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- **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 pa-

tient'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.

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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.

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- 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 validity 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

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3 BMJ. Vol 7, Issue 3, 2002, **Evidence-Based Medicine in Practice: EBM Notebook**

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Bidding a faithful friend a fond farewell

By Sharon Vallone, DC, FICCP

It is with gratitude that the editors of the JCCP take a moment to acknowledge our recently retired friend, Molly Rangnath, and the unwavering dedication and countless contributions she has made over decades of service to the International Chiropractor's Association's Council on Chiropractic Pediatrics.

Molly, who most recently has served as Editor-in-Chief and Deputy Executive Director for Programs for the International Chiropractic Association, was integral in the founding of the Pediatric Council and the launching of the Diplomate in Chiropractic Pediatrics with Drs. Maxine McMullen, Peter Fysh and Joan Fallon.

After launching the inaugural annual conference, Molly successfully hosted an annual conference for the Council, gathering together, year after year, the growing community of graduating diplomates (and their families!) as well as many participants ranging from chiropractic students to seasoned practitioners interested in staying on the cutting edge of pediatric education.

Molly also hosted many educational events here in the United States as well as around the world (always "Building Bridges") that have been offered over the decades to chiropractors wanting to expand their knowledge and

provide a more specialized level of care to the pregnant and pediatric population.

Always aware of the need to support chiropractors in their clinical practice as well as the face of pediatric chiropractic "in the world" (of insurance, legislation, etc), Molly supported the leadership of the Council in launching the *Journal of Clinical Chiropractic Pediatrics* in 1996, published in hard copy until 2014 when she then began to publish the JCCP online (jccponline.com), making it open access, enhancing the ability of chiropractors and other associated healthcare professionals to access pediatric chiropractic literature.

We will miss Molly's insight and ingenuity, her ability to imagine, organize and accomplish the unexpected, her constant reminders that we were pediatric chiropractors and the importance of guarding that privilege and her propensity to constantly raise the bar for us to be all she believed we could be. But what will be missed most is her understanding and support of providing excellent chiropractic care to a very special population — children.

We will never be able to thank you enough, Molly, and we wish you a peaceful and joyous next stretch of your journey!



A summary of current studies related to chiropractic and manual therapies for pediatric patients

By co-editors Cheryl Hawk, DC, PhD, CHES and Sharon Vallone, DC, FICCP

In the March 2019 position statement by the Chiropractic Board of Australia, Interim policy on spinal manipulation for infants and young children, the Board recommends that chiropractors do not treat any children under age two years with spinal manipulation (<https://www.chiropracticboard.gov.au/News/2019-03-14-Board-announces-interim-policy>).

This is an interim position awaiting an independent expert review by Safer Care Victoria on spinal manipulation for infants and young children.

The Board goes on to state that, “there is no current clinical guideline, or peer-reviewed publication, to guide chiropractors with respect to the care of infants and young children, and the use of spinal manipulation in particular.”

While we acknowledge that there is not enough research on the effects of spinal manipulation on infants and young children, we would like to be sure that chiropractors and the public realize that there currently exists a growing body of evidence, plus an evidence-based set of recommendations for “best practices” for chiropractic care of children, which provide fairly substantial support for the safety of chiropractic care.

It is also important to note that for this interim policy the Board defines “spinal manipulation” as “moving the joints of the spine beyond the child’s usual physiological range of motion using a high velocity, low amplitude thrust.” This definition is important to keep in mind, because much of the published research on manual therapy involving children, particularly infants, suggests that very often Doctors of Chiropractic (DCs) and osteopathic physicians (DOs) do not use high velocity, low amplitude (HVLA) thrusts.

This editorial will briefly address a few of the studies which we hope will also be covered in the future review by Safer Care Victoria. It focuses on the safety of manual therapy in general because this is the chief concern of the recent policy. Effectiveness is, of course, important, but safety must be a primary concern.

2019 Systematic review of manual therapy for the pediatric population. This review detailed the use of manual therapy for children. “Manual therapy” included high-velocity, low-amplitude thrust maneuvers, mobilization, and low-force manual techniques. It found that in the 20 (of 50) studies

that reported on adverse events, no serious or long-lasting adverse events were reported for children receiving any type of manual therapy.¹

2018 Systematic review and meta-analysis of manual therapy for unsettled, distressed and crying infants.² This thorough study is somewhat unique in that it included not only randomized controlled trials (RCTs) but observational studies as well, excluding only single case reports and non-peer-reviewed literature. It included studies in which the intervention was manual therapy, defined as involving “physical and/or manual contact with the patient for therapeutic intent.” This study stated that manual therapy is a “relatively low risk intervention.”^{2, p.13} In fact, in the meta-analysis, the authors found that, “there was an overall RR [Risk Ratio] of 0.12 (95% CI 0.12 to 0.66); that is, those who had manual therapy had an 88% reduced risk of having an adverse event compared with those who did not have manual therapy.”^{2, p.6}

2015 Review of adverse events related to manual therapy for infants and children.³ This extensive review searched from the inception of searchable databases through March 2014, and included all manual therapists—this is a period of more than 50 years. Serious adverse events in infants and children receiving any type of manual therapy were rare. A total of 15 serious adverse events were reported, including three reported deaths. It is important to note that none of the deaths and seven of the 15 serious adverse events were attributed to chiropractors, even though chiropractors provide a substantial majority of manual care for children. In four of the seven serious adverse events related to chiropractic care, underlying preexisting pathology such as osteogenesis imperfecta contributed. It is also important to note that HVLA manipulation was applied in 10 of the 15 total serious adverse events. Mild, transient adverse effects such as temporary soreness or temporarily increased crying were much more commonly reported.

Review of biomechanical forces of chiropractic techniques used with children.⁴ This study discusses the findings of literature related to the amount of biomechanical force applied when chiropractors work with infants and children. It found that DCs often modify their usual techniques according to the patient’s age, decreasing the amount of biomechanical force, particularly with respect to HVLA. The description of Marchand’s findings and recommendations arising from a survey of European chiropractors is particularly relevant to preventing adverse events.⁵ See Table 1 for a summary of these recommendations. In this context, it is worth noting that

many, if not most, chiropractic colleges in the U.S. are now using Force-Sensing Table Technology in training students in application of HVLA techniques, so they will be able to deliver selected levels of force.⁶ It is also worth noting that, as indicated in Table 1, thrust manipulation (HVLA) is not recommended for infants and children under age two.

Recommendations on “best practices” for chiropractic care of children.^{7,8} These recommendations were first published in 2009 and then updated, based on an accompanying systematic review, in 2016. The 2009 original paper was actually structured to follow a current (at that time) Australian draft guideline on the same topic. The updated one included a systematic review, but the recommendations regarding safety did not change substantially. Based on the literature, and still congruent with the more recent studies summarized above, we recommended practices which would not only address the safety of manual procedures

themselves, but would also help avoid what Vohra et al term “indirect” adverse events: those occurring as a result of delayed referral for necessary care from another provider, or failure to correctly diagnose “red flags” which would contraindicate chiropractic care.⁹ These recommendations include age-appropriate history and examination; detection of “red flags” and modification of manual techniques to be suitable to the patient’s age, size, developmental stage—especially in terms of skeletal development, muscle mass and ligamentous flexibility—and comfort.

Conclusion

The current studies summarized above suggest that manual therapies are rarely associated with serious adverse events in children, even infants. For additional protection of patients, our profession has also developed an evidence-based set of recommendations for “best practices” for chiropractic care of children.

Level and age	Type of force	% of force used for adults	Approximate Newtons (actual force)
Grade 1: Ages 0-2 months	Low force; Low speed	10%	~11 N
Grade 2: Ages 3-23 months	Low force; Low speed	30%	~34 N
Grade 3: Ages 2-8 years	Moderate force; Moderate speed	50%	~56 N
Grade 4: Ages 8-18 years	Moderate force; High speed	80%	~90 N

Table 1. Recommended application of biomechanical forces to children of different age groups.^{4,5}

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Improvement in behavior and attention in a 7-year-old girl with ADHD receiving chiropractic care: A case report and review of the literature

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ABSTRACT

Objectives: To present the case of a 7-year-old female previously diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD), and the improvement and management of symptoms under regular chiropractic care, including the integration of a retained asymmetrical tonic neck reflex (ATNR). **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 “ADHD”, “chiropractic” and “spinal manipulation” were used. **Clinical features:** A 7-year-old female previously diagnosed with ADHD presented with anxiety, sleep disturbances, learning difficulties and behavioral issues. Her mother reported sleep disturbances began at 22-months following a fall onto her forehead. Previous treatments for ADHD, including behavioral therapy, psychotherapy and dietary intervention, had marginal success. A retained ATNR and aberrant H-test (cranial nerves III, IV, and VI) was identified. Direct objective indicators of vertebral subluxation at C1, T2, T4, T9, and sacrum were identified on spinal examination. **Intervention and outcomes:** Modified Diversified using an Activator instrument as a force application was applied to correct vertebral subluxation. Within the 4 visits, the child's behavior, mood and sleep patterns had improved, and the retained ATNR had integrated. Cranial nerve findings had resolved. Direct objective indicators of vertebral subluxation had reduced. Ongoing care continued to improve and manage the presenting behavioral symptoms. **Conclusion:** Chiropractic care focused on the correction of vertebral subluxation, was associated with improvements in the child's presenting symptoms associated with ADHD.

Key words: Attention Deficit Hyperactivity Disorder; ADHD; Chiropractic; Pediatric; Vertebral Subluxation; Chiropractic Spinal Manipulation.

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a complex pattern of persistent inattention and/or hyperactivity and impulsiveness that can interfere normal functioning or development.¹⁻³ Within the criteria, an individual's academic and/or occupational activities are assessed relative to the expected developmental level of that individual's age.¹⁻³ The inattentive and/or hyperactive-impulsive symptoms must have a detrimental effect on the quality of social, academic or occupational functioning.³

ADHD is considered to be common behavioral disorders in children and adolescents.^{2,4,5} It has been estimated, through the Global Burden of Disease study, that 26 million children and adolescents have ADHD.³ Over the past two decades there has been a significant increase in the prescription of medications for children diagnosed with ADHD.⁶⁻⁸ Ritalin and Dexamphetamine are stimulants that have been used for over 40 years with short-term success in managing the symptoms of ADHD in 80-90% of children.⁶ The steady increase in diagnoses of ADHD in the past decade is only compounded by the concern that current best practice for treatment (pharmaceutical intervention) does not actually

treat the cause of ADHD, it only haphazardly manages the symptoms.⁹

Current non-pharmaceutical treatments for ADHD, including behavioral therapies,¹⁰ educational therapies,¹¹ family counselling,¹² and dietary or nutritional intervention,^{13,14} have exhibited varying degrees of success, though none stand out as significantly more effective than others. A common approach is to combine these methods to have a cumulative effect.¹⁵

Chiropractic care for the pediatric population has grown in acceptance.^{16,17} Parents regularly choose chiropractic care to help manage common childhood conditions.^{18,19} Chiropractic care aims to optimize health and wellbeing through the enhancement of the nervous system function by removing nerve interference caused by vertebral subluxation.²⁰ A vertebral subluxation represents an altered state of afferent input which can lead to maladaptive changes in central neural plasticity resulting in dysfunction.²⁰ 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.”²¹ The correction of vertebral subluxations is achieved through chiropractic adjustments that are typically manually performed.²²⁻²⁴

Current literature regarding the chiropractic management of pediatric patients with ADHD is limited, and primarily of a low level of evidence.²⁵⁻²⁷ The evidence to date suggests that chiropractic care may be beneficial for this population.²⁷ The purpose of this study is to report the improvements in symptoms associated with ADHD in a 7-year-old female following chiropractic care.

Methods

To assess the relevance to chiropractic, an online review of the literature on ADHD and chiropractic was performed. The Index to Chiropractic Literature and PubMed were consulted using the search terms “ADHD,” “chiropractic” and “spinal manipulation.” Databases were searched from inception through July 2017, with peer-reviewed and complete systematic reviews, clinical trials, case series and case reports, all being included. Abstracts from research symposia were not included in the review.

Case Report

History

A 7-year old female with anxiety, sleep disturbances, learning difficulties and behavioral issues presented for chiropractic assessment. The presenting complaints were reported to be worsened by overstimulation and change of routine.

A review of the child’s health history revealed a birth requiring forceps and ventouse extraction. The child’s sleep disturbances are reported to have begun at 22-months of age, following a minor fall resulting in a laceration above her nose requiring medical management to suture the wound. Her sleep disturbance is reported as lacking the ability to fall asleep.

The child’s anxiety is reported to be associated with being bullied at school. Her learning difficulties and behavioral issues are reported as a greatly reduced attention span, and difficulty in following instructions at home and at school. She was medically diagnosed at age seven with ADHD by a general practitioner and pediatrician. It is unknown if the general practitioner or pediatrician used a formal instrument to assess ADHD. The pediatrician prescribed Ritalin, however the child’s parents were interested in seeking alternative solutions.

Previous treatments sought include cognitive behavioral therapy (CBT), psychotherapy and dietary changes. The

parents reported these to be ineffective in helping manage their daughter.

Examination

The child presented with an unsettled demeanor and short attention span, was distracted, hyperactive and had difficulty following instructions. Generally, the child’s gait and coordination were observed to be normal.

Postural analysis revealed a high left mastoid and shoulder with left scapular winging. Anterior tilt of the pelvis was also noted. No other postural abnormalities were reported. All global ranges of motion were within normal limits. Posture and ranges of motion were assessed via manual observation and palpation only.

Neurological examination presented with a retained bilateral asymmetrical tonic neck reflex (ATNR).²⁸ Assessment of cranial nerves III, IV, and VI revealed inability to track on H-test (by having the patient follow an object moved across their full range of horizontal and vertical eye movements by the chiropractor), especially the right eye, with saccadic pursuit at the lateral right of H-test.²⁹

Initial chiropractic examination for vertebral subluxation was performed using commonly used clinical indicators.³⁰⁻³⁵ Direct objective indicators of vertebral subluxation at C1, T2, T4, T9 and sacrum were identified through static and motion palpation, leg length inequality, Derifield assessment, sacral restriction test and cervical syndrome test.

Intervention

Informed consent was obtained from the child’s mother at the initial consultation for the child to begin chiropractic care. Full spine chiropractic care was administered over a period of 11-weeks at a frequency of one visit per week. Vertebral subluxations were routinely assessed using static and motion palpation, muscle testing, muscle palpation and leg length analyses including leg length inequality, Derifield, cervical syndrome and sacral restriction.³⁰⁻³⁵

Chiropractic adjustments were made using Diversified 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.³⁶ The most commonly adjusted levels of the child’s spine were C1, the left sacrum and T9, addressed 10, 9 and 8 out of the 11 visits respectively. For a detailed list of spinal levels addressed each visit see Table 1.

When the child began chiropractic care, she was seeing a counsellor weekly for CBT. She had undergone three visits

for CBT prior to commencing chiropractic care. Only two further visits were attended once starting chiropractic care as the child's change in behavior was rapid, and the mother did not believe CBT had been as effective.

Outcomes

Over the course of chiropractic care the child demonstrated reduction in symptoms associated with ADHD, was less anxious and had improved sleep patterns. Following the second visit the parents reported that the child's sleep patterns had improved markedly, and had noticed improvement in her behavior and anxiety levels. By the third visit the parents reported she was able to better concentrate. At the time of the fourth visit the child had had a successful sleepover for the first time, and clinical examination revealed resolution of ATNR.

Generally, the child's behavior was reported to have improved over the course of care and now remains under the chiropractor's care at a reduced visit frequency, every two to three weeks as recommended each visit, for regular wellness care. For a detailed list of reported and observed changes in the child's behavior and presenting complaints see Table 1. No adverse reactions were identified or reported during the course of chiropractic care.

Cranial Nerve examination (CN III, IV, and VI) revealed normalization of ocular tracking on H-test. Saccadic pursuit on lateral right H-gaze had resolved.

Chiropractic spinal examination revealed a right leg length inequality and negative Derifield (short leg remaining short on knee flexion to 90°), right Levator Scapula hypertonicity, right C5/6 edema, and decreased joint play and intersegmental motion of T3/4. These findings indicated a reduction of direct objective indicators of vertebral subluxation when compared to the initial presentation of the patient.

Discussion

Improvements in behavior associated with ADHD, sleep patterns and anxiety were reported in a 7-year-old female over the course of 11-weeks of chiropractic care. The child had a 5-year history of sleep disturbance, anxiety associated with school bullying, and ADHD medically diagnosed at age seven prior to commencing chiropractic care.

Most commonly a pharmaceutical approach is used in the treatment of ADHD, however there has been concern about this approach.⁶⁻⁹ Non-pharmacological approaches such as dietary change and counselling have shown some positive benefits, and more so when used in combination.¹⁰⁻¹⁵ Com-

Visit	Vertebral segment adjusted/Chiropractic listing	Parent's and chiropractor's observations
1	PL Sac, C1 ASR	
2	L5 BL, C5 BL, C1 ASR	Symptoms reduced significantly to last week; sleeping better, not as jittery, calmer. Parents have noticed big difference in behavior and anxiety levels.
3	T12 BR, T4 BR, C1 ASR	Moods improved, and able to concentrate better. Some anxiety with a child at school. Sleeping well
4	PL SAC, T9 BL, T4 BR, C1 ASR	Still doing well; marked improvement in behavior. Had a (successful) sleepover for the first time
5	PL SAC, T9 BL, T4 BR, C1 ASR	Still doing well with behavior and sleeping well at night.
6	PL SAC, T9 BL, T4 BR, C1 ASR	Behavior has been difficult to manage past 5 days.
7	PL Sac, T9 BL, T4 BR, C1 ASR	Behavior much improved over past week.
8	PL Sac, T9 BL, T4 BR, C1 ASR	Has been a little anxious and sleep is unsettled.
9	PL Sac, T9 BL, C1 ASR	Anxiety has improved. Sleep has been better though still unsettled. Behavior good.
10	PL Sac, T9 BL	Sleep improved after adj; attempted a sleepover again and managed to stay the night with minimal anxiety.
11	PL Sac, T9 BL, C1 ASR	Maintenance visit. Behavior good and sleeping well.

