatrician check up due to failure to gain weight, in consultation with another provider because of past experience with a sibling or based on their reputation (taking their newborn to a chiropractor for breastfeeding difficulty), or due to an emergent condition requiring a trip to urgent care (a somnolent infant who cannot be roused). Although some of these professional interactions are with healthcare providers who have sought additional education or have experience in this arena, these interactions are often fraught with conflicting or misinformation which can lead to frustration and failure without seeking the support of an IBCLC.

Chiropractors should be most familiar with the diagnosis and treatment of musculoskeletal dysfunctions that could result in an inability to feed. The delicate balance required to nurse and transfer breast milk successfully is influenced by the functionality of the associated joints, soft tissue, and nerves of the cranium and cervical spine. Full, normal function may be negatively influenced by the neonate's innate ability to compensate for any "roadblocks" it might encounter (ranging from neurologic and musculoskeletal implications of birth trauma to the presence of a tongue or lip tie). The chiropractor also needs to recognize and treat the compensatory changes that will develop in a healthy, neurotypical neonate when challenged by an inability to feed efficiently to prevent the evolution of long term physiologic

and postural ramifications.^{12,13,14}

A chiropractor may not be the first individual who will be positioned to support the breastfeeding dyad when challenges arise. Frequently, our role will be collaborative. Yet, with the increasing number of parents seeking early assessment by a chiropractor for their newborns^{15,16,17,18} it behooves us to educate ourselves as to the differential diagnoses related to breastfeeding. This means the ability to identify the infant who cannot feed efficiently (or at all), is failing to thrive, or feeding in a compensatory pattern; and make referrals as appropriate.¹⁹

Other healthcare providers the chiropractor can expect to collaborate with when working with an infant who cannot feed include: IBCLCs, midwives, naturopaths, nurses, pediatricians, dentists, oral surgeons, pediatric surgeons, ear/nose/throat (ENT) surgeons or otolaryngologists, speech and language pathologists (SLP), occupational therapists (OT), oromyofunctional therapists (OMT), or other feeding or airway specialists who may play various roles in the care of the infant. Unfortunately, the parents may also be receiving conflicting information from these providers. When this happens, they are in even greater need for an advocate to help them create a plan of care for their infant to reduce the risk of premature cessation of breastfeeding.

When any one of these healthcare providers recognizes that the dyad is having breastfeeding challenges, an assessment should be performed including a system survey. The musculoskeletal examination (at which the chiropractor should be proficient) may reveal biomechanical dysfunction. For example, decreased range of motion of the joints of the cranium (like the temporomandibular joint) can interfere with a neonate's ability to gape comfortably and competently latch and transfer milk. Restricted cervical range of motion can result in discomfort or inability to latch with resultant behaviors like arching at the breast, crying in frustration, or pulling off the breast repeatedly.^{20,21,22,23,24,25,26,27,28,29}

The collaborative protocol might include components of natural alternatives and/or holistic interventions based on the presenting diagnosis. Interventions may be straightforward and limited to chiropractic adjustments to restore normal joint function and neurologic competency or may be fraught with comorbidities and expand to include surgery (most often to release tethered oral tissues),^{30,31} supplementation to provide calories, rehabilitative exercises, pharmaceuticals, homeopathy and nutritional supplements to support gastrointestinal health and wound healing under the instruction of the IBCLC or other healthcare providers.

It would be helpful for the chiropractor to familiarize themselves with the prescribed interventions as well as the sup-

portive measures to treat many of the comorbid conditions. Part of the chiropractor's role may be to help support the parents who have trepidation about recommended procedures. The chiropractor may also offer encouragement for parents having difficulty being compliant with protocols that may be required to help their infant attain competent feeding, ranging from a frequent pumping schedule to wound care and stretching after the revision of oral tethered tissues (lip, tongue, or buccal ties). The recognition that many of these interventions serve to prevent early cessation of breastfeeding³² is critical but the chiropractor is ideally suited to evaluate and explain the implications of musculoskeletal dysfunction as it relates to current dysfunction as well as potential problems that could arise in the future if left unaddressed.

To underscore the importance of correcting altered oral motor function (whether structural, neurological, or mechanical), there has been an association with a wide variety of developmental issues. Some that have been (or are currently) under multidisciplinary exploration include failure to thrive,³³ airway dysfunction, SIDS, aerophagia (resulting in colic and reflux),³⁴ dental caries,³⁵ oral motor dysfunction, malocclusion,^{36,37} decreased patency of the sinuses, narrowed palatal architecture, snoring, sleep apnea and sleep disordered breathing,^{38,39,40} disrupted immune function (including tonsillar hypertrophy), gastrointestinal dysfunction, and challenges in speech and articulation.^{41,42}

Physiologic function

There are far reaching effects because of the intimate relationship between the musculoskeletal and the nervous systems. Structure affects function and vice versa. Mechanical dysfunction can result in a lack of peripheral mechanoreceptor input to the central nervous system (CNS) which can influence a range of functions from the level of alertness to the modulation of visceral (mastication, swallowing, vomiting, peristalsis, glandular secretion, bladder control) and somatic (posture and general muscle tone) activities.

Local and global lack of mobility of the connective tissue (fascia) and articulations of the cranium, spine and extremities (due to injury, edema, adhesions, and compensations) can result in traction of the fascia which can also cause a mechanical barrier or alter afferent input to the CNS.⁴³

Breathing and eating are the neonate's primary driving physiologic functions. The neurologically competent neonate will draw his or her first breath and seek the breast immediately when there is no interference.⁴⁴ If anything impedes the accomplishment of these initial goals, compensations will be developed as rapid plastic connections are made in the neonatal brain. This neuroplasticity assures survival under adverse conditions even at the expense of

structural changes to achieve physiologic homeostasis. Even the neonate impaired by genetics, pharmaceutical intervention, or birth injury will frequently demonstrate this amazing ability to create compensatory neuronal pathways to accomplish these functions so basic to survival.

Structural interference impeding breathing may take other forms. For example, the use of the infant car restraint system, the "baby bucket," results in an infant positioned in a flexed posture who may not be able to inspire with sufficient capacity to supply the required oxygen to maintain sustainable pO₂. Premature or impaired infants like those with posterior tongue ties may be at even higher risk.⁴⁵

The neonate uses six cranial nerves, 22 bones connecting at 34 sutures, and 60 voluntary and involuntary muscles in order to accomplish a smooth suck, swallow, breath sequence.⁴⁶ When the movement at any of these articulations is decreased or impeded, there is an associated cascade of movements that are influenced by the original mechanical dysfunction. Mechanical dysfunction (Table 1) can result in an immediate challenge to the neonate's ability to breathe and feed. Mechanical dysfunction that interferes with critical life sustaining activities (such as breathing and eating) also results in an engagement of the sympathetic nervous system. The sympathetic nervous system responds to low pO₂ and the question, "Where's my next meal coming from?" Accordingly, the brain rapidly creates new plastic circuits in an effort to urgently resolve the problem. Compensations ensue that may be functional or dysfunctional. In the short term, the impact of these compensations on respiratory function, milk transfer, the infant's sleep patterns, and maternal stress level may be significant. Compensatory patterns may have long term effects as previously outlined.

Table 1. Structural and Physiological Pathology Can Hinder Efficient Suckling

Reduced cervical range of motion – (Torticollis, Craniocervical Dysfunction or Subluxation, Sustained or "Preferred" Head Position — rotation, flexion, lateral flexion)
TMJ Dysfunction – Muscle Hypertonia and Hypotonia and Aberrant Tongue Function (Bf)
Hyperactive Gag Reflex – Aberrant Tongue Activity (Retraction, Bundling, Thrusting, Curling, Cupping, Troughing)
Headache – Other Pain

Mechanical dysfunction also prompts nociceptive input to the central nervous system. Nociception (pain) via the spinoreticular tract can result in activation of the sympathetic nervous system (via the amygdala and the thalamus) with an associated exaggeration of infantile reflexes; altered res-

piration and infant sleep patterns; increased difficulty integrating sensory input; decreased digestion; and increased irritability — all manifestations of autonomic dysregulation.

An unmedicated neurotypical neonate will seek his mother’s breast for nourishment if left to his own devices. In utero constraint, a difficult labor and delivery, and interventions — both non emergent and emergent — employed during a home birth or in a hospital setting may thwart the neonate’s ability to nurse by altering normal biomechanical function and perhaps development (Table 2). The most direct way to effect immediate change for the neonate is to address any neuromusculoskeletal problems impeding normal function. The level of intervention will depend on the level of

Table 2. “Drive to Survive” can lead to:
<ul style="list-style-type: none"> • Autonomic Dysregulation or Imbalance in ANS • Decreased Range of Motion • Development of Muscular Imbalance • Damage to Mother’s Breast Tissue • Poor Milk Supply • Inefficient Transfer of Milk

complexity of the dysfunction. The earlier the intervention, the greater the chance of attaining competency.

The History

A thorough history and evaluation will facilitate management (including appropriate referrals) for your patient. From learning the details of the birth to recognizing key posturing or head position, a detail-oriented approach is critical. Specific questions are designed to elicit specific information about the breastfeeding relationship.

To determine appropriate management, every practitioner who interfaces with the dyad needs to look at form and function through a discerning lens and differentiate neuromusculoskeletal from other issues (Table 3). Chiropractors need to take into account the observations of the parents

Table 3. Other Factors Leading to Breastfeeding Dysfunction
<ul style="list-style-type: none"> • Lack of parental knowledge • Anatomical Variants in the mother or infant including: inverted nipple, tethered oral tissue, cleft lip or palate, tracheomalacia or laryngomalacia • Genetic Syndromes • Interventions Employed during Birth (medication, forceps, ventouse, manipulation) • Injury to the Nervous System such as perinatal stroke or anoxic incident

Table 4. Common Parental Observations that may Indicate Structural Complications
<ul style="list-style-type: none"> • Erect head control (“military” posture when held upright) • Preference to keep or turn head to one side • Inability to turn head left or right • Pushing off the breast or Arching at the breast • Milk dribbles out of mouth at breast • Frequently changing wet bibs • Facial asymmetry: crooked smile, uneven eyes, an ear that “sticks out” • Cannot lay baby down: must be carried • Intolerant of the car seat • Fusses or becomes frantic during tummy time

and caregivers who will often describe alterations in function in minute detail (Table 4).

The Exam

Examine the infant layer by layer. Indulge in observation and know that books exist to name things. A full assessment of all systems should be routinely performed with special attention given to neuromusculoskeletal integrity. Neurologic responsiveness, reflexes, and muscle tone should be assessed as well as the soft tissue structures (including skin turgor, color and temperature, fascial tension, and development of muscle mass); osseous structures to rule out fracture or displacement; and articulations to rule out hyper or hypomobility of the joints, capsular swelling, and muscle symmetry surrounding the joint.

Visual assessment (Table 4) as well as passive palpation can reveal many clues to the cause of the breastfeeding dysfunction. For example, reflexes like rooting and suckling can be stimulated digitally or, in a homebirth, simply observed while the neonate is lying prone across the mother’s chest and abdomen. A neurotypical neonate will spontaneously commando crawl (stepping reflex), root, latch, and suckle while palming the breast (Babkin) without assistance. Even the initial assessment of the suck, swallow, breath synchrony⁴⁷ can be performed by observing and listening. If the neonate is unable to do this unassisted, a chiropractic examination may reveal the cause (Table 5 - next page).

Conclusion

When evaluating an infant with breastfeeding dysfunction a “whole child” approach needs to be adopted as there are many factors that could interfere with successful latch and transfer including injured muscles, fractured clavicle, hip dysplasia, neurologic interference from an anoxic event, or an extended half-life of an administered medication. Although supplementation by bottle may be possible (whether with breastmilk or an artificial milk replacement), it may prove to be just as challenging for the impaired neonate

and ultimately more serious interventions like a nasogastric tube could be necessary.

Diligent evaluation and differential diagnosis are critical in the neonate who is having difficulty feeding. A collabora-

tive effort between chiropractors and other health care providers while utilizing an IBCLC for primary breastfeeding evaluation and support is often the most efficacious means to restoring competency for the breastfeeding dyad.

Table 5: Observation

Head Shape	Facial Features
Perfectly Round	Flat face
Elongated in the sagittal plane (scaphalocephalic)	One eye more open or protruding than the other One eyebrow higher than the other
Wider in the coronal plane (brachiocephalic) Occipital region is flattened or asymmetric (plagiocephalic)	Height of ears uneven or one appears more anterior Nose is not midline or nostrils appear uneven Wry smile as the mandible deviates left or right
Midline protrusion from the anterior fontanel to the nasal bridge (trigonocephaly — early fusion of the metopic suture)	Receding chin or mandibular retraction Mandibular width (dental arch) Mandibular length (oblique or inferior development) Lips Symmetry Peaking Buckling (deep philtrum) Cheeks Concave Convex Muscular engagement (are the muscles “awake”) Hard Palate Height Width (dental arch) Torus formation

***Adapted from Dosman 201222 and Fysh 200221.*

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Infant presentations and outcomes at a chiropractic clinic in the UK: Parent report of treatment outcomes using the United Kingdom Infant Questionnaire (UKIQ)

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ABSTRACT

Objective: The purpose of this study was to pilot a new-validated infant treatment outcome measure and to describe basic characteristics and outcomes of infant chiropractic patients. The aim was to assess the performance of an outcome measure of infant care by chiropractic treatment through a before and after survey. This preliminary study may indicate usefulness of a newly validated measure of manual therapy care for common complaints of infancy. **Methods:** A validated parent report of outcomes (PROMS) was used. Mothers completed a questionnaire at entrance to a university-affiliated chiropractic teaching clinic and again at follow up when treatment was completed / infant discharged. Collection of demographic data including age, gender, condition at presentation, previous clinicians consulted and medications were included. **Results:** The study sample included 194 infant patients at intake and 102 at follow-up. Overall, 56% of patients (n=108) were aged between three days and 4 weeks and classified as neonate. In all, 96% of the infants were under 6 months of age. The most common presenting complaints were crying (n=65; 21%), feeding problems (n=62; 20%), discomfort in supine sleeping (n=58; 19%), check up after difficult birth (n=49; 16%), general sleeping problems (n=49; 16%) and head shape (n=25; 8%). A total 68% (n=120) had seen 1-4 clinicians, before presenting to the chiropractor and 60% (n=104) were taking from one to four medications. Prior to treatment the average score of the baby's discomfort or pain was 4.3 (Pain scale 0-10). At the follow-up survey the average was 1.7, a 60% reduction and a statistically significant difference. The relative risk ratio for the parent report of improvement after attending treatment was 2.3 (95% confidence interval = 1.73-2.87). The mothers anxiety, depression and quality of life before and after treatment improved by a factor of 2.1 (95% confidence interval = 1.58-2.62). The narrow confidence intervals suggest that these findings might be applied to the general population. On follow-up, 97% of mothers reported a positive improvement of the baby's condition and or behaviour since the beginning of care and satisfaction with the care provided. No adverse events were reported. **Conclusion:** The pilot study of this validated infant survey suggests it can be administered to mothers and that they are compliant in completion. Mothers report good success for chiropractic treatment for the infant's problems along with satisfaction with the treatment.

