Feeding Problems and Oropharyngeal Dysphagia in Children

Pamela Dodrill

ABSTRACT

Like adults, infants and older children can present with swallowing and feeding difficulties. Unlike adults, children have rapidly developing body systems, and even short-term problems with swallowing and/or feeding can interrupt normal development and cause serious long-term sequelae. In order for a child to reach their physical and cognitive growth potential, sufficient energy and nutrients must be consumed. Feeding difficulties can have a detrimental effect on dietary intake and, hence, growth. This article aims to provide an overview of the typical development of feeding skills in children, as well as of interventions aimed at assisting children with feeding and swallowing difficulties. A review of the literature indicates that many intervention techniques utilized by clinicians have not been formally evaluated by high-quality research studies and, thus, further research in this area is needed to support and guide clinical practice.

© 2014 ACT. All rights reserved.

Key words: Children; Feeding; Dysphagia

feeding onto beginner (pureed) solid foods that are taken from a spoon, and then on to mashed and soft solid pieces that can be broken down with the tongue, and later soft- and hard-mechanical food textures that require chewing +/- biting (Table 1). Increasing oral-motor skills are also required to move from drinking from the breast/ bottle onto drinking via a spout or straw cup and then an open cup.

Infants generally begin weaning onto solid foods at the same time that they begin to be able to sit in an upright position and bring their hands to their mouth. Postural support is an important pre-requisite for the introduction of solids, as gross motor control of the trunk and neck is needed to support the fine motor skills involved in chewing and biting. As infants mature, their trunk control, neck control, and jaw control all mature in a sequential process. Supportive seating, as well as manipulation of the size and firmness of food pieces offered by the caregiver, assists to maximise the child’s ability to eat efficiently and safely.

Newborns require full postural support during feeds. From birth to 4 months of age, infants diet consists entirely of fluid, taken in the form of breastfeeds or bottle feeds. Young infants rely on adaptive oral reflexes (i.e. rooting and sucking) to locate and ingest feeds, and display a forward-backward tongue pattern while feeding. Young infants are unable to consume or effectively digest any solid foods, and display protective oral reflexes (e.g. tongue protrusion, phasic bite, and strong gag reflexes) to protect the airway.

At 4 months of age, most infants are still only consuming fluids (as either breastfeeds or bottle feeds). However, from 4-6 months infants begin to display separation of tongue and jaw movements, and transition from a reflexive suckle (forward-backwards) to a suck (up-down) tongue pattern while feeding. During this time, infants begin to be able to sit more upright, but still require full postural support (e.g. seated in a baby chair with straps, or on the feeder’s lap with the feeder’s arm supporting the head and trunk). Most infants will begin to bring their hands to their mouth at this stage for oral self-exploration. This helps to desensitise some of the protective reflexes (e.g. tongue protrusion) and, toward the end of this period, many infants will begin to consume beginner (i.e. pureed) solids from a spoon.

At 7-9 months of age, the infant diet still consists mostly of fluids, but infants are able to consume a greater volume and variety of solid foods. Infants continue to consume fluids from the breast or bottle, but many begin to be able to drink from a cup. As infants develop the core stability to sit up with less external support, and as many of the protective oral reflexes diminish and/or are integrated into more sophisticated, voluntary oral skills (e.g. phasic bite transitions during mastication), infants can begin to consume mashed solids and small pieces of soft foods (Table 1). As hand-to-mouth coordination improves, most infants begin some (messy) self-feeding, however, much assistance from caregivers is still required during mealtimes at this age.

At 9-12 months of age, infants are generally consuming a mixed diet of fluids and solids. During the day, an increasing proportion of fluids may be taken from a cup, though infants still require breastfeeds or bottle feeds to meet their nutritional requirements. Most infants can sit without support at this age, and most are beginning to stand and walk. However, the majority of infants continue to be fed in a baby chair or on a caregiver’s lap, in order to provide postural support while they continue to develop their fine motor skills. Self-feeding is more common at this age, and improved jaw stability and tongue lateralisation skills allow infants to bite and chew soft-mechanical foods.

