Physiology (code)-year 2

Lecture 2 (Salivary functions and Regulation of Salivary Secretion)

By Ass.L. Rafida Al-amiri

Basic Science Department

College of dentistry

University of Basrah

Objectives:

- Saliva Components, Properties of Saliva
- Functions of Saliva ,effect of drugs on salivary secretion
- Saliva As A Forensic Evidence
- Speech
- Nervous control over Speech

Saliva Components

- **Saliva: a thick, colorless, opalescent fluid that is constantly present in the mouth of humans and other vertebrates.**

❖It is a solution of 97.0% to 99.5% water, a pH of 6.8 to 7.0, and the following solutes:

❖Mucus, which binds and lubricates the food bolus;

❖Electrolytes, salts of Na+, K+, Cl– , phosphate, and bicarbonate;

❖ Lysozyme, an enzyme that kills bacteria;

❖ Immunoglobulin A (IgA), an antibacterial antibody;

❖ Salivary amylase, an enzyme that begins starch digestion in the mouth; and

❖Lingual lipase, an enzyme that begins fat digestion in the mouth (but mainly after the food is swallowed).

Composition of Saliva

- Saliva is made from blood plasma and thus contains many of the chemicals that are found in plasma.
- Considerable research is focused on detecting in saliva chemical markers for diseases such as cancer.

Properties of Saliva

- Saliva is mostly water, which is important to dissolve food for tasting and to moisten food for swallowing. The digestive enzyme in saliva is salivary amylase, which breaks down starch molecules to shorter chains of glucose molecules, or to maltose, a disaccharide.
- Most of us, however, do not chew our food long enough for the action of salivary amylase to be truly effective. However, another amylase from the pancreas is also available to digest starch.

- **Functions of Saliva**

1. Lubrication of food:

- Assisted by chewing, saliva gets mixed with food in the mouth; the mucin which is a sticky substance helps to form bolus. Saliva prepares the food for swallowing forming a slippery coat over the bolus.

2. Solvent action:

- Taste is a chemical sense. Any substance, the taste of which has to be perceived, has to be in dissolved state to stimulate the taste receptors present in taste buds thorough-out the oral cavity. Saliva acts as the solvent and thereby helps for perception of taste.

3. Cleansing action:

- The continuous flow of saliva keeps the mouth clean, free from food particles; shed epithelial cells and foreign bodies. Moreover, the lysozyme present in saliva helps to kill certain bacteria. The evidence of this action is obvious during fever. In most of the fevers, the salivary secretion is diminished.

4. Digestive function:

- Salivary amylase or ptyalin is a carbohydrate splitting enzyme. It acts at a pH of 6.8. It can act only on cooked starch. When the starch is boiled, the cellulose covering of starch granules break and amylase can penetrate cellulose.

5. Excretory function:

- Several substances can be excreted in saliva, e.g. heavy metals like mercury, lead, iodides, alkaloids like morphine, antibiotics like penicillin, streptomycin, microorganisms like viruses causing mumps, measles, polio, etc. But most of the times, the saliva formed is being swallowed. Thus it may not serve much of excretory function.

6. Helps in speech:

- The moistening action of saliva in the mouth helps in articulation of speech. Those who speak for a long time sip a little water in between to facilitate articulation of speech.

7. Role in regulating water content in body:

- Since saliva contains 99.5% water and daily secretion of saliva is **1** liter or more, decrease in body water content decreases salivary secretion and results in thirst sensation.

8. Buffering function:

- Saliva contains bicarbonate, phosphate, proteins, etc. They act as buffers to keep the salivary pH within the normal limits. Decreased pH predisposes to caries whereas increase in pH will be responsible for tartar material and destroys the alveogingival margin.

EFFECT OF DRUGS & CHEMICAL ON SALIVARY SECRETION

1) Sympathomimetic drugs like adrenaline & ephedrine stimulates salivary secretion
2) Parasympthomimetic drugs like acetylcholine , *pilocarpine* & physostigmine increase the salivary secretion
3) Histamine stimulates the secretion of saliva
4) Parasympathetic depressants like *atropine* inhibit the secretion of saliva
5) Anaesthetics like chloroform & ether stimulate the reflex secretion of saliva . However , deep anaesthesia decrease the secretion due to central inhibition.

Saliva helps maintain tooth integrity

The inorganic and organic salivary components mentioned above help prevent demineralization of tooth enamel by buffering against large pH changes.

