Bite & Chew Project: This project investigates oral-motor skills in a typically developing system.

Learning to eat occurs within …

• HOWEVER

Bite & Chew Project: This project investigates oral-motor skills in a typically developing system.

Solving the problems of pediatric dysphagia is complex (Leighton Greif & Arvedson, 2008; Manno et al., 2001; Stevenson & Allaire, 1991)
• cultural fabric
• medical & health status
• neurodevelopmental status
• sensory development
• cognitive development
• environmental & social context
• Interaction with the caregiver

Learner Objectives
- Identify 5 milestones toward advancing texture between 6-months & 31+ months.
- Describe at least 3 movement patterns that typically-developing children use for biting-off higher textures.
- Describe at least 3 movement patterns that typically developing children use for lateralizing food.
- State two current best-practice procedures to facilitate jaw and tongue movements for eating higher textures.
- Link the results to current clinical recommendations.
Our MISSION is to understand normal processes of development and to advocate for developmentally appropriate assessments and interventions in clinical practice.

We believe that the best practice for children with disorders has a foothold in a solid knowledge of typical processes.

Students must be:

1. Safe while eating in school
   - Adequately nourished and hydrated so that they can attend to and fully access the school curriculum
   - Healthy to maximize their attendance at school (free from aspiration pneumonia or other illnesses related to malnutrition or dehydration)
   - Developing skills for eating efficiently during meals and snack times so that they can complete these activities with their peers safely and in a timely manner

Field, Garland, & Williams (2003)


Field, Garland, & Williams (2003)

https://www.asha.org/Practice-Portal/Clinical-Topics/Pediatric-Dysphagia/
Observation of the child eating or being fed by a family member or caregiver using foods from the home and typically used utensils...

https://www.asha.org/policy/KS2008-00292/
Knowledge of typical development from birth to age 3 years, across domains, including an understanding of the integrated nature of these domains during early childhood, the course of communication, hearing, speech, language, emergent literacy, and swallowng and feeding development

Field, Garland, & Williams (2003)

n = 48 clinical reports

13- to 24-month texture advancement

n = 48 clinical reports

13- to 24-month weight gain

our own clinical pilot
Table 1. Presenting complaints during clinical evaluations of swallowing and feeding

<table>
<thead>
<tr>
<th>Complaint</th>
<th>4-to 12-m</th>
<th>13-to 24-m</th>
<th>25m-5 yrs</th>
<th>5 years+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issues with weight gain (n=19)</td>
<td>4</td>
<td>11</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Poor oral volumes consumed (6)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Restricted diet (3)</td>
<td>1</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Difficulty advancing texture (21)</td>
<td>1</td>
<td>11</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Coughing / choking at meals (2)</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Enemas (2)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Need for MBS (2)</td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Difficulty with liquids (8)</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Other (n=15)</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

(e.g., vocal fold paralysis, small bites, poor appetite, determine status of dysphagia, lack of independence in SF)

Table 2. Impaired Behaviors on Clinical Exam

**Lingual Function Assessment**

- No vertical movement/elevation
- Poor dissociation from face/tip, from jaw
- Reduced strength--with oral residue
- Restricted range of motion
- Movements: uncontrolled
- Restricted to one side
- Without transfer between molar surfaces
- Excessive oral movements to achieve lateralization of solid
- Protrusion past vermilion border: to swallow, to manipulate the bolus
- Expulsion of bolus, deviation to the right
- Mo/limited differentiated lingual movements (tip/blade elevation, depression)
- Persistent A-P movements to accomplish oral preparatory and swallow transport

**Jaw Function Assessment**

- Open-mouth posture (rest)
- No quieting to accept spoon
- Jaw Instability -- molar grinding, postural fixation at the TMJ, anterior protrusion, restricted ROM, excessive jaw excursions (for accept, oral preparation, oral swallow)
- Bite -- no hold, reduced strength, unsustainable, anterior bite that was unsustainable, no lateral bite
- Chew -- no vertical, diagonal and/or rotary chew, disorganized, reduced efficiency

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**Figure 1.** Frequency distribution of medical and developmental diagnoses. ALL = food/milk allergy, PREM = prematurity birth, GI = gastrointestinal, RESP = respiratory.

