The baby does not swallow: diagnostic and therapeutic intervention

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Pediatric Feeding Disorder

- Child's inability or refusal to eat and/or drink sufficient quantities of food to take in appropriate nutrition for their age

- Feeding disorders can take many forms, from refusing to eat only certain food groups to not eating at all, requiring tube feeding.

Feeding Clinic의 필요성

- 소아기의 섭식장애의 유병율
  - 정상 발달 아동 중 25%-45%
  - 발달 지연 아동 중 33%-80%

Diseases and Medical Conditions of the Infant that Interfere with Successful Feeding

- Prematurity
  - Chronic Lung Disease/ BPD
  - Necrotizing Enterocolitis
  - PDA
  - Intraventricular Hemorrhage
  - Porencephalic Cyst
- Cleft Palate / Cleft Lip
- Hypotonia
  - Down Syndrome
  - Prader Willi Syndrome
- Hypoxic Ischemic Encephalopathy
  - Neonatal seizures
- Bowel Obstruction
  - TE fistula
  - Duodenal Atresia
- Pulmonary anomalies
  - Congenital Diaphragmatic Hernia
- Congenital Heart Disease
- Neonatal Sepsis / Meningitis
  - Meconium Aspiration Syndrome

Infants with Dysphagia

Characteristics	
All Boys Girls	107 63 (58.9%) 44 (41.1%)
Gestational age(weeks)	35.1 ±5.3 weeks
≥ 37 weeks	67 (62.6%)
34weeks≤ GA <37 weeks	8 (7.5%)
<34weeks	32 (29.9%)
Birth weight ≥2500 gm <2500 gm	2381.0± 1026.3 gm 63(58.9%) 44(41.1%)
Age at the time of VFSS (CA)	3.8±3.5 weeks
Height at the time of VFSS	58.4±8.5 cm
Weight at the time of VFSS	5330. 0±2071.1 gm

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Associated Medical Conditions

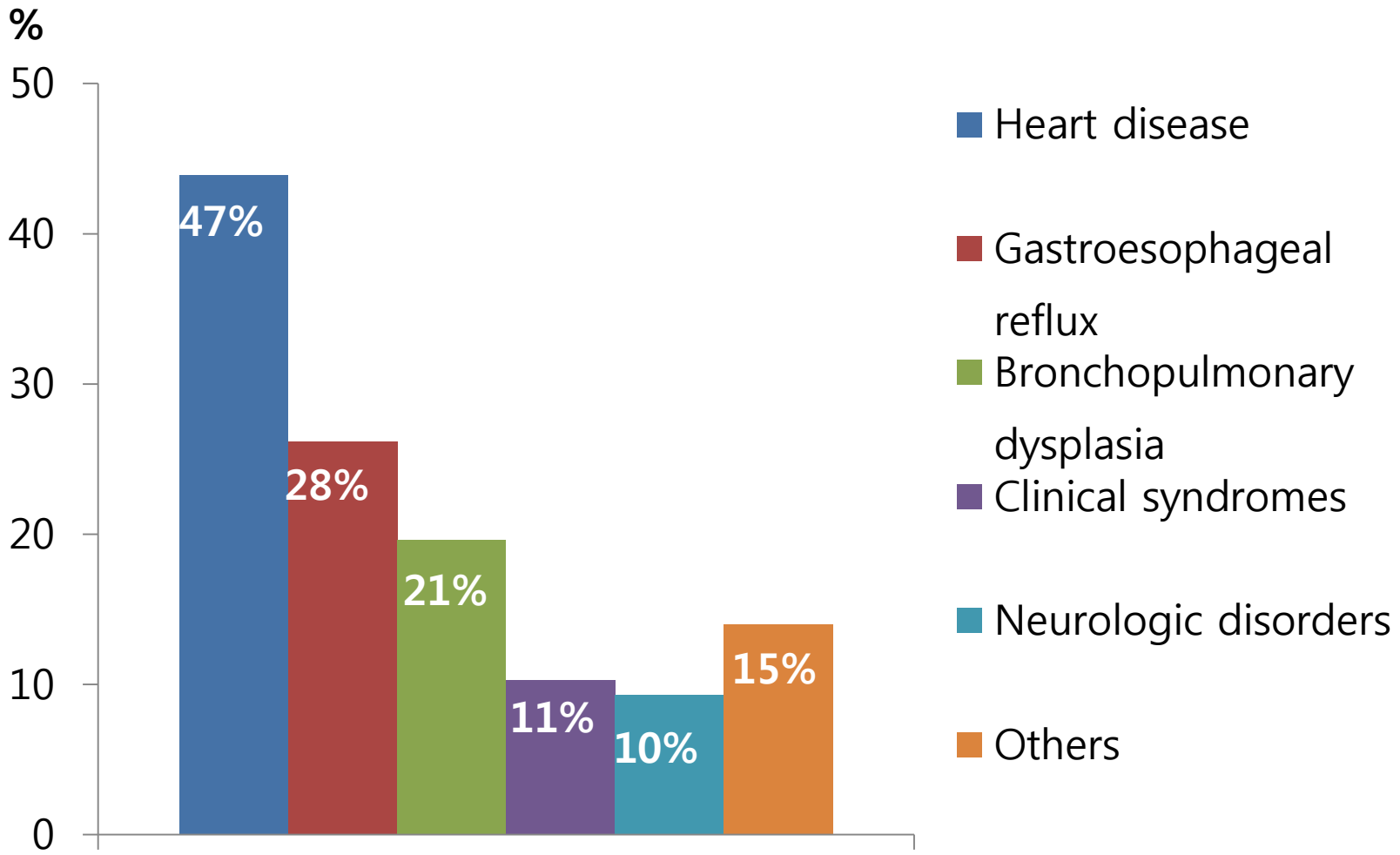


Table 2. Associated medical conditions

	All infants (n=107)	Full-term infants (n=67)	Preterm infants (n=40)
Congenital heart disease[a)]	47 (43.9)	41 (61.2)	6 (15.0)
Gastroesophageal reflux	28 (26.2)	18 (26.9)	10 (25.0)
Bronchopulmonary dysplasia[a)]	21 (19.6)	0 (0)	21 (52.5)
Clinical genetic syndrome[a)]	11 (10.3)	11 (16.4)	0 (0)
Neurological disorder[a)]	10 (9.3)	2 (3.0)	8 (20.0)

Values are presented as number (%).
[a)]$p<0.05$, significantly different between full-term and preterm groups according to Mann-Whitney U-test.

