STROBOSCOPIC INTERPRETATION

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DISCLOSURES

- None

OBJECTIVES

- Define stroboscopy and its role in laryngeal imaging
- Briefly discuss preliminary practice considerations, GBMC multidisciplinary clinic flow and stroboscopic competencies
- Describe stroboscopic rating tools and judgement of parameters

WHAT IS STROBOSCOPY?

Stroboscope: "Instrument used to study the phases of motion by means of a light source that is periodically interrupted."

Hirano and Bless, p.2

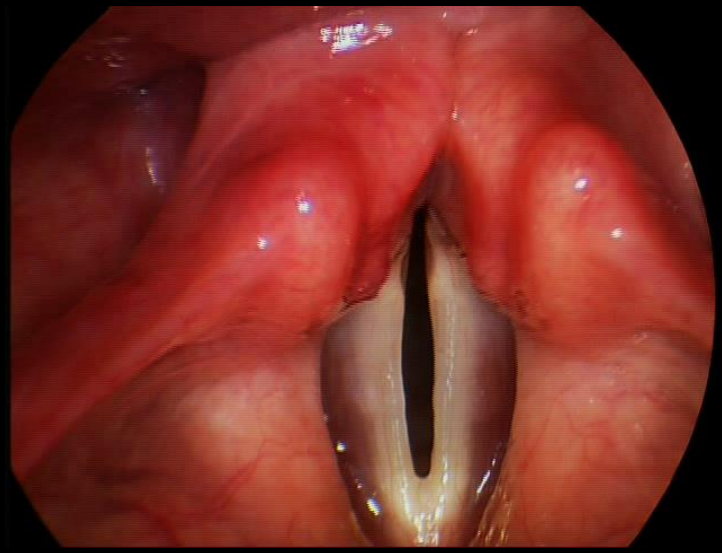
"Stroboscopy is a special method used to visualize vocal fold vibration. It uses a synchronized, flashing light passed through a flexible or rigid telescope. The flashes of light from the stroboscope are synchronized to the vocal fold vibration at a slightly slower speed, allowing the examiner to observe vocal fold vibration during sound production in what appears to be slow motion".

-Medscape

WHY IS STROBOSCOPY IMPORTANT?

- We can study vibratory patterns of the vocal folds
- Videos are recorded and available for education and reference
- We can view vocal folds in even slower motion frame-by-frame and compare to past exams
- Gold standard for laryngeal imaging

LIGHT SOURCE: HALOGEN VERSUS STROBE



SLP CONSIDERATIONS

- Check ASHA guidelines, state board guidelines, facility guidelines
  - ASHA's position is that endoscopy is within the scope of practice for speech-language pathologists
- Develop and follow a clinical competency for training stroboscopy
- SLP application of lidocaine varies across states
- SLPs cannot diagnose laryngeal pathology
- ASHA Resource: Vocal Tract Visualization and Imaging (asha.org)
- Great reference paper: Recommended Protocols for Instrumental Assessment of Voice: American Speech-Language-Hearing Association Expert Panel to Develop a Protocol for Instrumental Assessment of Vocal Function | American Journal of Speech-Language Pathology (asha.org)

ENDOSCOPY: RIGID OR FLEXIBLE

RIGID

- Pros
  - Excellent resolution (increased magnification)
- Cons
  - Only evaluate /i/ and not connected speech
  - Patient gag reflex and anatomy may interfere with visualization
  - Difficult to assess hyperfunction

FLEXIBLE

- Pros
  - Evaluate functional tasks- speaking and singing
  - Preferred to evaluate hyperfunction, neurological conditions, and vocal fold mobility
  - Evaluate velopharyngeal closure, etc.
- Cons
  - Patient tolerance

MULTI-DISCIPLINARY CLINIC FLOW AT GBMC

- SLP takes patient history and acoustic and aerodynamic measures
- SLP obtains verbal patient consent for stroboscopy and describes procedure to patient
- SLP applies lidocaine (and oxymetazoline if transnasal)
- SLP performs stroboscopic exam
- MD reviews images with patient and provides diagnosis and treatment recommendations along with SLP input

