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Sensory Changes in Adults: Impact on Swallowing & Diet Selection; Part 2

Presenter: Denise Dougherty, MA, CCC-SLP

Moderated by:
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Sensory Changes in Adults: Impact on Swallowing and Diet Selection Part 2

Denise Dougherty, MA, CCC-SLP
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Disclosures

Financial
- Honorarium - SpeechPathology.com
- Private Practice Owner

Non-Financial
- Quality Insights of Pennsylvania

Aging and disease processes change our swallow and impact nutrition/hydration. This two part seminar will review the normal aging swallow, physiologic changes in the aging patient and the impact on the swallow, diet and nutrition

Learning Objectives

As a result of this Continuing Education Activity, participants will be able to:

- 1) identify changes in dentition and mastication that occur with aging.
- 2) describe the impact of aging on the sense of taste.
- 3) identify three potential problems with texture-modified meals.

Dentition!

Chewing and Dentition Go Hand in Hand!

Why Floppy Teeth??

Weight Loss!

Xerostomia

- inadequate saliva
- tongue sticks to palate
- burning sensation mouth/tongue
- dentures need saliva to adhere to gums
- causes
  - sore gums
  - pressure sores
  - lacerations of mucosa

Bone resorption

- **3 years after loss, 50% of alveolar ridge bone GONE**
- earlier tooth loss, quicker process occurs (33)

Denture Adhesive and Zinc

- overuse of zinc denture adhesive is potential cause of copper deficiency
- overdose is *toxic*
- copper deficiency results in
  - anemia
  - neurological symptoms
  - affects walking and balance.
  - numbness and movement difficulty affecting feet and legs
  - rapidly progresses to arms
- Limited recovery (58)

Denture Adhesive and Zinc

- Denture fixative soluble over time
- Small pellets swallowed
- Zinc absorbed in gut (57)

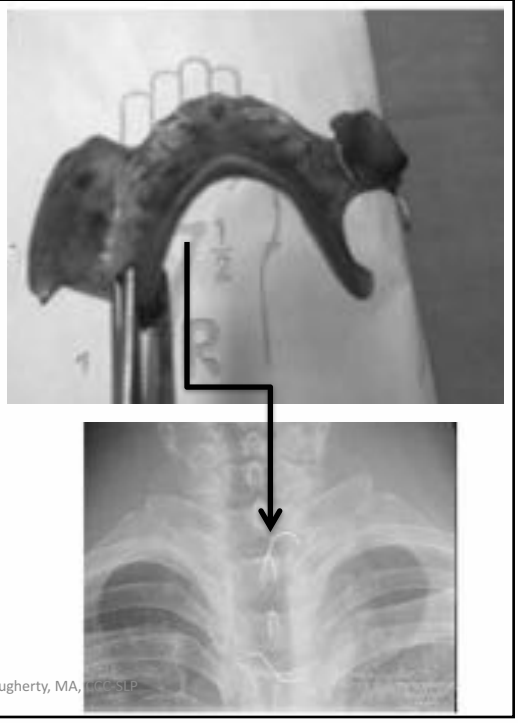
2.4-ounce tube of denture adhesive

- Should last 7 to 8 wks. if pt. has *upper and lower* dentures (56)

Swallowed denture

http://www.nature.com/ajg/journal/v104/n3s/full/ajg2009492_7a.html

removed surgically through left side neck incision,
not removable intra-operatively because of fully penetrated hooks



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Dentition Concerns(41)

- **Nutrition**
  - Won't wear dentures for meals
  - Avoid certain foods
  - Decreased ability to process foods
  - **Tooth loss increases bite size pts willing to swallow**
  - **Bite size too large to pass through UES and esophagus**
    - **Decreased elasticity of UES**
    - **POOR/weak peristalsis**

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Mastication Concerns (41)

Decreased muscle mass/density of masseter, temporalis and medial pterygoid muscles.

- should have **bilateral force**
- poor amt. of bone for support & stability of denture
- gums pinched between denture/bone
- chewing dislodges denture
- decreased biting/chewing
  - **normal bite force of natural teeth = 162 pounds**
  - **bite force w dentures = 35 pounds**

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Dentition

- **Minimum 20 functional teeth necessary** for good mastication,
  - ***only*** if antagonist pairs
- Individuals w fewer than 13 remaining teeth have double the risk of dysphagia
- Individuals w removable dentures produce a coarser bolus than people w intact dentition and achieve only 25% of the chewing effectiveness of dentate individuals (63)
- Greater risk of choking to death on food if edentulous (60)
- **Absent teeth, ill fitting dentures or dental disease are correlated on autopsy studies with sudden choking deaths**. (62)

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Denture Implants

Fixed implant supported mandibular prostheses

NEED adequate bone!

