

# Improvements in developmental delay in a female child following chiropractic care: a case report and selective review of the literature

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## ABSTRACT

**Objective:** To describe the improvement in developmental delay in a female child following age-appropriate chiropractic care for the assessment and reduction of vertebral and cranial subluxation. **Clinical features:** A three year four-month-old female was presented to clinic by her mother seeking help with concerns about communication and walking delay. Previous care included general practitioner visits and a speech therapist. Clinical assessment revealed she could partially manage two-year-old expected capacities. Additionally, vertebral and cranial subluxations were found. **Intervention and Outcome:** Age-appropriate chiropractic was delivered at seven visits over one month. Improvements in gross motor control, central sensitization, sleep, communication, balance, emotional regulation, and weight were noted. **Conclusion:** Chiropractic care involving touch and hold, cranial release and adapted diversified technique were associated with improvements in a child exhibiting developmental delay. Further research is warranted in this area including larger and more controlled sample groups utilizing validated testing tools.

**Key words:** developmental delay, chiropractic, pediatric, vertebral subluxation, spinal manipulation

## Introduction

Child development can be subdivided into four domains, including: motor, speech and language, social/emotional and cognitive. Development in each of these areas can progress as either typical or atypical with developmental delay occurring when a child does not achieve their milestones in these domains in comparison to peers of the same age.<sup>1</sup> Kim et al. explain that developmental disabilities caused by central nervous system dysfunction are termed neurodevelopmental disorders with these individuals exhibiting difficulties in areas such as physical, linguistic learning and behavior.<sup>2</sup> Delay may be noted in a single domain or more than one. If delay is observed in two or more domains under five years of age, the child may be termed as having global developmental delay.<sup>3</sup> This affects 1-3% of the population under five years of age, making it one of the most common conditions to present at pediatric clinics.<sup>4</sup> Piek and Dyck found that a child diagnosed with one developmental disorder is very likely to meet the criteria for another developmental disorder as well.<sup>5</sup>

Delay can be classified as mild (functional age <33% below chronological age), moderate (34-66% of chronological age) or severe (<66% of chronological age).<sup>3</sup> Alternatively, the delay is said to be significant if the child's performance is 1.5 standard deviations or more below age-expected norms.<sup>6</sup> Early detection of developmental delay is of utmost importance because early intervention can prevent or reduce sequelae. The Bayley-111 scale is most widely used for assessment however evidence is mounting that

use of the scale may lead to possible misclassifications.<sup>7</sup> The delay itself may be transient or sustained. If it is sustained, the child is at a higher likelihood to experience learning difficulties, behavioral issues and functional impairments in later life.<sup>6</sup> Risk factors associated with developmental delay include: poor maternal health during pregnancy, infections, birth complications, genetic characteristics, trauma, exposure to toxins, maltreatment and possibly low socioeconomic status.<sup>6</sup>

The prevalence of such delays is estimated to be as high as 5-20% and have shown a gradual trend upwards in recent years.<sup>7</sup> In a survey of children with developmental delay syndromes, over 65% of families reported current or past use of complementary and alternative healthcare options including chiropractic, diet modification and supplementation.<sup>8</sup> The literature is beginning to show indications that poor muscle tone is related to postural disorders as well as sensory-motor and coordination disorders. While current literature regarding chiropractic care of children suffering developmental delay is limited, the evidence suggests that chiropractic care may be beneficial for this population.<sup>8-12</sup>

Chiropractors and chiropractic students recognize that the central focus of chiropractic care is to assess for and reduce nerve interference, caused by vertebral subluxation, to enhance nervous system function and support the optimization of health and well-being.<sup>13-21</sup> The Australian Spinal Research Foundation conceptually define

subluxation as “a diminished state of being, comprising of a state of reduced coherence, altered biomechanical function, altered neurological function and altered adaptability.”<sup>22</sup> A vertebral subluxation has been recognized as a complex of functional and/or structural changes in articulations of the spine and pelvis that compromise neural integrity and may influence organ system function and general health.<sup>23</sup> A vertebral subluxation represents an altered state of afferent input which can lead to maladaptive changes in central neural plasticity resulting in dysfunction.<sup>24,25</sup> A vertebral subluxation may be characterized in various ways from a traditional misalignment, occlusion of an opening, pressure or impingement, and interference to the transmission of mental impulse, to tight vertebral muscles, reduced intervertebral movement and tenderness to touch.<sup>23,25</sup> Vertebral subluxation correction is thought to be achieved through chiropractic adjustments (specific spinal segment contact high velocity low amplitude thrusts as opposed to manipulation with non specific contacts of spinal regions)<sup>25</sup> that are typically manually performed. Cranial patterns of subluxation have been reported in the literature for decades<sup>26,27</sup> and textbooks are published on their assessment and correction.<sup>28-30</sup> Chiropractic adjustments in infants and children are appropriately modified for age and stage of development.<sup>31</sup>

The purpose of this case report is to describe the improvement, using the CARE guidelines<sup>32</sup>, in developmental delay in a female child following age-appropriate chiropractic care for the assessment and reduction of vertebral and cranial subluxation.

