Evidence Based Practice for Dysphagia

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What is Evidence-Based Practice (EBP)?

- "…the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients…[by] integrating individual clinical expertise with the best available external clinical evidence from systematic research" (Sackett, Rosenberg, Muir Gray, Haynes, & Richardson, 1996).

ASHA's Position on EBP

- "It is the position of the American Speech-Language-Hearing Association that audiologists and speech-language pathologists incorporate the principals of evidence-based practice in clinical decision making to provide high quality clinical care" (ASHA, 2005).

Definitions

- Efficacy
- Effectiveness

Levels of Evidence

Level	Description
I	Well-designed meta-analysis of more than one randomized controlled trial
II	Well-designed randomized controlled study
III	Well-designed controlled study without randomization
IV	Well-designed non-experimental studies from more than one group
V	Expert committee report, consensus conference, clinical experience of respected authorities

(www.evidence-based-medicine.co.uk/ebmfiles/Whatisebm.pdf, accessed January 11, 2006)

Where we are…

- No published randomized controlled trials for dysphagia treatment
  - One ongoing study, Protocol 201
- Mostly level IV and V studies with a few level III studies

What to do…

- Gather evidence from studies that do exist
- Is research sound?
  - Did authors control for any possible confounding variables?
  - Did authors control for any potential bias?
- If evidence does not exist in the research literature, look for related studies.

When no research evidence exists….

- What does your clinical experience tell you?
  - Use your clinical knowledge
  - Use sound reasoning
    - Does this make sense to you based on what you know about anatomy and physiology of the swallow?

What it all boils down to….

- Reliance on either clinical experience alone or research evidence alone is not sufficient.
- Clinicians who wish to incorporate EBP must compare what they know through clinical experience with the best evidence in the research literature.
- When research literature confounds clinical experience, clinicians must re-evaluate their therapy practices and make changes as appropriate.

Final thoughts on EBP

- EBP provides SLPs a means through which they can "…systematically improve in…[their] efforts to be better clinicians, colleagues, advocates, and investigators- not by ignoring clinical experience and patient preferences but rather by considering these against a background of the highest quality scientific evidence that can be found" (Dollaghan, 2004, p. 12).

Current Evidence Regarding Dysphagia Evaluation

- Bedside Swallow Evaluations
  - Oxygen saturation monitoring
  - Cervical auscultation
- Videofluoroscopy
- Fiberoptic Endoscopic Evaluation of Swallowing (FEES™)

Bedside Swallow Evaluations

- Evidence in the research indicates that bedside swallow evaluations are not accurate:
  - Aviv et al. (1996)
  - Logemann, Lazarus, & Jenkins (1982)
  - Splaingard et al. (1988)
- Silent aspiration can occur in 40% to 70% of dysphagic patients who aspirate (Daniels et al., 2000)

Bedside Swallow Evaluations

- Smithard et al., 1998
  - Evaluated 94 consecutive patients with a diagnosis of stroke.
  - Completed BSE and then VFSS within 3 days.
  - Results:
    - 20 patients aspirated during VFSS; BSE failed to detect this for 10 (50%).
    - 18 of 94 (22%) of patients were deemed by an SLP to have an unsafe swallow based upon BSE; VFSS indicated 39 (41%) had an unsafe swallow.
  - Conclusion:
    - "Bedside assessment of swallowing lacks the necessary sensitivity to be used as a screening instrument in acute stroke ."

There are some clinical predictors of aspiration:

- Dysphonia
- Wet vocal quality
- Presence of a spontaneous cough during the swallow
- Overall estimate of the presence of aspiration
- Weak volitional cough
- Dysarthria
- The presence of 2 of these features can accurately identify STROKE patients with mod. -severe dysphagia and objectively determine the need for VFSS (Daniels, 2000; McCullough, 1998; Rosenbek, McCullough, & Wertz, 2004).

BUT…

- Fewer than 50% of the measures clinicians typically employ during a BSE are rated with sufficient inter- and intrajudge reliability (McCullough et al., 2000).