- improved masticatory efficiency, better bite force results in fewer episodes of coughing and choking (59)

www.dentistinshreveportla.com

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Mastication Changes

Masticatory muscles associated w periodontal membranes help perceive

- firmness
- elasticity
- springiness
- chewiness

Need to keep these

muscles strong!

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Texture

Texture attributes generated throughout mastication process

- Particle size, stickiness, roughness require input from mechanoreceptors found in tongue, soft palate, cheeks and lips (14)

Texture attributes to describe fluids

- thickness, creaminess and mouth coating

Difference between texture of BLACK coffee vs. coffee w cream!

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Mastication Changes with Aging

Oral physiology/anatomy changes impact chewing

- Time and effort to consume meal safely
- insufficient food consumed to meet nutritional needs

Older adults

- use more chewing cycles to break down food
- longer chewing duration
- more prevalent w dentures

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Aging and Mastication

Increased perception food texture is hard!

- jaw muscle activity decreases w age
- compression bite forces are reduced
- prevalent in denture wearers (23)

50-85% loss of chewing efficiency found in edentulous individuals (14)

Asphyxiation

Gag reflex

- designed to eject insufficiently chewed bolus/large objects from oral cavity
- 1/3+ of healthy individuals have absent gag reflex. (64)

Death from asphyxiation on food

- 7 times higher in pts. 65+ yrs. than children aged 1-4 yrs. (66)
- Often misdiagnosed as myocardial infarction. (65)

Aging Impact on Anticipatory Phase

- **Increased Medications**
  - CNS impact?
  - Lethargy, impaired level of alertness
  - Difficulty with remembering strategies
- **Tremors**
  - Difficulty w self feeding, spillage
  - Contributes to fatigue
  - Chin/tongue tremors impacts oral phase

Fatigue when self feeding

- Self feed initially, then requires assistance

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Mouth and Aging

Periodontal membrane

- required for support and positional adjustment of teeth
- involved in sensory perception while chewing

Dental caries, periodontal disease and osteoporosis affect dentition

- Mouth closure contributes to bite forces necessary to break down food
- Muscles work in combination w mechanoreceptors during mastication to detect position of jaw and detect items in mouth (14)

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- 1.1 million US adults
- 80% taste disorders are **TRULY SMELL** disorders
- Taste sensation resides in brain
- Life span of taste bud?

  10 days!
- Lose buds after age 50
- Constant cell turnover

TASTE???

Single bud has 50-100 taste cells

- Each cell recognizes every taste
  - Increased sensitivity to one taste
    - Sweet, sour etc.

(29)

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Impact of Chewing on Flavor

- Chewing releases flavor throughout oral phase

BUT

- Foods requiring little chewing and more **tongue to palate contact** produced *retronasal flavor appreciation*
  - occurs after swallow (68)

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Taste

(39)

- Elderly w 1+ medical conditions and average of 3 meds needs ***11 times*** *as much salt and almost* ***3 times*** *as much sugar* to detect these tastes in foods
- Increased dependence on meds impacts taste
  - Meds alter taste perception (23)

Drugs that change taste:

- Lipid lowering drugs
- Antihistamines
- Antibiotics
- Anti-inflammatories
- Bronchodilators
- Asthma drugs
- Antihypertensives
- Parkinson's meds
- Antidepressants

