Review Article

Enhancing Pediatric Feeding Disorders Assessment and Management Through the Sequential Oral Sensory Approach

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Abstract

Pediatric feeding disorders (PFDs) can have significant impacts on a child's physical, social, emotional, and cognitive development, as well as increase caregiver stress and financial burden. Early identification and treatment of PFDs are critical to the long-term health and well-being of affected children. Optimal care requires a multidisciplinary approach, involving healthcare professionals from various disciplines to address the complex nature of feeding disorders. Interdisciplinary interventions can lead to increased oral intake, improved eating behaviors, and reduced parental stress. The Sequential Oral Sensory (SOS) approach to feeding is one of several strategies available for addressing feeding difficulties. It employs systematic desensitization techniques and oral motor training to help children tolerate, engage with, smell, touch, taste, and eat a diverse range of foods. This method is playful and intervention-based, aiming to expand both the variety and quantity of foods a child consumes. The SOS approach to feeding represents a promising method for managing PFDs, but further research is needed to address existing gaps in the literature, particularly regarding long-term outcomes. Implementing tailored, ethical, and evidence-based interventions can significantly improve the quality of life for children with PFDs and their families.

Keywords: Pediatric feeding disorders (PFDs), feeding difficulties, sequential oral sensory (SOS) approach

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Feeding problems affect approximately 25% to 45% of children in the general population and up to 80% of children with developmental disabilities including lack of appetite, picky eating, slow eating, refusal to eat, extended reliance on liquid or soft foods, difficulty chewing, temper tantrums, and disruptive behavior during meals [1-3]. Pediatric feeding disorders (PFDs) are defined as impaired oral intake that is inappropriate for a child's age, lasting at least two weeks, and associated with dysfunction in one or more of the following domains: medical, nutritional, feeding skill, and/or psychosocial. These domains are interconnected, meaning that a problem in one can cause issues in any of the others, ultimately leading to PFDs. Medically, impairments in the gastrointestinal, respiratory, cardiac, and neurological systems are commonly associated with dysphagia, disrupting feeding functions and contributing to PFDs [4]. Nutritionally, children with PFDs often have limited diets, placing them at risk for undernutrition, overnutrition, nutrient imbalances, and dehydration; negatively affecting growth, development, and health [5]. Feeding skill challenges may arise from illness, injury, or developmental delays, affecting oral sensory and motor functions and leading to unsafe or inefficient feeding, prolonged mealtimes, and the need for modified textures or specialized feeding tools. Psychosocially, issues such as developmental or behavioral health problems, environmental disruptions, or negative mealtime experiences can further complicate feeding, resulting in aversions, selective eating, refusal to self-feed, or inappropriate eating behaviors [4, 6].

Consequences of PFDs

Feeding difficulties can range from being minor and temporary, with no negative effects, to being severe and long-lasting, potentially affecting the child's health, development, and family relationships. The long-term consequences may include aversion to food

and oral intake, aspiration pneumonia or impaired lung function, undernutrition, poor weight gain, malnutrition, and weakened immunity. Additional risks include dehydration, gastrointestinal issues such as motility disorders, constipation, and diarrhea, as well as rumination disorder, which involves involuntary regurgitation and possible re-chewing and re-swallowing of food. Some children may continue to require enteral or parenteral nutrition. These issues can also lead to significant psychosocial impacts on both the child and their family, and may persist into adulthood, increasing the risk of choking, malnutrition, and ongoing feeding and swallowing challenges [3, 7-9].

Assessment and Evaluation of PFDs

Because failing to recognize PFDs can lead to serious outcomes, it's crucial to identify and address them early on. Assessing feeding issues in infants and young children is most effective when done by a team of professionals from various fields. This multidisciplinary approach allows for a comprehensive evaluation of the child's medical history and current conditions, growth and development, oral motor skills, nutritional intake, and the social environment in which the child lives [10].

