VOICE AND RESONANCE DISORDERS

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CHAPT.1 AN INTRODUCTION TO VOICE DISORDERS

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Phonation

- Phonation = series of openings and closings of the vocal folds.
- Results in the production of voice (speech sounds/s).
- Vocal folds lie within the laryngeal cavity/larynx.
- Larynx is the superior part of the respiratory passages.

NORMAL VOICE PRODUCTION

- Normal voice production needs the integration of three main systems:
- □ Respiratory System: generates power.
- Lungs, Ribs, and Abdomen.
- □ Laryngeal System: Voice production system.
- Consists of the **Vocal Folds** and the other laryngeal structures.
- Supralaryngeal Structures:vocal tract and champers,play a role in filtering the voice produced.

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The Larynx: Key Functions

- Airway Protection
- Intrathoracic pressure generation
- Valving for speech production.
- □ Biological function.
- Emotional function.
- □ Linguistic function.

PREVALENCE OF VOICE DISORDERS

- In General Population:5%-10%.
- In Children:5%-10%.
- In the Elderly:20%-30%.
- In Teachers:11%-15%.
- In Student Teachers :11%-15%.
- In SLPs:12%-15%.

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KINDS OF VOICE DISORDERS

- GENERAL CAUSES:
- 1-Pathologies.
- 2-Inflamatory conditions.
- 3-Trauma or injury.
- 4-Systemic conditions.
- 5-Nonlaryngeal aerodigestive disorders.
- 6-Psychiatric Psychological disorders.
- 7-Neurological disorders.

Cont.

□ Functional Voice disorders:

- I. Muscle Tension Dysphonia(MTVD).
- II. Psychogenic Voice Disorders(PVD).
- □ Organic Voice Disorders.
- □ Neurogenic Voice Disorders.

CHAPT.2 NORMAL VOICE ANATOMY AND PHYSIOLOGY

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The Phonatory System

- The source of voice.
- Normal phonation(voice production) results from:
- ✓ Normal expiratory airflow.
- ✓ Normal vocal folds structure and function.
- ✓ Normal supraglottic structure and function.
- ✓ Normal nervous system control.

Anatomy of Phonation

- Larynx positioned at the top of the trachea.
- At the level of vertebrate C4-C6 in adults, C1-C3 in children.
- 44mm(1.7inches)long in adult males.
- 36mm(1.5inches)long in adult females.
- Circumference of larynx in adults 120mm (5 inches).
- Larynx is a framework of Cartilage,Ligaments, Membranes,Folds,Intrensic and Extrinsic muscles.

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Vocal Folds Vibration

- Vocal Folds vibration is possible because of:
- 1-The vocal folds are located within a fixed laryngeal framework.
- 2-Muscles within the larynx facilitate vocal folds abduction and adduction.
- 3-Some of the intrinsic laryngeal muscles cause changes in the elastic properties of the vocal folds thus affecting their rate of vibration.

4-An outgoing airstream also affects vocal folds vibration. STUDENTS-HUB.com

HYOID BONE

- The only laryngeal bone, U-shaped.
- Called lingual bone because the Hypoglossus, Geniohyoid, and Mylohyoid muscles attach to it.
- It does not articulate to any other bone in the human body.
- The laryngeal structures attached to it through membranes, ligaments and muscles.



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LARYNGEAL CARTILAGES

- https://www.youtube.com/watch?v=Z3S2dD9BrSY
- UNPAIRED CARTILAGES
- Cricoid cartilage
- Thyroid cartilage
- Epiglottis
- PAIRED CARTILAGES
- Arytenoids
- Corniculates
- Cuneiforms

Cont.



LATERAL



Thyroid cartilage – male/female differences



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CRICOID CARTILAGE

- Unpaired.
- Hyaline type of cartilage.
- Complete cartilaginous ring on the top of the trachea, shaped like a signet ring.
- Has a thin anterior arch called **Anulus**, and a broader posterior **Lamina**(20-30 mm)in hight.
- Has 4 facets for the articulation of both the Thyroid and Arytenoid cartilages.

