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CASE SERIES

The successful chiropractic care of pediatric patients with chronic constipation: A case series and selective review of the literature

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Summary

Introduction: Chronic constipation is a common condition in the very young and the very old. So much so that approximately $800 million is spent on laxatives in the United States each year. Constipation is such a common problem in the pediatric population that it is the second most referred problem to the pediatric gastroenterologist and accounts for 25% of all visits. Given the many anecdotes and testimonials on the successful care of pediatric patients with constipation but the few documenting this in the scientific literature, we hope to contribute to evidence-based practice with this case series presentation.
Methods: We describe through a case series presentation the successful outcome of chiropractic care in pediatric patients with chronic constipation. All three patients were under 2 years of age with bowel movements ranging from once per week to every 3–4 days. Previous unsuccessful care involved dietary changes and the use of cod liver oil or mineral oil under the auspices of medical care.
Results: Following a trial of fullspine chiropractic care characterized as high velocity low amplitude thrusts and the activator technique, the patients responded to care immediately with improved bowel movements. Spanning a period of care of 3 weeks to 3 months in the three patients, there was an increase in frequency of bowel movements to once every 1–2 days. Furthermore, the bowel movements were described as soft without the accompanying straining, pain and rectal bleeding.
Conclusion: This study contributes to evidence-based practice on the chiropractic care of children with constipation.

Introduction

The elimination of food waste from the body is a common and simple daily occurrence for most

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individuals. Even so, between 5% and 28% of all children experience great difficulty with elimination of food waste, which is often accompanied with pain, fear, and avoidance.[1–3] The symptoms of constipation include infrequent or difficult evacuation of the feces. In the medical community, it is generally accepted that regular bowel movements consists of 3—4 eliminations per week. Frequencies less than this is indicative of constipation.[4] However, other healthcare providers with a holistic approach to patient care may classify constipation as anything less than one bowel movement per day.[4] Constipation is such a common problem in the pediatric population that it is the second most referred problem to the pediatric gastroenterologist and accounts for 25% of all office visits.[1–3] Most cases of constipation are diagnosed as ''functional'' as opposed to one with an organic origin (i.e., endocrine disorders, neoplasms, etc.).[5]

The ever increasing use of complementary and alternative medicine (CAM) in adults is also reflected in CAM use by children.[6,7] According to Spigelblatt et al.[8] and Lee et al.,[9] chiropractic stands as the most popular type of CAM therapy for children. In fact, adult CAM users are 3 times more likely to use CAM for their children compared to non-CAM users.[8] To date, the best estimate on the use of chiropractic services by children has been provided by Lee et al.[9] and placed at approximately 30 million visits per year. To the best of our knowledge, no data exists on what proportion of these visits constitute complaints for constipation. Van den Berg et al.[10] found the prevalence of functional constipation in children to vary from 0.7% to 29.6% with a median of 8.9%. The large variation in prevalence has been attributed to variations in sample size, different methods of data collection and the lack of a uniform definition to classify constipation. Regardless, it is a common problem. Given the many anecdotes and testimonials on the successful care of pediatric patients with this disorder[11,12] and the lack of documentation in the scientific literature in support of this phenomenon,[13–20] we present in a case series the successful chiropractic care of three pediatric patients with chronic constipation. By doing so, we aspire to contribute to the paucity of evidence that chiropractic care is effective in children with this problem.

Case series

Case report #1

The first case involved a 21-month-old 15 kg male infant with complaints of constipation since birth. His bowel movements occurred every 3—4 days with his feces described by his mother as hard and large enough to occasionally cause rectal bleeding. Eventually, fear and avoidance was associated with the task of defecation. Unsuccessful medical treatment consisted of increased fluid and fiber intake, ingestion of Lansoyl (a mineral oil) and cod liver oil along with elimination of dairy from his diet. History of trauma or a with familial history of constipation was denied.