A typical multidisciplinary team for managing pediatric feeding disorders includes several key professionals working collaboratively. Pediatricians such as general pediatricians, pediatric gastroenterologists, developmental-behavioral pediatricians, or neurodevelopmental pediatricians are responsible for evaluating and managing medical issues related to feeding impairments and coordinating care among team members. Pediatric speech-language pathologists (SLPs) assess oral function, the child's ability to manage age-appropriate diets, and detect signs of swallowing difficulties, determining when instrumental evaluations are needed. Occupational therapists (OTs) evaluate fine motor skills, self-feeding abilities, and sensory problems. Registered pediatric dietitian performs comprehensive nutritional assessments, reviews dietary intake, and tailors plans to meet cultural and family preferences into diet and mealtime routines. Nurses play a vital role in coordinating care, assisting with the use of medical formulas and equipment, and providing ongoing support to families. Depending on the child's needs, the team might also include a pediatric physical therapist, a child psychologist or psychiatrist, a pediatric social worker, a lactation consultant, and a pediatric otolaryngologist [8, 10].

Evaluating a feeding issue can be challenging due to underlying medical, sensory, and behavioral aspects. Assessment includes an interview with the caregiver, mealtime observation, clinical examination and laboratory studies [10-13].

The clinical interview gathers detailed information about a child's feeding habits to aid in diagnosis and treatment planning [11]. It covers key areas such as the onset and nature of feeding issues, medical and developmental history, feeding milestones, family routines and cultural practices, mental health and stressors, previous interventions, and the family's attitudes and readiness for therapy [14].

Direct observation of parent-child interactions during mealtime is a key part of feeding assessments, offering the most accurate way to evaluate behavior [15, 16]. Typically conducted in a home-like setting after a 2–4 hour fast, these observations often use one-way mirrors or closed-circuit video to minimize observer influence [14]. This process helps assess child's swallowing ability, airway safety, oral-motor skills, positioning, sensory responses, interaction patterns, and feeding techniques [11, 13].

Early Identification and Multidisciplinary Intervention for PFDs

A comprehensive evaluation of pediatric feeding issues includes physical, neurological, and oral-motor examinations to ensure safe oral feeding. This involves assessing facial symmetry, tongue movement, palate structure, and oral reflexes, while also checking for underlying medical concerns that may affect feeding. Additionally, a dietitian's assessment is vital to monitor the child's growth through weight, height, and head circumference, identify nutritional deficiencies, and estimate daily caloric and nutrient needs [13].

A detailed history, physical exam, growth tracking, and dietary assessment help identify red flag symptoms that require urgent, interdisciplinary care with specialists and a focus on behavioral therapy and caregiver involvement. These warning signs include swallowing difficulties, choking, painful feeding, frequent vomiting or diarrhea, developmental delays, chronic health issues, poor growth, prematurity, birth defects, and autism indicators [2, 17]. When organic disease is suspected, treatment should first focus on addressing the underlying medical issues [6].

Initial management of feeding difficulties involves nutrient stabilization, which includes providing additional calories, multi-nutrient supplements for children with restricted diets, and specific nutrients to address deficiencies [18, 19]. Alongside this, basic feeding strategies should be implemented, such as reducing distractions during meals, maintaining a calm and positive atmosphere, limiting mealtimes to 20–30 minutes, offering 4–6 meals or snacks at consistent intervals, serving appropriately sized portions based on the child's developmental stage, gradually introducing new foods, promoting self-feeding, and accepting age-appropriate messiness [2]. If there is no noticeable improvement after a few weeks, more

targeted interventions focusing on behavioral techniques and parental involvement are recommended [13].

Strategies to improve food acceptance in children include regular exposure to new foods, parental modeling with gentle encouragement, addressing sensory sensitivities, and incorporating sensory integration or behavioral therapy [20-23]. For children with limited appetite, interventions focus on stimulating hunger, increasing energy intake, using nutritional supplements, and applying behavioral therapy [2, 22, 24]. Medications like cyproheptadine and megestrol acetate are commonly prescribed and considered safe and effective for boosting appetite and promoting weight gain [25]. To reduce fear of feeding, adjustments to the mealtime environment, the use of alternative feeding tools, and anxiolytic medications may also be used [14, 24].

The primary goal of any intervention for feeding difficulties is to help children develop age-appropriate feeding skills while ensuring safe swallowing, proper nutrition, and healthy growth. Treatment may involve behavioral techniques, oral motor exercises, sensory and physical therapies, dietary adjustments, or a combination of these, with active caregiver involvement [10, 26, 27]. However, a systematic review, published in 2017, found limited high-quality evidence supporting the effectiveness of combined nutrition and behavioral interventions, systematic desensitization, and operant conditioning in improving feeding and swallowing in children [28].