Oxygen Saturation Monitoring

- Confounding reports in the literature:
  - Declines in SaO2 of 2% or more may be predictive of aspiration
    - Collins & Bakheit, 1997
    - Ramsey et al., 2003
    - Zaidi et al., 1995
    - Smith et al., 2000
  - Declines in SaO2 are not predictive of aspiration
    - Colodny, 2000
    - Higo et al., 2003
    - Leder, 2000
    - Sellars, Dunnet, & Carter (1998)
    - Wang et al., 2005

Oxygen Saturation Monitoring

- Conclusions:
  - Most of the studies in which the pulse oximetry was done simultaneously with instrumental examinations indicate no correlation between desaturation and aspiration.
  - Desaturation can be related to other factors such as breath holding, posture change, coughing, or the act of swallowing may affect SaO2.

Cervical Auscultation

May provide information about
- Perceived 'crispness' of the signal
- Bolus transit
- Sound quality of adjacent respirations
- Penetration/aspiration (coughing, throat clear, stridor)
- Number of swallows
- Presence of usually inaudible spontaneous vocalizations
- Timing of the swallow
- Relative 'strength' of the swallow

Clinicians make perceptual judgements as to the functioning of swallowing based on:
- Abnormal: noisy breath sounds; rattly; rapid; components obscured, non-rhythmical.
- Normal: rhythmical, crisp 'clunks'; expiration predictable; dry sounds.

Cervical Auscultation

Technique

- In dysphagia practice, CA is usually conducted with the use of a stethoscope hand held over the lateral lamina of the thyroid cartilage.
- The sounds of swallow, distortions of swallow and respiration may be tape recorded from a microphone or accelerometer held over the larynx.

Cervical Auscultation

Theoretical Causes of the Swallowing Signal

- First component:
  - hyolaryngeal excursion and bolus flow through the pharynx (Hamlet, Patterson, Fleming & Jones, 1992).
  - Generated as the bolus under pressure bursts through the UES (Selley et al., 1994).
  - Caused by vibrations resulting from simultaneous movement of laryngeal valving and BOT-PPW approximation (Cichero & Murdoch, 1998).

Cervical Auscultation

Theoretical Causes of the Swallowing Signal, cont..

- Second component:
  - Bolus flow though the hypopharynx and UES pharynx (Hamlet et al., 1992).
  - Generated by the final stages of pharyngeal clearance (Selley et al., 1994).
  - Opening of the UES and the pharyngeal peristaltic wave to clear the pharynx (Cichero & Murdoch, 1998).

Cervical Auscultation

Theoretical Causes of the Swallowing Signal, cont..

- Third component:
  - Laryngeal descent post swallow pharynx (Hamlet et al., 1992).
  - Motion of the epiglottis or lower esophageal activity (Mackowiak, Brenman & Friedman, 1967).
  - Vibrations generated by airway reopening (i.e. mechanical movement of epiglottis, vocal folds (true/false), arytenoid cartilages and release of subglottic air) (Cichero & Murdoch, 1998).

Cervical Auscultation

Zenner, Losinski, & Mills (1995):

- Incorporated CA with stethoscope into the CSE to enhance the ability to detect aspiration and to determine specialized diet management for patients in long term care.
- Subjects: 50 patients (males, 23-103yrs) referred for assessment of suspected dysphagia.
- Conducted CSE, with CA, on each patient, followed by VFS.

Cervical Auscultation

Zenner, Losinski, & Mills (1995) cont…

Results:

CSE and VFS agreement:
- Oral transit delay: 72%
- Oral residuals: 62%
- Pharyngeal delay: 66%
- Pharyngeal residuals: 42%
- Aspiration: 76% (stat. sig.)

Diet Mgmt:
- Restriction of thin liquids: 82%
- Restriction of bread products: 88%

Results support the use of CA in detecting aspiration and in diet recommendations for patients in long term care and the use of CA as a highly sensitive and specific method of dysphagia assessment in long term care

Cervical Auscultation

Eicher, Manno, Fox, & Kerwin (1994):

- Purpose: determine whether a clinical pediatric swallowing assessment (incl. CA) can accurately predict penetration/aspiration as documented by VFS
  - Subjects: 49 children: 1-319 months
- Clinical judgment and VFS agreement re: presence of penetration and aspiration:
  - without CA - 76%
  - with CA - 86% (stat.sig.)
- Authors conclusions:
  - CA can be used as an effective screening tool for penetration/aspiration as well as follow up in the treatment of pediatric dysphagia.
  - Feel confident when recommend to postpone or cancel a VFS study when evaluation with CA suggests a completely competent swallow.