On initial observation, the patient was a happy, thriving infant in the 95th upper percentile for his weight and length. The infant's prone posture revealed a short right leg by 3/4″ and a superior right iliac crest when compared to the left. Passive range of motion (ROM) in the lumbopelvic region was symmetric and full. Ortolani's test and infant reflexes were unremarkable. Static and motion palpation of the spine revealed dysfunctional motion at the C_{1-2}, at the T_{6-7} and L_{2-3} functional spinal units (FSUs). There were visible signs of discomfort by the infant in response to digital palpation of hypertonic paraspinal musculature at these levels, indicative of tenderness to palpation. Further static and motion palpation revealed the right posterior superior iliac spine (PSIS) as posterior inferior when compared to the left side. Due to the infant's agitation, no other tests were performed. Vertebral subluxations were diagnosed at the C_1 vertebral body (VB), at the L_2 VB and at the right ilium. The course of care involved the use of high velocity, low amplitude (HVLA) type thrusts and the activator technique. The treatment frequency was scheduled at 3 times a week for 3 weeks, followed by twice a week for 3 weeks, and eventually abated to weekly visits dependent on the patient's response to care. On the first visit, an HVLA type thrust was applied to the left posteriority of the C_1 VB, to the L_2 VB and to the right ilium. Note that similar types of care have been described for the care of the adult. However, the magnitude of the thrust applied to this patient and others of similar age and body habitus are modified (i.e., decreased) due to the child's immature neuromusculoskeletal system. The care employed resulted in an immediate response. Following this initial care, the patient's mother described her son's bowel movements as daily but still painful. The patient was cared for with HVLA type thrusts to sites of vertebral subluxations over the scheduled course of care. Following 2 months of care, the infant was experiencing regular (i.e., to once every 1—2 days) and painless bowel movements. Within this time period, the patient's feces continued to have a hardened consistency until dairy and wheat were eliminated from his diet as prescribed by the attending chiropractor. Long-term follow up 1 year later

revealed an infant with consistent, soft, painless bowel movements at frequency of every 1—2 days.

Case report #2

The second case was a 7-month-old female infant with a complaint of constipation since the age of 2 months. Her bowel movements occurred every 3 days and associated with severe straining and pain. Her feces were described by her mother as ''hard and pellet-like.'' Vegetable and fruit solids were introduced at 5 months of age with avoidance of cow's milk. Despite these attempts, the patient continued to suffer from constipation as described above.

On visual inspection, the patient's colour, tone, and development appeared normal. Postural evaluation noted a right gluteal fold deviation to the right indicating a right ilium subluxation. Static and motion palpation further confirmed the right ilium subluxation. A mild restriction on right cervical rotation was noted and upon further segmental examination (i.e., static and motion palpation), C_1 VB and T_4 VB subluxations with accompanying paraspinal muscle hypertonicity were discovered. Infant reflexes appeared normal.

A course of care was scheduled at twice a week for 3 weeks. The first set of adjustments was directed to the atlas VB and right ilium subluxation with the activator instrument. At the second visit the patient's mother revealed her daughter as having bowel movements without straining at every 1—2 days. Chiropractic care continued for the full duration of 3 weeks as scheduled. The chiropractic care rendered was as described above (i.e., activator technique to sites of vertebral subluxation). At 1-year follow-up, the infant continued to have normal and unstrained bowel movements every 1—2 days.

Case report #3

The third case was a 21-month old female child with encopresis and severe constipation characterized as bowel movements at once a week since the age of 10 months. Furthermore, the patient's bowel movements were described as ''very painful and traumatic.'' The patient's mother indicated that she would have to ''coach'' and reassure her daughter while defecating in order for her baby to have a bowel movement. On occasion, these were accompanied with rectal bleeding. Solids were introduced to the patient's diet at age 4 1/2 months and cow's

Table 1 Summary of case series presented.

Age (months)	Gender	Presenting complaint	Spinal care	Technique	Treatment freq	Length of care	Follow-up comments
21	Male	BM[a] every 3—4 days; feces hard and large causing rectal bleeding. Unsuccessful medical treatment of ↑fluid and fiber intake, ingestion of Lansoyl and cod liver oil	Fullspine	Activator methods	3×/week for 3 weeks followed by 2×/week for 3 weeks and then abated to weekly visits	2 months	One year follow-up has infant with consistent, soft, painless bowel movements at frequency of every 1—2 days
7	Female	BM every 3 days and associated with severe straining and pain; feces are ''hard and pellet-like.'' Increase intake of vegetable and fruit in diet and elimination of cow's milk was unsuccessful	Fullspine	Activator methods	2×/week for 3 weeks	3 weeks	One-year follow-up, normal and unstrained bowel movements every 1—2 days
21	Female	BM once a week since the age of 10 months; BM described as ''very painful and traumatic'' and accompanied with rectal bleeding. Previous care was mineral oil intake	Fullspine	Activator methods		2 months	Three-year follow-up resulted in BM daily

[a] BM, bowel movement.