**Table 2. Impaired Behaviors on Clinical Exam**

<table>
<thead>
<tr>
<th>Underlying DXs</th>
<th>ALL</th>
<th>PREM</th>
<th>GI</th>
<th>RESP</th>
<th>CARD</th>
<th>GEN</th>
<th>STR</th>
<th>ASD</th>
<th>NEURO</th>
<th>OTHER A</th>
<th>OTHER NA</th>
<th>MULTIPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Caregiver Stress is Measurable and Varies Across 3 Phases of Clinical Evaluation of Pediatric Dysphagia**

Capone Singleton, Braun, Masini, & Saks (2016)

- Intervention for longstanding pediatric dysphagia via inpatient hospital admission
- Improvements in levels of caregiver stress (Garro et al., 2005)
- Formal measures of stress & anxiety included Parent Stress Index -- Short Form (Abidin, 1990)
CAREGIVER STRESS
- Observable from the earliest stages of a child's swallowing and feeding disorder identification
- Stress varies and declines with education and training, or the perception of support

ENGAGEMENT
- Caregivers engage a child for feeding
- Inconsistent sensitivity to the needs of the child
- Engagement is more directive than child-centered

THE FEEDING PROJECT
Bite and Chew Study

On-going project that collects observational data of oral-motor skills and other behaviors related to feeding as children advance food textures

Translate into assessment, goal setting & intervention framework

Skills that typically develop in the 6 months to 12 months
The field needs peer-reviewed published normative data.

Bite and Chew Study

Functional context of eating a meal at home:
- akin to other scopes of practice in the field of speech-language pathology
- speech-language sample
- MU, speech-sound accuracy, phonological process resolution

Efficient mastication is important.

Efficient mastication leads to nutritional advantages – better nutrient uptake (LeReverend et al., 2013).

A decrease in particle size in the bolus leads to better nutrient uptake.

Mastication

- Apparatus
  - bones
  - muscles
  - teeth
  - soft tissue (tongue, lips, cheek)

- A wide variety of foods & textures can be processed only when the mastication apparatus develops.

- Muscle growth & Coordination are needed to apply force on the bones & teeth.

- Bone dimensions (e.g., palate, mandible) evolve as much over the 1st year as they subsequently do from 1 year to puberty.

- Textures are key to supporting development during the first year of tremendous oral-facial growth (LeReverend et al., 2013).
The Current Evidence-Based:

- Morris (unpublished 1978; revised 2000)
- longitudinal observations of 6 children
- 4/6 children criteria of a feeding behavior
- functional feeding context
- Mothers feeding
- typical position

Pre-feeding Checklist
Morris & Klein 2000


Table: Pre-feeding Checklist

<table>
<thead>
<tr>
<th>Task</th>
<th>6-12 months</th>
<th>12-18 months</th>
<th>18-24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texture</td>
<td>Pure</td>
<td>Mashed</td>
<td>Chopped</td>
</tr>
<tr>
<td>Bite-off</td>
<td>holds a soft cookie in one hand without breaking</td>
<td>contains a bite</td>
<td>fully grasps a variety of textures</td>
</tr>
<tr>
<td></td>
<td>and a hard cookie in the other hand</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Jaw trajectory     |         |             |             |
|--------------------|         |             |             |
| movements           |         |             |             |
| movements           |         |             |             |
| movements           |         |             |             |

VIDEO EXAMPLES

Historical Context of Lateral Lingual Movements in a Clinical Context

- Reliable Measures for infants to 8-year-olds:
  1. Chew duration
     * Placement of food in mouth ➔ swallow

Gisel and colleagues... Chew Efficiency
(Gisel, 1988, 1991; Schwab, Niman, & Gisel, 1990; Archambault, Milten, & Gisel, 1990; Sobel & Gisel, 1993)

Oral-motor skills supporting Spoon Feeding

- Jaw break-off
  - supportive Spoon Feeding
  - Oral-motor Skills

1/14/2020
Meal behaviors related to feeding that were reported in the scientific literature.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Refusal</td>
<td>Gag/Choke</td>
<td>Expel</td>
</tr>
<tr>
<td>6-7 months</td>
<td>12% of the time</td>
<td>No longer reported to</td>
</tr>
<tr>
<td>8-9 months</td>
<td>10-12 months</td>
<td>No longer reported to</td>
</tr>
<tr>
<td>10-12 months</td>
<td>13-18 months</td>
<td>No longer reported to</td>
</tr>
<tr>
<td>17-24 months</td>
<td>18-20 months</td>
<td>No longer reported to</td>
</tr>
<tr>
<td>24-months</td>
<td>40% of the time</td>
<td>No longer reported to</td>
</tr>
</tbody>
</table>