ENDOSCOPIC PROCEDURE

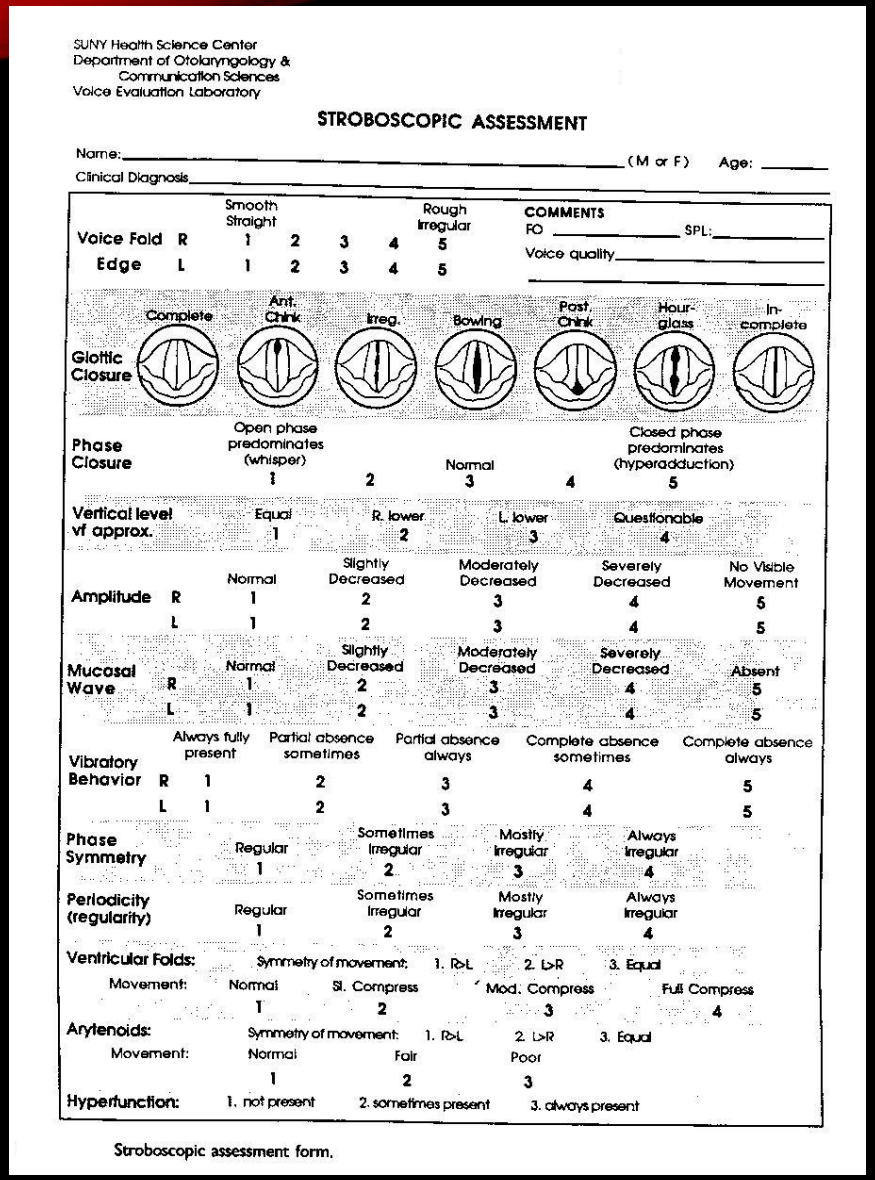
- Training Video (Dr. Simon Best): Laryngeal Stroboscopy Training: Introduction to rigid and flexible stroboscopy (youtube.com)
  - https://youtu.be/kJGk0JhbxGI

- Set-up equipment
- Place laryngeal microphone
- Position the patient appropriately
- Sustained modal /i/, high pitch, low pitch, ascending and descending glissandos, loud/soft, for flex exam obtain repeated sniff /i/, singing, conversation

STROBOSCOPIC INTERPRETATION

- Subjective
- Several Rating Tools Available
- Ratings MUST be made at modal (speaking) pitch
- The strobe light must pick up entrained vibration for several seconds
- We *cannot* infer judgements about vibration we cannot see

RATING TOOLS



SUNY Health Science Center
Department of Otolaryngology & Communication Sciences
Voice Evaluation Laboratory

STROBOSCOPIC ASSESSMENT

Name: _____ (M or F) Age: _____

Clinical Diagnosis _____

		Smooth Straight				Rough Irregular	COMMENTS
Voice Fold Edge	R	1	2	3	4	5	FO _____ SPL: _____
	L	1	2	3	4	5	Voice quality _____

	Complete	Ant. Chink	Irreg.	Bowing	Post. Chink	Hour-glass	In-complete
Glottic Closure							

Phase Closure		Open phase predominates (whisper)		Normal		Closed phase predominates (hyperadduction)
		1	2	3	4	5
Vertical level of approx.		Equal	R. lower	L. lower		Questionable
		1	2	3		4

		Normal	Slightly Decreased	Moderately Decreased	Severely Decreased	No Visible Movement
Amplitude	R	1	2	3	4	5
	L	1	2	3	4	5
Mucosal Wave	R	1	2	3	4	5
	L	1	2	3	4	5

		Always fully present	Partial absence sometimes	Partial absence always	Complete absence sometimes	Complete absence always
Vibratory Behavior	R	1	2	3	4	5
	L	1	2	3	4	5

Phase Symmetry	Regular	Sometimes Irregular	Mostly Irregular	Always Irregular	
	1	2	3	4	
Periodicity (regularity)	Regular	Sometimes Irregular	Mostly Irregular	Always Irregular	
	1	2	3	4	

Ventricular Folds:	Symmetry of movement:	1. R>L	2. L>R	3. Equal	
Movement:	Normal	Sl. Compress	Mod. Compress	Full Compress	
	1	2	3	4	
Arytenoids:	Symmetry of movement:	1. R>L	2. L>R	3. Equal	
Movement:	Normal	Fair	Poor		
	1	2	3		
Hyperfunction:	1. not present	2. sometimes present	3. always present		

Stroboscopic assessment form.

Stroboscopic Assessment of Voice (SAV)

Videostroboscopic Examination of the Larynx, M. Hirano and D. Bless, 1993, Singular Publishing

