CASE REPORT

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Osteopathic Management of Pediatric Feeding Disorder, Oral Aversion, and Growth Faltering: A Case Report

Abstract

Growth faltering is a complex problem in the pediatric population and can result from multiple mechanisms, including inadequate caloric intake. Feeding difficulties are common among children with growth faltering and can present significant challenges for achieving adequate nutrition and weight gain, particularly when coupled with any degree of oral aversion. The patient in this case is a 21-month-old child with oral aversion, pediatric feeding disorder (PFD), and growth faltering who had failed to gain weight while receiving the standard of care. Upon transitioning his care to an osteopathic pediatrician, who incorporated osteopathic manipulative treatment (OMT) into his care, he demonstrated weight gain, which was sustained over the 8 months of this study. This case report demonstrates the potential benefit of OMT for children with PFD, oral aversion, and growth faltering.

Introduction

Growth faltering—formerly known as "failure to thrive"—is a complex problem in the pediatric population. It arises from the interplay of medical, developmental/behavioral, nutritional, and psychosocial factors resulting in undernutrition.[1] Worldwide, undernutrition is linked to around 45% of deaths among children under 5 years of age.[2] Within the United States, the prevalence of growth faltering ranges from less than 2% to greater than 10%. In medically-complex children, refugee children, children in low-income households, and children born at lower birthweight, these rates are higher.[1] Children with growth faltering are at increased risk of complications of acute infections and chronic conditions, with potential impact on stature and development, as well as psychosocial and adult health.[1]

Growth faltering can result from multiple mechanisms, including inadequate caloric intake, inadequate absorption, excessive energy expenditure, or defective utilization of energy. Inadequate intake, the most common cause of growth faltering, can be due to inadequate supply or consumption of food.[1] In the context of inadequate supply, exploring social determinants of health and addressing food insecurity is essential, but beyond the scope of this case report. Feeding difficulties are common among children with growth faltering and, even in the context of adequate food supply, these can hinder a child's ability to achieve sufficient caloric intake.[1,3]

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Feeding difficulties are heterogeneous and complex, requiring a multi-disciplinary approach. In 2019, Goday et al. utilized the framework of the World Health Organization to propose a unifying diagnostic term: "Pediatric Feeding Disorder" (PFD). PFD is defined as impaired oral intake that is not age-appropriate and is associated with dysfunction in at least one of four domains: medical, nutritional, feeding skills, and psychosocial.[4] The overall annual prevalence of PFD in US children exceeds that of autism spectrum disorder, anorexia nervosa, and bulimia nervosa, ranging from 1 in 23 and 1 in 37 children under 5 years of age. In children under 5 years of age with other chronic diseases, the annual prevalence is between 1 in 3 and 1 in 5.[5] Among children with PFD, a subset develops oral aversion, characterized by severe aversive reactions to not only food, but also non-nutritive objects in or around the mouth. One study identified up to 28.3% of children with growth faltering who demonstrated symptoms of oral aversion.[3] This presents a significant barrier in progressing with oral feedings and requires the collaboration of a multidisciplinary team.[6]

In this case report, we describe a child with oral aversion, PFD, and growth faltering. This case was managed by an osteopathic pediatrician who incorporated osteopathic manipulative treatment into the child's comprehensive, multidisciplinary care plan. To the author's knowledge in reviewing the literature, this is the first case report of osteopathic manipulative treatment (OMT) for PFD and oral aversion.

Report of Case

Setting

The patient was seen by an osteopathic pediatrician in an outpatient clinic. The authors, both the pediatrician and an osteopathic medical student, treated him over the course of multiple visits spanning 34 weeks.

Initial Presentation

A 21-month-old male with a history of oral aversion, PFD, and growth faltering was brought in by his mother as a new patient with concerns for oral thrush. The patient's mother stated that his tongue had been white for the past 10 days with associated bad breath, but no signs of discomfort. She denied any prior episodes, new foods, recent antibiotics, recent illness, or history of reflux. During this visit, she also expressed concern about his weight gain, stating that he had not gained weight for the preceding 9 months. Weight-for-age data from outside facilities revealed that he had dropped from the 70th percentile to the 3rd percentile from 4- to 21-months of age with less than 0.5kg of weight change over the 9 months preceding this visit (Figure 1). On physical exam, he was found to be small for his age and with a white coating on his central tongue. Osteopathic structural examination, though limited due to patient cooperation, revealed somatic dysfunction at the cranial base and the cervical and thoracic regions (Table 1). The rest of his physical exam was otherwise unremarkable.