Keywords: pediatric, infant, manual therapy, chiropractic, demographic.

Introduction

The aim of this study was to investigate the parent report of outcomes of infant patients who attended a university-affiliated chiropractic teaching clinic on the south coast of England, using a newly validated parent reporting outcomes instrument, the United Kingdom Infant Questionnaire (UKIQ). Between 2006 and 2010, 21% of the patients that presented to this same clinic were pediatric patients, classified as being between the age of 2 days and 15 years.¹ In that study 98% of pediatric patients were infants. Likewise a Danish study of chiropractic care for pediatric patients showed that infants were the highest users of care.² The Center for Disease Control in the USA reported that

manual therapy was the most common type of practitioner-based Complementary and Alternative Medicine (CAM) therapy chosen for children and musculoskeletal conditions were the most common types of conditions for which treatment was sought.³ A 2007 Canadian study corroborated these findings, stating that musculoskeletal care was the most common type of CAM treatment chosen by parents for their children.³ Personal experiences, lack of appropriate treatments available from conventional medicine or referral from a physician were the key reasons given for parents seeking alternative care for their infant.⁴ Chiropractic has been criticized for too little research for pediatric care.⁵ The safety and effectiveness of pediatric chiropractic

care was investigated in a survey of chiropractors and parents in a practice-based research network,⁶ but no attempt was made to use a reliable or valid measuring instrument. Further, satisfaction with chiropractic care for children has been rarely studied.⁷ With chiropractic care widely sought by parents for their infants, it is necessary to investigate the parents' report of the outcomes of that care in an evidence-based approach.

Methods

This was a pilot study of the instrument that had previously undergone reliability and validity studies, the United Kingdom Infant Questionnaire, and was presented for use in the teaching clinic. The goal was to collect the first 150 forms in order to sample the ease of usage and results. Every infant's mother was given a 12-question form at entrance by the reception staff and 13 questions on completion of treatment. The first 12 questions were the same at presentation and follow-up. The 13th question was the Parent's Global Impression of Change (PGIC), a gold standard reference used to document change over treatment time.⁸ The questionnaire was set out to monitor the baby's progress over the course of treatment. Only mothers were chosen to complete the questionnaire as they have been shown to be excellent monitors and reporters of their child's health.⁹ They were asked to answer all the questions. The questions were set to obtain an overall picture of the baby's complaints or discomfort and also the mother's concerns. At discharge, the survey asked her to rate her level of dis-satisfaction or satisfaction with the care received along with any adverse events that occurred with treatment. The intake form was accompanied by a demographic survey to understand the type of patient who presented to the clinic.

After the follow-up questionnaire was completed, both evaluations were collected and data transferred into Microsoft Excel® where descriptive statistical analysis was performed. All data was held confidentially. Parents consented at intake that the data could be used for research purposes. Ethical approval was granted by the Anglo European College of Chiropractic Project Panel.

Whenever comparisons were made, a P value of < .05 or no overlapping 95% CI were considered significant.

Results

Initial questionnaires were completed (n=194) and 102 (53%) follow-up questionnaires were returned during the time of this project (more outcome forms are anticipated, but this study had to be cut-off at a specific point in time). Table 1 shows demographic results. Figure 1 shows ratings of infant behaviours before and after treatment. The average age of the mothers was 32 with a minimum age of 20 and a maximum age of 41. The average age of the infants presenting to the clinic was 8 weeks of age with a range from 3 days to 2 years. Regarding gender, 105 (55%) were

boys and 87 (45%) were girls. Two patients stated no identification of age or gender.

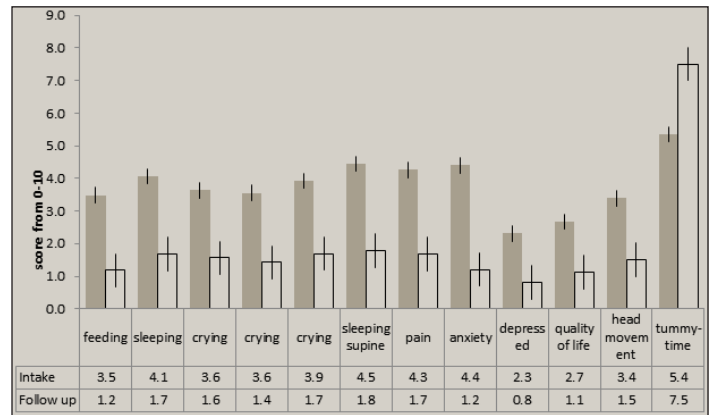


Figure 1. Mean scores for United Kingdom Infant Questionnaire. Shaded bar, mean at intake; open bar, mean at follow-up; solid line, standard error. The final question regarding tummy time was measured in an opposite way to the other questions. Hence an increase in tummy time was considered a positive result.

Figure 2 shows the most common complaints of the infants at presentation and Figure 3 duration of complaints and Figure 4 shows the irritability patterns of the infants. In the majority of cases (n=104) the problem started at birth (66%); 60% (n=96) of infants had an assisted birth and the remaining 40% were non-assisted (n=63) which is defined as home birth or hospital birth without medical intervention. Only 25% of patients presented to the chiropractic clinic first; 75% had previously attended one to more than four other health care professionals prior to attendance at this clinic. In all, 61% (n=108) of the infants were given one or more medications, without benefit, before presenting to the clinic.

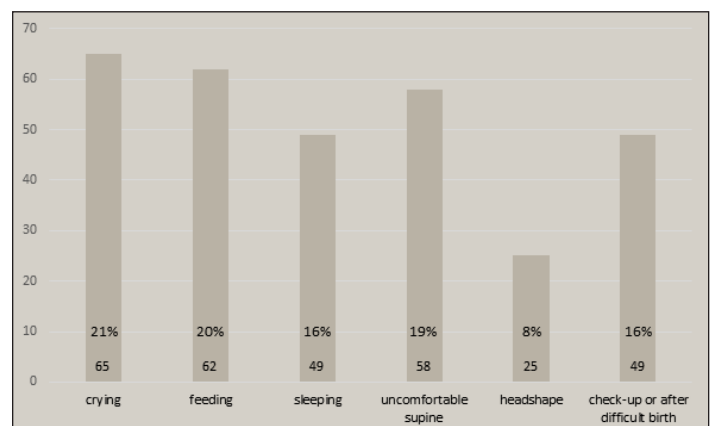


Figure 2. Reason for infant presentation to chiropractor. Total: 308*

*more than one option could be ticked

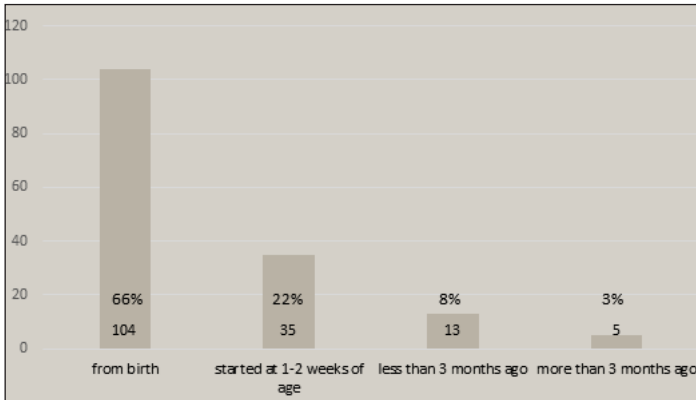


Figure 3. Duration of problem at presentation. Total: 157

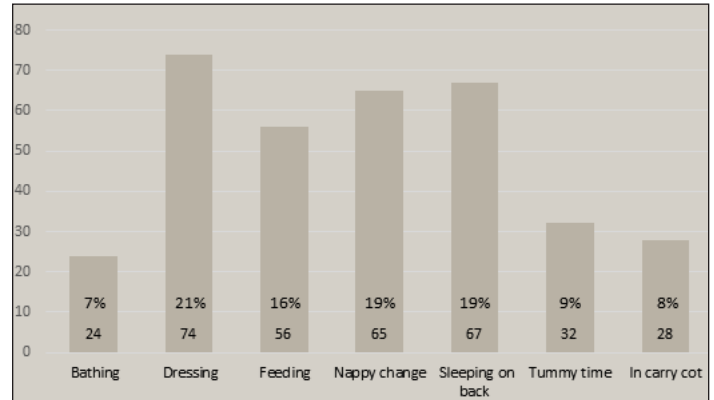


Figure 4. Maternal report of infant irritability. Total: 346 *
*more than one option could be ticked

Table 1. Socio-demographic characteristics of infants presented to a chiropractic clinic

Mother's age, years (n= 165)	Percentage	Frequency	Baby's preferred sleeping position (n = 207)*	Percentage	Frequency
<20	0%	0	Back	51%	105
20-24	5%	8	Front	19%	40
25-29	22%	37	right side	18%	38
30-34	45%	75	left side	12%	24
35-39	24%	39			
40-44	4%	6			
			Baby becomes irritable during different activities (n = 336)*		
Age of infant at presentation, weeks (n = 192)			dressing	21%	74
< 1	6%	12	sleeping on back	19%	67
1-4	50%	96	nappy change	19%	65
5-26	40%	77	feeding	16%	56
27-52	2%	3	tummy time	9%	32
> 52	2%	4	in carrycot	8%	28
			bathing	7%	24
Infant's feeding, milk (n = 173)			How many health consultant seen (n = 176)		
breast	58%	102	0	25%	44
formula	27%	48	1	31%	55
both but more breast than formula	12%	21	2	23%	40
both but more formula than breast	3%	6	3	10%	18
			4	4%	7
Reason for seeing chiropractor (n = 308)*			>4	7%	12
crying	21%	65			
feeding	20%	62	How many medication taken (n = 176)		
uncomfortable supine	19%	58	0	39%	68
check-up/after difficult birth	16%	49	1	31%	54
sleeping	16%	49	2	14%	24
Head shape	8%	25	3	10%	17
			4	5%	9
Onset of problem (n = 157)			>4	2%	4
at birth	66%	104			
between 1-2 weeks	22%	35			
less than 3 months	8%	13			
more than 3 months	3%	5			

*more than one option could be ticked

The relative risk ratio for the infant getting better after attending a chiropractic treatment was 2.3 (95% confidence interval = 1.73-2.87) indicating a child treated in the clinic was more than twice as likely to get better than if not presented here. The relative risk ratio for the mother to report

less anxiety, depression and increase in quality in life was 2.1 (95% confidence interval = 1.58-2.62). Over-all 97% of mothers reported positive improvement on the PGIC scale for global improvement and 34% stated "completely better, like a different baby."

There were no problems with dissemination, completion or collection of the surveys.

Discussion

The goal of this project was to investigate whether this newly validated infant PROMS survey was practical for use in a busy chiropractic clinic and whether it registered any change in the infant’s condition over a course of chiropractic care. No previous study has used PROMS to examine the effect of chiropractic treatment for infants. Overall, limited evidence exists to support chiropractic treatment for infants.^{10,11} The lack of a validated outcomes measure may be partially responsible for lack of infant research in the profession. The aim of this survey was to test whether a reliable and validated survey might be useful to address this paucity of evidence for chiropractic care of the infant patient and mother’s point of view.

Along with the report of outcomes, the demographics were examined to assess whether patients were representative of the general population. Boys (n=105) were more commonly presented than girls (n=87). This may be due to the prevalence of musculoskeletal health problems which have previously been shown to be more common in boys.¹² The patient proportions in that study (55% male versus girls (45%) were the same as in this clinic (55% male and 45% female). At birth, boys are often larger than girls and intra-uterine constraint may result in biomechanical imbalance or asymmetries in their cranium, spine or extremities.¹³ It is no surprise that mechanical constraints at any age would be amenable to chiropractic care.

In 2013-14 almost two-thirds of all childbirths (61.8%; 343,797) in the UK were spontaneous and did not need any assistance; 13.2% (73,486) were caesarean section and a quarter 25% (139,112) were induced.¹⁴ Compared to our study, only (40%; n=63) of deliveries were unassisted. The type of delivery has also been implicated in infant complaints in this study. Nearly two-thirds of infants had an interventional e.g. induced, ventouse, forceps or C-section delivery (60%; n=96). This has been shown in other studies as well, that babies with assisted births are over-represented in a chiropractic practice.¹⁰ It stands to reason that children born by instrumentation may be more likely to need musculoskeletal treatment.