## Case report

### History

A three year, four month old female was brought to the clinic by her mother with concerns about “communication delay and walking delay.” She further noted concerns with learning difficulties, achieving milestones, digestion/feeding, general co-ordination and balance, crawling/walking, hip/leg/knee/foot co-ordination, flexibility, and muscle tone (low). The child was co-managed with a general medical practitioner (GP) and speech pathologist and has a family history of siblings with autism.

Pregnancy history noted 4/5 anxiety levels (1=low, 5=high), 4/5 stress at work and home, fear of labour 4/5, 5/5 supported at home, 5/5 back pain through pregnancy, had a physically active job, didn't sit more than four hours a day, 5/5 morning sickness, no cigarette, alcohol, vaccines, or drugs used during pregnancy.

The child was the fourth live birth for the mother and was a planned Caesarean section. The mother noted she had high blood pressure, birth was in her place of choosing (hospital), that the fetus was in a breech presentation, and that it had

been engaged low in the pelvis for longer than three weeks pre delivery. The infant cried immediately after delivery, was reported as jaundiced, had a Vitamin K injection, and they remained in hospital for four days.

During the first eight weeks post-partum the mother reported that the infant recovered and slept well post birth, skin to skin was not achieved after birth, and the infant woke herself to have a feed. The infant's muscle tone was reported as average, regularly arched her back and head, and was diagnosed with “clicky hips.” The infant was formula fed, experienced colic/persistent crying, and experienced constipation with a lot of gas. There were no report of secondary exposure to tobacco smoke, no reported dermatological issues, or any medicines taken.

For the first two to twelve months the child preferred to play by herself, did not bang her head or have quick changes in temperament, and did engage in direct eye contact. She was transported in a pram predominantly and did not like tummy time. She did not reach their milestones at similar times to their peers. She continued to be formula fed. She had episodes of ear infections, tonsillitis, 39C plus temperatures, skin rashes, colic/reflux/excessive crying and persistent colds/flu. She began to use words at five and a half months, sat on their own at eight months, began crawling at eight months, and unsteadily walked with a very broad-based gait at three years. She had been diagnosed with global developmental delay with genetic duplications.

Between one and three years she experienced one hospitalization due to dehydration associated with gastritis. Her mother reported no reactions to her standard vaccination program. She reported the child has quick mood changes, tantrums, easy frustration, shying away from loud sounds. Physically she reported balance problems, walking problems, clumsiness, motion sickness and learning difficulties. Related to her immune system function, she reported the child has had chronic colds and the flu, ear infections/tonsillitis, upper respiratory infections, food sensitivities, and bowel challenges (diarrhea/constipation).

Relating to drawing, writing, and throwing, she is reported as right hand dominant, and uses eyes/ears/feet without a dominance displayed. She does not like to sit still for short periods and is hesitant on stairs. She frequently drops things, walks regularly on her toes, likes a heavy blanket, is weaker or tires easily compared to others and has difficulty with buttons or laces.

### Clinical findings

Initial clinical assessment revealed a height of 96.5 cm (50th centile) and weight 12.5kg (25th centile). Vertebral subluxations were noted at C0/1, C5(P), T4, T9, and S1(P).

Hypertonic erector spinae were present between T9 & T11 on the right, and T12 & L2 on the left. Cranial restrictions were noted at her left frontal, bilateral sphenoid, bilateral parieto-occipital, occipital and sagittal suture. Her muscle stretch reflexes at C5, 6, 7 and L4, S1 were 2/2.

In terms of gross motor development, she could partially manage two-year-old expected capacities. This included squat and spring, bending and touching toes, but was unable to complete her associative arm swinging. She was unable to jump with two feet, heel or toe walk, or climb onto the table unaided. In terms of balance, she was able to walk carrying a toy, but was unable to stand with eyes closed or walk in a straight line.

A schedule of two visits per week for three weeks as recommended, including the initial visit.

#### **Therapeutic intervention—chiropractic care**

**22-9-20 Visit 1:** Her position of ease was seated on her mother's lap, so spinal and cranial assessment was completed in that position. No impulse was delivered on any vertebral subluxations found. However the cranial distortion patterns listed were gently facilitated manually towards improvement.