Birth and Neonatal History

The patient was a 3895g male born at 40 weeks and 4 days via vaginal delivery with induction of labor utilizing pitocin. The patient's mother was a 39-year-old G2P2 who received prenatal care and whose prenatal labs were all within normal limits. The pregnancy was complicated by premature rupture of membranes. The labor was uncomplicated. His weight was in the 66th percentile, length was in the 30th percentile, and head circumference was in the 55th percentile. His neonatal history was uncomplicated.

Feeding History and Multidisciplinary Management

The patient had been exclusively breastfed from birth up to his initial visit. He displayed a shallow, but non-painful, latch. He never accepted a bottle. Additionally, he would gag on and reject pacifiers when they were introduced. He was introduced to purees at 6-months-old, at which time he experienced an episode of emesis. Following this episode, he began to refuse solid food. The patient also began exhibiting aversion to his mother's attempts at brushing his teeth, gagging from the finger toothbrush. The patient was referred to occupational therapy (OT) for feeding problems at 8 months old due to difficulty introducing solid foods and gagging on all foods. Upon OT evaluation, he demonstrated hypotonic muscle tone, no lateralization with foods, and was diagnosed with oral aversion.

The patient participated in OT every 2-3 weeks over the course of 8 months until 17 months old. Additionally, the patient was seen by a nutritionist at 16 and 19 months old, who recommended that he be referred to a pediatric gastroenterologist due to limited oral intake and growth faltering. Following this, the patient's health insurance changed and his care was transferred to the author's clinic before any further evaluation occurred.

Assessment/Plan

During the initial visit, the patient received OMT with objective post-treatment improvement in tissue texture changes and asymmetry. He was prescribed oral nystatin to treat the oral candidiasis. Additionally, he was referred to OT for oral aversion and PFD. He was also referred to a pediatric allergist and a nutritionist to optimize his diet, in addition to recommending supplementation with a multivitamin. Lastly, he was referred to a pediatric dentist for his lack of dental hygiene secondary to the oral aversion. The patient was scheduled for regular follow-up appointments every 2-4 weeks for additional OMT, the results of which are found in Table 1. Osteopathic structural examination and treatment was often limited due to patient cooperation.

Follow-up and Results

Upon follow-up at 4 weeks, the patient's mother reported that, within hours following his initial visit, he began showing interest in and eating other family members' food off their plates. His diet began to improve in variety and quantity, which continued throughout the length of this study. His weight-for-age increased from the 3rd percentile to the 23rd percentile by the end of this study, 34 weeks later (Figure 1). His candidiasis resolved by his second visit. He resumed weekly OT after his second visit, but was awaiting appointments with an allergist and dentist for the entirety of this study.

Standard of Care

Initial management of PFD is often done by the primary care physician. Milano et al. have proposed a stepwise approach to initially managing the spectrum of feeding problems, ranging from mild to severe, across clinical settings. Their approach begins with identifying "red flag" conditions (which include aspiration, dysphagia, and severe growth faltering), screening the child's oral motor development, stabilizing nutrient intake, and eliminating aversive parental feeding practices. If short term goals are not met with improvement in eating within 3 months, referral for targeted approaches or additional help from specialists is needed.[7]

Current treatment of PFD and growth faltering involves a two-pronged approach, which focuses on the nutritional and behavioral components of these problems. During the first 2 years of life, a child's nutrition has a profound impact on their neurodevelopment and lifelong mental

Figure 1. *The patient's weight-for-age growth curve. (Asterisks indicate data from outside facilities. The first non-asterisk data point corresponds to the patient's initial visit.)*