On a positive note, those with assisted births had similar outcomes to those with routine vaginal birth. This may

suggest that this is an appropriate treatment for the infant who has had a difficult birth, seeing as the biomechanical constraints were reduced with treatment. Different tensile strengths of adults and pediatric specimens have been documented in the literature along with care plans for infants.¹⁵

The largest age-group for mothers (n=75) was between 30-34 years of age (46%). There could be a correlation between age and seeking help from a health care professional. We had few mothers at the age between 20-24 years of age in our study. Those findings correlate with the findings of the office for national statistics,¹⁶ that babies born in England and Wales in 2014 were most likely to have a mother aged 25-34, with over a half (59%) of mothers in this age group (Table 2).

In our study the mothers aged 25-34 account for 68% (n=112) which is almost 10% higher than the statistics of 2014, but the number of births in a given year is dependent on the number of women in the key childbearing ages (15-44 years) and on fertility rates in that year.

Although the Back Safe to Sleep® campaign has been running for many years to decrease the sudden infant death syndrome (SIDS), just half of mothers stated that their child had a preferred sleeping position on the back. Other studies have suggested that chiropractic is appropriate and useful care for infants who cannot lie supine for sleep.¹⁷ Back Safe to Sleep® is an important public health issue and parents seem to understand that chiropractors can provide the treatment to assist the baby sleep with comfort in the safe supine position. In this study, the improvement of sleeping supine improved by 2.6 points (60% reduction, which can be classed as a clinically significant difference since other studies have labelled 34% improvement on such a scoring system sufficient to distinguish clinically meaningful improvement).¹⁸ This was the biggest infant improvement of all the questions we asked the parents. Because it is clinic policy not to release an infant from care unless they reach the healthy goal of supine sleep, this rating of change can be seen not only as statistically significant but also clinically significant for more than one reason. This is clear support for the role of chiropractic care in this key public health issue of Back Safe to Sleep®.

Part of the purpose of this project was to determine whether Patient Reported Outcome Measures (PROMs) are as useful for children as for adults. The National Health Service

Table 2. Live births by age group of mother in England and Wales 2014 compared to study population:

	Under 20	20-24	25-29	30-34	35-39	40-44	45 and over
Mothers in UK	3.7%	16.2%	28.3%	31.0%	16.6%	3.9%	0.3%
Study population	0.0%	4.8%	22.4%	45.5%	23.6%	3.8%	0.0%

and Care quality commission¹⁹ have urged that the parent's point of view be heard. This use of PROMS in this age group would meet that goal. PROMS were designed to measure either patient's perception of their general health or in relation to specific diseases. In common usage, a set of PROMs is to be completed after a certain time of patient treatment, and the two scores are then compared to show the change in score, indicating improvement or worsening of the condition.²⁰ Clinicians and hospitals are increasing the use of PROMs²¹ but widespread use is uncommon beyond England, Sweden and parts of the United States. In England, PROMs use has been encouraged by the government's wishes to have a public comparison of the health care practitioner's performance, whereas in Sweden and the US, it has been driven by practitioners' wish to improve. The routine use of PROMs is an opportunity to help change the way healthcare is organised, because it incorporates important perceptions of the patient, or in this study's case, the parent.^{22,23}

Although the results are positive and mothers appear to be very pleased with chiropractic care for their infant, this type of study cannot imply effectiveness of that care. However, with mothers as excellent reporters for their child's health, with the short term of treatment time (on average less than four treatments); these improvements by and large cannot be credited to the natural history of the disorders.

Limitations

This type of study, by its definition, cannot determine efficacy of the therapy given. A randomized controlled trial is the best way to determine conclusively whether manual therapy is a viable option of care. This study does serve to understand the mother's point of view, which is currently considered key to health care choice.¹⁹

All follow-up forms were not included because at the time it was necessary to stop the study. In total half of the follow-up forms had not been returned. This can be a problem with reaching statistical significance, although most of the maternal reports were quite positive. Further, some mothers did not have any problems with their baby and they just presented for a check-up and did not require follow-up care. Many of those patients were not treated and were instead discharged after the first visit. Further, it is likely that some patients have been lost to follow-up.

There were few negative reports so it is difficult to know whether there was a halo effect in reporting. One of the mothers stated that the baby was getting worse and suffering from "dairy intolerance." This may have indicated poor diagnosis or a concurrent condition, and one that is not treatable with manual therapy. This valuable information might have been missed in a much larger study including thousands of infants, rather than less than 200.

Conclusion

This study of parent report of treatment outcomes using a validated questionnaire for infants who presented to a chiropractic clinic found parent-reported improvement in the baby's condition to a significant degree. Parents of infants in this study were more than twice as likely to report statistically significant improvement after the chiropractic treatment. There were no impediments found in this study to the use of this questionnaire and it should be considered for wider usage.

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Arnold-Chiari Malformation

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Definition

The usual age of onset of Arnold-Chiari malformation ranged from the second to the fourth decade, with female preponderance. It is assumed to rarely present clinically before adolescence¹ and is often associated with syringomyelia². Arnold-Chiari Malformation can be divided in three subtypes;

Type 1: (MC) Caudal herniation of the cerebellar tonsils through the foramen magnum that exceeds 5 mm into the cervical spinal canal.^{1,3}

Type 2: Caudal herniation that involves the cerebellar vermis and medulla, usually diagnosed in childhood with an average survival time of less than 2-3 years.⁴

Type 3: Caudal herniation of cerebellum and medulla accompanied by meningoencephalocele of the top of cervical vertebra and occipital region, cerebellar prolapse and hydrocephalus. ACM type III is an extremely rare anomaly with poor prognosis for newborn infants because of respiratory failure, swallowing dysfunction, hypertonia, or amyotonia.¹

Symptoms

The symptoms usually consist of neck ache, headache, weakness and numbness that present and progress gradually, but can be asymptomatic.^{1,3,5} Compression of the medulla, spinal cord and cerebellum or blockage of CSF can cause various symptoms: lower cranial nerve palsies, vertigo, visual and hearing disturbances, nystagmus, swallowing difficulties, spastic or ataxic paraparesis, bladder dysfunction, gait abnormality, tremor and chronic headache because of hydrocephalus.^{1,2}

DDX: Multiple sclerosis, primary headache syndromes, spinal tumours and benign intracranial HT.

Diagnosis

Diagnosis of the disease without radiologic evaluations is difficult because there are no distinguishing symptoms of the disease.⁴ Radiography may offer early suspicion for ACM: Small posterior fossa; Enlarged foramen magnum with a convex posterior border; Enlarged diameter of the spinal canal. MRI is the procedure of choice.

Treatment

Arnold-Chiari Malformations may be prevented by precon-

ceptional folic acid (or methylfolate if positive for the MTHFR genetic mutation) and Vitamin B12 supplementation.⁷ The ACM process usually begins during the third week of embryonic life at the time of closure of the neural groove.⁶

ACM with pregnancy

Women with ACM were not more likely to die during delivery-related admissions despite more frequent severe morbidity. They are more likely to develop severe medical complications including acute respiratory distress syndrome, stroke/cardiovascular accident, sepsis and seizures. Women with ACM were also more likely to be delivered by caesarean or develop preeclampsia.⁷

Medical treatment

The typical management of ACM is suboccipito-cervical decompression surgery. Surgery has a typical prognosis of greater than 80% improvement in ACM.⁴

Chiropractic literature

Few studies reported on chiropractic treatment for ACM patient. The first showed no improvement of symptoms for two patients with ACM.⁶ In the second, Applied kinesiology chiropractic and SOT treatment was used for treatment of loss of vision and nystagmus. After treatment, the patient's ability to see, read, and performs smooth eye tracking showed improvement.⁸ According to another study, asymptomatic Type I ACM is not necessarily a contraindication to skilled adjustments to the cervical spine.⁹ The frequency of complications after spinal manipulation is not known, but seem to be relatively risk free. One case study, showed significantly increased of symptoms after spinal manipulation of ACM patient. The literature would suggest that there is a real, if small, complication rate with a substantial long-term morbidity and disability.⁵

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Bell's palsy in infants, children and adolescents

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Bell's palsy defined as unilateral facial weakness is a relatively common pediatric problem affecting children from infancy to adolescence.^{1,2} Considered idiopathic,^{2,3} it is the most common cause of unilateral facial weakness.^{1,3} It is believed to be a post infectious, allergic, or immune neuritis affecting the facial nerve.¹ Bell's palsy is a common neurologic manifestation of Lyme's disease.¹ Other causes of facial nerve palsy include congenital, traumatic and neoplastic.¹ Clinical manifestation may have sudden onset within a period of hours and are: weakness of upper and lower face¹ (forehead muscle sparing is suggestive of UMN lesion due to bilateral innervation); inability to close eye; excessive tearing or excessively dry eyes; unilateral drooping of the corner of the mouth;² loss of nasolabial fold; normal sensation; lost of taste anterior two-thirds of tongue; difficulty in feeding because of impairment of sucking.⁷ Initial presentation may be pain around the ear and surrounding areas and associated with hyperacusis or dysacusis.¹

Bell's palsy is a diagnosis of exclusion and a careful history and examination will usually lead to a correct diagnosis.¹ The details of pregnancy, labour and delivery, maternal medical history and family history should be carefully taken.⁷ In birth trauma, risk factors include long pregnancy, long and/or difficult labor^{5,6,7} especially forceps delivery.^{5,6,7} birth weight of more than 3500g⁵ (may be seen if mother has diabetes⁶) or cephalopelvic disproportion,⁵ use of epidural anesthesia,⁶ use of a medication to cause labor and stronger contractions⁶ and primiparity.⁵ With infant or newborn, observation and examination for ecchymosis, bruising of scalp, hemotympanum, facial swelling, severe head molding^{5,7} and for Erb's palsy^{7,9} is needed.

Dysmorphic features, other cranial nerve palsies, other coexisting anomalies and family history of facial nerve

palsy or of other congenital anomalies favor developmental cause.^{5,7} Developmental causes include those associated with syndromes (such as Moebius syndrome) and teratogens.⁵ If a syndrome is suspected, referral for genetic testing⁷ may be necessary.

Facial palsy may develop at any time during childhood.⁴ Other differential diagnosis include infections¹ (Otitis media,¹ Mastoiditis,¹ Temporal bone abscess¹), trauma¹(head trauma)⁴, iatrogenic surgical injury,^{1,4} tumors⁴ (nerve tumors, leukemic invasion of facial nerve, rhabdomyosarcomas¹), stroke and infarcts.¹ Electrophysiology tests of facial nerve function can be done and is useful to assist with future surgical planning.⁵ Careful audiologic evaluation⁵ may also be recommended. Other tests may include X-Rays,⁹ CT Scan^{2,5} MRI^{2,3,5,6} (for trauma, temporal bone fracture, to rule out tumor or stroke).⁵ Lab testing may be used for Lyme's disease.¹ Some infants may have difficulty in feeding and may need additional support in establishment of feeding.^{5,7} If the paralysis does not resolve, it may affect the child's future speech, expressions of emotion and mastication. Referral to a speech and language therapist⁴ may be needed. Ophthalmologic evaluations may also be indicated.^{5,7} Plastic surgery⁷ referral may be considered for persistent, severe cases. Future psychosocial problems^{4,5} may appear for the older child and adolescents because of facial asymmetry, leading to a loss of balanced appearance and function.³ Recovery rates in infant, children and adolescents are high (85-93%)^{1,2,3} with complete recovery from weeks to months after onset.¹

Medical treatments include reassurance, corticosteroids or antivirals (Acyclovir)² and eye care (use of drops or artificial tears).^{1,2} Surgery is usually delayed until later in life⁵ (but risk of iatrogenic injury is high).⁵ Other treatment may

include acupuncture³ and physical therapy.³ The reported case⁸ of chiropractic care of an infant with traumatic right-sided facial nerve palsy (Bell's palsy) and right brachial plexus neuropraxia suggest that vast majority of cases (excluding severe cases) can be managed conservatively with manual therapy⁸ but also recommend close monitoring of the patient's signs and symptoms in order to determine if continuing to manage conservatively is appropriate.⁸ In chiropractic care of Bell's palsy, evaluation of upper cervical spine and cranial bones (occiput, temporal) for evidence of vertebral subluxation complex (VSC) should be performed with chiropractic adjustments administered where indicated.^{9,10} The motor branches of the facial nerve exit the skull through the stylomastoid foramen which is immediately behind the styloid process.^{9,10} A common cause of Bell's palsy could be compression neuropathy.⁹ VSC particularly in upper cervical spine and cranial bones could cause a compression neuropathy of the facial nerve.^{9,10} This might help to explain why correction of VSC in patients with Bell's palsy could produce restoration of facial muscle activity.^{9,10}

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Selective Mutism

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Selective mutism (SM) is characterized by a persistent failure to speak in specific contexts where speech is typically expected, despite normal hearing and speaking in other contexts. Onset of SM typically occurs before a child is 5-years-old (between ages three and six). But, it is usually first noticed when the child enters school (diagnosis occurs between ages five and eight). This disorder and specific features are described in the *2000 Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)* (pp.125-127) as listed below:^{1,2,3}

- Consistent failure to speak in specific social situations in which there is an expectation for speaking (for example at school) despite speaking in other situations (at home or in familiar context).
- The disturbance interferes with educational or occupational achievement or with social communication.
- The duration of the disturbance is at least 1 month (not limited to the first month of school).

- The failure to speak is not due to a lack of knowledge of, or comfort with, the spoken language required in the social situation.
- The disturbance is not better accounted for by a Communication Disorder (like stuttering) and does not occur exclusively during the course of a pervasive developmental disorder, schizophrenia, or other psychotic disorder.