Proteins such as statherins, histatins, cystatins, and several others form a protective barrier, called a pellicle, around tooth enamel and actively promote remineralization with calcium and phosphate. This enables long-term maintenance of protective tooth enamel.

Fluoride also helps promote the formation of stronger, more caries-resistant tooth enamel, by replacing magnesium and carbonate within enamel crystals.

Saliva as a diagnostic aid:

- Oral diseases High risk caries patient, Patient susceptible to candidiasis
- Diagnostic aid for clinical problems Psychological problems, smoking, poisoning
- Systemic diseases affecting saliva Sjogren’s syndrome, Cystic fibrosis
- Monitoring of certain drugs that exhibit consistent saliva : plasma ratio. e.g., phenytoin, carbamazine, theophyline

- **Saliva As A Forensic Evidence**
- Saliva is a complex biological fluid It is an indicator of various plasma constituents.
- In recent years, its role as a diagnostic and forensic tool is being increasingly researched upon. Besides maintaining the homeostasis of oral structures such as tooth integrity, it also plays a critical role in genomics, proteomics, and bioinformatics.
- It is an important discriminating element in forensic biology, acting as an indicator of salivary gland conditions and toxicological and drug monitoring.
- Saliva is an extracellular fluid .In humans, saliva is 99.5% water plus electrolytes, mucus, white blood cells, epithelial cells (from which DNA can be extracted).

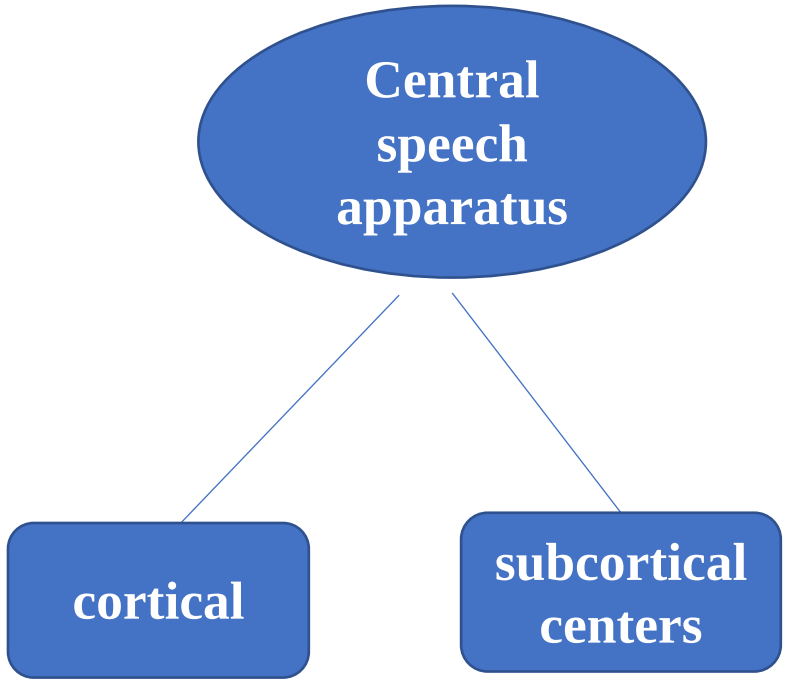
Disadvantages
Some patients require a longer time for sample collection
Contamination from food, beverages, kissing etc.
Low concentration of some analytes
Only small and uncharged molecules get from plasma to saliva
Microbial urease can bias measurements
Short delays in analysis might affect the results
Xerostomia in some patients on hemodialysis
Have to store at —80 °C as soon as possible after collection

