VISCERAL AND NEURAL MANIPULATION IN CHILDREN WITH CEREBRAL PALSY AND CHRONIC CONSTIPATION: FIVE CASE REPORTS

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ABSTRACT

The purpose of this case study series was to assess improvement in the quality of life, function, and colonic motility before and after visceral and neural manipulation in five children with cerebral palsy and chronic constipation who had Gross Motor Function Classification System (GMFCS) levels of IV and V. Quality of life and function were assessed using the CPCHILD and the WeeFIM respectively. The CPCHILD and WeeFIM were administered at baseline before the intervention, after the intervention, and again at least three months post intervention. Colonic motility was assessed radiographically at baseline and post-intervention utilizing ingested radiopaque markers (Sitz markers). Bowel movement number and quality were assessed through family diaries. All subjects showed some degree of improved quality of life and function on the CPCHILD and WeeFIM at the end of the intervention. Colonic motility assessed radiographically before and after treatment was not statistically significant due to the small number of participants; however, the number of bowel movements increased during the study for 100% of the participants. Visceral and neural manipulation modalities may provide clinicians and families with an alternative to medications and/or other more invasive interventions.

Keywords: Cerebral palsy, Visceral and neural manipulation, Constipation

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INTRODUCTION

In many children with cerebral palsy (CP), constipation is chronic, adversely affecting their quality of life. Treatment may require invasive measures beyond diet such as medications, digital stimulation, enemas, and hospitalization. Children with cerebral palsy and chronic constipation often have resulting comorbidities such as increased frequency of seizures, abdominal pain, decreased appetite, increased gastro-esophageal reflux, increased irritability, hospitalizations, and possible need for surgery. Use of a noninvasive modality to improve gut motility has the potential to significantly improve the quality of life and function for these children with complex health care needs. A previously published study found visceral manipulation in conjunction with myofascial release allowed a child to have her first spontaneous bowel movement in many years indicating potential benefit for this intervention in these children.[1]

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Cerebral palsy

Cerebral palsy (CP) refers to a group of permanent disorders in the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain.[2] Comorbidities may include chronic pain (75%), epilepsy (35%), intellectual disability (49%), musculoskeletal problems (28%), behavioral disorder (26%), sleep disorder (23%), functional blindness (11%), and hearing impairment (4%).[3]

CP is the most common physical disability, with a prevalence of greater than 2.1 per thousand live births in high income countries.[4] Children with CP have a 30-year survival rate of 90%.[5] Epidemiologic and genetic risk factors for cerebral palsy include: preterm delivery, coexisting congenital anomaly (maldevelopment), probable genetic causes, bacterial and viral intrauterine infection, altered fetal inflammatory or thrombophilic response (stroke), fetal growth restriction, higher-order pregnancy, risk greater with monozygosity and in vitro fertilization, tight nuchal umbilical cord, prolonged shoulder dystocia, placental pathology, e.g. chorioamnionits, funisitis, vitilitis, inborn errors of metabolism, male:female ratio 1.3:1.[6]

Motor impairment function in children can be classified utilizing the Gross Motor Function Classification System (GMFCS) which is a validated way of clearly communicating about children's gross motor function.[7]

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Constipation

Chronic constipation is a common comorbidity in children with cerebral palsy. Chronic constipation can decrease quality of life by negatively affecting the physical, mental, and social well-being of patients.[8] The etiology of constipation is usually multifactorial. The Rome Criteria II has been used to define functional constipation in children 4 years and older. Diagnostic criteria includes: At least 12 weeks, which need not be consecutive, in the preceding 12 months of two or more of: (1) Straining in >1/4 defecations; (2) Lumpy or hard stools in >1/4 defecations; (3) Sensation of incomplete evacuation in >1/4 defecations; (4) Sensation of anorectal obstruction/blockade in >1/4 defecations (5) Manual maneuvers to facilitate >1/4 defecations (e.g., digital evacuation, support of the pelvic floor); and/or (6) <3 defecations/week. Loose stools are not present, and there are insufficient criteria for IBS.[9]