Table 2 Normal bowel movements in children.

Age group	Bowel movements per week	Bowel movements per day
0–3 months: breast fed	5–40	2.9
0–3 months: formula fed	5–28	2.0
6–12 months	5–28	1.8
1–3 years	4–21	1.4
More than 3 years	3–14	1.0

milk at 10 months of age. The pediatrician prescribed mineral oil supplementation to address the patient's constipation with no positive results.

The examination procedure continued over the course of 1 week to facilitate infant rapport and confidence. Postural evaluation was unremarkable but static and motion palpation examination revealed a subluxated sacrum and $L_{3\text{-}5}$ spinous process deviations. These subluxations were accompanied with increased hypertonicity in the lumbar erector spinae muscles and at the quadratus lumborum regions, bilaterally. No abnormalities were detected with respect to infant reflexes.

Care was employed using an HVLA type thrust to sites of subluxations at the L_4 and L_5 VBs and to the sacrum. This resulted in an immediate bowel movement. Within 10 days, the patient's mother reported that her daughter was having daily bowel movements but still accompanied with severe straining and fear. With continued care, the patient continued to improve. Two months since initiating care, the patient's bowel movements became more comfortable and within 3 months her constipation resolved. Long-term follow-up at 3 years since initiating chiropractic care revealed the child to have normal healthy bowel movements.

A summary of the cases series is presented in Table 1.

Discussion

One study estimated an overall prevalence of 14.7% for constipation in the United States although the exact prevalence is unknown.[21] In the pediatric population, constipation affects 3% of preschool children and approximately 1–2% of school aged children.[22] It has been estimated that approximately 2.5 million visits are made each year for this problem, with adults >65 years of age making the largest proportion of these visits. In children, constipation accounts for 5% of outpatient visits to pediatricians and 25% to gastroentorologists.[23,24] The problem is of such gravity that approximately $800 million is spent on laxatives each year.[25,26] With respect to gender distribution in the pediatric population, the condition varies with age. In preschoolers and younger, there is no gender bias. However, at prepuberty, the condition is more common in boys than girls. After puberty, girls are 3 times more likely to suffer from constipation than boys. A familial relationship has been suggested from the findings that constipation occurs more commonly in children if a parent or sibling experienced the condition.[27]

What is constipation?

Parents generally refer to their child as having constipation with respect to the character and consistency of their child's stool rather than the frequency at which stool is passed. With this is mind, constipation cannot be defined solely on the frequency of defecation since children typically have varying frequencies. The normal frequency of bowel movements is provided in Table 2 as per Baker et al.[23] Based on an international committee, an operational definition of chronic constipation has been defined as a child having at least 2 weeks of the following, ''scybalous, pebble-like hard stools for the majority of the stools or firm stools for two or fewer times per week'' and without the presence of structural, endocrine or metabolic diseases.[28]

Etiology of constipation

Common explanations of functional constipation in childhood involve the following. The child has difficulty with the expulsion of stool and there is drying of the fecal mass in the colon as well as withholding.[27] The difficulty in defecating has been theorized to have a pain-based etiology where the child withholds the stool to avoid pain and discomfort. A vicious cycle ensues and large amounts of stool build up in the patient's sigmoid colon and rectum. When it is eventually passed, more severe pain is experienced by the patient with further postponement to avoid the pain. In time, this behavior becomes an automatic response. This pain-based etiology is supported by the finding that 63% of children with encopresis have a history of painful defecation beginning before 36 months of age.[29] Moments of psychosocial stress such as the birth of a sibling, parental disharmony, or new surroundings may

Table 3 Pathophysiologic causes of constipation in children.

Cause of constipation	Example
Structural abnormalities	Anal disorders, colonic strictures, pelvic masses
Endocrine, metabolic and immunologic conditions	Celiac disease, cystic fibrosis, diabetes mellitus, Hypercalcemia, hyperparathyroidism, hypokalemia, hypothyroidism, pregnancy, uremia
Neuromuscular conditions	Aganglionosis, infant botulism, pseudo-obstruction disease
Neurogenic conditions	Cerebral palsy, hypotonia, spinal cord abnormalities
Drugs	Antacids, anticholinergics, antidepressants, phenobarbital, sympathomimetics

result in a ''control issue'' with the child. Since the child cannot change these events, he or she may start to ''control'' their bodily functions, leading to constipation.[27] Other causes of functional constipation may also include inadequate dietary fiber intake, excessive cow's milk intake, dehydration and inflammatory bowel disease.