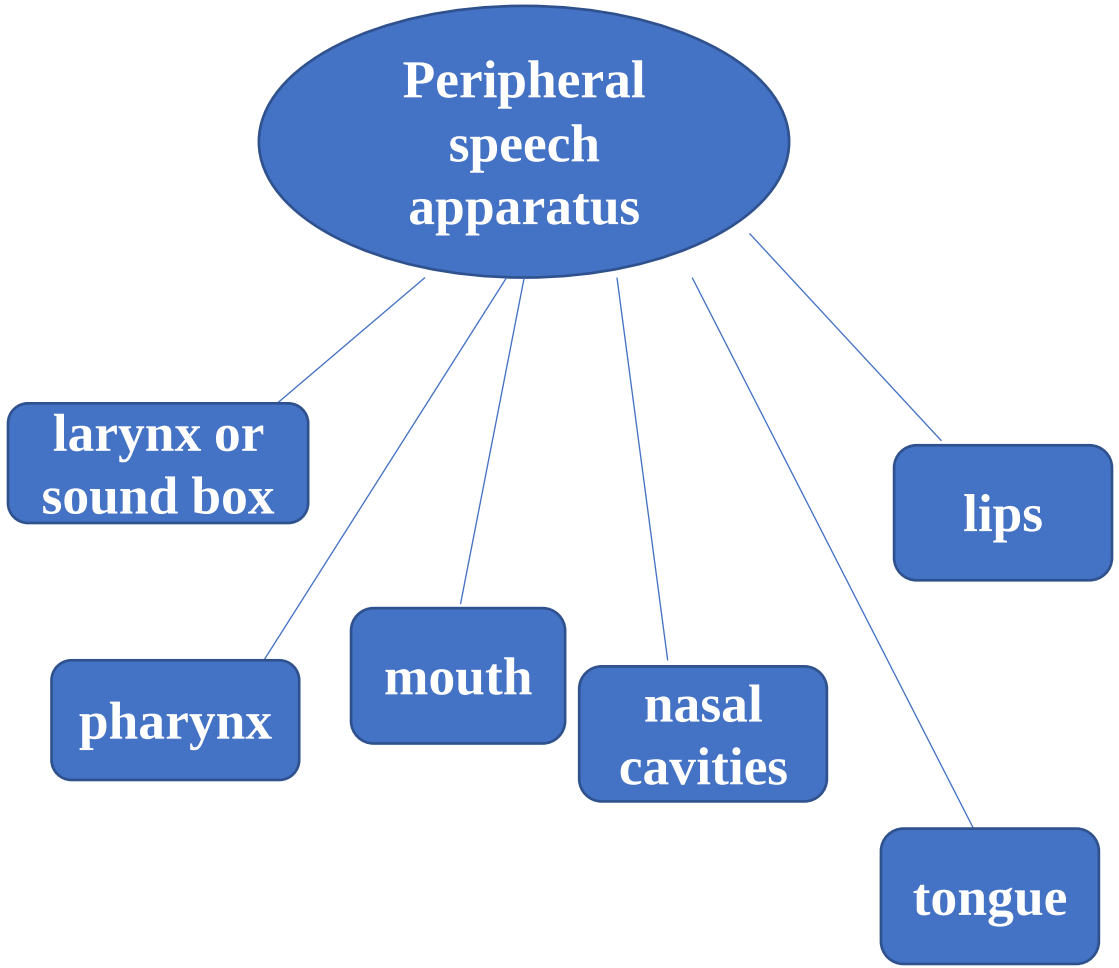
Speech

Is defined as the expression of thoughts by production of articulate sound, bearing a definite meaning.

- ❖ It is one of the highest functions of brain.
- ❖ When a sound is produced verbally, it is called the Speech.
- ❖ If it is expressed by visual symbols, it is known as Writing.
- ❖ If visual symbols or written words expressed verbally, known as Reading.

- Mechanism of Speech





Nervous control over Speech

Speech is an integrated and a well-coordinated motor phenomenon. So, many parts of cortical and subcortical areas are involved in the mechanism of speech.

- ❖Subcortical areas concerned with speech are controlled by cortical areas of dominant hemisphere.
- ❖In about 95% of human beings, the left cerebral hemisphere is functionally dominant and those persons are right handed.

