

REVIEW

Feeding children with cerebral palsy and swallowing difficulties

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Children with cerebral palsy (CP) are at risk for aspiration with oral feeding with potential pulmonary consequences, and commonly have reduced nutrition/hydration status and prolonged stressful meal times. There is considerable variability in the nature and severity of swallowing problems in these children whose needs change over time. Children with generalized severe motor impairment (for example, spastic quadriplegia) are likely to experience greater swallowing deficits than those with diplegia, but oropharyngeal dysphagia is prevalent even in children with mild CP. This review is focused on dysphagia in children with CP: types of deficits, clinical and instrumental evaluation, management decision making and evidence of effectiveness of interventions.

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INTRODUCTION

Children with cerebral palsy (CP) commonly have feeding disorders and swallowing problems (dysphagia) that in many instances place them at risk for aspiration with oral feeding, with potential pulmonary consequences. They also commonly have reduced nutrition/hydration status and prolonged stressful meal times. The specific nature and severity of the swallowing problems may differ, at least to some degree, in relation to sensorimotor impairment, gross and fine motor limitations, and cognitive/communication deficits. Children with generalized severe motor impairment (for example, spastic quadriplegia) are likely to experience greater swallowing deficits^{1,2} than those with diplegia, but oropharyngeal dysphagia is prevalent even in children with mild CP.³ Concerns are multifactorial and include issues of reduced volume of food and liquid consumed orally, nutrition deficits, inadequate hydration and limited range of textures with slow advance of oral skills.

Children with moderate-to-severe dysphagia usually are managed most effectively with an interdisciplinary team that allows for multiple factors to be addressed in a coordinated way. These factors include, but are not limited to, gastrointestinal issues, pulmonary status, nutrition/hydration, oral sensorimotor skills, behavioral issues and family interactions. The importance of a structured approach is stressed to handle these multiple problems.⁴ It is critical that all decisions for the management of feeding and swallowing problems are made in consideration of the primary needs of the child that is, a stable airway with adequate nutrition and hydration. In addition, any feeding/swallowing intervention should be pleasurable and non-stressful for patients and care givers. In some instances, tube feeding may be needed either temporarily or long term.^{5–8} It is expected, with rare exceptions, that these children can cope with at least minimal tastes for pleasure, a practice that may have a positive impact on management of saliva/secretions while maintaining oral function and swallowing.

This review paper is focused on dysphagia: types of deficits, clinical and instrumental evaluation, management decision making and evidence of effectiveness of interventions for children with CP.

TYPES OF SWALLOWING AND FEEDING PROBLEMS IN CHILDREN WITH CP

Oropharyngeal dysphagia may be characterized by problems in any or all phases of swallowing^{9,10} (Table 1). The types of oral and pharyngeal problems that children with CP have include reduced lip closure, poor tongue function, tongue thrust, exaggerated bite reflex, tactile hypersensitivity, delayed swallow initiation, reduced pharyngeal motility and drooling. Impaired oral sensorimotor function can result in drooling that in turn results in impaired hydration.¹¹ Problems with liquids are common and usually relate to a timing deficit with delayed pharyngeal swallow initiation. Problems with thick smooth, lumpy or mashed foods relate to residue in the pharynx when pharyngeal motility is reduced. Residue can spill into the open airway after swallows. Children may appear to handle thicker food and liquid more easily, as they have more time to initiate a swallow, but not in all instances. It is not possible to define pharyngeal physiology of swallowing by clinical feeding/swallowing evaluations or simply by observation of children while they are eating and drinking. The bolus size can be manipulated for safety in some children. Small boluses are easier for many children than large ones, although the opposite may be true for others. Children with CP frequently need more time to complete feeding tasks, but caution is urged as fatigue may become a factor, as well as reduced attention to the task. Meal times longer than 30 min, on a regular basis, often signal a feeding/swallowing problem.