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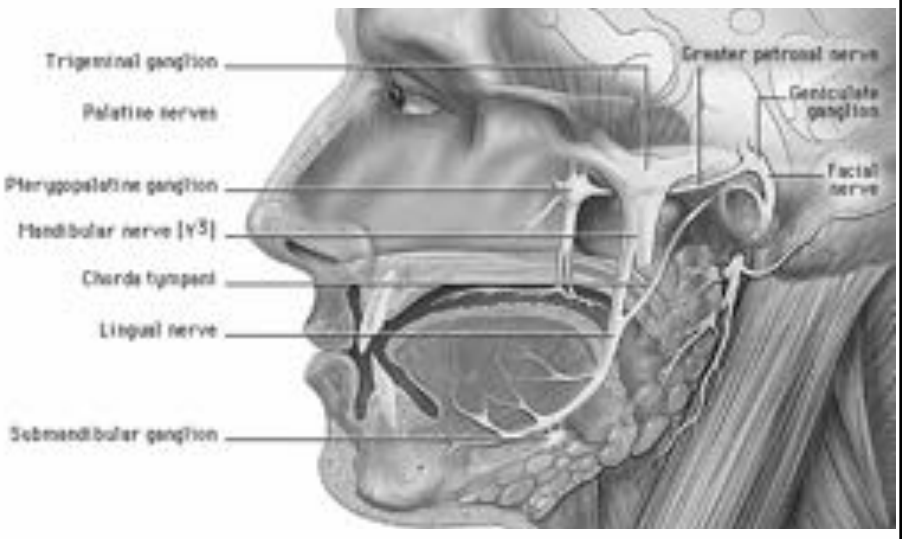
Chorda Tympani Nerve www.yale.edu/cnerves/cn7/cn7_20.html



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What impacts taste? (30)

- Poor oral hygiene **leading cause** of taste changes
  - Oral infections & inflammation/gum disease
- CNS damage
  - Multiple sclerosis**
  - Facial paralysis
  - Sjogren's syndrome**
  - Cirrhosis
  - Bell's Palsy**
  - Renal failure w dialysis**
- Nutritional deficiencies
  - Anorexia
  - Vitamin deficiencies
  - Malabsorption
  - Increased urinary loss
- Endocrine disorders
  - Diabetes mellitus**
  - Hypogonadism
  - Hypothyroidism**
  - Hormonal fluctuations
  - Pregnancy or menstruation

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Mouth care Protocol!

Improved hygiene/frequent professional oral health care reduced AP **40%** in high risk elderly

- Intensive oral care may reduce AP by **improving cough reflex sensitivity** in elderly NH pts.(31)
- Elderly suffer from poor oral health which impacts taste
- Increased bacterial growth associated w impaired taste (14)

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Mouth care (28)

- **Toothette® does not remove plaque** - brushing better
- Studies: (412 residents)
  - **70%+ had not seen dentist in 5+ yrs.**
  - **22%** reported dental problem
  - **82%** unable to clean dentures
  - Staff cleaned denture in **64%**
  - **95% dentures unhygienic**
  - **33% stomatitis***
  - Pts w teeth – **75%** unable to do mouth care
  - **0% received assistance**
  - ⅔ of tooth surface covered in plaque w mod/severe periodontis
  - Calculus in **82%** & cavities in **63%**

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Stomatitis www.vitaminsestore.com

- Denture stomatitis
  - common oral mucosal lesion
- more common in elderly
  - Reduced oral and denture hygiene
- Risk w age-related chronic disease
  - type 2 diabetes mellitus
  - drugs
  - age-associated immunocompromise
- Contact sensitivities to denture material
- Side effect of cancer tx

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(2)

Stomatitis

Caused by

- Radiation/chemotherapy
- Flagyl
- Dirty dentures
- Gold salts used to treat rheumatoid arthritis
- Dilantin - anticonvulsant
- Tegretal – anticonvulsant

(10)

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Thrush www.pharmgd.com

- infection of buccal cavity
  - yeast overgrowth
  - antibiotics, steroids, immune dysfunction.
- common in poorly nourished populations.
- tx of choice fluconazole or oral nystatin suspension
  - Swish and swallow
  - Failure to do so provides ineffective treatment for lesions in posterior pharynx and esophagus.

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Cancer and Taste

- 50% + have impaired taste w disease, treatment
  - **Several wks. to 6+ months**
- Zinc supplement
  - improves taste during chemo
  - **DOES NOT** prevent taste changes w radiation therapy
- Food aversion
  - **Can be learned**
  - Sensory properties of food associated w gastrointestinal distress
  - **Learned aversions & decreased food preferences persist long after all symptoms subside**

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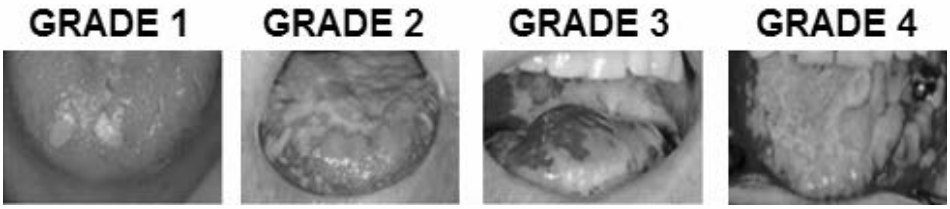
What impacts . Disorders of Taste and Smell