Patient characteristics	No. of patients (%)
Gender	
Boys	77 (52%)
Girls	71 (48%)
Age at presentation	
1-12 mo	52 (35.1%)
1-2 yr	55 (37.4%)
2-7 yr	41 (27.5%)
Gestational age (wk)	
mean	35.8
<34	36 (25%)
34-37	32 (21%)
≥38	80 (53%)
Diet status	
Tube feeding	13
Oral feeding	124
Tube + Oral	11

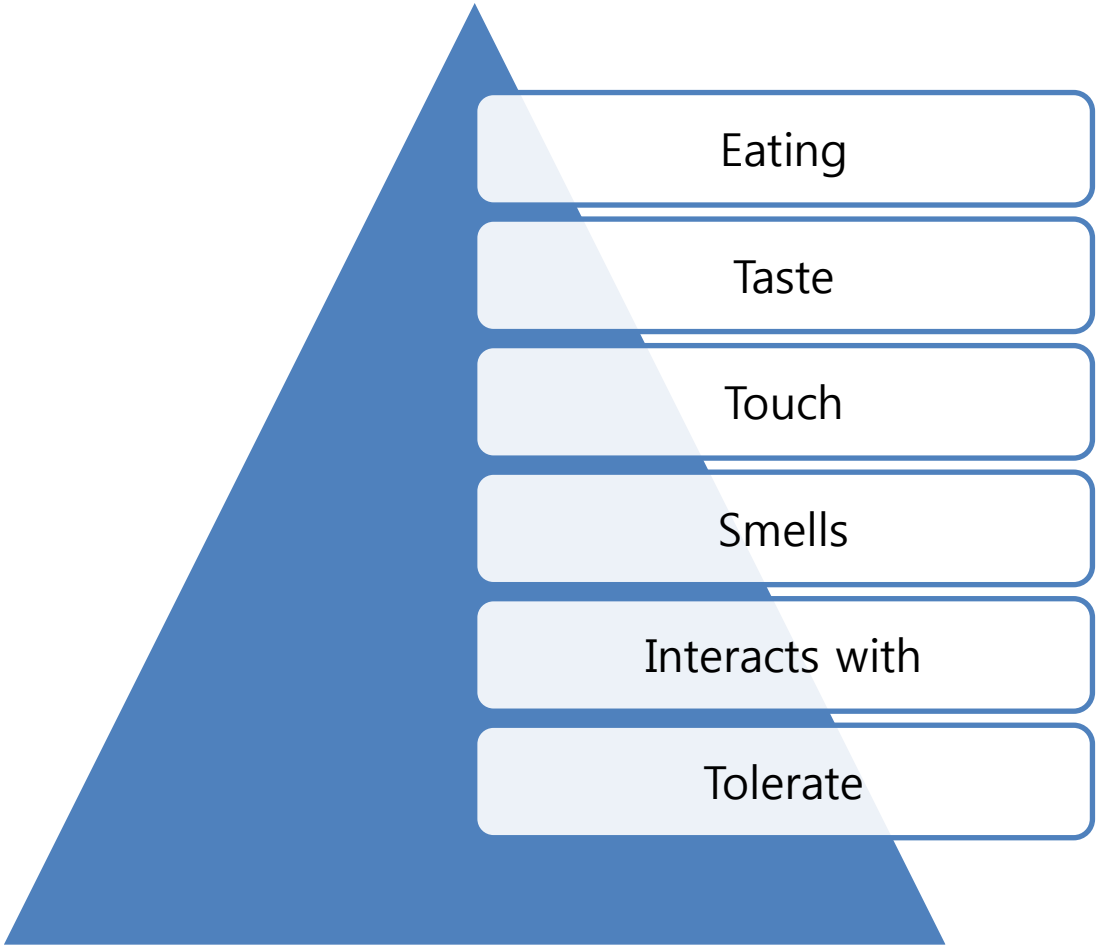
Profile of SMC Pediatric Feeding Clinic

	No. of patients (%)
Cardiorespiratory disease	42(28.4%)
Neurological disease	36(24.3%)
Gastrointestinal disease	28(18.9%)
ENT(swallow related anatomical abnormalities)	14(9.5%)
Metabolic disease	11(7.4%)
Genetic syndrome	6(4.1%)
Renal disease	1(0.7%)
Neurologic- Cardiorespiratory	6(4.1%)
Gastrointestinal- Cardiorespiratory	3(3.5%)
Two combined medical conditions	21(24.4%)
Three combined medical conditions	6(7.0%)
Four combined medical conditions	4(4.7%)

Profile of SMC Pediatric Feeding Clinic

The developmental progression in learning to eat various food textures requires advancing BOTH oral-motor functional AND sensory process