Oral-motor interventions aim to improve the strength, movement, and coordination of the lips, tongue, jaw, soft palate, and throat, with speech-language pathologists and occupational therapists employing strategies like modifying bolus size, using specialized feeding tools, thickened liquids, posture adjustments, and oral-motor exercises [10, 13]; however, current evidence supporting their effectiveness for treating pediatric feeding disorders is limited [29, 30]. Dietary interventions may include changing food textures, liquid thickness, and incorporating supplemental feedings [10, 13]. Sensory-based interventions address how sensory input affects feeding by modifying environmental factors or encouraging playful interaction with food to reduce aversion, though evidence supporting their use alone is limited [29, 31]. Learned-based interventions, such as flooding, involve rapid exposure to non-preferred foods to reduce anxiety and avoidance, though they can be distressing and risky for some children [32]. Behavioral interventions, particularly Applied Behavioral Analysis (ABA), are strongly supported by evidence and involve strategies like reinforcement, punishment, extinction, and desensitization to shape feeding behaviors [14]. Systematic desensitization offers a more gradual, child-centered approach by building comfort through repeated, non-threatening exposure to disliked foods and has shown positive outcomes in treating PFDs [22, 23].

Several strategies exist for addressing feeding difficulties, each is designed to address specific issues associated with feeding difficulties. Preferred practice patterns involve interventions combining systematic desensitization, behavioral interventions, and caregiver training, while also focusing on specific functional tasks [33, 34].

Sequential Oral Sensory Approach to Feeding

- **Background and Principles:** The Sequential Oral Sensory (SOS) approach to feeding program is a multidisciplinary approach that employes desensitization techniques and oral motor training to help children with feeding disorders through playful food exploration and structured food progression. The SOS Approach to Feeding program is a comprehensive program, created more than 30 years ago by Dr. Kay Toomey, designed to evaluate and treat children with feeding challenges across multiple disciplines. It aimed at identifying and addressing the factors that make eating difficult for children [35]. The program includes activities that lead children through 32 steps, organized into six categories (tolerance, interaction, smell, touch, taste, and eating), helping them progress through the eating hierarchy by engaging with food in various ways [35]. It considers nutritional, medical, psychosocial, and sensory-motor factors to support healthier eating habits through involving various professionals, including pediatric psychologists, pediatricians, occupational therapists, registered dietitians, and speech pathologists/therapists, to assess and treat the child holistically [23, 36].

  Many common myths about eating and mealtimes can hinder effective understanding and treatment of feeding issues. The SOS approach to feeding challenges these myths with research and evidence [37]. Key misconceptions include the beliefs that eating is the body's top priority (breathing and postural stability come first while eating is the third priority), that eating is an instinct (it becomes a learned skill by the end of the fifth or sixth month of age), and that eating is easy (it's a complex task involving all organ and sensory systems). Other myths include the ideas that food should not be played with, hunger will always drive a child to eat, three meals a day are enough, feeding problems are purely behavioral or physical, foods must be eaten at certain times, and children should always mind their manners at meals. Successful eating involves learning, sensory exploration, flexibility, and support, especially for children with feeding challenges. Learning to eat involves many steps around 25 for typically developing children and even

more for those with feeding challenges. Playing with food is an important part of learning, helping children explore and become comfortable with new textures and smells. Hunger does not always lead to eating; about 4–6% of children with feeding difficulties may refuse food due to pain or discomfort. Most children need 5–6 meals a day, not just three, to meet their energy needs. Feeding issues are usually a mix of both physical and behavioral factors, not just one or the other. Labeling foods by meal type or as "healthy" vs. "junk" can harm a child's relationship with food. Finally, while manners are important, children need to learn how to eat properly before they can develop good table manners, with parents acting as supportive teachers [38].

The SOS approach supports children with feeding difficulties through five key principles: creating consistent mealtime routines, encouraging learning to eat through social modeling, using positive reinforcement to promote food interaction, offering manageable, age-appropriate foods, and teaching children about food textures to help them better understand and control how they eat using their cognitive abilities [39].