Cervical Auscultation

- More recent research findings:
  - Poor inter-judge and intra-judge reliability (Leslie et al., 2004; Stroud, Lawrie, & Wiles, 1995)
  - Poor sensitivity (62%) and specificity (66%) for determining abnormal swallow (Leslie et al., 2004)
  - Little information on correlation of sounds with physiological events

Videofluoroscopy

- Generally considered the “gold standard” for dysphagia evaluation.
- We don’t really know how accurate an examination it is.

Videofluoroscopy

- Evidence suggests poor inter-judge reliability for determining swallow pathophysiology (Ekberg et al., 1988; McCullough et al., 2001; Stoeckli et al., 2003)
  - They found acceptable inter-judge reliability for penetration/aspiration scale scoring only.
- Intra-judge reliability is generally better.

Endoscopic Assessment of Swallowing (FEES™)

- Because events during the swallow cannot be visualized directly, clinicians and researchers have questioned the accuracy of FEES for the detection of aspiration during the swallow.

Endoscopic Assessment of Swallowing (FEES™)

- Is FEES as sensitive for determining aspiration as VFSS?
  - A number of studies indicate that there is good agreement between FEES and VFSS.
  - Specificity of FEES for the detection of aspiration, when compared to VFSS, has been reported to be as high as 87.5%, with sensitivity being somewhat lower at 70% (Perie et al., 1998).
  - Most (except Rao et al., 2003) did not do simultaneous examinations.

Endoscopic Assessment of Swallowing (FEES™)

- Is FEES as accurate as VFSS in determining other swallow-related events?
  - Langmore, Schatz, & Olsen, 1991
    - Percent agreement
      - Premature spillage = 66%
      - Pharyngeal residue = 80%
      - Laryngeal penetration = 85%
      - Tracheal aspiration = 90%
    - Less than 50% of exams were in total agreement for all 4 parameters

Rao et al., 2003

- Percent Agreement between exams
  - Laryngeal Penetration = 89.58%
    - On 10 boluses that were not in agreement, FEES detected laryngeal penetration all 10 times, and VFSS did not.
  - Aspiration = 96.69%
    - FEES detected 3 instances of aspiration that VFSS did not.
  - Pharyngeal Residue = 84.38%
    - FEES detected residue 14 times when VFSS did not.
    - VFSS detected residue 1 time when FEES did not.

Rao et al., 2003

- Further Results
  - Diet Recommendations
    - 100% agreement between exams
  - Recommendations for compensatory swallow strategies
    - 82% agreement

Therapeutic Management of Dysphagia

- Compensatory vs. Rehabilitative Therapy
- Feeding Tubes

Compensatory Techniques

- Strategies that provide an immediate but typically transient effect on the efficiency or safety of swallowing.
- As a rule, if the strategy is not consistently executed, swallowing will return to the prior dysfunctional status.

Huckabee & Pelletier, 1999

Compensatory Techniques

- Include:
  - Postural techniques
    - Chin tuck
    - Head turn
    - Head tilt
    - Side lying
  - Maneuvers
    - Mendelsohn maneuver
    - Effortful swallow
    - Supraglottic swallow
    - Super-supraglottic swallow
  - Changing bolus characteristics
    - Volume
    - Taste
    - Viscosity

Postural Changes: Chin Tuck

- Thought to be beneficial for patients with:
  - Delayed initiation of the pharyngeal swallow who may be at risk for aspiration of material before the swallow (Logemann, 1983; 1986)
  - Reduced tongue base retraction during the swallow (Logemann, 1998), and/or
  - Mildly reduced airway closure during the swallow (Logemann, 1998).

Postural Changes: Chin Tuck

- Effectiveness has been studied in individuals with:
  - Normal swallow function (Bulow et al., 1999; Castell et al., 1993)
  - Head and neck cancer (Lewin et al., 2001; Logemann et al., 1994)
  - Neurologic dysfunction, including stroke (Rasley et al., 1993; Shanahan et al., 1993; Welch et al., 1993).

