JCCP

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Case Report Components

• **Introduction**: State why this case is unusual or important.

• **Methods**: describe the search engine and key words used to review previously published literature on the subject

• **Case presentation**: Provide a brief summary of the patient's presenting demographics, other relevant characteristics, complaint(s) and related symptomatology.

• **Intervention and outcomes**: Describe the course of treatment, including frequency and duration, and summarize the patient's clinical outcomes, using recognized outcome measures if possible. Include whether informed consent was obtained and if there were any adverse events reported.

• **Discussion**: Succinctly state the important aspects of the case, in terms of its implications for patient care in general, or for specific patient populations or conditions. You may also compare/contrast the case to other cases in the published literature. Be cautious about overstating the importance/implications of your case.

Evidence-based Case Report Instructions

An Evidence-based Case Report (EBCR) is NOT the same as a traditional case report. The EBCR focuses on an answerable clinical question, how it was explored in the search, appraising the results and how it applies to the case, along with the integration of this information with the patient interaction. The final stage in this process is to audit the results.

These are the steps to include:[1,2]

• Brief summary of the chief complaint: 50-100 words

• Briefly describe the clinical case: 250-400 words

• Explain how you developed the clinical question: 200-300 words

• Explain your search for evidence (key words, databases used, number of articles retrieved): 50-100 words

• Evaluate the articles retrieved: critically appraise the evidence for validitiy and relevance: 200-300 words

• Describe how you made your clinical decision by applying these findings to the case, including how you considered and integrated the patient's preferences and values: 250-400 words

• Evaluate your performance: 50-100 words

1. Heneghan C, Badenoch D. *Evidence-based Medicine Toolkit*, 2nd ed. Oxford, UK: Blackwell Publishing, 2006. http://onlinelibrary.wiley.com/doi/10.1002/9780470750605.index/summary (download pdf of "all chapters" for free copy of the publication)

2. Jones-Harris AR. The evidence-based case report: a resource pack for chiropractors. *Clin Chiropr* 2003;6 73-84. (download for free from www.chiro.org/cases/FULL/Evidence-based_Case_Report.pdf)

Additional interesting articles to read about EBM and writing and EBCR:

Review an example of an EBCR at:
https://www-ncbi-nlm-nih-gov.uws.idm.oclc.org/pmc/articles/PMC1126937/pdf/302.pdf

Iran J Pediatr. 2010 Sep; 20(3): 261—268. Evidence Based Medicine in Pediatric Practice: Brief Review
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3446038/

J Can Chiropr Assoc. 2014 March; 58(1): 6—7. **Evidence-based case reports**
http://pubmedcentralcanada.ca/pmcc/articles/PMC3924510/

3 BMJ. Vol 7, Issue 3, 2002, **Evidence-Based Medicine in Practice: EBM Notebook**
http://ebm.bmj.com/content/7/3/68

Editorial

Evidence-based case reports

By Cheryl Hawk, DC, PhD, CHES

Evidence-based practice (EBP) has become a standard in all health care professions. Its purpose is to improve clinical practice by incorporating the best scientific evidence available into the process of patient care, in which the patient's welfare, values and preferences and the clinician's judgment are *equally important components* of EBP.

However, one big challenge in our profession is a frequent lack of sufficient evidence to provide any practical help to the clinician. Although the evidence base for chiropractic care has grown exponentially since the first brick was laid in 1975, we are still far from possessing a wealth of detailed evidence for many aspects of chiropractic practice. This is especially true for chiropractic care of children, because most high-quality research has been carried out among adult populations, and most often for spine-related musculoskeletal pain-related complaints.

I teach "Principles of Evidence-Based Practice" to chiropractic students in their last year of training (8th trimester). Part of the course is to present a case, emphasizing a clinical question student doctors had about case management, and how they used it to direct a literature search, analyze the articles they found, and explain how they applied them to their case. What we find is that when they have questions about specific management plans, there are no randomized controlled trials or systematic reviews–but there often are case reports.

Case reports, especially for unusual conditions, specific treatment protocols, and/or special populations like children, continue to be our richest source of detailed clinical information. Although case reports cannot prove cause and effect, they can give capable clinicians a "recipe" for a management plan that appeared to have clinical benefit for a similar patient, treatment protocol, or condition.

The *British Medical Journal* introduced the concept of the evidence-based case report (EBCR) in 1998, to provide clinicians with both the opportunity to share their experience and with readers to find the clinical detail often lacking in large controlled studies.[1]

EBCRs have been advocated in chiropractic education and practice as well.[2,3]

JCCP is introducing this streamlined approach to the case report in this issue. As our readers and authors know, a traditional case report can be quite a burden for a busy clinician to write and follow through to publication. But we need more case reports to help provide the rich clinical detail our evidence base currently lacks! The EBCR has the advantage of being *short* (750-1500 words).

However, it is very different from a traditional case report in that it focuses on the *literature* rather than the *patient*. This does not mean we are discouraging a patient-centered approach! What the EBCR does is help the reader understand how the literature can be used to find the best way to help the patient. Thus it serves the double purpose of providing a quick summary of evidence on the specific topic of the report, while also providing a practical tutorial for the reader in how to use the literature.

References

1. Godlee F. Applying research evidence to individual patients: Evidence based case reports will help. BMJ 1998;316:1621-1622.

2. Bolton J. Evidence-based case report. J Canad Chiropr Assoc 2014;58(1):6-7.

3. Jones-Harris AR. The evidence-based case report: a resource pack for chiropractors. Clin Chiropr 2003;6:73-84.

Improvement in concussion symptoms of headache, poor concentration and photophobia in a 13-year-old male receiving chiropractic care: A case report

By Bronwyn B. Hunt[1], BHK, BChiro, Kelly Holt[2], BSc, BChiro, PGDip, PhD and Alice Cade[3], BSc, BChiro, DICCP

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ABSTRACT

Objective: The following report discusses improved concussion symptoms (headache, low concentration and photophobia) in a 13-year-old male, while receiving chiropractic care. **Methods:** An electronic search was conducted in May 2017 using the following scientific journal databases: PubMed, Google Scholar, Elsevier, ChiroACCESS, and ScienceDirect. **Clinical Features:** An adolescent male suffering from concussion symptoms after a traumatic axial impact to his head was presented by his mother to the chiropractic office in Auckland, New Zealand. **Intervention and outcome:** Following a thorough history and examination, the patient received two chiropractic visits per week, with reevaluation on the eighth visit. He was assessed for vertebral subluxations using upper cervical specific and a functional neurology approach. Care provided included upper cervical specific, full spine diversified and Gonstead chiropractic adjustments only, based on the practitioner's palpatory and clinical expertise. Spinal levels adjusted were C1-2, C6, T1-6/7, and ilium. Marked improvements were noted; 80% overall improvement, and improvements in concentration, photophobia and headache pain levels. **Conclusion:** This case illustrates how concussion symptoms, specifically headaches, concentration, and photophobia may improve in patients receiving chiropractic care. Further clinical research is warranted to investigate the efficacy of subluxation based chiropractic care in relation to the improvement of concussion symptoms.

Keywords: chiropractic, adjustment, subluxation, concussion, brain injury, vision disturbance, headache, pediatric, case report

Introduction

Concussion, which may be referred to as a mild traumatic brain injury (mTBI), is a complex pathophysiological process from a traumatic biomechanical force (a direct or indirect impact to the head or violent shaking of the whole body), sometimes causing a loss of consciousness.[1-5] The definition has been noted as vague, and at times confusing due to not being based on validated criteria and/or clarified etiology.[1,4] The following article will use the terms concussion and mTBI interchangeably to reflect current knowledge and research, however the authors acknowledge that the science concerning concussion continues to evolve and knowledge should be updated with new information.

In 2010, there were approximately 2.5 million emergency department visits, hospitalizations, or deaths associated with concussions in the United States.[6] It is estimated that 65% of these concussions and other mTBIs related to sports and recreation activities were among children aged 5-18 years.[7] It has however been noted that concussions are likely underreported by the pediatric and adolescent population, as well as the sporting communities.[1,2,5,8] In New Zealand, approximately 24,000 cases of concussion occur every year, and cost New Zealand taxpayers over $70,000,000 NZD in 2013-2014.[9,10] Concussions or mTBIs can have varying symptoms including headache, neck pain, amnesia, behavioral and cognitive impairments; and sleep, hearing and

vision disturbances.[1,2,11-15] Many of these symptoms regularly present in chiropractic offices.[3] The majority (80-90%) of concussion symptoms naturally resolve within 10 days without intervention, however the recovery time frame for children and adolescents may be longer.[1,4,12]

Complete resolution of mTBI symptoms may eventually happen without intervention, however faster recoveries may occur from cervicovestibular rehabilitation for teens and young adults.[1,16] It is recommended that any treatment considers medical, physical and psychosocial factors.[1] Preliminary evidence also supports the use of aerobic exercise and a collaborative approach with cognitive behavioral therapy.[1] There is limited evidence, especially involving pediatric cases, showing improvements of mTBI symptoms following chiropractic adjustments of vertebral subluxations.[1,17,18,20]

Annually, over 68 million children visit chiropractic offices to aid their health and healing.[18] Chiropractic is a healthcare system focused on adjusting vertebral subluxations in order to improve nervous system function.[21] For instance, a functional definition of a vertebral subluxation is: "a potentially reversible and/or preventable alteration of the intervertebral relationships of one or more articulations of the spinal column or its immediate weight bearing components of the axial skeleton; accompanied by a change in the morphology of the tissue occupying the neural canal and/or intervertebral foramina; as well as an alteration of neural function sufficient to interfere with the transmission of organizing information, believed to be homologous to the mental impulse, thus contributing to negative health outcomes."[21] The neurological component of this definition is supported by basic science, which suggests chiropractic care may influence sensorimotor integration (SMI) and processing in the nervous system.[22] Patients with neurological symptoms may benefit from chiropractic adjustments as a result of improving central nervous system (CNS) function.[22,23] This case explores the resolution of concussive symptoms, specifically, headache and disturbances to concentration and photophobia in a patient receiving chiropractic care.

Method

An electronic search was conducted in May 2017 using the following scientific journal databases: PubMed, Google Scholar, Elsevier, ChiroACCESS, and ScienceDirect. Articles were located through the New Zealand College of Chiropractic library using online databases. The search was restricted to published articles written in or translated to English. When searching, the following key words and/ or phrases were utilized: "concussion," "chiropractic," "post-concussion," "upper +cervical + chiropractic + concussion," "Gonstead," "diversified," "pediatric," "intervention + for +concussion," "concussion + cervical + spine + injuries," and "mild + traumatic + brain + injury + chiropractic."

There were limited articles or studies similar to this case returned or found from including "chiropractic" as a key word. However, there were several non-chiropractic resources that provided adequate insight into mTBIs and pediatric neurology to suggest that chiropractic care may influence the outcomes of a pediatric patient recovering from a mTBI. Other articles and resources were used to provide background information.

Clinical Features

A 13-year-old male adolescent presented by his mother to a chiropractor in Auckland, New Zealand in June 2014. The adolescent presented with concussion symptoms secondary to a traumatic axial impact to his head sustained while skateboarding five days prior. He hit the vertex of his head on a tree, which left him unconscious for 30 seconds. His presenting symptoms included a 7/10 (visual analogue scale) right orbital/occipital headache, a subjective 6/10 concentration level, a moderately sore neck and increased sensitivity to sound and light. His head pain increased with walking and laughing, but he denied dizziness. Previous medical history included recent adenoid surgery, but no illnesses or other traumas, besides the event mentioned above. He was taking 15ml Ibuprofen and 15ml Paracetamol every 4 hours. There was no mention of the patient's medicine use after the initial visit. He had no previous chiropractic care before presenting to the chiropractic practice. No other abnormalities were mentioned during a full review of systems.

Initial Exam Findings

Upon investigation, the patient was hypersensitive to light when testing right direct pupillary light reflex, and had decreased left finger-to-nose coordination and "unstable" Fukuda's Stepping Test. He had head pain when he laughed, but had no abnormalities detected while screening his motor strength.

Objective indicators of subluxations were identified using upper cervical specific and functional neurology chiropractic analysis (static palpation, motion palpation, and spinal examination).24 Subluxations were initially assessed at C1 and T3/4 spinal levels.