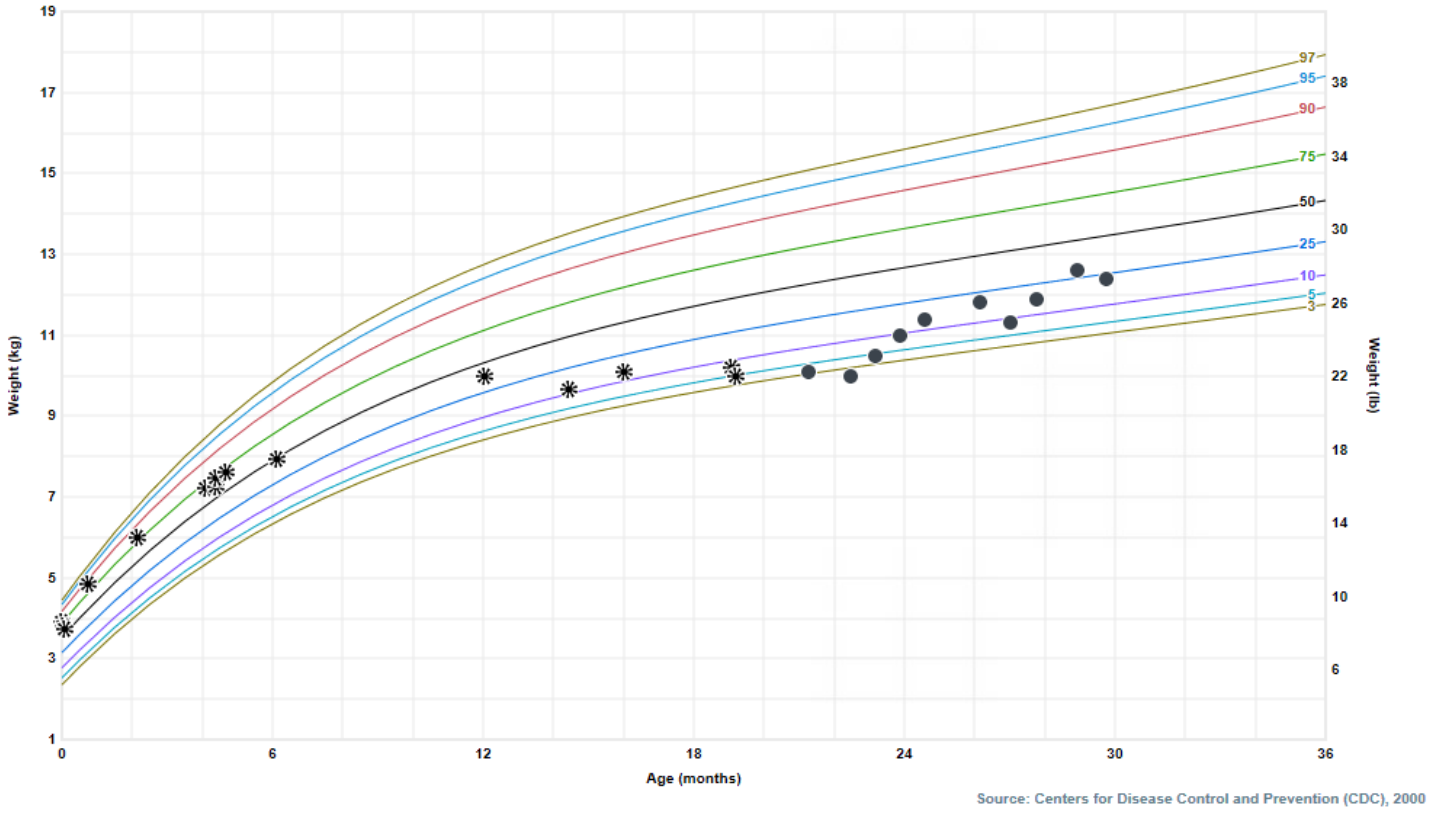

Table 1. *Somatic dysfunction and OMT interventions over multiple visits*

(MFR= myofascial release, ST= soft tissue technique, BLT= balanced ligamentous tension, FPR= facilitated positional release, OCMM= osteopathic cranial manipulative medicine, SBS= sphenobasilar synchondrosis, ESD= exhalation somatic dysfunction, ISD= inhalation somatic dysfunction, OM= occipitomastoid)

	Somatic Dysfunction	OMT Performed
Initial Visit (t= 0 weeks)	• Left occipital condyle compressed • Hypertonicity of B/L cervical and thoracic musculature	• Condylar decompression • Sub-occipital MFR • Cranial base balancing
Follow-up Visit (t= 4 weeks)	• Left occipital condyle compressed • Hypertonicity of bilateral cervical and thoracic musculature	• Condylar decompression • MFR • ST
Follow-up Visit (t= 7 weeks)	• Median axis rotated clockwise, bilateral parietal restriction, right occipital restriction at bevel change with temporal bone • C2-3 FRRSR, paraspinal musculature more compliant than before • T3-T6 FRLSL • Ribs 3-4 ESD on left • Left thoracic hemidiaphragm restriction • L2 FRLSL • Right posteriorly rotated innominate with out-flare • Gait is normal, but resting position is externally rotated on the right	• MFR • BLT • FPR • AT Still technique • OCMM
Follow-up Visit (t= 10 weeks)	• Left SBS torsion, bilateral OM suture restriction • Bilateral cervical hypertonicity • Left shoulder superior with scapular restriction • Right innominate out-flare, right unilaterally flexed sacrum	• OCMM • MFR • BLT • FPR • AT Still technique • Articulatory technique
Follow-up Visit (t= 13 weeks)	• Left SBS torsion • Bilateral cervical hypertonicity • Right thoracic inlet restricted • T5-8 rotated left with ISD of corresponding ribs • Left superiorly sheared innominate, left unilaterally extended sacrum	• OCMM • AT Still technique
Follow-up Visit (t= 19 weeks)	• SBS compression • T1-3 rotated left • Left lumbar hypertonicity • Left superiorly sheared innominate	• MFR • AT Still technique • OCMM
Follow-up Visit (t= 26 weeks)	• Left occipital condyle restricted • Bilateral hypertonicity of cervical paraspinal musculature, C2-4 sidebent left • T4-12 left-sided paraspinal hypertonicity • Left scapular restriction with significantly hypertonic levator scapulae muscle • Bilateral lumbar hypertonicity	• MFR • AT Still technique • OCMM
Follow-up Visit (t= 30 weeks)	• Superior SBS strain, right OM suture restriction • Bilateral suboccipital hypertonicity R>L • Bilateral hypertonicity in the lower thoracics, T6-12 rotated right • L1-4 rotated left • Right superiorly sheared innominate	• MFR • AT Still technique • OCMM