Factors affecting the defecatory mechanism such as preventing the feces from entering the rectum or the feces remains in the rectum far too long will cause constipation. Pathogenic causes of constipation are provided in Table 3.[24] Obviously, these pathophysiologic conditions would necessitate the appropriate referral to share in the care of the patient. Again, we advocate for a thorough history and physical examination of the child to rule in or rule out the necessity of a referral to a medical specialist.

The medical approach to the patient with constipation

According to Mason et al.,[27] the treatment for constipation includes education, clean-out, medication maintenance, and follow-up. Education includes informing the parents that the process may take as long as 6—12 months. This is done to increase the likelihood of a successful outcome and to avoid unrealistic expectations by the child's parents. Cleaning out involves the removal of hard stools or impaction by using high doses of oral medications or a series of enemas. As a general rule, oral clean-outs are preferable for the child. Possible exceptions include those with neuromuscular disorders and anorectal malformation. For children who refuse high doses of oral therapy, a nasogastric administration of polyethylene glycol/electrolyte solution is recommended. The patient is then placed on ''maintenance management'' where oral laxatives are administered along with a highfiber diet, increased fluids, behavior modification, and reinforcement. A simple formula for the recommendation of daily grams of fiber intake is the ''patient's age in years plus 5'' for patients up to the age 20 years. Failure in treatment can occur in up to 20% of children with constipation. Those who are more likely to fail are children with a long history of constipation or those who have found secondary gain.[30]

Implications to chiropractic care

A selective review of the literature was performed using Pubmed [1965—2007] and MANTIS [1965—2007] on the topic of the chiropractic care of children with constipation. We used the search terms ''constipation AND chiropractic'' and limited our search to patients under the age of 18 years and literature only in the English language. In the interest of brevity, the literature describing direct clinical care is provided in Table 4. Holbrook[31] published a commentary on the chiropractic care of children with constipation with a selective review of the literature using MANTIS and Pubmed. Our review of the literature further builds upon this review with a commentary. Ressel and Rudy,[32] following an evaluation of some 650 children, described a new subluxation pattern which they labelled as the pelvic distortion subluxation complex or PDSC. They theorized that PDSC was associated with complaints involving constipation in addition to many other childhood disorders. Hines[33] described the role of fiber in the successful management of children with constipation. In one of the early publications on this subject, an unknown author addressed the issue entitled, ''Constipated to Death''.[34] With respect to the types of technique employed, it would seem that children benefit from the care they received regardless of technique as they range from the generic HVLA thrust type to the ''non-force techniques'' such as in cranial work or the use of handheld instruments such as in the activator technique. We appreciate the efforts of previous authors in documenting the success of chiropractic care in patients with constipation. Case reports allow for biological plausibility through the accumulation of similar cases and establish a pattern of care that may assist clinicians with similar cases. However, as

Table 4 Clinical characteristics of previous reports.

Reference	Patient age	Gender	Chiropractic intervention	Treatment characteristics	Outcome
Quist and Duray[13]	8-year-old	Male	Thompson Technique directed to the sacrum with external massage of the abdomen	Eight visits at 2 times per week for 2 weeks	Consistent bowel function
Rowell and Stone[14]	21-month-old	Male	The diagnosis of intussusception was made during fluoroscopic X-ray examination. Treatment consisted of barium enemas and eventual surgery		Resolution of abdominal pain, constipation, and lethargy
Hunt[15]	3-month-old	Female	Cervical spine adjustments using the Laney instrument	Two times per week for 2 weeks, followed by once per week for 2 weeks to once every 2 weeks for 1 month	Following the 5th visit, the patient's constipation improved. From no bowel movements over a 1 week period to one or more bowel movements daily
Gossett[16]	13-year-old	Female	Fullspine diversified technique and cranial technique	Over a course of 12 weeks at undetermined frequency	Bowel movements at 1—2 times per week to bowel movements every 1—2 days
Killinger and Azad[17]	11-month-old	Male	Upper cervical specific (toggle recoil) technique to subluxation of the atlas vertebra	Approximated at 2 times per week for 3 weeks	Regular bowel movements without the aid of enemas
Eriksen[18]	5-year-old	Female	Grostic technique (upper cervical)	Three visits in a period of 3 weeks	Resolution of constipation
Marko[19]	10-month-old	Female	Fullspine chiropractic biophysics	Two visits over a 2 week period	Bowel movements occurred following the patient's second visit and after 2 weeks of care the patient's symptoms resolved
Hewitt[20]	7-month-old	Female	Fullspine diversified technique and cranial adjusting	Six visits in 2-week period	The patient's bowel function normalized to one to two soft, effortless stools per day

