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Physiology of Phonation



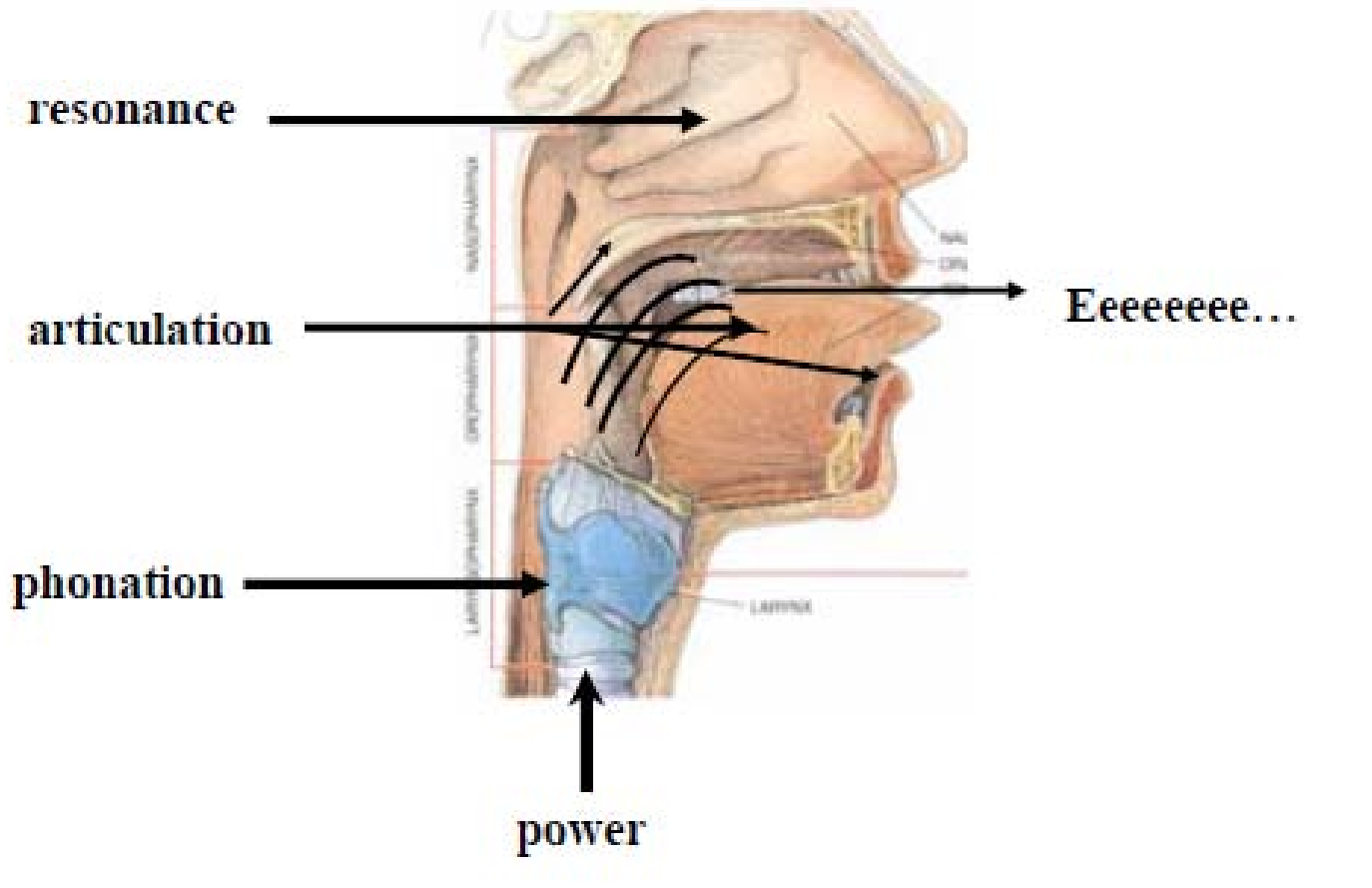
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Lecture Objectives:

To explore ...

- * Anatomy,
 - * Physiology,
 - * Assessment,
 - * Management,
 - * Prognosis
 - * Referrals
- of Voice Disorders.