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

plementary and alternative medicine (CAM) approaches are used by parents and healthcare providers, with ADHD being one of the most common reasons for seeking care.³⁷ Chiropractic care is one of the more common CAM modalities that parents choose for children, though still a very niche area.³⁷ Therefore, it is important to investigate the effect of chiropractic care on a child with ADHD.

While the chiropractic literature for this specific population is limited, a literature review revealed three systematic reviews of the literature,²⁵⁻²⁷ one clinical trial,¹⁵ one qualitative study,³⁸ four case series³⁹⁻⁴² and 18 case reports⁴³⁻⁶⁰ relevant to chiropractic management of people presenting with ADHD. All but one study described the care of pediatric patients. The clinical trial only described the proposed protocol for the study, results were to be published at a later date.¹⁵

The systematic reviews all report that the literature regarding the chiropractic management of pediatric patients with ADHD is not only limited, but primarily of a low level of evidence.²⁵⁻²⁷ The most recent systematic review however does suggest that chiropractic care may be beneficial for this population, though recognizes that higher level investigation is necessary.²⁷

Hermansen and Miller³⁸ conducted a qualitative study that adds weight to the inclusion of a biopsychosocial model in the clinical management of people with ADHD. In the study chiropractic care was well received by the patients reported by high levels of satisfaction, two-thirds of the subjects were using chiropractic solely with behavioural improvements reported by parents and teachers. The inclusion of Interactive Metronome treatment was found to be one of the major benefits of the course of care. The study suggests that parents felt the use of 'alternative' treatments was looked down on by other members of the public.

Alcantara and Davis³⁹ reported on four males, aged 7 to 11, who had been assessed using a 15-item Parent Teacher ADHD questionnaire. The children were managed with Diversified and Gonstead techniques for five months, with the inclusion of nutritional supplements. All children were found to have reduction in ADHD symptoms based on the questionnaire.

Cuthbert and Barras⁴⁰ reported on 157 children (86 male and 71 female) aged 6 to 13 diagnosed with developmental delay syndromes, including ADHD, via psychometric testing by a logopedist. Chiropractic care using Applied Kinesiology and Diversified techniques for 2 to 50 visits over a period of 5-days to 18-months. Parents reported behavioral improvements in all cases.

Hodgson and Vaden⁴¹ reported on four children aged eight to 12 who had been formally diagnosed with ADHD us-

ing the ADHD Symptom Regularity and Severity questionnaire, and had a history of medication for ADHD symptoms. Chiropractic care using Torque Release Technique over 5 to 10 months and all children showed improvements in ADHD symptoms indicated by the questionnaire.

Pauli⁴² reported on nine adults (four male and five female) presenting with ADHD assessed via the TOVA test. Chiropractic care using Network Spinal Analysis over a two month period resulting in all patients demonstrating significant improvements on the TOVA test.

The case reports suggest a generally positive benefit of chiropractic care with children and adolescents who present with ADHD.⁴³⁻⁶⁰ For a review of the case reports see Table 2.

Of the 23 peer-reviewed studies (qualitative study, and case series and reports) describing chiropractic management of patients presenting with ADHD, 15 (65.21%) specifically reported assessment and correction of vertebral subluxation,^{41-44,46,48-55,57,58} with 17 (73.91%) describing direct clinical indicators commonly used in the assessment of vertebral subluxation.^{41-44,46-55,57,58,60} The most commonly used approaches to address vertebral subluxation were Upper Cervical and Diversified techniques.^{39,40,43,45-49,52,54,55,59} Ten (43.47%) of the 23 studies reported additional intervention, such as auriculotherapy, soft tissue therapy and dietary supplementation in conjunction with chiropractic care.^{39,43-45,47,51,54,56,59}

Seventeen (73.91%) of the 23 studies describe formal/medical diagnosis of ADHD.^{38-45,47-50,53-55,57,59} One further case was assessed through the schooling system.⁵¹ Improvements in symptoms associated with ADHD were self-reported in the majority of cases, though there is little evidence of improvement following a course of chiropractic care being measured via a formal assessment instrument such as the TOVA test.^{39,41-45} In three cases a medical practitioner or therapist determined that the symptoms associated with ADHD had improved or resolved, though it is unclear if a formal assessment was used.^{50,57,59} In many cases the published literature indicates that reported improvements are either from parent and/or teacher observations, or self-reported.^{38,40,46-49,51-56,58,60}

Though limited, the current literature suggests that chiropractic care can improve symptoms related to ADHD.^{27,38-41,43-47,49-58} The findings from the current case study is congruent with previously reported studies investigating the effects of chiropractic care on the symptoms associated with ADHD. Of note is that the majority of studies report the assessment and correction of vertebral subluxation being associated with improvements, giving weight to research that investigates the vertebral subluxation in general.^{61,62} This study supports the use of chiropractic care for children and

young adults with ADHD.

Limitations

There are inherent limitations of a single case study. These include lack of a control group, and the inability to exclude spontaneous remission, accounting for cumulative effects of previous care, 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 ADHD was made through a medical practitioner assessment but may not have been via an instrument such as a TOVA test. Reported improvements were through subjective observations made by the parents and chiropractor. Additionally, there were limited outcome measures used in the manage-

ment of this child.

A further limitation is the current lack of higher level investigation into the chiropractic care of this population. Further higher level investigation should be undertaken by the profession.

Conclusion

Chiropractic care, using instrument assisted Modified Diversified technique for the correction of vertebral subluxation, was associated with improvements in the child's presenting symptoms associated with ADHD. Higher level research is needed to investigate the role chiropractic may play in helping infants and children who present with ADHD.

Authors	Patient presentation	General case management	Results reported
Bagnaro ⁴⁴	11-year-old male with noted behavioral and learning difficulties. ADHD formally assessed via behavioral Evaluation, TOVA	20 visits over 3 months, exercises and dietary advice given NUCCA technique	Reduced ADHD symptoms, improved TOVA assessment and academic performance
Hodgson and Fox ⁴⁵	21-year-old male with ADHD and migraine. ADHD assessed via Symptom Regularity and Severity Questionnaire	13 visits over 10 weeks, Auriculotherapy was also used Torque Release technique	Reduction in ADHD and migraine symptoms. Improved based on ADHD Symptom Regularity and Severity Questionnaire
Kuhn and Cambron ⁴⁶	15-year-old male with chronic headaches and 10-year history of behavioral issues. ADHD formally assessed via TOVA	42 visits over 19 weeks, home physical coordination activities prescribed Diversified technique	Improved based on patient reports and various validated methods, reduced medication
Manis and Rubenstein ⁴⁷	10 year old male with ADHD and involuntary motor tics	15 visits (8 adjustments) over a period of 10 months. Upper cervical technique	Parent reported changes in behavior
Muir ⁴⁸	5 year old male with medically diagnosed ADHD	21 visits over a 6-month period. Soft tissue therapy and myofascial release also used. Diversified technique	Parents reported improvement in behavior
Scroggin ⁴⁹	11-year-old male with upper back pain, and Autism and ADHD diagnosed by a pediatrician	8 visits (adjusted on 7) over 8 weeks. Grostic technique	Back pain resolved, No discussion of ADHD improvement
Wolfertz and Dahlberg ⁵⁰	16-year-old male medically diagnosed with bipolar disorder and ADHD	15 weeks, however the number of visits is unknown. Knee Chest Upper Cervical technique	Parent reported improvement in behavior
Zielinski and Mankal ⁵¹	8-year-old male diagnosed with inattentive type ADHD and learning disability. ADHD was diagnosed via private psycho-educational testing	27 visits, however the timeframe of care is unknown. Chiropractic Biophysics and Turner Cranial techniques	Pediatrician, teachers and parents reported improvement in presenting symptoms
Bedell ⁵²	7-year-old female identified through the school system as having behavioral concerns including aggression and inattention.	90 days (3 times per weekly) craniosacral therapy and nutritional supplementation (fish oils). Torque Release Technique	Parent reported improvement in behavior

Olafsson ⁵³	4 ½ year old male with suspected ADHD but not formally diagnosed	10 visits over 10 weeks, with dietary changes and exercises being prescribed. Diversified technique	Parent reported behavioral changes
Cassista ⁵⁴	4-year-old male with sleep disturbances and ADHD diagnosed by a pediatrician	3 visits per week for 2 ½ months, then reduced frequency to periodic care due to parents moving away. Pettibon technique	Parent reported behavior changes. The child's behavior reverted to pre care behavior and when assessed again after a 16 month hiatus from care the child demonstrated a marked increase in VS indicators similar to pre care
Stone-McCoy and Przybysz ⁵⁵	3 ½ year old male diagnosed with ADHD by a psychologist	3 visits weekly for 3 weeks, 1 visit weekly for 8 weeks, 1 visit every other week. Omegas and proprioceptive exercises were also introduced. Upper cervical technique	Parent and teacher reported improved behavior (attention and energy levels)
Elster ⁵⁶	9-year-old male with respiratory issues, ADHD, depression, insomnia and headaches. ADHD was diagnosed by a neurologist via the Attention Deficit profile worksheet	5 months Upper cervical technique	Parent, practitioner and self-reported improved behavior
Blum and Cuthbert ⁵⁷	2-year-old female with delayed developmental and emotional growth.	5 years Craniocervical therapy. (multi mineral supplement also given)	Parent reported changes in behavior. At 7 years of age is equal to her twin brother
Bastecki et al. ⁵⁸	5-year-old male with ADHD unsuccessfully treated with Ritalin. ADHD was medically diagnosed via the common ADHD checklist	35 visits over 8 weeks Chiropractic Biophysics technique	Medical doctor determined child no longer exhibited ADHD symptoms
Jaszewski and Sorbara ⁵⁹	7-year-old female with ADD, difficulty concentrating, vomiting and migraine. ADD was not formally diagnosed	1 visit weekly for 5 weeks Pierce Results System technique	Parent reported changes in behavior
Young ⁶⁰	4-year-old male with multiple behavioral conditions. ADHD was medically diagnosed	12 weeks (6 visits) with proprioceptive exercises, and dietary changes and supplements prescribed. Upper cervical technique	Parents, teachers and speech therapist reported positive behavior changes
Lovett and Blum ⁶¹	8-year-old male with behavioral symptoms associated with ADHD but not formally diagnosed	8 weeks (weekly visits) Sacro-Occipital Technique	Parents and teacher reported improvement in behavior

Table 2. ADHD case report summary.

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Prognosis of patellofemoral pain in adolescents: a case report

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ABSTRACT

Introduction: Patellofemoral pain is a common condition in adolescents and may significantly impact their activities of daily living. **Methods:** A literature search was performed using the PubMed database including the terms “knee pain,” “patellofemoral pain syndrome,” “patellofemoral pain,” and “anterior knee pain” combined with “prognosis” and “natural history.” Three relevant articles were identified including individuals aged 13-18 years. **Case presentation:** An active 14-year old female presented to the chiropractic clinic after being diagnosed with this condition by her general practitioner. The family wanted to know the long-term prognosis of the condition and if anything could be done, as the general practitioner had suggested that the condition would resolve on its own. **Intervention:** Home exercises were prescribed along with advice to temporarily suspend participation in physical education classes and consider orthotics. Soft tissue therapy and mobilizations of the knee joint were also applied. **Outcomes:** Despite these efforts, this patient continued to suffer from these complaints, though with reduced intensity, three years after the onset. **Discussion:** Three prospective studies examining the prognosis of this condition in a young population exist. Though heterogeneous in design, the evidence suggests that the course of patellofemoral pain in adolescents and young adults does not appear to be self-limiting in nature and its prognosis appears to be worse than that of other non-traumatic knee conditions. **Conclusion:** Early intervention appears to improve the chances of recovery, therefore chiropractors should be aware of this condition’s unfavorable prognosis and the urgency of initiating treatment in a timely manner.

Key Words: Patellofemoral pain syndrome, adolescent, knee pain.

Introduction

Knee pain is a common reason for which adolescents visit primary care providers,¹ with patellofemoral pain affecting approximately 6-7% of adolescents, and accounting for almost half of adolescent knee complaints.² The diagnosis of patellofemoral pain is made with peripatellar or retropatellar anterior knee pain of insidious onset provoked by activities such as long periods of sitting, kneeling, squatting, running and stair climbing.³

Traditionally, patellofemoral pain in adolescents has been regarded as a benign, self-limiting condition.^{4,5} However, one longitudinal study of female adolescents with patellofemoral pain showed that 78% continued to suffer from knee pain even after a long mean follow-up time of 16 years,⁶ indicating that the prognosis might not be as good as previously believed.

This work presents the case of an adolescent female presenting with patellofemoral pain, with consideration for the most recent evidence surrounding the prognosis of this condition in adolescents.

Methods

A search of the literature was performed using the PubMed

database. The following search terms were used: “knee pain,” “patellofemoral pain syndrome,” “patellofemoral pain” and “anterior knee pain” combined with the terms “prognosis” and “natural history.” Filters were used to limit the search to human studies of adolescents (ages 13-18 years). Hand searching of reference lists of relevant articles was also performed to identify additional relevant literature. Inclusion criteria included English language, publication between the years 2000 and 2019 and a prospective study design. Studies of a solely adolescent population were scarce, so it was decided that those including a young adult population (older than 18 years of age) along with adolescents (13-18 years of age) would not be excluded. In total, three relevant articles were identified.

Case Presentation

A 14-year old female presented with a new complaint of severe pain localized to the retropatellar area of her right knee at a consultation previously planned for maintenance care and monitoring of a scoliosis. There was no history of trauma, but the patient was highly active, cycling approximately 40 kilometers every school day and swimming recreationally once per week.

Approximately four weeks after the onset, mother had con-

sulted their general practitioner, who told them her pain was related to growth and would simply resolve on its own, not offering any further treatment options. At their next planned chiropractic appointment approximately two weeks after consulting the general practitioner, the family wanted to know whether chiropractic treatment could be of benefit for these complaints and whether the general practitioner's opinion about the complaints was correct.

Evaluation

No swelling or redness was visible, and pain was reproduced with patellar compression and palpation of the medial articular surface of the patella. An obvious pes planus deformity was present, with slight adduction and internal rotation of the thighs when standing.

Intervention and Outcomes

As a first step in approaching her complaint, the patient was provided with home exercises for her quadriceps, with particular focus on strengthening of the vastus medialis muscle. Since her transport to school required cycling, advice was given to stop participation in physical education classes for at least the next two weeks in order to allow some of the irritation to subside. A subsequent visit was scheduled at the usual interval of care, two months later, with the expectation that the knee pain would have diminished by then. At that moment, no obvious reason seemed present to lead one to expect that her complaint might become chronic.

At the next visit, the complaints had not resolved. Since the pain remained quite intense and an obvious pes planus deformity was present, a suggestion was made to consider having orthotics made by another practitioner. Soft tissue therapy for the vastus medialis and popliteus muscles and mobilizations of the knee joint were also applied. Due to other circumstances, her next appointment took place five months later. While it was hoped that physical rest during the summer vacation might have helped in her recovery, not much progress had been made. She admitted to very rarely doing her home exercises, but said that this was because the exercises were too painful to complete. As a result, more emphasis was put on proximal exercises for the hip musculature, which have been found to be effective in

more recent studies⁷ and were less painful for her to complete. (See Table 1.)

Her mother was also encouraged to try to monitor the home exercises. These changes resulted in greater compliance with the home exercise program and ultimately a decrease in the patient's subjective pain level. While able to continue participating in swimming, she also admitted that she limited the intensity with which she took part as a result of the pain. At follow-up three years after her initial presentation with this complaint, the patient reported some remaining symptoms, though these were mild in frequency and severity.

Discussion

The identified evidence is clear that while some patients with patellofemoral pain recover, a large proportion of affected adolescents and young adults continue to experience pain and disability in the long term and that the prognosis for patellofemoral pain tends to be worse than for other non-traumatic knee conditions.^{8,9,10} (See Table 2, pages 1532-1533).

When followed over a two-year period, adolescents with patellofemoral pain had a significantly higher risk of continued pain than subjects with other types of knee pain (Relative risk (RR) of knee pain at follow-up=1.26 (95% CI, 1.05-1.50)).¹⁰ They also reported more frequent and intense pain at follow-up than the subjects with other types of knee pain, though all types of baseline knee pain raised the risk of knee pain at follow-up (RR=4.51 (95% CI, 3.15-6.45)).¹⁰ Similarly, a longitudinal study of adolescent and young adult patients showed a worse prognosis for patellofemoral pain patients, with 40% experiencing persistent symptoms and only 19% of patients with unspecified knee symptoms experiencing persistent pain six years after study.⁹ Therefore, the evidence does not appear to support the assertion that patellofemoral pain is self-limiting. Rather, it suggests a high risk of chronicity for this condition.

Evidence also exists to suggest that the largest improvements in pain and functional outcomes for patellofemoral pain tend to occur during the first three months of follow-up^{8,9} which suggests that if patients are likely to recover ei-

Treatment Strategy	Challenge Encountered
Quadriceps strengthening exercises (particular emphasis on vastus medialis)	Too painful to complete, low adherence
Orthotics suggested	Costly
Relative reduction of use of knee	Commute to school required almost daily cycling
Proximal exercises (hip abduction strength)	Compliance/motivation to complete exercises doubtful

Table 1. Strategies Implemented in Treatment of Female Adolescent with Patellofemoral Pain and Associated Challenges

ther spontaneously or with treatment, that it will generally occur at an early stage. These findings point to the existence of a critical period in which interventions might have a better chance of success. Unfortunately, patients with non-traumatic onset of pain are known to be less likely to seek care.¹⁰ This, along with the erroneous belief that the condition is benign and self-limiting, are possibly barriers to the delivery of appropriate care and recovery.

When considering the relevant literature and the patient in this case, it did not appear that the information and advice that this family had received from their general practitioner was consistent with the current best evidence. Rather, the evidence seemed to suggest that early intervention was appropriate, rather than a “watch and wait” management style which would be indicated if this condition were truly self-limiting. A longer history of knee pain at baseline (more than two months of pain) has been identified as the most consistent predictor of poor outcome^{8,12} supporting the notion that early intervention may be desirable in order to attempt to avoid chronicity. Considering this knowledge, it seems that more frequent chiropractic appointments were probably indicated in the period following this patient’s presentation with this new complaint.