SM can be present with a variety of comorbidities such as enuresis, encopresis, obsessive-compulsive disorder, depression, language abnormalities, developmental delay, and Asperger's disorders. The majority of children with selective mutism will outgrow the disorder spontaneously for unknown reasons. However, residual social phobia and other anxiety disorders may persist.⁴

Traditional treatment consist in two primary domains: psychotherapeutic approaches and medication-based interventions. Most common non-medication approaches to treat

SM are psychodynamic therapy (in children it's called individual play therapy), behavioral therapy, and family therapy. Within medication-based options, selective serotonin reuptake inhibitors (SSRIs) have been shown to improve mutism and anxiety. Results tend to be optimized when both approaches are employed simultaneously.

Social Communication Anxiety Treatment (S-CAT) is an evidenced-based treatment and is implemented at the Selective Mutism Anxiety Research and Treatment Center. S-Cat consists in a complete program which incorporate anxiety lowering techniques, methods to build self-esteem, tools to help with social comfort and communication progression. Individualized treatment plan needs to be developed based on every child specific needs and particularity of his disorder. Parent and teacher educations, and environmental changes (at home and at school) are essential to help the child overcome SM.

Since SM is a very rare condition, no literature was found on chiropractic and SM. Neuro-Emotional Technique (NET) is a branch of chiropractic and is defined has "a methodology of finding and removing Neuro Emotional Complexes (NECs). A NEC is defined as a subjective maladaptation syndrome adopted by the organism in response to a real or perceived threat to any aspect of its survival. NET has been described as a treatment designed to address negative distressing stimuli by removing these patterns by accessing

the nervous system via stimulation of the spine."⁵ (Specific phobia is a quite common anxiety disorder and literature was found on the potential impact of NET on anxiety level associated with this disorder. "Compared with the non-intervention control group, statistical analysis indicates a significant advantage for the NET group in regard to state anxiety/subjective distress, reported fear, and avoidant behavior."⁶ Since specific phobias may have similar impact on activities of daily living (can disrupt lives, limit work efficiency, reduce self-esteem, and strain relationships) it would be interesting to explore NET with the child diagnosed with selective mutism.

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Improvement of gastroesophageal reflux disease (GERD) in an infant following chiropractic care: a case report

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ABSTRACT

Objective: This case report discusses the evolution of an infant with gastroesophageal reflux disease (GERD) under chiropractic care. It is the hope of the author to encourage more research about the role of chiropractic as a safe alternative in the resolution of GERD in infants. **Method:** A literature search on Google Scholar and PubMed was done to find recent and relevant papers using the keywords infant, GERD, regurgitation and chiropractic. **Clinical features:** A 4-month-old female presented for chiropractic care for recurrent regurgitation after feeding. The infant was exclusively breastfed. She was averse to being carried and her complaints included frequent post prandial regurgitation, difficult eructation, interrupted sleep, choking and rumination, wheezing during sleep, fussiness, distended stomach and excessive intestinal gas. No medication was taken by the infant or the mother and lifestyle changes were made before consulting a chiropractor. **Intervention and outcomes:** The infant was treated with chiropractic manipulation using craniosacral therapy, myofascial therapy and Diversified adjusting technique. The treatment consisted of 17 visits over a 20-week period using a full spine protocol adapted for the pediatric patient based on size and gestational age. The original diagnosis of GERD improved to physiologic gastroesophageal reflux (GER) after 14 visits and then totally resolved at the 17th visit. **Conclusion:** Since current evidence fails to support traditional medicinal methods to treat GERD in infants, chiropractic care merits investigation as a safe alternative that might prove more efficient than medication and with fewer side effects. This case report constitutes an addition to the scientific literature regarding chiropractic care of infants suffering from GERD.

Key words: GERD, regurgitation, infant, pediatric, chiropractic.

Introduction

Since current evidence fails to support traditional pharmaceutical methods to treat gastroesophageal reflux disease (GERD) in infants, there is a great need for a safe alternative approach that might prove more effective than medication and with fewer side effects. Indeed, peer-reviewed literature on traditional treatment for GERD in infants has shown that medication in those cases is not effective enough to be recommended and is usually not approved by guidelines for use in infants younger than 1 year of age.^{1,2,3} During a double-blind randomized placebo-controlled trial in infants with reflux, even the medication that is most often regarded as the most effective for the treatment of GERD, the Proton Pump Inhibitor (PPI), has not demonstrated superiority over placebo for reduction in irritability.^{4,5,6}

Although a large number of chiropractors treating infants will attest that the symptoms of many of their patients with GERD were reduced or resolved with chiropractic care, up until now, only a few studies have been conducted on the relationship between GERD in infants and chiropractic care.^{7,8,9,10,11,12,13,14} It is therefore even more important to properly document each case found to enhance the quantity and quality of supportive literature on this subject.

The purpose of this report is to describe the case of a four-month-old female under chiropractic care whose condition improved from GERD to physiologic gastroesophageal reflux (GER) and finally complete resolution.

Method

A literature search was done using the search engines Google Scholar and PubMed by using the key words infant, GERD, regurgitation and chiropractic. Papers were selected based on the date of publication and their relevance to non-medical avenues of treatment. Only a few case reports were published on the relationship of infant with GERD and chiropractic care.

Patient information

A 4-month-old female presented for chiropractic care for recurrent regurgitation after feeding. She was exclusively breastfed. The infant was averse to being carried and her symptoms included frequent post prandial regurgitation, difficult eructation, interrupted sleep, choking and rumination, wheezing during sleep, fussiness, distended stomach and excessive intestinal gas.

Clinical findings

RELEVANT HISTORY, COMORBIDITIES AND INTERVENTIONS

A full term female infant presented to the office at 12-days old. The mother reported these complaints: at the age of 2 days, her daughter’s sleep was interrupted by choking followed by rumination and crying. To complicate the problem, it seemed that her daughter was more comfortable sleeping in a prone position on her breast or in a more vertical position on her mother’s lap on the couch. After a few nights, to avoid regurgitation that she would have after almost every feed, the baby was put to sleep supine on an inclined changing mat. The regurgitation did not seem to hurt or bother the baby but the quantity of gastric content was enough to change the baby’s clothes frequently. The vomit was nonbilious with no suggestion of hematemesis. The infant regurgitated almost every time she raised her legs or when her diaper was changed after a feed. To avoid regurgitation, the mother needed to change her diaper before feeding her. When carried, the infant would cry, arch her back and neck while pushing away from the person holding her.

Also, the infant was wheezing during her sleep, was experiencing difficult eructation, had frequent hiccups during the day, frequent stomach distention and excessive intestinal gas. When she was fussy, her parents were able to calm her by carrying her while she was lying prone on their forearms. This was the parent’s third child and none of their two older boys had similar symptoms at the same age.

The infant did not have a pediatrician before she was 9 weeks old. The mother did not want to consult with him about the regurgitation because she did not want to administer medication to her baby. However, the pediatrician noted that her stomach was distended by intestinal gas and diagnosed a light cervical torticollis and a sinusitis.

The infant was born in a birth pool, at home, through vaginal delivery. No complications during the pregnancy or birth were noted and the infant had been exclusively breastfed. The mother did not drink milk. She ate cheese or ice cream three to four times a week. The baby and the mother were not taking any medication. The weight of the patient was around 70% percentile. The mother had not consulted other professionals regarding her baby’s condition.

The mother tried to minimize her baby’s symptoms by feeding her more frequently, one breast per feeding and in an inclined position. She kept the baby in an upright position for about 30 minutes after feeding to help with burping.

PHYSICAL EXAMINATION FINDINGS

The initial physical examination included visual postural

evaluation, vital signs, primitive reflex testing, neurological testing, active and passive range of motion of the spine, palpation of the abdomen, static and dynamic palpation of all spinal segments and evaluation of the cranium.

The posture was evaluated with the patient supine: the head was tilted to the right and slightly in right rotation. The thorax was also in right rotation.

The vital signs and the primitive reflex testing were within the normal limits for a 12-day old infant. Neurological testing was unremarkable.

All regional ranges of motion throughout the spine were within normal limits.

Palpation of the abdomen revealed a distention in the periumbilical area with mild spasms at the superior left region of the stomach and the diaphragm. Static and motion palpation of the cervical, thoracic, lumbar, pelvic region and general extremities were performed. Moderate muscle tension was found in the sub-occipital region bilaterally and at the right SCM. There was reduced mobility of C1 in right lateral flexion. In the thoracic spine, mild muscle tension was palpated in the paraspinal muscles bilaterally from T4-T6

Table 1. Timeline

Age	Milestone
2-days old	Interrupted sleep with choking followed by rumination and crying.
3-days old	Sleep in a prone position on the mother or in a more vertical position on the mother’s lap on the couch.
4-days old	Sleep in a supine position on an inclined changing mat to avoid regurgitation after feeds.
4-days old	Lifestyle changes.
12-days old	Start of chiropractic care: 17 visits in 4 months.
9 weeks old	1st visit to the pediatrician: he noticed a distended stomach full of intestinal gas and diagnosed a light cervical torticollis and a sinusitis.
13 weeks old	2nd visit to the pediatrician to see the evolution of the torticollis: resolution of the torticollis and stomach less distended. Sinusitis remains unchanged.
14 weeks old	Improvement of GERD into GER. No more Sandifer syndrome.
20 weeks old	No more signs and symptoms of GER. Total resolution of GERD.

with an extension restriction of T5. The infant also had an extension restriction of L1 and the left sacroiliac joint was misaligned posteriorly. In the extremities, restrictions of the left hip, the right elbow and both shoulders were noted.

During the evaluation of the cranium, the fontanelles were within normal limits. Following examination through craniosacral technique procedures,¹⁵ cranial distortions of the left frontal, parietal and temporal with the occipital bones were observed. (See Table 1. Timeline).

Diagnostic assessment

It is very important to recognize the difference between GER from GERD. By definition, GER is the passage of gastric contents into the esophagus with or without regurgitations and vomiting. Due to the immature lower esophageal sphincter which prohibits the gastric content to exit from the stomach, GER is a physiologic process occurring several times per day in healthy infants.^{1,16,17,18,19} Regurgitation is the most visible symptom of GER and it is reported to occur daily in 50% of all infants younger than 3-months old.^{1,19,20,21} GER is the topic of discussion with pediatricians of one-quarter of all routine 6-month old infant visits.^{22,23,24} In infants, GER typically peaks between the first and the fourth months of age¹⁹ and resolves spontaneously in most healthy infants by 12 to 18 months old.^{1,21,22,25,26,27}

GERD should be defined when adverse symptoms or complications are the results of GER. These associated symptoms or conditions are classified into esophageal and extraesophageal^{1,3,19,28,29} (See Table 2).

In infants, the most common presenting symptoms of GERD are: feeding refusal, recurrent vomiting, poor gain weight, irritability, sleep disturbance and respiratory symptoms.¹⁹ The incidence of GERD in the pediatric population is approximately one in 300 children.³⁰ Then GERD can be further classified after an endoscopic examination by erosive disease (ERD) and non-erosive disease (NERD).³¹

The diagnosis of GERD in infants is often made based on signs and symptoms subjectively described by the parents during history.³² The history allows the practitioner to rule out warning signals requiring investigation and also define a list of differential diagnosis. However, symptoms and signs associated with GERD are nonspecific and unreliable when the child is younger than 8-years-old, and in some cases, 12-years-old.¹ The symptoms and the signs that may be associated with GERD are listed in Table 3.¹

Since no exact diagnostic protocols exist to accurately diagnose GERD in infants, the definitive diagnosis of GERD in the pediatric population is determined by several means.³³ In this case, there were four of the symptoms (recurrent regurgitation, irritability, rumination and wheezing) and one significant sign (Sandifer syndrome) of GERD in the history. The spasmodic dystonia with arching of the neck and the back as a discomfort reaction, called Sandifer syndrome, is an uncommon but specific manifestation of GERD.^{34,35,36} The fact that the patient had sleep interruptions and sinusitis were further indications of complications of GER and led to the diagnosis of GERD.

Table 2. Esophageal and extraesophageal symptoms associated with GERD

Esophageal symptoms	Extraesophageal symptoms
Regurgitation or Vomiting	Recurrent otitis media
Poor weight gain	Dental erosions
Dysphagia	Pharyngitis
Abdominal or substernal/retrosternal pain	Sinusitis
Esophagitis	Respiratory symptoms (cough, laryngitis, wheezing, etc.)

Table 3. Symptoms and signs that may be associated with GERD

Symptoms	Signs
Hoarseness	Apparent life-threatening events
Weight loss or poor weight gain	Esophagitis
Irritability in infants	Esophageal stricture
Ruminative behavior	Barrett esophagus
Heartburn or chest pain	Laryngeal/pharyngeal inflammation
Dysphagia, odynophagia	Recurrent pneumonia
Wheezing	Dental erosion
Stridor	Feeding refusal
Cough	Apnea spells
Hematemesis	Anemia
Recurrent regurgitation with or without vomiting	Dystonic neck posturing (Sandifer syndrome)

Therapeutic intervention

At the start of the treatment, the recommended frequency of care was twice a week. This recommendation was based on the patient's initial complaints and the chiropractic evaluation findings. However, because of the distance needed to travel to the clinic, the patient was treated once a week for 14 visits. The signs and symptoms of GERD and subluxations had improved by then and the recommendation was changed to once every two weeks for three visits. There was resolution of the regurgitation after these three visits. Currently, the patient is being seen once a month. In total, the infant received 17 chiropractic adjustments over a 20 week period using craniosacral technique and Diversified adjusting technique. The patient received full spine adjustments at the level of C1, T5, L1 and the left sacroiliac joint using high velocity low amplitude adjustments with a force adapted for a pediatric patient. During each adjustment, the chiropractor applied a light thrust to the spinal segment being addressed in the direction of the line of correction with a specific contact point using the tip of the little fingers to better adapt to the size of the infant's spine. Cranial adjustments were performed where the distortions and restrictions were revealed during the examination, in particular the left frontal, parietal, temporal and the occipital bones. Also, a myofascial treatment was performed on the right SCM, on both sub-occipital muscles, on the abdomen in particular the left upper quadrant and diaphragm.¹⁰

The mother was asked to continue their lifestyle changes to help manage the condition:

- Continue breastfeeding her baby and keep the consumption of bovine milk protein as low as possible. Breastfed infants with regurgitation may benefit from withdrawal of cow's milk and eggs from the maternal diet.^{1,37,38} For some infants who may be allergic to bovine milk protein, the elimination of that type of protein from the diet decreases significantly vomiting frequency within 2 weeks.^{1,39,40}
- Continue to give one breast at a time, with more frequent feedings, because small feeding volume seemed to decrease reflux frequency.^{1,41}
- Continue to position her baby vertically:
 - Breastfeed her baby in an almost seated position.
 - Carry the baby in a prone position with the head elevated on their forearms. There is evidence that infants placed prone with head elevated have less reflux than those kept prone but flat.^{1,42,43,44,45,46}
 - Keep the baby in the upright position for about 30 minutes after feeding.
 - Put the baby to sleep in a supine position on a changing mat inclined at about a 15-degree angle. Even if the amount of reflux in supine infants with head

elevated is equal to or greater than in infants supine and flat.^{1,42,44,47,48} The mother was persuaded that it helped prevent the frequency and the volume of the regurgitation. We saw no reason for her to discontinue that habit.

