Oral sensorimotor development in Down syndrome

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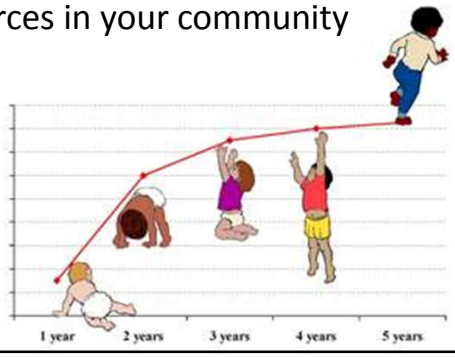
Down Syndrome Research Foundation
Together. Hand in Hand.

Presentation Goals

1. Oral sensorimotor development in Down syndrome:
   - What's different compared to typical development?
   - What are the possible effects on feeding, speech, and health?
2. Supporting optimal development
3. Seeking resources in your community

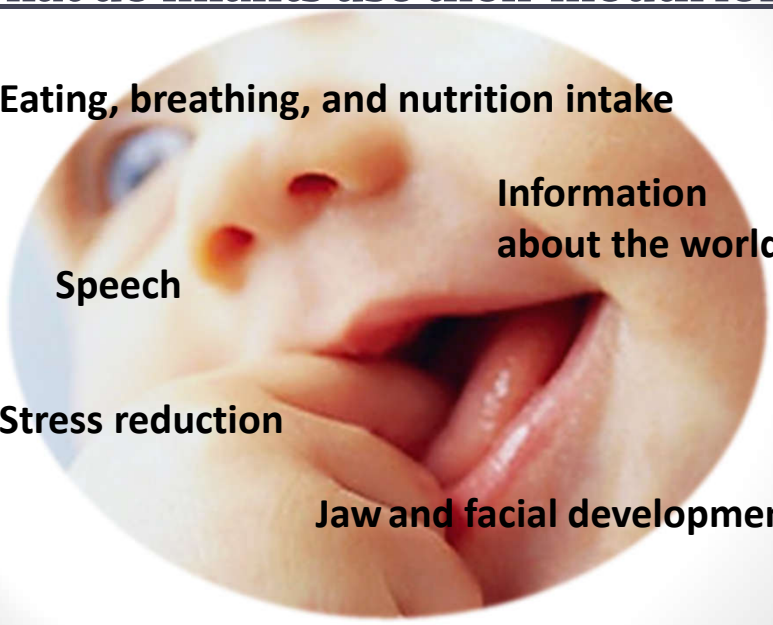


What we'll cover today:

1. Introduction
2. Sensory and motor skills
3. Orofacial development and health
4. Speech
5. Feeding
6. Treatment planning
7. Additional resources

Healthy mouth development supports health and quality of life

What do infants use their mouth for?



Eating, breathing, and nutrition intake

Information about the world

Speech

Stress reduction

Jaw and facial development

Key Concepts Discussed Today

- **Speech**
  - Communicating verbally
  - Making sounds with meaning
- **Feeding**

  - Gathering food and preparing to suck, chew, and swallow.
- **Oral sensorimotor skills**
  - Ability to use the lips, cheeks, jaw, tongue, and palate for oral functions
  - Skills can be seen in oral exploration, feeding, and sound play.
  - Affects speech and feeding development

The Educator's Guide: Chapter 1; ASHA

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- Orofacial development and health
- Speech
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- Treatment planning
- Additional resources

Oral-Motor Skills

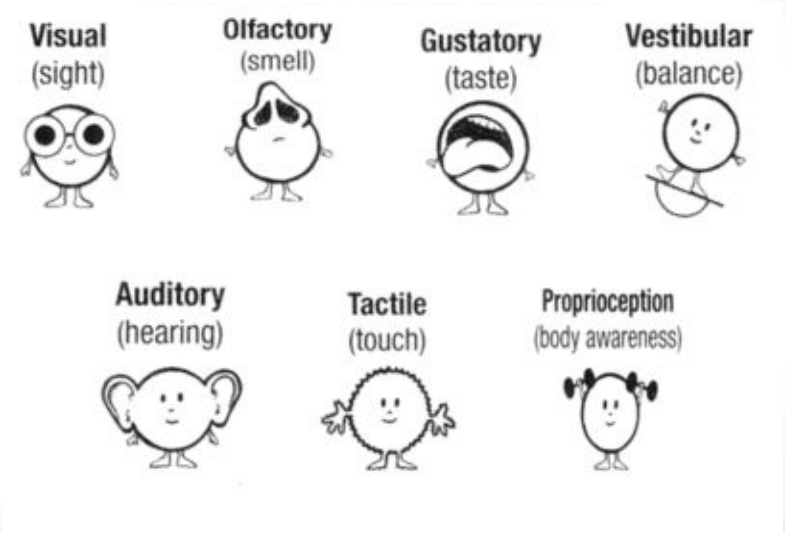
Movement of the muscles of the **Face**

- Muscle tone & strength
- Range of motion
- Speed
- Coordination
- Dissociation

- Lips
- Jaw
- Tongue
- Cheeks

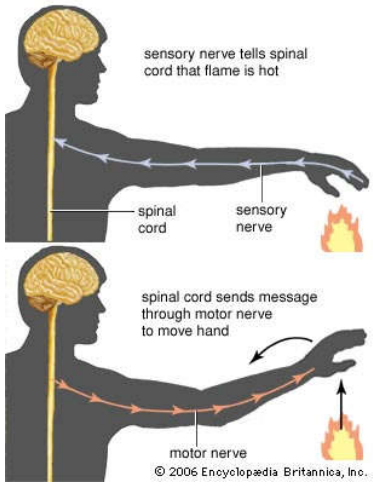
Kumin, n.d.

Senses that affect the mouth



Smith-Myles, 2000

Sensory and motor connection
Reflex responses



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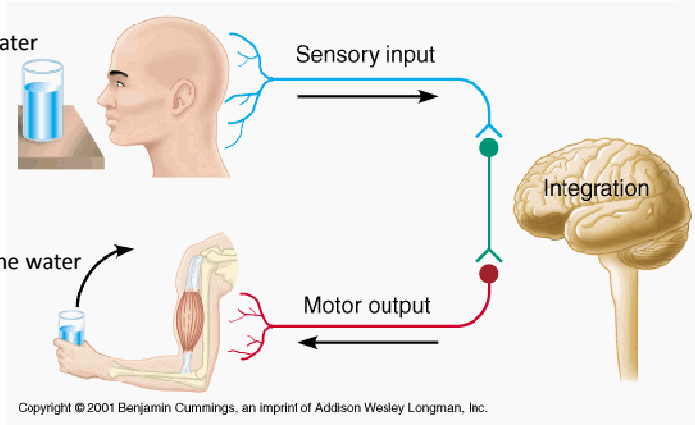
Sensory and motor connection
Planning movement