Exercise therapy is generally recognized as the mainstay of conservative treatment for patellofemoral pain, though the evidence for its efficacy is not of particularly high quality and focuses mainly on adults.^{13,14} Quadriceps exercises with a particular emphasis on the vastus medialis muscle, have traditionally been the most commonly used exercise approaches.¹⁵ Such exercises had been initiated with this patient. However, considering that her complaints had been present for a relatively long period before they were mentioned at a chiropractic appointment, this delay in initiating treatment might have negatively impacted her clinical outcome.

The response to exercise therapy in adolescents also seems to differ from that in older patients. One randomized trial using a physical therapy intervention demonstrated that 81% of patients aged 18-40 years reported moderate to marked improvement at 12 month follow-up on a global rating scale¹⁶ while similar interventions in a trial including patients aged 15-19 years resulted in only 38% self-reported recovery at 12 months.¹⁷ Adolescents have also been found to comply poorly with treatment recommendations. Low participation rates in supervised training sessions and low compliance rates with recommendations for home exercises were observed in the Rathleff (2015) trial, even though the study setting had significant supports in place to encourage compliance.¹⁷ However, those adolescents with the best home exercise adherence were found to have markedly better rates of clinical improvement (Odds ratio = 4.04, 95% C.I. 1.42 to 11.55).¹⁷ Clinicians may therefore need to find

innovative ways to improve adolescent adherence to treatment, which could involve strategies such as involving parents in monitoring home exercises, restricting screen time until exercises are completed, scheduling more frequent in-office visits or using time in physical education classes to do exercises.

Further concern about this patient’s situation arose from the existence of some evidence suggesting that patellofemoral pain may have more serious long-term consequences. One theory suggests that anterior knee pain in early life may lead to osteoarthritis of the knee in adulthood¹⁸ with a retrospective study showing a strong relationship between anterior knee pain in young adulthood and development of patellofemoral osteoarthritis later in adulthood.⁴ A systematic review failed to identify sufficient high-quality evidence for a causal relationship, but concluded that the two conditions might at least have some shared biomechanical risk factors including alignment issues in the lower limb, patellar tracking issues and muscular dysfunction¹⁹ making it conceivable that this theory might be applicable at least in certain individual cases.

Some research suggests that there is cause for concern about the long-term effects of this pain condition on adolescent females in particular. Altered pain processing mechanisms resulting in higher sensitivity to pain have been found in patients with patellofemoral pain, suggesting that altered central or peripheral pain processing mechanisms may play a role in this condition, particularly in female.^{20,21} This is of concern, due to the potential of this mechanism to contribute to other generalized pain conditions.

Other important effects of knee pain have been recognized including lower health-related quality of life scores in the adolescent and pre-adolescent population²¹ and decreased activity levels in participation in sport.^{10,23} Adolescents suffering from patellofemoral pain are more likely to reduce their participation in sports than patients with other forms of knee pain.¹⁰ The risk of low physical activity levels may be of particular concern in the female adolescent population. Females are affected by knee pain at higher rates than males^{3,11} and girls tend to be less active than boys throughout childhood and adolescence, with rates of activity declining faster in girls than boys during the teenage years.²⁴ This may have significant short and long term effects, as inactive teens may not achieve the activity levels required for them to reap the many recognized positive benefits on their physical and mental health.²⁵ Furthermore, levels of physical activity in early life tend to track into adulthood, possibly leading to adult sedentariness which may raise the risk of chronic conditions like obesity, osteoporosis, cardiovascular disease and diabetes.²⁶

Contrary to what the evidence suggested, there was little

Study Title	Study Design	Study Results	Conclusion
<p>Rathleff et al. 2016, Is Knee Pain During Adolescence a Self-limiting Condition? Prognosis of Patellofemoral Pain and Other Types of Knee Pain</p>	<p>Population-based cohort study. Initial population of 2846 Danish high school students screened for knee pain using a questionnaire. Those meeting inclusion criteria, invited for a clinical examination by an experienced rheumatologist (to diagnose specific knee condition). At 2-year follow-up, the 504 adolescents (16-18 years of age) with knee pain who had successfully been contacted at study initiation and 252 randomly selected individuals (acting as controls) from the initial cohort were invited to answer an online questionnaire</p> <p>Inclusion criteria: history of anteriorly located knee pain of at least monthly frequency and insidious, non-traumatic onset</p> <p>Exclusion criteria: concomitant injury, pain from the hip, lumbar spine or other knee structures, self-reported patellofemoral instability, knee joint effusion</p> <p>Outcomes measured at intake: Location of pain throughout body; Frequency of pain — as a surrogate for pain severity (rarely, monthly, weekly, more than once per week, almost daily); participation in leisure-time sport outside of school physical education (days per week), EuroQoL 5-Dimensions (age specific health-related quality of life measure)</p> <p>Outcomes measured at 2-year follow-up:</p> <p>Primary outcome: worst pain in the last week as measured on visual analog scale (VAS).</p> <p>Secondary outcomes: leisure-time sport participation per week, Knee Injury and Osteoarthritis Outcome Score (KOOS), Physical Activity Scale (PAS) and EQ-5D.</p>	<p>77% of initial population responded to questionnaire. 670/2200 respondents reported knee pain at least monthly, 504/670 were successfully contacted to assess eligibility. 180/204 invited for clinical examination accepted invitation and 172 were examined. 153 were diagnosed with patellofemoral pain (PFP) and 121 adolescents with a mean age of 17 years were enrolled in a randomized cluster trial. 351 adolescents with other causes of knee pain (traumatic and non-traumatic) were not included in the randomized trial. -79.6% completed the follow-up questionnaire with dropout analysis showing no significant differences between those who completed and those who did not.</p> <p>-55.9% of adolescents reporting knee pain at baseline also reported pain at 2-year follow-up, while 12.8% of those without knee pain at baseline reported pain at follow-up.</p> <p>Risk of continued pain was higher in those with PFP than other types of knee pain (Relative Risk (non-adjusted)= 1.26 [95% CI, 1.04-1.50]; RR (adjusted for age, sex and BMI)=1.24 [95% CI, 1.04-1.49])</p> <p>Risk of continued pain was higher for all patients with knee pain compared with those without knee pain (RR unadjusted=4.51 [95% CI, 3.15-6.45]; RR (adjusted)=4.47 [95% CI, 3.11-6.43])</p> <p>Those with PFP at baseline had higher frequency of daily knee pain (33% vs. 24%) and knee pain several times per week (22% vs. 13%) and 13 mm higher median pain intensity on VAS at follow-up when compared to those with other types of knee pain.</p> <p>PFP affected knee pain patients had higher rates of reduced or discontinued sport participation (71% vs. 52%) compared to patients with other types of knee pain. In those without knee pain, 55% reduced or discontinued participation during the same period</p> <p>EQ-5 ratings were not significantly different between groups with knee pain at follow-up, though knee pain patients had significantly lower EQ-5 ratings than those without at follow-up.</p> <p>Univariate model was used to examine prognostic factors and found: female adolescents not participating in sports with low EQ5D scores, high frequency of pain and long-standing knee pain at baseline were those at highest risk of continued pain at 2-year follow-up.</p>	<p>PFP seems to have a worse prognosis than other types of knee pain. History of frequent knee pain also significantly raises the risk of knee pain at follow-up.</p> <p>The evidence from this study does not support the conclusion that PFP is a self-limiting condition.</p>
<p>Kastelein, M. et al. 2015, The 6-year trajectory of non-traumatic knee symptoms (including patellofemoral pain) in adolescents and young adults in general practice: a study of clinical predictors</p>	<p>Prospective, observational cohort study of 1068 consecutive patients presenting to the general practitioner (GP) with a new episode of knee pain. Initial follow-up period was 1 year, but extended to 6 years due to findings of a high rate of persistent symptoms.</p> <p>Inclusion criteria: patients aged 12-35 years, consulting GP for with a new episode (defined as presenting to GP for the first time or recurrent knee symptoms for which the GP had not been consulted in the past 3 months) of non-traumatic knee pain (further classified as either “unspecified knee symptoms” or “patellofemoral knee symptoms” by GP)</p> <p>Exclusion criteria: Knee symptoms requiring urgent medical attention (fracture, infection, malignancies, neurological disorders etc.) and patients incapable of understanding ramifications of study participation</p> <p>Outcome measures: Self-report questionnaire at baseline, 3,6 and 9 months and 1 and 6 year follow-up collecting demographic data, history of other knee injuries, and information on symptoms, sick leave days, level of physical activity, pain level on numerical rating scale (NRS) At 1 and 6 years, experienced recovery or worsening of symptoms were also rated (measured on 7-point Likert scale).</p> <p>Functional disability and pain assess with Western Ontario and McMaster Universities Osteoarthritis Index</p>	<p>172 patients were included (74 patients with a mean age of 23.7 years for PFP and 98 patients with a mean age of 25.1 years for unspecified knee pain (UKP))</p> <p>Loss to follow-up was sizeable with only 55.1% of UKP patients and 60.8% of PFP patients available at 6 years (compared to 86.7% and 87% at 1 year). No significant differences between baseline characteristics or perceived recovery were found between those initially recruited and those available at 1 and 6 year follow-up</p> <p>There were also no significant differences in perceived recovery at 1 year between the groups available at 1 and 6 years of follow-up. In both knee pain groups, greatest improvements on mean pain, Lysholm knee score and mean WOMAC index occurred in the first 3 months of follow-up.</p> <p>In UKP group: At 1 year follow-up, 41% reported persistent knee symptoms with mean pain severity on NRS 3.6 (SD 2.2), mean Lysholm knee score 71.6 (SD 17.4) and mean WOMAC 16.1 (SD 16.9). At 6 year follow-up, 19% reported persistent knee symptoms, with 40% being the same knee symptoms</p> <p>In PFP group: At 1 year follow-up, 57% reported persistent knee symptoms with mean pain severity on NRS 3.7 (SD 2.3), mean Lysholm</p>	<p>Many patients with non-traumatic knee symptoms (including PFP) continue to experience pain 6 years after diagnosis.</p> <p>The prognosis for PFP seems worse prognosis than for other types of non-traumatic knee pain.</p>

	(WOMAC) at baseline and 1-year follow-up, Knee Injury Osteoarthritis Outcome Score (KOOS) at 6 year follow-up, Knee Society Score (KSS) function questions, Medical Outcomes Study Short Form 36 Health Survey (SF-36), Lysholm Knee Scoring Scale and Tampa Scale for Kinesiophobia (only at baseline).	knee score 75.3 (SD 15.4) and mean WOMAC 16.2 (SD 15.4) At 6 year follow-up, 40% reported persistent knee symptoms, with 78% of these being the same knee symptoms.	
Collins, N.J. et al. 2013, Prognostic factors for patellofemoral pain: a multicenter observational analysis	Data was extracted from two separate RCTs investigating the effectiveness of conservative therapies for PFP, including data from 179 participants from RCT#1 and 131 from RCT#2 (both with 12-month follow-up). Subjects in the RCT#1 received prefabricated foot orthoses, flat shoe inserts, multimodal physiotherapy or foot orthoses with physiotherapy while those in RCT#2 received exercise therapy or "usual care" with both groups receiving education on the condition and advice to avoid aggravating activities. Inclusion criteria: Age of participants varied (RCT#2 required a minimum age of 14 years while RCT#1 required a minimum age of 18 year). Insidious onset of anterior knee or retropatellar pain with a duration longer than 6 weeks aggravated by a minimum of 2 of the following that load the patellofemoral joint (prolonged sitting, kneeling, squatting, running, cycling and stair climbing). Exclusion criteria: other defined knee pathology such as osteoarthritis, patellar tendinopathy, Osgood-Schlatters disease and a history of a physiotherapy intervention in the last year. Outcome measures assessed at 3 and 12 month follow-up: pain severity (on a 100 mm VAS scale), function (assessed by the Anterior Knee Pain Scale and the Functional Index Questionnaire) and global recovery assessed dichotomously (favorable or unfavorable recovery, extracted from two different Likert scales used in the two RCTs)	Participants in RCT#2 were significantly younger than RCT#1 (mean age of 29.3 vs. 24.0 years), participated in significantly more sport (p=0.022) and had a lower BMI (p<0.05). Method of recruitment also differed significantly with more from RCT #2 having been recruited by health professionals (p<0.002). Participants in RCT#2 also had a shorter duration of complaints (p<0.001) and worse symptoms on the Anterior Knee Pain scale. -55% of participants reported unfavorable outcome at 3 month follow-up and 40% reported an unfavorable outcome at 12 months. -Fewer than 40% of the subjects had been randomized to minimal intervention or control arms of the study, suggesting that this condition is not self-limiting (at least not within 12 months of follow-up). -Mean pain severity decreased from 35/100 to 26/100 between 3 and 12 months (60.9/100 at baseline). The largest improvements on pain severity as well as AKP and FIQ appear to occur in the first three months of follow-up, with only modest change observed thereafter. -The following baseline predictor values were found to be associated with unfavorable recovery at 12 months: symptom duration greater than 2 months, baseline AKP scale score <70/100 and pain severity greater than 35/100 (usual pain/at rest) or greater than 60/100 (during worst pain/physical activity).	PFP does not appear to be self-limiting in this population and its prognosis is not favorable in all patients, even with intervention. Largest improvements in symptoms appear to occur in the first 3 months of follow-up. Only a portion of the variance in outcomes could be accounted for with the predictors studied, suggesting that other factors must be involved in determining prognosis.

Table 2: Prospective Studies Examining the Prognosis of Patellofemoral Pain in Populations Which Included Adolescents.

risk of low physical activity levels in this case, as eliminating her bicycle commute to school was not an option for this family.

The most widely accepted theory proposes that patellofemoral pain is caused by patellofemoral maltracking, causing increased stress on the patellofemoral joint, with various causes of patellar tracking issues proposed, generally involving muscular weakness or alignment issues in the lower limb.^{7,15} It seemed that a decrease in activity might actually be indicated in this patient's situation, in order to limit irritation at the patellofemoral joint. As a result, advice was given to temporarily stop participating in physical education classes and where possible, abstain from other

activities which aggravated her pain, while continuing her home exercises.

Conclusion

Treatment of patellofemoral pain in adolescents presents unique challenges and even with good quality treatment, it seems that the risk of chronicity remains great. Ideally, treatment aims to strike a balance between encouraging healthy movement and optimizing participation in sport and other physical activity while avoiding excessive irritation of the knee. Clinicians should be aware of the potential long-term effects of these types of complaints and attempt to tailor their treatment to the patient's individual situation to achieve the best possible outcome.

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Coping with Crying Babies: A Qualitative Study of Mothers' Experience

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ABSTRACT

Introduction: Excessive crying and fussiness in infants is a complaint commonly presented to healthcare professionals such as chiropractors. Clinicians that gain an understanding of this personal experience will be able to take an effective biopsychosocial approach to the treatment and the management of these cases. **Aim:** The aim of the study was to explore the personal experiences of parents coping with infants that cry excessively with a goal to further improve the management of these pediatric cases. **Method:** The study was an explorative study that used a qualitative design. Six mothers who presented to the AECC University College outpatient clinic with their infants, less than 6 months old who cried excessively were interviewed. The chiropractic impression and diagnosis of the cases were similar and there was no other serious diagnosis given alongside the excessive crying in any case. One-to-one semi-structured interviews were conducted with the participating mothers. Tapes of the interviews were transcribed as a dialogue and then thematically analyzed. **Results:** Four main themes emerged. These were: (1) how the lives of the mothers were disrupted by the crying, (2) the emotional fatigue experienced by the mothers, (3) the sense of failure that was present at some point during the experience and (4) the support that the mothers did or did not receive. **Conclusion:** This study was able to gain insight into the lived experience of mothers with crying babies. The results show that the whole experience is very difficult and can be quite distressing for those involved. A biopsychosocial approach to the management would be beneficial to the mothers to give them some needed support.

Keywords: Biopsychosocial model/approach, Colic, Excessive crying, Postnatal depression, Qualitative research.

Introduction

Approximately 21% of parents around the world present their children to health care professionals with excessive crying.¹ It is therefore considered a widespread problem which exerts a serious impact on families' lives. A range of 25-63% of pediatric cases under six months old presenting to the AECC University College out-patient clinic are cases of excessive unexplained crying.^{2,3} The literature shows that this type of behavior may have consequences in the future, not only for the infant involved but also for the family having to cope with the situation.⁴ There are a number of studies that look into the reasons for excessive crying in children and how these can be managed. However, there are very few studies that address the problems involved with coping by the parents.

Background

For this qualitative study on the lived experience of mothers with crying babies, a review of the published literature was conducted on a search of electronic databases relevant to medical and allied health professions. PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and the Cochrane Library were searched. Medical subject heading (MeSH) terms, keywords, natural language terms were combined in the appropriate Boolean combi-

nations in the search strategy. The search terms used were excessive crying, postnatal depression, colic, biopsychosocial model/approach. Primary studies that addressed or described lived experience or coping strategies of families with infants that cried excessively, stress levels and depression of mothers with excessively crying babies, and the effects of childcare in cases of cry babies. All study designs were included with no restriction in terms of publication or date. Only articles published in the English language were included. In all, 100 studies were identified during the electronic search process. These studies sourced were screened by title and abstract for relevance and their content assessed for additional references meeting the inclusion criteria. A total of 21 articles formed the background information of this research.

Effects of excessive crying on the family

Kurth et al. (2009)⁵ conducted a systematic review on the evidence of crying babies and tired mothers. The search for literature in the study by Kurth et al. used PubMed, CINAHL, Cochrane and PsycINFO search engines and included studies published in English, French and German from 1980-2007. Despite the extensive search which generated 100 studies, only ten studies were found to meet the inclusion criteria set by Kurth et al, signifying the lack of

research in this area. The review found that crying is associated with the experience of tiredness and fatigue in new mothers. Exhaustion reduced parents' ability to concentrate, which raised the fear of harming their children and triggered depressive symptoms, resulting in burdening the parent-child interaction. These findings correlate with the findings of Long and Johnson's qualitative study on living and coping with excessive infantile crying.⁶ The outcomes of their study showed that almost every aspect of family life was disrupted by the excessive crying and this resulted in strained relationships, feelings of guilt and concerns about losing control.

There is some evidence to show that excessive crying can affect the attachment process; some parents felt rejected by their child because it was difficult to establish contact with them.⁷ They found that crying was a sign that their baby was suffering and the parents felt an urgent need to find a way to alleviate it. Another study⁸ agreed that parents of children who cry excessively are more likely to provoke greater efforts to deal with the problem.