with all case reports, bias and confounders abound (i.e., natural history, placebo effect, etc.). In the cases reviewed, the techniques described were Upper Cervical, Biophysics, Grostic, and Diversified technique. The case series presented utilized the activator technique. The cornerstone of science is reproducibility. Given the heterogeneity of technique applied in the cases reviewed, not all clinicians may be familiar with the brand-name technique and would be unable to apply similar protocols of care. Secondly, Diversified technique is a generic description of chiropractic spinal manipulative therapy and there are as many variants of diversified technique as there are chiropractors. Therefore, there is uncertainty in the examination and treatment protocol applied in the cases presented under the banner of diversified technique.

Theories pertaining to the salutary effects (i.e., improvement in bowel movements) of the case series presented (and previous published literature) must address both the pathophysiology and mechanism of the vertebral subluxation complex. With respect to the pathophysiology, it is theorized that the presence of vertebral subluxation may lead to decreased mechanoreception, which in turn increases sympathetic tone. This is turn may cause vasoconstriction, sphincter constriction, and decreased peristalsis in the gastrointestinal (GI) system. The exact mechanism by which subluxation affects the autonomic nervous system (ANS) and hence the visceral system is not yet well understood. Korr[35] hypothesized that somatic dysfunction may affect the functioning of viscera innervated at various segmental levels. Sato,[36] in an animal model, performed several studies supporting the relationship between somatic afferents and ANS activity. For example, Sato found that sympathetic activation resulted from pinching the abdominal skin of the rat resulting in decreased gastric motility. Increased parasympathetic activation occurred from pinching the paws and an increase in gastric motility. The GI system is innervated sympathetically with preganglionic fibers from T_8 to L_2 spinal levels. The parasympathetic preganglionic input to the gut arises from the brain stem, via the vagus nerve, and from S_2 to S_4 sacral nerve roots. The vagus nerve exits the skull via the jugular foramen and lies in close proximity to the C_1 transverse process and mastoid process of the occiput. This provides for a mechanism by which a mechanical effect (i.e., spinal manipulation) may affect the vagus nerve and hence parasympathetic preganglionic input to the gut. In support of the notion that spinal manipulative therapy (SMT) affects ANS function, consider that recently Bakris et al.[37] described that manual correction of misalignments in the atlas vertebra was associated with reduced arterial pressure. According to the investigators, the sustained reductions in blood pressure were similar to the results of the use of two-drug combination therapy. McKnight and DeBoer[38] and Knutson[39] described similar findings. Decreased blood pressure in addition to heart rate and force of contraction are the effects of activating the parasympathetic innervation of the heart. This information may provide support for a segmental approach (i.e., upper cervical spine technique) to affecting the ANS. However, this information was provided to demonstrate the global effects of SMT on the ANS (i.e., SMT directed to the upper cervical with effects on anatomy beyond the cervical spine).

Given the growing popularity of CAM therapies for children, interest and concern on the safety and effectiveness of the various types of CAM therapies (including chiropractic) are on the rise. In the case series reported, the parents did not report any adverse reactions to the type of chiropractic care provided. Vohra et al.[40] recently performed a systematic review of the literature on adverse events associated with the use of SMT in children. Given that chiropractors use this mode of care more than any other healthcare provider, it was not surprising that a majority of the cases cited involved chiropractic. Criticisms have been made of this article[41–43] and are summarized here. Using eight electronic databases with the literature search spanning some 104 years, the authors identified 14 cases reporting direct adverse events with pediatric SMT. Ten of the 14 cases were attributed to chiropractic. Over half of these cases were minor, self-limiting and did not require hospitalization or the attention of a medical doctor. The cases documenting severe adverse events were fraught with confounders in the way of a pre-existing condition or a history of traumatic injury that made cause and effect inferences to chiropractic questionable. Vohra et al.[40] identified ''a further 20 cases of delayed diagnosis and/or inappropriate provision of chiropractic care.'' These were from references without merit in the hierarchy of evidence. As commented by Alcantara,[41] ''Ceteris paribus — all other things being equal'' — it would seem more appropriate to conclude that there is insufficient evidence to indicate that the use of SMT in children is harmful.