Intervention and Outcome

The patient was evaluated for subluxation and adjusted where necessary twice a week, with a reassessment on the eighth visit. Reassessment included re-testing positive initial findings and recording any subjective changes noticed over the course of his care. Over the eight visits, subluxations at various levels were analyzed and adjusted at each visit using upper cervical specific, full spine diversified and

Gonstead techniques based on the practitioner's palpatory and clinical expertise. These levels of subluxation included C1-2, C6, T1-6/7, and ilium (see Table 1). He noted significant symptomatic relief after the 1st visit and had near to complete resolution of symptoms after 8 visits that were performed over 5 weeks (see Table 2).

Subluxation	Technique	Visit when adjusted
C1	Upper Cervical	1st, 2nd
C2	Upper Cervical	3rd, 4th, 7th
C6	Diversified	2nd
T1	Diversified	6th
T2/3	Diversified	3rd
T3/4	Diversified	1st, 2nd, 6th, 7th
T4/5	Diversified	8th
T6/7	Diversified	7th
Ilium	Gonstead	4th, 5th

Table 1. Subluxated segments adjusted, the technique used for analysis and adjusting, and the visit when each subluxation was adjusted within the 8 visits over the 5 weeks.

Visit	Previously adjusted subluxations	Clinical details
2nd	C1, T3/4	"Improved concentration," and decreased photosensitivity
3rd	C1, C6, T3/4	Headache intermittent, not constant
5th	C1, C2, C6, T1, T2/3, T3/4, ilium	"Concentration 9/10"
8th	C1, C2, C6, T1, T2/3, T3/4, T4/5, T6/7, ilium	"8/10" overall improvement, "feeling freer," "breathing and sight" improved, "still sore head" when sneezing, concentration and photophobia within normal limits

Table 2. The visit when there was reported change, subluxations that were previously adjusted, and clinical subjective and objective details within the 8 visits over the 5 weeks.

After the first visit, subjective measures included "improved concentration" (originally rated 6/10) and decreased photosensitivity in the right eye. After the second visit, his headache was no longer constant, and within 5 visits, he rated his concentration at 9/10.

At the reassessment visit in the 5th week of care the patient reported an 80% overall improvement, and mentioned that he was "feeling freer." He also mentioned that his sight and breathing had improved, but he still had a "sore head" when sneezing. Subjectively, concentration levels and his photophobia during pupillary light reflex testing had returned to normal within 8 visits over 5 weeks.

Discussion

It is well known that many mTBIs result in altered SMI. [1,2,4,11-15] It has been theorized that restoring normal neurological function through chiropractic adjustments may contribute to improvements in symptoms caused by impact injuries to the head and neck, such as the skateboarding accident that left the boy concussed in this case.[25] Research suggests that a vertebral subluxation changes the way the CNS processes and integrates sensory information.[22,23] Recent studies have shown that chiropractic care may alter sensorimotor, cortical, visual processing and central oculomotor control, and cerebellar motor processing, all of which are known to be affected in mTBI.[23,26]

Chiropractic care, especially adjustments of the cervical spine have also been shown to improve proprioceptive input from the spine, and the upper and lower limbs.[26] It is possible that by adjusting this patient's vertebral subluxations, his SMI improved which contributed to an overall reduction in his symptoms.

Currently there is limited research on the efficacy of chiropractic care and its effects on mTBI symptoms, especially with respect to the pediatric population.[1,18] There have however been a few case studies demonstrating benefits. For instance, one case found that headache and neck pain in a young athlete may improve with chiropractic care, and another found that upper cervical chiropractic care may also help improve mTBI symptoms.[17,20]

It is important to note that it is unclear if the symptoms from a concussive impact result from damaged structures to the brain, or damage to surrounding structures.[1,4] For instance, damage to the cervical spine can result in similar symptoms, and it has been suggested that symptoms alone will not determine the diagnosis of concussion or cervical/vestibular injury.[27] It is important to recognize that when post-injury impairments are observed after a concussive impact, a proper understanding of their etiology is critical for designing appropriate care plans.[1,4,28] In other words, it is important to clinically determine if dysfunction or symptoms are directly from the brain, CNS and/or spine.[1,4] Due to the vital nature of these structures, it is imperative that the practitioner considers safety. In a narrative review, it was mentioned that while there, "are few readily available publications pertaining to the chiropractic management of concussion…," there were "… no articles reporting adverse outcomes of chiropractic management [of cases involving

concussion]."[29] This literature review however was specific to chiropractic management of sports concussion and did not discuss pediatric concussions. [29]

While an increasing body of literature has shown that children with single, uncomplicated mTBIs do not exhibit long-lasting neurocognitive impairments, there is also opposing literature suggesting that children with a history of a previous mTBI, migraines or pre-injury mental health problems have an increased risk for prolonged post-concussive symptoms.[1,28,30] Research has suggested that within 10 days the majority (80-90%) of adults' mTBI symptoms resolve, but it is inconclusive if the recovery times for children and adolescents are similar.[1,5,11,15,28] It has been suggested that adolescents, particularly females' health improvements, could take longer.[1,4] It is therefore unclear if the resolution of concussion symptoms documented above were due to chiropractic care or natural progression. It is also unclear whether chiropractic adjustments shorten recovery times after a mTBI. Further clinical research is warranted to investigate the efficacy of chiropractic adjustments and their effect on mTBI symptoms.

Conclusion

Chiropractors must recognize that each person presenting with mTBI and concussion symptoms may progress at a different rate, especially in pediatric populations. Concussion symptoms, specifically headaches, concentration, and vision disturbances may improve with subluxation based chiropractic care. Further clinical research is warranted to investigate the efficacy of chiropractic adjustments and their effect on mTBI and/or concussion symptoms.

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Excessively crying babies: are they all the same? Evidence-based case report

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ABSTRACT

A case report of a five-month-old infant suffering from infantile colic investigated different etiologies of cries and the application and efficacy of chiropractic management. Normalization of crying behavior was noted after a short trial of chiropractic therapy.

Keywords: pediatrics, colic, infantile, chiropractic, cry babies.

Introduction
Crying is the primary way infants express themselves. However, some infants will never settle, even when their needs appear to have been met and every method to soothe them has been trialled.[1]

Consequences of incessant crying range from high levels of parental stress and postnatal depression to economical burden, due to high costs of treating these babies, as well as child maltreatment like Shaken Baby Syndrome which can result in brain damage.[1,2]

Despite conscientious efforts to soothe the child, concerns for the infant drives parents to seek professional support. The incessant crying baby is the most common presentation to several healthcare professionals in the first sixteen weeks of life. Parents seek reassurance as well as an appropriate intervention that results in elimination or at least some reduction of presenting symptomatology. Chiropractors, or other alternative approaches, are usually sought after initial presentation to the pediatrician.[1,2]

Case report
The parents of a five-month-old boy presented to a chiropractic clinic complaining of excessive and uncontrollable crying, a short attention span, and difficulties with sleeping. The excessive crying behavior was noted immediately after birth and the parents reported at least five hours of inconsolable crying a day, starting in the late afternoon and lasting until around 10 p.m.

Birth history revealed a difficult and exhausting birth process, which exceeded 30 hours and required ventouse vacuum intervention. Immediately after birth, the newborn required tube feeding due to low blood sugar levels. Tube feeding made breast feeding challenging as these babies often show defensive behavior around the mouth.[3] The mother trialled breastfeeding for 7 weeks and then switched to formula feeding by bottle due to concerns that baby was irritable at breast and hungry after nursing.

After changing to formula, the infant began experiencing reflux, for which he was prescribed Gaviscon. Diffculties with flatulence were treated with Simethacone.

Clinical examination revealed tension in his right upper trapezius, right sternocleidomastoid and a left rotation restriction of T1. Significant muscle spasms and stiffness were noted throughout his spinal musculature and there was a slight restriction of the right sacro-iliac joint.

Visiting a chiropractor was the last attempt to find a solution for these parents. They had consulted several other healthcare professionals who diagnosed their concerns as colic and suggested that the infant would outgrow the condition by 3 months of age. At intake, the infant was 5 months old and was still experiencing the same symptoms.

This case report explores the evidence, investigates the distinctions between infant cries, and interrogates whether chiropractic therapy is an appropriate intervention.

Method
A search was conducted in April 2017 using Pubmed, Medline, Cochrane Database, the Index to Chiropractic Literature and the AECC Library. The following keywords were used: Excessive crying, infant, colic, chiropractic and outcome. In all, 1,045 articles were sourced and 16 articles were retrieved as relevant for this report.

The evidence
A single etiology for excessive infant crying is unknown.

Over time healthcare professionals have been able to differentiate potential etiologies for infant's crying behavior. As a didactic tool, Halpern and Coelho,[2] used the following classification: 1) normal/physiological crying, 2) excessive crying, secondary to disease or discomfort/pain and 3) without an apparent cause, also referred to as colic. In recent times, colic has more frequently been called excessive crying of infancy.

The most well-known definition for colic was published in 1954 by Wessel: "Bouts of crying amounting to more than three hours a day for more than three days a week for more than three weeks."[4] The underlying cause of colic has still not been found. Some research suggested that it can be a manifestation of abdominal discomfort, allergy or psychological problems,[5] while others suggest that there's a strong biomechanical or neurophysiological component.[6] The differential diagnosis includes:

1. **Colic:** This could better be characterised as infant nocturnal inconsolable crying syndrome, describing its chief characteristics, rather than trying to determine its etiology (Table 1). Colic crying usually begins in the first 7-10 days of life, results in long crying bouts at the end of the day, which is often inconsolable. However, feeding and sleeping are preserved in colic babies. It is far more common in babies having a difficult birth,[7] which may give a hint to biomechanical or neuromusculoskeletal etiology and why chiropractic care has been shown to have some efficacy.[8]

- Several hours of crying predominantly in the late afternoon or evening
- Crying is often inconsolable, but for feeding
- Crying bouts begin at 7-10 days of age
- Baby sleeps well
- Baby feeds well
- Baby is healthy and growing
- Associated with difficult or assisted birth or very rapid birth process
- Manual therapy has shown some efficacy
- Is said to spontaneously resolve at 12 weeks of age, but this has been refuted by the research but likely occurs in a percentage of cases

Table 1. Features of the colic baby.

2. **Severe crying syndrome:** This is the severe end of the crying spectrum and has been termed irritable feeding crying infant with disordered sleep (IFCIDS).[9] Again, it is merely a descriptive term that refers to the constellation of the features of this type of crying expressed by infants (Table 2).[1,9] However, this may describe the extreme end of the colic crying scale or, more likely, it may be a regulatory disorder of the child since it involves poor feeding and sleeping as well as crying.

- High intensity cries, more common in evening but often occurs throughout the day as well
- Feeding problems
- Sleep disorders
- General irritability, baby is never happy
- Paroxysmal fuss, cry patterns that are difficult to console
- 1-9 months of age
- More common in males than in females (60:40)

Table 2. Features of the IFCIDS (irritable feeding crying infant with disordered sleep) baby[8]

3. **Excessive crying of disease** represents less than 5% of cry babies. However, the first rule is always to rule out any serious illnesses or pathologies. It is important that the signs of illness are referred immediately to an appropriate health care professional if they present. Signs of illness are seen in Table 3.[1]

- Lethargy
- High fever
- Central cyanosis
- Dehydration
- High respiratory rate
- Tender abdomen
- Bulging fontanelle
- Projectile vomiting
- White tongue + red rash
- Growth chart irregularities
- Non-blanching rashes and purple spots
- Excessive drooling + difficult swallowing

Table 3. Signs of serious illness or pathology[1]

Cow's Milk Protein Intolerance (CMPI) and Gastro-Esophageal Reflux (GER) are commonly diagnosed in babies that show excessive crying behavior as part of the pain of those disorders and shouldn't be diagnosed as 'colic' as they have a known etiology.[1,4,10]

4. **Musculoskeletal dysfunction** such as the Irritable Infant Syndrome of Musculoskeletal Origin (IISMO)[8] and Kinematic Imbalance due to Suboccipital Strain (KISS)[11] belong to this category. This is the type of child that cries a great deal due to uncomfortable posture. They are consolable as soon as they reach a comfortable (termed antalgic) position. The underlying cause is biomechanical dysfunction which may be linked to a difficult birth process and possibly to

intra-uterine constraint or interventions such as forceps and ventouse. It is important that infants in this category receive treatment to relax their physical discomfort as in most cases they do not like sleeping supine and thus they do not meet the back-to-sleep programme set by government guidelines to reduce the risk of Sudden Infant Death Syndrome (SIDS). Chiropractors have demonstrated some success in treating babies to improve supine sleep.[12]

Is chiropractic manipulation effective for the excessive crying baby? A 2012 Cochrane review[8] identified six randomized controlled trials evaluating the efficacy and effectiveness of manipulative therapies for infantile colic. Four of the trials were chiropractic interventions; two were osteopathic. Overall the studies concluded that manipulative therapy had a significant effect to reduce the daily hours of crying. The amount of daily crying was reduced by more than one hour. Additionally, there was a positive change in the duration of sleeping. One study stated that chiropractic therapy and placebo have the same effect. However, the overall effect was beneficial to reduce crying in the baby. Cochrance concluded that there was moderate evidence that manual therapy treats colic successfully and that more research is needed.