Postural Changes: Chin Tuck

- Effects on the pharyngeal swallow:
  - Improved airway protection through narrowing of the airway entrance (Welch et al., 1993)
  - Pushing of the tongue base and epiglottis toward the posterior pharyngeal wall (Bulow et al., 1999; Welch et al., 1993)
  - Widening of the vallecular space (Logemann, 1983)
  - Decreased distance between the larynx and the hyoid bone and the mandible (Bulow et al., 1999)
  - Reduced depth of contrast penetration in the larynx and trachea when penetration occurs (Bulow et al., 2001)
  - Reduction in aspiration of material (Bulow et al., 2001; Logemann et al., 1994; Rasley et al., 1993).

Postural Changes: Chin Tuck

- Other effects:
  - May result in reduced pharyngeal contraction pressures (Bulow et al., 1999; Castell et al., 1993).
  - Ineffective in eliminating aspiration in instances where the bolus falls to the level of the pyriform sinuses before the pharyngeal swallow is initiated (Shanahan et al., 1993).

Postural Changes: Head Rotation

- Postural technique used to:
  - Compensate for unilateral pharyngeal paresis (Ertekin et al., 2001; Logemann, 1989; Ohmae et al., 1998)
  - Benefits patients with unilateral laryngeal dysfunction who are at risk for aspiration before the swallow by placing extrinsic pressure on the thyroid cartilage, increasing vocal fold adduction and improving airway protection during the swallow (Logemann, 1998).

Postural Changes: Head Rotation

- Also benefits patients with cricopharyngeal dysfunction by:
  - Increasing anterior-posterior cricopharyngeal opening,
  - Reducing upper esophageal (UES) pressure, and
  - Increasing duration of UES relaxation (Logemann et al., 1989; Ohmae et al., 1998)

Postural Changes: Side Lying

- Introduced as a means of preventing aspiration in individuals with significant bilateral pharyngeal weakness and reduced pharyngeal contraction or individuals with reduced laryngeal elevation who aspirate residual pharyngeal material after the swallow (Logemann, 1986).

Postural Changes: Side Lying

- Rationale:
  - Change in gravity that occurs with lying holds residual material against the pharyngeal walls rather than allowing it to fall into the airway, thereby eliminating aspiration.

Postural Changes: Side Lying

- Very limited research
  - Drake et al., 1997
  - Rasley et al., 1993

Postural Changes: Side Lying

- Effects
  - Improved efficiency of oral transit (Drake et al., 1997)
  - Reduced pharyngeal residue (Drake et al., 1997)
  - Elimination of aspiration for swallows of small liquid boluses only (Rasley et al., 1993)

Postural Changes: Head Tilt

- Recommended for patients with unilateral tongue dysfunction and unilateral pharyngeal weakness (Logemann, 1986)
- No empirical research to support its use

Maneuvers

- Designed to:
  - Alter timing
  - Bolus flow
  - Duration of swallow-related events.

Maneuvers

- Intended to be used temporarily as the patient's swallow function improves.
- Patient must be able to follow commands.
- Some maneuvers, such as the Mendelsohn or the effortful swallow, require that the patient generate increased muscular effort.

Maneuvers: Mendelsohn Maneuver

- Involves teaching a patient to:
  - Identify the moment of maximal laryngeal elevation during the swallow
  - Maintain laryngeal elevation for several seconds following this moment (Logemann, 1993).

Maneuvers: Mendelsohn Maneuver

- Beneficial for patients with:
  - Reduced laryngeal elevation
  - Decreased cricopharyngeal opening

Maneuvers: Mendelsohn Maneuver

- Effectiveness has been studied in individuals with:
  - Normal swallow function (Ding et al., 2002; Kahrilas et al., 1991; Ohmae et al., 1998),
  - Neurologic disease (Ertekin et al., 2001; Logemann & Kahrilas, 1990), and
  - Head and neck cancer (Lazarus et al., 1993)

Maneuvers: Mendelsohn Maneuver

- Effects:
  - Increased extent and duration of laryngeal excursion (Kahrilas et al., 1991)
  - Increased extent and duration of cricopharyngeal opening (Kahrilas et al., 1991; Lazarus et al., 1993; Logemann, 1998)
  - Improved coordination of the pharyngeal swallow (Lazarus, 1993)
  - Prolonged duration of tongue base to posterior pharyngeal wall contact (Lazarus, 1993)
  - Improved bolus clearance during the swallow (Lazarus, 1993)
  - Elimination of aspiration (Lazarus et al., 1993).