Steps to Eating



Reasons Children Won't Eat

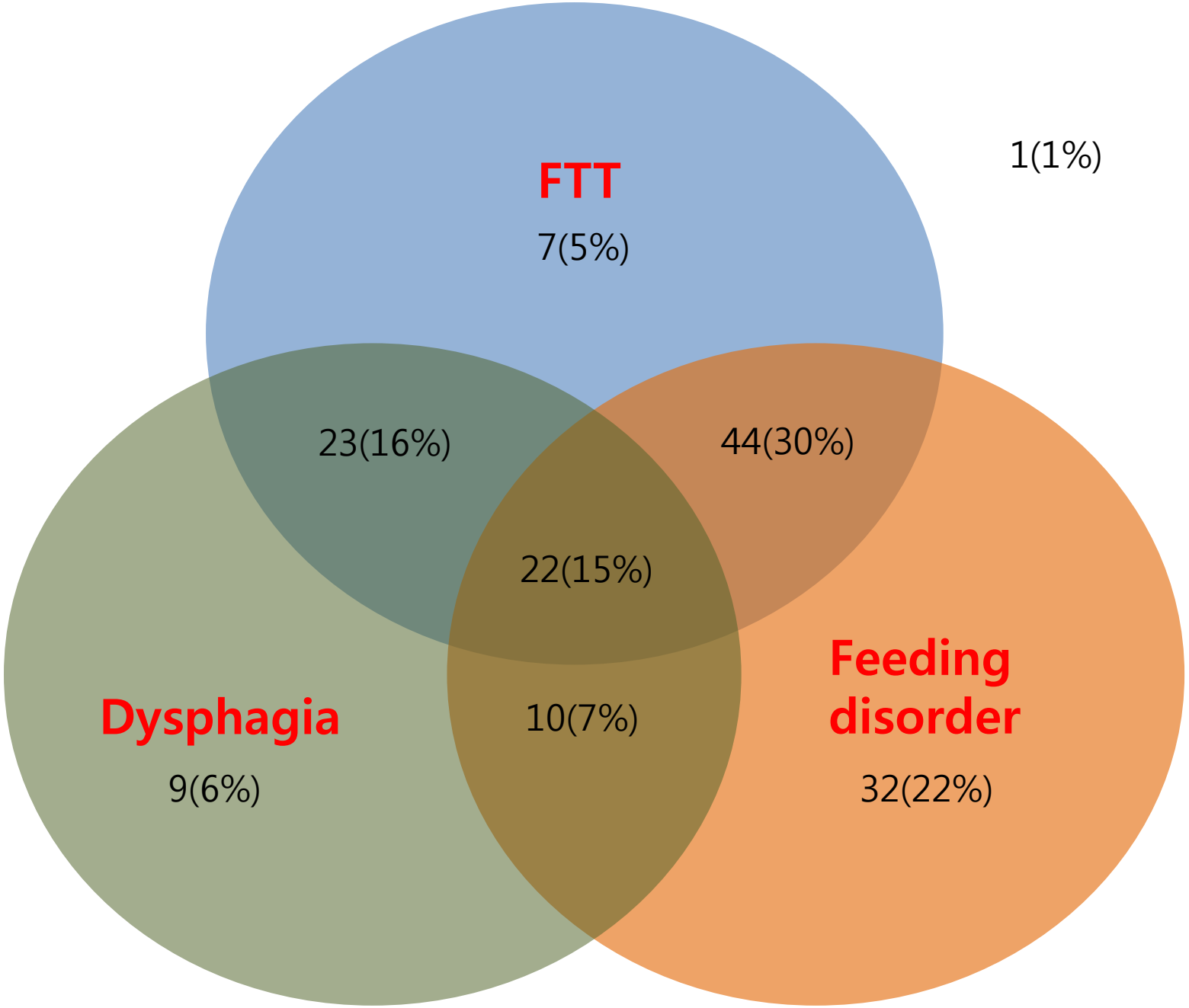
- Pain
- Malaise/Discomfort
- Immature motor, oral-motor, and/or swallow skills
- Sensory processing problems
- Learning/Behavioral
- Nutritional
- Parent factors
- Environmental factors etc.

Profile of SMC Pediatric Feeding Clinic

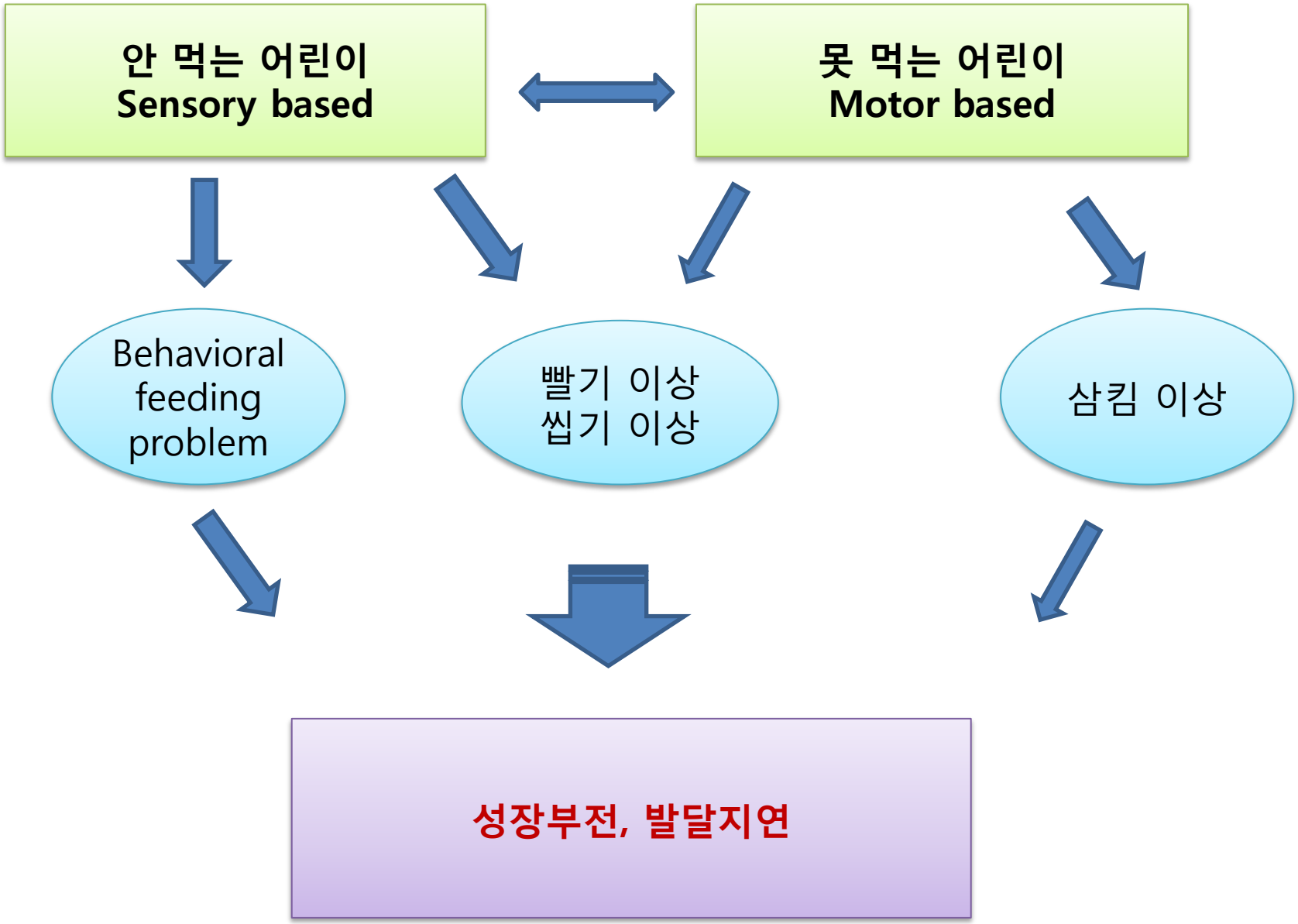
- Failure-to-thrive
- Feeding disorder
  - DSM-V for classification of Feeding Disorders of Infancy and Early Childhood (Chatoor & Ammaniti,2007)
- Dysphagia