1. See the water



2. Reach for the water

3. Use just enough force to drink the water without spilling

Sensory and motor connection

Skilled movement

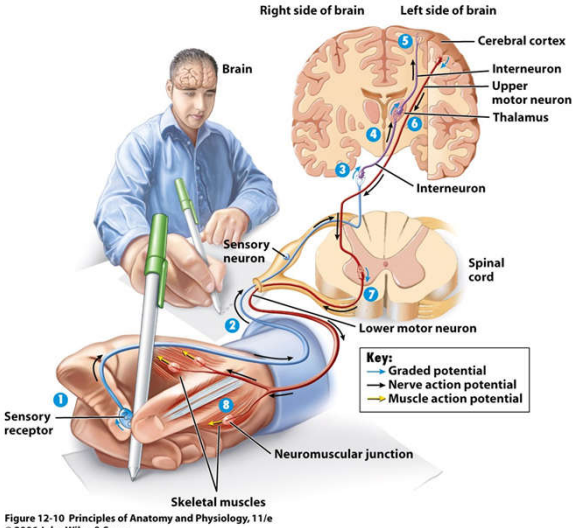


Figure 12-10 Principles of Anatomy and Physiology, 11/e
© 2006 John Wiley & Sons

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Sensory and the mouth

- The mouth contains more sensory nerve fibers than any other body structure.
- Mouth function supports organization of the entire body.
- Mouth sensitivity to touch can be normalized through therapeutic activities such as feeding therapy.
- Normalizing sensation is the foundation for improving oral movements and function.

Kumin & Bahr, 1999

People with DS often experience difficulties with:

- **Processing touch**
  - Making meaning from touch
- **Tactile feedback**
  - Using touch to tell if you've correctly completed a movement
- **Responsiveness to touch**
  - Reaction may be too big (hyper-responsive), too small (hypo-responsive), or mixed.
- **Tactile defensiveness can develop**
  - Learned avoidance of touch

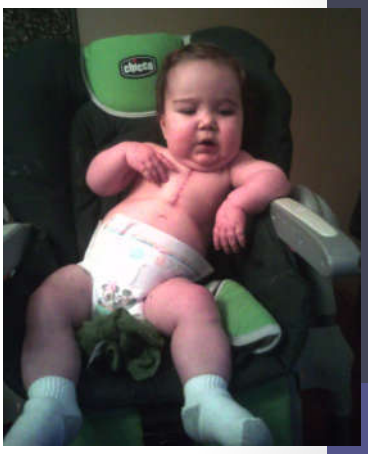
Clues there might be a sensory issue

- Response or reaction to sensory input is 'mismatched' with type of input. Reaction seems too big or too small.
- Intolerance of smells, sights, sounds, textures, temperatures, colors
- Inability to tell when you're hungry or full (interoception)
- Swallows food that isn't chewed well enough
- Puts non-food items in mouth (after a certain age)
- Stores or pockets food
- Gagging or choking
- Drool (after a certain age)
- Very messy eaters

Overland, Merkel-Walsh, 2013
Picture from http://www.lexistential.com/

What's different for children who have sensory and motor delays?

- **Poor postural control**
  - delays coordination for speech and eating
- **Poor sensory awareness**
  - I can't feel where the food is
  - I can't tell when it's chewed enough
  - I gag easily
  - My speech is unclear
- **Compensatory patterns develop**
  - Jaw and tongue move incorrectly



Kumin & Bahr, 1999

What's different for children who have sensory and motor delays?

- **Jaw and tongue are unstable or uncoordinated**
  - Food falls back and I gag, cough, or choke more easily
  - My speech is unclear
- **Infant reflexes last longer than typical**
  - I push food out of my mouth
  - I clamp my teeth down hard
  - I don't have good voluntary control of what my mouth does

Kumin & Bahr, 1999

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Health issues directly impact learning

"Physical well-being influences children's overall emotions, attitudes, and openness to new experiences. When they are even marginally unwell, children are not as available for learning and may reject new experiences or expectations because they lack the energy or ability to handle anything else."

Morris and Dunn Klein, 2000 pg. 23

Resources:

Health Watch Table available at:

www.surreyplace.on.ca/Documents/**Down**%20**Syndrome**.pdf

Health Watch Table — Down Syndrome

Forster-Gibson and Berg 2011

CONSIDERATIONS	RECOMMENDATIONS
1. HEENT (HEAD, EYES, EARS, NOSE, THROAT)	
Children and Adults: Vision: ~15% have cataracts; ~ 20%-70% have significant refractive errors 5%-15% of adults have keratoconus Hearing: 50%-80% have a hearing deficit	☐ Neonatally: refer immediately to an ophthalmologist if the red reflex is absent or if strabismus, nystagmus or poor vision is identified ☐ Arrange ophthalmological assessment: first by 6 months for all; then every 1-2 years, with special attention to cataracts, keratoconus, and refractive errors ☐ During childhood: screen vision annually with history and exam; refer as needed ☐ Arrange auditory brainstem response (ABR) measurement by 3 months if newborn screening has not been done or if results were suspicious ☐ During childhood: screen hearing annually with history and exam; review risks for frequently occurring serious otitis media ☐ Undertake auditory testing: first at 9 – 12 months, then every 6 months up to 3 years, annually until adulthood, then every two years

Health Care Guidelines

from the American Academy of Pediatrics
(Bull, et al. 2011)

http://www.healthychildren.org/English/health-issues/conditions/developmental-disabilities/Pages/Children-with-Down-Syndrome-Health-Care-Information-for-Families.aspx

Health Care Information for Families of Children with Down Syndrome

Child's Age: 1 Month to 1 Year

☐ **Regular well-care visits (check-ups)**
While infants with Down syndrome might need multiple special visits to their doctor and specialty physicians, it is very important that they get regular well-care visits (check-ups). These visits will include checking your child's health, giving immunizations (shots), and building the relationships between the doctor and the family. Developing these relationships will help support the medical and other needs of the child and the family.

☐ **Monitor growth**
It is important to check growth at every visit. Measurements include height, weight, weight for height, and head circumference. Discuss your child's diet, activity level, bowel and urine patterns, and growth. Your child's doctor can help with questions about any need for vitamins or supplements.

☐ **Immunizations (shots)**
Your child's doctor should follow the same shot schedule as for any other child. This includes yearly influenza (flu) shots. It may include other shots, too, depending on your child's health history.

Orofacial development in Down syndrome

- **Low tone**
  - Tongue
  - Cheeks
  - Lips
  - Jaw control muscles
  - Soft palate
- **Lax ligaments in TMJ**

How can it affect speech, feeding, breathing?