Maneuvers: Effortful Swallow

- Recommended for individuals with:
  - Reduced tongue base retraction
  - Decreased strength of pharyngeal constriction during the swallow

Maneuvers: Effortful Swallow

- Effectiveness has been studied in individuals with:
  - Normal swallowing (Bulow et al., 1999; Hind et al., 2001; Hiss & Huckabee, 2005; Huckabee et al., 2005; Pouderoux & Kahrilas, 1995)
  - Neurologic dysfunction (Bulow et al., 2001; Garcia, Hakel, & Lazarus, 2004).

Maneuvers: Effortful Swallow

- Effects:
  - Increased extent and duration of oral and pharyngeal pressure during the swallow (Hind et al., 2001; Hiss & Huckabee, 2005; Huckabee et al., 2005; Kahrilas et al., 1992, 1993; Pouderoux & Kahrilas, 1995)
  - Reduced depth of laryngeal penetration when material enters the laryngeal vestibule (Bulow et al., 2001)
  - Increased base of tongue retraction during the pharyngeal swallow (Kahrilas et al., 1993; Kahrilas, Logemann, Lin, & Ergun, 1992)
  - Increased duration of maximum anterior hyoid excursion, laryngeal vestibule closure, and extent of hyoid superior movement (Hind et al., 2001)

Maneuvers: Effortful Swallow

- Potentially negative effects:
  - Significantly reduced laryngeal elevation (Bulow et al., 1999)
  - Incomplete pharyngoesophageal segment relaxation (Bulow et al., 2001)
  - Decreased duration of PE segment relaxation (Bulow et al., 2001)
  - Delayed onset of pharyngeal contraction (Hiss & Huckabee, 2005)
  - Nasopharyngeal reflux (Garcia et al., 2004)

Manuevers: Supraglottic swallow & Super-Supraglottic swallow

- Supraglottic swallow:
  - Designed to achieve voluntary vocal fold closure before and during the swallow (Logemann, 1983; 1986)
  - Patients are instructed to:
    - Hold their breath,
    - Swallow while holding their breath, and
    - Cough immediately after the swallow (Logemann, 1983; 1986)

Manuevers: Supraglottic swallow & Super-Supraglottic swallow

- Super-supraglottic swallow:
  - Designed to achieve voluntary airway closure above the vocal folds before and during the swallow by causing the arytenoids to tilt anteriorly toward the base of the epiglottis (Logemann, 1986).
  - Patients are instructed to:
    - Hold their breath while bearing down,
    - Swallow while holding their breath, and
    - Cough immediately after the swallow to clear any material that might have entered the airway (Logemann, 1986; 1998).

Manuevers: Supraglottic swallow & Super-Supraglottic swallow

- Both maneuvers are designed to reduce the risk of aspiration before, during, and after the swallow (Logemann & Kahrilas, 1990)
- Considered to be appropriate for individuals with:
  - Reduced airway closure, including individuals who have undergone supraglottic laryngectomy or radiotherapy to the neck (Logemann, 1986; 1998), and/or
  - Delayed timing of airway closure.

Manuevers: Supraglottic swallow & Super-Supraglottic swallow

- Effectiveness has been examined in individuals with:
  - Normal swallow function (Bulow et al., 1999; Donzelli & Brady, 2004; Ohmae et al., 1996;),
  - Head and neck cancer (Lazarus et al., 1993; Logemann et al., 1997; Logemann, Gibbons, et al., 1994)
  - Neurologic dysfunction (Bulow et al., 2001; 2002; Logemann & Kahrilas, 1990).

Manuevers: Supraglottic swallow & Super-Supraglottic swallow

- Effects of the supraglottic swallow include:
  - Increased extent (Bulow et al., 1999; Ohmae, 1996) and duration of laryngeal elevation and closure (Bulow et al., 1999)
  - Increased extent and duration of pharyngoesophageal segment relaxation (Bulow et al., 1999; Ohmae et al., 1996)
  - Improved tongue base retraction (Logemann, 1998)
  - Increased intrabolus pressure during the swallow (Bulow et al., 2002)
  - Earlier onset, relative to normal swallows, of arytenoid adduction, arytenoid closure, and true vocal cord closure (Ohmae et al., 1996).