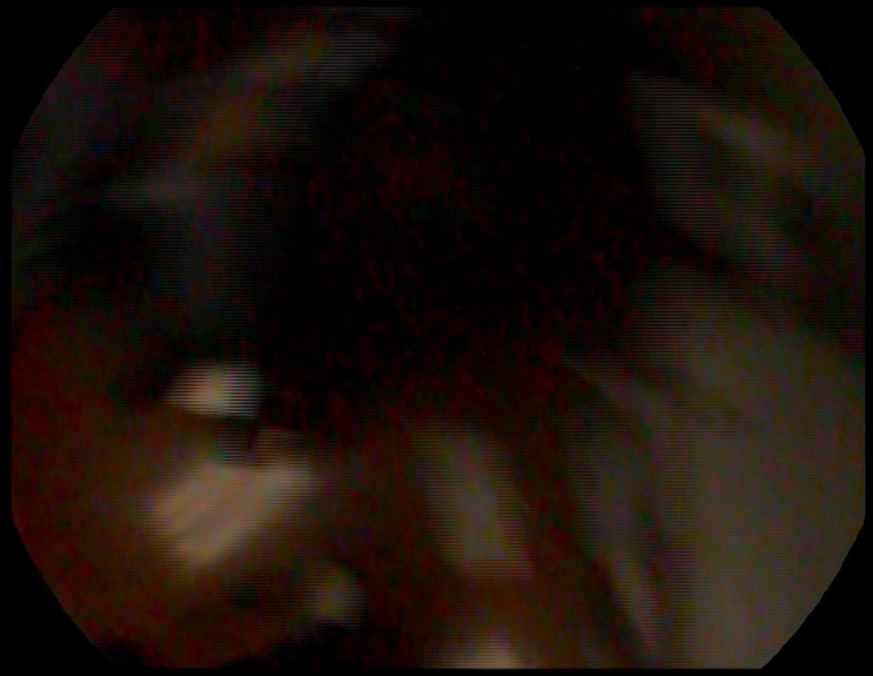
*See appendix for examples of SERF, VALI

STROBOSCOPIC PARAMETERS

- NON VIBRATORY CHARACTERISTICS
  - Vocal fold edge
  - Arytenoid movement and symmetry
  - Hyperfunction including ventricular fold movement and symmetry
- VIBRATORY CHARACTERISTICS
  - Vertical level
  - Glottic closure
  - Phase closure
  - Periodicity
  - Phase symmetry
  - Amplitude
  - Mucosal wave
- *Other findings (vallecular lesion, pooling of secretions, candidiasis, incomplete VP closure, etc.)*

Based on Stroboscopic Assessment of Voice (SAV) [Hirano& Bless] and recommendations by Patel et al.

VOCAL FOLD EDGE



Recognition of irregularity impacting the free edge of each vocal fold

<u>Ratings</u>

Normal: Smooth

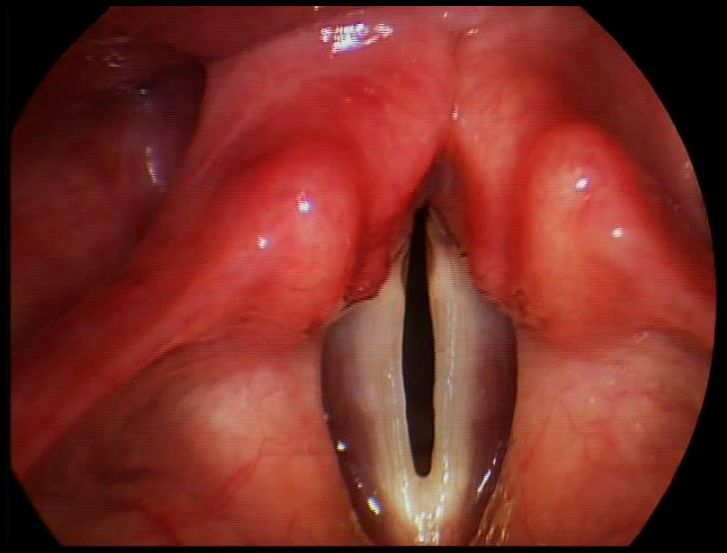
Abnormal: Rough, irregular, excrescence, edema, erythema, bowed

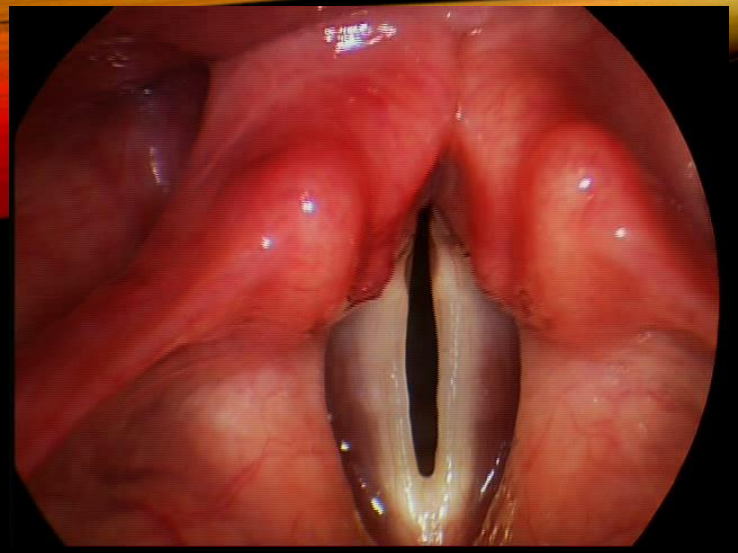
ARYTENOID MOTION AND SYMMETRY

Symmetrical opening and closing (hint: watch arytenoids)

<u>Ratings</u>
Normal
Abnormal: Absent, diminished, right leads left, left leads right

Cause of asymmetry: paralysis, paresis





HYPERFUNCTION

Recruitment of supraglottic structures during phonation--
Medial and anterior-posterior compression are common