**28-9-20 Visit 2:** She slept well post adjustment and the mother reported that the father thought her walking was smoother. Seated cranial work was completed; touch and hold contact on an atlas AIRA listing and T4 and T12 were adjusted with an anterior thumb lift move. Home care was given including tummy time, using an inflated ball to lie on for variation in prone movement patterns.

**1-10-20 Visit 3:** Her mother noticed she's a lot calmer, movements and walking are better, sleeping better and waking up better; she stood with her eyes shut which she'd never done before. Seated assessment and adjustment on mother's lap. Right PI Innominate mobilization, T12 T3 anterior thumb lift, ASLA touch and hold, seated bilateral cranial scan.

**6-10-20 Visit 4:** Her mother reported she was moving and sleeping better, as well as moving and talking more. Seated assessment and adjustment on mother's lap. S2 Touch and hold, T12 6 2 anterior thumb lift, ASR touch and hold, seated bilateral cranial scan.

**9-10-20 Visit 5:** Her speech was noticeably improved. Seated assessment and adjustment on mother's lap. S3PR Touch and hold, L1LP touch and hold, T3 anterior thumb lift, ASLA touch and hold, seated bilateral cranial scan. Her mother said "I'm amazed at how well she lets you touch her head — no one else can do that, I have more challenges with that, especially doing her hair — although that has got

better" and "she's trying to jump".

**13-10-20 Visit 6:** She was talking more, using more sign language. Her gait continues to get less broad; sleeping a lot better, bending knees and ankle more effectively; her mother reported she had a two and a half hour sleep at lunchtime after her first visit, then went to bed at 9pm (never goes to bed that early), slept through, woke up happy, not holding her head. Seated assessment and adjustment on mother's lap. S3PR touch and hold, ASLA touch and hold, T9 and 3 anterior thumb lift, bilateral seated cranial scan. Review next visit

#### **Follow up and outcomes**

**20-10-20 Visit 7- REVIEW VISIT:** Her mother said the staff at the Early Childhood Development program noticed significant changes; the speech therapist noticed her speech had improved. She jumped for the first time this week. She was picking up sign language quicker and her mother says she was responding more accurately to questions. Mother reported that she was "moving her head a lot more freely, bending over and picking things up more easily." Her walking pattern is noticeably better — instead of swinging legs through with stiffness of her lower limb, she was activating hip, knee and ankle flexion and extension.

Review clinical assessment revealed a height of 97 cm (50th centile) and weight 13.7kg (25th centile). Vertebral subluxations were noted at C1 (ASLP), C5(LP), T2, L3, and S1(LP). Cranial restrictions were noted at the front-maxillary junction, bilateral sphenoid, occipital and sagittal suture.

Parent reported global health improvements included: sleep quality improved, waking brighter, general mood improvements, general behavior improvements, number of meltdowns decreased, posture improved, improved walking and general movement, pain or discomfort has decreased, strength/stamina has increased, fruit and vegetable intake increased, cold or flu frequency/duration decreased, mental energy levels increased, vitality improved, fewer run down days, physical energy improved, bounced back better from fatigue/stress. Her mother strongly agreed with the statements: "I feel my child is healthier and has stronger resilience," "I feel my child has a higher level of health overall," and "I feel more confident with my health decisions for my family."

Following discussion with her mother regarding care options a further six weekly visits was decided upon. Improvements noted over this time included improved eye yoking, climbing regularly (including into the pantry with the strength to open food containers which she couldn't previously do), and starting to run.

At her second review her mother decided to continue care on a twice a month basis. Her lived experience for her daughter under care is reported below as of July 2021.

“(child) was diagnosed with global delayed development. Before (child) started getting adjusted, she was able to stand for very short periods of times, but it was never long. Her mode of transport was she used to walk upright on her knees or crawl, her speech was very delayed, and she would only say a few words but that wasn’t very many. She was always very unsettled and quite stiff in her movements, she used to fall a lot too. As for getting her hair done or touching her head, she would never let you do this as it was way too sensitive for her. I noticed a massive improvement after her 1st adjustment, that she was a lot happier, her movements were a lot smoother, and she started talking more. It wasn’t long till she started walking, using more words, sleeping better, eating better, and her overall health dramatically improved almost overnight. She has been getting adjustments regularly now and she is walking, running, talking more, and is gaining fast on all the things she was behind in, I would highly recommend this, for (child) it has been life changing on all fronts, we now have a much happier chatty active child now.”