A prospective cohort study in 2012 investigated whether there was a difference in outcome beween colic, IFCIDS and IISMO infants that have been treated with chiropractic manipulation. The study documented that in those infants considered to have a preponderance of musculoskeletal dysfunction (IISMO and colic) the average level of overall improvement was higher compared to the IFCIDS group.[9]

All previous studies looked mainly at the short-term effects of chiropractic treatment, but a British study in 2009 investigated the long-term effects of infant colic on a toddler. They compared two groups of children, one group of toddlers that had been treated successfully for infant colic by chiropractors during their infancy whereas the other group didn't receive any manual therapy. Results reported that untreated post-colickly infants demonstrated more negative behavioral patterns at two to three years of age.[13] Parents of infants who have been treated with chiropractic care reported less difficulties with behavior as well as sleep patterns of their toddlers. All of this suggests that chiropractic treatment may have an effect on long-term sequelae or that treating it early may have longterm effects.[13]

It must be noted that there is little or no evidence, certainly no randomized controlled trials or literature reviews, on the effects of chiropractic treatment on infants older than three months who have been diagnosed with colic, IISMO or IFCIDS or any excessive crying syndrome.

Everyone is unique – Babies with excessive crying shouldn't be seen as a homogenous group but should be evaluated individually and should receive specific treatment based on their particular needs.[9] More research is required to confirm that chiropractic therapy can reduce colickly symptoms, especially in infants over the age of three months.

Clinical implications

Different types of excessive crying require different approaches. Parents seek help from several different healthcare professionals, until they get help or give up. Chiropractors may be the last resort and thus they may face the more complicated cases of the incessant crying infant. Being able to differentially diagnose the etiology for baby's cry is an essential skill for chiropractors so that only babies with a biomechanical irriation are treated and the others are sent to appropriate clinicians. The question, 'is infant colic an allergic response to cow's milk?' was asked by Miller and Hellstenius.[10] This suggests that excessive crying can be more than a musculoskeletal problem and appropriate care is required. Further research into clinical implications of excessive crying is required as it is known that excessive crying in infants has a negative impact on infant-mother bonding, family life and behavioral patterns in older children.[13,14]

Applying the evidence

Despite all efforts to soothe their child, concerns that their child is in pain or something is wrong with their infant drives at least 21% of families in the UK to seek care.[14] This family had sought many types of care before presenting to the chiropractor. After the history and examination procedures, the parents were informed that the myofascial and articular restrictions identified were consistent with the infant's difficult birth process. They were informed of the current research that demonstrated that pediatric spinal manipulation in newborns up to the age of eight weeks was often successful to significantly reduce crying time if they presented before the age of six weeks. Because their child was five months old, and had already adapted to his situation, a short therapeutic trial was recommended to determine any benefit.

The parents consented to a trial of chiropractic treatment for their child. After five treatments over five weeks, both parents reported that their child was a lot more relaxed, he could settle to entertain himself, was less irritable, and his crying had reduced to the normal unit of less than two hours a day. The parents were very happy with the change, but we could not declare that the chiropractic therapy was the cause.

By its nature, a case review has severe limitations. It is a context-dependent observation so the positive results could represent spontaneous resolution. Also, the parents were

not blinded to treatment so their reported outcomes could be biased. Further, the medications that the child had been taking for over five months could have started to work after the chiropractic treatment began. However, in this non-standard care of excessive infant crying, that hadn't resolved in five months, a brief trial of chiropractic manipulation resulted in the desired outcome for the parents.

It can be concluded that there are different etiologies of excessive crying, each related to different underlying concerns. Even though the research isn't unanimous about whether chiropractic care does have a positive effect on excessive crying, there is evidence to suggest that chiropractic care is safe for the infant[15] and that taking an excessively crying infant to a chiropractic will result in fewer hours of crying.[16]

Conclusion

There was insufficient evidence to apply to this case, so I proceeded with the parents's consent, with a trial of manual therapy. When a treatment is safe, a clinical trial to try to help the family is an appropriate way forward. Further research is required to document the etiology, the clinical implications and appropriate care for the different presentation of excessive crying in infants.

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Infant demographic profile and parent report of treatment outcomes at a chiropractic clinic in the UK: an observational study

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ABSTRACT

Background: Children, particularly infants, commonly present to chiropractors. Few studies have concentrated on the demographic profile of infants as well as clinical changes reported by parents of infants under chiropractic care. **Objectives:** To identify the demographic profile of infants presenting to a chiropractic clinic and to investigate any change of infant symptoms and maternal feelings following an episode of chiropractic care. **Setting:** This health care observation study was performed at a chiropractic teaching clinic on the south coast of England. **Subjects/Patients:** The study included all mother-infant dyads who presented to the clinic between August 2011 and June 2015 and could read and write English and who consented to complete the forms. Exclusion criteria were mothers of infants older than one year of age at presentation. **Methods:** All mothers were asked to complete two questionnaires at the initial visit and two follow-up questionnaires at discharge. Data collected were sociodemographic characteristics along with questions asking for graded responses regarding the daily amount of irritable behavior in their child, level of distress the mother feels with her child's behavior, restfulness of infant sleep during the week and difficulty to console the child when crying as well as to the clinical experience provided. Additionally, the validated Edinburgh Postnatal Depression Scale (EPDS) was used as a report of the mother's feelings. **Results:** 413 mothers completed the intake questionnaires. 197 (48%) mothers completed the discharge questionnaires. At intake, 50.3% (n=182) of the patients were four weeks of age or younger. The presenting complaint appeared before the age of two weeks in 79.1% (n=161) of the cases. 30.2% (n=160) presented with colic/crying and 22.9% (n=121) with a feeding related complaint. The modal length of an episode of care was two weeks. Over the course of treatment, average maternal distress levels reduced by 48%. Mean amount of irritability reduced by 31%; mean restfulness of sleep improved by 27% and mean difficulty to console reduced by 38% in the infant. The median EPDS score dropped by 50% over the time of care. 96.3% of parents rated 8-10 satisfaction with care on a scale of 1-10. **Conclusion:** Infants who presented to the chiropractic clinic showed improvement of symptoms by parental report and parents were very satisfied with treatment. Additionally, lowered levels of distress and lowered EPDS scores were reported at the end of treatment. However, this study was not randomized or controlled, so that the therapeutic effect of chiropractic care of the common complaints of infant crying and sleep disorders cannot be generally accepted until higher level studies are done. However, maternal reports of infant health have been found credible.

Introduction

Health of children and adolescents is coming more and more into focus with the rise in lifestyle diseases such as cardiovascular disease and diabetes, which have been shown to begin in early life.[1] A similar pattern can be observed for musculoskeletal conditions such as back pain, where childhood back pain is a strong prognostic factor for back pain later in life.[2,3] Consequently, chiropractors are interested in the musculoskeletal health of children.

This study aimed to explore the demographic profile of the infant presented by their parent for chiropractic care at a chiropractic teaching clinic in the United Kingdom, as well as any reported change in parent perceptions of complaint after an episode of chiropractic care, along with the duration of that episode of care.

Background

Chiropractic care is common among pediatric patients, with over a third (37.5 %) of children seeking CAM therapies accessing chiropractic or osteopathic manipulation.[4] So far, generally known infant complaints presenting to a chiropractic clinic include excessive crying, feeding difficulties, infant colic and abnormal motor development.[4-10]

Despite common usage, there are few randomized controlled trials that show effectiveness of chiropractic treatment for children. The majority of pediatric chiropractic research is

published as case reports and case series. This study investigated the parents' report of the infant's care, rather than the clinician's point of view, which is usually the basis for case reports. Parent report, although still subjective with its own biases, is nevertheless, a more objective report of outcomes than that of the chiropractor. Mothers have been shown to be astute readers of their baby's health.[11]

From other health care areas it has been shown that the overall quality of the patient experience is associated with patient outcomes such as recovery and treatment adherence.[12,13] Of particular importance seems to be the fact whether or not the parents feel that the health care professional is listening to their concerns.[13-15] In pediatric practice, communication with parents is most strongly associated with parents' satisfaction with care.[16] Although this study does not investigate parent-practitioner and practitioner-practitioner communication, this study did investigate parent satisfaction with care, along with their report of outcome.

The aim of this study was to follow a cohort of infants who presented to a chiropractic teaching clinic on the south coast of England and to observe for any clinical changes. The objectives of this study were to identify the demographic profile of infants presenting to the chiropractic teaching clinic and to investigate reported changes of infant symptoms and maternal feelings during an episode of chiropractic care through the use of intake and follow-up questionnaires completed by the mother.

Methods

Four questionnaires were used; two questionnaires at the initiation of treatment and two follow-up questionnaires at discharge from care. One questionnaire was developed as a pilot project by experienced clinicians at the chiropractic teaching clinic. Data collected were sociodemographic characteristics along with questions asking for graded responses to the clinical experience provided. The mothers were asked to give a rating on a scale of 1 to 10 with regards to the daily amount of irritable behavior in their child, level of distress the mother feels with her child's behavior, restfulness of infant sleep during the last week and difficulty to console the child when crying. Additionally, the Edinburgh Postnatal Depression Scale (EPDS), a validated depression index, was also used, as a report of the mother's feelings. As follow-up questionnaires, there were one of two modified versions of the original questionnaire and the EPDS again.

All data collected were part of routine clinical practice and it was not possible to identify any patient based just on the completed survey. The paper surveys were not collected from the patient files until after the patient's care was complete, so that the information included was available to the treating clinicians at all times. The data were used only after all care was completed. This was considered an ethical use of health care data. Nevertheless, the surveys and plans for use were approved by the local ethics committee. All mothers entering the clinic gave written consent to be included in research. All information was confidential and voluntary.

The data were collected between August 2011 and June 2015 by student interns in the chiropractic teaching clinic. The interns gave a paper copy of the surveys to the mother at presentation of the infant to the clinic and a second time on the discharge visit. Sampling was by convenience. All mothers in infant-mother dyads who presented to the clinic and could read and write English and who consented to complete the forms were included. Exclusion criteria: parents of children older than one year, or who did not read and write English, or who did not consent.

All data recorded on the questionnaires as part of routine clinical care were transferred and analyzed in Excel and SPSS 24, where graphs and tables were produced where appropriate. The data collected were mainly descriptive data. Nominal data were presented as percentages in tables or bar graphs.

Results

A total of 417 mother-infant dyads entered the clinic. Four mother-infant dyads were excluded as the infant was older than one year. 413 were eligible for the study and completed the first set of questionnaires. 197 (48%) mothers filled out the second set of questionnaires at discharge.

Table 1 presents the demographic characteristics of the babies attending the clinic. When the first set of questionnaires was completed, 50.3% (n=182) of the patients were four weeks of age or less. The presenting complaint appeared before the age of two weeks in 71.9% (n=161) of the cases (Table 1). The parents could give more than one reason for attending the clinic. 30.2% (n=160) stated colic/crying, 22.9% (n=121) had a feeding related complaint, 19.5% (n=103) wanted a check-up and 27.4% (n=145) had other reasons for attending the clinic (Table 1). The preferred sleeping position was sleeping on the back for 54.1% (n=184) of the babies (Table 1). 52.1% (n=174) of the babies were irritable when lying on their backs (Table 1). 78.3% (n=267) of the babies received tummy time with 27.2% (n=81) being irritable on their tummy (Table 1).

48% (n=73) of the patients were discharged within two weeks after initial presentation (Table 2). The modal length of care was 2 weeks with a mean of 4.81 weeks.