health, as emphasized by the American Academy of Pediatrics Committee on Nutrition. Intervention during this time is considered the most critical in minimizing nutrition-related mortality risk and optimizing long-term health.[8] Depending on the child's stage in development, nutritional management may include lactation consultation and formula supplementation, fortification of solid foods, increasing calorically dense foods, and decreasing intake of beverages and foods with minimal nutritional value. High-calorie supplemental beverages and multivitamins can also be considered, but should be strategically scheduled to avoid replacing food and effectively exacerbating feeding difficulties.[1]

To address the behavioral component of PFD, parents are educated on structuring mealtimes to set limits and boundaries for the child in a consistent and positive manner.[1,9] When combined with parental education, behavioral interventions guided by principles of either systematic desensitization (bottom-up, play-based modeling style of intervention) or operant conditioning (top-down, prompt-and-reward) have demonstrated favorable outcomes in dietary quality and variety.[9]

To optimize these nutritional and behavioral interventions, underlying medical factors must be simultaneously evaluated and treated. These may range from aerodigestive disease to gastrointestinal anatomic or mucosal abnormalities.[1,4] By addressing the child's medical needs, implementing proper nutrition, and optimizing the mealtime environment, the healthcare team provides comprehensive support for the child with PFD.

Depending on the severity of PFD, medications may be used. While non-pharmacologic approaches are the first-line treatment for growth faltering, cyproheptadine can be beneficial, depending on a child's progress, degree of impairment, and family stress.[1] Cyproheptadine, a serotonin 5-HT_2 and histamine H_1 antagonist, has been shown to be a safe and well-tolerated appetite-stimulant in a variety of underweight and malnourished pediatric populations.[10]

For children with severe and/or complex feeding problems, intensive multidisciplinary intervention at day hospital programs and inpatient settings are required. These programs, which include psychology, nutrition, medicine, and speech-language pathologists or occupational therapists, have been found to increase oral intake, improve mealtime behaviors, and reduce parental stress.[11] As a last resort, initiation of tube feedings via nasogastric tube, orogastric tube, or gastrostomy tube is an option. Complex challenges exist, however, for the patient and family when deciding to initiate and wean from tube feedings.[12] Additionally, while tube feedings can ensure adequate nutrition and thereby support physical development, their use can negatively impact the development of oral feeding skills.[6]

Discussion

> "His mind will explore the bone, the ligament, the muscle, the fascia, the channels through which the blood travels from the heart to local destiny, with lymphatics and their contents—the nerves the blood vessels and every channel through or over which all substances are transmitted all over the body."[13] -A.T. Still

Feeding recruits a wide range of a child's structural and functional capacities. It "is a complex process that requires interaction of the central and peripheral nervous systems, oropharyngeal mechanism, cardiopulmonary system, and gastrointestinal tract with support from craniofacial structures and the musculoskeletal system."[4] This occurs in the context of the child-caregiver relationship and feeding environment. These complexities create many opportunities for potential dysfunction. An osteopathic approach to growth faltering, PFD, and oral aversion considers five models for patient care: biomechanical, neurologic, respiratory/circulatory, metabolic, and biopsychosocial. The patient in this case was cared for within this paradigm.

Biomechanical Model

Osteopathic structural examination identified somatic dysfunction in this patient. These findings suggested impaired structural support for feeding with correlating physiologic dysfunction. OMT was used to treat this somatic dysfunction and relieve the strain on the patient's osseus, ligamentous, cartilaginous, muscular, and fascial structures involved in feeding.