Functions of the Larynx



How many functions the larynx has?

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(1) Airway.



(2) Protection.



(3) Phonation.

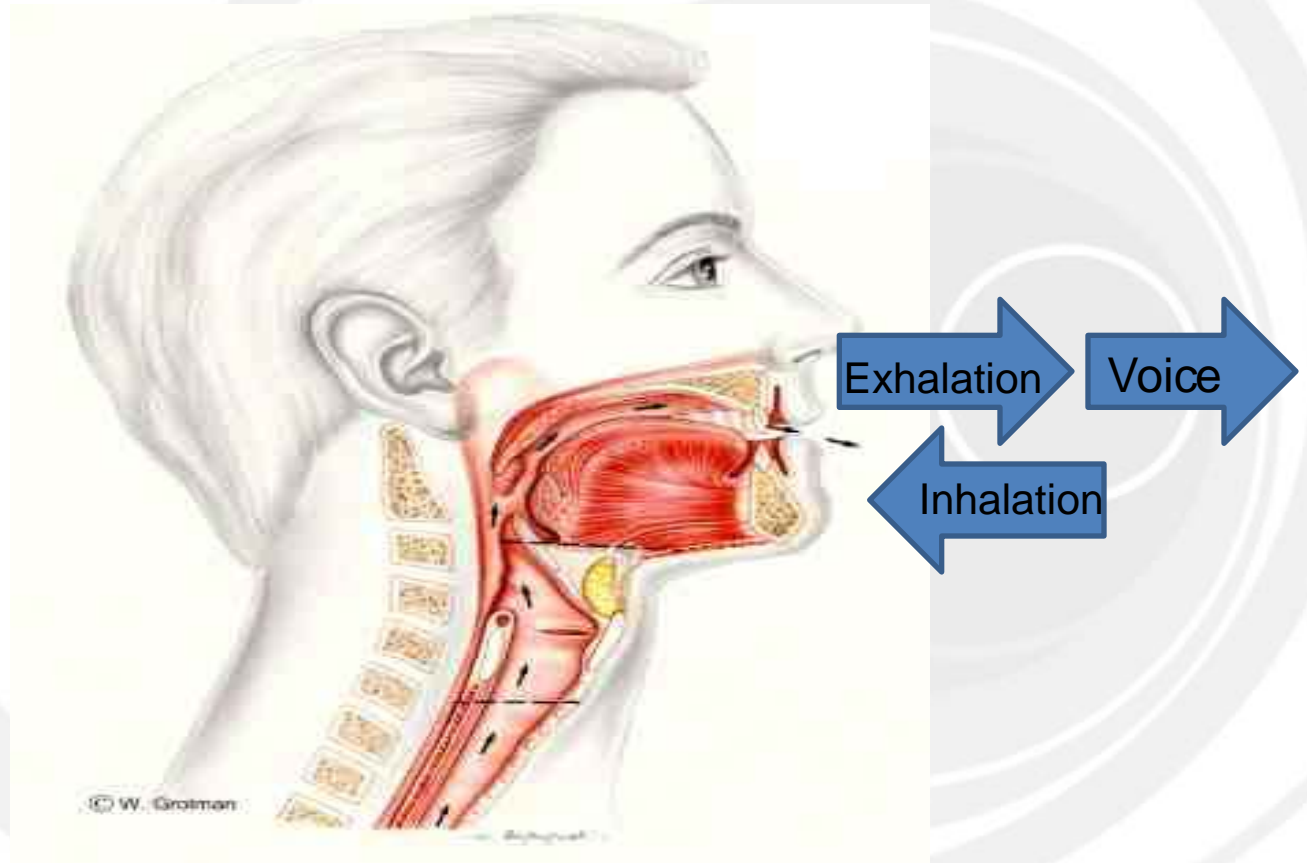


(4) Increasing intra-thoracic Pressure.



Voice

The result of vibration of the true vocal folds using the expired air.



Stages of Phonation

True vocal fold movements:

(1) Gross movements:

Adduction (phonation) and
Abduction (breathing).

(2) Fine movements:

Mucosal waves during adduction.