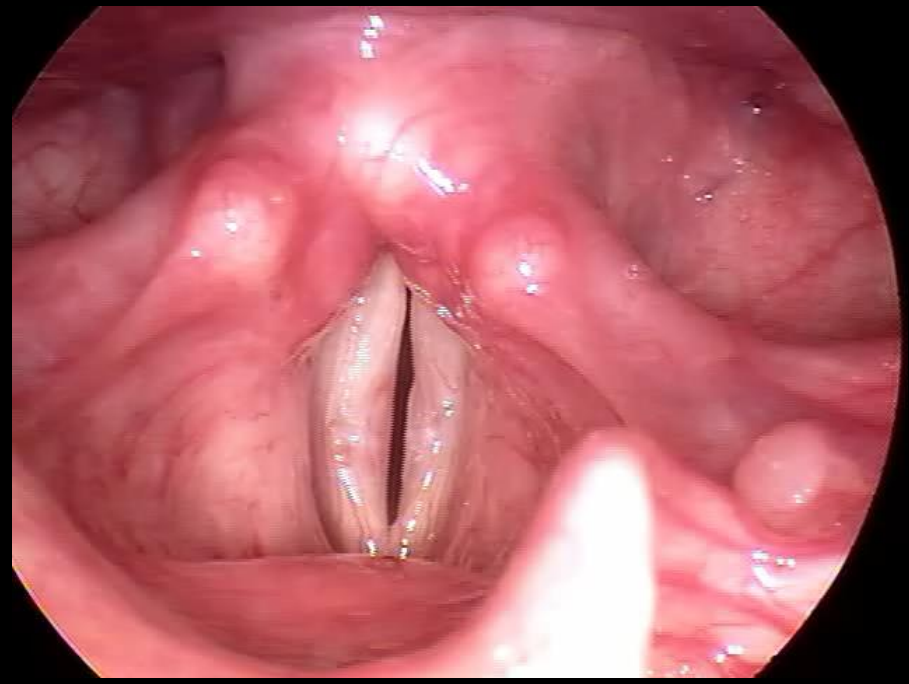
<u>Ratings</u>

Presence: not present, sometimes present, mostly present, always present

Symmetry of ventricular fold motion: equal, R>L, L>R

Severity: mild, moderate, severe

GLOTTIC CLOSURE

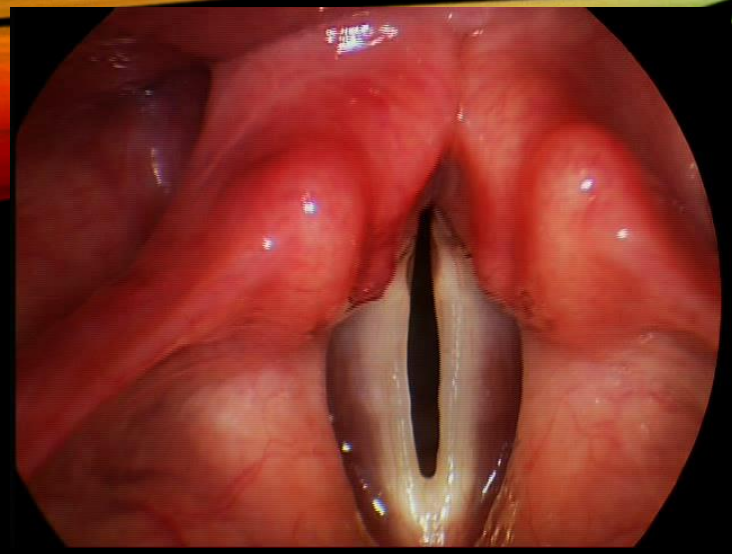


"Rated as "complete" or "incomplete" and is determined by the extent of vocal fold approximation during the maximum closing of the vibratory cycle. (Hirano and Bless, P. 112)

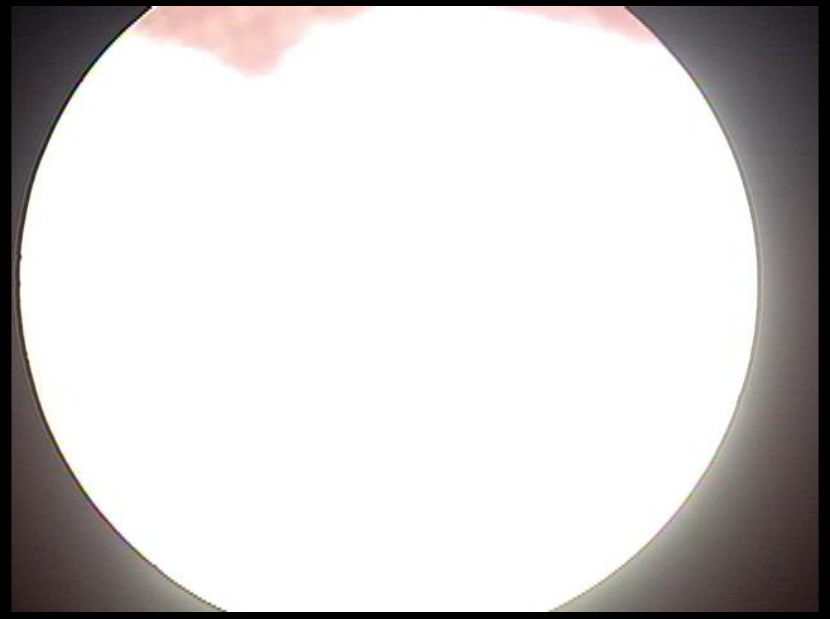
Incomplete ratings should describe the shape of closure if possible:

- Spindle gap/bowed
- Hourglass
- Anterior gap
- Posterior gap

Frequent causes of incomplete closure: paralysis, lesion(s), bowing, hypofunction