## Discussion

Global health improvements were observed in a three-year-old female with delay in gross motor function, co-ordination and speech delays following a course of chiropractic care lasting three weeks. Care was warranted based on failure of the child to meet her milestones with appropriate timing and the clinical cranial and vertebral subluxation findings. Improvements included improved sleep, behavior, posture, general movement, and vitality.

Generally accepted therapies involved in the multidisciplinary approach to developmental delay include speech and language, physiotherapy, occupational therapy and behavioral therapy (psychology).<sup>3</sup> Although pharmacologic agents have proven effective in improving some of the symptoms related to developmental delay, there are concerns about the long-term use of antidepressant as well as stimulant medications in children with these disorders.<sup>8</sup>

Regarding chiropractic care, although a review of the literature revealed a limited number of case series and case reports, all yielded positive results regarding developmental delay. The current report used a combination of treatment protocols including: ‘touch and hold’, modified diversified technique, cranial release maneuvers and home exercise. Aspects of these approaches have been used in the past by previous reports<sup>8-11</sup>, although inclusion of other techniques such as Sacro-Occipital technique,<sup>9,10</sup> extremity adjusting,<sup>10</sup> craniosacral therapy<sup>10</sup> and instrument assisted adjusting<sup>11</sup>

have also shown positive results. In terms of duration of care, the current report is in line with previous reports which range from seven visits over twenty-four days<sup>10</sup> to ten visits over sixteen weeks<sup>11</sup> up to forty-four visits over eight months.<sup>12</sup>

Outcomes noted in previous work have ranged from improvement of concentration, focus and impulse control<sup>8</sup> to integration of primitive reflexes,<sup>9</sup> improvement in milestone achievement<sup>10</sup> and generalized improvement in delay. The current report shares improvements in speech and walking seen by Troy et al<sup>9</sup> in a similarly aged male who was also partaking in speech therapy at the time of care. Whereas the previously identified reports focused more on sensory integration, primitive reflexes, and milestone attainment as their main results, the current report also includes improvements in areas such as: sleep quality, mood improvement, posture and having an overall higher level of health. These quality-of-life markers are of interest as they could be seen as signs that improvement in developmental delay is resulting in a child that is thriving.

A noteworthy finding was that mention was made in two reports<sup>8,9</sup> that upper cervical and cranial release were seen to be pivotal in the reduction of delay symptoms. The current report includes cranial release as well as upper cervical release techniques which too resulted in improvement of delay markers.

Previously, the subluxation has been conceptually defined by The Australian Spinal Research Foundation as “a diminished state of being, comprising of a state of reduced coherence, altered biomechanical function, altered neurological function and altered adaptability.”<sup>22</sup> It represents an altered state of afferent input linked to lack of appropriate joint motion<sup>10</sup> potentially leading to maladaptive changes in central neural plasticity resulting in dysfunction.<sup>24,25</sup> The effect of the chiropractic spinal adjustment is to normalize these altered joint functions. This in turn may optimize afferent information received by the central nervous system through joint mechanoreceptors from the periphery.<sup>10,25</sup> If this can improve cerebellar input as well as input to the vestibular and then onward to the sensory and motor cortices, the higher centres will be able to integrate sensory and motor output allowing more precisely for improved engagement and adaptability with the environment.<sup>10,25</sup> The outcome of this could be improved motor development, cognitive function, and social interaction.

Cranial patterns of subluxation have been reported in the literature for decades.<sup>26,27</sup> It is hypothesized that cranial release techniques both restore optimum cranial motion which encourages normal flow of cerebrospinal fluid whilst simultaneously relieving reciprocal membranous



tension within the cranial structures such as the falx cerebri and tentorium cerebelli and reducing dural torsion.<sup>9</sup> These changes may result in a normalization of neurological transmission, promoting neuroplasticity and more appropriate somatosensory filtering, processing and sensorimotor integration.<sup>25</sup> It has been postulated by Troy et al<sup>9</sup> that by normalizing the sensorimotor integration and increased processing speed, the brain is able to process and integrate stimulation more efficiently potentially leading to normal brain maturation through improved cortical connectivity and synchronization.

### Limitations

Single case reports have inherent limitations. Foremost among these are the lack of a control group and the potential

for spontaneous remissions. Although the diagnosis of global developmental delay had been given, clinical assessment and improvement were not graded with the use of a formal assessment tool. Rather, improvements were gauged by observations made by parent and chiropractor. The reader is cautioned as generalization of these findings to larger groups cannot be concluded.

### Conclusion

Chiropractic care involving touch and hold, cranial release and adapted diversified technique were associated with improvements in a child exhibiting developmental delay. Further research is warranted in this area including larger and more controlled sample groups utilizing validated testing tools.

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