From 12-24 months of age, toddlers’ oral feeding skills continue to improve and become more refined and coordinated, which results in improved efficiency of mealtimes and a greater variety of foods consumed. Children gradually learn to bite through hard-mechanical foods (Table 1) during this period. Toddlers also become more competent at using utensils to assist with eating. This process occurs in parallel with improvements in general motor development and sensory integration (the neurological process that organises sensations from the environment and one’s own body, such as sight, smell, touch, taste, and proprioception, to allow a functional response), as well as with maturation of cognitive processes.

### INTERRUPTIONS TO EARLY FEEDING DEVELOPMENT

Given the inter-relationship between anatomical and neurological maturation in early development, as well as between sensory, motor, and cognitive development, there is a potential for difficulties to occur if any or all of these processes are interrupted during the developmental process.

By virtue of their premature delivery, early development is interrupted in preterm infants. Premature exposure to the ex-utero environment forces preterm infants to breathe and feed for themselves at a time when oxygen and nutrients would have been provided to them by the placenta had they remained in utero. In addition, preterm infants are forced to support their body against the effects of gravity, rather than have the support of amniotic fluid and the uterine wall.

<table>
<thead>
<tr>
<th>Table 1 Transitional food textures</th>
<th>Oral movements required to consume texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluids (e.g. breast milk, formula, water)</td>
<td>Bolus sucked from the breast or bottle; tongue moves in a forward-backward plane of movement when drawing fluid into the mouth</td>
</tr>
<tr>
<td>Pureed food (e.g. rice cereal, yoghurt, pureed fruit, vegetables, and meats)</td>
<td>Bolus taken from a spoon; tongue moves in a forward-backward plane of movement during mastication</td>
</tr>
<tr>
<td>Mashed food (e.g. mashed potato, pumpkin, banana, and avocado)</td>
<td>Bolus taken from a spoon, fork, or fingers; food is masticated by the tongue; tongue moves in a forward-backward plane of movement during mastication</td>
</tr>
<tr>
<td>Soft pieces (e.g. pieces of banana and avocado, cooked pieces of potato and pumpkin)</td>
<td>Bolus taken from a fingers, spoon, fork, or chopsticks; food is masticated by the tongue; tongue moves in a forward-backward plane of movement during mastication</td>
</tr>
<tr>
<td>Soft mechanics (e.g. cooked chicken, pasta, and vegetables, meatballs, cheese)</td>
<td>Bolus is cut up or broken then taken from a fork, chopsticks, or fingers; food is masticated by the teeth; tongue lateralisation is required to move food onto the chewing surfaces</td>
</tr>
<tr>
<td>Hard mechanics (e.g. beef steak, raw apple, raw carrot)</td>
<td>Bolus is cut up or a bite is taken; the bolus is usually taken from fingers or possibly a fork; food is masticated by the teeth; tongue lateralisation is required to move food onto the chewing surfaces</td>
</tr>
<tr>
<td>Mixed textures (e.g. baked beans in sauce, pieces of cooked chicken and pasta in with mashed vegetables)</td>
<td>Bolus is usually taken from a spoon; components of food are fluid or pureed, and tongue moves in a forward-backward plane of movement; other components of food need to be masticated by the teeth, and tongue lateralisation is required to move food onto the chewing surfaces</td>
</tr>
</tbody>
</table>
around them. Further, either as a direct result of their premature birth or as a coinciding event, many preterm infants present with severe co-morbidities\textsuperscript{[6,7,11,12]}. Both the impairments themselves, as well as the interventions required to treat them, have the potential to further interrupt feeding development in these infants\textsuperscript{[8,11,12]}. In addition, prolonged hospitalisation (and the resulting frequent exposure to hospital lights, alarms, and painful procedures) can interfere with the infant’s sensory development, and can affect the family’s ability to interact and bond with their child\textsuperscript{[6,11]}

A summary of some of the possible interruptions to early oral feeding development commonly cited as being associated with illness and medical treatment is included in table 2\textsuperscript{[6,7]}.