In addition, "tummy time" was also suggested therapeutically where the baby would be put in the prone position for gradually increasing periods of time, depending on the baby's tolerance.

Follow-up and outcomes

The improvement was progressive and continuous during the 20-week period. After the first two adjustments, the mother noticed that the frequency of hiccups had decreased and her baby was regurgitating less frequently, about half of the time compared to almost all the time.

The first condition to resolve was the torticollis after 13 visits.

After the 14th visit, the mother saw significant changes: the infant was able to sleep supine flat without regurgitation; there was no more Sandifer syndrome and the baby was able to be relaxed on their shoulder when she was carried; there was no more wheezing during her sleep; there was no more distended stomach full of intestinal gas. At this time, the patient still had difficulty to eructate and had only a few episodes of reflux during the day and only a small volume each time, about a teaspoon. The GERD from the beginning of care was now improved to a physiologic GER. Considering the positive response to care, the frequency of treatment was reduced to once every two weeks.

After the 17th visit, the patient had a complete resolution in postprandial regurgitation and the vertebral subluxation and cranial indications also showed significant improvement over the course of care.

No adverse effects were reported while receiving chiropractic care.

As for the tummy time, it was always difficult for the baby. The infant was only able to do it for 30 seconds to 2 minutes at a time. The mother said that her baby was complaining "as soon as she put her on her belly" and that she would let her cry until she became so upset that she finally had to pick her up. The mother tried several times with several different strategies to put her baby supine: after changing diapers, during play time with her daughter or when she needed to put her baby down. She did tummy time on different surfaces: on her breasts, on the floor, on the bed, on a gym ball, on her tibias when lying back and on the changing mattress. Sometimes, she also carried the baby with her abdomen supported on her forearm. The baby was about 7

months old when she was able to tolerate five minutes of tummy time without complaining.

Discussion

As it is hard to diagnose GERD in infants because there is no single test that can rule it in or out, the author suggests that the use of the validated questionnaire developed by Kleinman et al^{19,49} or by Orenstein et al^{50,51} for documentation and monitoring the parent-reported GERD symptoms would be a good standard point in research.

Some of the weaknesses or limitations of this case report might be the distance between the parent's home and the treating chiropractor's office that did not allow for a more intensive frequency of care. This might mean that more treatments were given to get these results than would otherwise be needed.

Also, as in all case studies, it is difficult to infer similar widespread results in other infant GERD chiropractic cases. However, since the type of chiropractic care used does not allow for a Placebo been given or randomised controlled tests, the best method to validate the efficiency of this type of care is through epidemiology studies. Positive case studies are generally the first steps in gathering interest in such research.

As stated in the guidelines, a physiologic GER usually tends to resolve naturally after the first year of life. It is possible that the improvement seen in the patient's symptoms are reflective of a natural healing process and that the intervention had therefore minimal effect on the patient's outcome. However, since there is usually a peak of GER at the age when these improvements occurred and considering the speed of the recovery, this possibility is unlikely in our opinion. Furthermore, GERD does not necessarily resolve after the first year of life like GER does.

One of the strengths of this report is that, considering the prevalence of medication in GERD cases, and even in the general pediatric population, it is oftentimes difficult to find a case where neither the patient nor the mother has taken any kind of medication, let alone where the mother has also a very low intake of bovine milk. Since there were no notable changes in lifestyle and the ones recommended by the treating chiropractor had already been implemented, and since the mother was not able to implement the tummy time as recommended, the contribution of the chiropractic care in the explanation of the positive outcome of the patient is more likely.

Recommendations

This case and others that have had similar results pave the way for a more controlled research. As stated above, the best approach would be an epidemiology study where the

same protocol and technique would be used on all cases. The number of cases should be enough to account for the variations in personal differences from one practitioner to another. To avoid bias or Placebo effects, the children would be examined before and after a fixed amount of time by a blind examiner who would not know if the children were in the group receiving chiropractic care or in the control group.

Since parents with GERD infants are more likely to consult a medical doctor rather than a chiropractor for that condition, this kind of study would benefit greatly from a partnership with the medical field to increase the number of cases available.

Considering the lack of evidence to support medication for infants with GERD, the possible serious adverse effects of the medication itself and the invasiveness of the current diagnostic and intervention methods, it is imperative that alternative avenues of treatment be more thoroughly researched. The clinical results shown in this case indicate that chiropractic should be considered as one of those avenues.

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Diagnosis and management of a complex milk protein intolerance with chiropractic care: a case report.

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ABSTRACT

Objective: To discuss the chiropractic diagnosis and management of a non-neuromusculoskeletal condition such as neonatal milk intolerance. **Presenting concerns:** A six-day old girl presented with a gastrointestinal disorder, difficulty falling asleep, frequent crying periods and feeding abnormalities. Chiropractic spinal manipulation was the initial treatment. **Intervention and outcomes:** The patient received four treatments consisting of chiropractic spinal manipulation over a period of one month. After these treatments, she slept for longer periods of time, her stool was easier to pass, suckling improved but appetite remained variable. She required dietary changes in order to restore a normal feeding pattern and to gain weight. **Conclusion:** This case demonstrates the difficulty in differentiating gastrointestinal disorder in neonates. Chiropractic appears to be a supportive treatment to gastrointestinal disorder in facilitating neuromusculoskeletal function.

Key Words: food protein intolerance, colic, gastroesophageal reflux, chiropractic, spinal manipulation, pediatric.

Introduction

Parents are on a constant learning curve when they have a newborn and the well-being of the new family member becomes their priority. During the first months of life, 15% to 40% of all newborns will show signs of irritability and distress for a variety of reasons.¹ One of these may be food allergies or intolerance. A food protein allergy or intolerance can be the cause of persistent discomfort.¹ The diagnosis of milk intolerance is widely used to describe many symptoms seen in infants who are fed commercial formula. This broad term includes lactose intolerance (LI), cow's milk allergies (CMA) and cow's milk protein intolerance (CMPI).² Lactose intolerance can be congenital, in rare cases, and of primary origin (reduction in the production of the enzyme lactase) or secondary (disruption in normal gut flora after the use of antibiotics for example). Symptoms are located in the gastrointestinal tract only.² Cow's milk protein intolerance is seen in 1.8% to 7.5% of the pediatric population, depending on the criteria used. Intolerance often refers to non-IgE mediated reaction unlike allergies, which are IgE mediated and involve multisystemic reactions.²

The incidence of CMA is 2.5%. Occurrence in breastfed infants is 2.1%.³ If gastrointestinal symptoms appear shortly after milk ingestion, suspicion of intolerance arises. The diagnosis of CMA is made when hydrolysed milk is provided to the baby or if all cow's milk products are excluded from the mother's diet and digestion normalizes.⁴ Prior to investigation of this hypothesis, gastrointestinal symptoms may be confused with other frequent neonatal conditions such as gastroesophageal reflux (GER) and colic which

demonstrate a similar symptomatology such as gas, difficulty sleeping, discomfort, excessive crying, and disrupted feeding patterns. In severe cases, dehydration, vomiting, electrolyte abnormalities and failure to thrive have been observed.² Medication might be the first intervention in an attempt to relieve the neonate's discomfort, with relative but variable success. Dietary changes are another option. In both cases, if the neonate is breastfed, it is recommended that the mother eliminate cow's protein from her diet. For formula fed babies, a transition to hydrolyzed protein formula is recommended.

Parents might also chose a trial of complementary and alternative medicine (CAM), including chiropractic care, to find a solution to their child's discomfort. A limited search of the literature (*Pub Med* and *Science Direct*) using the terms "chiropractic and food intolerance" and "chiropractic and milk protein intolerance" and "spinal manipulative therapy" was performed. Chiropractic literature on food allergies is limited. Jamison and Davies⁵ did a therapeutic trial based on the sleep patterns of cow's milk intolerant infants. They noted improvement of sleep patterns in 14 of the 19 infants when manipulation consisting of a sustained light pressure for 8 to 10 seconds followed by low-amplitude, high-acceleration thrusts were combined with dietary changes. According to case reports on GER and colic, chiropractic can help, but needs to be confirmed by further research (for colic especially) because benefits are shown in case reports, small cohort studies that tend to use poor methodology.⁶

This case report is an attempt to add information on the

diagnosis, treatment and outcomes of an infant showing gastro intestinal difficulty who received chiropractic care.

Presenting concerns

A six-day-old Caucasian female was seen in a chiropractic clinic with symptoms of digestive disorder that began at four-days-old. Her appetite was variable, both when fed by bottle or when breastfed. She showed difficulty with eructation, taking several minutes to elicit, longer during the day versus at night. She was also having trouble eliminating stool, which had an inconsistent texture, sometimes liquid and sometimes solid, and was accompanied by crying. She did not pass a significant amount of intestinal gas and it did not seem to relieve her when she did. When her parents laid her supine, she would start crying immediately. Nothing seemed to relieve her discomfort, except being held in the arms of her parents.

Clinical findings

The patient was delivered by a scheduled Caesarean section at 39 weeks gestation (there was no spontaneous onset of labor before the scheduled date of surgery). The fetus was in a vertex presentation. The pregnancy itself was unremarkable. The neonate weighed 8 pounds and 2 ounces. Her APGAR score was 10/10. The results of the pediatric exam conducted at the hospital at birth were normal. The systems review revealed that she was breastfed from birth and received supplemental commercial formula. She took from 1 to 4 ounces by bottle but did not latch efficiently with milk leaking from either side of her mouth at every meal (even if breastfed) indicating a poor seal. Regurgitation happened occasionally in small quantities; parents noted that on occasions, these were in larger quantities. She slept uninterrupted for two to three hours at night and four to five hours during the day with no preferred position and would sleep for a longer period of time when in her parents' arms. She was taking a vitamin D supplement twice a day. She was scheduled for her first medical appointment with a family doctor in four weeks. No interventions were employed by the parents in an attempt to relieve the neonate's discomfort. They had sought chiropractic care with their first daughter and wanted to try the same for their second.

The physical exam found that posture was normal. The head shape and position were normal. The neurological evaluation showed that her rooting reflex was absent on the left. Suckling was present but only for a few seconds. Plantar-Flexor test was elicited normally. Both plantar and palmar grasp reflexes were present. Moro, vertical suspension and placing responses were normal. Orthopedic tests such as Ortolani and Barlow were negative. The gluteal crease check was vertical. Temporomandibular joint exam was normal, including absence of abnormal movement, tongue tie or lip tie. Spinal palpation showed restricted motion at vertebral level L1 and T4 in flexion and C1 in right rotation.

Based on the clinical presentation and physical exam, the diagnosis made was digestive disorder of somato-visceral origin associated with subluxation of L1, T4 and C1. Differential diagnoses included colic, gastroesophageal reflux and constipation.

After parents gave informed consent, spinal manipulation therapy (SMT) was performed following the exam using diversified techniques and modified for gestational age and size using low force. The baby was scheduled to be seen once a week, for four weeks. Parents were instructed on how to exercise her lower extremities to help with elimination and to gently stimulate the cheeks frequently to promote a secure seal when feeding. They were also asked to keep a journal of her symptoms to assess if her symptoms had any correlation with the mother's diet.

Follow-up and outcomes

Over the course of the four treatments in one month, sleep positioning and pattern improved. The baby was sleeping five to six hours at night. Parents changed her diet from two periods of breastfeeding a day to commercial formula only because they saw that it limited regurgitation. Stooling became easier although the liquid texture was still a concern. The rooting reflex on the left side appeared after the third visit. The neonate's appetite remained variable and she still had trouble gaining weight. At the third visit, spinal palpation revealed no restriction but appetite problems persisted. The chiropractor advised the parents to experiment with another commercial formula, a hydrolyzed protein formula possibly being easier to digest, with hypothesis of possible milk protein intolerance. Hydrolyzed Protein milk (Nutramigen®A+®) was tried once but discontinued because the parents felt the baby disliked the taste.

After the fourth visit, parents took their daughter to the emergency room one night after an intense crying period and 6 hours not feeding. She was seen by two pediatricians. One administered a proton pump inhibitor (Prevacid®) on the diagnosis of GER. Because they stayed overnight under observation, they met another pediatrician the next morning. He recommended an amino acid-derived formula (Puramino™ A+®), suspecting a severe protein intolerance.

