

Videofluoroscopic Swallowing Studies

A web-based continuing education course prepared by:



Alternatives to Videofluoroscopy

LENGTH: 30 minutes

OVERVIEW:

It is important for clinicians to be aware of alternative instrumental assessments that might provide similar information without involving the risks of radiation. This module will review a number of alternative instrumental procedures that can provide information about swallowing function, including the strengths and limitations of these alternatives, to assist clinicians in making the best choice when recommending additional assessment procedures for a patient with dysphagia.

Learning Objectives:

At the end of this module, the clinician learner will be able to:

- 1) Describe the differences between videofluoroscopy and FEES
- 2) Discuss the limitations of FEES with respect to the white-out period
- 3) Identify the limitations of cervical auscultation and pulse oximetry with respect to identifying aspiration
- 4) Describe the expected pattern of respiratory-swallow phasing seen in a nasal cannula signal
- 5) Understand how to measure maximum isometric or swallowing pressures using the Iowa Oral Performance Instrument
- 6) Describe the elements of swallowing that can or cannot be seen on an ultrasound recording
- 7) Explain why norms do not exist for the amplitude of submental muscle contraction during swallowing, measured using surface electromyography
- 8) Describe the features of swallowing that can be seen in a high resolution manometry heat map image

Overview: Alternatives to VFSS

- FEES
- Other instrumental assessment technologies
 - Cervical auscultation
 - Oximetry
 - Nasal airflow
 - Ultrasound
 - Tongue pressure
 - Pharyngeal Manometry
 - Electromyography

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FEES as an alternative to VFSS

- Difficult to access in Canada
- Regulatory barriers around inserting scope
- Infection control issues
- Primarily used in collaboration with ENTs and in voice clinics

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Endoscopy

- Provides a top-down view of the pharynx
- Can be repeated (no radiation involved)
- Uses real food (opaque ideal)
- LIMITATIONS:
 - White-out
 - May be uncomfortable
 - If anesthesia used, may alter behaviour

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Indications for FEES

- Questions about location/severity of residue
- Questions regarding foods that cannot easily be mixed with contrast agents
- Longer examinations with fatigue as a question
- Barriers to transport to radiology
 - Critical care patients, positioning challenges, bariatric patients
- Allergies to barium
- Velopharyngeal insufficiency
- Concomitant questions about voice
 - Post intubation, dysphonia, tracheotomy

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Cervical Auscultation



- the use of a stethoscope, laryngeal microphone or accelerometer to evaluate the acoustics or vibratory characteristics of swallowing
- controversial in the field of SLP

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Cervical Auscultation

- What sorts of information can cervical auscultation provide?
 - respiratory sounds/patterns during swallowing
 - swallowing sounds
 - timing of swallow(s) and of bolus entry into the pharynx
 - ? aspiration (controversial, insufficient evidence)
 - changes in the sounds or frequency of breathing after the swallow

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Pulse Oximetry

- non-invasive method for estimating arterial oxyhemoglobin (SpO_2) by utilizing wavelengths of light
- oxygen is carried in the blood attached to hemoglobin molecules
- oxygen saturation is a measure of how much oxygen the blood is carrying as a % of the maximum it could carry (1 hemoglobin molecule can carry 4 molecules of oxygen)
- a fit, healthy young person will probably have an oxygen saturation of 95 - 99%

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Pulse Oximetry

EXTRA
Cerebrovascular
Diseases

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Original Paper

Measurement of Oxygen Desaturation Is Not Useful for the Detection of Aspiration in Dysphagic Stroke Patients

Thomas Marian Jens Schröder Paul Muhle Inga Claus
Stephan Oelenberg Christina Hamacher Tobias Warnecke
Sonja Suntrup-Kröger Rainer Dziewas

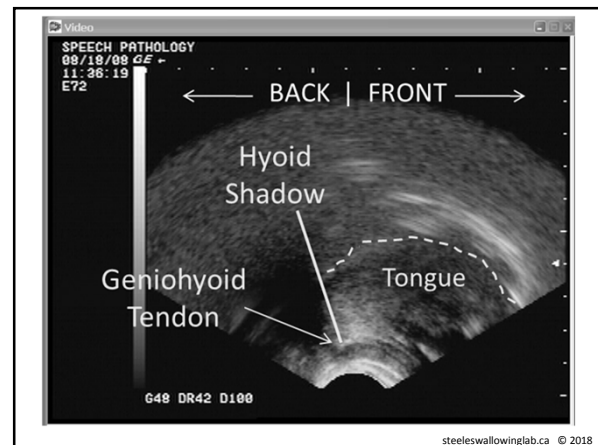
Department of Neurology, University Hospital Münster, Münster, Germany

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Ultrasound

- No radiation exposure
- Can be performed repeatedly and for extended recording periods using real food
- LIMITATIONS:
 - Ultrasound waves degrade at tissue-air or fluid-air boundaries
 - Head and transducer stabilization required (depth, angle)
 - Poor resolution at boundaries of image

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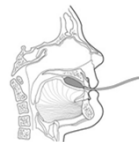


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Iowa Oral Performance Instrument



- Records signal when tongue compresses air-filled bulb against the palate
- Pressure displayed on screen in kPa