Methods of enhancing colonic transit include medications, diet, stimulation, movement, etc. Surgical options such as total colectomy or cecostomy may need to be considered if other treatment options fail. In one study of 58 children with cerebral palsy, 74% had chronic constipation. In 25 children with cerebral palsy and chronic constipation, 52% had slow movement of stool through the proximal segment of the colon, 36% through the left colon-rectum, and 12% through the rectum.[10] In another study, 23 out of 38 children with cerebral palsy had constipation and/or difficulty passing their stools. Ten children with chronic constipation and 17 of the 28 children without constipation showed a slow movement of stool through the large intestine.[11]

Visceral and neural manipulation

Visceral and neural manipulation is a hands-on therapy which works with specific tissues in the body, including nerves, fascia, joints, bones, organs and the vasculature.[12,13] The treatments are gentle, and do not cause damage. Visceral and neural manipulation has clinically been used as a gentle, non-invasive treatment for constipation.

Visceral manipulation is a manual therapy that encourages normal mobility, tone, and inherent tissue motion of the viscera and their connective tissues attachments. Strains in the connective tissue of the viscera can result from surgical scars, adhesions, illnesses, chronic postural patterns, abnormal neural activity or injury. The body must move around these fixed, abnormal points of tension, which leads to functional and structural problems. By restoring mobility of the organs, a person can have less pain, improved joint mobility, and improved organ function, such as improved digestion, elimination and respiration.[12–15]

Neural Manipulation is a manual therapy that assesses and treats neural and dural restrictions in relationship to the cranium and spinal hard frame. A nerve only functions correctly when it is able to move freely within its surrounding structures. Thus, by freeing local neural restrictions, the related structures, including muscle, blood supply, bone or joint, function better. Neural manipulation helps to relieve pain, improve mobility and thus, improve function.[13,16,17]. Neural manipulation has been shown to be effective in persons with peripheral nerve issues and pain[18–27], though no research has been done with Barral's neural manipulation in children with cerebral palsy.

In a pilot study (unpublished), Zollars and Burtner found that neural and visceral manipulation is a gentle, pain-free alternative treatment to the treatment of babies with torticollis, effectively improving neck range of motion, development, and social-emotional functioning.[28] With both visceral and neural manipulation, the therapist palpates the body to determine the location of the tissue restrictions. These restrictions can be in and around organs, connective tissue, joints, nerves, or vasculature. Once the restrictions are located, the therapist mobilizes the identified tissue with her hands. This type of manual therapy has been utilized successfully to treat children and adults with a variety of musculoskeletal, neural, functional and visceral disorders.[12,15,18]

Visceral and neural manipulation for constipation

Only one study has been published which utilized visceral manipulation in conjunction with myofascial release in children with cerebral palsy and constipation. One child in this study had her first spontaneous bowel movement in many years following myofascial release and visceral manipulation.[1]

However, a few studies have been published addressing the effectiveness of visceral manipulation on constipation in the adult population. Archambault-Ezenwa, Brewer, and Markowski describe a case of a 41 year-old woman with 8 year history of severe constipation, rectal pain, and levator ani spasm requiring use of daily laxatives and enemas twice a month in order to have a bowel movement.[29] This patient had previously undergone 10 sessions of internal rectal biofeedback and electrical stimulation, incorporating strengthening, resting, and coordination exercises. Visceral manipulation was a key part of this patient's treatment, along with home exercises, self-massage and bowel management changes. Her rectal pain with defecation decreased from 5–7 to 1–2/10, pain with urination resolved, she decreased MiraLax use by 50%, and she did not require the use of a water enema. She reported normal stool formation and no straining with defecation. McSweeney et al 2011 studied the effects of visceral manipulation of the sigmoid colon on lumbar pain in 15 subjects, and found that manipulation of the sigmoid colon immediately decreased the pain in the L1 segment of the subjects.[30]

Other researchers have studied connective tissue manipulation and massage in adults with constipation. A randomized controlled trial[31] showed connective tissue manipulation and lifestyle advice were superior in reducing symptoms of constipation and improving Quality of Life (QOL) as compared with lifestyle advice alone for patients with chronic constipation. Studies utilizing other types of massage in adults with chronic constipation have shown benefit outlined in a meta-analysis by Ernst[32] and studies by Lamas et al[33] and Harrington and Haskvitz.[34]

Other modalities have been studied in children with chronic constipation. Silva et al[35] studied the effects of muscular training, abdominal massage and diaphragmatic breathing in thirty-six 4–18 year old children with functional constipation as compared with a control group of patients with the same demographic treated medically (with laxatives). After 6 weeks of treatment, the frequency of bowel movements was higher in the physiotherapy group than in the medication group. In one study there was no evidence that the effects of abdominal massage could be sustained after the intervention ended.[36] Finally, Tarsuslu et al,[37] studied thirteen children with CP and chronic constipation. Most of the children were GMFCS level IV or V. One group had just medical intervention. One group had osteopathic and medical interventions. In both groups constipation improved with no significant differences between the two groups.