The child presented for chiropractic reevaluation one week later. Spinal palpation showed restricted movement at L1 in flexion and C1 in right rotation. Stool now had a constant consistency. She had gained weight, regurgitation was rare, appetite was good and the milk intake was increasing daily. Sleep was from six to seven hours at night. Evolution of symptoms and adjustments are documented in Table 1.

Parents decided to formula feed exclusively after the first treatment. They observed that regurgitation was less frequent when formula fed compared to breastmilk. Conse-

Table 1. Evolution of symptoms and adjustments

Date	Symptoms	Spinal restriction / Intervention
May 05th, 2015	Exam	L1flexion , D4 flexion, C1 right rotation
May 08th, 2015	Can lay on back Stool easier, less uncomfortable, diarrhea type Latch better, still variable Appetite better Vomit 1x 2 days ago Sleep 6 hours night	L1 flexion, C1 right rotation
May 13th, 2015	Appetite diminished, better since last 2 days. Stool stable, diarrhea appearance Regurgitations occasional Eructation takes several minutes Latch efficiently Rooting present both sides	No adjustment Trial with another formula
May 20th, 2015	Appetite variable Stool once liquid, otherwise stable Sleep 8 hours night Eructation ok	L1 flexion, C1 right rotation
May 21st, 2015	Visit to ER, Puramino™ A+® and Prevacid® are prescribed	
May 29th, 2015	Re-evaluation Stool has constant consistency Gained weight Regurgitation rare Appetite is good; formula intake increase daily sleep from six to seven hours at night	L1 flexion, C1 right rotation

quently, the mother was not compliant with maintaining the dietary journal associated with the newborn's symptoms, nor was there an attempt to eliminate cow's milk products from her diet. Otherwise, no adverse event due to chiropractic manipulation was reported by the parent.

Discussion

Breastfeeding is recognized to be the optimal milk source for infants from a nutritional, immunological, protective and linking aspect. It is unknown in this case, due to the parent's choice to use a commercial formula, whether removing all cow's milk protein products from the mother's diet would have resulted in improved tolerance of human breastmilk.

Infant formulas are a substitute that may be palliative when there is an inability to provide maternal milk.⁷ The key is the composition and its ability to mimic breast milk composition. As the main focus is protein, when allergic reactions are observed, a diet with extensively hydrolyzed protein or an amino acid mixture diet is recommended.⁸ Hydrolyzed protein milk is considered as pre-digested casein or whey

which provides nitrogen from peptide and amino acids. Two options are available: partially or extensively hydrolyzed. HPF is partially hydrolyzed peptides and contains lactose and eHPF has smaller peptide without lactose.³ The latter could be misnamed as hypoallergenic, but the reduction of the high molecule weight is not always optimal for every formula.⁹ They are prescribed as a first alternative to resolve the adverse reaction to formula. Every milk protein has an allergic potential and depending on the formula used, the infant may experience discomfort if the hydrolysed protein is still large enough to cause a reaction because of the ultrafiltration technique used in the final process of making hydrolyzed protein formula or does not remove the one to which they are sensitive.¹⁰ The hypothesis is that the intolerance to larger peptide fragments in the enzymatic hydrolysate is the mechanism for persistent intolerance. In fact, studies have demonstrated traces of P-lactoalbumine, β-lactoglobuline and casein in such formulas.¹⁰ An allergy to those formulas will induce gastrointestinal symptoms similar to CMA.³ Fussiness, irritability, loose stool and vomiting can still occur before changing to another amino acid based formula. These symptoms are still common in infants and

often misdiagnosed as gastroesophageal reflux or infantile colic.¹¹ Such food intolerances are transient in the child's life. In a Danish study where children were followed for three years it was discovered that at the age of one year, 56% of children had recovered from their cow's milk allergy, 77% had recovered at 2 years and 87% at 3 years of age.

Cases become more complex when comorbid diagnoses are treated simultaneously. In this particular case, GER was also treated. Treatment of this condition is not significantly different from the treatment for protein intolerance, in both cases, there is a potential to use extensive hydrolysed protein formula.¹³ A two to four weeks trial on formula helps differentiate protein intolerance from GER if the formula doesn't help to reduce the symptoms.¹⁴ The use of pump proton inhibitors is questionable. A systematic review suggests that the risks (respiratory and gastrointestinal infections) outweigh the benefits¹⁵ except in the treatment of more complicated case such as erosive esophagitis, neurological dysfunction, respiratory complications or Barrett's oesophagus.¹⁴ This class of medication is increasingly prescribed to help irritability and crying in infants.¹⁶ Otherwise, in simple GER, reassurance and explanation of head positions, frequency of feed and the use of thickening agents are recommended.¹⁵ The condition should self resolve by the time the child reaches one year of age.

Colic is also a diagnosis to consider. The classic definition comes from Wessel's rule of three: crying at least three hours per day on at least three days for at least three weeks.⁶ Other definitions emphasize the digestive problems, flexed position or intensity and length of crying. As with GER, colic is self limiting and improvement is usually seen by the age of four months. Etiology is unknown. Because there is no consensus on definition, efficient medical management and treatment, new trends are appearing in the nutritional field. Dietary approaches range from the avoidance of cow's milk proteins in breast-feeding mothers and bottle-fed infants to an increase in the use of new specialized substitute formulas. Many of these, such as partially hydrolyzed proteins and low lactose with prebiotics or probiotics added are under investigation. Proper intestine microbiota balance promotes motility and normalizes gas production.¹⁷ In a systematic review in 2013, authors found conflicting results regarding diet and colic symptoms management.¹⁸

Chiropractic manipulations modified for a neonate's gestational age and size range from non or low-force (press and hold technique) to diversified osseous techniques (usually low-amplitude high-velocity movements) performed manually, but may be performed utilizing a low force percussive instrument. The safety of such procedures regarding pediatric care has been demonstrated. The literature shows that there are no reports of serious or catastrophic adverse effects in any clinical trials or systematic reviews

using pediatric manual therapy.¹⁹ Adjustment force, velocity and amplitude are adapted to each patient's body size and weight.

Digestive spectrum evaluation might not be considered in the scope of chiropractic. The objective of the manipulation is in fact to restore optimal neuromusculoskeletal function. In this case, cervical dysfunction may impair the exit and tracking of the vagus nerve.²⁰ In this study, the neonate also showed signs of neurological issues with the absence of rooting reflex and poor swallowing control which involve cranial nerve V, VII, IX, X, XII.²¹ Autonomic dysregulation (an imbalance between sympathetic and parasympathetic tone) can also cause digestive and intestinal problems by the neurophysiologic component of the spinal dysfunction.²¹ Studies are investigating why sensory input from paraspinal tissues can evoke visceral reflexes affecting the sympathetic nervous system and may alter end-organ function, which is observed clinically in chiropractic offices.²²

Chiropractic can play a supportive role in digestive conditions, both diagnostically and therapeutically. Very few studies are available on food intolerance and CAM. However, keeping in mind that food protein intolerance, colic and GER share similar symptoms and have unclear definitions and criteria of evaluation especially with infants, research in these three areas might lead to better comprehension. This is true of GER where some case reports are listed, but for older children. Literature review is favorable in the chiropractic treatment of infantile colic, with few adverse reports, and no aggravation of symptoms.²³ Two RCTs are available. One concludes that spinal manipulations appear to be more effective compared to over the counter medication.²⁴ The other states that chiropractic spinal manipulations are no more effective than placebo.²⁵ The Kingston systematic review was unable to confirm a relationship between chiropractic subluxations and colic symptoms.²⁶

Limitations of this case report include the short period of time and small number of spinal manipulation that were performed. The numerous medical interventions created an additional challenge in directly correlating the interventions to outcomes. Precise information regarding crying, burping or sleeping time from the parents was also a challenge to obtain considering their subjective bias and the effect of a demanding newborn on the family. Fortunately, the mother was present at all consultations which reduces the difference between mother and father report of symptoms.

Conclusion

This case report adds information regarding diagnosis and management of milk protein intolerance of a newborn. Challenges lie in making a diagnosis and evaluating the possibilities to improve newborn and family quality of life. Because of the wide variety of gastro intestinal symptoms

and the overlap between condition and treatment, chiropractic can be considered in order to promote optimal neuromusculoskeletal function. Even if it has its limits regarding chiropractic scope of practice addressing neuromusculoskeletal conditions, this case observed changes in some aspects of the patient's symptomatology. In addition, in the current healthcare system, chiropractors are privileged to meet new family members at the beginning of their lives, to follow them closely and to earn parent trust. In pursuit of that goal, better definitions and clear diagnostic criteria should continue to be refined in research on neonatal conditions and their management.

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Clinical presentation of neurologic manifestations secondary to Leigh disease: a chiropractic case report

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ABSTRACT

Objective: To raise awareness and assist in recognizing the signs of neurodegenerative disorders as they are presented in a chiropractic office for assessment. This report addresses the clinical presentation, neurologic examination and a discussion about the clinical detection of neurodegenerative disorders in children. **Clinical Features:** A case of Leigh disease in a 4-month-old boy. Chiropractic care was sought for gastroesophageal reflux and difficulty feeding. Physical examination revealed hypotonia, developmental delay and abnormal cranial nerve function. **Intervention and Outcome:** Due to neurologic presentation, an immediate referral for medical evaluation was done. The child was diagnosed with Leigh disease and passed away one month later. **Discussion:** Leigh syndrome is a heterogeneous and progressive neurodegenerative disorder of infancy and childhood caused by a mitochondrial dysfunction. Central hypotonia, developmental regression or arrest, and signs of brainstem or basal ganglia involvement (respiratory and ophthalmologic abnormalities, dysphagia, ataxia, dystonia and seizures) are a classical presentation. This inherited disease is fatal and rapid medical referral is required for patients presenting this condition. **Conclusion:** Chiropractors should obtain a precise case history and perform a complete physical and neurological examination to investigate for neurodevelopmental delay or regression. Neurologic abnormalities should be quickly referred for medical investigation to identify the underlying condition.

Key words: Leigh syndrome, Leigh disease, mitochondrial disease, chiropractic, pediatric.

Introduction

Leigh Syndrome (LS), also known as subacute necrotizing encephalopathy, is a progressive neurodegenerative inherited disease. First described by Denis Leigh in 1951, this syndrome is a mitochondrial disorder¹ predominantly affecting infants and young children, and is rarely diagnosed in teens and adults.^{2,3} In the majority of cases, onset of symptoms is in early childhood, typically in the first two years of life.⁴ The onset of LS is often triggered by metabolic challenges such as acute infections and surgery.⁵ The incidence of Leigh syndrome is approximately 1 in 40 000 births⁴ but can be as high as 1 in 2000 births in French-Canadian specific sub populations such as in the Saguenay Lac-Saint-Jean area in Quebec.⁶ LS represents the most common pediatric mitochondrial disease.^{7,8} The estimated prevalence of LS is 2.05 cases per 100 000.⁹

LS results in a severe dysfunction in mitochondrial energy production.¹⁰ This heterogeneous metabolic disorder presents multiple genetic causes, involving both mitochondrial and nuclear DNA gene mutations.^{11,12} The modes of inheritance include autosomal recessive, x-linked recessive or maternal (mitochondrial) patterns.¹³ LS neuropathology is characterised by a unique pattern of focal, bilateral and symmetric lesions in the central nervous system (CNS).¹ The lesions most commonly take the form of necrosis, demyelination, vascular proliferation and gliosis in the brain-

stem, diencephalon, basal ganglia, and cerebellum.⁴ LS most commonly affects the brainstem.¹⁴

Depending on which areas of the central nervous system are involved, patients may demonstrate a wide variety of clinical presentations such as abnormal neurologic manifestations. The frequently encountered presentation of LS is characterized by:^{4,6,11}

- Psychomotor delay or regression
- Muscular hypotonia
- Ophthalmologic manifestations
- Seizures
- Swallowing and sucking dysfunction
- Respiratory disturbances
- Ataxia
- Dystonia

The diagnosis is often made only after a computed tomography or magnetic resonance imaging¹⁵ is performed. Currently, there is no cure for affected patients.⁵ The prognosis is poor and the disease is fatal.¹⁶ The median age of death is 2.4 years old¹⁷ and the majority of cases die before the age of 5¹⁸ with a high incidence of respiratory failure.⁶ Acute respiratory failure, attributable to involvement of the brainstem or respiratory muscle weakness, is a frequent feature and occurs in 64-72% of cases.¹⁹

Methods

A literature search was conducted using the following electronic journal databases: PubMed, Science direct, ChiroACCESS and Index to Chiropractic literature. Other articles and books were used to provide supporting information. Publications utilized included systematic reviews, case studies and randomized controlled trials. Relevant search key words included: Leigh disease, Leigh syndrome, mitochondrial disease, mitochondrial syndrome. There were no articles or studies available on the use of chiropractic care and Leigh disease or syndrome. Articles published between 1951 and 2014 were included.

Presenting Concerns

The mother of a 4-month-old boy presented her son for chiropractic care with a myriad of complaints: difficulty feeding, poor appetite, constipation, intestinal gas, fussiness, frequent vomiting and excessive crying (high-pitch sounds). The infant was previously diagnosed by his primary care physician with gastroesophageal reflux (GER) and was prescribed a proton pump inhibitor (Prevacid (TM) (Lansoprazole) 15mg/day) which blocks the production of acid by the stomach. Concurrent with medical care, the patient received osteopathic care (non medical manual therapy) for an unspecified number of treatments. Since the infant’s subjective complaints had somewhat improved but without total resolution, the mother sought care from a chiropractor with particular interest in pediatric care.

The mother reported a normal pregnancy and a full-term birth without complication. The infant’s birth weight was 9 lbs 2 oz (93rd percentile) with a length of 22 in. Breastfeeding was very difficult at first so the mother was expressing milk and giving it to the infant in a bottle. She switched to a breastmilk substitute/infant formula “Good Start” after three months due to lactation issues. At this time, patient’s weight dropped to 15th percentile.