I. Gross movements



**During breathing
(Abduction)**



**During phonation
(Adduction)**

II. Fine movements



**During phonation
(Adduction)**

STAGES OF PHONATION:

- I. Vocal Attack.
- II. Sustained Phonation.
- III. Termination of Phonation.

I. Vocal Attack:

Vocal attack is the process of bringing vocal folds together to begin phonation.

It requires muscular action (adduction).

I. Vocal Attack:

Types:

1. The **aspirate** (breathy) vocal attack.
2. The **hard** glottal attack.
3. The **soft** (even) glottal attack.

I. Vocal Attack:

The **soft** attack serves for expressing pleasant emotions. It is characteristic for joy, admiration, and pleasure,

While the **hard** glottal attack is correlated with the unpleasant moods of fear, anger, or impatience.

I. Vocal Attack:

All three of these attacks are quite functional in phonation and are not at all pathological.

Problems occur when an attack is misused.

II. Sustained Phonation:

Requires maintenance of a laryngeal posture through tonic (sustained tensing) contraction of musculature.

It does not requires muscular action.

II. Sustained Phonation:

The Bernoulli effect:

Given a constant volume flow of air or fluid, at a point of constriction there will be a decrease in air pressure perpendicular to the flow and an increase in velocity of the flow.

II. Sustained Phonation:

The Bernoulli effect:

If volume fluid flow is constant,
and at an area of constriction:

1. **velocity** of flow will increase, and
2. **pressure** at the constriction will decrease.

II. Sustained Phonation:

(1) The myoelastic-aerodynamic theory:

States that vibration of the vocal folds is induced by a combination of aerodynamic, muscular and elastic forces in the larynx.

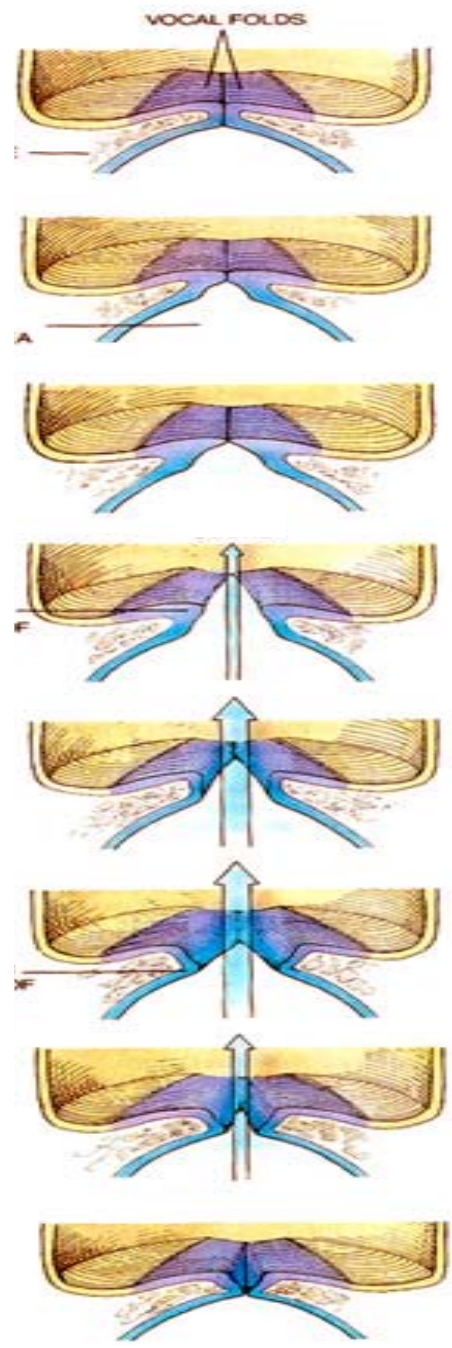
II. Sustained Phonation:

Myoelastic-aerodynamic theory (story):