Much of the research suggested there is an association between excessive crying and the development of depressive states of the parents. No cause and effect conclusions can be drawn from the research designs as it is not known which comes first and it seems that the two phenomena occur mostly simultaneously.⁵ However, there was also some mention of an association between family tension and paroxysmal fussiness of infants which suggests that the development of postnatal depression may further fuel the problem of excessive crying resulting in a negative feedback cycle.⁹ This, along with the prevalence of postnatal depression and the effects it can have on the child, prompts the need to address the crying and depression as early as possible.

One such study was carried out in 2009.¹⁰ Despite some reliance on retrospective data, their study concluded that both infant colic and prolonged crying (classified as crying three hours per day for three days per week at six months old) were associated with high maternal depression scores. More than a third of mothers experiencing prolonged crying were seen to be at risk of depression. The results were shown to be statistically significant and clinically relevant. However, it must be noted that mothers experiencing depression may have overemphasized problems with crying and factors associated with it. These findings are consistent with several other cross-sectional studies.¹¹⁻¹⁴

Not only depression, but anxiety is common in parents of excessively crying babies. One major anxiety found in a qualitative study⁶ was the danger of non-accidental injury to the baby. This was said to further feed the parents' feelings of guilt, stress and desperation. This finding was supported by another study which found an association between

maternal depression, family stress, family breakdown and child abuse.¹⁵ Further, persistent crying can cause the mothers to lack empathy, make hostile comments or maltreat their baby.¹² It follows that emotional unavailability of the child means the parents struggle to understand their child's behavioural cues. This could then affect the care the child receives and may also lead to the occurrence of blunted emotional responses from the parent to the child.

It has also been suggested that postnatal depression impairs the ability of a mother to care for and form a secure attachment with her infant and is an independent risk factor for the child to develop emotional, cognitive and behavioural problems later on in childhood.¹⁶ Attachment is a behavioural pattern established between a child and a parent in the first year of life. It reflects emotional connection and the reciprocal relationship between children and parents and impacts on human development.¹⁶

The Clinical Problem

From a clinical standpoint, it seems important to understand what the parents are facing. Even though chiropractors care for the child in an effort to improve the fussy behaviour, it is also important to address any presenting psychosocial issues with the parents. Future work should include researching the kind of support that would be most beneficial to parents trying to cope. However, in order to provide the correct support, it is imperative that the experience of living with a cry baby is known and understood.

Aim

The aim of this study was to explore and compare the personal experiences of mothers coping with children who cry excessively with a goal to further improve the management of these cases.

Method

The study was a qualitative study involving semi-structured interviews between researcher and parent. Data were analyzed using constant comparison thematic analysis.¹⁷ Interviews took place in treatment rooms of the AECC University College outpatient clinic directly after the first encounter between the child and the chiropractor. A pilot interview highlighted any questions that needed adapting. From this, some of the questions were modified to make it easier for the mothers to understand and answer. In total six interviews were carried out. All mothers were of Caucasian ethnic origin. No pilot data were included in the final analysis.

Ethics

The project proposal was approved by an AECC-BU University Ethics panel before the study commenced. The information sheet explained the risks and benefits of taking part in the study. Mothers were given the opportunity

to ask any questions before being asked to sign a consent form. They were assured complete confidentiality and anonymity. Subjects were assigned a number and recordings were deleted once they had been transcribed. It was emphasized that the mother could withdraw at any time and could refuse to answer any question.

Participants

Mothers who presented their babies to the AECC University College outpatient clinic were asked if they would like to take part in the study if they met the criteria, see Table 1.

Inclusion Criteria	Mother considered child to cry excessively Similar diagnosis by attending clinician Child <6 months old Mother of child
Exclusion Criteria	Any mother of child with serious disorders alongside excessive crying

Table 1. Inclusion/Exclusion criteria.

Interviews

Each interview began with an introduction to the interviewer and the study. The mother was presented with an information sheet and was then given the opportunity to ask any questions. It was assured that all information gathered would be completely confidential and anonymous. If the mother agreed to take part in the study, she signed the consent form and the interview commenced. The interviews were one to one and semi-structured lasting approximately 15-20 minutes. All interviews started with a general question asking them to describe their child's behaviour followed by the broad, open ended main questions. These questions were the basis for more specific questions that would be used if the mother seemed to need guidance. If the mother provided information that could be interesting for the purpose of the project which had not been suggested by the researcher, spontaneous in-depth questions were used. After the mother had answered, respondent validation¹⁷ was used to ensure that the researcher had interpreted the answer correctly. At the end of the interview the mother was asked if there was anything else that she would like to add that had not already been covered.

Data Analysis

To find themes in this qualitative study, each interview was analyzed individually, picking out substantive statements and forming categories until no new categories could be identified. A numerical reference was given to each substantive statement found in the transcript which corresponded to the category it related to. Against each core category a short definition was made. Every substantive statement

found in each transcript was checked against the existing core categories. If the statement fitted under any of the existing categories it was referenced accordingly; if it did not, it was regarded as a new category and was given a new numerical reference. The list of core categories was sorted into sub-categories by similarity of topic, resulting in the emergent overall themes.

Results

The results were split into four main themes which were the main emphasis from the mothers in the interview: disrupted lives, emotional fatigue, sense of failure and support.

Disrupted Lives

This theme was interspersed through each of the interviews. All the interviewed mothers described how the excessive crying of their children had disrupted their lives in every aspect. They talked of their child's crying habits, describing how long they would cry: most mothers (mothers 1, 4, 5, 6) described it as constant whereas others described cycles of alternating crying and contentment. Where mothers talked about constant crying, they said nothing would work to abate the crying and the child was inconsolable (mothers 1, 4, 5, 6). One mother saw it as a long-term problem and could only take so much (mother 5). However, other mothers seemed to be fairly realistic about their child's crying; there was a sense of acceptance (mothers 1, 2, 3, 4, 6) "it's not his fault, he is just a baby, he doesn't know" (mother 2), "you know it is just one of those things that he cries" (mother 1). Some mothers also stated how they tried to keep some normality in their lives and would try as often as possible to take time for themselves and relax (mothers 1, 4). Night time crying was common, and the lack of sleep seemed to fuel negative emotions (mothers 1, 2, 3).

All previously normal activities of daily living for the mothers were affected by the crying. Although there was some acknowledgement that this was to be expected after the birth of a baby, the excessive crying accentuated this disruption (mothers 1, 2). Even getting dressed in the morning became a burdensome task for one (mother 4).

Socially the mothers suffered because they felt like they were "tied to the house" (mother 4). They felt like they couldn't go out for fear of the baby screaming, which some stated they found very embarrassing and "would rather struggle on my own" with it (mother 5). One mother described how she would get very tense if other people, such as family were around (mother 2). Every mother stated how this made them feel very lonely.

All of the mothers interviewed were married and had husbands living at home, except for one who was a single parent (mother 2). The five mothers all expressed that there was now an added strain on the relationship with their

husband, which they found upsetting. However, they were also quite realistic about this situation and at the same time said that their partners were a great help and support for them (mothers 1, 4, 6).

Emotional Fatigue

This theme emerged when the mothers were asked to describe how the crying made them feel. Every mother described a feeling of sadness and emotional upset at the excessive crying, saying it was stressful as well as disappointing because it is supposed to be a happy time. There were also feelings of anger and frustration toward themselves and their child which added to feelings of guilt and sadness.

The general lack of sleep and constant struggle throughout the day caused all mothers to be fatigued. This also increased any negative emotions the mother was feeling; “the smallest thing would suddenly become the end of the world” (mother 5). One mother said that she knew she wasn’t looking after herself properly and this may have affected the care of her child (mother 2). Every mother said that the need for a break was all important because they couldn’t keep going otherwise.

One mother confided that she was suffering with “baby blues” which was aggravated by her child’s excessive crying (mother 3). Another mother said that she had to have counselling following the progressively worsening crying habits of her child because she felt so “down” (mother 5). There were constant feelings of worry for the child in all cases, with their health being of upmost importance. Being unsure of the reason for the crying led to catastrophizing in most cases and numerous trips to the doctor. There was a common want or an aim for the baby to become “normal” and in some mothers, a tendency for comparison with other children (mothers 1, 3, 6).

Sense of Failure

Every mother had feelings of guilt and a sense of failure at some point, although most, if not all, had moved on from these views, “we are in a different place now” (mother 5). It was a key issue driving mother’s emotions and affecting behaviours and relationships; it therefore was apparent when answering each of the questions.

The aim to be a good mother, make their child feel better and protect them was a driving factor in the constant search for answers and solutions to the problem in every case. Every mother in their interviews stated that they had “tried everything” and were willing to “try anything” to help their child. In failing to stop the crying there were feelings of helplessness, blame and failure (mothers 1, 2, 3, 4, 5). They knew the crying was not normal (mothers 1, 3, 4, 5) and in not being able to stop it, many concluded that it was

their fault; this led to the production of negative thoughts which reinforced the sense of failure. A few mothers wondered if they were good enough parents and were not sure if they could do it anymore, comparison with other children reinforced this. In one very emotive interview, one mother admitted that at one point she said to her husband “I don’t think I can do this anymore, I think you should take her away, give her to someone else, I just couldn’t do it” (mother 5).

Support

All mothers emphasised their need for support in order to be able to cope in the situation. This support was sought in many places: partners, family, medical doctors, health visitors and chiropractors.

The husbands of the five mothers who were married, and the family of the single parent were the main source of support for each. This support involved encouragement but mainly the chance for a break. When the husband came home from work it was a chance for the mother to have some hands-free time and time to do things she needed, for example cooking dinner. All the mothers recognized the support provided by their husbands and were very grateful for it. However, the strain put on the relationship sometimes made this difficult.

All mothers had visited the doctor regarding their child’s crying, looking for answers as to why their baby cried so much. One mother mentioned the lack of support she got from the medical system and felt that she was treated like a “paranoid parent” (mother 4).

Most mothers felt that the health visitor was a very good source of support for the mothers and were able to offer reassurance to the mother. However, one mother talked about getting a different kind of support from them. She stated that the health visitor helped her more with “teaching him the difference between night and day and how to try and soothe him” (mother 2) which was very useful to the mothers but it still wasn’t offering them a solution to the persistent problem that is excessive crying.

In most cases the mothers came to the chiropractor with fairly low expectations and a “give it a go” attitude (mothers 1, 5, 6). Sometimes there was hope that this may help from referrals and recommendations (mothers 2, 3). However, having already tried a number of health care options, there seemed to be a sense of not wanting to get hopes up. One mother was unaware of the possible help the chiropractor could offer her child’s crying and first presented for other reasons (mother 6).

Mothers presenting to the chiropractor seemed to be looking for similar things, namely, confirmation that there was

a problem and willingness from a healthcare professional to try to improve their child's behaviour. These were things they did not get elsewhere in their support system, especially improvement. Some mothers described their visit as "another avenue to explore" (mothers 1, 4, 5) having exhausted all others. However, some mothers had come straight to the chiropractor either from referral or recommendation from a friend or family member (mothers 2, 3). All mothers appreciated the treatment times available for them, the understanding shown to them and the chiropractor's experience in the area, and finding out that there were other mothers in the same situation. They stated that this was a good level of support as there was something being done; this was described by all the mothers as the best kind of support.

Discussion

The goal of this study was to understand the lived experience of mothers of excessively crying babies. The four main themes that emerged from this study give an idea of the important factors that affect the lives of mothers coping with children that cry excessively. Although each theme appears in each interview, the emphasis given to the themes varied between mothers. For example, the theme emphasised most by subject 4 was "support", whereas the theme emphasised most by subject 5 was "sense of failure." This shows the importance of treating each case individually. The themes in the transcript seemed to weave in and out of each other and the main couple of themes were interspersed throughout. This is a sign that there is interconnection between all themes which are to be expected due to the intimate content of the subject matter.

The themes "disrupted lives," "emotional fatigue," "sense of failure" and "support" found in this study have all been seen before in previous research.^{6,7} Other studies were done from a nursing perspective and although all the above themes were found, they also found other themes including search for a diagnosis, coping strategies and gaining trust in professional relationships. These results seem to suggest that the problem of excessive crying is still present when the interview is taking place, and therefore the main aim to find a treatment to reduce the crying is emphasized.

In this present study, the attitude of the mothers seems more positive, perhaps because they have had an interaction with a professional who has found a treatable problem and they may feel they have found a potentially successful treatment and therefore the emphasis is different.

The themes of emotional fatigue and sense of failure have features within them that confirm the previous research, suggesting that excessive crying can be related to postnatal depression.^{15,16}

Depression in the parent would be recognized in a bio-

psychosocial approach to treatment, which is a key part of medical education and should be used in every healthcare profession. However, it seems that use of the biopsychosocial model may not always occur.⁶ Long and Johnson found that mothers felt let down by the medical system and did not receive the emotional support they felt they needed.⁶ There is research to show that this approach would be beneficial in cases of excessive crying.^{6,7,12} The results of the current study confirmed this by showing that mothers appreciated the time spent with them and positive approach in the chiropractic office. Another qualitative study of new mothers attending a chiropractic clinic found that mothers want more than a "there, there, everything is OK" type of reassurance.¹⁸ They want real, competent, specific, contextualized help; only then do they feel reassured.¹⁸

Of course, with regard to physician-patient relationship and communication in excessive crying cases, the main communication occurs between the physician and the parent. Therefore, the biopsychosocial approach is directed toward the parent. The literature shows that excessive crying may have consequences in the future, not only for the infant involved but also for the family having to cope with the situation.¹⁹ Therefore it is essential for the physician involved to not only treat the child medically but also to direct some of the care (or caring) toward the mother.

It has previously been found that attempts to establish a diagnosis and find a cure becomes all important for parents with excessively crying babies.⁶ Such failed attempts lead to a cycle of hope and disappointment for the parent and continued "doctor shopping." A similar pattern is seen in parents with children who have chronic illness.^{20,21} These conditions can lead to the development of a chronic condition for the parents involved, possibly in the form of depression. Depression can be identified with the use of yellow flags; these can greatly impact the recovery, progression and recuperation from disease.²²

Although reassurance was important, this could be gained from other sources such as the health visitor. However, it seems that confirmation, understanding and a willingness to try other options was all-important to every mother interviewed. Each mother stated that the best support they could get was an improvement in their child's well being and behaviour (which was apparent in most cases). This was confirmed in a study²³ that found that health visitors involved in excessive crying cases were more concerned about the emotional reactions of the parents and their level of tiredness in the situation. Although the parents involved also expressed feelings of uncertainty and anxiety and so on, these were subordinate to their worries about the child's well-being. Studies have found that considering the parent's point of view is key to addressing the issues appropriately.^{24,25} Despite years of research, there is still no medical

answer to the disturbance that crying babies cause to parents and even their families.²⁶

Limitations

The quality of the data collection and quality of the analysis was dependent on the skills of a fourth-year clinical student in a research project of the AECC University College with no past experience of interviewing technique or qualitative analysis. Although the study was carried out to the best of her ability, it is necessary to take into consideration when interpreting the results and the conclusions made in this study. However, students have full access to faculty supervisors.

Only six mothers were interviewed for this study. Although qualitative studies are notably small in sample size, the generalizability of the results to the larger population may be reduced. Another factor contributing to the reduced generalizability of the results is the lack of randomization of participants which is not a feature of qualitative research.

Further, there is a possibility that the responses given by the mothers were reserved because they were worried about

how the interviewer may perceive them and therefore their answers may be more consistent with social standards so as not to present themselves negatively. The attempt to avoid this was made by ensuring complete anonymity and expressing understanding at the difficulty of coping with such a personal and disruptive experience.

The main strength of this study was the qualitative structure, which allowed mothers to elaborate on personal views of their experiences and emphasise what was most important to them. A quantitative structure might have obscured the complexities of the mother's behaviour and emotions.

Conclusion

In this qualitative study of mothers with excessively crying babies, mothers emphasized a sense of a disrupted life, emotional fatigue, a real sense of personal failure and the need for and appreciation of support. Using a biopsychosocial approach and taking advantage of empathic listening, the chiropractor is in an ideal position to spot negative behaviours and make any necessary referrals in these cases, preventing negative long-term effects on the family, as well as having the ability to treat the baby for an effective outcome.

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What is the evidence that chiropractic care helps sub-optimal breastfeeding?

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Introduction

Breastfeeding is regarded as the optimal method of neonatal and infant nutrition.¹ The long and short term benefits to the mother-infant dyad are well documented; for the mother, breastfeeding has been attributed to a reduction in breast and ovarian cancer and diabetes.² The benefits of early initiation of breastfeeding for the neonate is a significant increase in his/her immune response, providing protection against infection and reducing infant mortality.¹

Exclusive breastfeeding for the first six months has been associated with lower rates of gastroenteritis, respiratory tract infections, otitis media, eczema and asthma in infants.³ Long term, children who are breastfed are less likely to be obese, perform better on intelligence tests at school, and progress to obtain higher income in adult life.² A report commissioned by UNICEF UK in 2012 concluded that for just five illnesses, a moderate increase in breastfeeding would save the NHS £40 million, and tens of thousands GP appointments and hospital admissions.³

Despite growing evidence that breastfeeding improves the health and survival of women and children, and contributes to human capital development,² every country in the world fails to meet recommended breastfeeding standards.¹

Therefore, identification and resolution of factors that contribute to sub-optimal feeding is vital in order to improve breastfeeding continuation. The majority of interventions focus attention on the mother. However chiropractors who see pediatric patients have long purported their role in addressing the biomechanical dysfunctions in the infant which may contribute to sub-optimal breastfeeding (SIB).⁴

Chiropractors are frequently asked about the evidence base for manual intervention for this problem. Therefore, it was important to review the relevant clinical research for this type of care. It was also considered that it was necessary to investigate what types of studies have been done in order to determine whether it would be appropriate or not to design a randomized controlled trial. Other authors have investigated the wider research stemming from all types of manual therapy.⁴ Their research question was, "Have manual interventions been used to correct infants' musculoskeletal dysfunctions thought to be linked to suboptimal breastfeed-

ing?" As such, theirs was a scoping review that included all types of manual therapies. The purpose of this current review was to be specific to the investigation of chiropractic clinical care for this condition. It was considered that other types of therapy, particularly osteopathy, may supply care, though often under quite different circumstances.