Manuevers: Supraglottic swallow & Super-Supraglottic swallow

- The super-supraglottic swallow:
  - Has similar effects to the supraglottic swallow
  - Provides better laryngeal vestibule protection and maintains airway protection longer than the supraglottic swallow (Donzelli & Brady, 2004; Ohmae et al., 1996;)

Manuevers: Supraglottic swallow & Super-Supraglottic swallow

- Potentially negative effects:
  - Delayed onset of hyoid movement
  - Delayed onset of laryngeal movement
  - Delayed laryngeal closure
  - Delayed base of tongue retraction
  - Delayed base of tongue to posterior pharyngeal wall contact (Ohmae et al., 1996).
  - Abnormal cardiac findings, including:
    - Supraventricular tachycardia
    - Premature atrial contractions
    - Premature ventricular contractions, in patients with stroke and/or coronary artery disease (Chaudhuri et al., 2002).

Changing Bolus Characteristics: Volume

- Effects:
  - Decreased oropharyngeal transit times
  - Longer duration of palatal elevation
  - Shorter pharyngeal delay times (Bisch et al., 1994)
  - Increased extent and duration of hyolaryngeal excursion (Bisch et al., 1994)
  - Increased extent and duration of anteroposterior UES opening (Bisch et al., 1994; Ertekin et al., 1997; Lazarus et al., 1993)

Changing Bolus Characteristics: Volume

- Effects (cont.):
  - Longer deglutitive apnea (Hiss, Treole, & Stewart, 2001)
  - Increased oropharyngeal pressure profile
  - Longer thyroarytenoid contraction (Chi-Fischman & Sonies, 2002; Dantas, et al., 1990; Ergun, et al., 1993; Perlman, Schultz, & VanDaele, 1993)

Changing Bolus Characteristics: Viscosity

- Effects
  - Increase in:
    - Oropharyngeal transit time
    - Lingual pressure
    - Duration of pharyngeal pressure (Chi-Fischman & Sonies, 2002; Dantas et al., 1990).

Changing Bolus Characteristics: Taste

- Some have suggested that presentation of a sour bolus facilitates swallowing (Ding et al., 2003; Kajii et al., 2002; Logemann, 1995; Palmer et al., 2005; Pelletier & Lawless, 2003).

Changing Bolus Characteristics: Taste

- Rationale:
  - Presentation of a sour bolus increases stimulation to the oropharyngeal receptors, leading to higher activation of the nucleus of the tractus solitarius, and resulting in greater drive to the nucleus ambiguus (Ding et al., 2003; Logemann et al., 1995; Palmer et al., 2005).
  - This would, in turn, produce a stronger and faster swallow.

Changing Bolus Characteristics: Taste

- Effectiveness of sour bolus presentation for the facilitation of swallowing has been examined in:
  - Younger and older individuals with normal swallow function (Ding et al., 2003; Palmer et al., 2005)
  - Those with oropharyngeal dysphagia resulting from neurologic disease (Logemann et al., 1995; Pelletier & Lawless, 2003).

Changing Bolus Characteristics: Taste

- Effects:
  - Improves timing of the swallow (i.e., shortens swallow duration) (Ding et al., 2003; Logemann et al., 1995; Palmer et al., 2005)
  - Increases strength of muscle contraction during the swallow (Ding et al., 2003; Palmer et al., 2005)
  - Reduces incidence of penetration and aspiration (Pelletier & Lawless, 2003)
  - Increases the number of spontaneous swallows following initial bolus presentation (Pelletier & Lawless, 2003).

Changing Bolus Characteristics: Taste

- Sour bolus presentation may benefit individuals with oropharyngeal dysphagia who present with:
  - Delayed initiation of the swallow
  - Reduced pharyngeal constriction during the swallow
- Stimulus would be presented prior to and during the course of a meal.