VERTICAL LEVEL



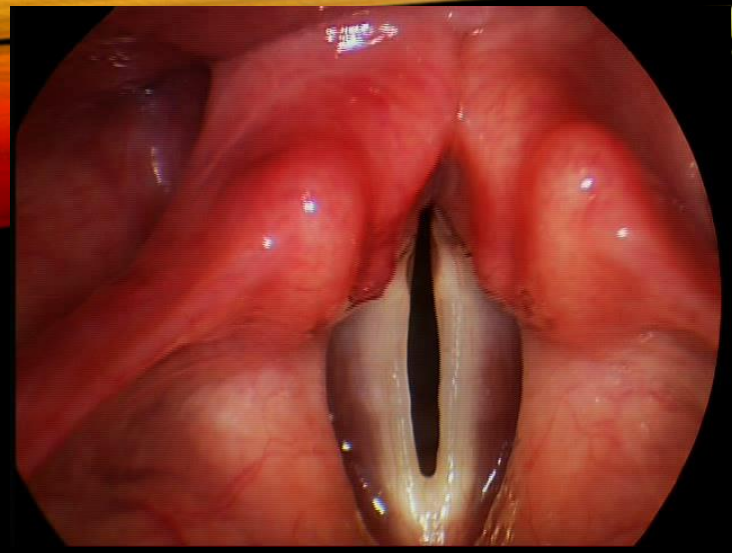
In the closed phase, vocal folds should meet on the same vertical plane

<u>Ratings</u>

Normal: Equal

Abnormal: Right lower, left lower, questionable

Frequent causes of height mismatch: Paralysis, CA joint injury



PHASE CLOSURE

Ratio of open to closed phase

<u>Ratings</u>

Normal, open phase predominates, closed phase predominates, mostly open, mostly closed, somewhat open, somewhat closed

PERIODICITY

"The regularity of successive apparent cycles of vocal fold vibration…considered to be uniform in amplitude and time" (Hirano & Bless, p.110).

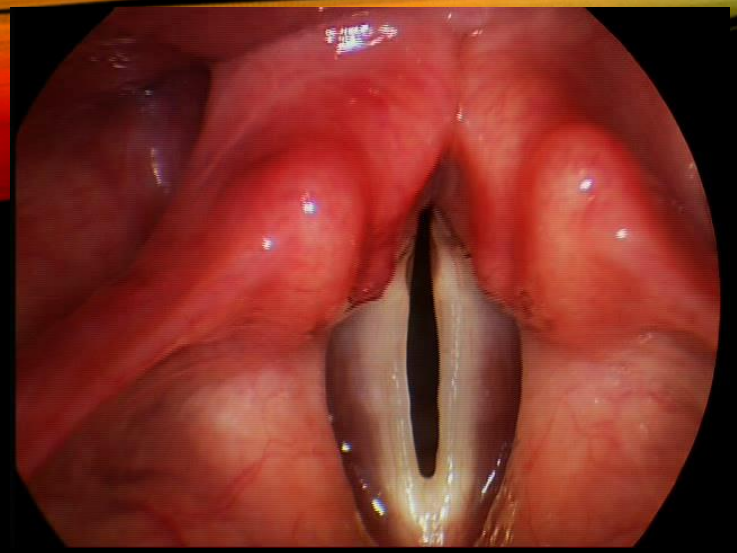
To assess this, strobe light must be tracking

<u>Ratings</u>

Normal: Regular

Abnormal: Sometimes, Mostly or Always Irregular

Frequent causes of aperiodicity: tremor, spasmodic dysphonia, lesion



PHASE SYMMETRY

"The degree to which the two vocal folds provide mirror images of one another during vibration." (Hirano & Bless, P. 114)