- Feeding disorder
  - Feeding disorder of state regulation
  - Feeding disorder of caregiver-infant reciprocity
  - Infantile anorexia
  - Sensory food aversion
  - Posttraumatic feeding disorder, feeding phobia
  - Feeding disorder associated with a concurrent medical condition

Profile of SMC Pediatric Feeding Clinic



Medical correlate	Feeding disorders					
	Feeding disorder of state regulation (n=5)	Feeding disorder of caregiver-infant reciprocity (n=2)	Infantile anorexia (n=28)	Sensory food aversion (n=63)	Posttraumatic feeding disorder, feeding phobia (n=15)	Feeding disorder associated with a concurrent medical condition (n=30)
Neurologic condition	2	0	3	12	7	11
Gastrointestinal condition	1	0	7	14	5	15
Cardiopulmonary condition	2	0	10	12	6	11
Ear-Nose-Throat	0	0	0	5	3	4
Metabolic disease	1	0	2	1	0	3
Genetic disease	0	0	0	1	1	0
Renal disease	0	0	0	1	0	1

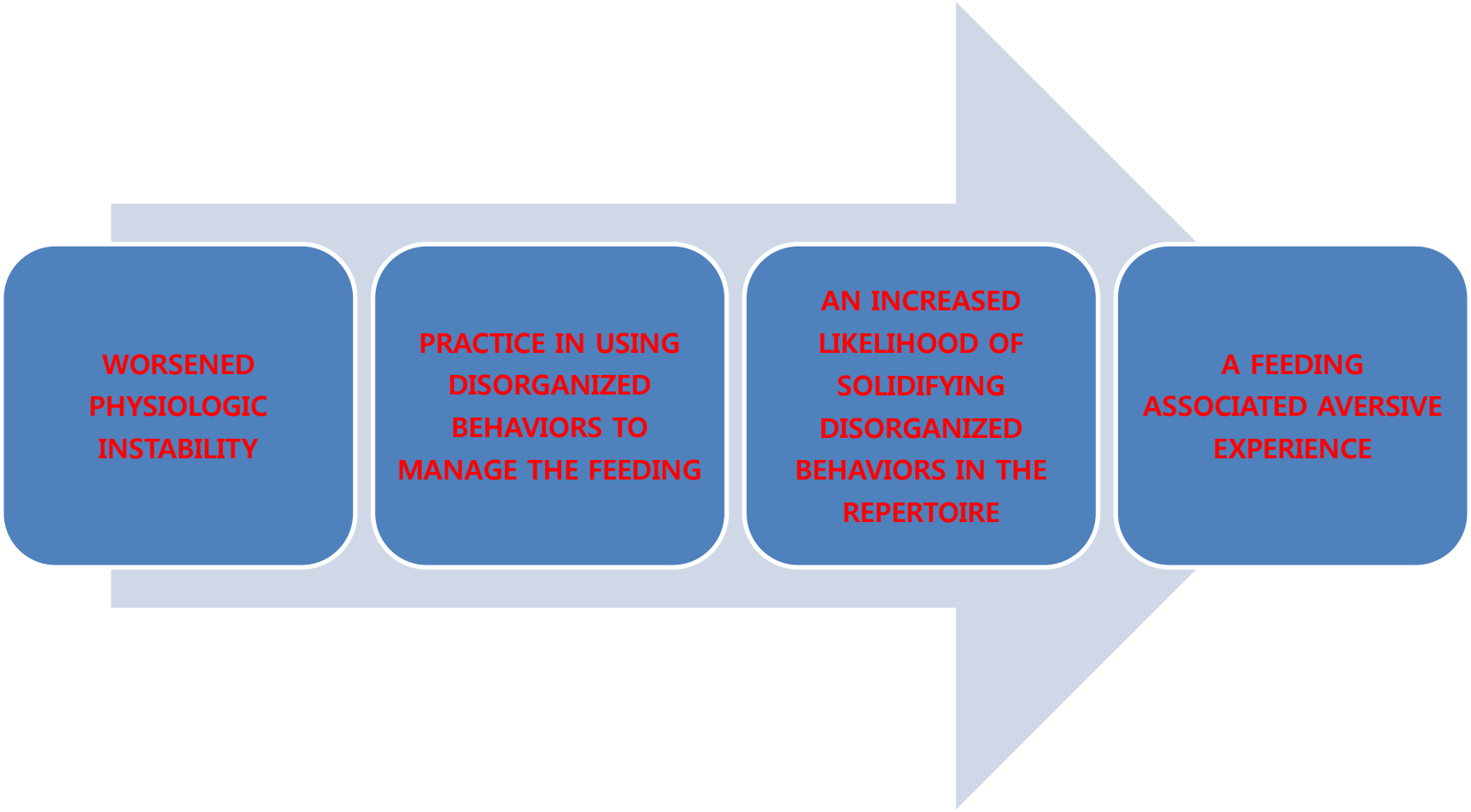

안 먹는 어린이
Sensory based
못 먹는 어린이
Motor based
Behavioral feeding problem
빨기 이상
씹기 이상
삼킴 이상
성장부전, 발달지연