Table 3 contains a list of conditions that are commonly associated with feeding difficulties\textsuperscript{[7,8,12]}. It should be noted that some of these conditions have the potential to impact on oral feeding directly (i.e. they may affect sucking strength, suck-swallow-breath coordination, or the ability to bite and chew effectively), and others impact on oral feeding indirectly (i.e. they may not directly impact on the oral or pharyngeal phases of swallowing, but may cause pain, discomfort, or fatigue with feeds, or limit the volume the child can consume by mouth). However, during the period of time when young children are developing their oral feeding skills, any feeding disturbances can potentially impact on later feeding skills through interruption of the normal developmental process\textsuperscript{[6,7]}.

Often, prematurity and/or chronic, ongoing illness can result in periods of time where infants cannot feed by mouth. Then, even once an infant is well enough and mature enough to attempt oral feeds, it may be some time before their feeding skills have developed enough to support independent oral feeding\textsuperscript{[6,7,11,12]}. During the period of time when medically complex infants are unable to feed exclusively by mouth, they will require some form of artificial tube feeding to meet their energy, nutrition, and fluid requirements\textsuperscript{[6,7]}.

As discussed in table 2, in the short term, tube feeding (as well as other invasive procedures that occur in and around the mouth, such as suctioning and intubation) may cause obstruction and/or irritation of the structures involved in feeding\textsuperscript{[13-41]}. In the longer term, the iatrogenic effects of medical interventions affecting the mouth and associated structures, as well as a lack of oral feeding practice, may contribute to the development of altered oral sensitivity and/or oral aversion, as well as inefficient feeding patterns\textsuperscript{[6,7,13-41]}. In addition, any coinciding developmental delays in motor skills or alterations to muscle tone may result in poor postural support and reduced control of the muscles of the mouth involved in oral feeding\textsuperscript{[3,11]}. Further, due to the effects of prematurity and/or illness, many medically complex infants will display poor nutritional and energy reserves, which may result in low endurance levels for the work of feeding\textsuperscript{[11]}

**FEEDING AND SWALLOWING DIFFICULTIES**

During normal swallowing, the bolus is propelled from the oral cavity through the pharynx and down the oesophagus. At the same time, the vocal folds close and a brief deglutition apnoea occurs, along with superior and anterior laryngeal excursion\textsuperscript{[6,42]}. This helps to ensure that the bolus ends up in the gut and not in the airway. Dysphagia occurs when there is a problem with bolus containment and/or propulsion, and may occur at the oral, pharyngeal, and/or oesophageal phases of swallowing\textsuperscript{[6,43]}. A prolonged apnoea event occurs when the airway closes over and fails to re-open in time for

<table>
<thead>
<tr>
<th>PRIMARY CONDITION</th>
<th>INTERVENTION</th>
<th>OUTCOMES</th>
<th>EFFECTS OF INTERVENTION</th>
<th>VARIABLES</th>
<th>INTERRUPTED DEVELOPMENT FOR INFANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREMATURITY</td>
<td>Artificial feeding</td>
<td>PRIMARY CONDITION PERSISTS TO SOME DEGREE</td>
<td>1. Local irritation of swallowing mechanism</td>
<td>1. Age when intervention started</td>
<td>1. Delayed development of oral-motor skills</td>
</tr>
<tr>
<td>Premature:</td>
<td>Enteral nutrition (gavage feeds)</td>
<td>1. Energy imbalance</td>
<td>2. Obstruction of swallowing mechanism</td>
<td>2. Duration of intervention</td>
<td>2. Defensive oral behaviour/ food/ fluid aversion</td>
</tr>
<tr>
<td>1. Anatomical and physiological development (cardiac, respiratory, gastrointestinal systems)</td>
<td>2. Oesophageal (OG)</td>
<td>3. Injury to swallowing mechanism</td>
<td>3. Frequency of intervention</td>
<td>3. Reduced association between feeding and reduction of hunger</td>
<td></td>
</tr>
<tr>
<td>2. Neurological development (reflexes, tone, coordination)</td>
<td>3. Gastrostomy</td>
<td>4. Altered breathing</td>
<td>4. Total vs. supplemental tube feeding (i.e. opportunity for any oral experience)</td>
<td>5. Altered sensitivity in swallowing mechanism</td>
<td></td>
</tr>
<tr>
<td>2. Nasopharyngeal (NP)</td>
<td>4. Tracheostomy</td>
<td>1. Ongoing morbidity</td>
<td>Route for tube feeding (via oral/ nasal cavity or directly into gut)</td>
<td>6. Altered bonding opportunities with parents</td>
<td></td>
</tr>
<tr>
<td>3. Jejunostomy</td>
<td>Parenteral nutrition</td>
<td>2. Energy imbalance</td>
<td>Rate of tube feeding (bolus or continuous)</td>
<td>7. Reduced parental confidence in feeding infant</td>
<td></td>
</tr>
<tr>
<td>5. Jejunostomy</td>
<td>Parenteral nutrition</td>
<td>3. Injury to swallowing mechanism</td>
<td>Type of feed offered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Jejunostomy</td>
<td>Parenteral nutrition</td>
<td>3. Injury to swallowing mechanism</td>
<td>Positioning during feeds</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2** Possible interruptions to oral feeding development associated with illness and medical treatment.

