

VFSS Best Practice Recommendations

Standardization of all aspects of a videofluoroscopy is critical to ensure that results can be compared across: 1) time points (e.g. pre vs. post), 2) individuals, 3) clinicians, 4) research studies, and 5) to translate research to clinical practice. We strongly recommend adopting standard approaches to each of the following aspects of videofluoroscopy below.

Pre-VFSS	Bottom Line	Supporting Evidence
Barium Concentration	✓ Use the same low concentration barium every time	If you do not have access to commercially available low-concentration barium (i.e., 40% w/v concentration Varibar®), be sure to follow standard recipes for preparing your barium stimuli. If you are mixing powdered barium into water to create a suspension, weigh the barium using a scale. Pay attention to the barium quantity to obtain a low weight to volume (w/v) concentration that has sufficient concentration to be reliably visible (i.e., at least a 20% w/v) but low enough to avoid coating on the mucosa of the oropharynx (i.e., less than 100% w/v).
Stimulus Consistency	✓ Know how the consistencies of the barium stimuli map to the different levels on the IDDSI Framework	If possible, use commercially available pre-thickened barium (i.e. Varibar®), otherwise use standard recipes. Use the IDDSI Testing Methods to understand how your barium stimuli map to the different levels on the IDDSI Framework (www.iddsi.org). This is important in making appropriate recommendations upon completion of the study. Be aware that mixing barium with anything other than water is “off-label” and falls outside manufacturer instructions for use. Mixing barium with starch-based thickeners may result in further thickening of the product over time.
Frame Rate	✓ Ensure adequate frame rate (30 fps with North American systems, 25 fps elsewhere)	An adequate frame rate will ensure that you do not miss brief but important events. The recommended minimum rate on a North American system is 30 frames per second (fps) and 25 fps elsewhere. Be aware that fluoroscopy image rate (i.e. the number of images created per second) is not necessarily the same thing as the recording or archiving frame rate. Make sure that the recording does NOT contain fewer images per second than the live exam, so that ALL important information is available to you when reviewing the recording after the exam. If you are unsure of your system’s setup, consider a conversation with your Radiology Department. For more details, see Ingleby et al. (2021) https://link.springer.com/article/10.1007/s00455-021-10335-y

During VFSS	Bottom Line	Supporting Evidence
VFSS Protocol	✓ Use a standard core protocol	Choose and stick to a standard core protocol for your examinations. Starting with a standard set of tasks in a head neutral/natural position does not preclude including a customized section of the examination with selected stress test tasks or probes of therapeutic/compensatory strategies, based on your initial findings.
Positioning image	✓ Take still image in a neutral position for anatomical reference	Collect a still image/positioning frame at the beginning of the exam, prior to introducing contrast material, for later reference regarding the darkness of anatomical structures. Consider also collecting a saliva swallow at the beginning of the exam for reference regarding physiological movement without a bolus.

During VFSS	Bottom Line	Supporting Evidence
Bolus Holds & Cued Swallows	<ul style="list-style-type: none"> ✓ Include one cued thin sip at the beginning to evaluate oral bolus containment 	We recommend including one thin liquid sip with a cued swallow at the beginning of an exam to evaluate the person's ability to contain a bolus in the mouth without losing it into the pharynx. After evaluation of oral bolus containment, we recommend using non-cued swallows for all other boluses in order to capture behaviour that is representative of what happens outside the exam.
Order of Stimulus Presentation	<ul style="list-style-type: none"> ✓ Use sips of thin liquid to evaluate safety ✓ Use sips of mildly thick liquid to evaluate efficiency 	Thin liquid boluses are the most likely to reveal problems with swallowing safety. Therefore, it makes the most sense, to begin the exam with thin liquids in order to identify penetration-aspiration problems. For swallowing efficiency (i.e., residue), we prefer to use discrete sips of mildly thick liquid (Steele et al., 2019a). Other consistencies represent interventions that can be explored for their effectiveness in addressing safety and/or efficiency concerns.
Sip Size	<ul style="list-style-type: none"> ✓ Self-administer, if possible ✓ Use natural sip sizes for liquids ✓ Use spoons for thicker consistencies 	Allow the person to self-administer boluses if possible. We recommend including natural sips or controlled larger volumes (i.e. at least 10 ml) in your protocol. For reference, the average sip size for thin liquid in healthy young adults falls between 11-14ml (Steele et al., 2019a) and does not change with healthy aging (Mancopec et al., 2021). If you limit your protocol to testing controlled volumes (e.g., 1, 3 or 5 ml of thin liquid), you may be under-challenging the person. Thicker consistencies (moderately and extremely thick) should be administered by spoon. For mildly thick liquids, smaller spoon delivered volumes lead to less residue than cup sips.
Task Repetitions	<ul style="list-style-type: none"> ✓ Administer up to 4 sips of thin to rule out impaired safety 	In order to be confident that a person does not have impaired swallowing safety, research suggests that it is necessary to administer up to 4 natural sips of thin liquid as people who display penetration-aspiration on thin liquid DO NOT do so on every bolus (Steele et al., 2019b).