Specifically, osteopathy is a medical profession and as such, often has much earlier exposure to the patient, often in the hospital. Therefore, they also have access to every type of medical procedure and equipment, so there is no fear of harm, as any procedure is easily remedied in that environment. Almost all of chiropractic care is provided in outpatient settings. The purpose of this review was to find and evaluate the types of clinical studies that have been done in the arena of chiropractic care for suboptimal infant breastfeeding, in order to determine whether a RCT was an appropriate next step. There was no attempt to do a Systematic Review or a Meta-analysis.

Background

The WHO recommends breastfeeding initiation within an hour of birth, exclusively for the first six months and continued alongside appropriate foods up to two years of age and beyond, to achieve optimal health, growth and development.⁵

Often however, despite optimal hospital support, breastfeeding fails due to the infant's inability to feed. Biomechanical causation, as a result of structural restrictions or birth trauma, can contribute significantly to suboptimal feeding and in these cases, a referral to a musculoskeletal specialist, such as a chiropractor, for structural treatment may be beneficial.⁷

A number of studies have attempted to identify the factors contributing to suboptimal feeding and determine the most effective package of interventions to influence breastfeeding duration. The purpose of this study was to investigate the available literature on the accessible services of chiropractic care, alone or as part of multidisciplinary care in their support and resolution of nursing difficulties, and the impact on breastfeeding continuation in the mother-infant dyad. The goal was to determine whether there was sufficient background evidence to ground a higher level randomized trial.

Method

A search of electronic databases relevant to medical and allied health professions, was conducted to review published literature on suboptimal breastfeeding in infants. PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Index to Chiropractic Literature (ICL) and the Cochrane Library were searched. Medical subject heading (MeSH) terms, keywords, natural language terms were combined together in the appropriate Boolean combinations in the search strategy. Spelling variants were also used as it was found that by hyphenating the confound verb “breastfeeding” to “breast-feeding”, or separating it into two individual words (“breast feeding”), very different results were generated. The strategy included terms referring to the population studied, the intervention analysed by the study and the control intervention (Table 1).

Population	Dysfunctional (keyword), suboptimal (keyword), difficulties (keyword) breast feeding [MeSH] infant [MeSH]
Intervention	Chiropractic [MeSH], spinal manipulative therapy, manipulation, adjustment
Control Intervention	Midwifery [MeSH], multidisciplinary (keyword) interdisciplinary (keyword)
Outcome	Improved breastfeeding, exclusive breastfeeding, extended breastfeeding

Table 1. MeSH terms & Keywords.

Selection Criteria Employed

Primary studies that addressed or described chiropractic or chiropractic/multidisciplinary care of breastfed, infant, human participants were included. All study designs were included with no restriction in terms of publication or date. Only articles published in the English language were included.

Results

104 studies were identified during the electronic search process. A further three papers were received by personal communication with study authors. Of the 107 studies sourced, 26 duplicate records were removed and the remainder screened by title and abstract for relevance. Twelve studies were retrieved as full text articles and their content assessed for additional references meeting the inclusion criteria. A total of ten records that included chiropractic care were appraised to determine their methodological quality using appraisal checklists relevant to the study design (see Table 2 on pages 1546-1547 for individual study results and level of critical appraisal).

Ten records were reviewed, all demonstrating a low to moderate level of evidence with nine being case series or

case reports.^{4,8-16} In all, a total of 541 newborns, mothers reported improved breastfeeding after chiropractic care.⁸⁻¹⁶ As well, there was some evidence that collaboration between chiropractors and midwifery teams¹⁰ resulted in improved and even sustained breastfeeding.

All of these individual papers were included in Hawk et al’s scoping review⁴ who found that there is moderate positive evidence for the use of manual therapy for suboptimal breastfeeding.

Discussion

The aim of this review was to investigate the impact of chiropractic care on the continuation of breastfeeding in the mother-infant dyad to determine whether there was sufficient evidence to under-pin a randomized trial. Evidence of benefit for chiropractic care for the breastfeeding dyad exists only at low-to-moderate-level. This is at least partly because it must be considered unethical to include infants with suboptimal breastfeeding into a high level randomized controlled trial where some children would be allocated to a non-treatment group. If there is any evidence of assistance, infants should be allowed to be treated because the benefits of breastfeeding are so key to long-term health.

Still, randomized trials must be done because there is a distinct lack of high-level evidence available on the effects of chiropractic intervention on suboptimal breastfeeding. That which exists comes mostly from cohort studies and case series featuring few participants, relying heavily on clinical experience and anecdotal evidence. Despite the trend towards resolution of breastfeeding difficulties, with all cases reporting an improvement in the infant’s nursing habits, most papers have too much bias to add significantly to the evidence base. Only because of the larger number of cases and the prospective management, one cohort study suggested significant clinical benefit of chiropractic care as a sole disciplinary intervention to resolving breastfeeding difficulties.⁸ That cohort study reviewed 114 medically-referred cases of infants who had received chiropractic treatment for infant biomechanical dysfunctions relating to suboptimal feeding. Their study reported improvement noting 78% being able to exclusively breastfeed after 2-5 treatments. While the results appear impressive, without a control group, the study is only able to suggest potential links with chiropractic care in the resolution of breastfeeding dysfunction but unable to provide strong evidence. This type of study cannot determine cause and effect due to the lack of a control group and strongly biased results based on reports of maternal perceptions.

A study with equally impressive results (80% recovery rate) by Vallone⁹ included a group of ten infants without breastfeeding difficulties, indicating early efforts to provide comparison groups.

Citation: Author, Year, Title, Journal	Type of Design / Population	Results	Comments / Appraisal
Chiropractic Care for Infants with Dysfunctional Nursing Hewitt E G - 1999 <i>Journal of Clinical Chiropractic Pediatrics</i>	Case series 8-week old female & 4-week old male	Female - Normal feeding following 2 adjustments over 14 days Male - Immediate suckling after first adjustment. Received 4 adjustments in 21 days	Case series so convenience sample therefore no explicit inclusion or exclusion criteria; Both participants were examined and findings reported but it's unclear whether valid, identical methods were used; clear reporting of participants clinical information, outcomes and follow up results but number too small for statistical analysis. Total = 2/10 (JBI)
Chiropractic Evaluation & Treatment of Musculoskeletal Dysfunction in Infants Demonstrating Difficulty Breastfeeding Vallone S - 2004 <i>Journal of Clinical Chiropractic Pediatrics</i>	Case Study 25 infants with suboptimal breastfeeding / 10 infants without breastfeeding complaints	80% of infants with breastfeeding difficulties resulted in improved nursing following soft tissue therapies and chiropractic adjustment	Study addressed a focused question and the design appropriate; subjects and setting are representative to the population to which the findings would be referred; researcher's perspective clearly outlined. Unable to deduce whether quality control methods were used to analyse data or whether analysis was repeated by more than one researcher therefore unable confirm results are credible, relevant for practice and transferable to other settings. Total = 5/10 (CEBM)
Chiropractic Management of an Infant Experiencing Breastfeeding Difficulties and Colic Sheader W E - 1999 <i>Journal of Clinical Chiropractic Pediatrics</i>	Case Study 15-day old male	Immediate improvement following first adjust with complete resolution within 5 days	Study addressed a focused question and the design appropriate; subjects and setting were representative to the population to which the findings will be referred. However researcher's perspective was not described; unable to ascertain whether quality control methods were used to analyse the data. Further, analysis would not have been repeated by more than one researcher as the study was carried out by the clinician, therefore results unlikely to be credible and may not be relevant for practice, or transferable to other settings. Total = 4/10 (CEBM)
Chiropractic Management of Breastfeeding Difficulties Holleman A C - 2011 <i>Journal of Chiropractic Medicine</i>	Case Report 8-day old female	Immediate improvement and complete resolution of nursing problems following 3 treatments over 14 days	Patients' demographic characteristics not described however patients' history clearly detailed and presented as a timeline. Patient's clinical condition on presentation clearly described as were the assessment results, intervention procedures and post-intervention clinical condition. No adverse or unanticipated events were described although the limitations of the study was clearly stated. Total = 6/8 (JBI)
Parent Reports of Exclusive Breastfeeding After Attending a Combined Midwifery and Chiropractic Feeding Clinic in the United Kingdom: A Cross Sectional Service Evaluation Miller J E - 2016 <i>Journal of Evidence-Based Complementary & Alternative Medicine</i>	Cross-Sectional Service Evaluation / Study 85 mother-infant dyads	67 mothers reported improvement as well as satisfaction. Also an increase of 60% in infants exclusively breastfed	Study addressed a clearly focused issue and the study design appropriate; method of selection of the feeding clinic involved is clearly described. The sample was a continued convenience which could introduce bias but was representative of the population to which the findings will be transferred; the response rate achieved (85%) was satisfactory, the statistical significance assessed and confidence intervals given for the main results; confounding factors were accounted for; the results could be applied to another setting. Total = 9.5/12 (CEBM)
Contribution of Chiropractic Therapy to Resolve Suboptimal Breastfeeding: A Case Series of 114 Infants Miller J E - 2009 <i>Journal of Manipulative and Physiological Therapies</i>	Case Series 114 infants	All infants showed improvement with 78% being able to exclusively breastfeed following 2-5 treatments over a 2-week period	A clear criteria for inclusion was given; the condition was measured and identified in a standard, valid way for all participants. The case series had consecutive and complete inclusion of participants; clear reporting of clinical information and outcomes; statistical analysis was appropriate. However the demographic of the clinic and participants were not reported. Total = 8/10 (JBI)
Paediatric Chiropractic and Infant Breastfeeding Difficulties: A Pilot Case Series Involving 19 Cases Stewart A - 2012 <i>Chiropractic Journal of Australia</i>	Case Series 19 infants	100% reported improved attachment; 94% reported reduced extension / arching; 88% reported decreased side shaking; 84% reported reduction in overall feeding stress; 77% reported decreased feeding pain & 64% reported a reduction in side preference	No clear criteria for inclusion; unclear whether the condition was measured in a standard, reliable way or if methods used for identification of the condition were valid. Unclear whether inclusion was consecutive; no reporting of participants' or clinic's demographics. Participants' clinical information unclear. Follow up results were detailed however method section too limited in detail for complete analysis. Statistical analysis was not appropriate due to small sample size. Total = 2/10 (JBI)

<p>The Restoration of Optimal Breastfeeding after Chiropractic Care in a Neonate with Breastfeeding Difficulties: A Case Report</p> <p>Willis S A - 2011</p> <p><i>Journal of Clinical Chiropractic Pediatrics</i></p>	<p>Case Report</p> <p>4-week old female</p>	<p>Immediate improvement and resolution after one adjustment</p>	<p>Patient's demographic characteristics were not described, however patient's history was detailed and presented as a timeline; the current clinical condition of the patient on presentation, diagnostic assessment methods and treatment procedures were clearly described, as was the post-intervention clinical condition (although detail limited). Adverse or unanticipated events were not identified however the case report did provide takeaway lessons. Total = 5/8 (JBI)</p>
<p>The Chiropractic Care of a 6-day old Neonate with Breast Feeding Difficulties and Breastfeeding Jaundice</p> <p>Bernard M - 2012</p> <p><i>Chiropractic Journal of Australia</i></p>	<p>Case Report</p> <p>6-day old male</p>	<p>Immediate improvement following first treatment</p>	<p>Patient's demographic characteristics were not described, however patient's history was detailed and presented as a timeline; the current clinical condition of the patient on presentation, diagnostic assessment methods, treatment procedures and post-intervention clinical condition were described in great detail, as were adverse and unanticipated events. Report also gave take away lessons. Total = 7/8 (JBI)</p>
<p>Manual interventions for musculoskeletal factors in infants with suboptimal breastfeeding: a scoping review</p> <p>Hawk et al. 2018</p> <p><i>Journal of Evidence Based Integrative Medicine</i></p>	<p>Scoping review of all manual interventions for sub-optimal infant breastfeeding</p>	<p>Search yielded 461 articles with 27 included. Their result was moderate positive evidence for the effect of manual therapy on suboptimal breastfeeding.</p>	<p>One high quality RCT, 1 low quality cohort, 1 pilot study, 2 cross-sectional surveys, 5 narrative reviews, 10 case series or reports and 7 expert commentaries were reviewed. Their conclusion was that infants who received manual therapy improved without any adverse events. No single checklist could be used; the authors appraised each article individually.</p>

Table 2: . Evidence of chiropractic care for sub-optimal breastfeeding.

Critical appraisal checklists used: Case Series - Joanna Briggs Institute; Case Study - Centre for Evidence-based Medicine; Case Reports - Joanna Briggs Institute; Cross Sectional Survey - Centre for Evidence-based Medicine; Qualitative Study - Critical Appraisal Skills Programme; Randomised Controlled Trial - Critical Appraisal Skills Programme

Likewise, only moderate-level evidence was available to support a combined midwifery and chiropractic intervention. Miller et al in 2016¹⁰ showed significant improvement in sustained breastfeeding to six months with an interdisciplinary intervention. This is biologically plausible as literature has shown that a traumatic birthing process often results in some form of physical dysfunction in infants, causing imbalance to the spine and muscles of mastication.¹⁷ It is thought that even a 'normal' birth causes trauma to the infant due to the complicated assortment of compression, contraction, torque and traction during the process.¹⁸

Correction of the bio-mechanical disturbance in the infant and provision of one-to-one personal support to assist with maternal concerns, such as positioning, resulted in 93% of mothers reporting an improvement in feeding, with 60% exclusively breastfeeding after intervention.¹⁰

However, it could be argued that considerable bias is present in that research and all studies in this review where mothers have sought assistance with breastfeeding difficulties. Intention to breastfeed for a prolonged period has been recognized in literature as a predictor of exclusive and extended breastfeeding.¹⁹ These mothers are considered to be a highly motivated population and, therefore, not indicative of the general, wider populace.

While observational studies are useful in assessing treat-

ment outcomes where it may be impractical or unethical to carry out an RCT (for example the provision or withholding of breastfeeding interventions), they cannot provide evidence of actual effectiveness of the treatment, but only anecdotal evidence.

That said, this is a common professional and maternal choice for patients with this condition and because the therapy is safe,²⁰ a trial of treatment is appropriate. Because there is evidence of safety of chiropractic care for the infant, and there is some baseline evidence for benefit to the breastfeeding dyad, there is sufficient support to study the problem with a randomized comparison trial.

Limitations

Only studies in the English language were considered for selection, which may have limited the number of studies assessed.

This review may have failed to consider all confounding variables. Literature identifies there are many predictors of breastfeeding.²¹ Equally, there is a wide range of non-modifiable factors that can lead to early cessation of breastfeeding, which cannot be controlled or altered clinically. These variables will undoubtedly impact on results, irrespective of the quality of evidence.

Conclusion

Both chiropractic care alone and in a multi-disciplinary set-

ting appear to help sub-optimal breastfeeding but are supported by the lowest levels of scientific evidence and, as such, no statistical significance can be drawn from the positive results reported. Higher quality studies are required to fully determine the cause and effect of such interventions

on sub-optimal breastfeeding. However, it must be stated, that since these interventions are safe for the infant and mother, a therapeutic trial is appropriate for these difficult cases. These studies can form a basis upon which to develop a randomized comparison trial.

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Treating infants for suboptimal breastfeeding, is there a difference between chiropractic care versus multidisciplinary care: A pragmatic randomized comparison trial protocol

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ABSTRACT

Background: Suboptimal breastfeeding is a problematic concern of mothers of newborns in all societies, with huge economic and sociological ramifications. All professionals support breastfeeding, but some professions have set up special clinics to assist these families. Both chiropractors individually providing care and chiropractors within multi-disciplinary clinics have shown some benefit. Since many resources are involved, we propose a randomized clinical comparison trial that may be able to determine whether there are superior benefits to one approach or the other. **Methods:** Randomize mothers and babies who consent to participate to two different treatment arms: (1) chiropractic manual therapy along with advice and (2) chiropractic manual therapy along with midwifery care and routine advice. Maternal report will provide the outcomes at the infant's ages of 6, 12 and 24 weeks. **Discussion:** The purpose of this trial is to investigate the actual difference in effectiveness of chiropractic care alone versus a multi-disciplinary approach. As such, the results should be helpful to determine what resources should be reserved for this population. The purpose of the proposed publication is to receive recommendations from other professionals to strengthen the protocol.

Introduction

The WHO recommends breastfeeding initiation within an hour of birth, exclusively for the first six months and continued alongside appropriate foods up to two years of age and beyond, to achieve optimal health, growth and development.¹ The importance of breastfeeding is undeniable. Only 37% of infants under six months of age are exclusively breastfed.² This is despite the evidence that the meta-analysis performed by Victora et al (2017)² showed increased intelligence along with protection against infections, overweight, diabetes and malocclusions for the breastfed child. If everyone breastfed (who can or can learn), 823,000 annual deaths of children under five years of age could be prevented as well as 20,000 annual deaths in the mothers from breast cancer.²

Breastfeeding education and support, through healthcare professionals and peer counsellors, are thought to be critical in increasing breastfeeding rates and promoting positive outcomes. However, while prenatal education has been shown in one study to improve initiation rates,³ postnatal education was found to have no effect on duration according to a recently updated Cochrane review.⁴ Conversely, breastfeeding support provided by professional or lay/peer supporters, particularly on a face-to-face basis, appears to address some of the issues causing suboptimal feeding thus increasing breastfeeding exclusivity and duration.⁵

Often however, despite support, breastfeeding fails due to the infant's inability to feed. Biomechanical causation, as a result of structural restrictions or birth trauma, can contribute significantly to suboptimal breastfeeding and in these cases, a referral to a musculoskeletal specialist, such as a chiropractor, for structural treatment may be beneficial.⁶

A number of studies have attempted to identify the factors contributing to suboptimal feeding and determine the most effective package of interventions to influence breastfeeding duration.

Background

Difficulty in breastfeeding is a common problem in the newborn population and families seek care both in-hospital and upon release. It afflicts a large percentage of families. To help meet this need on the south coast of England in the UK, a chiropractic teaching University College clinic accepted large numbers of these cases. When the midwifery department of a local University offered to join the program, a multi-disciplinary clinic to manage these cases was also implemented. Both clinics showed positive outcomes collected using the mother's report.^{7,8} Despite the fact that these low-level scientific studies have suggested both multidisciplinary care and chiropractic care of infants may improve breastfeeding outcomes, no clear way forward can be drawn from these reports. A scoping review has found

some evidence for manual interventions for musculoskeletal factors in suboptimal breastfeeding.⁹

Aim and Purpose

The aim of this study is to determine whether there is an advantage to either chiropractic care or multidisciplinary care as an intervention for suboptimal infant breastfeeding (SIB) to improve outcomes and, consequently, the impact on exclusive and enhanced duration of breastfeeding.