Further on the subject of confounders, we caution the reader that with all case reports/case series there lacks generalizability to clinical practice in similar patients. Placebo effects are common in gastrointestinal diseases and there seems to be no clear differences between placebo effects in functional gastrointestinal diseases and organic gastrointestinal disease.[44] In addition to placebo, the

reported improvements in this case series and those of the reviewed literature are confounded by regression to the mean, the demand characteristics of the clinical encounter, subjective validation and the natural history of the disorder. There are indications that the natural history of constipation involves a high rate of resolution with only a 20% failure rate.[30] Loening-Baucke[45] described 174 children less than or equal to 4 years of age with chronic constipation. They reported a 63% recovery rate despite the lack of care. Van den Berg et al.[46] found similar findings with 47 children (60% boys; median age, 3.5 months) who had constipation in their first year of life. Six months after initial evaluation, 69% of the children had recovered with a relapse in 15% of these children. They concluded that most infants with severe constipation recover after 6 months. They further indicated that early therapeutic intervention seems to beneficially contribute to the resolution of constipation. In the case series presented, barring a control group, randomization, etc.; one cannot delineate the role of confounders as discussed. However, consider the temporal association between the chiropractic care provided and the resolution of constipation in these patients. Furthermore, despite the lack of detailed mechanism of effect on the effects of spinal manipulation on the ANS, there are indications that such an effect does exist as discussed above. This gives credence to the notion of biological plausibility and coherence. Based on our review of the literature, the case series presented seem at face value, to be consistent with previously published literature. With further research involving higher level designs, information on these cause and effect variables in addition to dose—response relationships, strengths of association, etc. will be more apparent.

Despite its lack of generalizability and the attitude that case reports/case series merely provide anecdotal evidence, they still provide an important contribution to evidence-based practice. Sackett et al.[47] incorporated descriptive surveys and case reports as part of the levels of evidence hierarchy for evidence-based medicine. Case reports and case series provide a description of the clinical encounter between doctor and patient and provide a starting point for further research. Case reports describe the clinical encounter from examination and evaluation, to diagnosis and prognosis, the intervention and outcome in the care of the patient. They also focus on the ethical dilemmas encountered in patient care; the use of technology may address educational as well as administrative concerns. Case reports stimulate further research and "help develop practice guidelines and critical pathways."[48] They actually illustrate "how clinicians integrate the best available research evidence, clinical experience, and patient choice".[48] Case reports therefore are not anecdotal.

With the above considerations and given the many techniques available and practiced by chiropractors, further research should aspire to determine the optimum treatment protocols for patients with constipation. Where in terms of the effectiveness hierarchy should we place the non-force techniques versus cranial techniques versus HVLA thrust type techniques in the care of these patients? What are the patient characteristics that will respond best to the eclectic practice of chiropractic? Furthermore, there is the question of what critical region(s) of the spine should be addressed in such patients. Should one approach a patient with full-spine care or regional care? Or is combination therapy (i.e., spinal adjustments with adjunct therapy such as dietary modification, etc.) the optimum approach? Presently, there are those that question the need for segmental specificity in the delivery of manual therapy.[49] To date, these issues and many more remain largely unexplored. We advocate for more research that should begin from the "bottom up" of research design from case report/case series, case control and prospective studies to eventually, the randomized controlled clinical trials. We also advocate for research that incorporates the holistic and vitalistic approach to patient care. Case reports/case series provide that starting point.

Conclusion

We described the successful outcome in pediatric patients with chronic constipation following chiropractic care. This case series provides supporting evidence on the effectiveness and safety of chiropractic care in patients with constipation. We advocate for further research in this field.

Conflict of interest statement

There are no conflicts of interest with regards to the authors of this paper, the writing of this paper and the reported findings.

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DMM contributed to data collection and literature review. JA and DMM were involved with data analysis and interpretation. JA and DMM produced the preliminary draft of the manuscript. JA and DMM made all critical revisions for important intellectual content and were responsible for creating the final version of the manuscript. All authors have approved the final version of the manuscript.