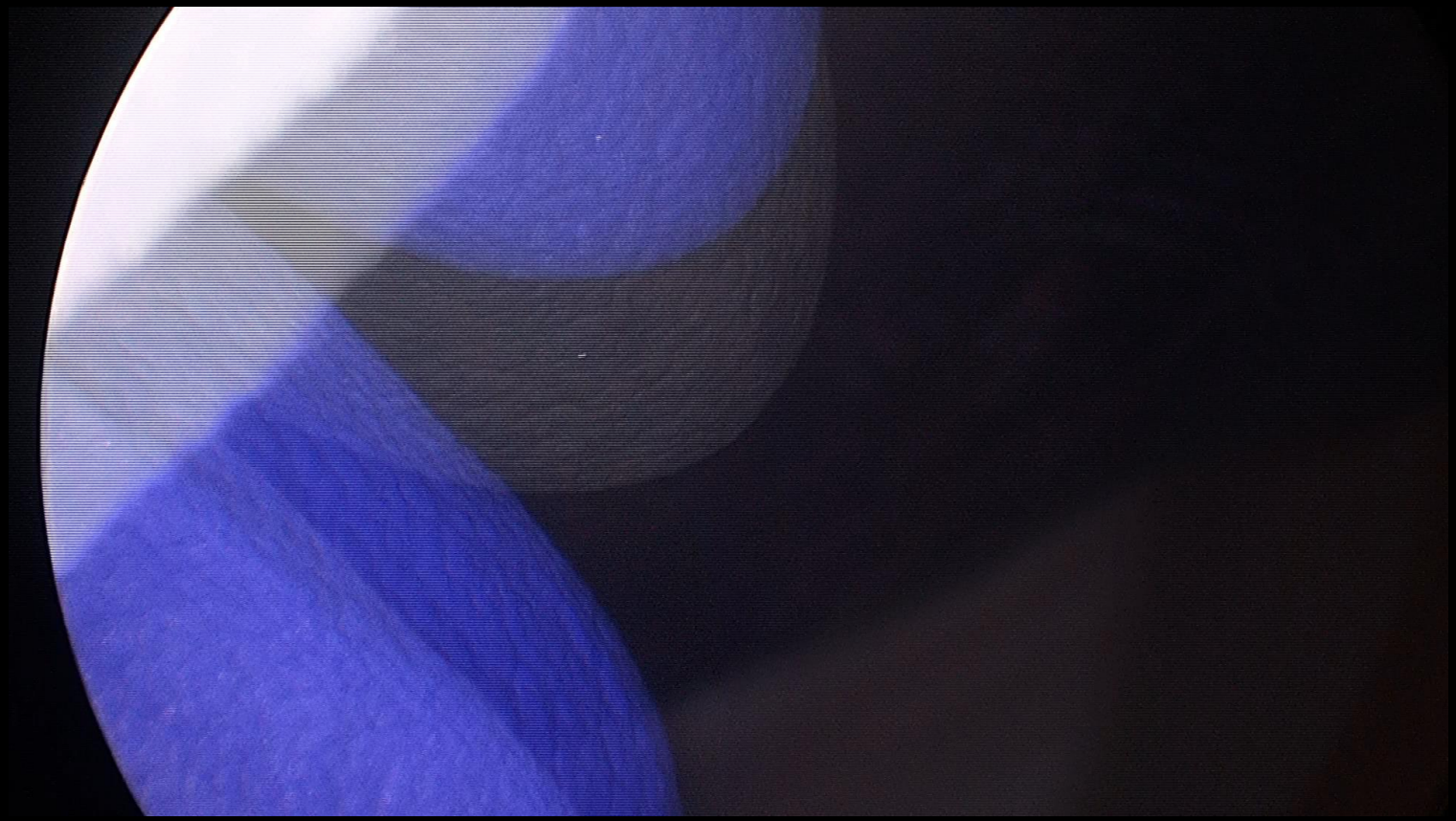
<u>Ratings</u>

Normal: Symmetrical

Abnormal: Sometimes irregular, mostly irregular, always irregular

Changes in mass, tension, shape, elasticity, etc. will impact symmetry

PHASE SYMMETRY



AMPLITUDE

"Extent of horizontal excursion of the vocal folds during vibration." (Hirano and Bless, p.110)

Rate L and R vocal folds independently

Ratings

Normal: Horizontal excursion is approximately 1/3 the width of visible fold (subjective)

Abnormal: reduced (mildly, moderately, severely) or absent

Main factors reducing amplitude: mass, scar, lack of closure

MUCOSAL WAVE

Mucosal wave "normally traverses at least half the entire width…of the vocal fold" (Hirano and Bless, p. 114)

Considered to be a good measure of vibratory behavior

Rate each vocal fold separately

Only judge at modal pitch

<u>Ratings</u>

Normal

Abnormal: mildly, moderately or severely reduced

Most common causes of change in mucosal wave: scar, lesion

CONCLUSIONS

- Stroboscopy is the gold standard of laryngeal imaging as it allows us to assess vibratory characteristics of the vocal folds
- MDs and SLPs can perform stroboscopy, but only MDs can diagnose
- Check facility, state board, and national regulations before you start

THANK YOU!

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APPENDIX

REFERENCES

- American Speech-Language-Hearing Association. (2004b). *Knowledge and skills for speech-language pathologists with respect to vocal tract visualization and imaging* [Knowledge and skills]. Retrieved from http://www.asha.org/policy

- American Speech-Language-Hearing Association. (2004c). *Vocal tract visualization and imaging* [Position statement]. Retrieved from http://www.asha.org/policy

- Hirano, M. & Bless, D. (1993).*Videostroboscopic Examination of the Larynx*. San Diego, CA: Singulair.

- Patel, R., Awan, S., Barkmeier-Kraemer, J., Courey, M., Deliyski, D., Eadie, T., Paul, D. Svec, J., & Hillman R. (2018). Recommended Protocols for Instrumental Assessment of Voice: American Speech-Language Hearing Association Expert Patel to Develop a Protocol for Instrumental Assessment of Vocal Function. *American Journal of Speech-Language Pathology*, 27,887-905.

MARYLAND BOARD SLP GUIDELINES

SLP Guidelines for the Use of Endoscopy

Speech-Language Pathologists provide diagnostic and treatment services that may call for the use of endoscopy to complete swallowing, voice, and/or velopharyngeal diagnostic and treatment procedures. For example, rigid and flexible endoscopy are techniques used to visualize the vocal tract and larynx during voice and swallowing assessments.

It is the position of the Maryland Board of Examiners that the use of rigid and flexible endoscopy by speech-language pathologists is within the Speech-Language Pathology Scope of Practice when used to complete functional evaluations and/or treatment interventions of swallowing and/or voice.

The following Guidelines have been adopted by the Board for speech-language pathologists to consider when using endoscopy:

1. Speech Language Pathologists may use flexible or rigid endoscopy independently during an appropriate diagnostic and/or treatment activity.
2. Speech Language Pathologists should review and utilize appropriate professional protocols to ensure that their training is adequate and complete. It is recommended that such training be documented in the Speech-Language Pathologist's personnel file and be updated annually.
3. Speech Language Pathologists should have an on-going relationship with an otolaryngologist for information and referral purposes.
4. Speech-Language Pathologists should be able to access a physician when utilizing endoscopy in their practice.
5. Care should be taken to use endoscopy only in settings that assure patient safety.
6. Speech Language Pathologists should review relevant scope of practice documents, position statements, and related ethics issues prior to implementing the use of endoscopy in their practice.