Interdisciplinary Team Approach

- Pediatric gastroenterologists
- Developmental pediatricians
- Pediatric psychologists
- Occupational therapists
- Care managers
- Pediatric dieticians
- Nursing
- Rehabilitation technicians
- Speech and language pathologists
- Social workers

협진시스템 구축

Deleterious outcomes



Assessment

- Feeding history
- Growth history
- Physical examination
- Development
- Oral motor skills
- Sensory
- Behavior
- Swallowing
- **Seating/positioning**
- **Physiologic stability – HR, RR**

Oral Motor Skills

- Jaw stability
- Movement and tone of lips
- Cheeks
- Tongue

The early feeding skills assessment tool

- Suzanne Thoyre
- A Guide to Cue-Based Feeding in the NICU

Neonatal Oral-Motor Assessment Scale (NOMAS®)

- Developed by Marjorie Meyer Palmer
- NOMAS enables one to look at the oral motor components of the tongue and jaw during neonatal sucking and to identify the type of sucking pattern that an infant uses

Disorganized

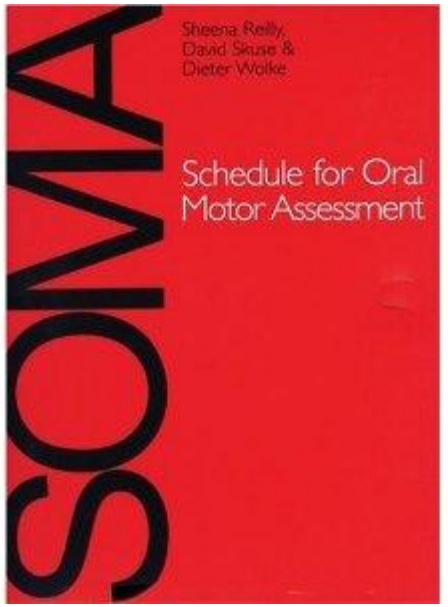
Oral Motor Assessment

- No standardized assessment test or scale is recommended for universal use to assess oral motor skills in children
- Assessment instruments may include:
  - Neonatal Oral-Motor Assessment Scale
  - Pre-Feeding Skills
  - Schedule for Oral-Motor Assessment
  - The Multidisciplinary Feeding Profile

Evaluation : Clinical or bedside evaluation

- observation and assessment of the adequacy of oral motor skills for feeding

- Schedule for Oral-Motor Assessmer (Reilly et al. 1995)
  - Age range: 8-24months
  - Types of feeding assessed
    - liquid(bottle/cup), puree, semi-solid, solid, biscuit
  - Reliability and validity studies have been done



VFSS의 장점

- 삼킴의 과정을 관찰할 수 있음.
- 다양한 성상의 액체와 음식을 시도할 수 있음
- 실제 식사를 모방할 수 있음.
- 치료법을 적용시켜 호전 여부를 관찰 할 수 있음.
- 기록으로 남겨 향후 호전, 악화 여부를 판정할 수 있음.

VFSS의 제한점

- 방사능 노출
- 이동용 기기가 없음
- 실제 식사와는 차이가 있음
- 자세잡기가 힘들고 적절한 협조를 얻기 어렵다.
- 직접적인 감각평가는 이루어지지 않는다
- GERD or 식도의 구조 이상을 잘 발견하기 어려움
- 소아에서 Scoring system이 존재하지 않음.
- 신뢰도?

1) Thin liquid
2) Thick liquid
3) Semi-solid
4) Solid
5) Solid + liquid

SOMA & VFSS Oral Phase

	SOMA: normal	SOMA: abnormal
VFSS oral phase: normal	2	1
VFSS oral phase: abnormal	3	21

** Kappa=0.419, P=0.023*

* SOMA as the gold standard, oral phage of VFSS

- Sensitivity : 95%
- Specificity : 40%
- positive predictive value : 88%
- negative predictive value : 67%

Ann Rehabil Med 2011; 35: 477-484

SOMA & VFSS Oral Phase

- Children who failed oral phage evaluation in VFSS
- Able to evaluate oral-motor function through SOMA
  - 2/6: Normal group in SOMA
  - 4/6: Abormal group in SOMA

SOMA & VFSS Pharyngeal Phase

	SOMA: normal	SOMA: abnormal
VFSS pharyngeal phase : normal	2	11
VFSS pharyngeal phase : abnormal	5	15

** Kappa= -0.105, P=0.509*

Flexible Endoscopic Evaluation of Swallowing

- FEES and FEES plus sensory testing (FEES-ST)
  - use of an endoscope to directly visualize the hypopharynx during the swallowing process to assess airway protection ability
  - initially described by Langmore in 1988
  - *Colodny N, 2002*
    - good reliability when using FEES as compared with the videofluoroscopic study

- Usefulness of FEES and FEES-ST
  - preoperative evaluations for pediatric airway reconstruction