The objective is to investigate the following primary research question: “In infants with suboptimal breastfeeding, is there a difference in short- and long-term outcomes, whether they are treated exclusively with chiropractic care versus a multidisciplinary approach of both midwifery and chiropractic care?”

Research Question(s)

The research questions are:

1. Is there a difference in short-term outcomes (in infants aged 6 and 12 weeks) in SIB depending on the type of treatment?
2. Is there a difference in long-term outcomes (in infants aged 24 weeks) in SIB depending on the type of treatment?
3. What is the parental rating of the success of breastfeeding upon initial presentation versus after intervention?
4. Is there a difference in the parental rating of the success of breastfeeding relative to the type of treatment?

Methodology

Study Design: Double blinded randomized comparison trial (with a wait-list control group)

In order to best test the primary research question, the study proposed is a randomized comparison trial with two intervention groups. This particular study design is chosen over a randomized controlled trial to overcome the potentially unethical scenario of a control group of infants experiencing breastfeeding difficulties receiving no care for their complaints. The two types of interventions can be considered ethical because there is a modest amount of evidence to suggest that both approaches have some benefit, but no research that shows that one or the other is more efficacious. As the problem is so vast and egregious, there could be considerable long-term benefits (and huge time and cost savings) if one method or the other were found to be more effective.

Sampling, Recruitment and Selection of Participants

Subjects will be recruited from routine intake at the AECC University College Clinic, located on the south coast of England.

Inclusion criteria:

Babies:

- Full term
- Healthy
- Between day 0 and 8 weeks of age
- Any type of birth
- Singleton or twin
- Has been seen by routine medical care (Hospital care, Pediatrician, Midwife, GP and/or Lactation Consultant or health care professional who routinely works with breastfeeding problems) who confirmed a breastfeeding problem.
- Inability to breastfeed fully, effectively and efficiently by mother’s report and corroborated by health care professional

Mothers:

- 18 years of age or older
- English speaking and able to complete survey instruments

Exclusion Criteria:

Babies:

- Premature
- Any sign of illness or known genetic condition
- Admission to NICU for longer than 48 hours

It would be preferable to select only primiparous mothers for this study, as this population is unable to bring to bear any previous breastfeeding experience and therefore cannot “add” to the intervention and bias results. However, current data from the AECC feeding clinic shows that multiparous mothers also encounter difficulty breastfeeding; therefore, these mothers should also be involved in the trial. Their inclusion also enhances the trial size and analysis at the end of the study, along with the pragmatic nature of the study. Thus, this will determine whether there was any statistical difference between the sub-grouping primipara and multipara populations, which will be helpful for future studies.

Upon initial contact with the clinic, mothers will be provided with a validated intake form and information of a trial involving free routine care (although there may be a short wait involved). The inclusion of a waiting list is not an additional treatment arm, but a measure that organically emerges out of necessity. Due to the sheer volume of mothers-infant dyads routinely treated at the AECC clinics, there can be up to a two-week waiting list in order to attend. The use of the waiting list as a control group allows for additional observation and provides the added benefit of determining whether care is indeed effective, or whether it is the act of “doing something” to address the problem. All efforts will be made to see every baby as soon as possible, however.

Mothers consenting to participate will be block randomized at the front reception and entered into either chiropractic care or combined midwifery/chiropractic. Mothers who de-

cline entering the trial will receive routine care as normal. The only difference is that the mothers who decline to enter the trial will incur the expense of treatment. Mothers who drop out of the trial will be followed up and included in their own group (intention to treat analysis).

Prior to treatment, mothers will be asked to complete the informed consent and intake form. The follow-up form will be collected after treatment and again at the ages of 6, 12 and 24 weeks of the infant, in order to compare the maternal ratings of the infant’s breastfeeding problem. A few babies who are presented to the clinic later than six weeks of age, will not be included in the data collection at the six week age timeline, but will be included in the older age groups.

Randomization

To minimize selection bias and to ensure participants receive equal probability of allocation into either intervention, participants will be randomized by computer in blocks of 16 to even out presentation to each intervention. Random numbers will be computer-generated and slotted automatically into Clinic Office program which will assign the patient to the interventions.

Blinding

Everyone involved with the trial, who can be, will be blinded. This includes the reception staff, who collects the informed consent and follow-up measures, but will be blinded to actual group assignment; the statistician; the manual therapist and the mothers. Blinding of the manual therapist should be fairly easy to administer at the AECC clinic — by the very nature of its business, it already provides care to mother-infant dyads for a myriad of conditions. Therefore, therapists are able to be blinded to participant’s involvement in the trial, as treatment will be routine and commonplace. Each subject will be enrolled and followed up by the research assistant and not anyone working in routine clinic jobs.

Sample size

When estimating a sample size that would achieve a detectable and reasonable effect, data from prior studies relating to treatment of SIB in infants were considered. In a randomized controlled trial by Jolly et al (2012)¹⁰ which consisted of 2,724 participants, the sample size was powered by a 6% increase of initiation as outlined in a study by MacArthur et al (2009).¹¹ In a smaller study conducted by McDonald et al (2010),¹² the trial size of 849 participants was influenced by an already high level of exclusive breastfeeding at six months, as observed by Henderson et al (2003).¹³ Based on previous research therefore, in order to have an 80% chance of identifying a reasonable effect at 0.05 level of significance, a minimum of 850 mothers are required to enter this trial. In light of the effort required to do this study, a 10% overage will be added to the trial size to account for drop-outs.

Recruitment for the trial is unlikely to be arduous. The number of hospital births in the local population are detailed in Table 1.

Location	No. of Births Apr 14 - Apr 15
Royal Bournemouth Birth Centre	290
Poole Hospital	4,400
New Forest Birth Centre	300
Dorset County Hospital	1,850
Salisbury District Hospital	2,300
Princess Anne Hospital, Southampton	5,350
Total Births	14,490

Table 1. Local Hospital Births — April 2014 to April 2015
 Figures taken from www.which.co.uk/birth-choice

Research from Geddes¹⁴ shows that up to 44% of newborns have suboptimal breastfeeding. This would suggest an estimated 6,400 babies eligible for participation in the trial. A pilot study at AECC showed that in one year, AECC accessed approximately 42% of the babies in the local hospitals.⁷

Procedures / Treatments

Participants in this study will be given either chiropractic care (manual therapy) as is routine for this clinic, or multidisciplinary care. The multidisciplinary care arm is a coalescence of midwifery support, which includes advice on attachment and positioning, and manual therapy (mobilization of joints and soft tissue).

The two groups will be characterized as (1) chiropractic manual therapy for breastfeeding and (2) chiropractic manual therapy plus midwifery advice for breastfeeding.

Manual therapy has been used in other studies to address and restore full competency in feeding^{7,8,9} in spite of low levels of evidence to support its effectiveness. Studies have found that 3-4 treatments are the mode and mean number of treatments to reach full effect.¹⁵ This study will not place limits on the number of treatments, as each clinician makes these decisions based on the response of the patient. It is anticipated that these numbers may hold true for this study and the costs will be based upon the average of four treatments per infant.

Outcome Measures

Outcome measures are ‘no breastfeeding,’ ‘partial breastfeeding’ or ‘exclusive breastfeeding.’ The definition of exclusive breastfeeding by WHO is where the infant receives only “breast milk without any additional food or drink, not

even water.”¹¹ Outcome measures are recorded by the mother on a daily basis in a breastfeeding diary. These measures are recorded at the time of follow-up, which has been defined as 6, 12, and 24 weeks after the intervention. With the use of the diary, it will be possible to determine the actual method of breastfeeding in each time frame.

The mother will complete the follow-up form at 6, 12 and 24 weeks, which will be an addition to the daily breastfeeding diary, and the answers compared through statistical analysis. Use of other health care professionals' time will also be collected and mothers asked about any visits to the GP, midwife, health visitor, pediatrician, consultant, lactation consultant or other health care professional. This is important to assess the true costs associated with suboptimal breastfeeding health care. It may also show that there are significant confounding factors in how well or poorly the baby's breastfeeding commences.

There are no ethical issues in offering this treatment as manual therapy has been found to be safe and a very low risk activity. One chiropractic teaching clinic has tracked approximately 86,000 infant treatments over 20 years without a single adverse event (AECC computerized clinic office). Other studies have also provided evidence that the risks are very low.^{15,16,17}

Fully informed consent will be obtained from the mothers when they report for treatment. It is part of routine clinical care as well as care in this trial.

Drop outs

Drop-out rates will be tracked. The AECC Clinic has demonstrated reasonable follow-up, as seen in the study by Miller et al (2016),⁸ where the response rate achieved was 85% in the cases of suboptimal breastfeeding.

Methods of data analysis

Data will be stored and analyzed using SPSS v. 23 for Windows. Recruitment rates, attrition rates, and overall proportion exclusively breastfeeding, will be calculated with 95% confidence intervals.

An attempt will be made to obtain data on the outcomes measures from subjects who have not completed care or dropped out, in order to perform an intention-to-treat analysis. Their diaries should be very helpful in discerning why they dropped out of the trial. The proportion of mothers totally breastfeeding will be compared between the two groups using the chi-squared test for association or Fisher's Exact test, as appropriate. Data will be tested for normality although it is anticipated that this data will be non-normally distributed.

Satisfaction levels of the mothers will be compared using

the independent samples t-test or Mann-Whitney U test, whichever is appropriate.

Further statistical analysis will be discussed with a statistician to strengthen and fine-tune the analysis as the trial ensues, as the most appropriate tests for the data and research questions must be utilized.

Descriptive statistics will be used to describe the proportion of mothers totally or partially breastfeeding both at the beginning and end of the treatment, and at 6, 12 and 24 weeks. Any comments made by the mothers on the outcome instruments will be collected over the duration of the trial as well. Any adverse effects of treatment will also be collected.

Resources

Like most randomized trials, it will be necessary to fund this study. These details will be supplied completely in the request for funding with application to funding agencies. At this point, a Research Assistant (RA) will be required, just as in the last RCT done in the AECC clinic to study the colic baby. That funding was supplied by the British Columbia Chiropractic Association.

The additional major cost is for treatment for the babies. The parents of babies who enter the study will not be required to pay, therefore each subject's individual visits will be paid at the fee of £24/visit (or current fee) by the funding agency. In the last RCT, this was covered by the TAM club. However this trial will be a much larger study, therefore request for fees will be made to the same funding agency. Other incidental requirements such as stationery, printing and copying, travel to train referrers, statistician time, etc, will be added together to determine the final funding requirement.

Strengths / Weaknesses

A strength of this trial is that randomization is a high level method of research as it randomly distributes the biases that can confound any study. However, there can be high drop-out rates which could lessen statistical strength and undermine the initial randomization.

An additional strength is that care is routine at AECC; therefore no special provisions are required. Further, mothers have been found to be very accurate reporters of their infant's abilities.¹⁷ However, it is possible that there is inaccuracy of maternal recall and this can be a weakness.

Conclusion

A pragmatic design was selected for this study so that the outcomes can more readily be applied to the real-world situation where sub-optimal infant breastfeeding is a serious problem. Suggestions to improve this study before its embarkation are welcome.

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Maternal Report of Outcomes of Chiropractic Care for Infants.

Miller JE, Hanson HA, Hiew M, Lo Tiap Kwong DS, Mok Z, Tee YH.

J Manipulative Physiol Ther. 2019 Apr 24. pii: S0161-4754(18)30145-3. doi: [10.1016/j.jmpt.2018.10.005](https://doi.org/10.1016/j.jmpt.2018.10.005). [Epub ahead of print].

ABSTRACT

OBJECTIVE: The purpose of this study was to investigate the report by mothers of their infants' condition before and after a trial of care provided by registered chiropractic clinicians in addition to ratings of satisfaction, cost of care, and reports of any adverse events or side effects. A second purpose was to report the demographic profile of infants who presented for care to 16 chiropractic clinics in the United Kingdom. **METHODS:** This observational study prospectively collected reports by mothers of their infants' demographic profiles and outcomes across several domains of infant behavior and their own mental state using the United Kingdom Infant Questionnaire. Participating registered chiropractors were recruited through the Royal College of Chiropractors annual meeting in January 2016, and 15 clinics and the Anglo-European College of Chiropractic University College teaching clinic volunteered to participate. **RESULTS:** In all, 2001 mothers completed intake questionnaires and 1092 completed follow-up forms. Statistically significant ($P < .05$) improvements were reported across all aspects of infant behavior studied, including feeding problems, sleep issues, excessive crying, problems with supine sleep position, infant pain, restricted cervical range of motion, and time performing prone positioning. Maternal ratings of depression, anxiety, and satisfaction with motherhood also demonstrated statistically significant improvement ($P < .05$). In total, 82% ($n = 797$) reported definite improvement of their infants on a global impression of change scale. As well, 95% ($n = 475$) reported feeling that the care was cost-effective, and 90.9% ($n = 712$) rated their satisfaction 8 or higher on an 11-point scale. Minor self-limiting side effects were reported (5.8%, $n = 42/727$) but no adverse events. **CONCLUSION:** In this study, mothers reported that chiropractic care for their infants was effective, safe, and cost-effective. Although the observational design makes it impossible to determine efficacy, the study's findings indicate that, on average, the changes observed by mothers were positive and may be clinically relevant.

KEYWORDS: Chiropractic; Complementary therapies; Infant.

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Utilization of Chiropractic Care in US Children and Adolescents: A Cross-Sectional Study of the 2012 National Health Interview Survey.

Peng T, Chen B, Gabriel KP

J Manipulative Physiol Ther. 2018 Nov - Dec;41(9):725-733. doi: [10.1016/j.jmpt.2018.07.003](https://doi.org/10.1016/j.jmpt.2018.07.003). Epub 2019 Feb 18.

ABSTRACT

OBJECTIVE: The purpose of this study was to describe the prevalence of chiropractic utilization and examine sociodemographic characteristics associated with utilization in a representative sample of US children and adolescents aged 4 to 17 years. **METHODS:** Data are from 9734 respondents to the 2012 National Health Interview Survey. Age, sex, race/ethnicity, geography, family income, parental educational attainment, and other health care providers served as exposure variables. Chiropractic utilization in the past 12 months (yes/no) was the targeted outcome. Weighted crude and adjusted logistic regression models, controlling for relevant covariates, were performed. **RESULTS:** The 12-month prevalence of chiropractic utilization in US children was 3.0% (95% confidence interval: 2.6%-3.6%). The adjusted odds (95% confidence interval) of chiropractic utilization were higher among 11- to 17-year-olds (2.02 [1.41-2.90]) (vs 4- to 10-year-olds), Midwest residents (2.45 [1.36-4.44]) (vs Northeast), families with incomes \geq \$100000 (3.25 [1.87-5.66]) (vs $<$ \$35000), and those that visited other Complementary and Integrative Health (also known as Complementary and Alternative Medicine) practitioners (11.26 [7.19-17.64]). Blacks and Asians had lower adjusted odds of chiropractic utilization compared with whites (0.17 [0.06-0.47] and 0.17 [0.07-0.43], respectively). Sex, parental education, and having an orthodox medical personal physician were not associated with utilization. **CONCLUSION:** Although overall prevalence was low, sociodemographic characteristics of child and adolescent users of chiropractic care were identified. Age, race/ethnicity, region of residence, family income, and utilization of other Complementary and Integrative Health services were associated with chiropractic utilization, after adjusting for sociodemographic covariates.

KEYWORDS: Adolescent; Child; Chiropractic; Complementary therapies; Integrative medicine; Pediatrics.

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Manual therapy for the pediatric population: a systematic review.

Parnell Prevost C, Gleberzon B, Carleo B, Anderson K, Cark M, Pohlman KA
BMC Complement Altern Med., 2019 Mar 13;19(1):60. doi: [10.1186/s12906-019-2447-2](https://doi.org/10.1186/s12906-019-2447-2).

ABSTRACT

Background: This systematic review evaluates the use of manual therapy for clinical conditions in the pediatric population, assesses the methodological quality of the studies found, and synthesizes findings based on health condition. We also assessed the reporting of adverse events within the included studies and compared our conclusions to those of the UK Update report. **Methods:** Six databases were searched using the following inclusion criteria: children under the age of 18 years old; treatment using manual therapy; any type of healthcare profession; published between 2001 and March 31, 2018; and English. Case reports were excluded from our study. Reference tracking was performed on six published relevant systematic reviews to find any missed article. Each study that met the inclusion criteria was screened by two authors to: (i) determine its suitability for inclusion, (ii) extract data, and (iii) assess quality of study. **Results:** Of the 3563 articles identified, 165 full articles were screened, and 50 studies met the inclusion criteria. Twenty-six articles were included in prior reviews with 24 new studies identified. Eighteen studies were judged to be of high quality. Conditions evaluated were: attention deficit hyperactivity disorder (ADHD), autism, asthma, cerebral palsy, clubfoot, constipation, cranial asymmetry, cuboid syndrome, headache, infantile colic, low back pain, obstructive apnea, otitis media, pediatric dysfunctional voiding, pediatric nocturnal enuresis, postural asymmetry, preterm infants, pulled elbow, suboptimal infant breastfeeding, scoliosis, suboptimal infant breastfeeding, temporomandibular dysfunction, torticollis, and upper cervical dysfunction. Musculoskeletal conditions, including low back pain and headache, were evaluated in seven studies. Twenty studies reported adverse events, which were transient and mild to moderate in severity. **Conclusions:** Fifty studies investigated the clinical effects of manual therapies for a wide variety of pediatric conditions. Moderate-positive overall assessment was found for 3 conditions: low back pain, pulled elbow, and premature infants. Inconclusive unfavorable outcomes were found for 2 conditions: scoliosis (OMT) and torticollis (MT). All other condition's overall assessments were either inconclusive favorable or unclear. Adverse events were uncommonly reported. More robust clinical trials in this area of healthcare are needed.

KEYWORDS: Pediatric, Manual therapy, Chiropractic, Osteopathic, Systematic review.

PROSPERA registration number: CRD42018091835.