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**Child Oral Motor Proficiency Scale (ChOMPS; Pados, Thoyre, & Park, 2018)**

- Does not replace a clinical evaluation
- Based on parent observation provides normative information
- Reference values: No Concern, Concern, High Concern

**METHOD**

- JAW PILOT
- LINGUAL LATERALIZATION Study
- BITEStudy

**Inclusion Criteria**

- Full-term birth
- Non-complicated birth
- Typically developing
- No medical diagnosis known to interfere with feeding

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**JAW PILOT STUDY**

**Recruitment - Word of mouth**

- Pilot one (n = 8) : Video recording instructions
- Pilot two (n = 9) : Coding definitions, training, reliability
- Pilot these: (n = 14)

---

**PILOT Coding of Video Recordings**

- 2 hours of coding per video recorded meal
- 1st coding → primary behaviors
- 2nd coding → jaw trajectory
- Reliability coding (6/14 = 43% of video recordings)
Pilot 3—Descriptive Results
Operational definition ➔ Data

Feeders Type

Non-self-feeder = presented by another person into the oral cavity
Self-feeder = food enters oral cavity by child’s hand/utensil

Percent Acceptance and Refusal in Non-Self-Feeders

Acceptance
• child allows food into oral cavity

Refusal
• child does not allow food into oral cavity
Note reason for refusal
• CNBD = cannot be determined

Reasons for Refusal
Still chewing
State they are not hungry
Refuse NSF but self-feed – they want to SP
“all done” – not hungry
Want to drink – thirsty
Cannot be determined (CNBD code)
Hold = food is held between dental/gum surfaces without removing a piece.

Hold+Break-off = a piece is removed with the hands.

Sustained bite = food is removed by dental/gum surfaces moving through the food to meet and separate the food.

Position

Anterior = before the canines
Lateral = after the canines

4 participants were re-coded for inter-rater reliability — only 1 of the 4 was reliable at >80% for all behaviors.
**Chewing Trajectory**

**OPERATIONAL DEFINITION:**

- **To be considered chewing**
  - Lateral placement of food
  - Bite force or traction perceived (graded; Morris & Klein, 2000)
  - Excluded extraneous movements that were lingual manipulations

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**Mouth Clean Before the Next Bolus – Across Textures**

**Expel, Cough, Gag**

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**Other Behaviors**

- **Mouth Clean** – Swallowing has cleared the mouth of food before the next bolus
  - Swallow = lip pursing and/or laryngeal movement is observed (Wilson, Green & Weismer, 2015)
- **Expel** – food moves out of the oral cavity past the vermillion border

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**Inter-rater coding:**

- **Vertical**
  - Mental protuberance (central/lowest chin) moved in superior-inferior plane at least 1 cycle that was complete.
  - 79% agreement
- **Diagonal**
  - Inferior angular movement to right or left that returned to medial start-point at least 1 cycle that was complete.
  - 70% agreement
- **Rotary**
  - Inferior angular movement to right or left that becomes horizontal, may include a cord-like movement as return to superior position.
  - 86% agreement
**Bolus Duration & Duration between Bites**

- **Bolus Duration** = Time from when the food enters oral cavity until the mouth is clean
- **Duration between Bites** = Time between Mouth Clean and the next Acceptance

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**The Problem of Chew Trajectory**

- Failure to find the Vertical ➔ Diagonal ➔ Rotary sequence in objective kinematic studies (e.g., for review Lefeverend, Edelson, & Less, 2014)
- Texture bias
- Poor reliability
- Validity of observational method
- Is this sequence a specific indicator of typical development?
- Would the sequence be a sensitive indicator of an oral-motor disorder?