Maryland Department of Health SLP Guidelines for the Use of Endoscopy

GBMC COMPETENCY FLEXIBLE ENDOSCOPY

	Unable to perform (1)	(2)	Performs with minimal prompting (3)	(4)	Performs easily with good flow (5)	Comments
Hand hygiene						
Appropriate donning of PPE						
Explains procedure to patient						
Scope tracking in computer						
Administration of topical anesthetic						
Set up scope (plug in, brightness, white balance						
Patient positioning						
Laryngeal mic placement						
Advancement of scope						
Assessment of VP closure						
Assessment of BOT						
Assessment of pyriforms						
Laryngeal image (centered, View of entire structure (including AC), clear, adequate brightness, clear of secretions)						
Modal pitch vibration > 3 seconds, synced with stroboscopy						
Abduction/Adduction						
Pitch glide						
High pitch						
Conversation						
Singing if appropriate						
Application of therapy techniques if appropriate						
Scope clean up (endoscope handling)						
Explains findings to MD						
Reinforces MD recommendations (treatment, therapeutic process, check benefits, scheduling)						

GBMC COMPETENCY (STROBOSCOPIC INTERPRETATION PORTION)

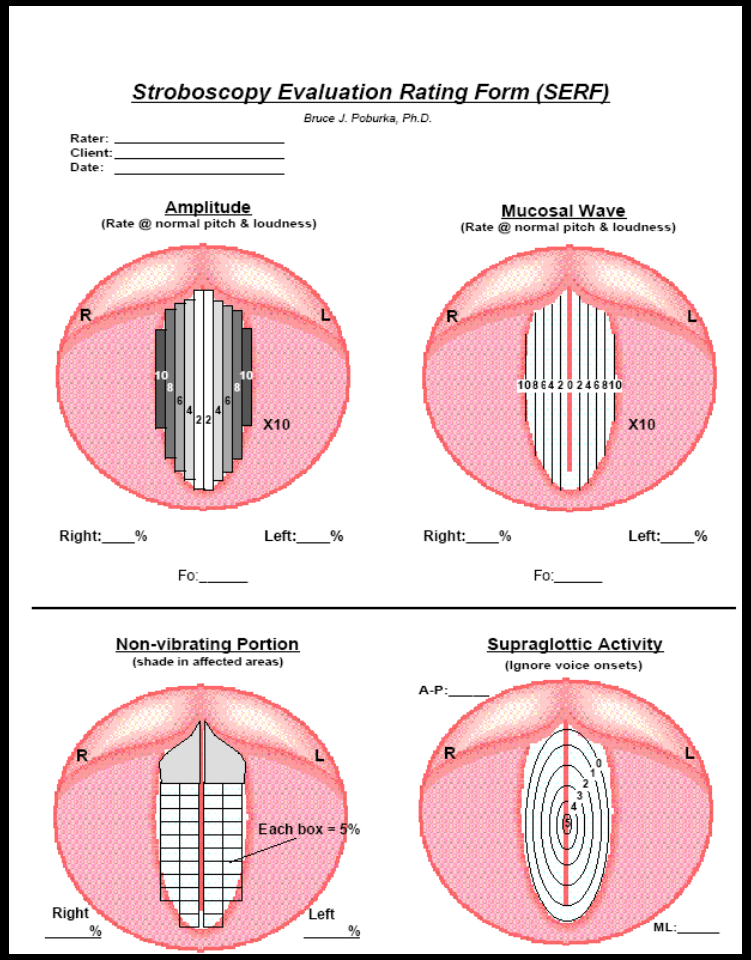
Stroboscopic Interpretation:

	Unable to assess (1)	(2)	Assesses with minimal prompting (3)	(4)	Assesses easily and accurately (5)	Comments
vocal fold closure						
vocal fold edges						
phase closure						
amplitude						
mucosal wave						
vertical approximation						
vibratory behavior						
phase symmetry						
periodicity						
ventricular fold symmetry						
ventricular fold motion						
arytenoid symmetry						
arytenoid motion						
hyperfunction						

RATING TOOLS

Stroboscopy Evaluation Rating Form (SERF)

Bruce J. Poburka, Ph.D., Journal of Voice 1999



Stroboscopy Evaluation Rating Form (SERF)

Bruce J. Poburka, Ph.D.

Rater: _____
Client: _____
Date: _____

Amplitude
(Rate @ normal pitch & loudness)

R L

10 8 6 4 2 2 4 6 8 10

X10

Right:____% Left:____%

Fo:_____

Mucosal Wave
(Rate @ normal pitch & loudness)

R L

10 8 6 4 2 0 2 4 6 8 10

X10

Right:____% Left:____%

Fo:_____

Non-vibrating Portion
(shade in affected areas)