- Speech movements can be more difficult to achieve, especially with adequate timing and precision. May hear poor articulation, nasal resonance issues.
- Movements for chewing, drinking, and swallowing can be difficult to coordinate.
- Smaller upper airway space from soft tissue crowding. Airway more likely to collapse during sleeping (sleep apnea).

Uong, et al., 2001

Orofacial development in Down syndrome

- Misaligned bite (malocclusion)
- Dental anomalies (teeth develop differently)

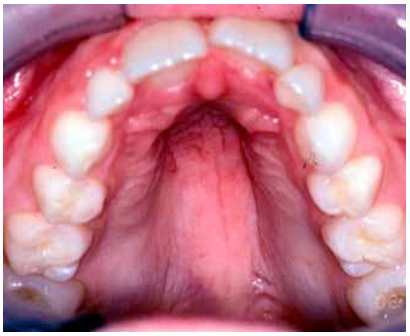
How can it affect speech, feeding, breathing?

- Jaw can be unstable, further challenging movements of tongue and lips.
- Chewing and managing solid foods can be difficult.
- Airway space can be affected. Poor dental health or oral care can lead to more illness and respiratory infections.

Hennequin et al., 1999

Orofacial development in Down syndrome

- **High, arched palate and shallower palate**
  - Typically, the palate forms around the resting tongue during growth.
  - If tongue is resting low in the mouth or mouth is open the palate can't form around the tongue.



How can it affect speech, feeding, breathing?

- Some speech sounds can be distorted or more difficult to achieve (eg. sh, ch, j, tongue tip sounds)
- Food can become stuck in the high palate.
- May affect nasal airway space.

Mew, 2015
Uong, et al., 2001
Rosenfeld-Johnson, 1997

Orofacial development in Down syndrome

- **Enlarged tonsils**
  - May be a sign of sensitivity or allergy to environmental or food allergen.
  - Associated with increased teeth grinding and other habits
  - Associated with mouth breathing (nasal obstruction)
- **Chronic upper respiratory infection**

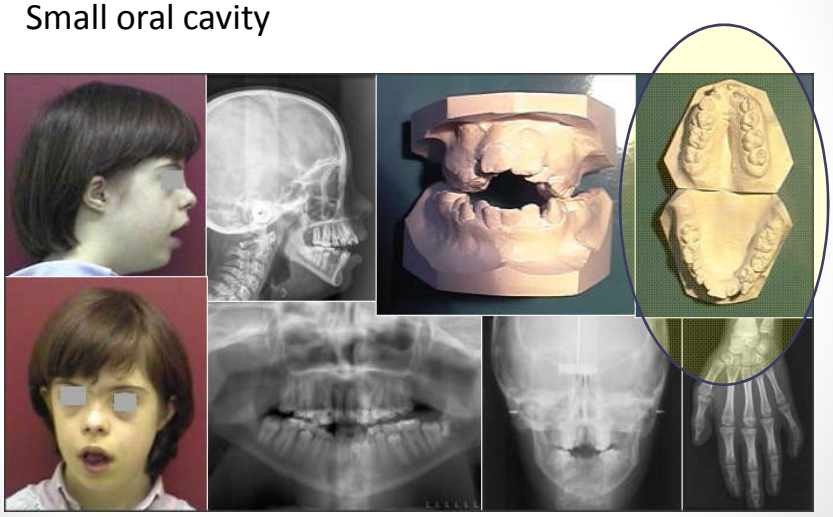
How can it affect speech, feeding, breathing?

- Affects resonance of speech sounds.
- May develop sensitivities affecting acceptance of solid foods.
- Airway space is limited. Airway more likely to close during sleeping (sleep apnea).

Grechi, et al. 2007

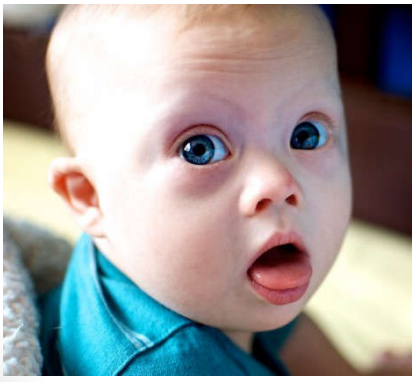
Orofacial development in Down syndrome

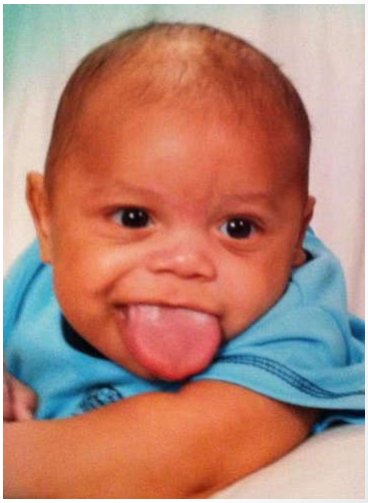
Small oral cavity



Orofacial development in Down syndrome

- Relative or true macroglossia





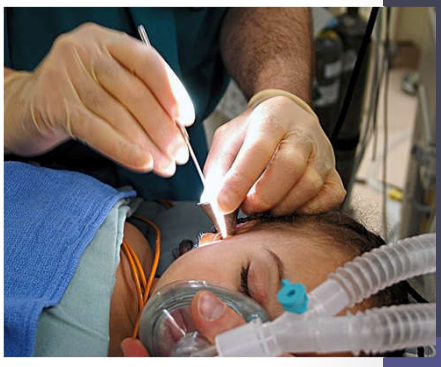
What contributes to tongue protrusion?

- **Bottle drinking**: if milk comes too quickly from the bottle for baby to handle, baby might begin to push tongue forward to stop milk flow so they don't choke. Tongue thrusting and forward position become established.
- **Smaller airway**: If the airway space is smaller, the tongue needs to move forward to allow room to breathe. Enlarged tonsils and adenoids or underdeveloped midface can make airway smaller.
- **Open mouth at rest:**
  Tongue rests on the mouth floor instead of up in the palate. Tongue is visible.