Mean parental distress levels reduced by 48% (Table 3). The mode of parental reports restfulness of infant sleep dropped from 7 to 1 over the course of care (Table 4). The mode of parental rating of satisfaction, amount of improvement and expectations met after treatment were 10, 9 and 10, respec-

	Percentage	Frequency
Gender (n=349; 85% reported)		
Male	52.4%	183
Female	47.6%	166
Age at presentation (n=403; 98%)		
2 weeks or younger	26.2%	106
3 - 8 weeks	50.2 %	203
9 - 12 weeks	11.6%	47
13 - 24 weeks	8.4%	34
25 - 36 weeks	3.0%	12
37 — 52 weeks	0.5%	2
Age of problem starting (n=224; 54%)		
Birth	71.9%	161
>2 weeks of age	28.1%	63
Complaints at presentation (n=529 complaints for 413 patients)		
Colic/Crying	30.2%	160
Feeding	22.9%	121
Check-up	19.5%	103
Other	27.4%	145
Age at discharge (n=183; 93% of the 197 who were discharged)		
2 weeks or younger	2.7%	5
3 - 8 weeks	45.9%	84
9 - 12 weeks	25.1%	46
13 - 24 weeks	19.1%	35
25 - 36 weeks	3.8%	7
37 - 52 weeks	2.2%	4
>52 weeks	1.1%	2
Preferred sleeping position (n=340; 83%)		
Back	54.1%	184
Other	45.9%	156
Irritable on back (n=334; 81%)		
Yes	52.1%	174
No	47.9%	160
Receive tummy time (n=341; 83%)		
Yes	78.3%	267
No	21.7%	74
Irritable on tummy (n=298; 72%)		
Yes	27.2%	81
No	72.8%	217

Key: Multiple answers for patient complaints were allowed. N in each variable is the total number who reported out of the total sample of 413.

Table 1. Sociodemographic Characteristics of infants presented to the AECC clinic (n=413).

	Mode	Mean	SD	Median	IQR
EOC	2	4.81	7.715	3	3

Key: EOC = episode of care; SD = standard deviation; IQR = interquartile range

Table 2. Mode, mean, standard deviation, median and interquartile range of episode of care for infant patients at the AECC clinic (n=152).

	Percentage change
Amount of irritability	31% reduction
Feeling of parental distress	48% reduction
Restfulness of sleep	27% reduction
Difficulty to console	38% reduction

Table 3. Percentage change of mean parental ratings of symptoms from before (n=413) to after (n=197) treatment at the AECC clinic.

tively (Table 5). The median score of the EPDS dropped from 6 to 3 over the time of care whilst the mean dropped from 6.58 to 3.66 (Table 5).

Discussion

The goal of this study was to investigate the demographic profile of infants attending a chiropractic teaching clinic along with any maternal rating of change at the end of the episode of care. As in other studies,[10] it was a young population. The majority of infants presented to the chiropractic teaching clinic within the first two months of life, with the most common age of one week. The most common symptoms were crying and feeding disorders. The modal length of an episode of care was two weeks. This was corroborated by all other studies that reported treatment length and showed a symptomatic improvement reported by the parents within two weeks of manual therapy treatment.[9,17] What is also known about infant treatment is that when they improve, it begins right away, after 1.1 treatments.[6] The key factor about episode of care is that it must beat the natural history of the disorder. For example, if the baby could be expected to recover from the excessive crying of infant colic within two weeks or less (which, considering the young age of the infants presenting for care is unlikely), then it would be highly unlikely that it was the care helping the condition but rather just time passing. However, excessive crying of infant colic is said to take 12-24 weeks for recovery. As it is, this type of study cannot determine actual efficacy of the treatment, but can only report what the parent said about the benefits of treatment. It can be said, however, that the parents reported that the benefits for the child beat the natural history of the disorders, as they are known at this time. In fact, mothers reported that all symptoms reduced from presentation to end of treatment.

Both mean amount of crying and difficulty to console reduced by over 30% after the episode of care. Reports of low scores (1 to 3) doubled over the course of treatment in both categories so that at the end 60% reported low levels of irritability and difficulty to console. At the same time, reports

	N	Mode	Mean	SD	Median	IQR	Min	Max
Prior to presenting to the AECC clinic								
Amount of irritability (1-10)	342	5	4.87	2.408	5	4	1	10
Feeling of parental distress (1-10)	347	7	4.63	2.623	5	5	1	10
Restfulness of sleep (1-10)	347	7	5.06	2.656	5	4	1	10
Difficulty to console (1-10)	342	3	4.75	2.477	5	4	1	10
At discharge from care from the AECC clinic								
Amount of irritability (1-10)	142	3	3.35	1.845	3	2	1	10
Feeling of parental distress (1-10)	143	1	2.43	1.461	2	2	1	9
Restfulness of sleep (1-10)	142	1	3.67	2.205	3	3	1	9
Difficulty to console (1-10)	25	2	2.96	1.767	2	3	1	7

Key: 1 = lowest level of amount of irritability, feeling of parental distress, restfulness of sleep and difficulty to console; 10 = highest level of amount of irritability, feeling of parental distress, restfulness of sleep and difficulty to console. N = frequency; SD = standard deviation; min = minimum; max = maximum.

Table 4. Parental rating of symptoms before (n=413) and after (n=197) treatment at the AECC clinic.

	Mode	Mean	SD	Median	IQR	Min	Max	Frequency
Expectations met (1-10)	10	9.48	1.122	10	1	5	10	27
Amount of improvement (1-10)	9	8.27	1.659	9	1	2	10	110
Satisfaction (1-10) 10	9.66	0.870	10	0	2	10	140	
EPDS prior to treatment	4	6.58	4.651	6	7	0	24	240
EPDS at discharge	0	3.66	3.375	3	5	0	17	137

Key: 1 = lowest level of amount of irritability, feeling of parental distress, restfulness of sleep and difficulty to console; 10 = highest level of amount of irritability, feeling of parental distress, restfulness of sleep and difficulty to console. N = frequency; SD = standard deviation; min = minimum; max = maximum.

Table 5. Parental rating of satisfaction out of 1-10, amount of improvement and expectations met after treatment of their infant at AECC clinic (n=197) and Edinburgh Postnatal Depression Scale score of mothers before (n=413) and after (n=197) treatment of their infant at AECC clinic.

of high scores (7 to 10) reduced by six times to only being reported by less than 5% of the parents at discharge. Other studies as well, have found a positive effect of manual therapy on infant crying and difficulty to console.[9,17-19] This appears to be true for a certain subgroup of crying infants, namely infants with colic where the difficulty to console the baby is a major complaint.[9,18]

Another area where parents reported improvement was in the baby's ability to sleep comfortably supine. This has seldom been studied, as it was unknown that this ability could improve with musculoskeletal care and was not just innate. It is important for babies to sleep supine for their own safety. In fact, the safe to sleep campaign (formerly known as back to sleep campaign) was started over 25 years ago and has achieved impressive results in reducing the sudden infant death rate in Great Britain.[20] Although the exact causes for sudden infant death syndrome remain unknown, an important risk factor is sleep position. It is now recommended that infants sleep exclusively on their backs.[21] Recently, a British health survey found only half of the questioned mothers were able to name sleep position as a risk factor for sudden infant death syndrome.[22] This is corroborated with the findings in this study where only 54.1% of the infants were put exclusively on their back for sleep. A recent American study found a rate of 49.2%.[23] These findings show that there is still potential to reduce the risk of sudden infant death syndrome even further and one way would be to address the sleeping position with parents and for chiropractors to help the baby achieve comfort in that position. It is also interesting that the unexplained infant death rate continued to slowly decrease over the last decade despite the relatively high percentage of infants' not exclusively sleeping supine. Perhaps other risk factors play a greater role than currently assumed.

This study found parental reports of poor infant sleep quality (scores 7-10) to reduce by more than 2.5 times after an episode of care. Whilst disrupted parental sleep in itself is a risk

factor for depression,[24] disturbed infant sleep has also been linked with higher scores in the EPDS.[25,26] This makes parents vulnerable for postnatal depression. Not only may they have difficulty sleeping restfully as they are getting adjusted to the new lifestyle and worry about their new child, but the child may have their own sleep issues further disturbing parental sleep. Resolving any sleep issues may therefore increase the chances of reducing postnatal depressive symptoms in parents.

As a matter of fact, the largest improvement in scores was found in the reduction of scores on the maternal depression scale. Parental reports of low scores (1 to 3) of feeling distressed doubled over the course of an episode of care to 80%. Maternal distress levels and EPDS scores were cut in half after their infant experienced an episode of care. A mean intake score of 6.6 on the EPDS within the first eight weeks postpartum, in this study population, is comparable with other interventional studies (6.0,[27] 7.5,[28] and 8[29]). At discharge, which generally happened two to three weeks after initial consultation, this study sample had a mean score of 3.7. This change can be classified as clinically significant as other studies have deemed a 30-34% change on a similar scoring system sufficient to define a clinically significant change.[30-32] However, defining a change as clinically significant is difficult as it is essentially a very subjective measure. The EPDS scores on follow-up were low compared to other studies. However, those studies looked at long-term change over a range of 4-12 months, and there was no measure of the children's clinical care making comparisons difficult.[27-29] One other study found similar results following a course of treatment at a chiropractic clinic.[33] Again, long-lasting effects were not investigated. That said, what parents need is some immediate relief from the stress of the new infant, and benefits that occur quickly can be just what is required at the time to reduce the immediate vulnerability of the dyad. This study only investigated short term results over a short time of treatment.

In this study, parents' expectations were reported to have been met by the care given. Interestingly, parent satisfaction was rated higher (10) than infant recovery (9). This may be due to the parents' baseline attitude towards treatment, continued treatment and an improved perception of their infant's health in combination with a reduction of depression scores.[34] Essentially, this all boils down to effective patient-practitioner communication.[15,35] If the practitioner does not communicate and educate the patient adequately, the patient may not fully understand the natural course of the condition and may not understand the effectiveness and necessity of the treatment in question. Not meeting expectations may result in non-compliance of a treatment plan[36] or a poorer outcome.[37,38] Parents may have specific expectations in themselves in their role as parents, in their infant, in parenthood and how any (perceived) issues in any of these areas may be solved. A thought that may occur commonly in some parents is the expectation that a good parent can always calm their infant.[39] This may lie in the fact that in today's society a lot of first-time parents experience their earliest contact with a new-born when their own first child is born. They may not truly know what to expect from an infant, how the infant will behave and how the infant should be behaving or how they as parents should respond to their infant's cries and needs.

Another factor, which influences parents, is social media and television. Inconvenient situations with babies are usually not glamorous enough to be posted on Instagram or do not fit within the time slot of a television series. Matching expectation of parenthood with reality of parenthood can be very difficult and is an important component of parental stress levels.[40] It seems therefore logical that this study found a reduction in parental distress alongside a reduction in amount of infant irritability and difficulty to console with some detailed and appropriate reassurance from the clinicians.[7]

Limitations and Future Research

There was considerable loss to follow-up, which may have skewed the results one way or another. Unfortunately, in this study there was no way of finding out the reason for loss to follow-up. Certainly, it is likely that some children did not need treatment or were referred for treatment elsewhere, so they would not be included in the follow-up.

A study of this type has further significant limitations. Firstly, the questionnaires were not validated, except for the EPDS, which has been validated and is recognized worldwide. Secondly, the structure and set up of the questionnaires, both intake and follow-up, were flawed in multiple places. This is evidenced by the change of the style of questionnaire over the course of the study. This has led to a substantially smaller return of these particular answers compared to the other follow-up questions.

Another limitation was the fact that both initial and follow-up questionnaires were generally handed out to the mothers by the same intern who also performed the assessment and treatment. Some mothers may have felt pressured to give sociably desirable answers to please the intern or present themselves in a different light. All scores are reflections of the parent's perception at the time of data collection. As in all studies, one can therefore not guarantee that the data were reported accurately.

High quality research in chiropractic practice and especially pediatric chiropractic care is still relatively sparse. Future prospective and controlled studies are needed to investigate the efficacy of chiropractic care on complaints such as infant crying, difficulty to console and sleep quality alongside maternal stress and depression scores. Future studies should

focus on the first two months of life for the initiation of the investigation considering their high prevalence in this study. To investigate long-term efficacy of therapy, future studies should include several follow-ups over a prolonged period of time of at least one year. Ideally, these follow-ups would be accompanied by telephone reminders or even done by telephone or text to increase the response rate. In addition, a systematic classification for the common complaints, such as excessive crying, needs to be developed. Randomization will most likely be very difficult as not treating an infant complaint could be considered unethical.