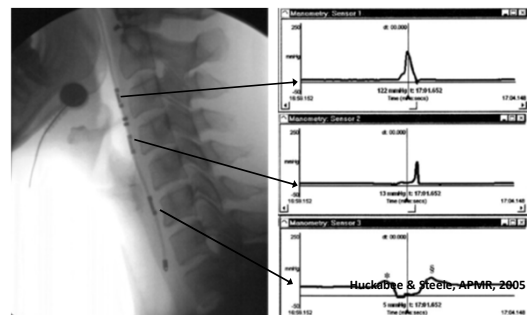


LIMITATIONS:

- Difficulty standardizing bulb placement
- Slippage
- ? Validity in the context of bolus swallows

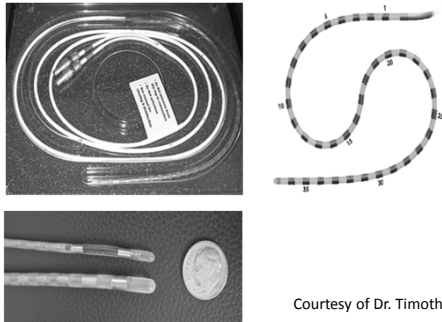
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Pharyngeal Manometry



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High-Resolution Manometry



Courtesy of Dr. Timothy McCulloch

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Surface Electromyography

- Non-invasive, easily accessible
- No radiation exposure
- Can be performed repeatedly and for extended recording periods using real food
- LIMITATIONS:
 - Surface EMG provides a composite picture of muscle activity in recording location
 - Artifacts and variability
 - Inference regarding the association between muscle events and bolus or swallowing events

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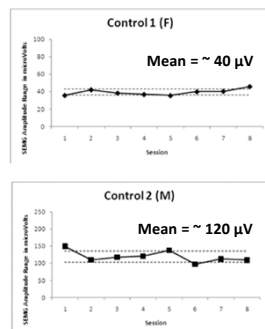
Surface Electromyography

LIMITATIONS:

sEMG signals may vary across sessions and people, due to:

- differences in placement
- damping from subcutaneous fat and tissue
- signal degradation due to facial hair, skin oils, etc.

For these reasons, amplitude measurements taken at different times should be normalized to another (reference) activity.



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Key Messages

- Instrumental assessments can be used to confirm the presence, nature, and severity of swallowing impairment, and to identify mechanisms of impairment and guide treatment.
- VFSS involves the use of ionizing radiation, so it is important to be aware of alternatives that might provide similar information without involving the risks of radiation exposure.

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Key Messages

- FEES (Fiberoptic Endoscopic Examination of Swallowing):
 - is the most commonly performed alternative to VFSS
 - does not involve the use of radiation
 - can be conducted with normal food and drink
- FEES limitations:
 - discomfort from the tube in the nose/nasopharynx
 - anaesthetics may alter swallowing behaviour
 - many swallowing events are assumed during the “white out”

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Key Messages

- Nasal cannula:
 - is used to monitor breathing and its coordination with swallowing
 - collects objective measures
 - can be used as biofeedback for patient education and training
- Nasal cannula limitations:
 - can not confirm aspiration

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Key Messages

- Ultrasound:
 - is useful for studying the contour and movement of the tongue
 - does not involve radiation exposure
 - does not require the use of contrast media
 - may be a restricted act
- Ultrasound limitations:
 - no standard protocols exist
 - variations in the angle and depth of the transducer can alter the image acquired
 - can not detect penetration/aspiration or residue

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Key Messages

- IOPI (Iowa Oral Performance Instrument):
 - measures tongue strength
 - this may help determine the need for instrumental assessment
 - research suggests that aspiration is more common in individuals who have reduced tongue strength
- High resolution manometry:
 - measures circumferential pressures from the nasopharynx to the esophagus
 - this can help a clinician develop an appropriate management plan

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Key Messages

- sEMG:
 - measures the contraction of extrinsic muscles of swallowing
 - can be used as biofeedback in therapy
 - is non-invasive, easily accessible, no radiation exposure
 - can be performed repeatedly using real food
- sEMG limitations:
 - provides a composite picture of muscle activity
 - artifacts and variability
 - inference regarding the association between muscle and swallowing events

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Key Messages

- Controversial methods of instrumental assessment include:
 - cervical auscultation
 - pulse oximetry
- Information gathered via these methods does not provide enough information to guide dysphagia management.

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KNOWLEDGE CHECK

1. **True or False? It is possible to measure the timing and extent of hyoid movement during a FEES exam.**
A True
B False

2. **True or false? In Alberta, speech-language pathologists are allowed to perform and interpret medical ultrasound independently.**
A True
B False

3. **When testing tongue strength in an older adult using the Iowa Oral Performance Instrument, which of the following maximum isometric pressure values would suggest tongue weakness?**
A 25 kPa
B 40 kPa
C 45 kPa
D 60 kPa

4. **True or false? Surface EMG values for the amplitude of swallowing-related muscle contraction will differ across people due to the damping effect of fat and other tissue between the surface of the skin and the underlying muscles.**
A True
B False

Answer key found on the following page.

KNOWLEDGE CHECK ANSWER KEY

1. B False
2. B False
3. A 25 kPa
4. A True

EXPAND YOUR KNOWLEDGE

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