Clinical Findings

Clinical evaluation included a detailed neurologic assessment examining tone, strength, and reflexes. Physical examination revealed hypotonia in active and passive muscle activity of the baby’s extremities. A preferred head position in right lateral flexion was present with a normal head shape. The range of motion (ROM) of the cervical spine was without restriction.

During the neurological examination, primitive reflexes and cranial nerves evaluation revealed abnormal tongue movement (poor sucking). The blink reflex, landau and asymmetric tonic neck reflex (ATNR) were absent. A lack of visual tracking and poor eye contact were observed. Developmental milestones revealed a motor developmental delay: when prone, the infant was unable to lift his head

(unable to recruit the cervical extensors and the more superficial muscles like the trapezii which are often additionally recruited in extension) and the head and shoulders could not be supported by his forearms. Multiple areas of vertebral dysfunction were identified upon palpation, specifically at C0 antero-superior, C1 lateral right, T4 posterior, T12 posterior right, with a posterior left sacrum at the S1 segment. Cranial restrictions were noted in occiput and sphenoid.

Intervention and Outcome

The child was adjusted using diversified techniques modified for an infant’s gestational age and specific anatomy and physiology and no adverse events noted as a result of chiropractic adjustment. The combination of severe hypotonia, developmental delay, visual and feeding difficulties raised serious concerns about this patient’s neurologic health status. The patient was immediately referred to a pediatric hospital for further assessment and testing. Clinical investigations included: biochemical laboratory investigations, swallow study, cerebral MRI, and eye, cardiac and neurologic evaluation. Results from swallow study showed evidence of aspiration with feeds and swallowing difficulties. Basal ganglia and brainstem lesion were evident on MRI. The diagnosis of mitochondrial disorder (Leigh disease) was given approximately 3 weeks after the last chiropractic consultation. The child passed away one month later. (Table 1: Timeline).

Table 1. Timeline	
Date	Milestone
December 2014	Birth: feeding dysfunction, fussiness, high-pitch crying, constipation, gastroesophageal reflux.
January 2015	Osteopathic treatment: no significant improvement noted after treatments. Discontinued.
February 2015	Diagnosis (pediatrician) = GER; prescription of Prevacid with some amelioration
March- 2015	Evaluation by a chiropractor with pediatric focus. Referred immediately for medical evaluation due to neurologic presentation.
April - 2015	Pediatric hospital investigations: biochemical laboratory, swallow study, cerebral MRI, eyes, cardiac and neurologic evaluation = Diagnosis of Leigh disease
May - 2015	Death

Discussion

This case highlights the importance of adequately correlating patient symptoms with examination findings. Although the clinical presentation raised “red flags” for the presence

of a serious disease, the neurologic signs could have been missed, especially if the clinician had omitted to perform a complete pediatric neurologic exam. In fact, chiropractors do not have the necessary resources to diagnose LS. However, they can recognize symptoms indicative of a neurodegenerative disorder.

An affected child typically shows symptoms in the first 2 years of his life, including developmental delay or regression with loss of previously acquired skills.¹⁵ Neurodegenerative symptoms include muscular hypotonia or spasticity, dystonia, seizures, ataxia, dysphagia, ptosis, abnormal eye movements such as nystagmus or slow saccades, breathing irregularities such as apnoea and psychomotor retardation, feeding difficulties leading to vomiting and failure to thrive.^{11,20}

Because heterogeneous presentations can be first revealed in a chiropractic practice, it is essential that chiropractors be trained to recognize the signs and symptoms associated with LS. As primary health care providers, chiropractors need to remain current on the information pertaining to this condition in order to evaluate patients through a detailed case history and thorough physical examination including a complete neurologic evaluation²¹ (Table 2) and a developmental checklist of milestones achieved at certain ages²² (Table 3). The chiropractor's role is to detect the neurologic impairment and quickly refer the patient for further investigation.

The medical investigation for a potential diagnosis of LS is based primarily on the clinical history, the physical examination and then the laboratory parameters (blood and urine analysis). When clinical initial signs and laboratory examinations suggest a possible diagnosis of LS, cerebral MRI (T2-weight)²³ should be performed as well as other imaging techniques such as proton magnetic resonance spectroscopy (MRS).²⁴ Even if cerebral MRI is an effective way to identify characteristic findings of LS, biochemical analysis of muscle biopsies or, when applicable, cultured fibroblasts biopsies and genetic diagnosis are key elements to establishing genetic diagnosis and finding the causal defect.²⁵

To date, there are no causative treatment options for LS.⁶ However, prevention strategies can be implemented. Interdisciplinary palliative care still remains a mainstay of LS treatment to help and support problems due to brain lesions.²⁶ For example, ophthalmologists and audiologists should be involved in the care of affected children with problems like optic atrophy or progressive hearing loss. Home-care ventilator support for respiratory dysrhythmia and a nasogastric tube in case of dysphagia should be made available. Early intervention physiotherapy programs (exercise training) are recommended to support neurodevel-

Table 2. Pediatric neurological examination checklist (0 to 12 months)

Posture and observation

- Flexed or extended arms and legs
- Spontaneous movement
- Asymmetric movement
- Hypotonia
- Spasticity
- Tremors
- Seizures

Primitive Reflexes

Supine:

- Rooting
- Sucking
- Palmar and plantar grasp
- Blink / Acoustic blink
- Tonic neck
- Moro
- Plantar-flexor (Babinski)

Upright:

- Vertical suspension
- Placing response
- Stepping

Prone:

- Landau
- Gallant

Cranial nerves

- I. Olfactory
- II. Optic
- III. Oculomotor
- IV. Trochlea
- V. Trigeminal
- VI. Abducens
- VII. Facial
- VIII. Acoustic
- IX. Glossopharyngeal
- X. Vagus
- XI. Spinal accessory
- XII. Hypoglossal

Deep tendon reflexes

- Patellar, Achilles, Biceps (0 to 3+)
- Clonus

* Adapted from Fysh 2002

opment of affected patients.^{27,28} Specialized palliative care teams should be involved, providing in-home nursing and support for children and their parents.⁵ The current literature contains no studies or case reports on chiropractic management. It is possible that chiropractors can be members of the team alongside other health care profession-

Table 3: Developmental milestones chart for quick office reference (0 to 12 months)

Age	Gross motor	Fine motor	Communication	Cognitive	Social
Newborn	Moro reflex, Flexed posture	Palmar grasp reflex	Rooting and sucking reflexes, variable cries	Turns to visual stimuli (contrast, colors)	Cries when other infant cries
Two months	Holds head up 45° in prone, ATNR emerges	Holds a rattle placed in hand	Gurgles and coos	Follows objects across field of vision	Smiles, more awake during day
Four months	Head and shoulders can be supported by the forearms in prone	Brings hands together in midline, bats a toy, reaches, grasps and shakes rattle	Laughs	Plays with hands, looks for familiar objects and finds caregiver	Enjoys eye contact, calms when spoken to
Six months	Primitive reflexes gone, pulls up to sit, sits without support, rolls from prone to supine	Passes objects from hand to hand, checks objects by placing them into the mouth	Turns to voice, vocalizes to answer/babbles uses one-syllable words = “da”, imitates sounds	Plays with feet, looks for dropped object, bangs objects together, recognizes own name	Facial expression, prefers familiar people, shows interest in other infants
Nine months	Postural reflexes present, rolls both ways, crawls, stands holding onto furniture	Radial-digital and raking grasp	Looks to familiar named object, inhibits to ‘no’, uses 2-syllable words: Mama/Dada	Object permanence, explores caregiver’s face, searches for hidden toy	Attachment development established, clearly shows joy and pleasure
Twelve months	Pulls to standing position, walks holding on and/or unassisted, catches rolling ball	Pincer grasp, voluntary object release into cup, holds bottle, feeds self with fingers	Turns to name, understands several words, uses 2-3 words vocabulary, imitates clapping, waves bye-bye	Looks for object hidden, ‘Cause and effect’ toys	Plays Peekaboo

***Adapted from Dosman 2012 and Fysh 2002.*

als to support neurodevelopment and the well being of a child diagnosed with LS. Chiropractors could play a role with chiropractic adjustments and exercises to preserve and maximize strength, mobility and function. Further research is warranted to assess the outcomes and safety of chiropractic intervention in patients with similar presentations.

Conclusion

When evaluating a pediatric patient, chiropractors should

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obtain a precise history in order to investigate for delay or regression of developmental milestones, and perform a complete neurologic examination. The confluence of findings including unexplained hypotonia, neurodevelopmental delay or regression and physical neurologic abnormalities should be referred for medical investigation in order to identify the underlying condition. Outcome of a neurodegenerative condition is usually fatal and available therapies are often limited but may serve to support quality of life.

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Barriers to implementing a reporting and learning patient safety system.

Pediatric Chiropractic Perspective.

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Journal of Evidence-Based Complementary & Alternative Medicine, April 2016; vol. 21,2: pp. 105-109., first published on October 4, 2015

ABSTRACT

A reporting and learning system is a method of monitoring the occurrence of incidents that affect patient safety. This cross-sectional survey asked pediatric chiropractors about factors that may limit their participation in such a system. The list of potential barriers for participation was developed using a systematic approach. All members of the 2 pediatric councils associated with US national chiropractic organizations were invited to complete the survey (N = 400). The cross-sectional survey was created using an online survey tool (REDCap) and sent directly to member emails addressed by the respective executive committees. Of the 400 potential respondents, 81 responded (20.3%). The most common limitations to participating were identified as time pressure (96%) and patient concerns (81%). Reporting and learning systems have been utilized to increase safety awareness in many high-risk industries. To be successful, future patient safety studies with pediatric chiropractors need to ensure these barriers are understood and addressed.

Key Words: pediatric, doctor of chiropractic, spinal manipulation, patient safety

Attitudes toward chiropractic.

A Survey of Canadian Obstetricians.

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Journal of Evidence-Based Complementary & Alternative Medicine, April 2016; vol. 21,2: pp. 92-104., first published on September 8, 2015

Key Words: chiropractic, low back pain, complementary therapies, manipulation, spinal manipulation, obstetric, pregnancy

ABSTRACT

We assessed the attitudes of Canadian obstetricians toward chiropractic with a 38-item cross-sectional survey. Ninety-one obstetricians completed the survey, for a response rate of 14% (91 of 659). Overall, 30% of respondents held positive views toward chiropractic, 37% were neutral, and 33% reported negative views. Most (77%) reported that chiropractic care was effective for some musculoskeletal complaints, but 74% disagreed that chiropractic had a role in treatment of non-musculoskeletal conditions. Forty percent of respondents referred at least some patients for chiropractic care each year, and 56% were interested in learning more about chiropractic care. Written comments from respondents revealed concerns regarding safety of spinal manipulation and variability among chiropractors. Canadian obstetricians' attitudes toward chiropractic are diverse and referrals to chiropractic care for their patients who suffer from pregnancy-related low back pain are limited. Improved interprofessional relations may help optimize care of pregnant patients suffering from low back pain.

The use of chiropractic by special populations.

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Journal of Evidence-Based Complementary & Alternative Medicine, April 2016 vol. 21 no. 2 83-84

Full article available at: <http://chp.sagepub.com/content/21/2/83.full>

ABSTRACT

Chiropractic care, known best for its emphasis on spinal manipulative therapy, is the most commonly used provider-based complementary and alternative medicine therapy in the United States. It has accumulated a substantial body of evidence for the management of low back pain and other musculoskeletal complaints in adults. However, at this time, fewer studies have focused on its use in different populations who may have different needs, risk factors, and response to treatment. Current recommendations and guidelines are based, for the most part, on research investigating chiropractic care for primarily white adults with uncomplicated nonspecific musculoskeletal complaints. This is congruent with current patterns of use of chiropractic. A recent population-based survey indicated that 93% of current chiropractic users are white, and 18% were 65 years or older. A 2015 report using National Health Interview Survey data found that only 3% of children ages 4 to 17 years had used chiropractic or osteopathic manipulation within the past year; infants were not included. However, it is important to investigate the use of chiropractic among special populations in order to gather evidence on whether the general findings may appropriately be extrapolated to diverse population groups. This issue presents articles addressing issues related to chiropractic care for special population groups.

Parent reports of exclusive breastfeeding after attending a combined midwifery and chiropractic feeding clinic in the United Kingdom.

A Cross-Sectional Service Evaluation.

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Journal of Evidence-Based Complementary & Alternative Medicine, April 2016 Vol. 21, No. 2, 85-91.

Key Words: children; complementary and alternative medicine

ABSTRACT

This service evaluation investigated an interdisciplinary allied professional health care strategy to address the problem of suboptimal breastfeeding. A clinic of midwives and chiropractors was developed in a university-affiliated clinic in the United Kingdom to care for suboptimal feeding through a multidisciplinary approach. No studies have previously investigated the effect of such an approach. The aim was to assess any impact to the breastfeeding dyad and maternal satisfaction after attending the multidisciplinary clinic through a service evaluation. Eighty-five initial questionnaires were completed and 72 (85%) follow-up questionnaires were returned. On follow-up, 93% of mothers reported an improvement in feeding as well as satisfaction with the care provided. Prior to treatment, 26% of the infants were exclusively breastfed. At the follow-up survey, 86% of mothers reported exclusive breastfeeding. The relative risk ratio for exclusive breastfeeding after attending the multidisciplinary clinic was 3.6 (95% confidence interval = 2.4-5.4).

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Core competencies of the certified pediatric doctor of chiropractic.

Results of a Delphi Consensus Process.