Conclusion

The demographic profile of infant patients presented to a chiropractic practice setting showed the two leading complaints were feeding problems and excessive crying. The complaints were often present from birth and accompanied by potential anxiety/depression levels in the mother. The end of treatment reports, after an average episode of care of two weeks, revealed improvement in the infant's behaviors and a reduction in depression scores in the mother. Parents were highly satisfied with care and their expectations were met. However, this type of study only reports parent's perceptions and cannot establish efficacy of therapy since it has neither randomization nor a control group. Further higher level studies are indicated to establish effectiveness of chiropractic manual therapy for the common problems in infant's activities of daily living.

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Improvement in motor developmental delay in a 15-month old male following chiropractic care to correct vertebral subluxation: A case report

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ABSTRACT

Objective: To chronicle the improvements in a 15-month-old male presenting with motor developmental delay following chiropractic care for the correction of vertebral subluxation. **Methods:** Online review of the literature on motor development delay and chiropractic was performed using The Index to Chiropractic Literature, PubMed and Google Scholar. Search terms "motor development delay", "children" "chiropractic" and "spinal manipulation" were used. **Clinical features:** A 15-month-old male with motor developmental delay presented for chiropractic care. He was able to sit unassisted, walk assisted, but could not crawl (creep) in any way, pull himself up to stand, stand alone, or walk alone. **Intervention and outcome:** The child received full spine chiropractic care for 10 visits over 16 weeks using Diversified technique (Activator™ instrument assisted) for the correction of vertebral subluxation. Throughout the chiropractic care the child developed the ability to crawl on hands and knees, pull himself up to stand, stand alone, and began to walk unassisted. **Conclusion:** A course of chiropractic care using Diversified technique for the correction of vertebral subluxation was associated with improvements in the child's presenting motor development delay.

Keywords: : motor developmental delay; chiropractic; pediatric; spinal manipulation.

Introduction

Developmental delay is defined as a child who is not meeting a range of milestones at the expected rate of development.[1] Typically, this involves multiple areas of development including cognitive skills, social and emotional skills, speech and language skills, fine and gross motor skills and activities of daily living.[1] These alterations may be intermittent or sustained.[2] The World Health Organization has outlined windows of achievement for 6 gross motor development milestones (see Figure 1).[3] A range of scales can be used to provide a grade to the level of the child's delay such as the Bayley (III) or the Nipissing District Developmental Screen. However, the accuracy of these is questionable.[2,4] Developmental delays in infants and toddlers can have long-term residual effects if the underlying problem is not corrected.[2] In some parts of North America, it is becoming common practice to screen children at regular intervals from 9 to 30 months, because early detection and intervention of developmental delays improves the final prognosis.[4]

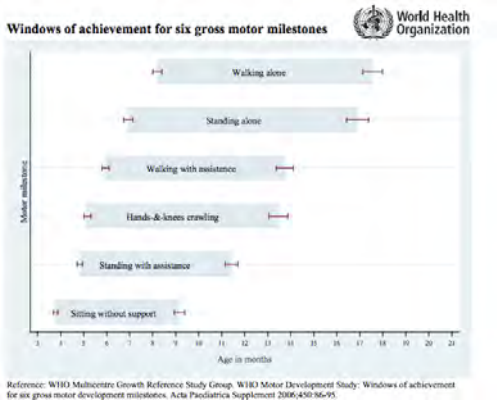

Figure 1. World Health Organization: Windows of achievement for 6 gross motor milestones[3]

Current interventions include physical therapy, occupational therapy, speech therapy, psychological therapy and early special education.[5] The effectiveness of some of these interventions is debatable as some literature shows that physical therapy and neurodevelopment treatment do not have a favorable effect on motor development in infants.[6-8] There has been little growth in studies investigating improvement in gross motor skills over the past decade. However, programs to increase the development of gross motor skills have shown promising results, although the evidence of optimal dose and implementation is still weak. [6-8]

Chiropractic care for the pediatric population is growing in acceptance.[9,10] While conditions such as colic are a common reason for parents choosing chiropractic care,[11,12] Alcantara et al.[13] reported 'wellness care' to be the most common reason for presenting to a chiropractor. Chiropractic care aims to

optimize health and wellbeing through the enhancement of the nervous system function by removing nerve interference caused by vertebral subluxation.[14] A vertebral subluxation represents an altered state of afferent input which can lead to maladaptive changes in central neural plasticity resulting in dysfunction.[14]

Current literature regarding the chiropractic management of infants and children with developmental delays is limited.[15-18] The evidence to date suggests that chiropractic care may be beneficial for this population.[15-18] The purpose of this case report is to chronicle the improvements in motor delays found in a 15-month-old male following Diversified technique chiropractic care for the correction of vertebral subluxation.

Methods

To assess the relevance to chiropractic, an online review of the literature on motor development delay and chiropractic was performed. The Index to Chiropractic Literature, PubMed and Google Scholar were consulted using the search terms "motor development delay", "child" "chiropractic" and "spinal manipulation". Databases were searched from inception through July 2017, with utilized studies, clinical trials and case reports, all being peer-reviewed.

Case Report

History: A 15-month old male with motor developmental delay presented for chiropractic care. The child was not able to crawl (creep) in any way, pull himself up to stand, stand alone or walk; which would be expected to have already been achieved as developmental milestones,[3] He was able to sit unassisted from around 6-months and rolled at around 9-months of age. He was born vaginally at 39-weeks gestation with ventouse assistance. The child weighed 2,500 grams at birth. He was breastfed for 6-months with solids being introduced around 6-months of age.

The child appeared to have no obvious speech delay; he said "mum" and "dad" and indicated that he wanted to be picked up by raising up his arms. He had been observed informally by a speech therapist who determined that his social and language skills were "not too delayed in any way."

The parents reported that in the first 12-months of his life the child did not spend much time lying prone ('tummy-time'). From an early age the child was placed in a sitting aid (Bumbo™ seat). The child was under the care of a caregiver during the day, and it was unknown what activities were undertaken by the child when with the caregiver.

Examination: Chiropractic examination revealed restricted joint play of the right sacrum, restricted joint play of the T5/T6 area with increased paraspinal muscle tone bilaterally, and decreased left lateral flexion of C7 and restricted joint play, increased right paraspinal muscle tone. Observation of assisted walking showed minimal balance, core strength and coordination with steps. In an attempt to assess upper body strength, the child was placed on his hands and knees. He demonstrated difficulty in supporting himself in this position and made no attempt to move his limbs in any coordinated way.

Intervention: Full spine chiropractic care was administered over a period of 16-weeks where the child was seen weekly for 4 visits and then bi-weekly for 6 visits. Informed consent to receive chiropractic care was verbally obtained from the patients' parents prior to initiation of the course of care. Vertebral subluxation was assessed using commonly used, and reliable, clinical indicators of restricted inter-segmental range of motion, asymmetric intervertebral muscle tension and abnormal spinal joint play.[19-21]

Chiropractic adjustments were made using Diversified

Visit	Vertebral segment adjusted/Chiropractic listing	Parent's and chiropractor's observations
1	PR sacrum, T6 BR, C7 BL	Agitated and uncooperative
2	PR sacrum, C7 BL	Unable to hold his own weight to do the cross crawl pattern
3	PR sacrum, L4 BR, T4 BR	On all fours and is able to cross crawl
4	PR sacrum, L4 BR, C7 BL	Pulling himself up to stand on furniture
5	L5 BR, C2, BR	Continuing crawl and pull himself up
6	T6 BR	Crawling well and letting go to stand
7	T12 BR, T8 BR	Father said he was talking a lot more
8	T10 BR, C7BL	Taking a few steps and seems happier
9	PR sacrum, C7 BL	Confidently taking more steps
10	PR sacrum C7 BL	Improved walking ability

Table 1. Vertebral segments adjusted each visit and observations of both the parents and chiropractor.

technique (Activator™ instrument assisted). Diversified is the most widely used chiropractic technique and system of adjusting that uses primarily motion and static palpation to locate levels of vertebral subluxation, and focuses on the restoration of proper biomechanics within the spine.[22] Additionally, on the first visit he was passively assisted through the sequence of moving all 4 limbs in a coordinated cross crawl pattern. Home care advice included cessation of assisted walking, and encouragement of floor play and the use of swings and slides to support development of the vestibular system.

Outcomes: Over the course of chiropractic care, the child made significant progress in motor development. Following the first 2 visits, the child started to crawl on his hands and knees unassisted, and after the third visit he began to pull himself up to stand. At the sixth visit he was able to crawl on his hands and knees with ease and began letting go of assistance while in a standing position. From the seventh visit he began taking unassisted steps with increasing confidence. For a detailed list of reported changes in the child's motor development see Table 1. No adverse reactions were identified or reported during the course of chiropractic care.

Discussion

Motor development improvements were reported in a 15-month-old male over the course of 16-weeks of chiropractic care. The child had initially presented with motor development delay, with inability to crawl in any manner, stand or walk unassisted. Common interventions for developmental delay involve a multi-disciplinary approach that includes physical therapy, occupational therapy, speech therapy, psychological therapy and early special education.[5] Early motor development is important because it forms the basis for the development of verbal and non-verbal communication. Walking, for example, results in the child developing better social interactive skills with their caregivers.[23] Therefore, it is important to investigate the effect of chiropractic care on a child experiencing motor development delay.

While the chiropractic literature for this specific population is sparse, a literature review revealed 1 clinical trial and 3 case reports relevant to the current case report. Cuthbert and Barras[15] conducted a study involving 157 children (aged 6 to 13 years) with various developmental syndromes. Each child was managed using Applied Kinesiology chiropractic technique over a visit duration ranging from two to five visits over a period of 5-days to 18-months. All children presented with motor system dysfunction assessed through manual muscle testing. All showed improvement in muscle strength, coordination and flexibility, and pronounced improvement in gross and fine motor function.

Ferranti and Alcantara[16] reported the improvement of fine and gross motor skills, and communication in a 2-year-old male following Diversified chiropractic care. The child was diagnosed using independently applied Peabody Developmental Motor Scales-2 (PDMS-2) and Preschool Language Scale-5 (PLS-5) instruments. Improvements in both assessments were noted in comparison to baseline assessments.

Troy et al.[17] reported the improvement of developmental motor delays in a 4-year-old male following Diversified technique chiropractic care. Fifteen visits were attended over a course of 4-months. The child was diagnosed with dyspraxia at 1-year-old, was 15-months-old before he started to walk, and 3-years-old before verbalizing basic sounds. During the course of chiropractic care the child's vocabulary, and fine and gross motor control dramatically improved. The child was also undergoing speech therapy and various exercises were prescribed in conjunction with chiropractic care.

Quezada and Haan et al.[18] reported the improvement of motor skills in an 8-month-old male following full spine and craniosacral chiropractic care. Seven visits were attended over a course of 24-days. The infant displayed an inability to sit unsupported, difficulty in holding his head up or supporting his upper body on his forearms while prone, and an asymmetrical, poorly executed belly crawl during the initial chiropractic consultation. The chiropractor prescribed exercises in conjunction with chiropractic care, which the mother complied with. A 7-month follow-up assessment indicated the child was ahead of expected milestones.

In all 3 case reports vertebral subluxation assessment and correction was described as the core clinical application of chiropractic care.[16-18] The Australian Spinal Research Foundation developed a conceptual definition of vertebral subluxation that states, "A vertebral subluxation is a diminished state of being, comprising of a state of reduced coherence, altered biomechanical function, altered neurological function and altered adaptability."[24] Vertebral subluxation has been described as being a central segmental motor control problem that involves a joint, such as a vertebral motion segment, that is not moving appropriately, resulting in ongoing maladaptive neural plastic changes that interfere with the central nervous system.[25] The correction of vertebral subluxations is achieved through chiropractic adjustments that are typically manually performed.[26-28]

Chiropractic care has been demonstrated to alter sensorimotor integration which is the coordination between incoming sensory information and the resulting motor processes.[29] Accurate sensorimotor integration is necessary for a number of daily activities such as being able to reach for objects, respond to a sound in a particular direction and responding to the ever changing environment.[29] Chiropractic care may be beneficial in supporting the development of a child as they

learn to accurately respond to their surroundings by allowing them to learn how to creep and walk.