- **Objectives and process of SOS Approach:** Unlike other feeding programs, the SOS approach prioritizes developing and improving eating skills as well as aims to cultivate a healthy relationship with food, embracing the social elements of mealtimes and ensuring dietary diversity for proper nutrition and growth as its main objective, while its secondary aim is to boost caloric intake, which is accomplished by enhancing eating skills [23, 40]. A tailored treatment plan is designed to address the specific needs of each child. The treatment approach is shaped by several factors, including the immediate priorities and needs of the child and family, financial considerations, and the therapy setting. Treatment options may include one-on-one therapy sessions, group therapy sessions, or a structured home program with continuous support and follow-up [40].

The SOS approach to feeding employs **play with a purpose**, the steps to eating, and research as frameworks to direct therapy. It prominently features **systematic desensitization** and play aiming at enhancing a child's comfort with food by encouraging exploration and understanding of its various properties. This program enables children to engage with food in a fun and relaxed manner [41]. Play-with-a-Purpose is designed to align with each child's unique interests and developmental stage. Since children learn most effectively through play, engaging them with food at a level that matches their interests and abilities enhances their natural motivation and supports their ability to manage the characteristics of the food in a positive way. Food is used as a means to develop eating skills, taking into account the sensory characteristics and motor challenges of the food, as well as the child's oral motor, sensory, cognitive abilities, and previous food experiences and perceptions [40]. Playing with food is seen as the relaxation response. If the child's stress levels become too high during food presentation, the therapist removes the food and reverts to a lower step in the hierarchy to help the child relax and reorganize [23].

- **Description of a meal therapy session:** A meal therapy session ideally takes place in a group setting with other children, but if that isn't feasible, the parent and therapist act as role models. The session begins with sensory preparation, which may include calming or stimulating exercises or marching into the therapy room. The routine continues with the child taking a designated seat, engaging in deep breathing exercises using bubbles, cleaning and drying their hands, and helping distribute plates and napkins. Feeding follows a structured order, offering a variety of foods such as proteins, fruits and vegetables, starches, purees, crunchy snacks, and dissolvable solids, with an emphasis on linking foods by color, shape, or texture. Throughout the session, the child is praised for any level of engagement with the food, looking at it, touching it, smelling it, tasting it, or eating it, without ever being forced to eat. The session concludes with a cleanup routine where the child is signaled that mealtime is over, then helps discard leftover food, wipe down the table and wash and dry their hands [42].

The SOS approach is a child-led, family-centered program that emphasizes building trust between the therapist, child and family to understand the child's internal motivations. Caregivers are actively involved in therapy to better interpret their child's cues and develop individualized home programs in collaboration with professionals. After 5 to 8 weeks of therapy sessions, families begin incorporating "therapy meals" at home starting with one per week and gradually increasing to every other day focusing on exposure to unfamiliar foods rather than consumption. The approach also supports caregivers in creating meaningful, culturally sensitive mealtime experiences both at home and in the community [40].

Success of the SOS approach is measured by several criteria: maintaining a lasting interest in trying new foods, developing the appropriate eating and drinking skills for one's developmental stage, consuming the right amount of calories for optimal growth and development, and enhancing family dynamics during meal times [23].

SOS Approach to Feeding in Research: Evidence and Challenges

Despite the widespread use of the SOS approach to feeding, there are limited outcome studies on this

approach [34]. According to Toomey et al. (2011), [23] in 2002, a presentation at the Annual Conference of the Society for Developmental and Behavioral Pediatrics shared outcomes from 46 children with poor weight gain due to feeding difficulties who showed significant improvements in weight and height after 12 weeks of SOS feeding therapy. Additionally, an independent analysis of 30 children reliant on G-tube feedings revealed that those who could already consume some food (n=19) fully transitioned to a regular diet within a year, while those entirely dependent on G-tubes (n=11) took an average of 24 months to make the transition using the SOS Approach [43].

A pilot study by Creech (2006), [44] cited in Toomey et al., [23] evaluated a 10-week SOS Feeding intervention in ten children aged 17 to 31 months. The results showed improvements in positive mealtime behaviors like smiling, vocalizing, and engaging with caregivers, as well as increased food interaction and a reduction in negative behaviors such as gagging, vomiting, and food refusal.

Boyd's (2007) study examined the impact of a 12-week SOS Feeding intervention on 37 children with multiple diagnoses, aged 8 to 61 months. The findings showed a 41% increase in the variety of foods consumed after the first intervention, with an additional 17% increase for those who completed a second round of the program [45].