CPCHILD and WeeFIM tools

Two validated quality of life instruments were used in this study; the WeeFIM and the CPCHILD. The Functional Independence Measure for Children (WeeFIM) is a validated measure which assesses the functional abilities and need for assistance in children six months to seven years with disabilities. It can also be used in children beyond age seven in the presence of delays in functional development. It is a minimum data set that measures severity of disability. The WeeFIM contains eighteen items organized in six domains (self-care, transfers, locomotion, sphincter control, communication, and social cognition), with each item scored on a seven level ordinal scale ranging from complete or modified independence to complete dependence. The higher the score, the more independent the person. The WeeFIM is supported by an extensive and growing national database with benchmark values for comparative reporting of progress and outcomes. Reliability studies have shown robust intra-rater and inter-rater correlations.[38] The two participating physicians in the study were trained to administer the WeeFIM.

The CPCHILD measures caregivers' perspectives on the health status, comfort, well-being, functional abilities and ease of caregiving of children with severe developmental disabilities. It was developed to measure the effectiveness of interventions intended to improve or preserve these outcomes for children with severe disabilities, including non-ambulant children with severe cerebral palsy, and traumatic or other acquired brain injuries.[39,40] The CPCHILD is recognized as a clinically useful, current, validated measurement, and is a standard of care in the field of cerebral palsy and rehabilitation. The higher the score, the higher health-related quality of life for the child and family.

METHODS

Study participants and setting

Nine children were recruited from local New Mexico clinics, and the Cerebral Palsy Parent Association. In this paper, five of the nine children's case studies will be discussed. Inclusion criteria included participants 2–18 years of age with a diagnosis of static encephalopathy (cerebral palsy) secondary to brain injury before one year of age, non-ambulatory GMFCS levels IV or V, and a diagnosis of constipation according to Rome II criteria modified for children with cerebral palsy. Exclusion criteria included children in spica casts, children with coagulation abnormalities or blood dyscrasias, abdominal aneurysms, and no major surgery within six weeks before the first therapy visit.

Parents of participants gave informed consent as per the institutional protocol. Each child participated in a 12 session (24 week) therapy program in the private office of a therapist experienced in visceral and neural manipulation. All participants remained on their usual bowel medications during the study period and no major changes were made in diet. The study lasted approximately nine months. The actual treatments at the therapist's office occurred every two weeks for a total of 6 months. Each treatment lasted 45 min. At the beginning of the session, the therapist determined the tissue with the greatest tension and shortening. Treatment focused on the abdomen and related aspects of the nervous system.

Measurements

Quality of life and function were assessed using the CPCHILD and the WeeFIM respectively. The CPCHILD and WeeFIM were administered at baseline before the intervention, after the intervention, and again at least three months post intervention.

Colonic motility was assessed radiographically at baseline and post-intervention utilizing ingested radiopaque markers (Sitz markers). Each Sitz capsule contained twenty-four radio-opaque markers of three different shapes. A capsule was given once daily every twenty-four hours for three consecutive days. On the fourth day, a regular flat abdominal X-ray was taken of the child. Per the radiologist, the radiation exposure was low when compared to other every day risks. Use of radio-opaque markers is an established and safe technique.[11] X-rays were taken pre and post therapy per protocol. The X-ray was read for retained markers.[11] These same pre and post-therapy flat plate radiographs were analyzed for stool retention.

The family diary form was developed specifically for this project. Bowel movement number and quality were assessed through the use of family diaries. The parent recorded stool quality including consistency, color, size and frequency. Standardized drawings of stools were provided to facilitate description of consistency and color (Modified Bristol Stool Form Scale).[41] Other items were recorded including: interventions for constipation, such as medications and/or treatments, appetite as measured by Likert scale[42], vomiting/reflux episodes, quality and duration of sleep, seizure frequency and duration, and Wong Baker Faces Pain Scale.[43,44] The diary was filled out daily for one week at baseline, 8, 16, 24 and 36 weeks.