Laryngeal cleft

2개월 남아

Sensory processing difficulties in toddlers with NOFT and feeding problems

TABLE 1. Demographic characteristics of participants

	NOFT with feeding problems group (n = 16)	Control group (n = 16)	*P* value
Sex (number)			
Boys	5	9	0.29
Girls	11	7	
Age, mo	21.56 ± 8.40	23.63 ± 7.89	0.48
Weight, kg	9.29 ± 1.70	12.34 ± 1.58	<0.01*
Weight-for-age (*z* score†)	−173 ± 0.49	0.26 ± 0.59	<0.01*
Height, cm	79.68 ± 7.49	87.62 ± 5.57	<0.01*
Height for age (*z* score†)	−1.53 ± 0.81	0.43 ± 0.94	<0.01*
Gestational age, wk	38.31 ± 1.97	38.57 ± 1.22	0.68
Birth weight, kg	2.79 ± 0.55	2.96 ± 0.21	0.27
Maternal education, y	16.00 ± 1.11	16.38 ± 0.81	0.29

Values are mean ± standard deviation unless otherwise indicated. NOFT = nonorganic failure-to-thrive.
* $P < 0.05$.
† Word Health Organization anthropometric *z* score.

Sensory profile

TABLE 2. The atypical performances in each sensory section score of the Infant/Toddler Sensory Profile

	NOFT with feeding problems group (n = 16)	Control group (n = 16)	*P* value
Auditory	0 (0.0)	1 (6.3)	>0.99
Visual	4 (25.0)	1 (6.3)	0.33
Tactile	5 (31.3)	0 (0.0)	0.04*
Vestibular	8 (50.0)	1 (6.3)	0.02*
Oral	15 (93.8)	2 (12.5)	<0.01*

Values are expressed as the number (percentage) of children. NOFT = nonorganic failure-to-thrive.

* $P < 0.05$.

Development

TABLE 3. Comparison of development between NOFT with feeding problems and the age-matched control groups

	NOFT with feeding problems group (n = 16)			Control group (n = 16)			
	Mean	SD	Range	Mean	SD	Range	*P* value
Bayley							
MDI	91.06	15.00	63.00–117.00	107.56	10.32	86.00–120.00	0.01*
PDI	79.06	18.18	55.00–109.00	107.63	8.94	91.00–120.00	<0.01*
SELSI							
Expressive (DQ)	92.14	14.94	68.42–118.75	105.62	13.51	85.71–129.41	0.01*
Comprehensive (DQ)	96.68	15.67	69.23–118.75	109.18	11.60	88.24–128.57	0.02*

DQ = developmental quotient; MDI = Mental Development Index; NOFT = nonorganic failure-to-thrive; PDI = Psychomotor Development Index; SD = standard deviation; SELSI = Sequenced Language Scale for Infants.

* $P < 0.05$.

BPFAS

TABLE 4. Comparison of Behavioral Pediatrics Feeding Assessment Scale between NOFT with feeding problems and the age-matched control groups

	NOFT with feeding problems group (n = 16)	Control group (n = 16)	*P* value
Child behavior			
Mean intensity of ratings	9.00 (2.00/14.00)	0.00 (0.00/0.00)	<0.01*
Frequency of problems	68.00 (62.00/73.00)	43.00 (39.25/49.75)	<0.01*
Parent behavior			
Mean intensity of ratings	4.00 (1.00/6.00)	0.00 (0.00/0.00)	<0.01*
Frequency of problems	29.00 (26.00/31.00)	19.00 (17.00/21.75)	<0.01*

Values are median (25th/75th quartile). NOFT = nonorganic failure-to-thrive.
* $P < 0.05$.

Feeding Intervention

Motor-Based Feeding Disorder

- Change positions
- Change nipples/bottles/cups
- Change the thickness
- Adjust timing and # of feedings
- Adjust caloric density of foods/beverages

- Cue-based pacing
  - Regulation

- Chin support
- Chick support
- Oral motor stimulation etc.

Sensory-Based Feeding Disorder

- Incremental Progression
- *"Use of regular, consecutive, and measurable additions and/or changes to aid feeding transitions that occur in a connected series"*
- Systematic desensitization
- Positive reinforcement & Environment manipulation
- SOS(Sequential-Oral-Sensory) approaches to feeding by Toomey
- Food chaining by Fraker
- etc

Physiologic stability

- If the infant cannot maintain physiologic stability and a drowsy or alert state with nonnutritive sucking while held in arms

- Stabilize the infant and accomplish the feeding by slow **gavage** possibly with a **positive oral experience (tasting or smelling milk)**

Engagement/participation

- Is the infant actively trying to nipple?
  - Low tone, sleeping, not sucking spontaneously, or trying to escape

Active participation is necessary for learning coordinated, well-regulated feeding behavior

Position and posture changes

- Trunk and head control are closely related to development of oral-motor skills.
- In particular, children with cerebral palsy and accompanying motor deficits frequently have poor head control and poor trunk stability.
- Position changes need to be monitored closely for adjustments over time.
- Special seating

Feeding efficiency: nipple unit flow rate

- Feeding efficiency
  - The amount taken from the bottle compared to the amount swallowed and the effort expended.
- Feeding is not efficient if the nipple flow is too fast or too slow

Slow flow nipple

- A slower flow nipple and rest breaks improved efficiency for infants with RDS

- Slowing the rate of flow often improves SSB coordination and reduces fluid loss

Fast flow nipple

- Infants with chronic lung disease or conditions causing oromotor weakness
  - Who do not have the suction strength to pull the milk/formula out of the bottle
- **Caution**
  - More volume per suck
  - Interruption of regular breathing
  - Apnea, oxygen desaturation
  - Aspiration or choking

Change the thickness

- Food thickener
- Rice cereal

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY REVIEW

The effects of oral-motor exercises on swallowing in children: an evidence-based systematic review

JOAN ARVEDSON[1] I HEATHER CLARK[2] I CATHY LAZARUS[3] I TRACY SCHOOLING[4] I TOBI FRYMARK[4]

- *DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY, 2010*
  - Based on the results of this evidence-based systematic review, there is insufficient evidence to determine the effects of OME on children with oral sensorimotor deficits and swallowing problems.
  - Well-designed studies are needed to provide clinicians with evidence that can be incorporated into the preferences of the client and the clinicians' knowledge of anatomy, physiology, and neurodevelopment in the management of this group of children.