Changing Bolus Characteristics: Taste

- Practicality of such a treatment approach is questionable.
  - Individuals often find a sour bolus unpalatable (Logemann, 1995; Pelletier & Lawless, 2003).
  - Pelletier and Lawless (2003) found that swallow function improved when an unpalatable 2.7% w/v citric acid-deionized water bolus was given to individuals with neurogenic dysphagia but not when a more palatable 1.1% w/v citric acid-8% w/v sucrose mixture was presented.

Rehabilitative Treatments

- Interventions that when provided over the course of time are thought to result in permanent changes in the substrates underlying deglutition, that is, changing the physiology of swallowing mechanisms (Huckabee & Pelletier, 1999).

Rehabilitative Treatments

- Include:
  - Stimulation techniques
    - Thermal-tactile application
    - Electrical stimulation
  - Exercises
    - Oral-motor exercises
    - Shaker exercise
    - Lee Silverman Voice Treatment (LSVT®)

Thermal-tactile application

- Meant to decrease pharyngeal delay time in individuals with delayed initiation of the pharyngeal swallow (Lazzara et al., 1986; Rosenbek et al., 1996).

Thermal-tactile application

- Results indicate that using TTA results in immediate and temporary improvement in the speed of swallowing (Lazarra et al.,1986; Kaatzke et al., 1996; Rosenbek et al., 1991; Sciortino et al., 2003).
- However, the long-term carryover to non-TTA facilitated swallowing has not been shown (Rosenbek et al, 1996; Sciortino et al., 2003).

Electrical stimulation

- Electrical stimulation (e-stim) is used to enhance muscle performance by:
  - Increasing ROM
  - Improving strength
  - Re-educating contraction patterns and timing
  - Correcting abnormal muscle tone

Electrical stimulation

- Recently introduced as a means of treating individuals with oropharyngeal dysphagia (Freed et al., 2001; Leelaminit et al., 2002).

Electrical stimulation

- Effects of surface neuromuscular electrical stimulation (either oral or pharyngeal) have been studied in individuals with:
  - Normal swallow function (Fraser et al., 2003; Hamdy et al., 1998; Ludlow et al., 2004; Suiter, Leder, & Ruark, 2006)
  - Oropharyngeal dysphagia resulting from neurologic disease (Fraser et al., 2002; Freed et al., 2001; Leelaminit et al., 2003; Power et al., 2004a; 2004b)
  - Other populations (unpublished reports)

Electrical stimulation

- Effects:
  - Increased motor cortex excitability and increased area of cortical representation for the pharynx 30-60 minutes after stimulation (Hamdy et al., 1998; Fraser et al., 2002; 2003)
  - Increased swallowing corticobulbar excitability in the undamaged hemisphere in patients with stroke (Fraser et al., 2002)
  - Improved swallow function (Fraser et al., 2002; Freed et al., 2001; Leelaminit et al., 2003)
    - Others (Power et al., 2004) found no functional changes in swallowing function in patients with stroke.

Electrical stimulation

- Effects have been found to be:
  - Frequency specific
    - Fraser et al., 2002; Power et al. 2004
  - Intensity specific
    - Fraser et al., 2002
  - Duration specific
    - Fraser et al., 2002

Lingual Strengthening Exercises

- Lingual weakness correlates with:
  - Increased oral transit times (Meyers, 1986)
  - Oral residue on the tongue after the swallow (Meyers, 1986)
- Lingual strength correlates with:
  - Oral and pharyngeal transit times (Lazarus, 2000, 2001)
  - Maximal swallow pressures (Kays et al., 2004)

Lingual Strengthening Exercises

- Effects:
  - Improved tongue strength (Hind & Robbins, 2004; Lazarus et al., 2003; Sullivan et al., 2001)
  - Increased swallowing pressures (Hind & Robbins, 2004)
  - Improved Penetration-Aspiration scale scores (Kays et al., 2004)

Shaker Exercise

- Involves two components:
  - Isometric
    - Patient lies on back, lifts head toward chest while keeping shoulders down, holds for up to 30 seconds
  - Isotonic
    - Patient lifts head toward chest and repeats 30 times

Shaker Exercise

- Appropriate for individuals who aspirate after the swallow secondary to reduced hyolaryngeal excursion and/or reduced upper esophageal sphincter opening.