In a 2013 retrospective study, Benson et al. evaluated the impact of the SOS Approach on 34 children aged 30 to 92 months with neurodevelopmental conditions like ASD, cerebral palsy, and neurological impairments. The study found that the SOS method was beneficial, particularly for children with neurological impairments who responded consistently to the intervention. It also suggested that children with minimal or no drinking difficulties might be ready to progress to the next stage of feeding development [46].

A case study by Dow's (2015) explored the impact of the SOS approach on a 2-year-old child with long-standing feeding difficulties, developmental delays, and a history of NG tube use following a liver transplant. After an eight-week outpatient intervention, the child significantly increased the variety and texture of foods in his diet, improved his oral motor skills, and demonstrated greater independence in self-feeding, showing notable progress according to the SOS Food Hierarchy [47].

In 2016, a randomized controlled trial by Peterson et al. compared a modified SOS approach to an applied behavioral analysis (ABA) based intervention for treating sensory-based feeding disorders in six boys aged 4 to 6 with autism. The study found that the ABA approach significantly increased food acceptance and consumption in all participants, while the modified SOS method did not show the same effectiveness [48].

In 2019, a retrospective study by Korošec et al. evaluated the effectiveness of an SOS-based feeding therapy program in 79 children (average age 2.5 years) with various feeding issues, including food selectivity and fear of eating. The results showed a significant increase in the variety of foods the children were willing to try. Parents also reported reduced stress and greater satisfaction with the program, supporting its overall effectiveness [49].

Kim et al. (2021) conducted a randomized clinical trial comparing sensory-based feeding therapy using the SOS Approach to nutritional education in toddlers aged 12 to 36 months with over a month of food refusal. The study found that the 12-week sensory-focused intervention significantly improved mealtime behaviors, demonstrating its effectiveness for toddlers with feeding challenges [50].

Hawkins et al. (2022) explored the impact of teletherapy using the SOS hierarchy and tactile play on two children with autism who resisted wet foods. Over a six-week intervention, the study found that caregiver education and guided tactile play via teletherapy helped improve the children's acceptance of non-preferred wet foods, offering preliminary support for this approach [51].

Hsin et al. (2023) conducted a retrospective study on a 12-week outpatient family group therapy program combining cognitive behavioral therapy principles with the SOS Approach for 93 children (ages 30 months to 11 years) with feeding difficulties. Some children also had medical or developmental disorders. The study found that by week 12, caregivers reported fewer mealtime challenges and a reduced impact of feeding issues on family life. Children showed increased positive food interactions during group sessions, and caregivers of children with developmental conditions experienced the most significant drop in stress. The study concluded that multidisciplinary group therapy can effectively improve feeding outcomes and reduce caregiver burden [34].

Machado et al. (2024) reported a case of a 3-year-old boy with feeding difficulties, including food rigidity, trouble tolerating textures, stressful mealtimes, and eating challenges at school. Despite normal neurological and cognitive development, he had a history of limited intake after his sister's birth. Using an adapted 32-stage SOS approach feeding hierarchy, therapy helped the child gradually try new foods and progress at his own pace, demonstrating the approach's support in overcoming feeding challenges [33].

In a recent review, Eodanable et al. (2025) mentioned that programs such as the SOS program may be fundamental for children with intellectual

disabilities who experience difficulties with feeding, weight, or growth as this approach uses a strengths-based, gradual desensitization method that guides children through playful activities and food progression stages. It addresses key nutritional, medical, psychosocial, and sensory-motor factors involved in eating to enhance this vital aspect of a child's life [36].

CONCLUSION AND RECOMMENDATIONS

The SOS approach for feeding is widely used in clinical practice and supported by numerous studies; however, existing research involved small sample sizes, varying evaluation tools and treatment outcome measures, and lacks long-term follow-up (beyond six months). Clinicians should tailor interventions by assessing contextual factors such as parental capacity and the child's specific needs to determine the most appropriate method for each individual case. It is also essential to identify optimal ways to conduct assessments and interventions while maintaining ethical standards, including client safety and professional collaboration. Treatment decisions should be guided by a thorough review of the literature combined with individual assessments to provide the most effective and appropriate care for each child.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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