Limitations

There are inherent limitations of a single case study. These include lack of a control group, and the inability to exclude spontaneous remission, or a self-limiting clinical presentation. We caution the reader that generalizations to a larger population cannot be made. In this case the assessment of motor development delay was not made through a formal assessment instrument, rather through subjective observations and reports of the parents and chiropractor. Additionally, it is unknown whether the parents followed the homecare advice given, and if followed whether this resulted in the improved motor changes observed.

Conclusion

Chiropractic care, using Diversified technique for the correction of vertebral subluxation, was associated with improvements in the child's presenting motor development delay. More research is needed to investigate the role chiropractic may play in helping infants and children who present with similar conditions.

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Positive chiropractic treatment outcome of chronic constipation in a 2-year-old male: a case report

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ABSTRACT

This case report discusses the chiropractic treatment outcome of a 2-year-old male patient suffering from idiopathic constipation and problems sleeping. The patient was treated with manual manipulation techniques. After four treatments, the frequency of bowel movements increased from once every other day to twice a day and use of medication decreased. Sleep quality also improved. As a result of the improvements noted with this intervention, a musculoskeletal mechanism for the development and persistence of constipation in children has been proposed. This case report highlights the need for high quality research on the effect of spinal manipulation in the treatment of constipation in the pediatric population to provide a potential alternative option to medical treatment or co-management of constipation.

Keywords: constipation, sleep, pediatric, spinal manipulation.

Introduction

Constipation is prevalent in 5-30% of the child population, with more than one third of cases becoming a chronic issue lasting for more than 8 weeks.[1] There are a number of possible causes of constipation in children, such as dehydration, dietary factors, e.g. cows milk intolerance, change in diet, organic causes, e.g. anal fissure, or psychological factors, e.g. withholding stools can become an acquired behavior.[2] Constipation is commonly referred to as idiopathic when no anatomical or physiological abnormalities are detected. Signs and symptoms of childhood constipation include excessive flatulence associated with a foul smell, infrequent passing of stools, abdominal pain and withholding or straining to stop the passage of stools. Chronic constipation in the pediatric population is a common issue that is most commonly managed in the United Kingdom with the use of laxative medication.[2]

Method

An online literature search was conducted using scientific journal databases; Pubmed, Alt Health Watch, The Allied and Complementary Medicine Database (AMED), Cochrane Library, Index to Chiropractic Literature, Medline. Databases were searched from January 2000 through February 2017 using the keywords constipation, sleep, pediatric, spinal manipulation. 352 articles were retrieved.

Case presentation

A 2-year old male presented with his mother complaining of right shoulder and arm pain of three weeks duration that was affecting both daily activities and sleeping. It was additionally reported by the mother that the child was suffering with constipation for which he was taking a significant amount of medication. For one year the patient was supplemented with 5ml/day of senna and 6.9g/day Movicol© to control and regulate bowel movements that were reported to be extremely malodorous and painful for the child to pass. The National Institute for Health and Care Excellence recommends macrogols such as polyethylene glycol (Movicol©) as a first-line treatment, replacing this initially with osmotic laxatives and then latterly with stimulant laxatives such as senna for the clinical management of constipation. The mother was keen to reduce the medication, however under the advice of pediatric, nutritional and gastrointestinal specialists was reluctant to do so in the apprehension that symptoms would be exacerbated. This chronic problem was an issue that was becoming increasingly challenging for both parent and child, especially due to the patient being of an age where toilet training would normally be deemed appropriate.

Physical examination revealed a fit and healthy child. Active and passive range of motion of the affected shoulder was full and pain free, however an audible 'click' confirmed some palpable laxity and therefore a likely sprain of the gleno-humeral joint. Additional palpation revealed a degree of muscular hypertonicity associated with poor facet joint motion in the thoracic spine. The sacro-iliac joints were found to be significantly restricted in movement to extension and flexion bilaterally. As a result of the shoulder assessment, the parents were reassured that the complaint would be a self-

resolving issue; kinesio-tape was applied in order to provide some additional stability to the joint and within two weeks the patient was asymptomatic. Despite this, the latter findings from the physical examination provoked consideration of a potential clinical link to constipation and musculoskeletal dysfunction. It was subsequently postulated that the imbalances in pelvic movement were associated with the child experiencing difficulty with bowel movements as evaluation of a food diary demonstrated an excellent diet of good nutritional value.

Therapeutic Intervention

After one treatment involving pediatric spinal manipulative therapy, categorised as a high velocity, low amplitude thrust (modified) for the age of the child to the sacro-iliac joints bilaterally and the thoracic spine, the mother reported an increased frequency of bowel movements associated with 'looser' stools and less straining from the child. As a result of this rapid improvement in only ten days, the mother appropriately reduced the dose of senna to 2.5ml/day. Symptoms of constipation continued to improve and the effects of manipulating the sacro-iliac joints and thoracic spine appropriately were maintained over the course of six treatments spread over an eight-week time period. Frequency of treatment then decreased to approximately once every eight weeks.

Follow-Up and Outcomes

After four treatments, the mother reported that for the first time in his life, the child was sleeping throughout the night without waking and routinely passing a stool with no complaint. After six treatments the regularity of bowel movement and associated lack of straining was sustained. Palpatory findings on examination also revealed a large increase in movement and function of the sacro-iliac joints. Medication had been reduced to 1ml/Senna given on alternate days and a daily 6.9g dose of Movicol©. A maintained and continued improvement regarding alleviation of symptoms and regularity of bowel movement is still apparent after 16 weeks.

Discussion

Current literature regarding chiropractic care as a treatment for constipation in the pediatric population is extremely limited, with poor reliability due to the nature of the research. Additionally, there is a distinct focus on the theory of subluxation as a cause for constipation using a combination of high velocity, low amplitude thrusts and activator therapy at the 'site of vertebral subluxation' to resolve constipation.[3] The term "subluxation" is traditionally defined by chiropractors as 'an alteration of the biomechanical and physiological dynamics of contiguous structures which may cause neural disturbances."[4]

More recent case studies respectively claim that 'chiropractic relieves constipation when areas of misalignment in the lower back and sacral areas are rectified,' and use of the Thompson Technique© to adjust areas in the neck and sacrum can induce a bowel movement, although they do not elaborate on a plausible mechanism.[5,6] Reports of the use of diversified technique to address vertebral subluxations in the atlas, thoracic spine and sacrum have additionally been made after which 'the mother noted an immediate, dramatic improvement in bowel function of the patient following the first chiropractic adjustment that was maintained thereafter in the form of consistent, normal bowel function after each feed'.[7]

As mentioned above, the conclusions drawn from the literature must be taken with caution due to the inevitable subjectivity and therefore lack of validity associated with the type of research. Nonetheless, the increasing quantity of documentation regarding chiropractic treatment and the effects on pediatric constipation forms an expanding evidence base, which as a result improves the clinical justification of chiropractic as an intervention. As a consequence of this positive response to a conservative approach to the management of constipation, it would seem appropriate to propose a musculoskeletal model for the explanation of the condition in this case. It is therefore postulated that the significant restriction of movement within the sacro-iliac joints of the pelvis were causing the child to experience severe lower back discomfort with the effort of straining and therefore inconsistency associated with the passing of a stool. It is possible that a subgroup of children may have constipation due to a mechanical dysfunction and that removing this dysfunction reduces pain that may have caused the child to 'withhold' the passing of stools. The longer the fecal matter remains in the rectum, the more noxious gas is produced, hence the increasingly unpleasant odour when eventually passed.

Conclusion

Pediatric manipulative therapy was used as a tool to increase movement and therefore function of the spine, which resulted in less pain and a dramatic improvement in the straining, foul smell and difficulty associated with the child's constipation. Despite this, it must be recognised that the evidence regarding this approach to the treatment of constipation in pediatrics remains both minimal and of poor validity, requiring further high quality studies with appropriate subgrouping, in order draw reliable conclusions with clinical applicability. Constipation in the pediatric patient is an important area of interest from both a practitioner and patient perspective.

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An electronic parent reported infant outcome measure in chiropractic clinics: a feasibility study

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ABSTRACT

Background: The United Kingdom Infant Questionnaire (UKIQ) is a validated and reliable parent reported outcome measure based on common public health issues and presenting complaints of infancy. The UKIQ is proposed as a pragmatic tool for research purposes and an electronic version might be advantageous for large-scale data collection in chiropractic clinics. **Study objectives:** The primary objective of this study was to test the feasibility of an electronic version of an infant outcomes instrument. To this end, feasibility benchmarks were set based on technical performance and acceptance of the tool by its users, chiropractic offices and mothers. **Materials and methods:** In this prospective, multi-center observational study, mothers of infants (0-12 months) were asked to complete the electronic UKIQ at initial presentation and at follow-up in chiropractic clinics in the United Kingdom. Technical issues encountered and rates of non-consent were tracked during the study period. Feasibility benchmarks included the following: recruitment of four participating clinics, a minimum of 70% maternal consent to participation, 80% completeness of data, 80% response from mothers that the questionnaire was "easy to use" and a follow-up rate of 50%. Participating chiropractors and receptionists were asked for feedback and ratings of their experience with the tool. Additionally, clinics who showed interest in participating but did not participate were asked to provide feedback in order to elucidate barriers to implementation. **Results:** During the testing period, 100 intake and 46 follow-up forms were completed. All feasibility benchmarks were achieved, except for follow-up rate (46%) and lower than anticipated participation of recruited clinics (n=2). No technical difficulties prevented mothers from completing the form and collected data had a high rate of completeness with <0.03% missing data for standard questions and no undecipherable answers. No incidents of maternal non-consent occurred and 98.9% of mothers found the tool easy to use. Clinicians and receptionists rated their experience with the tool highly (mean 5/5 for clinician perception of clinical utility and likelihood of continued use and mean 4.5/5 for receptionist's ease of administering and 5/5 for receptionist perception of willingness of mothers to complete and ease with which mothers completed the questionnaire). **Conclusions:** This tool is technically capable of large-scale data collection and well-accepted by users. However, implementation of the instrument in private chiropractic clinics was lower than anticipated. Future research must investigate methods to improve uptake of key outcomes instruments in chiropractic practices.

Introduction

Recently, a parent-reported outcome measure based on common public health issues and features of infant life has been developed and found to be valid and reliable.[1] This questionnaire is referred to as the United Kingdom Infant Questionnaire (UKIQ), and was designed to capture information about an infant's complaints and maternal concerns across various domains including maternal impressions of feeding, sleeping and crying behaviors, comfort in the supine position, cervical range of motion and "tummy time."[1] Additionally, it enquires about the mother's mental state, which may be of relevance clinically due to its recognized impact on infant health outcomes.[2,3]

Historically, patient-reported outcome measures (PROMs) have mainly been implemented for research purposes.[4] However, their application in clinical practice is becoming more common for monitoring patient progress and quantifying response to treatment. Additionally, PROMs have become recognized as tools for improving communication between clinicians and patients and aiding shared decision making.[5] The use of PROMs in infant care has lagged behind, not least because the infant cannot complete their own questionnaires.

Though infants are disproportionately frequent users of chiropractic care[6,7,8] the chiropractic profession has been the object of criticism for a lack of high quality research supporting its treatment of this population.[9,10,11] A valid and reliable outcome measure is a key requirement for conducting high quality clinical research and the UKIQ could meet the need

for a patient-centered tool for research of chiropractic care for infants.[1]

An electronic version of such a measure might be particularly useful. Some evidence suggests that patients prefer electronic methods for collecting information to paper methods[12] particularly in younger populations[13] and that use of electronic methods may improve completion rates when using PROMs.[14,15] An electronic version of this tool could circumvent the substantial logistic and administrative challenges involved in paper-based collection of PROMs.[16]

The use of electronic PR0Ms for adult patients in chiropractic clinical practice has been shown to be feasible.[17] An electronic version of the UKIQ seems theoretically well-suited to the collection of data from large populations. However, it would need to be adopted by chiropractors in practice in order for it to be effectively used for this purpose and it is possible that certain factors might impede widespread adoption. In particular, clinician perception of an outcome measure's clinical value and ease of use have been suggested as important factors for the successful routine implementation of outcome measures in addition to good organizational and administrative support.[16,18]

This study's primary objective was the investigation of the feasibility of using an electronic version of the previously validated UKIQ widely across chiropractic care.

Methods

This was a prospective, multi-center observational study conducted during October and November, 2016, in the United Kingdom. The infant clinic within the Anglo-European College of Chiropractic and four other private chiropractic clinics were recruited for participation. Ethical approval was granted by the Anglo-European College of Chiropractic Research Ethics Sub-Committee.