R L

Each box = 5%

Right ____% Left ____%

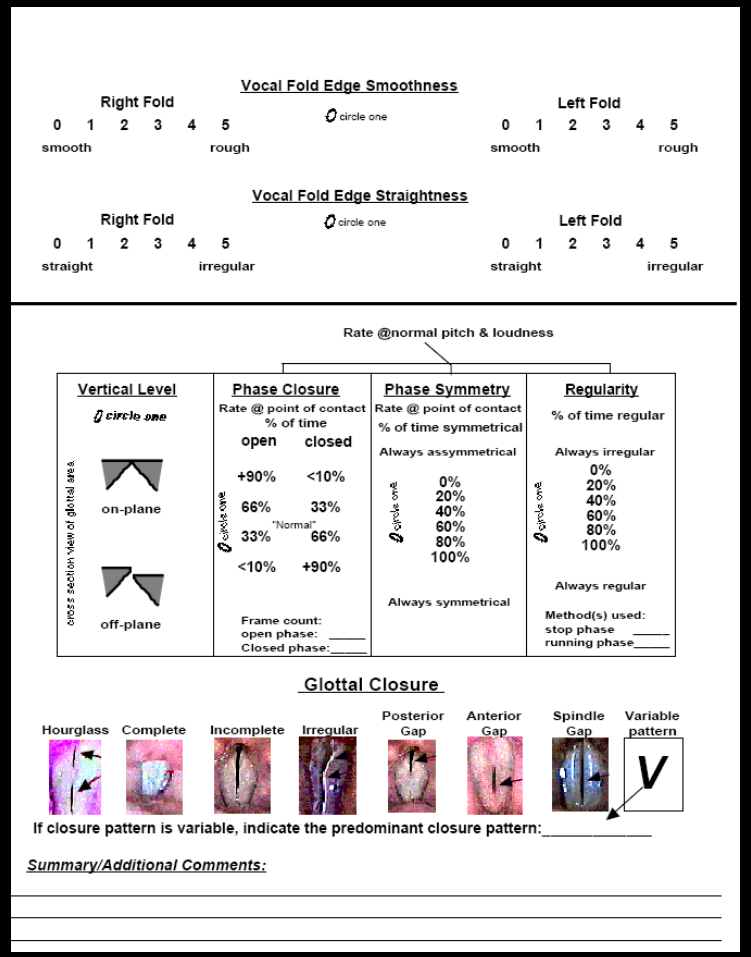
Supraglottic Activity
(Ignore voice onsets)

A-P:_____

R L

0 1 2 3 4

ML:_____



Vocal Fold Edge Smoothness

Right Fold: 0 1 2 3 4 5 (smooth — rough)

circle one

Left Fold: 0 1 2 3 4 5 (smooth — rough)

Vocal Fold Edge Straightness

Right Fold: 0 1 2 3 4 5 (straight — irregular)

circle one

Left Fold: 0 1 2 3 4 5 (straight — irregular)

Rate @normal pitch & loudness

Vertical Level

circle one

cross section view of glottal area

on-plane

off-plane

Phase Closure

Rate @ point of contact
% of time

open	closed
+90%	<10%
66%	33%
"Normal"	
33%	66%
<10%	+90%

circle one

Frame count:
open phase: _____
Closed phase:_____

Phase Symmetry

Rate @ point of contact
% of time symmetrical

Always assymmetrical

circle one

0%
20%
40%
60%
80%
100%

Always symmetrical

Regularity

% of time regular

Always irregular

circle one

0%
20%
40%
60%
80%
100%

Always regular

Method(s) used:
stop phase _____
running phase_____

Glottal Closure

Hourglass | Complete | Incomplete | Irregular | Posterior Gap | Anterior Gap | Spindle Gap | Variable pattern

If closure pattern is variable, indicate the predominant closure pattern:_____

Summary/Additional Comments:

VALI

Voice-Vibratory Assessment with Laryngeal Imaging (VALI) - Stroboscopy

Poburka, B., Patel, R., and Bless, D. 2016

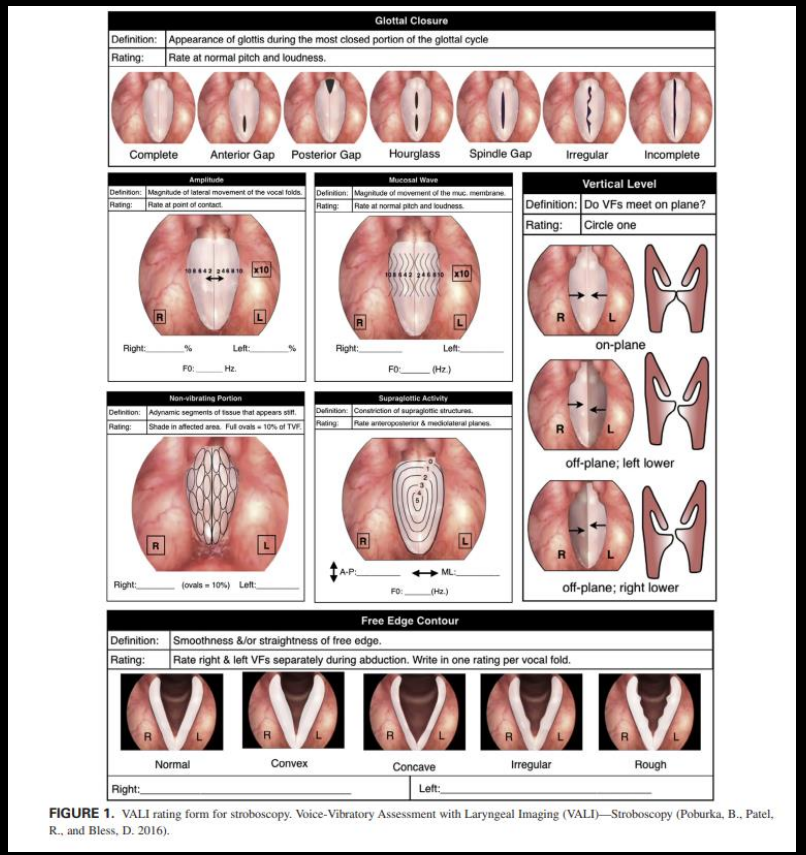


FIGURE 1. VALI rating form for stroboscopy. Voice-Vibratory Assessment with Laryngeal Imaging (VALI)—Stroboscopy (Poburka, B., Patel, R., and Bless, D. 2016).