Morris & Klein, 1999
Rosenfeld-Johnson, 1997

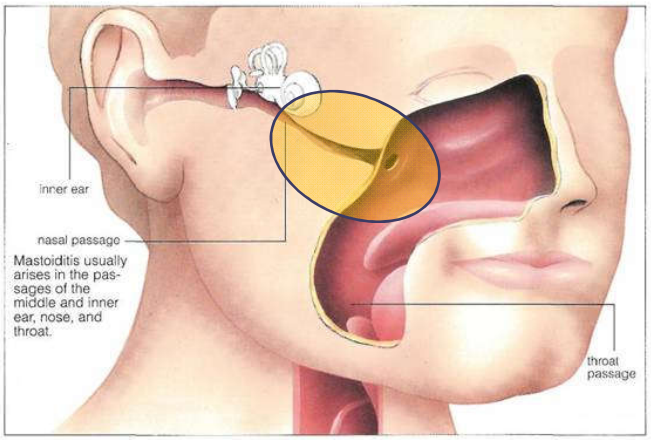
Mild to moderate conductive hearing loss

- Low tone also affects the muscles that open and close the eustachian tube
- High milk flow from bottle and baby lying on her back means milk flows into ear canal
- Leads to recurrent infections in ear canal -> fluctuating hearing loss

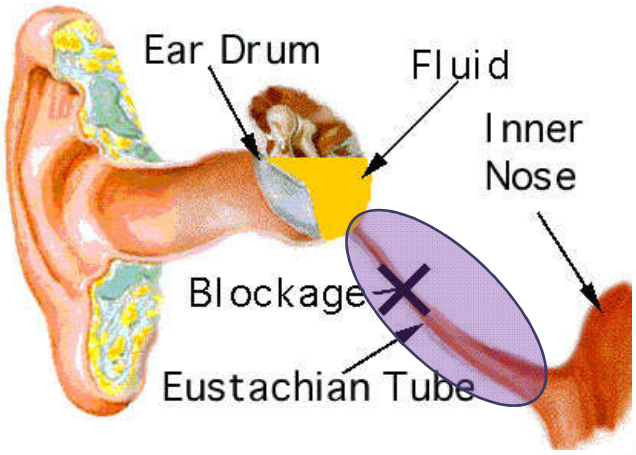


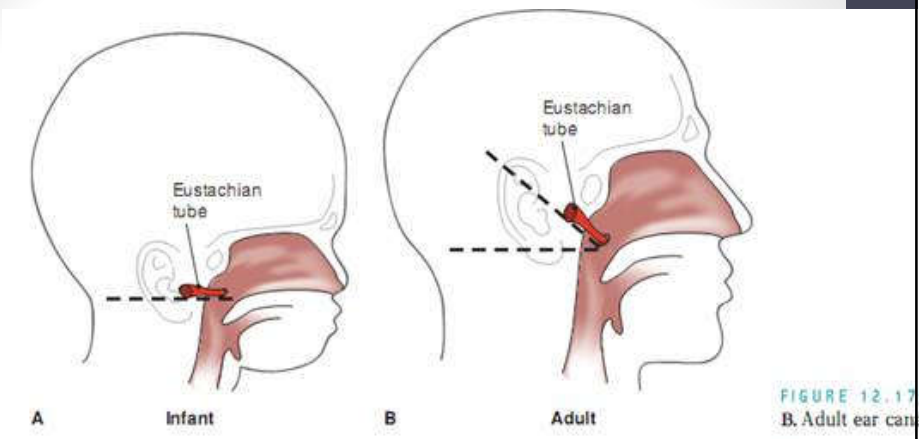
Kanamori, 2000
Rosenfeld-Johnson, 1997

Eustachian Tubes



Eustachian Tube Dysfunction





Eustachian tubes are oriented flatter in babies and children, making it more difficult for fluid to drain and contributing to higher rates of ear infection.

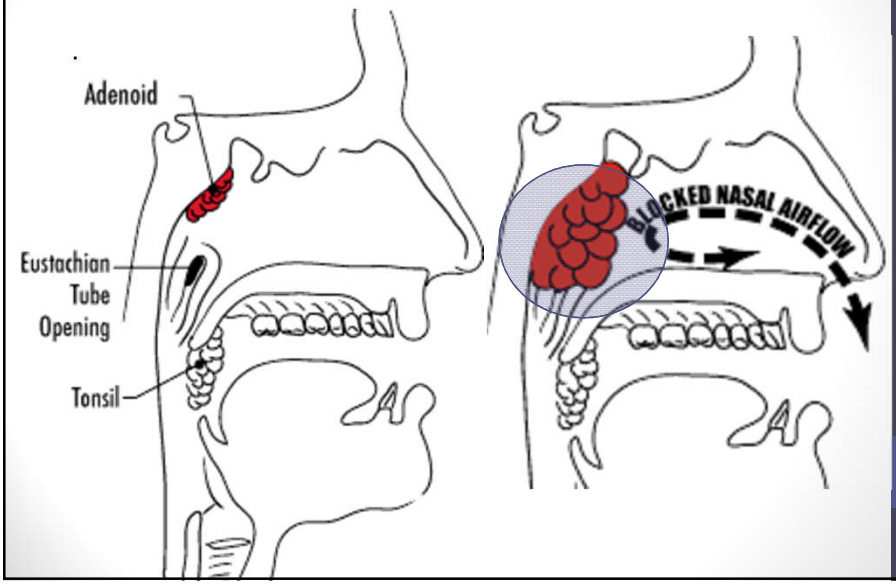
Orofacial development in Down syndrome

- Open mouth at rest
- Mouth breathing

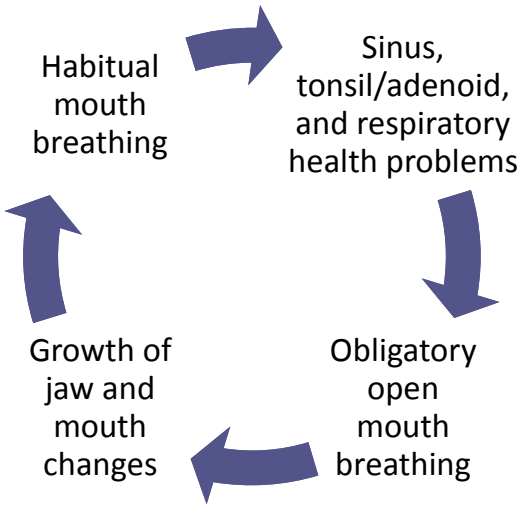
How can it affect speech, feeding, breathing?

- Impaired sensory feedback cycle in mouth develops, reducing precision of articulators. Tongue can become less active.
- Sensitivities to textures and tastes can develop.
- Airway and respiratory health concerns develop, including higher risk of ear infection, enlarged tonsils.

Airway obstruction → mouth breathing → affects face and jaw development



Is an open mouth a problem?