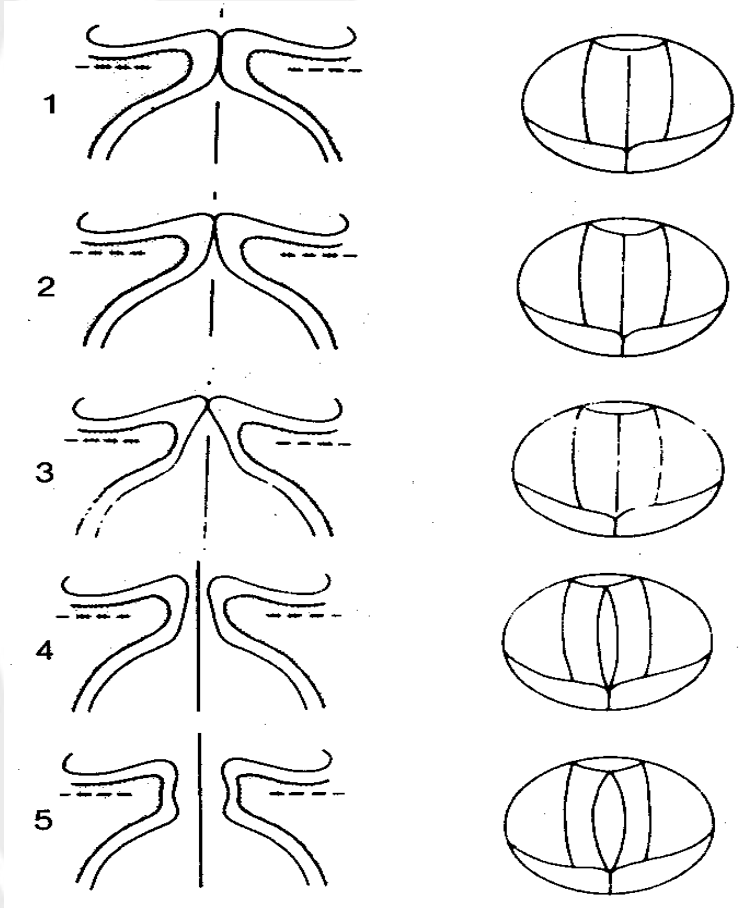
1. Vocal fold adduction.
2. Subglottic pressure increases.
3. Bernoulli effect and elastic tissue recoil.
4. Repetition.



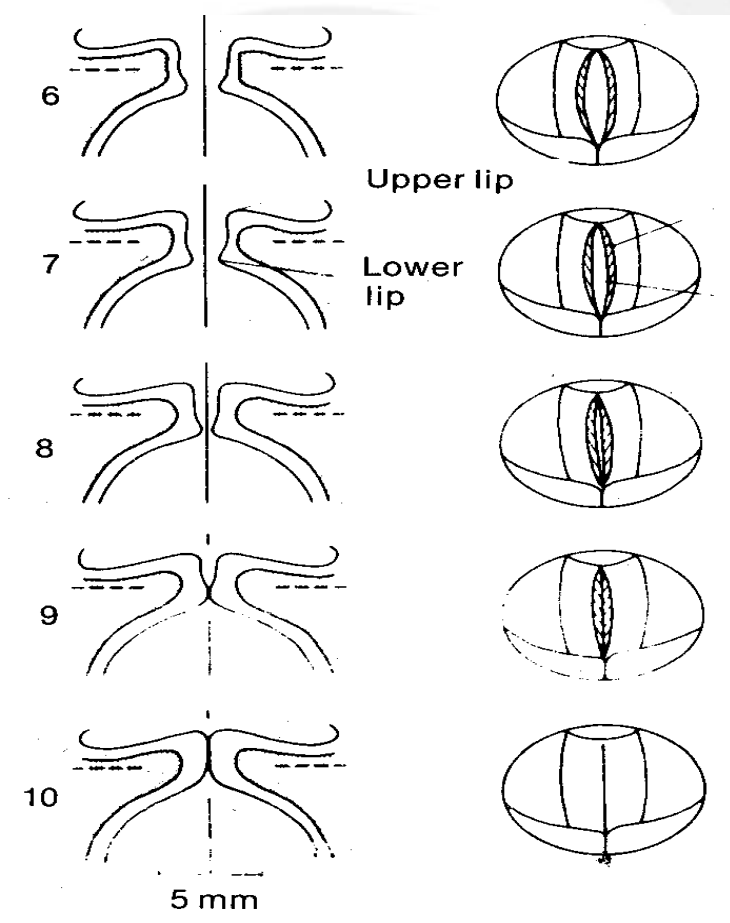
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Bernoulli effect