Donald Leopold, MD; Chief Editor: Arlen D Meyers, MD, MBA *Otolaryngology and Facial Plastic Surgery*, Apr 12, 2012,



- Radiation-induced mucositis
- Surgical manipulation
  - Tongue resection decreases # of taste buds
- Stretching chorda tympani nerve
- Smoking
- Dentures
- Meds
  - Some antibiotics & blood pressure pills cause bad taste or loss of taste.
- Radiation/chemo**
  - Affects microvilli of taste buds
  - **High turnover cells sensitive to radiation/ chemo**
  - Anticancer therapy
    - Binds w zinc
    - May create metallic taste

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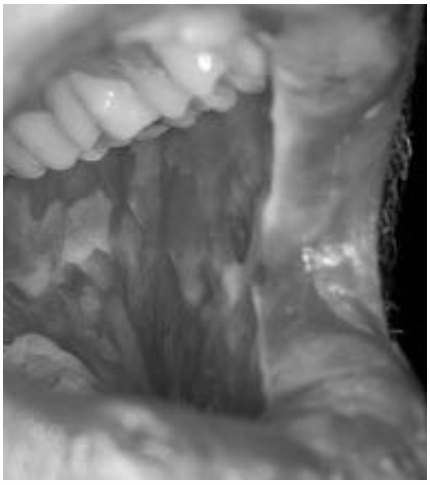
Oral mucositis



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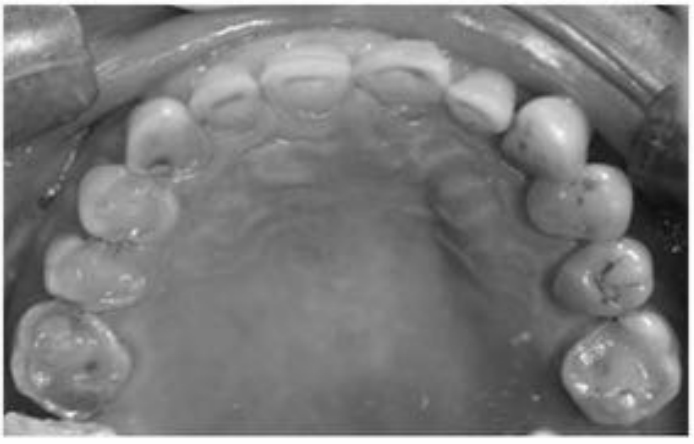
Reflux damage www.hindawi.com



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Tongue and Aging

Decreased stereognostic function of tongue
- reduced ability to sense bolus size/shape during processing

Taste buds on tongue and epithelium of palate
dentures interfere w taste buds on palate

Reduced taste sensitivity
- Salt/sour sensitivity reduction in 80% of studies
- Sweet and bitter sensitivity reduction in 70% of studies
- Other studies report greater losses in sour/bitter tastes w aging (14)

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Remember Sarcopenia? (19)

Reduces tongue strength, lateralization & protrusion
- Over age 60?
  - Affects 1 in 5!
- *%* of Skeletal muscle loss!
  - Over 60?
    - *10-50%*
  - Age 75-85?
    - *45-50%*
  - Age 85?
    - 55%+
  - General age related changes/loss of muscle mass throughout body
  - Reduces number/size of muscle fibers, particularly type II
  - Impact chewing ability

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Tongue Coating and Lingual function!

- Correlation between **amt.** of tongue coating & **reduced lingual function**
- Tongue coating = Micro-organisms, food residues, abrasive epithelia.
- **Motor function of tongue, lips & saliva secretion decrease w aging & have effect on build up of tongue-coating.**
- Possible reduction of coating by functional training of tongue. (32)

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Sensory Impairments and Bolus Prep

Sensory and motor impairments affect oral prep of bolus

- Bolus moisture critical to activate swallow reflex
  - not just reduced particle size and soft texture
- Bolus cohesion + bolus pressure provides input to oral sensory receptors
  - Bolus ready to swallow (56)
- Chewed particles bound together by saliva
  - swallow ready bolus has moisture content of about 50%
- Individuals w c/o oral dryness?
  - double the risk of swallowing difficulties compared to those without oral dryness (56)

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Sensory perception of food

- Occurs during oral processing
  - mastication and swallowing
- Sensory perception at different stages during consumption affected by
  - processes that occur in mouth
  - temperature changes
  - interaction w saliva
- Reduction in sensory capabilities is so gradual that individuals are not aware it is happening