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Three-dimensional assessment of pharyngeal airway in nasal- and mouth-breathing children

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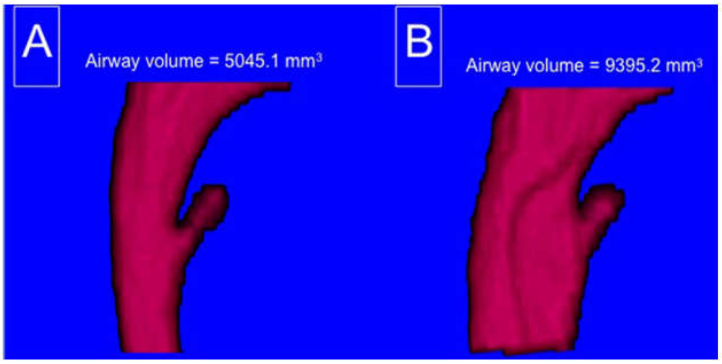
ABSTRACT

Objectives: The aim of this study was to assess the pharyngeal airway space (PAS) in nasal and mouth-breathing children using cone beam computed tomography (CBCT).
Methods: Volume, area, minimum axial area and linear measurements (PAS-NL, PAS-UP, PAS-OccL, PAS-UT, PAS-Bgo, PAS-ML, PAS-TP) of the pharyngeal airway of 50 children (mean age 9.16 years) were obtained from the CBCT images. The means and standard deviations were compared according to sexes



A: Airway during mouth breathing

B: Airway during nasal breathing

Alves et al., 2011

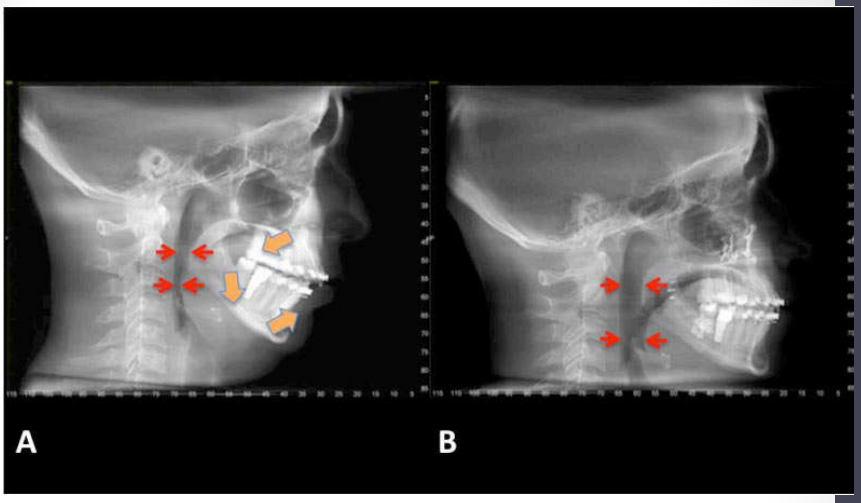
What do the authors conclude from this article?

Conclusion

"According to our results, there are differences between nasal and mouth breathers in airway volume, area and minimum axial area, suggesting that *pharyngeal airway dimensions are higher in nasal-breathers than mouth-breathers*.

The authors believe, that once detected airway constriction, multidisciplinary approach involving pediatricians, physicians, dentists, and ear–nose–throat specialists is required. *The treatment aim should be the improvement of the children breathing condition and consequently all its associated medical, social, and behavioral problems."*

Alves et al., 2011



Narrowed airway due to jaw position and alignment issues

Airway space after jaw position corrected with surgery

http://www.drlarrywolford.com/orthognathic-corrective-jaw-surgery/

Sleep Apnea

Incidence in people with DS is estimated to be between 50 – 80%

Associated with:

- Lower verbal IQ scores
- Poorer performance on measures of cognitive flexibility
- Early cognitive decline in adulthood (including Alzheimer's)
- Difficulties with executive function and attention

Breslin et al., 2014
Chen et al. 2012
Fernandez & Edgin, 2013

Sleep Apnea Treatments:

CPAP Machine: Full Mask

CPAP Machine: Nasal Prongs

Sleep Apnea Treatment Options: Tonsil Surgery

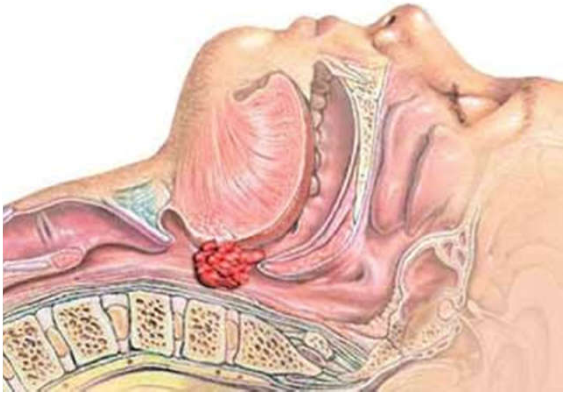
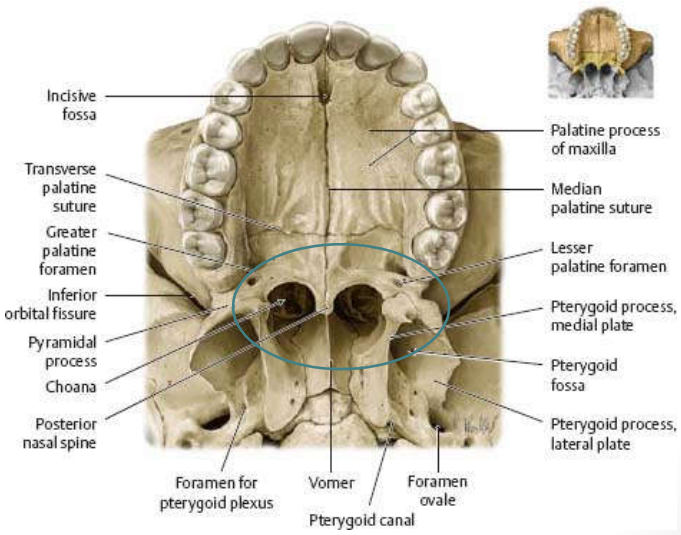


Image: http://besthowtovideosever.com/what/what-is-obstructive-sleep-apnea-news-medicalnet.html

Mid face development affects airway size



Conclusion: oral development contributes to functional concerns:

Children with DS found to have more difficulty with:

- Spoon feeding
- Chewing
- Drinking
- Bolus formation (managing food before you swallow it)
- Swallowing
- Speaking clearly
- Sleep apnea

Kumin & Bahr, 1999
Add reference from swallowing article

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- ✓Orofacial development and health
- **Speech**
- Feeding
- Treatment planning
- Additional resources