Supplemental tube feedings

- Dysphagia associated with respiratory compromise

- When a patient is unable to achieve adequate alimentation and hydration by mouth

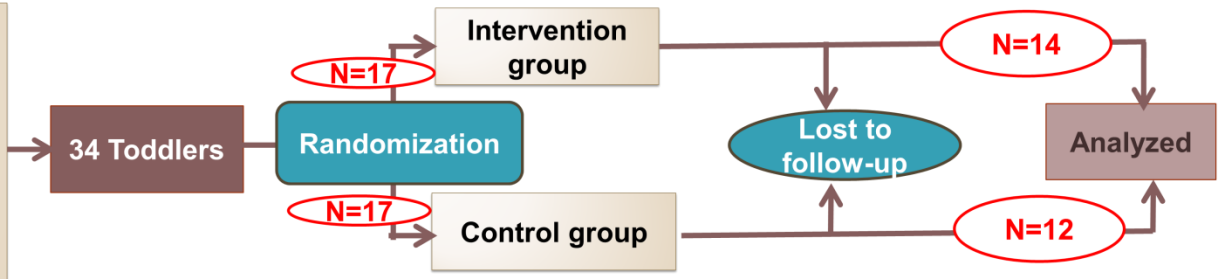
Sensory-based Feeding Intervention for Toddlers with Failure to Thrive and Feeding Problems

Methods

❖ Study design: Randomized controlled study

❖ Intervention: Sensory-based feeding intervention, 30min, 5 times a week, 8 consecutive weeks

❖Eligibility criteria
- ✓ Aged 12 to 36 months
- ✓ Slow weight gain relative to reference population
- ✓ Weight below 5th percentile on growth charts
- ✓ Feeing difficulties at mealtime



❖ Outcome Measures: Pre- and post-measures
- ➢ Anthropometric data
- ➢ Mealtime behavior: Behavioral Pediatrics Feeding Assessment Scale(BPFAS)
- ➢ Oral-motor functioning: Schedule for Oral Motor Assessment (SOMA)
- ➢ Sensory processing ability: Infant/Toddler Sensory Profile (ITSP)

Demographic characteristics of participants

		Intervention Group (n=14)	Control Group (n=12)	p-value
Sex (n)	**Boys**	5	4	>0.99
	Girls	9	8	
Corrected Age (months)		23.93 ± 10.20	19.08 ± 7.95	0.20
Gestational age (weeks)		34.86 ±5.16	34.58 ± 6.01	0.90
Birth weight (kg)		1.94 ± 1.05	2.20 ± 1.15	0.54
FTT classification (n)	**Oraganic**	7	8	0.45
	Nonorganic	7	4	

Values are mean ±standard deviation unless otherwise indicated.

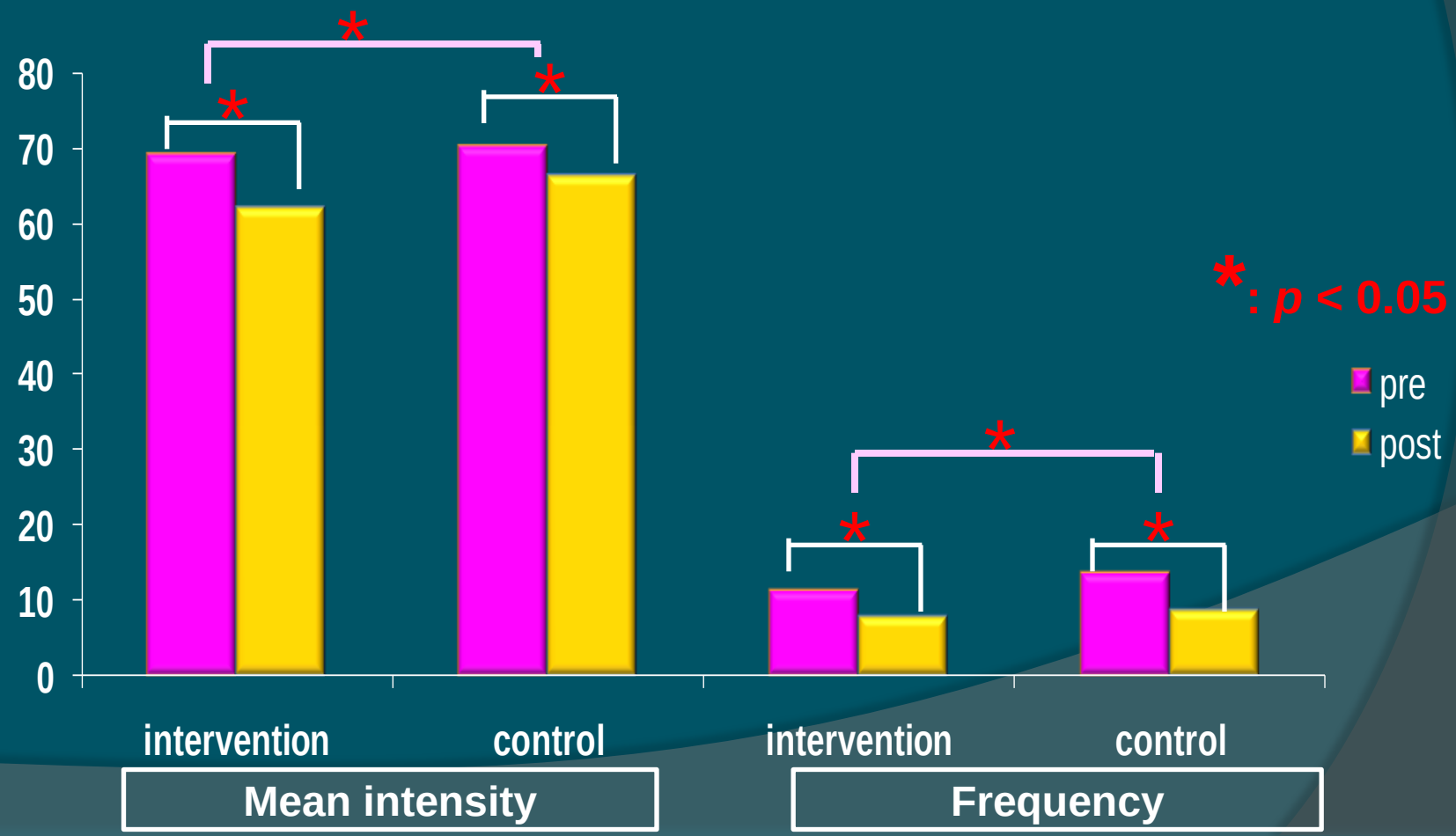
Changes of Anthropometric Data between Intervention and control Groups