Feeding disorders may present as inadequate growth, prolonged feeding times, delayed progression of oral feeding skills and/or recurrent respiratory disease. Children with CP have dysphagia caused by a central nervous system disorder in which passive tone is variable (hypertonia common with spastic CP), active tone is normal or mildly decreased and primitive reflexes may be strong and persistent. Although children with neurological-based dysphagia may not produce a gag upon stimulation, they may be appropriate for oral feeding. There is no direct relationship between gag and swallowing ability.

Chronic aspiration is of concern in this patient group and may be difficult to delineate when there is no cough response to aspiration events.¹² Hypoxemia may occur during oral feeding.¹³

Table 1. Oropharyngeal dysphagia: processes and problems by phase of swallowing

<i>Phase of swallowing</i>	<i>Processes in brief</i>	<i>Possible problems (not intended to be all inclusive list)</i>
Bolus formation	Getting food into mouth, manipulating via lip closure, jaw stability, tongue action, getting ready to propel food or liquid over tongue posteriorly	Loss of food from mouth; material in anterior or lateral sulcus; limited or immature chewing; limited tongue action
Oral transit	Moving material through oral cavity (mouth) into pharynx (throat)	Initial tongue motion is forward resulting in spillage from the mouth; delayed initiation of posterior tongue propulsion
Pharyngeal phase initiation	Involving critical timing of tongue propulsion and closure of airway	Material in valleculae more than 1 s and/or into pyriform sinuses before swallow initiation; material on tonsil tissue or posterior pharyngeal wall (PPW)
Pharyngeal phase	Involving active coordinated strong muscle function of tongue base, pharyngeal constrictors, and PPW, to move material through pharynx into upper esophagus sphincter (UES)	Reduced airway closure resulting in aspiration, especially with thin liquid; residue in pharynx with reduced muscle strength, usually thick food; pharyngonasal backflow; reduced UES opening
Upper esophageal phase	Opening of UES by anterior & superior movement of hyolaryngeal complex; peristaltic action to move bolus on down through esophagus	Reduced UES opening; reduced duration of UES opening; cricopharyngeal bar that may or may not inhibit bolus transit; peristaltic action moves bolus on down through esophagus

Table 2. Key questions to ask parents that may reveal the need for possible assessment of feeding/swallowing problems in children with cerebral palsy

<i>Questions</i>	<i>Red flags</i>
How long does it take to feed your child?	More than 30 min, on any regular basis
Are meal times stressful to child or parent?	Yes, if one or other, or both
Is your child gaining weight adequately?	Lack of weight gain over 2–3 months in young child, not just weight loss
Are there signs of respiratory problems?	Increased congestion at meal times, 'gurgly' voice, respiratory illnesses

The risk of aspiration in children with CP can decrease over time as developmental gains are made, although it is not unusual for children to show increased signs of dysphagia as they reach puberty, at which time changes in nutritional needs occur as well as possible increased scoliosis or kyphosis. Further, the risks of aspiration complications are dependent partially on the initial condition of the child.

KEY QUESTIONS TO ASK PARENTS TO ASSIST IN THE DETERMINATION OF NEED FOR COMPREHENSIVE EVALUATION

Four questions will yield pertinent information from parents that can aid in directing next steps in decision making for evaluation and management by physicians, nurses and/or therapists. These questions cover major areas of potential deficits (Table 2) to provide a basis for further investigation. They do not necessarily define the specific problems. A feeding time of > 30 min and/or absence of weight gain for 2–3 months could be a sign of a problem in young children, particularly in the first 2 years of life. Stressful mealtimes are likely to exacerbate feeding/swallowing problems and can cause further stress to care givers and children. A gurgly voice quality indicates secretions in the laryngeal vestibule that could be aspirated and contribute to respiratory problems. Clearly, a history of respiratory illnesses that could be related to oral feeding requires in-depth exploration.