Feasibility benchmarks were set a priori (Table 1). While arbitrarily determined, these benchmarks were thought to be realistic indicators of user acceptance and the technical feasibility of widespread use of this tool.

- 70% consent rate (of eligible mother-infant dyads
- Recruitment of four participating clinics
- 70% completion via electronic method (no technical difficulties)
- 80% completeness of questionnaire (less than 20% blank or undecipherable items)
- 80% response from mothers that questionnaire was "easy to use"
- 50% follow-up rate
- Acceptance rating of a minimum of 9/15 for receptionists
- Acceptance rating of a minimum of 6.5/10 for clinicians

Table 1. Benchmarks for Defining Feasibility of Implementing Electronic United Kingdom Infant Questionnaire.

Participating clinics were required to have access to their own hand-held device for completion of the questionnaire. All mothers presenting their infant (0-12 months) for treatment and/or examination for the first time were eligible for inclusion. Exclusion criteria included mothers presenting a child over one year of age, who did not speak English or were intellectually incapable of providing consent to participation and infants being presented by someone other than the mother. Mothers younger than 16 years of age were also ineligible for inclusion. Clinics were asked to track instances in which mothers did not consent to participation or were unable to provide consent.

The electronic UKIQ was completed during patient registration in the reception area to prevent interaction with the clinician from influencing responses. The questionnaire was completed in a web browser and data was subsequently entered into an Excel™ worksheet on a web server in encrypted form using SSL technology. All data was password protected. Formstack® provided the services for this project. A follow-up questionnaire was completed in a similar fashion at the fourth visit or when deemed clinically appropriate by the treating chiropractor. Chiropractors were allowed to use their discretion in determining appropriate timing of follow-up, but were given the guidance that this should take place when they thought that clinically significant change (improvement or worsening) had occurred. In cases where patients were discharged or parents decided to discontinue care, the questionnaire was provided at the last visit even if this was prior to the fourth visit. No follow-up was pursued in cases that were referred to another professional without treatment given at the first visit or in cases where care was discontinued without the follow-up being completed at the last visit.

All data were collected anonymously and analyzed in pooled form. Infant gender and age in weeks were collected due to their clinical relevance, but no other identifying data were obtained.

Clinics were encouraged to contact the lead researcher with any problems encountered and to log any occurrence of technical issues preventing online completion. Additionally, clinics that did not actually implement the electronic UKIQ during the study period despite initial enrolment were contacted for their feedback, specifically regarding any barriers to implementation. At the close of the study, one chiropractor and one receptionist from each participating clinic were asked to complete a questionnaire in order to rate their experience in using the electronic UKIQ.

Results

100 intake questionnaires and 46 follow-up questionnaires were completed during the study period. The follow-up rate of 46% (46/100) therefore did not meet the predetermined feasibility benchmark. There were no cases of maternal refusal to participate, maternal inability to consent or an infant being presented by someone other than the mother.

No incidents of a logistic or technical issue preventing online completion of the questionnaire were noted. Data were incomplete for 0.1% of standard questions on the intake questionnaire and 0.9% of standard questions on the follow-up questionnaire, representing a rate of less than 0.3% for all standard questions. For items that could be answered with "other," 2.6% (13/500) were left unspecified by the mothers on the intake. Therefore, the feasibility benchmark of more than 80% completeness of data was achieved. One incident was recorded in which the "submit" button was not hit and some loss of data occurred, but there was no indication that his had occurred more often.

All mothers consented to participation and most responded that they found the questionnaire easy to use (97/98=98.9%), indicating a satisfactory level of maternal acceptance of the tool.

Five clinics initially enrolled in the study, but only two of these implemented the electronic UKIQ during the study period. Feedback from non-participating clinics is summarized in Table 2, but all clinics indicated time constraints as an issue in implementing the electronic questionnaire. Two of these clinics began using the questionnaire after the study period was complete.

Participating chiropractors and administrative staff rated their acceptance of the questionnaire highly. Clinical usefulness and likelihood of continued use were both rated at 5/5 by clinicians. Administrative staff provided the following mean ratings: 4.5/5 for ease of administering using a handheld device, 5/5 for willingness of mothers to complete and 5/5 for perceived ease with which the mothers completed the online questionnaire.

Discussion

All feasibility benchmarks were met, with the exception of lower than anticipated clinic participation and follow-up rate. These findings indicate that this electronic tool possesses the technical features necessary for widespread implementation and that it is well-accepted by its users: mothers, chiropractors and administrative staff.

The low follow-up rate may be partially attributable to the short study period, as it is possible that some infants were not far enough in the treatment process to warrant completion of a follow-up questionnaire at the close of the study. However, this finding brings to light an area that warrants attention in future studies using the UKIQ.

The main barriers to widespread implementation encountered during this feasibility study appear to be related to

Clinic No.	Comments
1	• had "a couple of very poorly babies" present and did not want to add stress to mother by asking her to complete the questionnaire • receptionists were busy with participating in other research efforts • still interested in using the electronic UKIQ, but had no time to get started yet
2	• did not hear about the study until late in the study period • did still intend to begin using the questionnaire, but had not had time to properly look at the instructions and implement due to hearing about the study late • this clinic did eventually start collecting data using the UKIQ but after the study period was closed
3	• busy clinic • head receptionist was away on vacation and later ill, both of which de-layed implementation • this clinic was already collecting data using the paper version of the UKIQ and did eventually start using the electronic UKIQ but after the study period was closed • experience with paper UKIQ had shown some difficulties with getting follow-up forms completed and the receptionist was hopeful that the electronic version might help them complete the follow-up more often

Table 2. Feedback from Non-Participating Clinics Regarding Barriers to Implementation of the Electronic United Kingdom Infant Questionnaire in Their Clinic.

shortage of time and high workload of clinicians and administrative staff. The low follow-up rate is likely also a reflection of these issues. This is unsurprising, as workload is commonly cited in the literature as an impediment to the implementation of routine use of PROMs[16,19] and the initial phase of implementation of such outcome measures is recognized as being particularly problematic.[20] The short study period likely served to highlight this issue.

Utilization of PROMs in research on chiropractic care of infants is congruent with the current trend in growing use of PROMs by governments and government agencies in evaluating and attempting to improve healthcare and therefore, it seems that endeavors to overcome barriers to implementation are worthwhile. Future research efforts using the electronic UKIQ might consider ways in which additional support can be offered during the implementation phase and a longer study period.

Evidence suggests that clinician perception that PROM use leads to improved patient care will foster clinician acceptance and utilization, while perception that a PROM is only useful for research purposes tends to hinder clinician acceptance.[16] While clinical utility and likelihood of future use was rated highly by the participating chiropractors, recruitment efforts focused mainly on the need for better quality research in the area of pediatric chiropractic care. Shifting the focus towards the clinical utility of this tool and the known benefits of PROMs in improving patient satisfaction with care and even patient outcomes[5,21] might boost future efforts at recruiting participating chiropractors.

Chiropractors working in private practice generally do not receive compensation for non-clinical activities like research. Even in settings like academic hospitals, where research efforts are given priority, a need to support and provide incentive for clinicians to participate in research has been noted in the literature.[22] Overcoming this lack of incentives will continue to be challenging when attempting research involving private chiropractic clinics.

Conclusion

Most feasibility benchmarks were met during the study period, suggesting that the electronic UKIQ possesses the necessary technical features for widespread use. However, lower than expected clinic participation and completion of follow-up were encountered. Future research efforts might look to the identified barriers in attempts to improve participation rates.

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JOURNAL ABSTRACTS

Association between maternal intake of n-6 to n-3 fatty acid ratio during pregnancy and infant neurodevelopment at 6 months of age: results of the MOCEH cohort study.

Nutr J 2017 16:23

Kim H[1], Kim H[1], Lee E[2], Kim Y[3], Ha EH[4], Chang N[5].

ABSTRACT

BACKGROUND & AIMS: Long-chain polyunsaturated fatty acids (LC-PUFAs) are essential for infant neurodevelopment. The nutritional adequacy of dietary LC-PUFAs depends not only on the LC-PUFAs intake but also on the n-6 to n-3 fatty acid ratio (n-6/n-3 PUFAs). This study aimed to identify the association between the maternal dietary n-6/n-3 PUFAs and motor and cognitive development of infants at 6 months of age. **METHODS:** We used data from 960 participants in the Mothers and Children's Environmental Health (MOCEH) study, which is a multi-center prospective cohort study. Dietary intake of pregnant women was assessed by a one-day 24-h recall method. Food consumption of infants was estimated based on the volume of breast milk and weaning foods. The duration of each feed was used to estimate the likely volume of milk consumed. Dietary intake of infants at 6 months was also assessed by a 24-h recall method. Cognitive and motor development of infants at 6 months of age was assessed by the Korean Bayley scales of infant development edition II (BSID-II) including the mental developmental index (MDI) and the psychomotor developmental index (PDI). **RESULTS:** Maternal intakes of n-6/n-3 PUFAs and linoleic acid (LA)-to-α-linolenic acid (ALA) ratio (LA/ALA) were 9.7 ± 6.3 and 11.12 ± 6.9, respectively. Multiple regression analysis, after adjusting for covariates, showed that n-6/n-3 PUFAs was negatively associated with both the MDI (ß= -0.1674, P = 0.0291) and PDI (ß= -0.1947, P = 0.0380) at 6 months of age. These inverse associations were also observed between LA/ALA and both the MDI and PDI (MDI; ß = -0.1567; P = 0.0310, PDI; ß = -0.1855; P = 0.0367). Multiple logistic regression analysis, with the covariates, showed that infants whose mother's LA/ALA were ranked in the 2nd, 3rd, and 4th quartile were at approximately twice the risk with more than twice the risk of delayed performance on the PDI compared to the lowest quartile (1st vs. 2nd; OR = 2.965; 95% CI = 1.376 - 6.390, 1st vs. 3rd; OR = 3.047; 95% CI = 1.374 - 6.756 and 1st vs. 4th; OR = 2.551; 95% CI = 1.160 - 5.607). **CONCLUSIONS:** Both the maternal dietary n-6/n-3 PUFAs and LA/ALA intake were significantly associated with the mental and psychomotor development of infants at 6 months of age. Thus, maintaining low n-6/n-3 PUFAs and LA/ALA is encouraged for women during pregnancy.

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Full text can be retrieved at:
https://nutritionj.biomedcentral.com/track/pdf/10.1186/s12937-017-0242-9?site=nutritionj.biomedcentral.com

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Spinal Manipulative Therapy for Adolescent Idiopathic Scoliosis: A Systematic Review.

J Manipulative Physiol Ther. 2017 Jul - Aug;40(6):452-458. doi: 10.1016/j.jmpt.2017.03.009.

Théroux J, Stomski N, Losco CD, Khadra C, Labelle H, Le May S.

ABSTRACT

OBJECTIVE: The purpose of this study was to perform a systematic review of clinical trials of spinal manipulative therapy for adolescent idiopathic scoliosis. **METHODS:** Search strategies were developed for PubMed, CINHAL, and CENTRAL databases. Studies were included through June 2016 if they were prospective trials that evaluated spinal manipulative therapy (eg, chiropractic, osteopathic, physical therapy) for adolescent idiopathic scoliosis. Data were extracted and assessed by 2 independent reviewers. Cochrane risk of bias tools were used to assess the quality of the included studies. Data were reported qualitatively because heterogeneity prevented statistical pooling. **RESULTS:** Four studies satisfied the inclusion criteria and were critically appraised. The findings of the included studies indicated that spinal manipulative therapy might be effective for preventing curve progression or reducing Cobb angle. However, the lack of controls and small sample sizes precluded robust estimation of the interventions' effect sizes. **CONCLUSION:** There is currently insufficient evidence to establish whether spinal manipulative therapy may be beneficial for adolescent idiopathic scoliosis. The results of the included studies suggest that spinal manipulative therapy may be a promising treatment, but these studies were all at substantial risk of bias. Further high-quality studies are warranted to conclusively determine if spinal manipulative therapy may be effective in the management of adolescent idiopathic scoliosis.

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Breastfeeding in Infancy is Associated with Body Mass Index in Adolescence: A Retrospective Cohort Study Comparing American Indians/Alaska Natives and Non-Hispanic Whites.

