21.2D: Structures Used in Voice Production

Voices produce sounds through a steady flow of air through the larynx, which causes vibrations and creates fluctuations in air pressure.

Learning Objectives

- Describe the anatomy of voice production structures in the respiratory system

Key Points

- The three basic mechanisms of voice production are air supply, vibration, and resonance.
- Pressure and air-flow speed through the larynx determine the strength and volume of voice.
- The articulation of consonants involves parts of the vocal tract obstructing phonation, and can be active or passive.
- A vowel is any articulation that comes from an open vocal tract.
- Vowel articulation depends mainly on the shape of the lips, position of the tongue, but the shape of the vocal folds are involved as well.

Key Terms

- **Resonance**: The amplification of vibration by the structures of the upper respiratory tract, which can also influence the quality or tone of the sound.
- **Articulation**: The process by which raw phonation from the vocal cords is refined into specific sounds, such as consonants and vowels.
• **glottis**: An organ of speech located in the larynx and consisting of the true vocal cords and the opening between them.

Voice production is a complex process with many different layers and intricacies. The three basic mechanisms of voice production are air supply, vibration, and resonance.

Passive and active articulation shapes and refines phonation (vocal sound production) into the sounds and words used in communication. Voice production is an important physiological process because it enables complex communication between humans.

While the brain is responsible for higher organization and understanding language, the structures of the respiratory system are largely responsible for the production of sound itself.

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**Basic Mechanisms of Voice Production**

Sound is produced by a combination of different structures of the respiratory system working together to create and resonate a sound. There are three basic mechanisms by which the human body produces a voice.

1. **Air Supply**: In order for voice to be produced, air must flow through the vocal folds. The supply of air for phonation comes from the lungs, and the speed and pressure by which it flows through the vocal folds is determined by the diaphragm. The speed of air flow also determines the strength and loudness of the voice.

2. **Vibration**: The vocal folds in the glottis of the larynx vibrate as air passes through them. The vibration creates changes in air pressure that manifest as audible sound waves. They only vibrate if the vocal folds are in the closed position, when the folds are held together by the movement of arytenoid cartilage. The pitch of the vibration depends on the length and tension of the vocal folds, which can be altered by muscle action.

3. **Resonance**: The structures of the upper respiratory tract—particularly the soft palate of the mouth, the nasopharynx, and the paranasal sinuses—resonate and amplify the vibration of the vocal folds, making the sound louder and changing its tone. It works similarly to the way the sounding board of a guitar amplifies the vibration of the strings.

These basic mechanisms work together to create the voice. If they are altered, the produced voice will also be altered as well.

For example, during loud voice production, such as shouting or singing, a greater air supply and greater pressure for the flow of air through the vocal folds is required to produce the louder sound. The diaphragm must contract harder to support this greater flow of air compared to normal speech.

Similarly, whispering takes less air compared to normal speech, because the sound produced during whispering is much weaker in comparison.

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**Articulation**

Articulation is the process by which phonation is refined into the specific consonants and vowels used to form words. The articulation of consonants occurs at a point of either active or passive articulation, which is a place in the vocal tract where an obstruction stops the sound.
After the sound is obstructed, the pressure from the air builds based on the shape of that obstruction, which changes the sound into the form it is vocalized as. Vowels are articulated sounds that do not come from obstruction, and instead come from an open vocal tract.

Passive Place of Articulation

The passive place of articulation is the place on the more stationary part of the vocal tract where the articulation occurs. It can be anywhere from the lips, upper teeth, gums, roof of the mouth, or the back of the throat. These areas are passive because no specific action or activity is involved within that area to pronounce the consonant.

Passive articulation is considered a continuum because the obstruction of many different places is needed to produce most of the consonants. There are also several different combinations of areas that can produce the same consonant; for example, many languages may distinguish consonants by articulating them in different areas. Passive places of articulation include:

- The upper lip (labial).
- The upper teeth, either on the edge of the teeth or inner surface (dental).
- The alveolar ridge, the gum line just behind the teeth (alveolar).
- The back of the alveolar ridge (post-alveolar).
- The hard palate on the roof of the mouth (palatal).
- The soft palate further back on the roof of the mouth (velar).
- The uvula hanging down at the entrance to the throat (uvular).
- The throat itself, also known as the pharynx (pharyngeal).
- The epiglottis at the entrance to the windpipe, above the voice box (epiglottal).

Active Place of Articulation

The articulatory gesture of the active place of articulation involves the more mobile part of the vocal tract. This is typically some part of the tongue or lips. It is considered active because these areas change the consonant pronounced by moving or changing.

The active places of articulation are not considered a continuum (unlike passive articulation) because they work independently of each other, but they have the capacity to work together for certain consonants. Active places of articulation include:

- The lower lip (labial).
- Various parts of the front of the tongue.
- The back of the tongue. The aryepiglottic folds at the entrance to the larynx (also epiglottal).
- The glottis (laryngeal).
A vowel is a sound that comes from an open vocal tract, and does involve strict obstruction of the sound as with consonants. Therefore, there is more variation in the mechanisms used to create vowels compared to consonants. Vowels are mainly articulated by the shape of the lips, the position of the tongue (both vertical and horizontal), and by the phonation of the larynx itself.