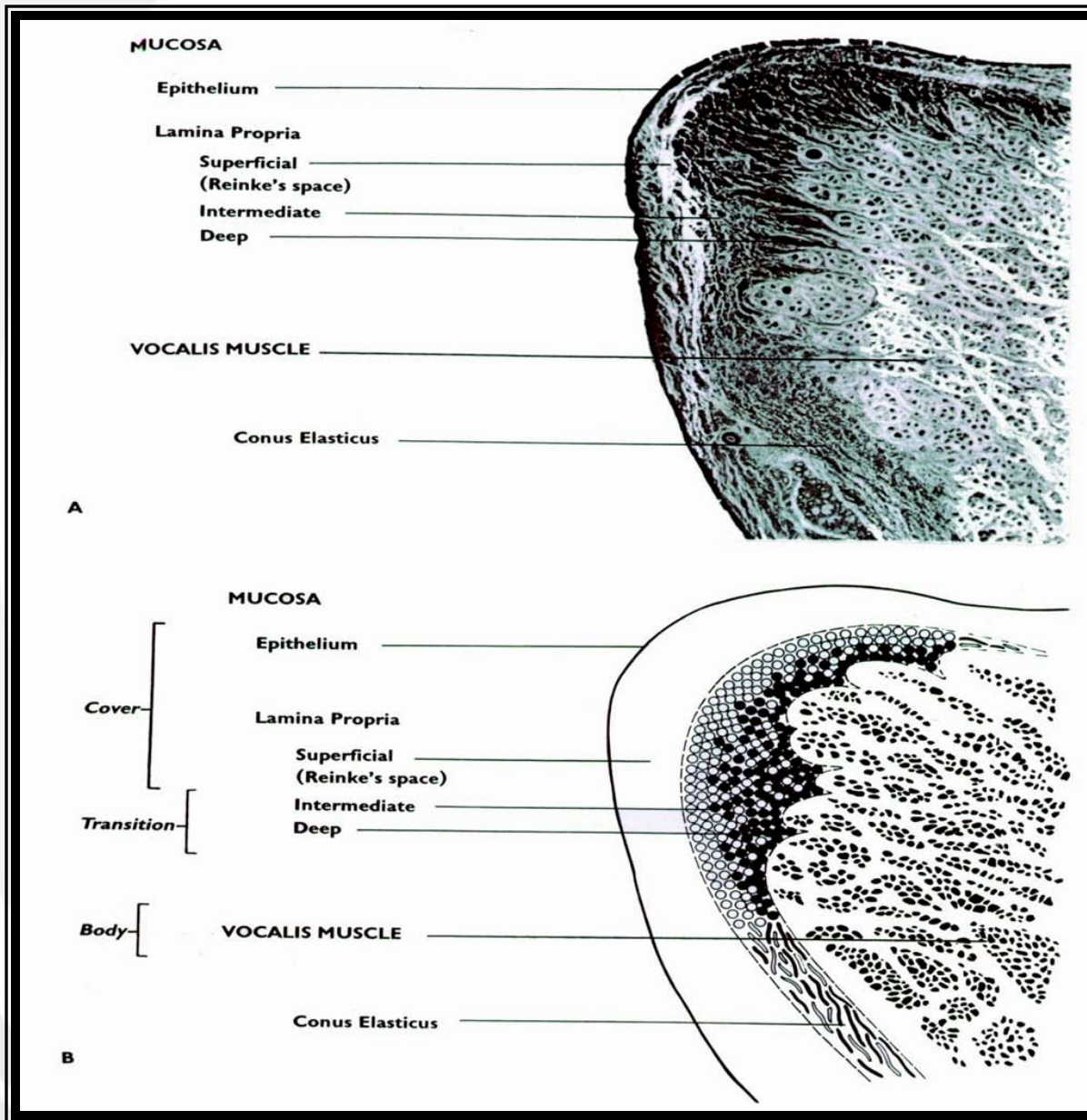


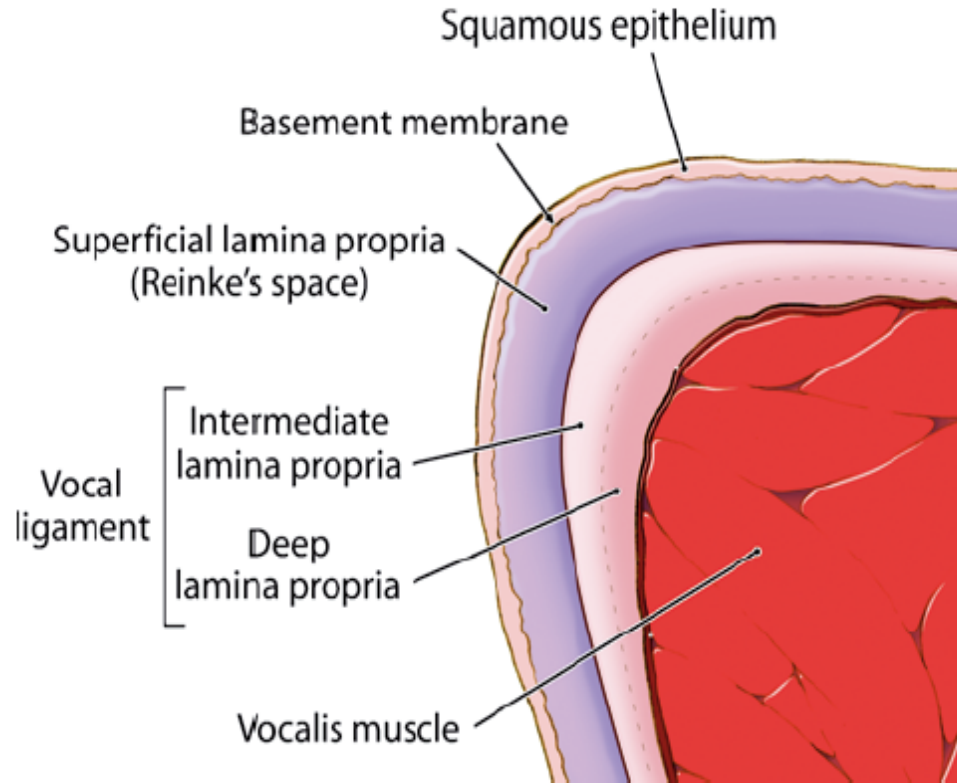
II. Sustained Phonation:

(2) Cover-Body concept:

During phonation, **mucosal waves** travel from the *inferior* to the *superior* surface.

Existence of a soft and pliant **COVER** moving freely on a **CORE (BODY)** is essential for the occurrence of the **mucosal wave**.





Fine movements



**During phonation
(Adduction)**

II. Sustained Phonation:

Prerequisites of “normal” voice production:

1. Normal range of movement of vocal folds.
2. Normal mobility of mucosa on deep layers.
3. Optimal coaptation of vocal folds' edges.
4. Optimal motor force.
5. Optimal pulmonary support.
6. Optimal timing between vocal fold closure and pulmonary exhalation.
7. Optimal tuning of vocal fold musculature (int. & ext.).

II. Sustained Phonation:

Register:

Registers are “series of consecutive voice tones of equal timber”.