**Table 1** Possible interruptions to oral feeding development associated with illness and medical treatment.
Arise in association with dysphagia, aspiration, or a choking event. Mealtime behaviour disturbances or food/fluid aversion commonly of the vocal folds. Aspiration occurs when the bolus enters the airway below the level occurs when the bolus (liquid or solid) enters the laryngeal vestibule. It is widely accepted that interdisciplinary team management be developed. Once the nature and any possible factors contributing to the feeding/swallowing are usually involved at some level. Table 3 Disorders commonly affecting feeding and swallowing in infants and children. Table 4 Areas commonly assessed during a paediatric feeding assessment. regular breathing to continue after a swallow. Airway penetration occurs when the bolus (liquid or solid) enters the laryngeal vestibule. Airway penetration occurs when the bolus enters the airway below the level of the vocal folds. Choking occurs when a solid bolus physically blocks the airway. Mealttime behaviour disturbances or food/fluid aversion commonly arise in association with dysphagia, aspiration, or a choking event. At other times, there is no apparent physical reason for behavioural feeding issues, although averse experiences in or around the mouth (e.g. tube feeding, suctioning), undetected pain (e.g. as associated with tonsillitis, pharyngitis, or teething), or sensory disturbances (e.g. oral hypersensitivity) are usually involved at some level. Interventions for feeding and/or swallowing difficulties need to be targeted at the cause/s of the problem in order to be effective. For this reason, a thorough assessment is required to guide any intervention offered. Paediatric feeding assessments generally involve assessment across a number of different developmental areas that have the potential to impact of feeding, and these are detailed in table 4. Once the nature and any possible factors contributing to the feeding/swallowing difficulty have been established, the treatment plan can be developed.

It is widely accepted that interdisciplinary team management of feeding and swallowing difficulties is desirable, involving members from various medical specialties, nursing, dietetics, and developmental therapies (i.e. speech pathology, occupational therapy, physical therapy, and psychology), as appropriate, working together to manage the various components of the problem. In addition, it is also widely recognised that it is essential to have parent involvement in assessment, setting therapy goals, delivering therapy, and monitoring progress, to ensure that any intervention is meaningful for the child and family, and to assist with the generalisation of therapy gains to the home environment.

For children with oral phase swallowing problems, a review of the literature suggests that treatment generally involves working on improving the sensory and/or motor skills required for drinking and eating. While commonly used in clinical practice, there are only a few small, randomised controlled trials evaluating these techniques in young preterm infants. A recent Cochrane systematic review investigating the use of oral sensori-motor techniques in older children with dysphagia related to neurological problems found that there is currently insufficient high-quality evidence from randomized controlled trials to provide conclusive results about the effectiveness of any particular type of therapy technique for children in this population and, thus, further research is required to evaluate these treatment strategies.

For children with swallowing problems affecting the pharyngeal phase, a literature review suggests that treatment generally involves teaching the child to modify their swallowing strategy or for the feeder to modify the bolus. A summary of interventions used with infants with poor suck-swallow-breath coordination and older children with poor swallowing and breathing coordination is detailed in table 5 and 6. A few small studies have reported these strategies to be effective in improving physiological stability during feeds and improving volume of intake in young in preterm infants, though no randomised controlled trials have been conducted. Further research is required to evaluate the effectiveness of treatment strategies in both infants and older children.