CLINICAL FEEDING EVALUATION

The clinical feeding evaluation offers the opportunity to observe children at mealtime settings. One can describe oral sensorimotor deficits, but pharyngeal swallow status can only be inferred from a clinical evaluation. It is highly likely that both sensory and motor deficits occur, although not always in equal proportion. All cranial nerves involved in swallowing have sensory and motor innervation, except cranial nerve XII that provides motor innervation only to intrinsic muscles of the tongue. Mixed textures, such as pasta

pieces in liquid, tend to be difficult to manage for all children. Children with primarily oral sensory disorders may hold food under the tongue to avoid swallowing. If they vomit, they are likely to vomit only certain textures. In contrast, children with primarily oral motor problems may be unable to hold and manipulate food on the tongue; therefore, food may fall out of the mouth. Their vomiting is not likely to be texture specific. Children with major oral sensory problems will put their own fingers or toys in their mouth but usually will not accept oral stimulation by others. They often reject tooth brushing, whereas children with motor disorders usually will tolerate tooth brushing. Children with immature feeding skills may be easier to manage than those with abnormal patterns. However, it is common for children with CP to have both patterns.

INSTRUMENTAL EVALUATION OF SWALLOWING

Criteria for an instrumental swallowing study in children with CP include the following: (1) risk of aspiration (by history or observation), (2) prior aspiration pneumonia, (3) suspicion of a pharyngeal or laryngeal problem (for example, breathy or husky voice quality), (4) gurgly voice quality. A Videofluoroscopic Swallow Study (VFSS) provides dynamic visualization of oral, pharyngeal and upper esophageal phases of swallowing. A flexible endoscopic evaluation of swallowing (FEES) allows direct visualization of some aspects of the pharyngeal phase.¹⁴ FEES is useful in selected instances, particularly with concerns related to possible upper airway obstruction and/or vocal fold paresis or paralysis. Advantages of FEES include the absence of radiation as well as the possibility to do bedside examinations, to evaluate handling of secretions and to do sensory testing. FEES does not always delineate aspiration events. Each examination is a 'brief window in time' and does not therefore represent a typical meal.¹⁵ Overall, agreement of findings between VFSS and FEES is low.¹⁵ Pharyngeal residue is perceived greater on FEES than from VFSS.¹⁶ However, VFSS allows visualization of all phases of swallowing, which makes that study more comprehensive in most instances.

Table 3. Interventions with available evidence

Categories of intervention	Examples of specific interventions
Oral sensorimotor	No differences versus control group: eating time, clearing time, textures consumed, weight gain; ²⁶ In children who aspirated, eating efficiency & safety improved with puree, but not solid; ²⁷ systematic review showed conflicting evidence that techniques are more effective than alternative treatment or no treatment in enhancing feeding safety and efficiency, well designed studies needed ²⁸
Texture/consistency	Mashed foods safer than solid food & swallowed more quickly. ²⁹ Limited evidence (2b). ²¹
Positioning	Level 2b evidence (limited)—positive effect on feeding safety & efficiency by decreasing risk of aspiration. ³⁰ No randomized control trials (RCTs) found ²¹
Adaptive equipment	Case study: in combination with positioning—gains in skills to begin self-feeding ³¹
Oral appliances or feeding devices	Food intake & weight were maintained using an electric feeder, but eating efficiency reduced; ³² improvements in some components of oral-motor behavior with consistent food presentation, but not necessarily maintained at follow-up. ³³
Neuromuscular electrical stimulation (NMES)	Systematic review of evidence showed promising but insufficient evidence with need for high-quality controlled trials; ³⁴ NMES of anterior neck muscles did not improve swallow function more than patients receiving usual oral motor training and dietary manipulations without NMES ³⁵

MANAGEMENT DECISION MAKING

Management decision making must take into account all interrelated factors and not simply therapeutic programs to advance oral skills. Children vary from day to day and over the course of a day, which complicates decision making for precise recommendations. Children may appear safe for oral feeding at some times but not at others. Factors that may have a negative impact include, but are not limited to, fatigue, lethargy and seizure disorder. Individual decision making with close monitoring over time is critical as children show changes in oral skills and safety of swallowing.