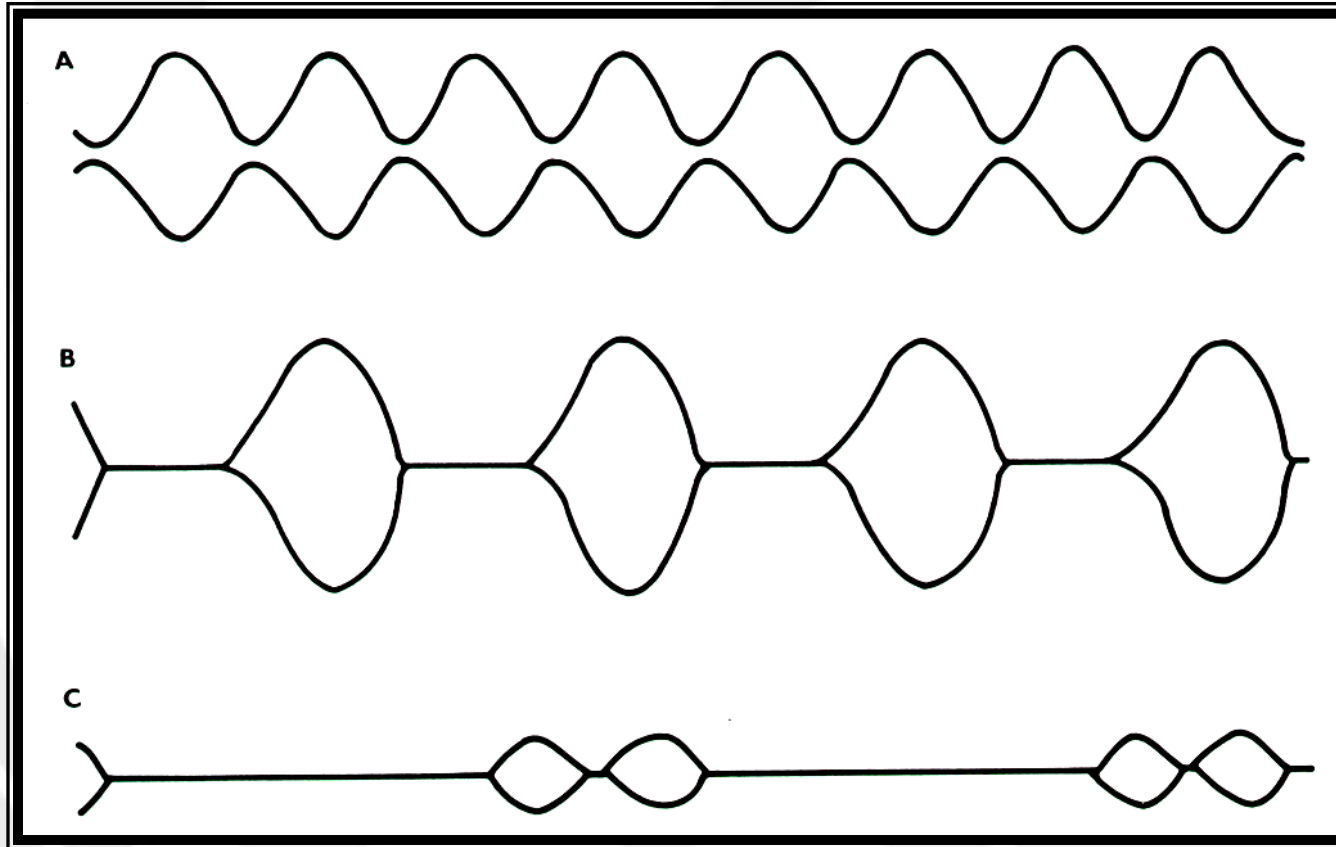
Each register includes a range of succeeding tones having the same quality and being produced by the same mechanics.

II. Sustained Phonation:

Types of register:

1. **Falsetto** (light) register.
2. **Modal** (heavy) register: **chest, mid, and head.**
3. **Vocal fry** (pulse) register.
4. **Whistle** register.

In the untrained singer, transitions between register are hard as changes in quality and even as a “break” in the voice.



Registers: A. falsetto; B. modal; C. vocal fry.

III. Termination of Phonation:

Termination of phonation requires that we *abduct* them. We pull the vocal folds out of the airstream far enough to reduce the turbulence.

It requires muscular action (abduction).

Pitch and Pitch Control

PITCH:

Pitch is the physiological (perceptual) correlate of frequency.

Vocal pitch is determined by the frequency with which the vocal folds vibrate against one another.

PITCH CONTROL:

Frequency **increases** with:

1. Increase in vocal fold **length**.
2. Increase in vocal fold **tension**.
3. Increase in **subglottic pressure**.
4. Decrease in vocal fold **mass**.

Loudness and Loudness Control

LOUDNESS:

Loudness is the physiological (perceptual) correlate of intensity.

Intensity is a function of the force of vibration.

It is determined by the **wave amplitude**.

LOUDNESS CONTROL:

Loudness **increases** with:

1. Increase in **subglottic pressure (expiratory air flow)**.
2. Increase in **glottal resistance (adduction)**.



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Thank You

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