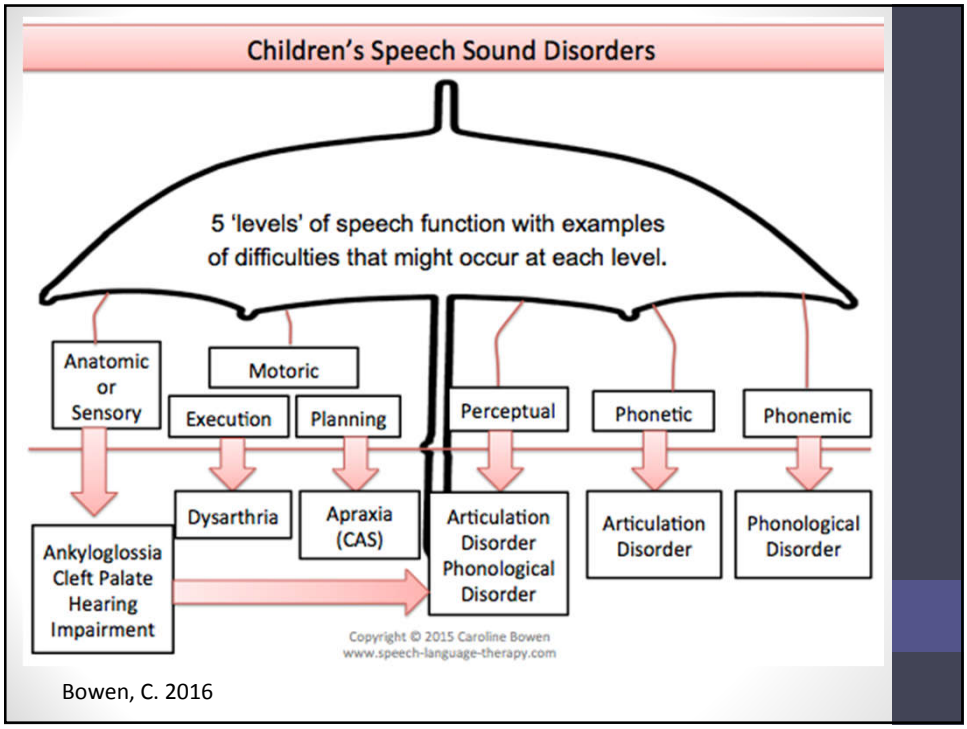
Speech

"Speaking is one of the most refined fine motor functions in the body, and we are often judged by our basic speaking abilities." Bahr 2010, pg 216

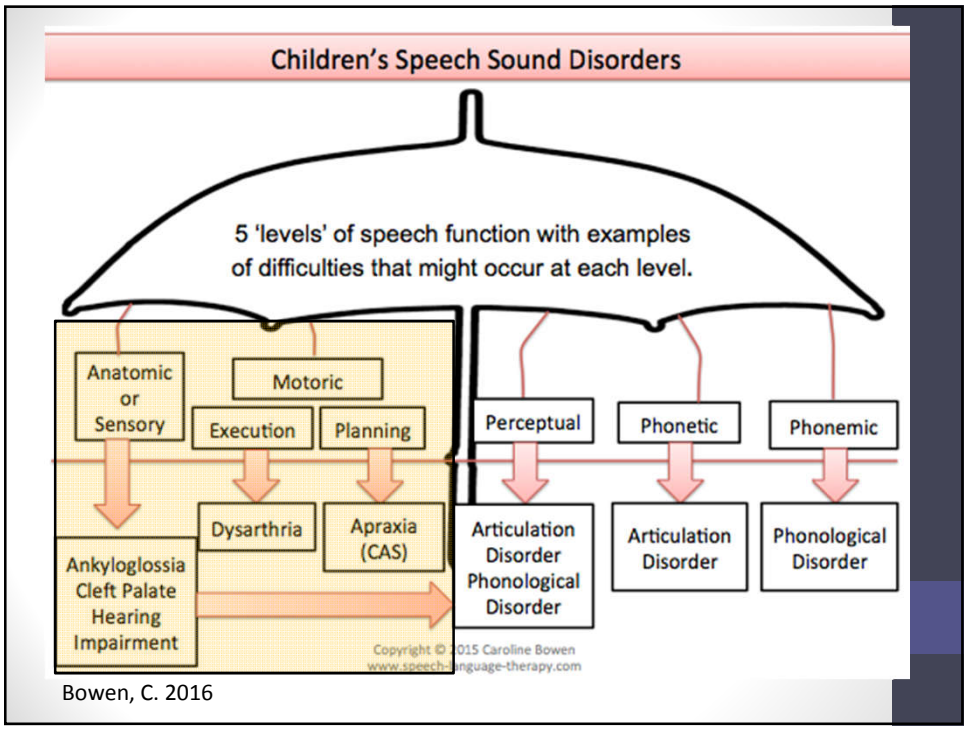
Speech

The most difficult fine motor activity of the body

- https://www.youtube.com/watch?v=-kHtGlhPs3Y



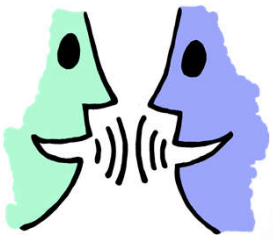
Bowen, C. 2016



Bowen, C. 2016

Speech and Down syndrome

- Speech intelligibility is generally **moderately** to **severely reduced**, continuing into adulthood
- This can be an additional disability.



- The lasting effects of genetics on functioning are thought to be mitigated with early intervention

Speech therapy is important!

- Every child needs an individually tailored therapy plan
- Assessments should look at all aspects of communication
- Goals should be functional – focused on helping people participate in life and the community

Ask your SLP!

What will we work on in speech therapy?

Speech goals might include:

- **Exercises** to support oral motor function
- **Imitation** practice (learn to do what I do)
- **Specific sounds** to practice
- **Sequences** of movements or sounds

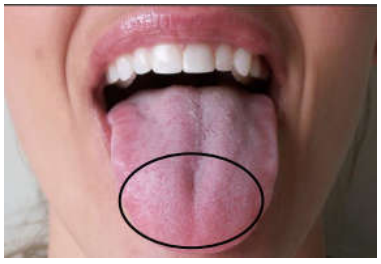
Process of Articulation Therapy

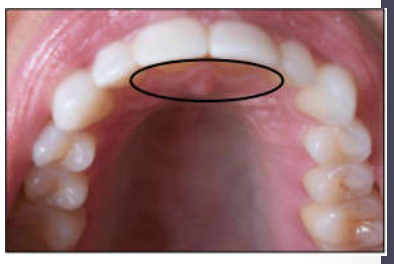
Articulating

"mmmm"

Articulating

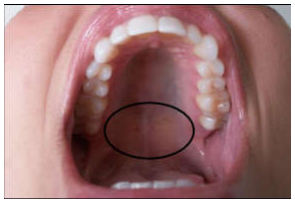
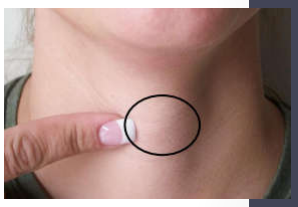
"sss"





Articulating

"g"

Strategies: Video Example

- What strategies is Riley using to help this girl say, "Banana"?