For children with mealtime behaviour disturbances or food/fluid aversion, therapy is usually either based on the principles of operant conditioning (clinician-driven, top-down, prompt-and-reward therapy) or systematic desensitization (child-driven, bottom-up, play-based therapy). A few small studies have reported that behavioural treatment based on operant conditioning is effective in children with Autism Spectrum Disorder (ASD), though no randomised controlled trials have been conducted to date. Further research is required to evaluate the effectiveness of behavioural treatments.
Table 5 Summary of interventions reported to be used with infants with poor suck-swallow-breath coordination.

<table>
<thead>
<tr>
<th>EVENT DETAILS</th>
<th>POSSIBLE CONSEQUENCES</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aspiration</td>
<td>1. Lung damage 2. Hypoxia</td>
<td>Child can’t control bolus</td>
</tr>
<tr>
<td>2. Prolonged apnoea</td>
<td>1. Child may not finish feed 2. Reduced risk of lung damage or hypoxia</td>
<td>Child actively controls bolus</td>
</tr>
<tr>
<td>2. Choke</td>
<td>1. Feeds may take longer 2. Greater input is required from the feeder 3. Reduced risk of lung damage or hypoxia</td>
<td>Feeder actively controls bolus</td>
</tr>
</tbody>
</table>


Table 6 Summary of interventions reported to be used with older children with poor swallowing and breathing coordination.

<table>
<thead>
<tr>
<th>EVENT DETAILS</th>
<th>POSSIBLE CONSEQUENCES</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aspiration</td>
<td>1. Lung damage 2. Hypoxia</td>
<td>Child can’t control bolus</td>
</tr>
<tr>
<td>2. Choke</td>
<td>1. Child may not finish feed 2. Feeds may take longer 3. Reduced risk of lung damage or hypoxia</td>
<td>Child controls bolus</td>
</tr>
<tr>
<td>3. Improved sensory awareness (oral sensory exercises may be used to increase sensory awareness) 4. Protective swallowing manoeuvres (strategies such as chin tuck may be taught)</td>
<td>1. Feeder offers softer or more processed food 2. Feeder offers smaller pieces of food 3. Feeder assists child and offers food at slower pace</td>
<td>Feeder controls bolus</td>
</tr>
</tbody>
</table>

1. Gag/ cough to clear bolus 2. Increased chewing (oral-motor exercises may be used to increase chewing strength, chewing speed, chewing effort) 3. Protective swallowing manoeuvres (strategies such as chin tuck may be taught)

for other groups of children with feeding difficulties, as well as to evaluate the relative effectiveness of different behavioural feeding approaches.

CONCLUSION

Feeding skills undergo a period of rapid development throughout early childhood, alongside general development and growth. Safe and efficient feeding and swallowing skills are important to allow children to meet their expanding dietary requirements as they grow. In a developing system, even short-term problems with swallowing and/or feeding can interrupt normal development and have serious long-term sequelae. This article provides an overview of normal feeding development in children, as well as of interventions aimed at assisting children with feeding and swallowing difficulties. The importance of a thorough assessment to guide intervention is highlighted. A review of the current evidence-base demonstrates that many intervention techniques utilized by clinicians have not been formally evaluated in the literature and, thus, further research is needed to support and guide clinical practice.

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

REFERENCES

17. Greenspan JS, Wolfson MR, Holt WJ, Shaffer TH. Neonatal gas-
Dodrill P. Childhood feeding problems


19 Haxhija EQ, Rosegger H, Prechtl HF. Vagal response to feeding tube insertion in preterm infants: Has the key been found? Early Hum Dev 1995; 41(1): 15-25


27 Tos M, Bonding P. Middle ear pressure during and after prolonged nasotracheal and/or nasogastric intubation. Acta Oto Laryngologica. 1977; 83(3-4): 353-359


35 Logemann J. Evaluation and treatment of swallowing disorders 2nd ed. Austin, Tx: PRO-ED; 1998


Peer reviewer: Bernice Mathisen, Associate Professor Bernice Mathisen, Head of Speech Pathology, LaTrobe Rural Health School, Bendigo, Australia.