Cricoid Cartilage



1.Anterior arch
2.Posterior lamina
3.Articular facet

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CRICOID CARTILAGE



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THYROID CARTILAGE

- Unpaired.
- Hyaline type of cartilage.
- Composed of two pentagonal plates or laminae meet anteriorly in the mid line forming a prominance called Adam's Apple in males.
- The angle between the plates in male larynx is 90 while in females 120.
- Superior edge of the laminae meet superiorly to form V-shaped thyroid notch.
- Two superior cornu attach to the major cornu of the hyoid bone through ligamints.
- Two inferior cornu articulate with the cricoid cartilage.

THYROID CARTILAGE



Figure 3-2. Thyroid cartilage.

ARYTENOID CARTLAGE

- Paired –Hyaline+elastic cartilage.
- Pyramidal shaped with **Apex** and **Base**.
- Articulates on the superior facets of the signet portion of the cricoid cartilage.
- It has two projections:
- 1- Anterior projection(Vocal Processes) where the two Vocal Folds attached posteriorly.
- 2- Lateral projection(Muscular Processes) insertion of the cricoarytenoid muscles.
- Arytenoids move in a Rocking , Gliding and Rotationalmanner. UDENTS-HUB C



Figure 4-33. The arytenoid cartilages, shown in three perspectives. STUDEN Key/I are apex, vp = vocal process, and mp = muscular process

CORNICULATE CARTILAGE

- Also known as **SANTORINI** catilage.
- Paired and fibroelastic cartilage.
- Articulated on the top of the arytenoid apex.
- Pyramid in shape.
- There function is part of the arytenoids.



CUNEIFORM CATILAGES

- Also known as WRISBERG cartilage.
- Paired small hyaline cartilages.
- Embedded in the mucous of the aryepiglottic folds lateral to the corniculate cartilage.
- Give framework supportive and rigidity to the aryepiglottic folds, which function as ramparts that guide the food bolus away from the laryngeal entrance.
- They have no role for phonation.

CUNEIFORM CARTILAGES

- club shaped
- placed one on either side , in the aryepiglottic fold
- just in front of the arytenoids ligament and gives the support the vocal folds and the lateral aspects of the epiglottis. STUDENTS-HUB.com



EPIGLOTTIS CARTILAGE

- Non-paired, fibroelastic leaf-shaped cartilage.
- It's anterior surface projects above the thyroid cartilage and faces the base of the tongue and lingual tonsils.
- The inferior portion is narrower stemlike connected to the thyroid cartilage just below the thyroid notch.
- The anterior surface of epiglottis attached to the hyoid bone by ligaments.
- Closes the airway directing food toward esophagus in swallowing.
- It has no real function in phonation and/or articulation

EPIGLOTTIS CARTILAGE



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- 1. Thyroid prominence
- 2. Cricothyroid ligament
- 3. Arytenoid cartilage
- 4. Corniculate cartilage
- 5. Vocal ligament
- 6. Vestibular fold
- 7. Cricoid cartilage
- 8. Articular facet for inferior cornu of thyroid cartilage



LARYNGEAL MUSCLES

- **Intrinsic Laryngeal Muscles**:
- Origin and Insertion(Attachments) to the Laryngeal structures (cartilages).
- **Extrinsic Laryngeal Muscles**:two groups
- One attachment to the larynx, the second attachment to structures other than the larynx
- An other group of Extrinsic muscles in which both attachments outside the larynx, and the Hyoid Bone is the site of insertion called Supplementary (Accessory)Laryngeal Muscles.

INTRINSIC LARYNGEAL MUSCLES

- Both Attachments (Origin and Insertion) to the Laryngeal structures (cartilages).
- Play the great role in phonation:
- Abduction of the vocal folds.
- Adduction of the vocal folds.
- ✓ Shaping the glottis.
- Changes the vibratory characteristics of the vocal folds:
 - Length.
 - Tension.
 - Cross-sectional contour(Thickness).