Shaker Exercise

- Effects:
  - Strengthens suprahyoid muscles
  - Improves UES opening
  - Reduces post-deglutitive residuals
  - Eliminates aspiration after the swallow

  (Easterling et al., 1999; Easterling et al., 2000; Shaker et al., 1997; Shaker et al., 2002)

Lee Silverman Voice Treatment (LSVT®)

- Treatment program originally designed to improve speech intelligibility in patients with hypokinetic dysarthria secondary to Parkinson's disease.
- Some evidence that it improves swallowing (Sharkawi et al., 2002)

Feeding Tubes

- Do they prevent aspiration pneumonia?
  - The evidence in the literature suggests that they do not.

Finucane T, Christmas C, Travis K. (1999) Tube feeding in patients with advanced dementia. JAMA, 282, 1365-1370.

- "Tube feeding cannot be expected to prevent aspiration of oral secretions, and no data show that it can reduce the risk from regurgitated gastric contents. In fact, in children and in animal models, gastrostomy tube placement may reduce lower esophageal sphincter pressure and increase the risk of gastroesophageal reflux with a change in the gastroesophageal angle (as) the suspected mechanism."

Finucane T, Christmas C, Travis K. (1999) Tube feeding in patients with advanced dementia. JAMA, 282, 1365-1370.

- "Three caseload control studies identified tube feeding as a risk factor for aspiration pneumonia and demonstrated high rates of pneumonia and death in tube-fed patients."
- "In a nonrandomized, prospective study, orally fed patients with oropharyngeal dysphagia had significantly fewer major aspiration events than those fed by tube."
- "Artificial feeding does not seem to be a satisfactory solution for preventing pneumonia in elderly prandial aspirators."
- "We found no published studies suggesting that tube feeding can reduce the risk of aspiration pneumonia."

Finucane T, Christmas C, Travis K. (1999) Tube feeding in patients with advanced dementia. JAMA, 282, 1365-1370.

- "Tube feeding is a risk factor for pneumonia; it has never been shown to be an effective treatment, and neither regurgitated gastric contents nor contaminated oral secretions can be kept out of the airways with a feeding tube."
- "Survival has not been shown to be prolonged by tube feeding."

Finucane T & Bynum J. (1996) Use of tube feeding to prevent aspiration pneumonia. Lancet, 348, 1421-1424.

- ***"Although the use of feeding tubes is widespread, no data show that they reduce the risk of aspiration pneumonia in neurogenic dysphagia. There are data to the contrary …For almost all conscious patients we suggest a dedicated attempt at feeding by hand. We would generally reserve the offer of enteral tube feeding, as prophylaxis against aspiration and pneumonia, to those who have developed recurrent pneumonia despite our best efforts, those whose coughing during meals is extremely uncomfortable, and those who are acutely ill with impaired consciousness."***

Does our intervention help prevent aspiration pneumonia?

- Doggett et al., 2001
  - Addressed 3 issues:
    - Does use of noninstrumented exams in an acute stroke dysphagia program reduce pneumonia rates?
    - Does use of VFSS in an acute stroke dysphagia program reduce pneumonia rates?
    - Does use of FEES in an dysphagia program in a rehabilitation setting reduce pneumonia rates?
  - Reviewed 1808 published articles, 32 unpublished articles

Does our intervention help prevent aspiration pneumonia?

- Results:
  - Bedside Swallow Evals
    - Odderson et al. study
      - Studied pneumonia incidence 1 year prior to implementation of dysphagia program and then for 4 years after dysphagia program was implemented
      - Incidence of pneumonia was significantly reduced when dysphagia program was introduced
      - However, problems with this study
        - » Groups were not homogeneous
        - » Other factors may have contributed to reduction in pneumonia rates
  - VFSS
    - Daniels et al. study
      - Performed VFSS on 55 consecutive stroke patients
      - Introduced treatment based on results of VFSS
      - Incidence of pneumonia was 1.8%
  - FEES
    - Studied incidence of pneumonia prior to and after FEES was used and treatment started
    - Once FEES introduced, no incidence of pneumonia

Does our intervention help prevent aspiration pneumonia?

- Doggett et al. Conclusions
  - "Implementation of a systematic program of diagnosis and treatment of dysphagia in an acute stroke management plan may yield dramatic reductions in pneumonia rates."