RESULTS

Visceral/neural manipulation patient cases

Case A

Case A was an eight-year-old male, who was born full term and adopted from China. At the age of 15 months, he suffered a stroke during a heart catherization procedure to repair a Tetralogy of Fallot. After that event, he had mixed tone quadriplegia (GMFCS IV): his left side was more involved than his right side. He also had swallowing difficulties as well as reflux and an overactive gag reflex. He was unable to take much food by mouth, so a gastrostomy tube (G-tube) was placed for nutrition. The reflux was treated with a protein pump inhibitor and erythromycin. He also had right hip surgery when he was 4 years of age. He was non-ambulatory, and was able to sit on a mat table, but could fall over if not supported, so he was often transported in a wheelchair with postural seating supports. He communicated mostly by facial expressions. His trunk was hypotonic, with athetosis of both upper extremities. He had significant right hip pain with his right hip limited in hip flexion, abduction and external rotation. He also gagged and vomited frequently. Prior to the study, he had to be given glycerin suppositories three times/week to promote bowel movements.

Palpation findings and results of treatment

Initially, the greatest area of tension in his body was his right hip. This tension created tightness in the cecum, ascending colon and liver. After two sessions treating the right sciatic, obturator and superior gluteal nerves, his right hip pain diminished, and he was able to bear weight on his leg in standing. The next major areas of tension were his left vagus nerve (at the anterior stomach and jugular foramen in the cranium) and heart. After two sessions, he started to have larger bowel movements, though still required suppositories. The mother was instructed in gentle massage for the colon and the ileocecal valve. After six treatments, he started to have bowel movements without suppositories. His major tension continued to be at the left vagus nerve at the lesser curvature of the stomach and left jugular foramen. However, he also started to show tension in the sigmoid colon and hypogastric plexus. This part of his colon improved with neural manipulation treatment to his right hip and visceral treatment to proximal colon. The vomiting and gagging lessened. Originally, the right hip pain aggravated the cecum and ileocecal junction. At the end of the research study, he did not have a change in bowel movement frequency but was able to have bowel movements without suppositories. His WeeFIM scores increased from the intake (41) to 8 weeks during treatment (42) then increased to (53) three months post treatment. CP Child scores increased from intake (47.8) to 8 weeks (62.3), then decreased three months post treatment (47.4).

Case A's neurophysiological trauma of the stroke during his heart surgery affected the ability of his autonomic nervous system (ANS) to regulate. Even though the treatments helped, the underlying trauma of that surgery continued to recur, indicated by the tension in his left vagus nerve. With trauma at such a young age, this child was continually challenged with regulatory and safety issues. Thus, a custom designed home program administered by his loving parents helped to calm his digestive system.

Case B

Case B was an eighteen-year-old male high school student, GMFCS V with spastic quadriplegia of unclear etiology. He lived with his supportive family. As a baby, he underwent a Nissen fundoplication and G-tube placement. He used a wheelchair with a seating system but could sit in a chair by himself in a chair and could take some steps with assistance. His trunk and extremities had low tone and he sat with a posterior pelvic tilt. His hamstrings were very tight. He was non-verbal and did not have a communication device, but his parents knew when he was distressed. He did not sleep well, thrashed around in bed which made his parents think he was in pain, perhaps due to constipation. He was taken to the emergency room many times due to this pain. Prior to the study, he had seven bowel movements/week but needed frequent Miralax and suppositories or enemas once a week.