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**The TONGUE team**

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**Participants Lingual Laterization analysis**

- **n = 28 participants**
- **mean age = 16 months**
- **age range: 6 months – 29 months**

**Texture Category Levels**

- **IDDSI**
  - 1: easy to chew
  - 2: regular
  - 3: hard

*International Dysphagia Diet Standardisation Initiative (IDDSI)*
Participants
Lingual Lateralization analysis
By Age Groups

Mean Rate per Minute
6- to 8 Months  n = 4
6- to 12 Months  n = 8
15- to 18 Months  n = 8
20- to 24 Months  n = 5
25- to 29 Months  n = 4

Variables
Mean Rate of Lateralization per Minute

3 Dependent Variables
- Direction
- Zone of the tongue
- Lingual Orientation
  - Horizontal
  - Vertical tilt
  - Differential movements #1 and #2

Clear Food Residuals
- Lips
- Tongue
- Teeth

Results

Criteria to code:
- Tip-blade and Anterior body visualized
- Food present

Coding Video recordings
- 2 teams coded separately
- Team data sheets compared for consensus coding
- Reliability coding: currently training and coding

Textures

Lingual Zone of Lateralization

Mean Rate per Minute
6- to 8 Months  0
6- to 12 Months  0.5
15- to 18 Months  1
20- to 24 Months  1.5
25- to 29 Months  2

Mean Rate per Minute
Texture
- 15 PRQWhV
- 7 PRQWhV
- 7 PRQWhV
- 17 PRQWhV
- 10 PRQWhV
- 18 PRQWhV
- 7 PRQWhV
- 19 PRQWhV
- 12 PRQWhV
- 23 PRQWhV
- 29 PRQWhV
- 23 PRQWhV
- 16 PRQWhV
- 28 PRQWhV
- 23 PRQWhV
- 10 PRQWhV
- 0
- 0.5
- 1
- 1.5
- 2
- 2.5
- 3
Increasing texture is associated with
- an increase in lateral movements &
- an increase in the types of lingual postures

L5/L6 Textures ↔ Teeth ↔ Finer Differential Lingual movements on those textures
(← → : are associated with)

Lateralizing textures accomplished by
- Horizontal shifts out of midline of various shapes
  - C-shape
  - Medial branching pushing up/over
  - Flatter shift with body of tongue
- Vertical tilt to see underside of tongue
- Finer differential movements

Bite & Refusal Coding
2020
Capone Singleton & Failey (in progress)

Current data set
\[ n = 29 \]
Mean = 16.62 months
range = 7 months to 29 months

<table>
<thead>
<tr>
<th>Age-Range</th>
<th>n = 4</th>
<th>n = 7</th>
<th>n = 10</th>
<th>n = 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>7- to 9 Months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10- to 13 Months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15- to 20 Months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23- to 29 Months</td>
<td></td>
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</tbody>
</table>

Current Coding of Video Recordings
- accept to accept
- bolus duration measures
- Pilot data & Clinically Related
- Refusal data & Why
- Reliability coding

Coding - Data Sheet

Subject: Patient 1
Date: 10/02/2020

Bite Trajectory
30 sec intervals

30 sec intervals

Total mouth closure

Notes for Refusal
Bite-Off Behavior
Age Analysis
n=27

Bite-Off Behavior by Texture

Puree & Lumpy

NonSelf Feeder

Acceptance

Reasons for NonSelf Feeder Refusal
Intervention Implications

Medical Management
Agency in Eating
Skill in Eating

Comprehensive Assessment

- What oral motor pattern is the child using?
- What factors are contributing to maintain the child's use of that pattern?

Manno et al. (2008)

Werthmann, Jansen, Havermans, Nederkoorn, Kremers, & Roefs (2015)

- Picky-eating is most prevalent in 30- to 48-month olds
- What affects acceptance/refusal in toddlers/preschools?

A child's Agency in eating

- Recommendation to allow textures on the tray.
- Sensory & Motor consequences

LeReverend et al. (2015)

- Early exposure to a range of textures facilitates the acceptance of foods of various textures later on.
### Treatment Goals & Best Practice Recommendations

- **Lingual dissociation & differentiation** (e.g., Morris & Klein, 2000)
  - Present spoon or texture to tongue with downward lingual pressure in the tongue tip/blade region
  - Encourages **dissociated** lingual movements and **differential** lingual movements
- **Normalization of tone – Facilitate muscle movement**
- **Tactile cues** (e.g., Manno et al., 2008)
- **Verbal cues**

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### Before Positioning and Lingual Facilitation

### AFTER Positioning and Lingual Facilitation

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### Acknowledgements

Thank you to the families who shared the intimate practice of meal-time with us.

&

Natalie Nunez, BA

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