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Posterior cricoarytenoid (PCA)



Origin:

Posterior (dorsal) surface of cricoid cartilage Insertion: posteromedial surface of muscular process of arytenoid Action: abducts VF through (pivoting arytenoids) Motor Supply: CN X (recurrent laryngeal nerve)

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Posterior cricoarytenoid (PCA) Action



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Lateral cricoarytenoid (LCA)



Origin:

Superior edge of lateral border of cricoid cartilage (arch of cricoid) **Insertion:** anterolateral surface of muscular process of arytenoid Action: adducts VF through (pivoting arytenoids) Motor Supply: CN X (recurrent laryngeal nerve
Lateral cricoarytenoid (LCA) Action



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(Inter)arytenoid (IA)



Often considered to have 2 fiber types

- 7 Transverse
-] Oblique

Origin:

Posterior (dorsal) surface of arytenoid surface Insertion:

Posterior (dorsal) surface of opposite arytenoid **Action:** adducts VF(bringing Arytenoids together) **Motor Supply:** CN X

(recurrent laryngea Bnerve)alaymeh

Interarytenoid (IA) Action



Thyroarytenoid (TA)



Forms the bulk of the mascular portion of the vocal folds Often considered to have 2 parts Thyro-Vocalis Thyro-Muscularis **Origin:** Internal surface of the thyroid angle **Insertion:** Vocal and muscular process of arytenoid Action: shorten & adducts VF Motor Supply: CN X (recurrent laryngeal nerve)

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Thyroarytenoid (TA) Action



Cricothyroid (CT)



Often considered to have 2 fiber types Pars-Oblique Pars-Recta-Vertical **Origin:** ventral and lateral surfaces of arch of cricoid cartilage **Insertion:** Caudal border of the thyroid cartilage and anterior surface inferior horn **Action:** lengthens and tenses VF Motor Supply: CN X (external branch of superior larvng al nariva

Cricothyroid (CT) Action



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EXTRINSIC LARYNGEAL MUSCLES

- Attaches partialy or completely outside the larynx.
- Group A: One attachment to the larynx, the second attachment to structures other than the larynx
- Group B:both attachments outside the larynx, the Hyoid Bone is the site of insertion,called Supplementary (Accessory)Laryngeal Muscles.
- Supporting and stabilizing the larynx.
 Changing larynx position within the neck.
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Group A Extrinsic Muscles

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Sternothyroid



Origin:

superior and posterior portion of the sternum and first costal cartilage **Insertion:** oblique line of thyroid **Action:** depresses thyroid cartilage **Motor Supply:** XII.C1-C3 Ansa cervicalis

Sternothyroid



Ansa Cervicalis

• Its name means "handle of the neck" in Latin.

ANSA CERVICALIS

- It is a nervous loop situated in front of the carotid sheath.
- It is formed by union of **2** limbs :
- A) Superior limb : Descending from the hypoglossal n. and containing fibers of C1 spinal nerve .
- B) Inferior limb : From C2 and C3 spinal nerves .
- Branches : arise from the tip → supply all infrahyoid muscles (near their lower ends) except thyrohyoid.

Ansa Cervicalis



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Thyrohyoid



Origin: oblique line of thyroid **Insertion:** hyoid bone Action: depresses hyoid and elevates thyroid cartilages(decreases) the distance between them Motor Supply: XII C1. Sulaf Salaymeh

Group B Extrinsic Muscles Supplementary(Accessory)Laryngeal Muscles.

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Group B Extrinsic Muscles

- All of these seven muscles insert to the Hyoid Bone.
- Of two groups:
- 1-Suprahyoid muscles group (Digastric, Stylohyoid, Myolohiod, Geniohyoid, Hyoglossus)
- 2-Infrahyoid muscles group(Sternohyoid, Omohyoid).

ذات بطنينDIGASTRIC

- Suprahyoid muscle.
- 2 bellies anterior and posterior.
- Origin:Anterior belly –mandible.
 Posterior belly mastoid process.
- Insertion: Hyoid Bone.
- Function:
- Anterior belly: pulls the hyoid bone up and forward and elevates larynx.
 - Motor supply:cranial V(Trigeminal).
- Posterior belly:pulls the hyoid bone up and backward and elevates larynx.
 - -Motor supply:cranial VII(Facial).