Palpation findings and results of treatment

The major area of tension for this young man was the lesser curvature of the stomach and beginning of the duodenum. His trunk tended to pull into flexion as if he was in pain. The scar tissue from his Nissen fundoplication procedure was very tight, as was the left vagus nerve. He did not make eye contact, would not tolerate touch, had increased tension in his pelvis, his legs were moving into adduction, and he wanted to leave treatment. There were concerns with sexual abuse at school. This was discussed with the parents, the attendant at the school was changed, a report was made to the proper authorities, and the mother started to be present at the school. After these changes, and treating the vagus nerve, he did not have pain for three weeks. At the fourth session, this young man's affect had changed considerably. After the alleged sexual abuse was addressed, this young man's belly and cranium softened, he had less pain and better bowel movements. The mother was instructed in treatment of the lesser curvature of his stomach, and for gentle massage of his small intestine. He still had difficulty sleeping and regulating his ANS, so continuing with a home program was helpful. The frequency of the bowel movements/week increased to eleven/week, and he occasionally required enemas. His WeeFIM scores increased from the intake (28) to 8 weeks during treatment (35) then decreased to (29) three months post treatment. CP Child scores increased from intake (48.1) to 8 weeks (59.2), then increased three months post treatment (60.3).

Case B's abnormal tightness in his vagus nerve possibly from the Nissen fundoplication surgery, was aggravated by emotional issues and alleged sexual abuse. In addition to the visceral and neural manipulation, part of the plan for this young man was finding an appropriate way to communicate his needs using an augmentative communication system.

Case C

Case C was a three-year-old male, GMFCS V, who suffered a traumatic brain injury caused by non-accidental trauma which resulted in spastic quadriplegia, left occipital contusion, left parietal subdural hematoma and bilateral retinal hemorrhages, CVI, and intractable seizures. He mistrusted people other than his caregivers. His body was pulled into a flexed fetal position. He had a G-tube. Also, he used a wheelchair with a seating system and was dependent in all activities. Medications included: Keppra, Protein Pump Inhibitor, Clonidine and Baclofen. Prior to the research study, he had bowel movements two times/week.

Palpation and findings

Case C's major area of tension were his vagus nerves, ANS and cranium constituting a "frozen" nervous system, with very little mobility or motility. With gentle treatment on these areas, he often had a seizure. He calmed to his mother's touch and voice. Talking and singing to him was essential as well as working very slowly and gently. He also had tension in his transverse, descending and sigmoid colon and the sacral and hypogastric plexuses innervating these areas. With the treatment, he was better at modulating his trauma response (not going into seizures, making more eye contact, smiling, not flexing up into a fetal position). His bowel movements were still inconsistent. He started to tolerate his other therapies more, and began to use a tricycle, and play with sitting and movement. Teaching his mother massage was helpful. The frequency of his bowel movements increased to three times/week, with the need for an occasional suppository. Also, his formula changed to Compleat formula during the research study. His WeeFIM scores increased from the intake (28) to 8 weeks during treatment (32) then decreased to (27) three months post treatment. CP Child scores increased from intake (58.4) to 8 weeks (71), then decreased three months post treatment (51.4).

The most helpful, therapeutic aspect for this boy was having consistent, familiar people touching and interacting with him. As he trusted the therapist more and more during the research study, and allowed more touch to his body, his nervous system relaxed for longer periods of time. This allowed for longer periods of decreased tension in his belly, less strained bowel movements and decreased seizure intensity.

Case D

Case D was a seven-year-old female, GMFCS IV, who incurred a traumatic brain injury caused by non-accidental trauma resulting in CP, CVI and a seizure disorder. She was adopted by wonderful, supportive parents and attended elementary school. Due to her original injury, she underwent a right craniectomy and the placement of a ventriculo-peritoneal (V-P) shunt. One month prior to treatment, she underwent a right derotational femoral osteotomy. She used a wheelchair for transportation and was beginning to weight bear using a Kidwalk assistive walker. She had a G-tube but was eating orally. Overall, she was quite a happy child, so that when she had pain, she clearly communicated her discomfort. Prior to the study, she had eleven bowel movements/week.

Palpation and findings

Case D's main areas of tension and restrictions included: cranial tension, left vagus nerve at the cardiac plexus, and the scar tissue from the V-P shunt, sigmoid colon and hypogastric plexus. The rest of the organs had fair to good motility and mobility. She had right hip pain. Treating the tension and length of the nerves of the hip helped with the pain. Midway through the study, she underwent left hip surgery and was put on Valium and Motrin for pain. At that point, she became even more constipated, and required "Smooth Move" senna tea. After the hip healed and she was taken off these medications, her bowel movements improved. Her WeeFIM scores increased from the intake (27) to 8 weeks during treatment (41) then increased to (44) three months post treatment. CP Child scores decreased from intake (47.8) to 8 weeks (43.6), then increased three months post treatment (54.2).