The natural course of low back pain from childhood to young adulthood - a systematic review.

Junge T, Wedderkopp N, Boyle E, Kjaer P
Chiropr Man Therap., 2019 Mar 20;27:10. doi: [10.1186/s12998-018-0231-x](https://doi.org/10.1186/s12998-018-0231-x). eCollection 2019.

ABSTRACT

Background: Taking the natural course of recurrent and fluctuating low back pain (LBP) seen in longitudinal studies of adults into consideration, the aetiology and development of LBP in children and adolescents also needs to be reflected in a long-term course. Therefore, a systematic critical literature review was undertaken to assess the natural course of LBP in the general population from childhood through adolescence to young adulthood. **Methods:** A systematic literature search was conducted in MEDLINE, EMBASE, CINAHL and PsycINFO with synonyms of search terms for 1) low back pain; 2) natural course; 3) cohort study and 4) children. Records in English, German, French, Danish, Swedish, and Norwegian were included. To assess the methodological quality of the studies, the NIH quality assessment checklist for cohort studies was adapted and risk of bias was assessed on a study level. Two authors independently reviewed selected studies, assessed quality, and extracted data. A synthesis of results in relation to the natural course of LBP was created. **Results:** Totally, 3373 records were identified, eight articles were included for quality assessment, and finally, four studies of good to fair quality were included for synthesis of results. Indication of three common patterns of LBP were identified across studies and labelled as 1) 'children and adolescents with no LBP or low probability of LBP' (49 to 53%), 2) 'children and adolescents with fluctuation of LBP' (16 to 37%) and 3) 'children and adolescents with repeated reporting of LBP' (<1 to 10%). **Conclusion:** Although methodological heterogeneity, mainly due to different age ranges, an indication of a natural course of LBP was seen across studies. The majority of children and adolescents repeatedly reporting no or low probability of LBP. With recall periods between one week to three months and sampling rates ranging from one to four years, a very low rate repeatedly reported LBP, and approximately one-fifth to one-third of children and adolescents had fluctuating reports of LBP. A need of future research of LBP trajectories with short reporting period lengths and narrower sampling windows in a long-term perspective is emphasized in order to study childhood influences on the development of LBP throughout life.

KEYWORDS: Children and adolescence; Low back pain; Natural course.

The Feeding Infants and Toddlers Study (FITS) 2016: Moving Forward.

Johanna T Dwyer

J Nutr. 2018 Sep; 148(Suppl 3): 1575S—1580S.

Published online 2018 Aug 31. doi: [10.1093/jn/nxy159](https://doi.org/10.1093/jn/nxy159)

ABSTRACT

INTRODUCTION: The years from birth through preschool involve more changes in growth, development, eating patterns, nutrition, and other functions than any other time of life. Food consumption during this time is dynamic and is influenced by rapidly changing trends in feeding practices for infants and young children, as well as by longer-term trends in family incomes and food programs. It is critical to know what children are being fed, what they are eating, and how practices are changing, if we are to craft interventions that lay a solid nutritional foundation for later health, decrease risks of inappropriate eating habits, and develop evidence-based feeding recommendations. Informal guidelines for feeding the young have been available since antiquity. Today, we use formal evaluation of the evidence before making recommendations. Of particular relevance here is the Birth to 24 Months (B-24) project to evaluate data and support the addition of the first ever recommendations for children younger than 24 mo to the 2020—2025 Dietary Guidelines for Americans. Sound recommendations must be based on up-to-date information, and yet data on intakes and eating patterns are sparse, particularly for those <24 mo of age. NHANES provides much useful information for children <24 mo of age, but the sample sizes of both breast- and bottle-fed infants and toddlers are insufficient to trace the rapid changes in intakes that occur during that time. The *Feeding Infants and Toddlers Study (FITS) 2016* contributes to this evidence base and complements NHANES by applying similar methods to a large sample of infants and toddlers aged <24 mo, including minorities, providing greater detail about the adequacy of usual nutrient intakes and the foods and food groups consumed. FITS 2016 is a cross-sectional study of caregivers of children under the age of 4 y living in the 50 states and Washington DC. Data collection occurred between June 2015 and May 2016. A recruitment interview (respondent and child characteristics, feeding practices including responsive feeding and reasons for starting or stopping breastfeeding, physical activity, screen use, sleep habits, participation in food assistance programs) was completed by telephone or online. This was followed by a feeding practices questionnaire and a 24-h recall conducted by telephone. A second 24-h recall was collected for a random subsample of 25% of the total sampled population. Because FITS is a telephone survey, direct anthropometric data could not be collected; the lack of accurate anthropometric data or other biomarkers to link the food consumption data collected to health outcomes is a limitation.

Association of Maternal Neurodevelopmental Risk Alleles With Early-Life Exposures.

Beate Leppert, Ph.D.; Alexandra Havdahl, Ph.D., Lucy Riglin, Ph.D., et al

JAMA Psychiatry, Published online May 01, 2019. doi:[10.1001/jamapsychiatry.2019.0774](https://doi.org/10.1001/jamapsychiatry.2019.0774)

ABSTRACT

Importance: Early-life exposures, such as prenatal maternal lifestyle, illnesses, nutritional deficiencies, toxin levels, and adverse birth events, have long been considered potential risk factors for neurodevelopmental disorders in offspring. However, maternal genetic factors could be confounding the association between early-life exposures and neurodevelopmental outcomes in offspring, which makes inferring a causal relationship problematic. **Objective:** To test whether maternal polygenic risk scores (PRSs) for neurodevelopmental disorders were associated with early-life exposures previously linked to the disorders. **Design, Setting, and Participants:** In this UK population-based cohort study, 7921 mothers with genotype data from the Avon Longitudinal Study of Parents and Children (ALSPAC) underwent testing for association of maternal PRS for attention-deficit/hyperactivity disorder (ADHD PRS), autism spectrum disorder (ASD PRS), and schizophrenia (SCZ PRS) with 32 early-life exposures. ALSPAC data collection began September 6, 1990, and is ongoing. Data were analyzed for the current study from April 1 to September 1, 2018. **Exposures:** Maternal ADHD PRS, ASD PRS, and SCZ PRS were calculated using discovery effect size estimates from the largest available genome-wide association study and a significance threshold of $P < .05$. **Main Outcomes and Measures:** Outcomes measured included questionnaire data on maternal lifestyle and behavior (eg, smoking, alcohol consumption, body mass index, and maternal age), maternal use of nutritional supplements and medications in pregnancy (eg, acetaminophen, iron, zinc, folic acid, and vitamins), maternal illnesses (eg, diabetes, hypertension, rheumatism, psoriasis, and depression), and perinatal factors (eg, birth weight, preterm birth, and cesarean delivery). **Results:** Maternal PRSs were available from 7921 mothers (mean [SD] age, 28.5 [4.8] years). The ADHD PRS was associated with multiple prenatal factors, including infections (odds ratio [OR], 1.11; 95% CI, 1.04-1.18), use of acetaminophen during late pregnancy (OR, 1.11; 95% CI, 1.04-1.18), lower blood levels of mercury (β coefficient, -0.06; 95% CI, -0.11 to -0.02), and higher blood levels of cadmium (β coefficient, 0.07; 95% CI, 0.05-0.09). Little evidence of associations between ASD PRS or SCZ PRS and prenatal factors or of association between any of the PRSs and adverse birth events was found. Sensitivity analyses revealed consistent results. **Conclusions and Relevance:** These findings suggest that maternal risk alleles for neurodevelopmental disorders, primarily ADHD, are associated with some pregnancy-related exposures. These findings highlight the need to carefully account for potential genetic confounding and triangulate evidence from different approaches when assessing the effects of prenatal exposures on neurodevelopmental disorders in offspring.

A scoping review of chiropractic management of female patients with infertility.

Budgell B, Yee B

J Can Chiropr Assoc., 2018 Aug;62(2):117-124.

Abstract in [English](#), [French](#)

ABSTRACT

Background: Debate concerning chiropractic management of female infertility occurs largely in the absence of reference to the extant literature. **Methods:** A scoping review was conducted of primary (original) data publications on the chiropractic management of female infertility based on searches of the Index to Chiropractic Literature and Pubmed, supplemented by papers from one author's archive. **Results:** Ten articles, all case studies, met the review's inclusion criteria and documented the experiences of 11 women (mean age 31 years; mean period of infertility 3 years). Pregnancy occurred, on average, after five months of treatment with spinal manipulation and adjunctive modalities. No adverse events were reported. **Discussion:** There are very few original data articles documenting responses of infertile females treated with spinal manipulation. **Conclusions:** In the absence of a robust body of primary data literature, the use of spinal manipulation the management of female infertility should be approached with caution.

KEYWORDS: Chiropractic; Infertility; Scoping review.

The Awareness of the Fascial System.

Bordoni B, Simonelli M

Cureus, 2018 Oct 1;10(10):e3397. doi: [10.7759/cureus.3397](https://doi.org/10.7759/cureus.3397).

ABSTRACT

Fascia is a cacophony of functions and information, a completely adaptable entropy complex. The fascial system has a solid and a liquid component, acting in a perfect symbiotic synchrony. Each cell communicates with the other cells by sending and receiving signals; this concept is a part of quantum physics and it is known as quantum entanglement: a physical system cannot be described individually, but only as a juxtaposition of multiple systems, where the measurement of a quantity determines the value for other systems. Fascial continuum serves as a target for different manual approaches, such as physiotherapy, osteopathy and chiropractic. Cellular behaviour and the inclusion of quantum physics background are hardly being considered to find out what happens between the operator and the patient during a manual physical contact. The article examines these topics. According to the authors' knowledge, this is the first scientific text to offer manual operators' new perspectives to understand what happens during palpatory contact. A fascial cell has not only memory but also the awareness of the mechanometabolic information it feels, and it has the anticipatory predisposition in preparing itself for alteration of its natural environment.

KEYWORDS: Fascia; Fascial system; Myofascial; Physiology; Quantum physics.

The Role of Vitamin D in the Pathogenesis of Adolescent Idiopathic Scoliosis.

Ng SY, Bettany-Saltikov J, Cheung IYK1, Chan KKY

Asian Spine J, 2018 Dec;12(6):1127-1145. doi: [10.31616/asj.2018.12.6.1127](https://doi.org/10.31616/asj.2018.12.6.1127). Epub 2018 Oct 16.

ABSTRACT

Several theories have been proposed to explain the etiology of adolescent idiopathic scoliosis (AIS) until present. However, limited data are available regarding the impact of vitamin D insufficiency or deficiency on scoliosis. Previous studies have shown that vitamin D deficiency and insufficiency are prevalent in adolescents, including AIS patients. A series of studies conducted in Hong Kong have shown that as many as 30% of these patients have osteopenia. The 25-hydroxyvitamin D₃ level has been found to positively correlate with bone mineral density (BMD) in healthy adolescents and negatively with Cobb angle in AIS patients; therefore, vitamin D deficiency is believed to play a role in AIS pathogenesis. This study attempts to review the relevant literature on AIS etiology to examine the association of vitamin D and various current theories. Our review suggested that vitamin D deficiency is associated with several current etiological theories of AIS. We postulate that vitamin D deficiency and/or insufficiency affects AIS development by its effect on the regulation of fibrosis, postural control, and BMD. Subclinical deficiency of vitamin K₂, a fat-soluble vitamin, is also prevalent in adolescents; therefore, it is possible that the high prevalence of vitamin D deficiency is related to decreased fat intake. Further studies are required to elucidate the possible role of vitamin D in the pathogenesis and clinical management of AIS.

KEYWORDS: Bone density; Scoliosis; Vitamin D; Vitamin K.

Massage, reflexology and other manual methods for pain management in labour.

Smith CA, Levett KM, Collins CT, Dahlen HG, Ee CC, Sukanuma M.

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ABSTRACT

Background: Many women would like to avoid pharmacological or invasive methods of pain management in labour, and this may contribute towards the popularity of complementary methods of pain management. This review examined the evidence currently available on manual methods, including massage and reflexology, for pain management in labour. This review is an update of the review first published in 2012. **OBJECTIVES:** To assess the effect, safety and acceptability of massage, reflexology and other manual methods to manage pain in labour. **SEARCH METHODS:** For this update, we searched Cochrane Pregnancy and Childbirth's Trials Register (30 June 2017), the Cochrane Central Register of Controlled Trials (CENTRAL; 2017, Issue 6), MEDLINE (1966 to 30 June 2017, CINAHL (1980 to 30 June 2017), the Australian New Zealand Clinical Trials Registry (4 August 2017), Chinese Clinical Trial Registry (4 August 2017), ClinicalTrials.gov, (4 August 2017), the National Center for Complementary and Integrative Health (4 August 2017), the WHO International Clinical Trials Registry Platform (ICTRP) (4 August 2017) and reference lists of retrieved trials. **SELECTION CRITERIA:** We included randomised controlled trials comparing manual methods with standard care, other non-pharmacological forms of pain management in labour, no treatment or placebo. We searched for trials of the following modalities: massage, warm packs, thermal manual methods, reflexology, chiropractic, osteopathy, musculo-skeletal manipulation, deep tissue massage, neuro-muscular therapy, shiatsu, tuina, trigger point therapy, myotherapy and zero balancing. We excluded trials for pain management relating to hypnosis, aromatherapy, acupuncture and acupressure; these are included in other Cochrane reviews. **DATA COLLECTION AND ANALYSIS:** Two review authors independently assessed trial quality, extracted data and checked data for accuracy. We contacted trial authors for additional information. We assessed the quality of the evidence using the GRADE approach. **MAIN RESULTS:** We included a total of 14 trials; 10 of these (1055 women) contributed data to meta-analysis. Four trials, involving 274 women, met our inclusion criteria but did not contribute data to the review. Over half the trials had a low risk of bias for random sequence generation and attrition bias. The majority of trials had a high risk of performance bias and detection bias, and an unclear risk of reporting bias. We found no trials examining the effectiveness of reflexology. **Massage** We found low-quality evidence that massage provided a greater reduction in pain intensity (measured using self-reported pain scales) than usual care during the first stage of labour (standardised mean difference (SMD) -0.81, 95% confidence interval (CI) -1.06 to -0.56, six trials, 362 women). Two trials reported on pain intensity during the second and third stages of labour, and there was evidence of a reduction in pain scores in favour of massage (SMD -0.98, 95% CI -2.23 to 0.26, 124 women; and SMD -1.03, 95% CI -2.17 to 0.11, 122 women). There was very low-quality evidence showing no clear benefit of massage over usual care for the length of labour (in minutes) (mean difference (MD) 20.64, 95% CI -58.24 to 99.52, six trials, 514 women), and pharmacological pain relief (average risk ratio (RR) 0.81, 95% CI 0.37 to 1.74, four trials, 105 women). There was very low-quality evidence showing no clear benefit of massage for assisted vaginal birth (average RR 0.71, 95% CI 0.44 to 1.13, four trials, 368 women) and caesarean section (RR 0.75, 95% CI 0.51 to 1.09, six trials, 514 women). One trial reported less anxiety during the first stage of labour for women receiving massage (MD -16.27, 95% CI -27.03 to -5.51, 60 women). One trial found an increased sense of control from massage (MD 14.05, 95% CI 3.77 to 24.33, 124 women, low-quality evidence). Two trials examining satisfaction with the childbirth experience reported data on different scales; both found more satisfaction with massage, although the evidence was low quality in one study and very low in the other. **Warm packs** We found very low-quality evidence for reduced pain (Visual Analogue Scale/VAS) in the first stage of labour (SMD -0.59, 95% CI -1.18 to -0.00, three trials, 191 women), and the second stage of labour (SMD -1.49, 95% CI -2.85 to -0.13, two trials, 128 women). Very low-quality evidence showed reduced length of labour (minutes) in the warm-pack group (MD -66.15, 95% CI -91.83 to -40.47; two trials; 128 women). **Thermal manual methods** One trial evaluated thermal manual methods versus usual care and found very low-quality evidence of reduced pain intensity during the first phase of labour for women receiving thermal methods (MD -1.44, 95% CI -2.24 to -0.65, one trial, 96 women). There was a reduction in the length of labour (minutes) (MD -78.24, 95% CI -118.75 to -37.73, one trial, 96 women, very low-quality evidence). There was no clear difference for assisted vaginal birth (very low-quality evidence). Results were similar for cold packs versus usual care, and intermittent hot and cold packs versus usual care, for pain intensity, length of labour and assisted vaginal birth. **Music** One trial that compared manual methods with music found very low-quality evidence of reduced pain intensity during labour in the massage group (RR 0.40, 95% CI 0.18 to 0.89, 101 women). There was no evidence of benefit for reduced use of pharmacological pain relief (RR 0.41, 95% CI 0.16 to 1.08, very low-quality evidence). Of the seven outcomes we assessed using GRADE, only pain intensity was reported in all comparisons. Satisfaction with the childbirth experience, sense of control, and caesarean section were rarely reported in any of the comparisons. **AUTHORS' CONCLUSIONS:** Massage, warm pack and thermal manual methods may have a role in reducing pain, reducing length of labour and improving women's sense of control and emotional experience of labour, although the quality of evidence varies from low to very low and few trials reported on the key GRADE outcomes. Few trials reported on safety as an outcome. There is a need for further research to address these outcomes and to examine the effectiveness and efficacy of these manual methods for pain management.

Physical risk factors for adolescent neck and mid back pain: a systematic review.

Wirth B, Potthoff T, Rosser S, Humphreys BK, de Bruin ED

Chiropr Man Therap., 2018 Sep 24;26:36. doi: [10.1186/s12998-018-0206-y](https://doi.org/10.1186/s12998-018-0206-y). eCollection 2018.

ABSTRACT

Background: Besides low back pain (LBP), also neck pain (NP) and mid back pain (MBP) are common health issues in adolescence. Psychological factors are regarded as main risk factors for spinal pain in adolescence, but recent studies suggest that the importance of physical factors might be underestimated. The purpose of this study was to summarize the results of studies on physical risk factors for adolescent NP and MBP. **Methods:** Cross-sectional and prospective English studies on NP and MBP in adolescents aged 10 to 18 were searched by a professional librarian in Medline (OvidSP), Premedline (PubMed), EMBASE, Cochrane, CINAHL, PEDro and PsycINFO up to October 2016. Studies that were restricted to self-report via questionnaires were excluded. **Results:** Eight cross-sectional studies could be included in this review. Some aspects of sagittal alignment in sitting (increased lumbar lordosis) and standing (anteroposition of the head, sway-back posture) were associated with NP. Study comparability was impeded by inconsistent definitions of NP and MBP and a wide variety of outcome measures. **Conclusions:** This systematic review indicates that prospective studies using a consistent definition of NP and MBP are needed. Such studies might further investigate sagittal alignment in sitting and standing as possible risk factors for NP and MBP in adolescence using a consistent terminology for the outcomes and longitudinal research designs.