While OMT has not been studied in the context of PFD or oral aversion, it has been demonstrated as safe and effective for some gastrointestinal disorders in term and preterm infants.[14] OMT has also shown benefit when coupled with lactation consultation for infants with biomechanical sucking difficulties.[15] Additionally, infants who received OMT have demonstrated improvement in food intolerance and spitting/vomiting compared to infants who did not receive OMT.[16] One retrospective chart review identified somatic dysfunction at the cranial

base in 100% of infants with ankyloglossia, raising the question of how somatic dysfunction contributes to feeding issues in this particular subset of infants with feeding difficulties.[17] These studies suggest the potential benefit of OMT for children with feeding difficulties.

Neurologic Model

In addition to cranial nerves V, VII, and IX, the vagus and hypoglossal nerves provide neurologic support for normal swallowing mechanics via sensory innervation from the oral cavity and motor innervation to pharyngeal and tongue muscles. Cranial nerves IX and X carry the afferent and efferent components of the gag reflex, respectively. The patient had demonstrated poor oral motor skills, aversive reaction to intra-oral stimulation, and gagging on pacifiers, toothbrushes, and food. By addressing somatic dysfunction at the cranial base with OMT, the authors attempted to relieve any strain or impingement on these cranial nerves to allow for optimal functioning.

Respiratory/Circulatory Model

Safe and functional feeding requires the coordination of breathing and swallowing.[2] While this patient did not demonstrate any signs or symptoms of aspiration, the physician must evaluate and address any potential respiratory dysfunction or disease. However, this patient was found to have restriction of his thoracoabdominal diaphragm. By treating this restriction, the authors attempted to relieve any impingement on the esophagus as it passes through the esophageal hiatus, thereby supporting optimal functioning and comfort with swallowing.

Metabolic Model

Adequate and proper nutrition is essential for children's growth and development.[1, 8] To optimize the patient's diet, he was referred to a nutritionist for additional parental education. Supplementation with a multivitamin was also prescribed to ensure his intake of necessary micronutrients. Due to his aversive reactions during the introduction of solid foods, he was referred to a pediatric allergist to mitigate any future immune-mediated reactions to new foods. Finally, oral nystatin was prescribed at the initial visit to treat the oral candidiasis. Collectively, these efforts were targeted at reducing metabolic demand, while increasing caloric intake, to promote weight gain.

While receiving the standard of care, the patient's weight-for-age had decreased from the 70th to the 3rd percentile over the course of 17 months. While receiving osteopathic care, which included OMT, the patient's weight-for-age increased from the 3rd to the 23rd percentile over the course of 8 months.

Biopsychosocial Model

During the transition from nipple-feedings to solid foods, texture aversion may develop as the child learns to manipulate and swallow foods. Aversive reactions may present as coughing, gagging, and emesis of newly-introduced foods. When severe, children may become conditioned to fear and avoid stimuli associated with food. Development of feeding aversion then occurs, which is characterized by distress and resistance when presented with food or liquid at mealtime. In more severe cases, this can develop into oral aversion, which is marked by defensive behavior and a high degree of distress with extra- or intra-oral stimulation from both food and non-food objects. Compared to their non-orally averse peers, these children can present with significantly lower food acceptance rates and greater maladaptive feeding behaviors. However, these children may positively respond to intensive interdisciplinary feeding intervention, similar to their non-orally averse peers.[6]

This extreme intolerance to food and non-food stimuli presented a significant barrier for progressing with oral eating in this case. OT addressed the patient's feeding environment and mealtime behaviors through parental education and behavioral intervention to facilitate positive feeding experiences. During the months following the patient's initial visit, he exhibited improvement in mealtime behaviors and dietary variety with the acceptance of new foods, varying in texture and flavor.

Strengths and Limitations

The patient's weight gain in this case demonstrates the potential benefit of OMT for children with not only PFD, but also oral aversion and growth faltering. However, this report has its limitations. The mechanism underlying the effect of OMT on the cranial base, while derived from the understanding of anatomy and osteopathic principles, is not yet fully understood. Additionally, the patient's OT transitioned to a new provider at the same time he began receiving OMT from his new primary care provider. Therefore, since OMT was not the only variable that changed in the patient's care, the patient's weight gain cannot be entirely attributed to its implementation. Lastly, this study includes only one subject.

Conclusion

This case report describes a patient with PFD, oral aversion, and growth faltering who demonstrated weight gain while receiving osteopathic care, which included OMT. The need for further research into interventions and treatment for PFD is great, as only a minority of studies on PFD in the last 10 years have investigated this topic.[18] As demonstrated by the patient in this case, OMT can potentially support children with these health problems. However, further research is needed to evaluate the effectiveness of OMT for PFD, oral aversion, and growth faltering.

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