Case D's hip pain and the tension around the shunt caused her to pull into spinal flexion and her abdomen tightened. When the neural tension decreased, her visceral tightness and elimination lessened. At the end of the study, the frequency of her bowel movements increased to 13 times/week with the occasional need for an enema.

Case E

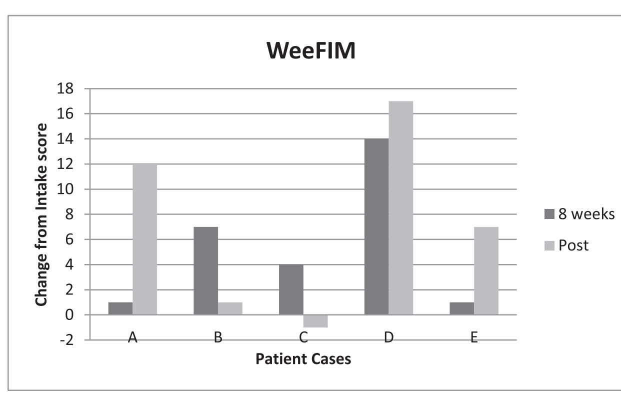
Case E was a four-year-old female, GMFCS IV who was a triplet, born at 25 weeks gestation. She underwent a V-P shunt which was revised ten times, and placement of a G-tube. She also had a hearing impairment, a cochlear implant, and a seizure disorder. She was able to take fifty percent of her nutrition orally. This young girl was able to sit and crawl by herself, was beginning to take some steps, and was able to verbally communicate. She had decreased central tone, and mildly increased tone in her extremities, greater on her right side. She had constipation, gagged frequently, occasionally vomited, and had head and neck pain. Medications included Keppra. Prior to the study, she had six bowel movements/week.

Palpation and findings

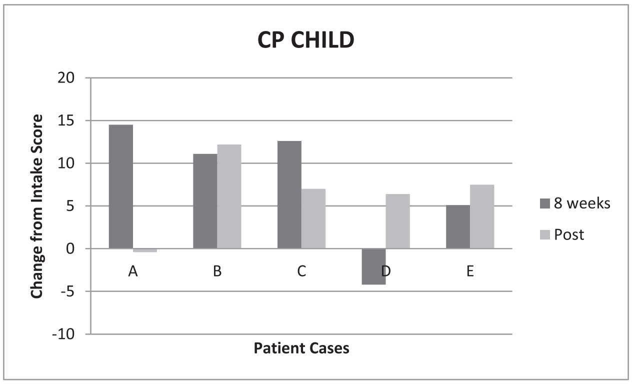
For Case E, tension was found in her left and right vagus nerves, and in the fascia at the left side of her neck at the shunt, and again as it entered the peritoneum. The stomach, transverse, descending and sigmoid colons were tight with decreased motility. After 4 sessions, the bowel movements became regular, and the tension was felt more in the cranium. Her cranium was very tight due to the scar tissue from all the surgeries; however, with cranial and neural manipulation the cranium began to expand, she had fewer headaches and less emotional outbursts. This young girl's constipation was mostly due to mechanical tension of the vagus nerves and the scar tissue from the shunt. Once those restrictions were released, her bowel movements improved. The secondary neural tension from the shunts, revisions, and from the initial brain insult improved also, as evidenced in improved gait, decreased pain, decreased emotional outbursts, and improved balance. At the end of the study, the frequency of her bowel movements increased to eight times/week. Her WeeFIM scores increased from the intake (65) to 8 weeks during treatment (66) then increased to (72) three months post treatment. CP Child scores increased from intake (68.6) to 8 weeks (73.7), then increased three months post treatment (76.1).