References

1. Leung AK, Chan PY, Cho HY. Constipation in children. *Am Fam Physician* 1996;**54**:611—8.
2. Youssef NN, Di Lorenzo C. Childhood constipation: evaluation and treatment. *J Clin Gastroentol* 2001;**33**:199—205.
3. Borowitz SM, Cox DJ, Tam A, Ritterband LM, Sutphen JL, Penberthy JK. Precipitants of constipation in early childhood. *J Am Board Fam Pract* 2003;**16**:213—8.
4. Bricklin M. *Encyclopaedia of natural healing*. 2nd ed. Burnaby, BC: Alive Publishing Group; 1997. p. 616.
5. Seth R, Heyman MB. Management of constipation and encopresis in infants and children. *Gastroenterol Clin North Am* 1994;**23**:621—36.
6. Eisenberg DM, Davis RB, Ettner SL, Appel S, Wilkey S, Van Rompay M, et al. Trends in alternative medicine use in the United States, 1990—1997. *JAMA* 1998;**280**:1569—75.
7. Vessey JA, Rechkemmer A. Natural approaches to children's health: herbals and complementary and alternative medicine. *Pediatr Nurs* 2001;**27**:61—7.
8. Spigelblatt L, Laine-Ammara G, Pless IB, Guyver A. The use of alternative medicine by children. *Pediatrics* 1994;**94**(6 Pt 1):811—4.
9. Lee AC, Li DH, Kemper KJ. Chiropractic care for children. *Arch Pediatr Adolesc Med* 2000;**154**:401—7.
10. Van den Berg MM, Benninga MA, Di Lorenzo C. Epidemiology of childhood constipation: a systematic review. *Am J Gastroenterol* 2006;**101**:2401—9.
11. Andersen GD. Diet and the environment. *Dynamic Chiropractic* 1997;**15**(March 24 (7)). p. 24,43.
12. Butler G. Constipation, the awesome creator of disease. *Dynamic Chiropractic* 1995;**13**(September 12):C8.
13. Quist DM, Duray SM. Resolution of symptoms of chronic constipation in an 8-year-old male after chiropractic treatment. *J Manipulative Physiol Ther* 2007;**30**:65—8.
14. Rowell RM, Stone K. Intussusception in chiropractic practice: a case report. *Top Clin Chiropr* 2001;**8**:55—9.
15. Hunt JM. Upper cervical chiropractic care of an infant with irregular bowel function: a case study. *J Clin Chiropr Pediatr* 2000;**5**:312—4.
16. Gossett LJ. The effect of chiropractic care on Rett syndrome: a case report. *J Clin Chiropr Pediatr* 1999;**4**:248—52.
17. Killinger LZ, Azad A. Chiropractic care of infantile colic: a case study. *J Clin Chiropr Pediatr* 1998;**3**:203—6.
18. Eriksen K. Effects of upper cervical correction on chronic constipation. *Chiropr Res J* 1994;**3**:19—22.
19. Marko SK. Case study. The effects of chiropractic care on an infant with problems of constipation. *Chiropr Pediatr* 1994;**1**:23—4.
20. Hewitt E. Chiropractic treatment of a 7-month-old with chronic constipation: a case report. *Chiropr Tech* 1993;**5**:101—3.
21. Stewart WF, Liberman JN, Sandler RS, Woods MS, Stemhagen A, Chee E, et al. Epidemiology of constipation (EPOC) study in the United States: relation of clinical subtypes to sociodemographic features. *Am J Gastroenterol* 1999;**94**:3530—40.
22. Felt B, Wise CG, Olson A, Kochhar P, Marcus S, Coran A. Guideline for the management of pediatric idiopathic constipation and soiling. Multidisciplinary team from the University of Michigan Medical Center in Ann Arbor. *Arch Pediatr Adolesc Med* 1999;**153**:380—5.
23. Baker SS, Liptak GS, Colletti RB, Croffie JM, Di Lorenzo C, Ector W, et al. Constipation in infants and children: evaluation and treatment. A medical position statement of the North American society for pediatric gastroenterology and nutrition. *J Pediatr Gastroenterol Nutr* 1999;**29**:612—6.
24. Abi-Hanna A, Lake AM. Constipation and encopresis in childhood. *Pediatr Rev* 1998;**19**:23—30.
25. Arce DA, Ermocilla CA, Costa H. Evaluation of constipation. *Am Fam Physician* 2002;**65**:2283—90.
26. Sonnenberg A, Koch TR. Physician visits in the United States for constipation: 1958—1986. *Dig Dis Sci* 1989;**34**:606—11.
27. Mason D, Tobias N, Lutkenhoff M, Stoops M, Ferguson D. The APN's guide to pediatric constipation management. *Nurse Pract* 2004;**29**:13—21.
28. Rasquin-Weber A, Hyman PE, Cucchiara S, Fleisher DR, Hyams JS, Milla PJ, et al. Childhood functional gastrointestinal disorders. *Gut* 1999;**45**(Suppl. 2):II60—68.
29. Lewis LB, Rudolph CD. Practical approach to defecation disorders in children. *Pediatr Ann* 1997;**26**:260—7.
30. Buttross S. Encopresis in the child with a behavioral disorder: when the initial treatment does not work. *Pediatr Ann* 1999;**25**:317—21.
31. Holbrook B. Chiropractic treatment of childhood constipation: a review of the literature. *J Clin Chiropr Pediatr* 2005;**6**:427—43.
32. Ressel O, Rudy R. Vertebral subluxation correlated with somatic, visceral and immune complaints: an analysis of 650 children under chiropractic care. *J Vert Sublux Res* 2004;**2004**:1—23.
33. Hines C. The role of fiber in the management of intestinal disorders. *J Chiropr* 1989;**26**:64—8.
34. Unknown. Constipated to death!. *J Aust Chiropr Assoc* 1976;**10**:8—9.
35. Korr IM. Somatic dysfunction, osteopathic manipulative treatment, and the nervous system: a few facts, some theories, many questions. *J Am Osteopath Assoc* 1986;**86**:109—14.
36. Sato A. The reflex effects of spinal somatic nerve stimulation on viscera; function. *J Manipulative Physiol Ther* 1992;**15**:57—61.
37. Bakris G, Dickholtz Sr M, Meyer PM, Kravitz G, Avery E, Miller M, et al. Atlas vertebra realignment and achievement of arterial pressure goal in hypertensive patients: a pilot study. *J Hum Hypertens* 2007;**21**:341—2.
38. McKnight ME, DeBoer KE. Preliminary study of blood pressure changes in normotensive subjects undergoing chiropractic care. *J Manipulative Physiol Ther* 1988;**11**:261—6.
39. Knutson GA. Significant changes in systolic blood pressure post vectored upper cervical adjustment vs resting control groups: a possible effect of the cervicosympathetic and/or pressor reflex. *J Manipulative Physiol Ther* 2001;**24**:101—9.
40. Vohra S, Johnston BC, Cramer K, Humphreys K. Adverse events associated with pediatric spinal manipulation: a systematic review. *Pediatrics* 2007;**119**:e275—83. [Epub 2006 Dec 18].
41. Alcantara J. Adverse events associated with pediatric spinal manipulation: what does the data really show? *World Federation of Chiropractic 9th Biennial Congress*. 2007.