J Acad Nutr Diet. 2017 Jul;117(7):1049-1056. doi: 10.1016/j.jand.2016.11.013. Epub 2017 Jan 10.

Zamora-Kapoor A, Omidpanah A, Nelson LA, Kuo AA, Harris R, Buchwald DS.

ABSTRACT

BACKGROUND: American Indians and Alaska Natives have the highest obesity prevalence in the United States, but the influence of early childhood variables on body mass index (BMI; calculated as kg/m2) is not well understood. Previous studies have investigated the association between breastfeeding in infancy and offspring BMI, but rarely included American Indians and Alaska Natives. **OBJECTIVE:** This study investigated the association between breastfeeding in infancy and BMI in American Indians and Alaska Native and non-Hispanic white adolescents and young adults. **DESIGN:** Longitudinal analysis based on data from the National Longitudinal Study of Adolescent to Adult Health (1994 to 2008). **PARTICIPANTS:** Adolescent respondents who self-identified as American Indians and Alaska Native or non-Hispanic white, and whose parents completed the parental questionnaire, reported their height and weight. The final sample included 655 American Indians and Alaska Native and 10,305 non-Hispanic white respondents. **STATISTICAL ANALYSES PERFORMED:** Generalized estimating equations were used to measure the mean differences, 95% CIs, and P values of the association between breastfeeding in infancy and offspring BMI in adolescence, stratifying by race, and adjusting for demographic and socioeconomic variables. **RESULTS:** The length of breastfeeding was inversely associated with BMI in both populations. American Indians and Alaska Natives that were breastfed for 6 to 12 months or for more than 12 months had a mean BMI of 2.69 (95% CI -3.46 to -1.92; P<0.01) and 1.54 (95% CI -2.75 to -0.33; P<0.05) units lower than those that were never breastfed. Non-Hispanic whites that were breastfed for 3 to 6 months, 6 to 12 months, or more than 12 months had a mean BMI of 0.71 (95% CI -0.93 to -0.50; P<0.01), 0.68 (95% CI -0.87 to -0.50; P<0.01), and 0.85 (95% CI -1.09 to -0.62; P<0.01) units lower than those that were never breastfed. The association between the length of breastfeeding and offspring BMI varied by race (P<0.01). **CONCLUSIONS:** Breastfeeding in infancy is associated with lower mean BMI. Future research should investigate causal pathways and whether interventions promoting breastfeeding in American Indians and Alaska Natives can prevent increasing BMI.

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DOI: 10.1016/j.jand.2016.11.013

Back Pain Prevalence is Associated with Curve-type and Severity in Adolescents with Idiopathic Scoliosis: A Cross-sectional Study.

Spine (Phila Pa 1976). 2017 Aug 1;42(15):E914-E919. doi: 10.1097/BRS.0000000000001986.

Théroux J, Le May S, Hebert JJ, Labelle H.

ABSTRACT

STUDY DESIGN: A cross-sectional study. **OBJECTIVES:** he aim of this study was to investigate spinal pain prevalence in adolescents with idiopathic scoliosis (AIS) and to explore associations between pain intensity and pain-related disability with scoliosis site, severity, and spinal bracing. **SUMMARY OF BACKGROUND DATA:** The causal link between spinal pain and AIS remains unclear. Spinal asymmetry has been recognized as a back pain risk factor, which is a known cause of care-seeking in adolescents. **METHODS:** Participants were recruited from an outpatient tertiary-care scoliosis clinic. Pain intensity and pain-related disability were measured by the Brief Pain Inventory questionnaire and the Roland-Morris Disability Questionnaire. Scoliosis severity estimation was performed using Cobb angles. Associations were explored using multiple linear regressions and reported with unstandardized beta coefficients (ß) adjusted for age and sex. **RESULTS:** We recruited 500 patients (85% female) with mean (SD) age of 14.2 (1.8) years. Means (SD) of thoracic and lumbar Cobb angle were 24.54(9.77) and 24.13 (12.40), respectively. Spinal pain prevalence was 68% [95% confidence interval (95% CI): 64.5-72.4] with a mean intensity of 1.63 (SD, 1.89). Spinal pain intensity was positively associated with scoliosis severity in the main thoracic (P=0.003) and lumbar (P=0.001) regions. The mean (SD) disability score was 1.73 (2.98). Disability was positively associated with scoliosis severity in the proximal thoracic (P=0.035), main thoracic (P=0.000), and lumbar (P=0.000) regions.Spinal bracing was associated with lower spinal pain intensity in the thoracic (P=0.000) and lumbar regions (P=0.009). Bracing was also related with lower disability for all spinal areas (P<0.045). **CONCLUSION:** Spinal pain is common among patients with AIS, and greater spinal deformity was associated with higher pain intensity. These findings should inform clinical decision-making when caring for patients with AIS. **LEVEL OF EVIDENCE:** 3.

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Infant feeding and growth trajectory patterns in childhood and body composition in young adulthood.

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Rzehak P, Oddy WH, Mearin ML, Grote V, Mori TA, Szajewska H, Shamir R, Koletzko S, Weber M, Beilin LJ, Huang RC Koletzko B; WP working group of the Early Nutrition Project.

ABSTRACT

Background: Growth patterns of breastfed and formula-fed infants may differ, with formula-fed infants growing more rapidly than breastfed infants into childhood and adulthood. **Objective:** Our objectives were to identify growth patterns and investigate early nutritional programming potential on growth patterns at 6 y and on body composition at 20 y. **Design:** The West Australian Pregnancy Cohort (Raine) Study and 3 European cohort studies (European Childhood Obesity Trial, Norwegian Human Milk Study, and Prevention of Coeliac Disease) that collaborate in the European Union-funded Early Nutrition project combined, harmonized, and pooled data on full breastfeeding, anthropometry, and body composition. Latent growth mixture modeling was applied to identify growth patterns among the 6708 individual growth trajectories. The association of full breastfeeding for <3 mo compared with ≥3 mo with the identified trajectory classes was assessed by logistic regression. Differences in body composition at 20 y among the identified trajectory classes were tested by analysis of variance. **Results:** Three body mass index (BMI; in kg/m2) trajectory patterns were identified and labeled as follows-class 1: persistent, accelerating, rapid growth (5%); class 2: early, nonpersistent, rapid growth (40%); and class 3: normative growth (55%). A shorter duration of full breastfeeding for <3 mo was associated with being in rapid-growth class 1 (OR: 2.66; 95% CI: 1.48, 4.79) and class 2 (OR: 1.96; 95% CI: 1.51, 2.55) rather than the normative-growth class 3 after adjustment for covariates. Both rapid-growth classes showed significant associations with body composition at 20 y (P < 0.0001).Conclusions: Full breastfeeding for <3 mo compared with ≥3 mo may be associated with rapid growth in early childhood and body composition in young adulthood. Rapid-growth patterns in early childhood could be a mediating link between infant feeding and long-term obesity risk.

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Free full text: http://ajcn.nutrition.org/content/106/2/568.long Accessed 10/9/2017

Elbow Injuries in Pediatric Overhead Athletes.

AJR Am J Roentgenol. 2017 Oct;209(4):849-859. doi: 10.2214/AJR.17.17861. Epub 2017 Aug 10.

Wong TT, Lin DJ, Ayyala RS, Kazam JK.

ABSTRACT

OBJECTIVE: The purpose of this article is to discuss common elbow injuries found in pediatric athletes who participate in sports that entail overhead movements with focus on mechanism, clinical features, imaging appearance, and treatment options. **CONCLUSION:** Elbow injuries are commonly seen in pediatric overhead athletes and have been on the rise owing to the increased participation in and demand of youth sports. Imaging plays a critical role in identifying the type and severity of injury, which helps to determine appropriate treatment options.

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Beverage Consumption Patterns at Age 13 to 17 Years Are Associated with Weight, Height, and Body Mass Index at Age 17 Years.

J Acad Nutr Diet. 2017 May;117(5):698-706. doi: 10.1016/j.jand.2017.01.010. Epub 2017 Mar 2.

Marshall TA, Van Buren JM, Warren JJ, Cavanaugh JE, Levy SM.

ABSTRACT

BACKGROUND: Sugar-sweetened beverages (SSBs) have been associated with obesity in children and adults; however, associations between beverage patterns and obesity are not understood. **OBJECTIVE:** Our aim was to describe beverage patterns during adolescence and associations between adolescent beverage patterns and anthropometric measures at age 17 years. **DESIGN:** We conducted a cross-sectional analyses of longitudinally collected data. **PARTICIPANTS/SETTING:** Data from participants in the longitudinal Iowa Fluoride Study having at least one beverage questionnaire completed between ages 13.0 and 14.0 years, having a second questionnaire completed between 16.0 and 17.0 years, and attending clinic examination for weight and height measurements at age 17 years (n=369) were included. **EXPOSURE:** Beverages were collapsed into four categories (ie, 100% juice, milk, water and other sugar-free beverages, and SSBs) for the purpose of clustering. Five beverage clusters were identified from standardized age 13 to 17 years mean daily beverage intakes and named by the authors for the dominant beverage: juice, milk, water/sugar-free beverages, neutral, and SSB. **OUTCOMES:** Weight, height, and body mass index (BMI; calculated as kg/m2) at age 17 years were analyzed. **STATISTICAL ANALYSES:** We used Ward's method for clustering of beverage variables, one-way analysis of variance and x2 tests for bivariable associations, and y-regression for associations of weight or BMI (outcomes) with beverage clusters and demographic variables. Linear regression was used for associations of height (outcome) with beverage clusters and demographic variables. **RESULTS:** Participants with family incomes <$60,000 trended shorter (1.5±0.8 cm; P=0.070) and were heavier (2.0±0.7 BMI units; P=0.002) than participants with family incomes ≥$60,000/year. Adjusted mean weight, height, and BMI estimates differed by beverage cluster membership. For example, on average, male and female members of the neutral cluster were 4.5 cm (P=0.010) and 4.2 cm (P=0.034) shorter, respectively, than members of the milk cluster. For members of the juice cluster, mean BMI was lower than for members of the milk cluster (by 2.4 units), water/sugar-free beverage cluster (3.5 units), neutral cluster (2.2 units), and SSB cluster (3.2 units) (all P<0.05). **CONCLUSIONS:** Beverage patterns at ages 13 to 17 years were associated with anthropometric measures and BMI at age 17 years in this sample. Beverage patterns might be characteristic of overall food choices and dietary behaviors that influence growth.

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The risk associated with spinal manipulation: an overview of reviews.

Syst Rev. 2017 Mar 24;6(1):64. doi: 10.1186/s13643-017-0458-y.

Nielsen SM, Tarp S, Christensen R, Bliddal H, Klokker L, Henriksen M.

ABSTRACT

BACKGROUND: Spinal manipulative therapy (SMT) is a widely used manual treatment, but many reviews exist with conflicting conclusions about the safety of SMT. We performed an overview of reviews to elucidate and quantify the risk of serious adverse events (SAEs) associated with SMT. **METHODS:** We searched five electronic databases from inception to December 8, 2015. We included reviews on any type of studies, patients, and SMT technique. Our primary outcome was SAEs. Quality of the included reviews was assessed using a measurement tool to assess systematic reviews (AMSTAR). Since there were insufficient data for calculating incidence rates of SAEs, we used an alternative approach; the conclusions regarding safety of SMT were extracted for each review, and the communicated opinion were judged by two reviewers independently as safe, harmful, or neutral/unclear. Risk ratios (RRs) of a review communicating that SMT is safe and meeting the requirements for each AMSTAR item, were calculated. **RESULTS:** We identified 283 eligible reviews, but only 118 provided data for synthesis. The most frequently described adverse events (AEs) were stroke, headache, and vertebral artery dissection. Fifty-four reviews (46%) expressed that SMT is safe, 15 (13%) expressed that SMT is harmful, and 49 reviews (42%) were neutral or unclear. Thirteen reviews reported incidence estimates for SAEs, roughly ranging from 1 in 20,000 to 1 in 250,000,000 manipulations. Low methodological quality was present, with a median of 4 of 11 AMSTAR items met (interquartile range, 3 to 6). Reviews meeting the requirements for each of the AMSTAR items (i.e. good internal validity) had a higher chance of expressing that SMT is safe. **CONCLUSIONS:** It is currently not possible to provide an overall conclusion about the safety of SMT; however, the types of SAEs reported can indeed be significant, sustaining that some risk is present. High quality research and consistent reporting of AEs and SAEs are needed.

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