Post-VFSS	Bottom Line	Supporting Evidence
Standard Definitions	<ul style="list-style-type: none"> ✓ Use well defined measures 	Standard definitions are needed for the parameters that will be measured. In order to decide whether a person has atypical swallowing, it is important to know what healthy normal swallowing looks like.
Number of Swallows	<ul style="list-style-type: none"> ✓ More than one swallow per sip/bolus is atypical 	Healthy adults USUALLY clear a bolus completely in a single swallow. In our research, more than 1 swallow was seen in healthy adults only 20% of the time, regardless of bolus consistency (Steele et al., 2019a). More than 1 swallow for a bolus is atypical and outside the healthy reference range.
Bolus Location at Swallow Onset (Thin Liquids)	<ul style="list-style-type: none"> ✓ Bolus lower than the ramus of the mandible is NOT atypical for thin liquids (cued or non-cued) 	Data show that with non-cued sips of thin liquid, the bolus is BELOW the ramus of mandible at the point of swallow onset 75% of the time in healthy young adults (Steele et al., 2019a) and 85% of the time in older adults. Thin liquid boluses had reached the pyriform sinuses 37% of the time in young (Steele et al., 2019a) and 40% of the time in older adults. Even with cued swallows, healthy participants given 10cc thin liquid had the bolus below the ramus of the mandible 65% of the time, but the bolus was never as deep as the pyriform sinuses (Nagy et al., 2013). Bolus location reference values for other consistencies can be found in Steele et al. (2019a).

References & Additional Resources:**Pre-VFSS:****Barium concentration:**

- a. Fink, T.A. & Ross, J.B. (2009). Are we testing a true thin liquid? <https://doi.org/10.1007/s00455-008-9203-y>
- b. Steele, C.M., et al. (2013). Challenges in preparing contrast media for videofluoroscopy. <https://doi.org/10.1007/s00455-013-9476-7>
- c. Swallowing Rehabilitation Research Lab. Barium Calculator: <http://steeleswallowinglab.ca/srrl/best-practice/barium-recipes/iddsi-barium-calculator/>

Stimulus consistency:

- a. International Dysphagia Diet Standardisation Initiative. <https://iddsi.org>
- b. Steele, C.M. (2017). Mapping Bracco's Varibar® barium products to the IDDSI Framework. http://ftp.iddsi.org/Documents/Mapping_Varibar_to_IDDSI.pdf
- c. Barbon, C.E.A. et al. (2019). Characterizing the flow of thickened barium and non-barium liquid recipes using the IDDSI Flow Test. <https://link.springer.com/article/10.1007/s00455-018-9915-6>

Frame Rate:

- a. Bonilha, H.S., et al. (2013). Preliminary Investigation of the Effect of Pulse Rate on Judgments of Swallowing Impairment and Treatment Recommendations. <https://doi.org/10.1007/s00455-013-9463-z>
- b. Swallowing Rehabilitation Research Lab. Videofluoroscopy Frame Rate. <http://steeleswallowinglab.ca/srrl/best-practice/videofluoroscopy-frame-rate/>
- c. Ingleby, H., et al. (2021). Diagnostic benefit and radiation risk in videofluoroscopic swallowing studies. <https://link.springer.com/article/10.1007/s00455-021-10335-y>

During VFSS:

- a. Steele, C.M., et al. (2019a). Reference values for healthy swallowing across the range from thin to extremely thick liquids. https://doi.org/10.1044/2019_JSLHR-S-18-0448
- b. Gandhi, P., et al (2021). The Frequency of Atypical and Extreme Values for Pharyngeal Phase Swallowing Measures in Mild Parkinson Disease Compared to Healthy Aging. https://doi.org/10.1044/2021_JSLHR-21-00084
- c. Mancopes, R., et al. (2021). Which physiological swallowing parameters change with healthy aging? OBM Geriatrics, 2021. Volume 5, Issue 1, <https://www.doi.org/10.21926/obm.geriater.2101153>
- d. Steele, C.M., et al. (2019b). Development of a Non-invasive Device for Swallow Screening in Patients at Risk of Oropharyngeal Dysphagia: Results from a Prospective Exploratory Study. <https://doi.org/10.1007/s00455-018-09974-5>

Post-VFSS / Analysis:

- a. Steele, C.M., et al. (2019a). Reference values for healthy swallowing across the range from thin to extremely thick liquids. https://doi.org/10.1044/2019_JSLHR-S-18-0448
- b. Steele, C.M. et al. (2017). Reflections on Clinical and Statistical Use of the Penetration-Aspiration Scale. <https://doi.org/10.1007/s00455-017-9809-z>
- c. Nagy, A., et al. (2013). Timing differences between cued and non-cued swallows in healthy adults. <https://doi.org/10.1007/s00455-013-9456-y>

HAVE QUESTIONS? Visit our website at steeleswallowinglab.ca or send us an email at TRI-SwallowingLab@uhn.ca