42. Alcantara J. Manual therapy in children. Role of the evidence-based clinician. *J Man Manipulative Ther* 2007;**15**(4): 247—9.
43. Rosner A. Adverse events in the manipulation of pediatric patients: flaws in a systematic review. *Pediatrics* 2007;**119**: 1261—4.
44. Musial F, Klosterhalfen S, Enck P. Placebo responses in patients with gastrointestinal disorders. *World J Gastroenterol* 2007;**13**:3425—9.
45. Loening-Baucke V. Constipation in early childhood: a patient characteristics, treatment and long term follow-up. *Gut* 1993;**34**:1400—4.
46. Van den Berg MM, van Rossum CH, de Lorijn F, Reitsma JB, Di Lorenzo C, Benninga MA. Functional constipation in infants: a follow up study. *J Pediatr* 2005;**147**:700—4.
47. Sackett DL, Straus SE, Richardson WS, Rosenberg W, Haynes RB. *Evidence-based medicine: how to practice and teach EBM*. 2nd ed. Edinburgh, Scotland: Churchill Livingstone Inc.; 2000. p. 173—7.
48. McEwen I, editor. *Writing case reports: a how-to manual for clinicians.*. 2nd ed. Alexandria, VA: American Physical Therapy Association; 2001.
49. Huijbregts P. Prediction rules: time to sacrifice the holy cow of specificity. *J Manual Manipulative Ther* 2007;**15**:5—8.