Total oral feeding is not a realistic goal for all children with CP but the aim should be to introduce some feeding that is physiologically possible and fits in with the social situation of the child and his/her family. The highest priorities are always adequate health status, particularly nutrition/hydration and pulmonary function.

FEEDING/SWALLOWING INTERVENTIONS: EVIDENCE OF EFFECTIVENESS

General guidance

It is critical that feeding/swallowing teams include dietitians who make recommendations regarding nutrition and hydration, growth patterns, allergies or food sensitivities that could have an impact on intervention(s) aimed at oral skills and swallowing. The child should take part in family meal times, even if not fed orally. It is important to consider sensory responses when planning intervention(s), not only motor aspects. Non-nutritive oral opportunities are thought to facilitate oral feeding skills, for example, sucking opportunities for preterm infants, most often via pacifier.^{17–19} Older children who are not safe to take nutrition orally can be given opportunities to mouth toys or to put their fingers into food and suck on their fingers with a miniscule amount of food on them, and to accept two to three drops of water via a spoon. It is rare that a child cannot take anything orally (nil by mouth). However, it is important that children are not put at risk for aspiration. Gastrostomy tube feedings may improve growth, especially with severely affected gross motor function and those children who have had poor weight gain along with their severe feeding and swallowing problems.²⁰

Evidence-based interventions

It would seem logical that feeding and swallowing interventions lead to benefits, which are measurable and objective. However, the current level of evidence is poor²¹ with limited information regarding outcomes (Table 3). Empirical data are needed. Randomized controlled trials for intervention are extraordinarily difficult to carry out. Snider *et al.*²¹ found only five randomized

controlled trials in their review of 12 electronic databases. Feeding safety and efficiency were primary outcomes in some studies, height and weight changes in others. Oral sensorimotor interventions were compared in two studies involving children with CP.²² They found it impossible to compare as these treatments used different approaches with different durations and intensity. Oral feeding interventions for children with CP may promote oral motor function, but these interventions have not been shown to be effective in promoting feeding efficiency or weight gain.²³ Scianni *et al.*²⁴ examined muscle strengthening in children and adolescents with CP (which did not include oral motor muscles), and suggested that strengthening interventions are neither effective nor worthwhile. Although it is not possible to directly correlate approaches to interventions across body systems, these findings suggest that techniques that propose to strengthen the lip, tongue and jaw muscles that are often included in oral-motor therapy should be critically evaluated. Similarly, data at higher levels of evidence than case studies or case series are needed for all types of interventions.²⁵

Opportunities for production of purposeful swallows are important for oral skill development and for pleasure. Stimulation with 'tastes' can be part of the daily routine for children with CP, with rare exceptions. Children receiving nutrition and hydration via tube should be appropriate for brief 'taste' sessions over 2–5 min multiple times per day.

Spoon presentations with a very small amount of water or flavored water may be tolerated without compromising pulmonary status. A few drops of lemon juice or ice water via spoon may be appealing to stimulate swallowing and to give pleasure without increasing risk for aspiration and its consequences. Regular and thorough oral care is vital for all children. All of these suggestions need validation (or refutation) with systematic data collection.

In summary, children with CP present with a wide range of feeding and swallowing problems that need to be scrutinized comprehensively and monitored over time. All children deserve opportunities for oral feeding to whatever extent is possible in light of pulmonary status and oropharyngeal skill levels, in developmentally appropriate ways. It is hoped that all oral taste and feeding experiences are non-stressful for children and their parents. No matter how much care givers and therapists want children to be total oral feeders, nutrition and hydration needs should always take top priority. Children must be well nourished in order to maximize global developmental function and overall health (where possible).

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CONFLICT OF INTEREST

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