Activity: Changing a Habit

"Oh the places you'll go!
There is fun to be done!
There are points to be scored.
There are games to be won.
And the magical things you can
do with that ball will make you
the winning-est winner of all." Dr. Seuss

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- ✓Orofacial development and health
- ✓Speech
- **Feeding**
- Treatment planning
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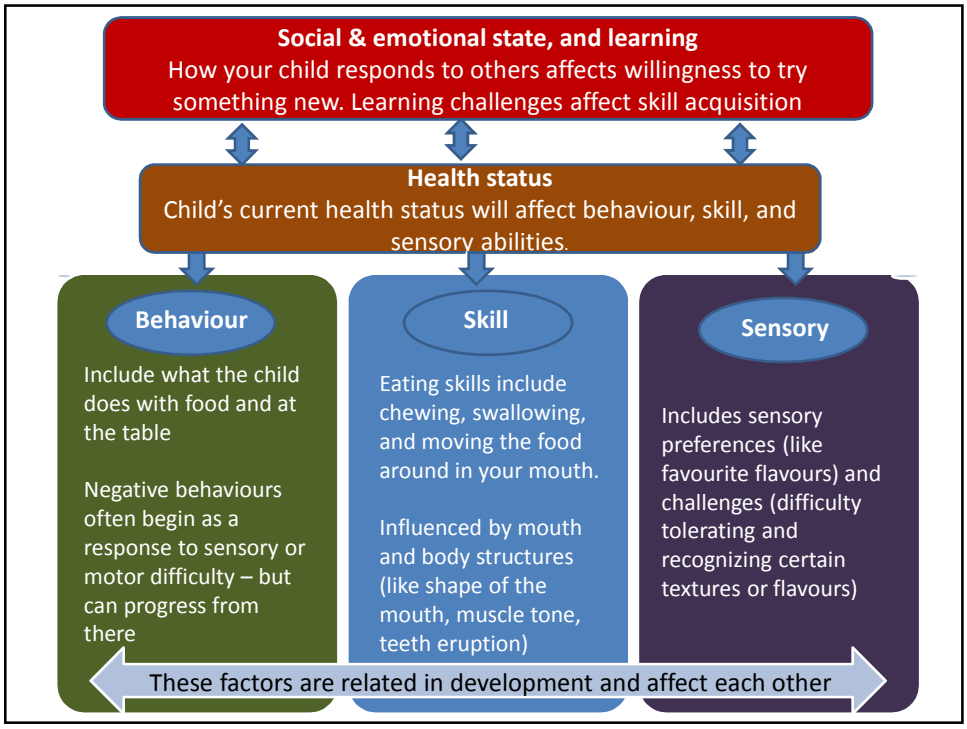


Feeding Therapy

1. Improve sensorimotor skills

2. Modify food characteristics (eg. texture) and mealtime routines to match current skills and needs (keeping safety in mind)

What we'll cover today:

- ✓Introduction
- ✓Sensory and motor skills
- ✓Orofacial development and health
- ✓Speech
- ✓Feeding
- **Treatment planning**
- Additional resources

Down syndrome – Early intervention planning

1. **Early feeding and oral sensorimotor support from day one**
   - Ideally, everyone would have the option to be appropriately supported in breastfeeding if they wanted.
   - Alternative oral development activities like massage may be needed if no breastfeeding.
   - Muscle-based therapies and oral sensory stimulation through specialist (SLP, OT, LC, myofunctional therapist, RMT)

Down syndrome – intervention planning

2. Seek multidisciplinary treatment for medical issues. If needed, seek referrals to:

- **ENT:** treatment for airway obstructions or chronic respiratory issues.
- **Body work** eg. chiropractic / osteo /specialized massage: treatment for constipation, eustachian tube dysfunction, jaw development, cranial shape.
- **Dental & orthodontics**: intervention for palate development and dentition – protect airway development.
- **Nutrition**: support nutrition in the event that modified diet is necessary, or allergy/sensitivity is present.
- **Sleep assessments**: monitor sleep breathing.

Down syndrome – Treatment planning

4. Preventative feeding therapy: support in beginning solids successfully

- Ongoing support to ensure optimal development of chewing, drinking from a cup/straw, accepting solids.
- Find a feeding therapist in your community. Usually SLPs or OTs are trained in feeding therapy. Be aware that there are a variety of approaches out there!
- As new foods are introduced, be on the look out for changes in skin (eczema), congestion, bowel changes, bloating, behaviour challenges… any signs of sensitivity, allergy, or intolerance.

Down syndrome – Treatment planning

5. Each child is unique! What blend of activities or interventions could benefit your child?

- Behavioural intervention (especially positive behaviour support)
- Sensory integration therapy (through an OT)
- Many other out there! Network in your community

So how can we help to conquer sensory issues?

For little ones:

- Provide opportunities for sensory and exploratory play
  - If they can't or don't start this kind of play themselves, bring the opportunities to them! Use a variety of mouth safe toys and objects your baby can access easily.
- Infant massage – focus on the face and mouth
  - Seek out Infant Massage courses in your community or find an RMT who specializes in infants

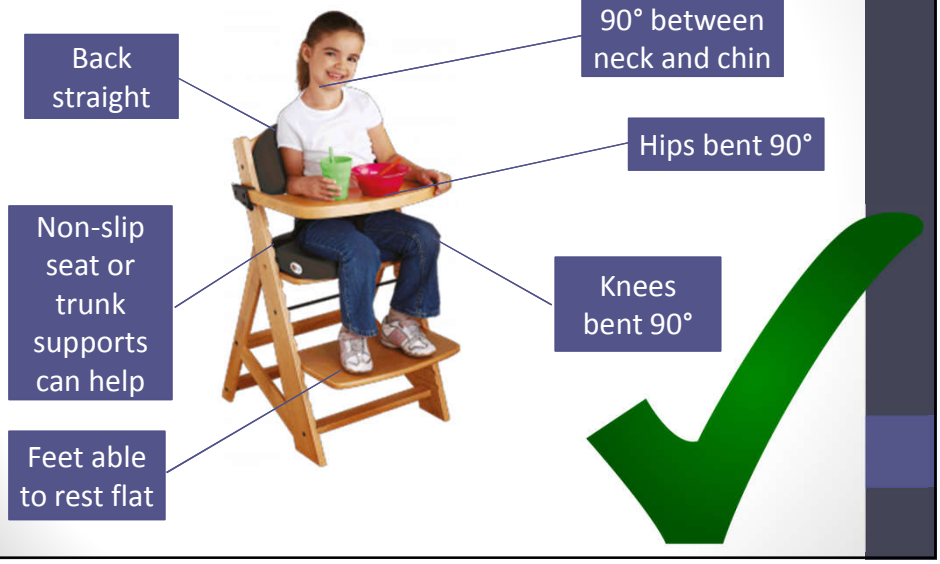
So how can we help to conquer sensory issues?

- Work with an occupational therapist with experience in sensory processing disorders.
- Discuss appropriate and individualized sensory preparation activities for before mealtimes and to support speech therapy.
- Work with an SLP or OT with specialization in oral sensorimotor issues.
- Make sure your child has supportive seating (including back, side, and foot support as needed) for mealtimes.