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- Fluid foods processed between tongue and palate vs. solids processed on teeth
- Food textural properties change as soon as it's placed in mouth
  - changes in foods structure (14)
- First change in food is
  - increase in temperature especially for chilled food products
- Mouth
  - Food warmed to body temperature
  - may result in decrease of viscosity
- Mixing w saliva dilutes food to a certain extent and affects lubrication properties (14)

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Texture modified meals

Diet of necessity NOT diet of choice

- Two reasons for texture modified foods
  - Dysphagia – 80%
  - Poor dental status – 20%
  - Frequently malnourished
- Swallow safe particles average 1.4-2mm
  - avoid pharyngeal/esophageal injury
- Larger particles soft enough to swallow whole

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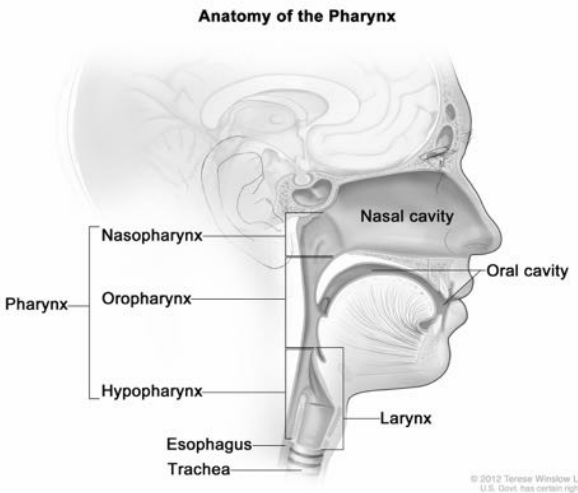
Aging and the Pharynx www.cancer.gov

- Pharyngeal wall thickness decreases
- Muscles atrophy
- Pharyngeal lumen greater during swallow (46)
- Vallecular residue longer than 6 seconds increases penetration-aspiration risk (16)



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Remember Changes in Normal Aging Swallow?? (14)

- Age **45** – slower pharyngeal phase
- Age **50** – penetration normal, **15%** penetrate w swallow
- Age **60** – more dippers
  - increased transit time does not mean **abnormal swallow**
- Age **60** – pharyngeal swallow triggered later
  - Past faucial arches to approx. middle of tongue base!
- Age **70** – pharyngeal phase significantly slower
- Age **80** – significant change in esophageal peristalsis

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Purees and Pharyngeal Stripping Wave

- Very thick boluses require **high tongue driving force and increased pharyngeal pressure** to effectively clear bolus from the pharynx. (58)
- Poor pharyngeal constriction to clear bolus tail allows residue to remain in pharynx post swallow
  - increases likelihood of aspiration after swallow once airway is reopened

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Purees and Pharyngeal Stripping Wave

- Dysphagic pts. w impaired pharyngeal contraction more at risk of aspirating pureed food than individuals w normal pharyngeal contractions.
- Thin pureed textures may better suit dual purpose of improving swallowing safety and minimizing pharyngeal residue (59)

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Esophagus and Dry Foods

Dry foods (meat and bread) can cause esophageal impaction

- pain, discomfort and heartburn sufficient enough to require emergency admission
- Must be cleared for food and liquids to reach stomach
  - Acidic effervescent drinks – coke, proteolytic enzymes – pineapple juice, papain or endoscopic removal of impacted bolus (56)

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Texture modified meals

- It's possible to eat regular textured or soft textured foods and supplement w oral nutritional supplements to meet energy needs
- literature shows some pts. actually reduce amt. of solid food in order to consume all the oral nutritional supplements (56)
- Thicker fluids and pudding level consistency produce *heightened feelings of satiety* compared with thin liquids of the same energy content, energy density, volume and macronutrient composition (61)

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Aging and Decreased Consumption

Decreased Food Intake

- Changes of taste/smell
- Natural reduction in hunger drive
- Psychological variables such as depression
- Natural aging process

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Oral Processing and Temperature

Oral processing delays common for stroke pts
- food may remain in mouth for 10+ sec.
- increasing likelihood of intra-oral injury from steaming hot food **(67)**

Burns occur in less than 1 second if temperatures over 60 degrees centigrade
- affect tongue and palate
- Elderly may not be able to remove food from oral cavity if too hot increasing potential risks associated w thermal burn

Foods that retain heat
- Soups
- Purees
- Sauces containing cream and cheese
- More viscous foods have slower rate of cooling

Texture modified meals

More texture modified food
- greater challenge in ensuring food is flavorsome and motivating for pts. to consume

Studies found hospitalized adults ate more food when it was flavor enhanced (14)

Strong natural oriental food flavors
- increased food/energy intake of hospitalized elderly pts. by 13-26%

Flavors w most significant positive effect
- Oyster sauce
- Ginger
- Garlic (68)

Importance of Visual Perception!