DIGASTRIC



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ذقني لأميGENIOHYOID

- Suprahyiod muscle.
- Paired muscle lies on the top of mylohyoid.
- Origin:Symphysis of the mandible.
- Insertion:anterior surface of the hyoid bone.
- Functtion: pulls the hyiod bone and the larynx forward and upward.
- Motor Supply: XII.C1-C3 Ansa cervicalis.

ذقني لأميGENIOHYOID





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الفكية اللامية MYLOHYIOD

- Suprahyoid, Unpaired muscle.
- Thin muscle forming the floor of the mouth.
- Origin: inner surface of the mandible.
- Insertion:fibers of the midline raphe that extends to the hyoid bone.
- Function: pulls the hyiod bone and the larynx forward and upward.
- Motor Supply: Cranial Nerve V.

الفكية اللامية MYLOHYIOD





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الابرية اللامية STYLOHYOID

- Paired, Suprahyoid muscle.
- Origin:styloid process of the temporal bone.
- Insertion:body of the hyoid bone.
- Function: pulls the hyiod bone and the larynx backward and upward.
- Motor Supply: Cranial Nerve VII

الابرية اللامية STYLOHYOID





اللامية اللسانية HYOGLOSSUS

- Paired, suprahyoid muscle.
- Origin: the greater cornu of the hyoid bone.
- Insertion:posterior half of the sides of the tongue.
- Action:depresses and retracts the tongue.
- Motor supply:cranial Nerve XII.

اللامية اللسانية HYOGLOSSUS



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القصية اللامية STERNOHYOID

- Infrahyoid, Paired muscle.
- Origin:Manubrium of the sternum and origin of the clavicle.
- Insertion: Hyoid bone body.
- Function:pulls the hyoid bone down.
- Motor Supply: XII-C1-C3 Ansa cervicalis

القصية اللامية STERNOHYOID



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الكتفية اللامية OMOHYOID

- Infrahyoid, Paired muscle.
- Long narrow 2-parts muscle=inferior and superior bellies.
- Origin:
- □ Inferior Belly:surface of the scapula.
- □ Superior Belly: intermediate tendon.
- Insertion:
- □ Inferior Belly:intermediate tendon.
- □ Superior Belly:great horn of the hyoid.
- Function:pulls down the hyoid.
 - Motor Supply: XII-C1-C3 Ansa cervicalis

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الكتفية اللامية OMOHYOID



VOCAL FOLDS MOVEMENT

• VF.Abduction:

-Posterior Cricoarytenoid(PCA).

• VF.Adduction:

-Interarytenoids(IA)(transverse and oblique).

-Lateral cricoarytenoid(LCA).

- Raising Pitch: Cricothyroid(CT).
- Decreasing Pitch: Thyroarytenoid (TA).

LARYNGEAL CAVITIES

- Laryngeal Vistibile:contains:
- ✓ Ventricular Folds:called false V.F.
- ✓ True vocal folds:called Vocal Folds V.F.
 - The area between the false and true V.F called the **VENTRICULAR SPACE**, it contains sacs that secrete mucus to coat and moisture the vocal folds below.

Cont.

- Three main cavities:
- 1-Glottic cavity:Glottis,the V.F and the space in between them(Reema Glottidis).
- 2-Supraglottic Cavity:above the glottis, up to the boundaries of the Epiglottis.
- 3-Supglottic Cavity:below the glottis,down to the end of the cricoid cartilage.



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MEMBRANES & LIGAMENTS

Extrinsic

Intrinsic

Thyrohyoid

 Quadrangular membrane & vestibular ligament

Cricotracheal

Hyoepiglottic

 Crico-vocal membrane & vocal ligament

٠



Thyrohyoid Membrane



Internal Laryngeal Nerve

Superior Laryngeal Vessels

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INTRINSC MEMBRANES

 CONUS ELASTICUS:Paired triangular membranes(crico-vocal membranes).



