SOFI: Step-wise Oral Feeding in Infants

Victoria General Hospital, BC, Canada
Oral feeding in the Premature Infant: Objectives of this presentation

• Review maturation of feeding skills
• Describe the Plan-Do-Study-Act (PDSA) Quality Improvement Cycle approach
• Describe the Step-wise Oral Feeding in Infants (SOFI) guideline
Oral feeding

• Oral feeding in the preterm infant can be a challenge!
  
  • Everyone knows that food is a basic requirement
  • Term infants demonstrate a range of primitive neonatal reflexes suggesting that early feeding behaviours are innate
  
  • Why can’t my preterm baby feed?
Oral feeding in the premature infant

- In the preterm infant there can be a variety of challenges to overcome:
  - immaturity of suck/swallow/breathe coordination
  - environmental stresses
  - interventional neonatal intensive care
Oral feeding in the premature infant

- Parents view feeding their infant as:
  - One of the final steps prior to discharge home
  - A special relationship with their infant

- Increased stress may be experienced by parents because of:
  - Inconsistent and delayed feeding progression
  - Perceived alterations in the parenting role
Challenges in oral feeding in the premature infant

- There is little published data on oral feeding strategies
- Many stakeholders are involved, including parents & multidisciplinary healthcare professionals
- Guideline implementation and evaluation is as important as guideline development
- It’s not just about feeding, but includes incorporating maturational skills
  - Non-nutritive and nutritive sucking
  - Sucking and expression
  - Suck-swallow-breathe coordination
Suck-swallow-breath cycle

Suction and Expression

- Mature sucking is characterised by the rhythmic alternation of suction and expression
  - Suction is the negative intra-oral pressure which draws milk into the mouth
  - Expression is the positive pressure generated by the compression/stripping of the nipple

- Stages of sucking
  - I: arrhythmic expression, no suction
  - II: rhythmic expression, no suction
  - III: rhythmic expression, rhythmic suction (inconsistent)
  - IV-V: suction more consistent, suction amplitude increases, sucking burst duration increases
30/40 baby, now 36 weeks CGA: mature non-nutritive suck on pacifier is not maintained when offered bottle, due to uncoordinated suck-swallow-breath during feeding

Lau C & Kusnierczyk I; 2001
Mature nutritive sucking pattern following mature non-nutritive sucking in 29/40, now 36/40 CGA

Lau C & Kusnierzcyk I; 2001
Suck-swallow-breath cycle in the premature infant

- The preterm infant makes short sucking bursts with breathing occurring in the pauses
- When the baby has a swallowing event, this interrupts airflow and is termed “swallow apnea”
- The preterm infant has a high respiratory rate (50-60/min) and generates small tidal volumes which cannot be increased
  - Minute ventilation (gas exchange) = rate x tidal volume
  - As respiratory rate falls during feeding and tidal volume does not increase, gas exchange is reduced leading to desaturation and rising CO₂
Maturation of the suck swallow breathe cycle

- As the baby matures:
  - The duration of swallow apnea decreases
  - Swallowing rates increase
  - Development of coordination of sucking and swallowing with each respiration improves
  - There is less adverse effect on respiratory rate and gas exchange
Immature Infant

Figure 9.2  Effect of swallow on respiration or swallow apnoea.

Figure 9.3  Immature pattern of sucking.

Mature Infant

Figure 9.4  Mature pattern of sucking.
Timing of swallow during inspiration-expiration cycle

Schematic representation of swallow-respiration interfacings. Position 1: swallow (Sw) at start inspiration/end expiration; position 2: Sw during inhalation; position 3: Sw at end of inspiration/start expiration; position 4: Sw during exhalation; position 5: Sw interrupting inspiration; position 6: Sw interrupting exhalation; position 7: Sw episodes when respiration is halted (≥2 sec).

Gewolb IH, Vice FL. Maturational changes in the rhythms, patterning, and coordination of respiration and swallow during feeding in preterm and term infants. Developmental Medicine and Child Neurology 2006;48:589-94

Percentage of swallows in an inspiration–swallow–expiration (I–S–E) phase relation. I–S–E is the predominant swallow–breath pattern in term infants (●) and is significantly bigger compared with preterm infants (○). I–S–E is directly correlated with increasing postmenstrual age (PMA; \( r^2 = 0.456; p < 0.001 \)).
 Behaviour and organisation

• Behavioural state and state organization during feeding also affects infant’s success

  • Behavioral state
    • Drowsiness, Quiet alert, Active alert (Als)