KEYWORDS: Adolescent; Mid back pain; Neck pain; Systematic review.

Demographic Profile of Chiropractors Who Treat Children: A Multinational Survey.

Matthew F.Doyle MSc., Joyce E.Miller DC, PhD

Journal of Manipulative & Physiological Therapeutics, Volume 42, Issue 1, January 2019. <https://doi.org/10.1016/j.jmpt.2018.03.007>

ABSTRACT

Objective: The purpose of this study was to survey the demographic profile and educational background of chiropractors with pediatric patients on a multinational scale. **Methods:** A multinational online cross-sectional demographic survey conducted over a 15-day period in July 2010. The survey was electronically administered via chiropractic associations in 17 countries, using SurveyMonkey for data acquisition, transfer, and descriptive analysis. **Results:** The response rate was 10.1%, and 1498 responses were received from 17 countries on 6 continents. Of these, 90.4% accepted pediatric cases. The average practitioner was male (61.1%) and 41.4 years old, had 13.6 years in practice, and saw 107 patient visits per week. Regarding educational background, 63.4% had a bachelor's degree or higher in addition to their chiropractic qualification, and 18.4% had a postgraduate certificate or higher in pediatric chiropractic. **Conclusion:** This is the first study about chiropractors who treat children from the United Arab Emirates, Peru, Japan, South Africa, and Spain. Although the response rate was low, the results of this multinational survey suggest that pediatric chiropractic care may be a common component of usual chiropractic practice on a multinational level for these respondents.

KEYWORDS: Chiropractic, Child, Pediatrics, Demography.

Injuries of the adolescent girl athlete: a review of imaging findings.

Kimberly Shampain, Kara Gaetke-Udager, Jessica R. Leschied, Nathaniel B. Meyer, Matthew R. Hammer, Keri L. Denay, Corrie M. Yablon
Skeletal Radiology, (2019) 48: 77. <https://doi.org/10.1007/s00256-018-3029-y>

ABSTRACT

With the rising participation of girls in sports at both the recreational and elite levels, there has also been increased awareness of injuries common in this athlete population. Anatomic differences between boys and girls cause girl athletes to be predisposed to certain injuries. Certain behavioral patterns, such as eating disorders, also cause problems specific to girl athletes that may result in injury. Imaging plays a large role in diagnosis and ongoing management, but there has been only scant literature dedicated to the specific topic of imaging in girl athletes. The purpose of this article is to review the imaging findings and recommendations for injuries and other conditions affecting the adolescent girl athlete. This article first provides an overview of the key anatomic differences between boys and girls, including both static and dynamic factors, as well as non-anatomic differences, such as hormonal factors, and discusses how these differences contribute to the injury patterns that are seen more typically in girls. The article then reviews the imaging findings in injuries that are commonly seen in girl athletes. There is also a discussion of the "female athlete triad," which consists of osteoporosis, disordered eating, and amenorrhea, and the role of imaging in this condition.

KEYWORDS: Female athlete; Female athlete triad; MRI; Pediatrics; Sports medicine.

Dietary Intake, Nutrient Status, and Growth Parameters in Children with Autism Spectrum Disorder and Severe Food Selectivity: An Electronic Medical Record Review.

Sharp WG, Postorino V, McCracken CE, Berry RC, Criado KK, Burrell TL, Scahill L.
J Acad Nutr Diet., 2018 Oct;118(10):1943-1950. doi: [10.1016/j.jand.2018.05.005](https://doi.org/10.1016/j.jand.2018.05.005). Epub 2018 Jul 10.

ABSTRACT

BACKGROUND: Food selectivity is common in children with autism spectrum disorder (ASD). The clinical characteristics, however, of severe food selectivity in children with ASD is not well documented. **OBJECTIVE:** This study examined the demographic characteristics, anthropometric parameters, risk of nutritional inadequacy, dietary variety, and problematic mealtime behaviors in a sample of children with ASD with severe food selectivity. **DESIGN:** The study involved a cross-sectional electronic medical record review. Data extraction followed a systematic protocol for data extraction. **PARTICIPANTS/SETTING:** Children (age 2 to 17 years) with ASD, severe food selectivity, and complete nutritional data who received a multidisciplinary evaluation at a specialty feeding clinic in the southeastern United States between January 2014 and January 2016. Criteria for severe food selectivity used in this clinical practice required complete omission of one or more food groups (eg, fruit, vegetable, protein, grain, dairy) or consuming a narrow range of items on a weekly basis (eg, five or fewer total food items). **MAIN OUTCOME MEASURES:** Analyses examined demographic characteristics, dietary preferences, risk for nutritional inadequacies, anthropometric parameters, and problematic mealtime behaviors. **RESULTS:** Of the 279 patients evaluated during the 24-month period, 70 children with ASD and severe food selectivity met inclusion criteria. Caregivers reported 67% of the sample (n=47) omitted vegetables and 27% omitted fruits (n=19). Seventy-eight percent consumed a diet at risk for five or more inadequacies. Risk for specific inadequacies included vitamin D (97% of the sample), fiber (91%) vitamin E (83%), and calcium (71%). Children with five or more nutritional inadequacies (n=55) were more likely to make negative statements during meals ($P < 0.05$). Severe food selectivity was not associated with compromised growth or obesity. **CONCLUSION:** Children with ASD and severe food selectivity may be at increased risk for nutritional inadequacies. Future research should examine causes, consequences, and remediation of severe food selectivity in this population.

KEYWORDS: Autism spectrum disorder; Avoidant or restrictive intake disorder; Food selectivity; Nutrition; Pediatric feeding disorders.

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Effects of pregnancy on lumbar motion patterns and muscle responses.

Biviá-Roig G, Lisón JF, Sánchez-Zuriaga D.
Spine J., 2019 Feb;19(2):364-371. doi: [10.1016/j.spinee.2018.08.009](https://doi.org/10.1016/j.spinee.2018.08.009). Epub 2018 Aug 22.

ABSTRACT

BACKGROUND CONTEXT: The kinematics of the lumbar region and the activation patterns of the erector spinae muscle have been associated with the genesis of low back pain, which is one of the most common complications associated with pregnancy. Despite the high prevalence of pregnancy-related low back pain, the biomechanical adaptations of the lumbar region during pregnancy remain unknown. **PURPOSE:** This study analyzes lumbar spine motion and the activation pattern of the lumbar erector spinae muscle in healthy pregnant women. **STUDY DESIGN:** A case-control study. **PATIENT SAMPLE:** The study involved 34 nulliparous women (control group) and 34 pregnant women in the third trimester (week 36 ± 1). **OUTCOME MEASURES:** We recorded the parameters of angular displacement of the lumbar spine in the sagittal plane during trunk flexion-extension, and the EMG activity of the erector spinae muscles during flexion, extension, eccentric and concentric contractions, and the myoelectrical silence. **METHODS:** The participants performed several series of trunk flexion-extension movements, which were repeated 2 months postpartum. The position of the lumbar spine was recorded using an electromagnetic motion capture system. EMG activity was recorded by a surface EMG system and expressed as a percentage of a submaximal reference contraction. **RESULTS:** Antepartum measurements showed a decrease (relative to control and postpartum measurements) in lumbar maximum flexion ($52.5 \pm 10.5^\circ$ vs $57.3 \pm 7.7^\circ$ and $58.7 \pm 8.6^\circ$; $p < .01$), the percentage of lumbar flexion during forward bending ($56.4 \pm 5.6\%$ vs $59.4 \pm 6.8\%$ and $59.7 \pm 5.6\%$; $p < .01$), and the time keeping maximum levels of lumbar flexion ($35.7 \pm 6.7\%$ vs $43.8 \pm 5.3\%$ and $50.1 \pm 3.7\%$; $p < .01$). Higher levels of erector spinae activation were observed in pregnant women during forward bending ($10.1 \pm 4.8\%$ vs $6.3 \pm 2.4\%$ and $6.6 \pm 2.7\%$; $p < .01$) and eccentric contraction ($12.1 \pm 5.2\%$ vs $9.4 \pm 3.1\%$ and $9.1 \pm 2.9\%$; $p < .01$), as well as a shortened erector spinae myoelectric silence during flexion. **CONCLUSIONS:** Pregnant women show adaptations in their patterns of lumbar motion and erector spinae activity during trunk flexion-extension. These changes could be associated with the genesis of pregnancy-related low back pain, by means of biomechanical protection mechanisms against the increase on abdominal mass and ligamentous laxity.

KEYWORDS: Electromyography; Erector spinae; Flexion relaxation phenomenon; Low back pain; Lumbar region; Pregnancy.

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Effect of Exercise Duration on Subsequent Appetite and Energy Intake in Obese Adolescent Girls.

Masurier J, Mathieu ME, Fearnbach SN, Cardenoux C, Julian V, Lambert C, Pereira B, Duclos M, Boirie Y, Thivel D
Int J Sport Nutr Exerc Metab, 2018 Nov 1;28(6):593-601. doi: [10.1123/ijsnem.2017-0352](https://doi.org/10.1123/ijsnem.2017-0352). Epub 2018 Aug 1.

ABSTRACT

There is a growing interest regarding the effect of exercise on appetite and energy intake in youth. While the role of exercise intensity has been a primary focus of study, the effect of exercise duration on subsequent food intake has not been fully examined in obese adolescents. On three separate mornings in a randomly assigned order, obese adolescent girls ($n = 20$) aged 12-15 years old were asked to perform a rest session (control, CON) or two cycling sessions for 20 (EX20) or 40 min (EX40) set at their ventilatory threshold. Absolute and relative energy intake were measured from an ad libitum lunch meal 30 min after rest or exercise and appetite feelings assessed using visual analogue scales throughout the day. Hunger, satiety, and prospective food consumption were not significantly different between conditions. Absolute energy intake (kcal) did not differ between conditions, while relative energy intake on EX40 (571 ± 381 kcal) was significantly lower than during CON (702 ± 320 kcal; $p < .05$) and EX20 (736 ± 457 kcal; $p < .05$). Fat ingestion (in grams) was significantly lower on CON (7.8 ± 3.2 g) compared with EX20 (10.3 ± 4.6 g; $p < .01$). Protein intake (in grams) was higher on EX20 (37.0 ± 16.6 g) compared with both CON (29.5 ± 11.7 g; $p < .01$) and EX40 (33.1 ± 10.9 g; $p < .05$). However, the percentage of total energy derived from each macronutrient was not different between conditions. Obese adolescent girls do not compensate for an acute bout of exercise set at their ventilatory threshold by increasing energy intake, regardless of the exercise duration.

KEYWORDS: Food intake; Hunger; Pediatric obesity; Physical activity; Satiety.

Manual therapy for unsettled, distressed and excessively crying infants: a systematic review and meta-analyses.

Dawn Carnes, Austin Plunkett, Julie Ellwood, Clare Miles
BMJ Open, 2018;8:e019040. doi: [10.1136/bmjopen-2017-019040](https://doi.org/10.1136/bmjopen-2017-019040)

ABSTRACT

Objective: To conduct a systematic review and meta-analyses to assess the effect of manual therapy interventions for healthy but unsettled, distressed and excessively crying infants and to provide information to help clinicians and parents inform decisions about care. **Methods:** We reviewed published peer-reviewed primary research articles in the last 26 years from nine databases (Medline Ovid, Embase, Web of Science, Physiotherapy Evidence Database, Osteopathic Medicine Digital Repository, Cochrane (all databases), Index of Chiropractic Literature, Open Access Theses and Dissertations and Cumulative Index to Nursing and Allied Health Literature). Our inclusion criteria were: manual therapy (by regulated or registered professionals) of unsettled, distressed and excessively crying infants who were otherwise healthy and treated in a primary care setting. Outcomes of interest were: crying, feeding, sleep, parent-child relations, parent experience/satisfaction and parent-reported global change. **Results:** Nineteen studies were selected for full review: seven randomised controlled trials, seven case series, three cohort studies, one service evaluation study and one qualitative study. We found moderate strength evidence for the effectiveness of manual therapy on: reduction in crying time (favourable: -1.27 hours per day (95% CI -2.19 to -0.36)), sleep (inconclusive), parent-child relations (inconclusive) and global improvement (no effect). The risk of reported adverse events was low: seven non-serious events per 1000 infants exposed to manual therapy ($n=1308$) and 110 per 1000 in those not exposed. **Conclusions:** Some small benefits were found, but whether these are meaningful to parents remains unclear as does the mechanisms of action. Manual therapy appears relatively safe.

Effect of maternal pre-pregnancy BMI and weekly gestational weight gain on the development of infants.

Chao Li, Lingxia Zeng, Duolao Wang, Shaonong Dang, Tao Chen, Victoria Watson and Hong Yan
Nutrition Journal, 2019;18:6 <https://doi.org/10.1186/s12937-019-0432-8>.

ABSTRACT

OBJECTIVE: The aim of the present study is to identify the average effect across different time points and to specify the time effects of maternal pre-pregnancy BMI and weekly gestational weight gain on the mental development and physical growth of infants. **METHODS:** The present cohort study used a repeated measures study design that began in 2004 with follow up at 3, 6, 12, 18, and 24 months of age. The participants were a subset from a controlled, cluster-randomized, double-blind trial. Bayley Scales of Infant Development (BSID) were used to estimate the mental development of infants. A generalized estimating equation linear model was used to estimate the effects of maternal BMI and weight gain. **RESULTS:** The average effect of maternal BMI and weight gain on the weight for age Z scores (WAZ), length for age Z scores (LAZ) and mental development index (MDI) across the different time points of infants was significant. In addition, the maternal BMI and weight gain were positively and significantly associated with the WAZ and LAZ in infants of different ages. However, the effect of weekly gestational weight gain was significant only during the earlier period of life (3 months, Coefficient: 11.15, 95%CI: 4.89-17.41). **CONCLUSIONS:** Our results indicate positive effects of pre-pregnancy and prenatal nutrition on the physical growth of infants. Weekly gestational weight gain of the pregnant women had a positive effect on the mental development of the infants, but this effect appears to decline over time.

KEYWORDS: Development of infants; Maternal pre-pregnancy BMI; Weekly gestational weight gain.

The Effect of Stabilization Exercises on Pain, Disability, and Pelvic Floor Muscle Function in Postpartum Lumbopelvic Pain: A Randomized Controlled Trial.

Teymuri Z, Hosseinfar M, Sirousi M
Am J Phys Med Rehabil., 2018 Dec;97(12):885-891. doi: [10.1097/PHM.0000000000000993](https://doi.org/10.1097/PHM.0000000000000993).

ABSTRACT

OBJECTIVE: The effect of stabilization exercises on pain, disability, and pelvic floor muscle function in postpartum lumbopelvic pain. **DESIGN:** This is a single-blind, randomized controlled trial. **SETTING:** This study was performed at the physiotherapy clinic, Zahedan University of Medical Science, from January to November 2017. **PARTICIPANTS:** Thirty-six multiparous women with persistent postpartum lumbopelvic pain were recruited at least 3 mos after delivery. **INTERVENTIONS:** Subjects in the training group (n = 18) received electrotherapy modalities and specific stabilizing exercises. The control group (n = 18) received only electrotherapy modalities. **MAIN OUTCOME MEASURES:** Pain, disability, and bladder base displacement (at rest and pelvic floor muscles contraction) were measured through visual analog scale, Oswestry Disability Index questionnaires, and transabdominal ultrasound imaging respectively at baseline and after 6 wks of intervention. **RESULTS:** Between-groups comparison showed significant improvement in pain, disability, and bladder base displacement in the training group ($P < 0.05$). In within-group comparison, training group had significant difference for all variables ($P < 0.05$). In the control group, pain and disability had significant difference ($P < 0.05$), whereas bladder base displacement had no significant change ($P < 0.05$). **CONCLUSIONS:** The stabilizing exercises can remarkably improve pain, disability, and pelvic floor muscles function in postpartum lumbopelvic pain.

Clinical Trial Registry: NCT03030846.

Screen media activity and brain structure in youth: Evidence for diverse structural correlation networks from the ABCD study.

Paulus MP, Squeglia LM, Bagot K, Jacobus J, Kuplicki R, Breslin FJ, Bodurka J, Morris AS, Thompson WK, Bartsch H, Tapert SF. *Neuroimage*, 2019 Jan 15;185:140-153. doi: [10.1016/j.neuroimage.2018.10.040](https://doi.org/10.1016/j.neuroimage.2018.10.040). Epub 2018 Oct 16.

ABSTRACT

The adolescent brain undergoes profound structural changes which is influenced by many factors. Screen media activity (SMA; e.g., watching television or videos, playing video games, or using social media) is a common recreational activity in children and adolescents; however, its effect on brain structure is not well understood. A multivariate approach with the first cross-sectional data release from the Adolescent Brain Cognitive Development (ABCD) study was used to test the maturational coupling hypothesis, i.e. the notion that coordinated patterns of structural change related to specific behaviors. Moreover, the utility of this approach was tested by determining the association between these structural correlation networks and psychopathology or cognition. ABCD participants with usable structural imaging and SMA data (N = 4277 of 4524) were subjected to a Group Factor Analysis (GFA) to identify latent variables that relate SMA to cortical thickness, sulcal depth, and gray matter volume. Subject scores from these latent variables were used in generalized linear mixed-effect models to investigate associations between SMA and internalizing and externalizing psychopathology, as well as fluid and crystallized intelligence. Four SMA-related GFAs explained 37% of the variance between SMA and structural brain indices. SMA-related GFAs correlated with brain areas that support homologous functions. Some but not all SMA-related factors corresponded with higher externalizing (Cohen's d effect size (ES) 0.06-0.1) but not internalizing psychopathology and lower crystallized (ES: 0.08-0.1) and fluid intelligence (ES: 0.04-0.09). Taken together, these findings support the notion of SMA related maturational coupling or structural correlation networks in the brain and provides evidence that individual differences of these networks have mixed consequences for psychopathology and cognitive performance.

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