	Intervention Group (n=14)			Control Group (n=12)			p-value†
	Pre	Post	p-value*	Pre	Post	p-value*	
Weight (kg)	9.30± 2.07	10.36 ± 2.29	<0.01	8.73 ±1.66	9.68 ±1.66	<0.01	0.64
Height (cm)	79.96 ±9.29	83.57 ± 8.61	<0.01	76.63 ±7.39	80.22 ±6.84	<0.01	0.97
Triceps skin fold (cm)	8.16 ±1.21	9.25 ±182	<0.01	8.22 ±1.75	9.18 ± 1.31	0.07	0.99

*: comparison between values of pretreatment and posttreatment within groups
†: comparison of changes between intervention group and control group
Values are mean ±standard deviation unless otherwise indicated

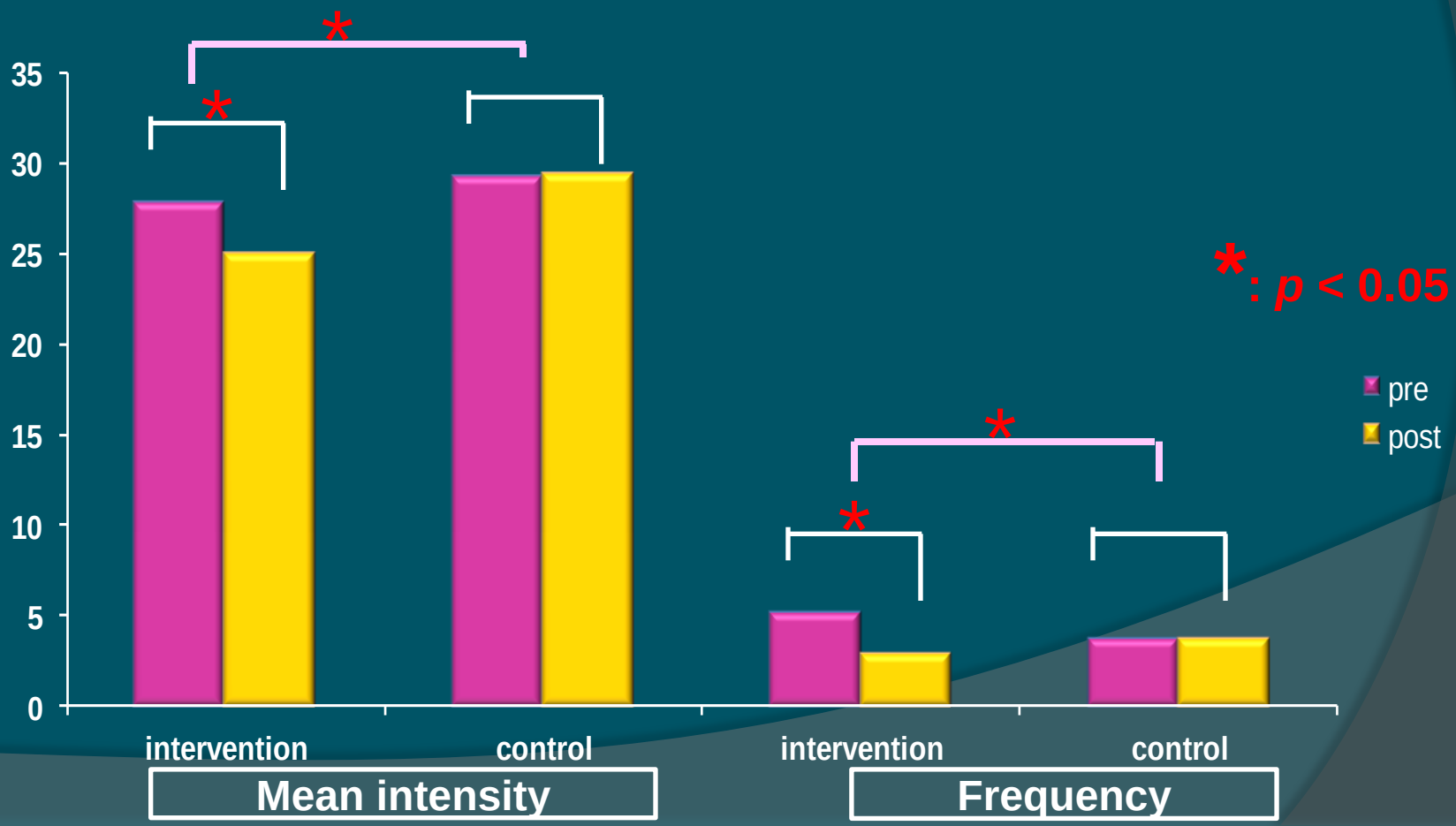
Changes of Behavioral Pediatrics Feeding Assessment Scale between groups

(a) Child behavior



Changes of Behavioral Pediatrics Feeding Assessment Scale between groups

(b) Parent behavior



Other Works

- Education
- GERD with oral aversion
- G-tube feeding & Supporting oral feeding
- Transitioning off G-tubes
- Intestinal Rehab