  • State organization
    • A level of maturation is required to allow the required state organization for feeding
    • Preterm infant transition rapidly from one state to another

• Assessment of readiness for infant feeding
  • Validated behavioural rating scales
  • Nursing observation and judgement
Plan-Do-Study-Act Quality Improvement Cycle

1. Setting aims
2. Establishing measures and indicators
3. Selecting changes
4. Testing changes

Quality Improvement Cycle

- To test and implement changes in real work settings

- Philosophy: the most effective way to make changes in health care processes and outcomes is to test a relatively small change in a process, learn from it, and then make further changes so that the cumulative effect over time may be one of major change and improvement

- The Plan-Do-Study-Act Cycle is shorthand for testing a change - by planning it, trying it, observing the results, and acting on what is learned
Development of an oral feeding guideline for premature infants

- A step-wise oral feeding framework was developed based on the work of Glass and Wolf (University of Washington, unpublished) for use in premature infants in the NICU
- We utilised parent and care provider feedback to:
  - develop the guideline
  - promote dissemination of the guideline
  - evaluate the guideline
  - evaluate the implementation process
  - maintain stakeholder involvement
- Continuing PDSA cycles will provide a framework for ongoing evaluation, updates and implementation of change
- We named our guideline “Step-wise Oral feeding in Infants”: SOFI
SOFI: Step-wise Oral Feeding in Infants

- SOFI is based on the concept that the skills required to establish full oral feeding in preterm infants may be delayed due to:
  1. immaturity of suck/swallow/breathe coordination
  2. environmental stresses
  3. interventional neonatal intensive care

- We felt that a feeding schedule is required which accounts for the clinical status and maturational stage of the baby and the needs of the family.

- SOFI was designed for preterm infants <35+0 weeks gestation in the NICU

- Our aim is safe oral feeding for discharge home
SOFI: Goals

1. Adequate weight gain
2. Safe for baby
3. Consistency between caregivers
4. Family involvement
SOFI: Feeding Plan

• A feeding plan results in faster attainment of full oral feeding

• Feeding plan should demonstrate:
  1. Progression of skill development
  2. Clear criteria
  3. Support breast-feeding when this is the family’s goal
  4. Include discharge planning
SOFI... 

- SOFI is a 4 phase feeding plan: 
  1. Prefeeding (non-nutritive) 
  2. Early feeding (1-2 feedings/day) 
  3. Skill building (3-6 feedings/day) 
  4. Transition to home (7-8 feedings/day) 

- Each phase includes 
  1. Feeding support activity 
  2. Breastfeeding guidelines 
  3. Bottle feeding guidelines
SOFI Phase 1: Prefeeding

- **Aim:** Prepare infant for oral feeding
  - All infants are eligible for phase 1
  - The focus is on building maternal milk supply
  - Should involve promotion of skin to skin care
  - Involves non-nutritive sucking with nuzzling at the breast and latch practice

- **Progress to phase 2 when infant is:**
  - Full gavage feeding
  - Medically stable
  - Has a competent non-nutritive suck
  - Is wakeful for 5-10 minutes prior to feed
### Bottle feeding

- Not introduced yet

### Feeding Support Activity

- Build milk supply (pump 8-10x/day)
- Skin to skin
- Non-nutritive sucking, oral stimulation

### Breastfeeding

- Nuzzle at breast
- Latch practice

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**Phase 1: Pre-Feeding (Non-Nutritive)**
SOFI Phase 2: Early feeding

- A baby receiving 1-2 feeds/day is in SOFI phase 2
- The aim is to safely establish early feeding by attaining 80% of target intake prior to increasing daily target and avoiding subsequent reduction in daily intake
- Prior to increasing the target intake (breast + bottle), the baby should:
  1. achieve 80% of target intake for the day (% total oral intake as documented in the oral intake record sheet);
  2. with no desaturation/bradycardia;
  3. within reasonable time (15-30 minutes).
  4. The feeding effort should be on the part of the baby not the feeder
  5. The baby should exhibit appropriate cues throughout the feed
SOFI Phase 2: Early feeding

- Appropriate cues for feeding include:
  1. Relaxed
  2. Absence of eye-widening
  3. Absence of finger splaying
  4. Absence of disengagement from nipple

- The target intake should only be decreased if there is a medical setback
- The timing of oral feeds should be based on infant cues and family availability, not regimented
- Breastfeeding skills promoted and encouraged
- Gavage feeds are given as top-ups as required
- Bottle feeds should be given by or with nurse to optimize early family support.
Phase 2: Early feeding (1-2 feeds/day)