- Flavor intensity is linked to color
- Plate presentation more likely to be found appealing
  - expectations it will taste better than messy food presentation
- Purees should not seep liquid onto the plate
- Transport and delivery process in hospitals took 45-95 minutes.
  - Food dry , discolored and altered in temperature (56)
  - Discolored foods regarded w suspicion
  - unlikely to be eaten.
  - plate waste from hospitals reported at 26%

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Purees and Nutrition

Pureeing reduces nutrient density of food
- addition of liquid
- food particles don't bind tightly (56)

To meet nutritional requirements,
- Greater volumes of energy diluted food must be consumed
- Larger portions are overwhelming!

Texture modified foods
- protein and energy intake levels **34-37% lower** than regular diet
- risk of malnutrition (60)

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Elderly and Portion Size

Serve moderate portion

- Portion too large perceived as overwhelming and unappealing

For low appetites

- Serve small portion
- offer snacks between meals

Serving small frequent meals has not been shown to increase energy intake (68)

Adapt food to meet elderly need and preference in terms of cuisine, texture and seasoning

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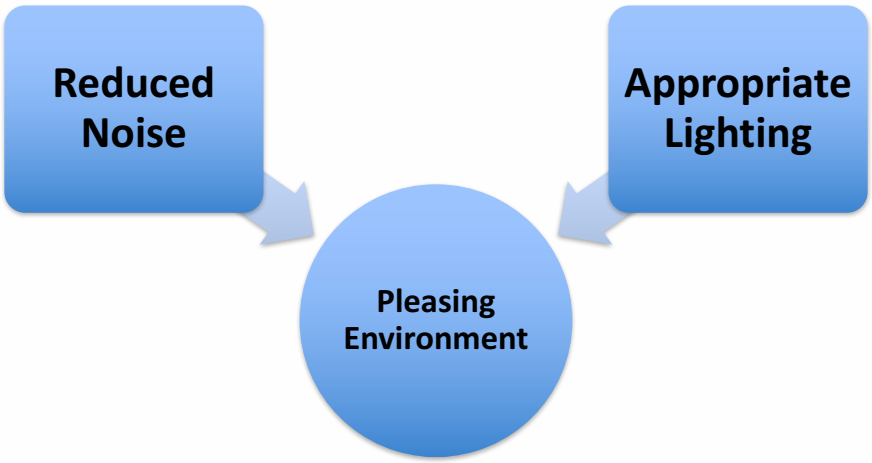
Adapt Environment for Sensory Changes (56)



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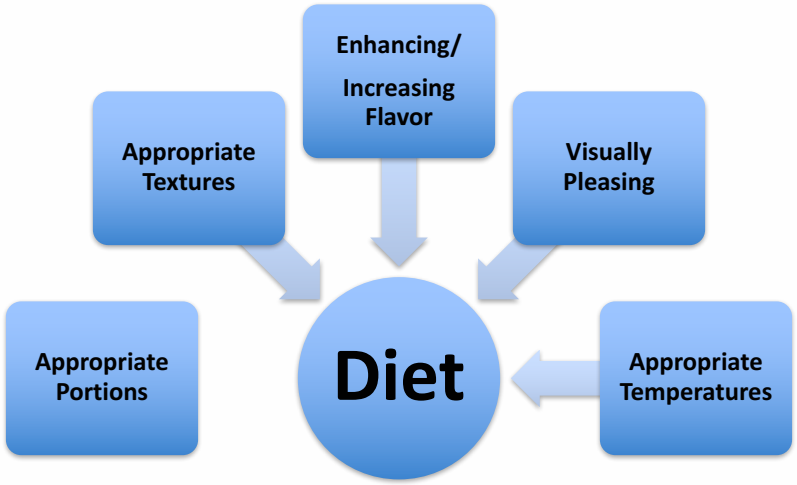
Senses and Nutritional Challenges!



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Put the pieces together!

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- Knowledge of physiologic changes
- Better understanding of impact of sensory changes
- Helps connect dots w what you observe

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