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Intrinsic Membranes and Ligaments



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VOCAL LIGAMENT

Vocal Ligament



VOCAL FOLDS

- False(Ventricular)Vocal Folds:
- Attached anteriorly to the thyroid and posteriorly to the arytenoid a short distance above the vocal process.
- ✓ The lower border of the F.V.F is the upper boundary of the laryngeal vintricle.
- The space between the ventricular(false) folds called the rima vestibuli.
- The false(ventricular)folds should not adduct during normal phonation.

FALSE VOCAL FOLDS



TRUE VOCAL FOLDS

- True vocal folds lie <u>inferior</u> to the false folds.
- Separated by a small cleft called the ventricle.
- Attached anteriorly to the thyroid cartilage, posteriorly to the vocal process of the arytenoid cartilage.
- The upper border of the V.F is the lower boundary of the laryngeal ventricle.
- The space between the V.F is called rima glottides(Glottis).
- In adult males 17-20mm.
- In adult females 11-15mm.

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TRUE VOCAL FOLDS

- VOCAL FOLD
 - 1. Mucosa
 - 2. Muscle (Thyroarytenoid)
 - D MUCOSA:
 - THREE MAJOR LAYERS
 - A. Epithelium.
 - B. Lamina propria:
 - Superficial.
 - Intermediate.
 - Deep.
 - **MUSCLE-VOCALIS**



Figure 4-35. The vocal fold, shown in coronal section and an enlargement to represent the layered structure.

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NERVOUS CONTROL

- Speech production involves coordination of more than 100 laryngeal,velar,orofacial,and respiratory muscles.
- Central control of voice production is conducted by two pathways:
- 1-Limbic vocal control pathway:innate nonverbal and emotional vocalization.
- 2-Laryngeal motor cortical pathway:regulates the fine motor control of voluntary voice production and voluntary production of innate vocalization.

NERVE SUPPLY OF LARYNX

MOTOR

- All the muscles which move the vocal cords (abductors, adductors or tensors) are supplied by the *Recurrent Laryngeal Nerve* except the cricothyroid muscle, which is supplied by *Superior Laryngeal Nerve*.
- Both of these are branches of the Vagus Nerve.

SENSORY

 Above the vocal cords, larynx is supplied by
 Internal Laryngeal Nerve – a branch of Superior
 Laryngeal Nerve & below
 the vocal cords by
 Recurrent Laryngeal Nerve.

SUPERIOR LARYNGEAL NERVE

- It arises from Inferior Ganglion of the Vagus nerve, descends behind Internal Carotid artery & at the level of Greater cornu of Hyoid bone, divides into External & Internal branches.
- The external branch supplies cricothyroid muscle while the internal branch pierces the thyrohyoid membrane & supplies sensory innervation to the larynx & hypopharynx.



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RECURRENT LARYNGEAL NERVE

- Rt. Recurrent laryngeal nerve arises from the Vagus nerve at the level of Subclavian artery, hooks round it & then ascends between the trachea & oesophagus.
- The Lt. Recurrent laryngeal nerve arises from the Vagus in the Mediastinum at the level of Arch of aorta, loops round it & then ascends into the neck in the tracheo-oesophageal groove.
- Thus, Lt. Recurrent Laryngeal Nerve has a much longer course which makes it more prone to paralysis as compared to the right one.



Life Span Changes

Position:

- Children: at the level of C1-C3.
- Adult Males: at the level of C7.
- Adult Females: at the level of C6.
- □ Configuration and Size:
- INFANTS:
- Pediatric hyoid bone in much lower position may overlap the thyroid cartilage.
- No adam's apple, the angle of 110°-120°
- Vocal folds length 2.5-3.0mm.

Cont.

- ADULT MALES:
- Angle 90°
- Length 17-21mm.
- ADULT FEMALES:
- Angle 120°
- Length 11-15mm.
- □ Larynx is smaller in infants compared to body size.
- Supglottic region is the narrowest part of children larynx.
- The glottis region is the narrowest part of adult larynx.