SUMMARY OF RESULTS

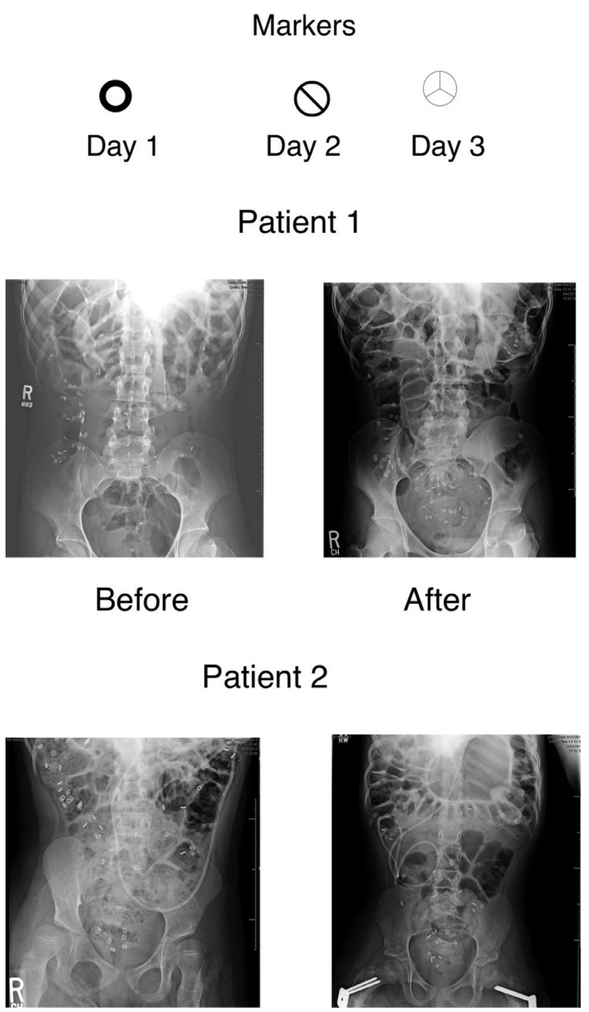
In summary, all five subjects showed some degree of improved function on the WeeFIM at the end of the intervention, but three out of five subjects did not maintain the improved function after three months on the follow-up assessments. Using the CPCHILD, four out of the five subjects showed some improvement in their quality of life at the end of the intervention and continued to improve for at least three months after the intervention. Three of the subjects had increased number of bowel movements at 8 weeks from baseline and three subjects had increased bowel movements for at least three months after the intervention. Colonic motility assessed radiographically was not statistically significant due to the small number of participants; however, the number of bowel movements increased during the study for 100% of the participants.



WeeFIM Scores for Patient Cases A-E. (Note: Intake/baseline score is 0).



CP Child Scores for Patient Cases A-E. (Note: Intake/baseline score is 0)



Abdominal Xrays with radiopaque markers before and after treatment regimen

Patient 1 is Case A and Patient 2 is Case D.

DISCUSSION

The majority of the children in our study showed some degree of improved quality of life and function on the CPCHILD and WeeFIM during and at the end of the intervention. Even though the five subjects had a diagnosis of cerebral palsy (GMFCS levels IV or V), and a diagnosis of constipation, each child was very different in their presentation. Some of the children had very high levels of spasticity which adversely affected the motility of their digestive systems. In addition, often these children were on many medications to control spasticity and seizures, which also promoted decreased motility of the intestines. Some children had medical and emotional trauma affecting their perception of touch and hands-on therapy as being safe. Some children had pain which affected the ability of the nervous and digestive systems to relax. When the cause of the pain was addressed (hip pain in Case A and D, stomach/vagal nerve pain in Case B, neural tension around shunt in Case D and E), the children's nervous systems relaxed, and intestinal motility improved. Also, hands-on techniques carried out by the families to assist the nervous and digestive systems helped to improve constipation between treatment sessions and after the conclusion of the study. Another consistent finding was that it was not enough to treat the organs themselves, but additionally the autonomic nervous system, often at the cranium, throughout the course of the vagus nerves and the sacral plexus. An important aspect of visceral and neural manipulation is the therapist's ability to assess each person individually by palpation, and to identify the parts of the body that require treatment. This palpation was particularly essential in this study, as most of the subjects were non-verbal, so they could not express which part of the body was causing discomfort.

CONCLUSION

Chronic constipation is a common condition which negatively affects the quality of life and function in non-ambulatory children with cerebral palsy. Visceral and neural manipulation is a noninvasive intervention can improve their quality of life and function. These interventions provide clinicians and families with an alternative to medications and/or more invasive interventions. Pediatric physical and occupational therapists may want to consider pursuing training in these modalities. Future research plans include the possible expansion of the number of subjects pending further funding.

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