Supportive seating for alignment : 90° 90° 90°

"What you see in the body is what you get in the mouth"
Seek physio or occupational therapy support if unsure

Supportive seating helps kids use sensory and motor skills to the best of their ability



Great household items for mouthing

Specialty items for oral sensorimotor development

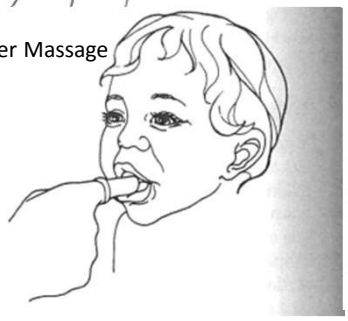
Available through www.talktools.com or www.arktherapeutic.com

Specialty item: Myomunchee

http://myomunchee.com/

Sensory Preparation Activities – 'Wake ups'

Infa-dent finger Massage



Lip Tapping

Hold your fingers together, and tap or clap the fingers on your child's lips in a playful fashion. This is especially effective if your child opens and closes the mouth while you are doing it.

From: Dunn-Klein & Delaney, 1994

Facial massage / facial molding

- A technique to gently but firmly massage the mouth towards a closed position

Dunn Klein & Delaney, 1994

Take Home Messages

- Oral-motor and sensory challenges are common in Down syndrome.
- Health challenges can further compromise development.
- We can positively affect developmental outcomes through intervention.
- Find resources in your community to support your child's development

Celebrate every victory along the way!

What we'll cover today:

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Who can help?

- **Speech-language Pathologist (SLP)**: BC association, Alberta association and Canadian association all have private practice listings and resources
  - www.bcaslpa.ca; http://acslpa.ab.ca/, www.sac-oac.ca
- **Occupational Therapist (OT)**: COTBC private practice listings
  - www.caot.ca/CAOT-BC/CAOTBC_Directory__2015.PDF
- Developmental pediatrician
- Behaviour specialist
- Dentist
- Orthodontist
- ENT
- PT
- Dietician/nutritionist
- Gastroenterologist

Knowledge = prevention!
Be prepared and start early

Resources: Feeding and Oral Motor Development (Books and manuals)

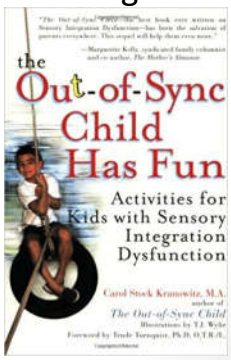
- Nobody Ever Told Me (or my Mother) That!: Everything from Bottles and Breathing to Healthy Speech Development, Diane Bahr, 2010
- A Sensory Motor Approach to Feeding by Lori Overland, Robyn Merkel-Walsh, 2013
- Feeding and Nutrition for the Child with Special Needs: Handouts for Parents Paperback, Marsha Dunn Klein, 2006
- Pre-Feeding Skills: A Comprehensive Resources for Mealtime Development Paperback, Suzanne Evans Morris & Marsha Dunn Klein, 2000
- Just Take a Bite: Easy and effective answers to food aversions and eating challenges. Lori Ernsperger and Tania Stegen-Hanson, 2004

Resources: Feeding and Oral Motor Development (websites)

- Feeding Matters. Organization for supporting parents of children with feeding struggles, includes professional resources https://www.feedingmatters.org/
- Ages and Stages, website by Diane Bahr http://www.agesandstages.net/
- Lactation Consultants in BC registry http://www.bclca.ca/Find-a-BCLCA-Lactation-Consultant
- Talk Tools. Company offering products, training, books, and articles on the subject of oral motor development for speech and feeding www.talktools.com
- ARK Therapeutics. Company offering products and articles on the subject of oral motor development for speech, feeding, and habit elimination www.talktools.com
- AOMT: Academy of Orofacial Myofunctional therapy https://aomtinfo.org/

Resources: Sensory Processing

- The Out of Sync Child – Carol Kranowitz
- The Out of Sync Child Has Fun – Carol Kranowitz
- Pathways to Play: Combining Sensory Integration and Integrated Play Groups – Glenda Fuge and Rebecca Berry



Resources: Speech & Language Development (books)

- Early Communication Skills for Children with Down Syndrome, Libby Kumin, 2012
- Helping Children with Down Syndrome Communicate Better, Libby Kumin, 2008
- Teach Me to Talk!: The Therapy Manual, Laura Mize, 2011
- Building Verbal Imitation in Toddlers, Laura Mize, 2012
- It Takes Two To Talk: A Practical Guide For Parents of Children With Language Delays, by Jan Pepper and Elaine Weitzman, 2004

Resources: Speech & Language Development (websites)

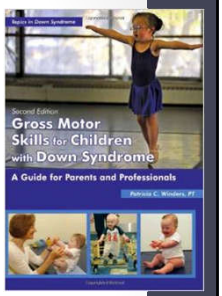
- Childhood Apraxia of Speech Association of North America (CASANA) http://www.apraxia-kids.org/
- American Speech-Language Hearing Association (ASHA) www.asha.org
- Speech-language and Audiology Canada (SAC) http://www.sac-oac.ca/
- Marshalla Speech and Language www.pammarshalla.com
- Mommyspeechtherapy.com
- The Hanen Centre www.hanen.org

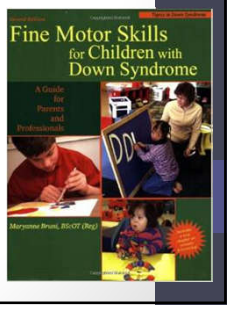
Resources: Nutrition

- Super Baby Food – Ruth Yaron, 1997
- Down Syndrome and Vitamin Therapy - Kent MacLeod, 2003
- The Down Syndrome Nutrition Handbook: A guide to promoting healthy lifestyles - Joan Guthrie Medlen & Timothy P. Shriver, 2006

Resources: Gross and Fine Motor Development

- Gross Motor Skills In Children With Down Syndrome, Patricia C. Winders, 2013
- Fine Motor Skills in Children with Down Syndrome, Maryanne Bruni. 2006





Resources: New Parents and DS general resources

- The Guide to Good Health for Teens and Adults with Down Syndrome, Dr. Brian Chicoine and Dennis McGuire (2010).
- Parent's infant development journal available for free at: http://www.ncb.org.uk/media/528564/developmental_journal_for_babies_and_children_with_down_syndrome.pdf
- Babies with Down Syndrome, Susan Skallerup, 2008
- (DVD) Down Syndrome: The First 18 Months, Blueberry Shoes Productions, Will Schermerhorn, 2004
- The Parents' Guide to Down Syndrome, Jen Jacob & Marda Sikora (2015)

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