Cont.

- HISTOLOGY: fine structures of Vocal Folds
 INFANTS:
- Crtillaginous to Membranous parts of 1:1 ratio.
- No vocal ligaments in newborns.
- Immature ligaments at age 1-4 years.
- Vocal fold mucosa is thinner.
- Lamina propria is of single layer, the two layers appear between the ages of 6-12 years.
- ADULTS: fully defferentiated vocal structures apparent at age of puberty and up.

STUDENTS-HUB.com • Crtillaginous to Membranous parts of 2.3 ratio

THE GERIATRIC LARYNX

- Considerable changes happened that affect: accuracy,speed,range,endurance,coordination stability and strength of muscle movements.
- Changes in laryngeal anatomy and physiology coupled with changes in the Nervous, Respiratory, and supralaryngeal systems.
- These changes are counted for elder voice changes.

AGE RELATED CHANGES

- Hardening of laryngeal cartilages.
- Atrophy and degeneration of the intrinsic laryngeal muscles.
- Degenerative changes in the lamina propria.
 - superficial layer of lamina propria loses density and become more edematous.
 - intermediate layer of lamina propria tends to atrophy only in males.
 - deep layer of lamina propria in males thicken because of increased collagen deposition.

STUDEN Vocalis muscle atrophies in both sexes d By: Sulaf Salaymen

Cont.

- Degeneration of cricoarytenoid joint.
- Degeneration of glands in the laryngeal mucosa.
- Degenerative changes in the conus elasticus.
- Decreased laryngeal blood flow.
- These changes result in **PRESBYPHONIA**.
- Characterised by:perceptual changes in:pitch, pitch range,loudness,and voice quality.

PRINCIPLES OF PHONATION

- NEUROCHRONAXIC THEORY
- MYOELASTIC-AERODYNAMIC THEORY

How are vocal fold vibrations produced?

- Neurochronaxic Theory (Husson, 1950)
 - Every new vibratory cycle is initiated by a nerve impulse transmitted via the X nerve
 - Frequency of the VF vibration is dependent on the rate at which the impulses are transmitted
- Problems
 - The course of the RT and the LT X nerve are different in length (about 10cm)
 - VF don't vibrate without the air stream

Myoelastic-Aerodynamic Theory

- Model describing voice production (phonation) as a combination of:
 - Muscle force (myo)
 - Tissue elasticity (elasticity)
 - Pressures and flows (aerodynamic laws)

Phases of the Theory

- V.Fs adduct due to intrinsic laryngeal muscles contraction.
- Increased supplottal air pressure.
- V.Fs separate(abducted).
- Increased airflow between the V.Fs.
- Pressure decreased between the V.Fs (Bernoulli Principle).
- Decreased air pressure and the elastic recoil of the V.Fs causes them to move back toward the midline
- V.Fs approximate inferiorly first then superiorly.

Cont.

- Each V.Fs one cycle(closed-open-closed).
- Minimum supglottal air pressure(3-5cmH2O).
- Cycles repeated approximately in the habitual phonation:
 - Males: 125 times/second(Hz).
 - Females: 225 times/second(Hz).
 - Children: 265 times/second(Hz).

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Cont.

Forces that cause the vocal folds to open:

- Buildup of air pressure on the lower side of the vocal folds.
- **Forces that cause the vocal folds to close:**
- Drop in pressure along the glottal margin of folds.
- 2) Force of elastic recoil of the folds(elasticity).

Important factors governing vocal fold vibration

- Degree of adduction:glottal adductors
- 1-Lateral cricoarytenoid muscle.
- 2-Transverse and oblique interarytenoid muscles
- Length and Tension:glottal tensors and relaxers
- 1) cricothyroid muscle.
- 2) thyroarytenoid muscle.
- Degree of pressure drop along the folds.

Voice Registers

- Different Pitch values.
- Different patterns of vocal folds vibration.
- Result in a perceived changes in voice quality.
- Three types of voice register:
- □ Modal.
- □ Falsetto.
- □ Glottal fry(pulse).