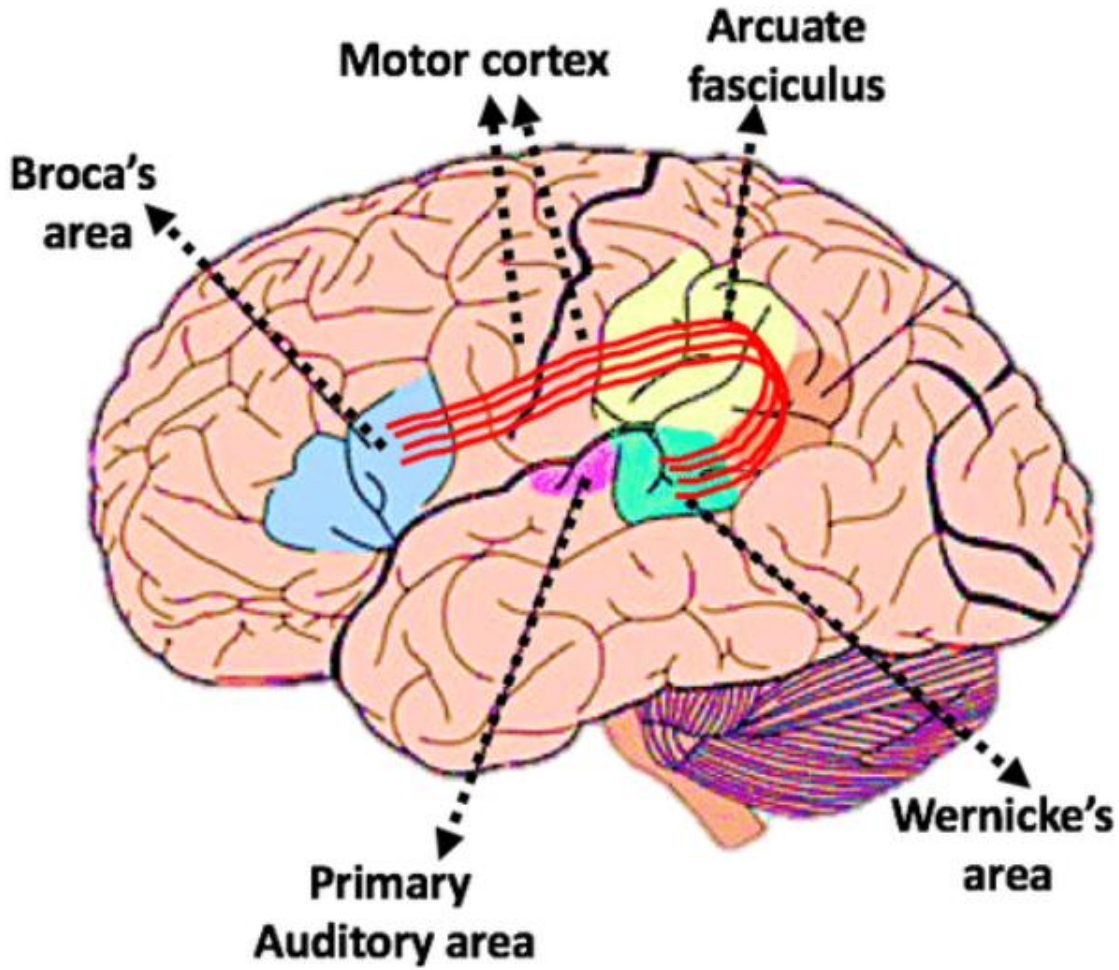
Nervous control over Speech

Motor areas

- Broca's Area
- Precentral cortex – Premotor & Primary Motor Area

Sensory areas

- Auditory Association Area
- Visual Association Area
- Wernicke's area



Broca's area: involved in production of speech sound

Wernicke's area: involved in Understanding of speech

Motor cortex: controls the Movements of muscles

Arcuate fasciculus: connects Wernicke's area to Broca's area.

Parts of the Brain that controls Speech

Applied Physiology

Communication disorder characterized by disrupted speech.

I. Aphasia

II. Anarthria or Dysarthria

III. Dysphonia

IV. Stammering.

APHASIA (in Greek, Aphasia = without speech) Aphasia is defined as the loss or impairment of speech due to brain damage.

Developmental disorders – Poor development or atrophy of damage of speech centers. Aphasia is not due to paralysis of muscles of articulation.

Applied Physiology

ANARTHRIA OR DYSARTHRIA The term dysarthria refers to disturbed articulation. Anarthria means inability to speak. Dysarthria or anarthria is defined as the difficulty or inability to speak because of paralysis or ataxia of muscles involved in articulation.

DYSPHONIA

Dysphonia is a voice disorder. Often, it is characterized by hoarseness and a sore or a dry throat. Hoarseness means the difficulty in producing sound while trying to speak or a change in the pitch or loudness of voice. The voice may be weak, scratchy or husky.

STAMMERING

Stammering or shuttering is a speech disorder characterized by hesitations and involuntary repetitions of certain syllables or words. It is also described as a speech disorder in which normal flow of speech is disturbed by repetitions, prolongations or abnormal block or stoppage of sound and syllables.

It is due to the neurological incoordination of speech and it is common in children. Stammering is associated with some unusual facial and body movements.

Exact cause for stammering is not known. It is thought that stammering may be due to genetic factors, brain damage, neurological disorders or anxiety.


Thank
you!