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Journal of Evidence-Based Complementary & Alternative Medicine. January 5, 2016 2156587215622769

Key Words: children, chiropractic, education

ABSTRACT

An outline of the minimum core competencies expected from a certified pediatric doctor of chiropractic was developed using a Delphi consensus process. The initial set of seed statements and substatements was modeled on competency documents used by organizations that oversee chiropractic and medical education. These statements were distributed to the Delphi panel, reaching consensus when 80% of the panelists approved each segment. The panel consisted of 23 specialists in chiropractic pediatrics (14 females) from across the broad spectrum of the chiropractic profession. Sixty-one percent of panelists had postgraduate pediatric certifications or degrees, 39% had additional graduate degrees, and 74% were faculty at a chiropractic institution and/or in a postgraduate pediatrics program. The panel were initially given 10 statements with related substatements formulated by the study's steering committee. On all 3 rounds of the Delphi process the panelists reached consensus; however, multiple rounds occurred to incorporate the valuable qualitative feedback received.

The influence of early infant-feeding practices on the intestinal microbiome and body composition in infants.

O'Sullivan A, Farver M, Smilowitz JT.

Nutr Metab Insights, 2015 Dec 16;8(Suppl 1):1-9. doi: 10.4137/NMI.S29530. eCollection 2015.

Keywords: Baby Friendly Hospital Initiative; Bifidobacterium; body composition; breastfeeding; formula-feeding; human

ABSTRACT

Despite many years of widespread international recommendations to support exclusive breastfeeding for the first six months of life, common hospitalfeeding and birthing practices do not coincide with the necessary steps to support exclusive breastfeeding. These common hospital practices can lead to the infant receiving formula in the first weeks of life despite mothers' dedication to exclusively breastfeed. Consequently, these practices play a role in the alarmingly high rate of formula-feeding worldwide. Formula-feeding has been shown to alter the infant gut microbiome in favor of proinflammatory taxa and increase gut permeability and bacterial load. Furthermore, several studies have found that formula-feeding increases the risk of obesity in later childhood. While research has demonstrated differences in the intestinal microbiome and body growth between exclusivelybreast versus formula-fed infants, very little is known about the effects of introducing formula to breastfed infants either briefly or long term on these outcomes. Understanding the relationships between mixed-feeding practices and infant health outcomes is complicated by the lack of clarity in the definition of mixed-feeding as well as the terminology used to describe this type of feeding in the literature. In this commentary, we highlight the need for hospitals to embrace the 10 steps of the Baby Friendly Hospital Initiative developed by UNICEF and the WHO for successful breastfeeding. We present a paucity of studies that have focused on the effects of introducing formula to breastfed infants on the gut microbiome, gut health, growth, and body composition. We make the case for the need to conduct well-designed studies on mixed-feeding before we can truly answer the question: how does brief or long-term use of formula influence the health benefits of exclusive breastfeeding?

The effectiveness of lactation consultants and lactation counselors on breastfeeding outcomes.

Patel S, Patel S.

J Hum Lact. 2015 Dec 7. pii: 0890334415618668. [Epub ahead of print]

ABSTRACT

Breastfeeding for all infants starting at birth and continuing until at least 6 months of age has been recommended by the World Health Organization and the American Academy of Pediatrics. The health benefits to infants and mothers have been demonstrated in many studies. Dedicated lactation specialists may play a role in providing education and support to pregnant women and new mothers wishing to breastfeed to improve breastfeeding outcomes. The objective of this review was to assess if lactation education or support programs using lactation consultants or lactation counselors would improve rates of initiation and duration of any breastfeeding and exclusive breastfeeding compared with usual practice. A systematic literature review of the evidence was conducted using electronic databases. The review was limited to randomized trials and yielded 16 studies with 5084 participants. It was found that breastfeeding interventions using lactation consultants and counselors increase the number of women initiating breastfeeding (odds ratio [OR] for any initiation vs not initiating breastfeeding = 1.35; 95% confidence interval [CI], 1.10-1.67). The interventions improve any breastfeeding rates (OR for any breastfeeding up to 1 month vs not breastfeeding = 1.49; 95% CI, 1.09-2.04). In addition, there were beneficial effects on exclusive breastfeeding rates (OR for exclusive breastfeeding up to 1 month vs not exclusive breastfeeding = 1.71; 95% CI, 1.20-2.44). Most of the evidence would suggest developing and improving postpartum support programs incorporating lactation consultants and lactation counselors.

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Hydrolysed formula and risk of allergic or autoimmune disease: systematic review and meta-analysis.

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ABSTRACT

Objective: To determine whether feeding infants with hydrolysed formula reduces their risk of allergic or autoimmune disease. **Design:** Systematic review and meta-analysis, as part of a series of systematic reviews commissioned by the UK Food Standards Agency to inform guidelines on infant feeding. Two authors selected studies by consensus, independently extracted data, and assessed the quality of included studies using the Cochrane risk of bias tool.

Data sources: Medline, Embase, Web of Science, CENTRAL, and LILACS searched between January 1946 and April 2015. **Eligibility criteria for selecting studies:** Prospective intervention trials of hydrolysed cows' milk formula compared with another hydrolysed formula, human breast milk, or a standard cows' milk formula, which reported on allergic or autoimmune disease or allergic sensitisation. **Results:** 37 eligible intervention trials of hydrolysed formula were identified, including over 19 000 participants. There was evidence of conflict of interest and high or unclear risk of bias in most studies of allergic outcomes and evidence of publication bias for studies of eczema and wheeze. Overall there was no consistent evidence that partially or extensively hydrolysed formulas reduce risk of allergic or autoimmune outcomes in infants at high pre-existing risk of these outcomes. Odds ratios for eczema at age 0-4, compared with standard cows' milk formula, were 0.84 (95% confidence interval 0.67 to 1.07; I²=30%) for partially hydrolysed formula; 0.55 (0.28 to 1.09; I²=74%) for

extensively hydrolysed casein based formula; and 1.12 (0.88 to 1.42; I²=0%) for extensively hydrolysed whey based formula. There was no evidence to support the health claim approved by the US Food and Drug Administration that a partially hydrolysed formula could reduce the risk of eczema nor the conclusion of the Cochrane review that hydrolysed formula could prevent allergy to cows' milk. **Conclusion:** These findings do not support current guidelines that recommend the use of hydrolysed formula to prevent allergic disease in high risk infants.

Review registration: PROSPERO CRD42013004252

Unsolved mysteries of the human mammary gland: defining and redefining the critical questions from the lactation consultant's perspective.

Marasco LA.

J Mammary Gland Biol Neoplasia. 2014 Dec;19(3-4):271-88. doi: 10.1007/s10911-015-9330-7. Epub 2015 Jun 18.

ABSTRACT

Despite advances in knowledge about human lactation, clinicians face many problems when advising mothers who are experiencing breastfeeding difficulties that do not respond to normal management strategies. Primary insufficient milk production is now being acknowledged, but incidence rates have not been well studied. Many women have known histories of infertility, polycystic ovary syndrome, obesity, hypertension, insulin resistance, thyroid dysfunction, hyperandrogenism or other hormonal imbalances, while others have no obvious risk factors. Some present with obviously abnormal breasts that are pubescent, tuberous/tubular or asymmetric in shape, raising the question of insufficient mammary gland tissue. Other women have breasts that appear within normal limits yet do not lactate normally. Endocrine disruptors may underlie some of these cases but their impact on human milk production has not been well explored. Similarly, any problem with prolactin such as a deficiency in serum prolactin or receptor number, receptor resistance, or poor bioavailability or bioactivity could underlie some cases of insufficient lactation, yet these possibilities are rarely investigated. A weak or suppressed milk ejection reflex, often assumed to be psychosomatic, could be related to thyroid dysfunction or caused by downstream post-receptor pathway problems. In the absence of sufficient data regarding these situations, desperate mothers may turn to non-evidence-based remedies, sometimes at considerable cost and unknown risk. Research targeted to these clinical dilemmas is critical in order to develop evidence-based strategies and increase breastfeeding duration and success rates.

Clinical risk score for persistent postconcussion symptoms among children with acute concussion in the ED.

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JAMA. 2016;315(10):1014-1025. doi:10.1001/jama.2016.1203.

ABSTRACT

Importance: Approximately one-third of children experiencing acute concussion experience ongoing somatic, cognitive, and psychological or behavioral symptoms, referred to as persistent post-concussion symptoms (PPCS). However, validated and pragmatic tools enabling clinicians to identify patients at risk for PPCS do not exist. **Objective:** To derive and validate a clinical risk score for PPCS among children presenting to the emergency department. **Design, Setting, and Participants:** Prospective, multicenter cohort study (Predicting and Preventing Postconcussive Problems in Pediatrics [5P]) enrolled young patients (aged 5-18 years) who presented within 48 hours of an acute head injury at 1 of 9 pediatric emergency departments within the Pediatric Emergency Research Canada (PERC) network from August 2013 through September 2014 (derivation cohort) and from October 2014 through June 2015 (validation cohort). Participants completed follow-up 28 days after the injury. **Exposures:** All eligible patients had concussions consistent with the Zurich consensus diagnostic criteria. **Main Outcomes and Measures:** The primary outcome was PPCS risk score at 28 days, which was defined as 3 or more new or worsening symptoms using the patient-reported Postconcussion Symptom Inventory compared with recalled state of being prior to the injury. **Results:** In total, 3063 patients (median age, 12.0 years [interquartile range, 9.2-14.6 years]; 1205 [39.3%] girls) were enrolled (n=2006 in the derivation cohort; n=1057 in the validation cohort) and 2584 of whom (n=1701 [85%] in the derivation cohort; n=883 [84%] in the validation cohort) completed follow-up at 28 days after the injury. Persistent postconcussion symptoms were present in 801 patients (31.0%) (n=510 [30.0%] in the derivation cohort and n=291 [33.0%] in the validation cohort). The 12-point PPCS risk score model for the derivation cohort included the variables of female sex, age of 13 years or older, physician-diagnosed migraine history, prior concussion with symptoms lasting longer than 1 week, headache, sensitivity to noise, fatigue, answering questions slowly, and 4 or more errors on the Balance Error Scoring System tandem stance. The area under the curve was 0.71 (95% CI, 0.69-0.74) for the derivation cohort and 0.68 (95% CI, 0.65-0.72) for the validation cohort. **Conclusions and Relevance:** A clinical risk score developed among children presenting to the emergency department with concussion and head injury within the previous 48 hours had modest discrimination to stratify PPCS risk at 28 days. Before this score is adopted in clinical practice, further research is needed for external validation, assessment of accuracy in an office setting, and determination of clinical utility.

Management of post-traumatic headaches in children and adolescents.

Joanne Kacperski, MD, Todd Arthur, MD

Headache 2016;56(1):36-48.

ABSTRACT

Traumatic brain injuries (TBI) occur in an estimated 475,000 children aged 0–14 each year. Worldwide, mild traumatic brain injuries (mTBI) represent around 75–90% of all hospital admissions for TBI. mTBI are a common occurrence in children and adolescents, particularly in those involved in athletic activities. An estimated 1.6–3.8 million sports-related TBIs occur each year, including those for which no medical care is sought. Headache is a common occurrence following TBI, reported in as many as 86% of high school and college athletes who have suffered from head trauma. As most clinicians who manage concussion and post-traumatic headaches (PTHs) can attest, these headaches may be difficult to treat. There are currently no established guidelines for the treatment of PTHs, especially when persistent, and practices can vary widely from one clinician to the next.

Suicidality and aggression during antidepressant treatment.

Systematic Review and Meta-Analyses Based on Clinical Study Reports.

Tarang Sharma, Louise Schow Guski, Nanna Freund, Peter C Gøtzsche;

BMJ 2016; 352 doi: <http://dx.doi.org/10.1136/bmj.i65> (Published 27 January 2016)

Cite this as: *BMJ* 2016;352:i65

ABSTRACT

Objective: To study serious harms associated with selective serotonin and serotonin-norepinephrine reuptake inhibitors. **Design:** Systematic review and meta-analysis. **Main outcome measures:** Mortality and suicidality. Secondary outcomes were aggressive behaviour and akathisia. **Data sources:** Clinical study reports for duloxetine, fluoxetine, paroxetine, sertraline, and venlafaxine obtained from the European and UK drug regulators, and summary trial reports for duloxetine and fluoxetine from Eli Lilly's website. **Eligibility criteria for study selection:** Double blind placebo controlled trials that contained any patient narratives or individual patient listings of harms. **Data extraction and analysis:** Two researchers extracted data independently; the outcomes were meta-analysed by Peto's exact method (fixed effect model). **Results:** We included 70 trials (64 381 pages of clinical study reports) with 18 526 patients. These trials had limitations in the study design and discrepancies in reporting, which may have led to serious under-reporting of harms. For example, some outcomes appeared only in individual patient listings in appendices, which we had for only 32 trials, and we did not have case report forms for any of the trials. Differences in mortality (all deaths were in adults, odds ratio 1.28, 95% confidence interval 0.40 to 4.06), suicidality (1.21, 0.84 to 1.74), and akathisia (2.04, 0.93 to 4.48) were not significant, whereas patients taking antidepressants displayed more aggressive behaviour (1.93, 1.26 to 2.95). For adults, the odds ratios were 0.81 (0.51 to 1.28) for suicidality, 1.09 (0.55 to 2.14) for aggression, and 2.00 (0.79 to 5.04) for akathisia. The corresponding values for children and adolescents were 2.39 (1.31 to 4.33), 2.79 (1.62 to 4.81), and 2.15 (0.48 to 9.65). In the summary trial reports on Eli Lilly's website, almost all deaths were noted, but all suicidal ideation events were missing, and the information on the remaining outcomes was incomplete. **Conclusions:** Because of the shortcomings identified and having only partial access to appendices with no access to case report forms, the harms could not be estimated accurately. In adults there was no significant increase in all four outcomes, but in children and adolescents the risk of suicidality and aggression doubled. To elucidate the harms reliably, access to anonymized individual patient data is needed.