Modal Register

- Register we use for most conversational speech.
- Span in adult men 80-450 Hz.
- Span in adult women 150-500 Hz.
- Habitual speaking pitch falling in the low-to-mid part of the range.
- Minimum supglottal pressure 3-5 cm H2O.
- Airflow rate 100-350 cc/s.
- Moderate (longitudinal tension, medial compression, and adductive force).
- Vocal Folds vibration is periodic.

Glottal Fry(Pulse)

- Frequencies below the modal register with some overlap.
- For both men and women 35-90 Hz.
- Minimal longitudinal tension, short and thicker vocal folds with a lax cover.
- Moderate medial compression of the vocal folds.
- Mild adductive force.
- Vocal Folds vibration is characterized by (double or triple)closure patterns.

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Cont.

- Mode of vibration generates a secondary beat perceived as crackling sound.
- Minimum supglottal pressure 2 cm H2O.
- Airflow rate 12-20 cc/s.
- May used as facilitating approach to eliminate muscle tension dysphonia.

Falsetto Register

- Frequencies above the modal register with some overlap.
- Pitch of 300-600 Hz in adult male voice.
- Moderately high longitudinal tension.
- Long and stiff , thin along the edges , bow-shaped vocal folds.
- Moderately high medial compression.
- High adductive force.
- Posterior cartilagenous portion of the glottis is tightly adducted, with little or no posterior vibration occures.

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Cont.

- The anterior portion of the vocal folds vibrates rabidly.
- Vocal folds contact very briefly causing breathy quality.
- Sometimes there is a posterior chink adding to the breathy quality.
- Amplitude of vocal folds lateral movement is reduced.
- Minimum supglottal pressure is less than that of modal register.
- The voice is high-pitched, thin airy, with very little attack.

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Mechanism of Vocal Pitch Change

1) Length , Tension, Mass, .

- Cricothyroid , Thyromuscularis.
- 2) Increasing/Decreasing:
 Supglottal Pressure.
 Medial Compression of the vocal folds.
 Glottal Airflow Rates.

Mechanism of Vocal Loudness Change

- Intensity (SPL)=Loudness.
- Pressure supplied to the larynx by the respiratory pump.
- Determinants of intensity:
- 1- Supglottal pressure.
- 2- Medial compression of the vocal folds.
- 3- Duration , Speed and Degree of vocal fold closure.

Mechanism of Vocal Quality Change

- Voice that is breathy, rough, strained, harsh(strained +rough), hoarse (strained,rough and breathy).
- Quality of the phonatory system (tissues, elasticity, age, smoking)
- Coordination of the muscles (tremor)
- Shape and configuration of the vocal tract (cleft palate)
- Size of resonators (oral, nasal, pharyngeal)
- Style of the articulators (high hard palate)
- Periodicity of the vibrating tissue.

Resonance mechanism

- The vocal tract act as a resonating chamber to filter and amplify the acoustic signal (filtering the glottal tone)
- Some areas of the vocal tract, depending on their configuration, are compatible with the periodic vibration coming from the VF and amplify the Fo and its harmonics
- The vocal characteristics related to the individualization of each person's vocal tract will have given each voice its own unique characteristics (vocal quality)as the result of amplification and filtering unique to each vocal tract

Resonance mechanism

- We can hear several familiar voices all saying the same few words at the same Fo and still be able to differentiate each voice. Even if we don't know the speaker ,we can fairly accurately tell the approximate age, gender of speaker and if he is angry, tired, frightened..etc
- The F configuration of supraglottal vocal tract is constantly changing (mandible,tongue, velum movement)
- The action of pharyngeal constrictors and other supraglottal muscles would change the dimensions of pharynx
Resonance mechanism

- The mouth is capable of the most variation in size and shape
- The mouth has fixed structures (teeth, dental arch and hard palate) and moving structures (tongue, velum, cheeks, mandible and lips).
- We are most concerned with the moving structures in resonance
- The intrinsic muscles would change tongue's shape (narrowing ,flatting, lengthening...).