**Bottle feeding**
- 1-2 times per day
- By or with nurse
- Monitor physiologic stability

**Feeding Support Activity**
- Continue to build milk supply
- Continue skin to skin
- Non-nutritive sucking (at breast)

**Breastfeeding**
- During gavage feeds
- Periodic pre-post weights
- Expect small intake; adjust gavage amount only if necessary
## Oral Intake Record Sheet

<table>
<thead>
<tr>
<th>Date</th>
<th>Target # feeds/day</th>
<th>Target volume</th>
<th># Breast feeds initiated</th>
<th>Total oral intake in 24 hours (mls)</th>
<th>Total oral %</th>
<th>Stay v. progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>40mls</td>
<td></td>
<td>36mls</td>
<td>90%</td>
<td>Progress</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>80mls</td>
<td>1</td>
<td>66mls</td>
<td>83%</td>
<td>Progress</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>120mls</td>
<td>1</td>
<td>80mls</td>
<td>67%</td>
<td>Stay</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>126mls</td>
<td>1</td>
<td>93mls</td>
<td>74%</td>
<td>Stay</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>126mls</td>
<td>1</td>
<td>112mls</td>
<td>89%</td>
<td>Progress</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>176mls</td>
<td>2</td>
<td>141mls</td>
<td>80%</td>
<td>Progress</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>220mls</td>
<td>3</td>
<td>143mls</td>
<td>65%</td>
<td>Stay</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>220mls</td>
<td>2</td>
<td>163mls</td>
<td>74%</td>
<td>Stay</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>225mls</td>
<td>3</td>
<td>185mls</td>
<td>82%</td>
<td>Progress</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example of a completed oral intake record sheet in a 33 week gestation infant, starting weight 2 kg receiving 160 mls/kg/day as 3 hourly feeds.
SOFI Phase III: Skill building

- A baby receiving 3-6 feeds/day is in SOFI phase 3.
- The aim is to promote oral feeding skills, with the emphasis on breast feeding where this meets the family goal.
- Intake targets are increased as in phase 2.
- Breast feeds should continue to be topped up by gavage, not bottle, as required.
**Phase 3: Skill building (3-6 feeds/day)**

**Bottle feeding**
- Up to maximum target level (3-6 times per day)
- By or with nurse until >4x/day oral feeds

**Feeding Support Activity**
- Build/maintain milk supply
- Non-nutritive sucking

**Breastfeeding**
- Good intake: BF with pre/post weights; intake counts toward oral feeding goal; gavage after
- Low intake: “non-nutritive” suck at breast during gavage; periodic pre/post weights
SOFI Phase 4: Transition to home

- A baby receiving 7-8 feeds/day is in SOFI phase 4
- The aim is to maintain maternal milk supply, develop a discharge feeding plan and ensure appropriate weight gain on milk intake expected at home
- In order to ensure adequate weight gain in an infant receiving preterm formula or fortified EBM, this should be discontinued or changed to a community-available product at least 2-3 days prior to discharge
- Breast feeds may be topped up by bottle not gavage if this is the parents choice
Phase 4: Transition to home (7-8 feeds/day)

### Feeding Support Activity
- **Maintain milk supply** *(pump; info on weaning from pump)*
- **Develop a clear discharge plan** *(how to integrate BF and bottle; volume and length of feedings)*
- **Utilize community support**

### Breastfeeding
- **Good intake**: BF with pre/post weights; intake counts toward oral feeding goal; may bottle after *(maximum total feed time 45min)*
- **Low intake**: “non-nutritive” suck at breast during gavage; or BF 1-3x/day with bottle after *(maximum total feed time 45min)*

### Bottle feeding
- **Perhaps 1-2 times per day** *(for supplemented EBM if needed)*
- **Up to maximum target level** *(7-8 times per day)*
SOFI: In summary

- SOFI is only for infants <35 weeks gestation age at birth
- The guideline is designed to allow for maturation of feeding/respiration in the preterm infant
- It is a 4 phase feeding plan:
  1. Prefeeding (non-nutritive)
  2. Early feeding (1-2 feedings/day)
  3. Skill building (3-6 feedings/day)
  4. Transition to home (7-8 feedings/day)

Each phase includes:

1. Feeding support activity
2. Breastfeeding guidelines
3. Bottle feeding guidelines
References


Feeding plan based on “Feeding the Premature Infant” workshop provided by Glass RP, Wolf LS, (Children’s Hospital and Regional Medical Center, Seattle) at Children’s and Women’s Health Centre of BC, January 2007.