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DETAILED STUDY OF UDAN VAYU AND ITS PHYSIOLOGICAL ACTION W.S.R. TO VAKPRAVRUTTI (SPEECH)

***[1]Dr. Shewale Yogesh Kashinath, [2]Dr. Pawar K.B., [3]Dr. Dhimdhime R.S., [4]Dr. Kanchan Lovalekar and [5]Dr. Vaibhav Bhadage**

[1]PG Scholar, Kriya Sharir Dept., GAC Osmanabad.
[2]Asst. Professor, Kriya Sharir Dept., GAC Osmanabad.
[3]Professor and H.O.D, Kriya Sharir Dept., GAC Osmanabad.
[4]PG Scholar, Rog Nidan- Vikruti Vigyan Dept., TAM Pune.
[5]PG Scholar, Rachana Sharir Dept., GAC Osmanabad.

***Corresponding Author: Dr. Shewale Yogesh Kashinath**
PG Scholar, Kriya Sharir Dept., GAC Osmanabad.

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ABSTRACT
Speech is the special quality which is distinguishes human beings from lower animal species. In Ayurveda, production of speech is the function of the normal udan vayu. Larynx plays a crucial role in production of speech and breathing. Shabda (Voice) is produced by the union and disunion of the vocal cords of human beings. The air passing through the larynx and vocal cords produces different types of syllables. The pitch of vibration is depends on stretching or relaxing the vocal cords and also by changing the shape & mass of the vocal cords edges. Vata is mainly responsible for all the function occurs in the body. The normal functions of udan vayu are vak pravritti (production of speech), and also helps in Bhaashitageetadi karma (singing, respiration etc.). When the Udana Vayu is get aggravated *then it* is responsible for the *urdha-jatru-gata roga, swarabheda, kasa-shwasa, hikka* in the body.

KEYWORDS: Larynx, Speech, Udan Vayu, Vakpravrutti, Voice.

INTRODUCTION
Udan vayu is situated at nabhi (umbilical region), uras (chest region), kantha (neck and throat region). The normal functions of udan vayu are vak pravritti (production of speech), prayatna (efforts), urja (enthusiasm), bala (energy/ strength), varna (complexion), smriti (memory), kriya (voluntary actions).[1]

Direction of udan vayu is upwards. It is also called as best vayu (pavanottam) by acharya sushruta.[2] It stays in chest region (uras)[3] but according to acharya sharangadhara, lungs supports udan vayu.[4]

Acharya Sushruta has specified the production of phonetic actions viz. *geeta* (singing of song) and *bhashita* (speech). Aggravated *udana vayu* is responsible for the *urdha-jatru-gata roga, swarabheda, kasa-shwasa, hikka* in the body i.e. the disease concerned with eyes and ears, nose, throat etc.[5]

Functions of Udan Vayu[1]
1. Uchhavasan (Exhalation) - The direction of udan vayu is upwards through chest. Living person can realizes it when it is exhaled through nose.
2. Vakpravritti (Production of speech) - It includes the mechanism of sound (speech). Its function includes speech & singing etc. (bhashitgeetadi).
3. Prayatna (Efforts) - It is done when a person is induced in some work. Mind has imagination power but udan vayu induces to do.
4. Urja (Enthusiasm) - Energy (Urja) is needed to do any work. Enthusiasm is depends on the normal function of the udan vayu.
5. Bala- Acharya Vagbhata directly explained Udan as strength of body as it maintains the respiration as vital process in the body with prana vayu.
6. Varna (Complexion) - It is the color of the body reflected on entire body. Due to circulation in the body, nourishment to the skin is provided that's reflected as Luster of skin.
7. Smriti (Memory) - Its special function and it also related with mind.

Larynx (the voice box)[6]

Larynx plays an essential role in the body as involved in breathing, sound production and prevents the entry of food material into the trachea. The most important work of larynx can be described as the phonation, with the help of outgoing air (expiration) from the lungs and so it is commonly called as the voice-box. The larynx extends from the 3rd to 6th cervical vertebrae and is situated anterior to the oesophagus. It consists of nine cartilages (three paired and three unpaired) covered with various membranes and ligaments which strengthen and control its activity. It plays a crucial role in speech and breathing. Its functions includes-

1. Protection of airway as it prevents the entry of food material into trachea.
2. Control of airflow during breathing.
3. Production of sound.

Cartilage[7]

It consists of three paired and three unpaired cartilages covered with various membranes and ligaments.
Unpaired cartilages- Thyroid cartilage
Cricoid cartilage
Epiglottis
Paired cartilages- Arytenoid cartilages
Corniculate cartilages
Cuneiform cartilages

Glottis and Epiglottis[8]

The superior opening of the larynx is glottis and is guarded by the epiglottis. The vocal cards are grouped in two pairs viz.

A. Superior or vestibular false vocal cords.
B. Inferior or true vocal cords or vocal folds.

At the stage of normal breathing, the space between vocal cords forms an enlongated triangle with the apex infront. In forced breathing the aperture expands in width. When we swallow any semi-solid or liquid material the cords are tightly closed and the chances of entering the swallowed material into the larynx are checked.

Muscles of Larynx[9]

Muscles of larynx are divided into two type i.e. intrinsic muscles and extrinsic muscles. Further Intrinsic muscles are also divided into phonatory & respiratory muscles.

1. Respiratory muscles- It moves the vocal cords apart & helps in breathing.
2. Phonatory muscles- It moves the vocal cords together & helps in the production of voice.

The phonatory muscles are further divided into two types as follows-

1. Adductors (Arytenoid muscles, Lateral cricoarytenoid muscles)
2. Tensors (Cricothyroid muscles, Thyroarytenoid muscles).

Speech involves following

1. Respiratory system,
2. Nervous system- Specific speech control centers in cerebral cortex,
3. Respiratory control centers of the brain,
4. The articulation & resonance structures of mouth & nasal cavities.

Centre of Speech[10]

1. Broca's area- It's a region in the inferior frontal gyrus of left side & it is discovered by Broca. Damage to it makes impossible for a person to speak whole words. It is more devoted to language production than language comprehension.
2. Wernicke's area[11]- It is situated at posterior part of superior temporal gyrus. It is involved in the understanding of written and spoken language. Any damage in this area leads to inability in formulating thoughts for the communication process i.e. wernicke's aphasia.
3. Auditory word area- Situated in superior temporal convolution and damage to this produces word deafness.
4. Visual word area- Situated at cortical area in angular gyrus and damage to this produces word blindness.

The process of speech involves the following stages-

1. In mind, formation of thoughts to be expressed and choices of words to be used.
2. Motor control of vocalization.

Speech is composed of two mechanical functions:

1. Phonation-
2. Articulation-

Phonation[12]

Phonation means the production of voice. Larynx is the structure which acts as a vibrator. The vibrating structure is called as vocal folds or vocal cords. During normal breathing, vocal folds are widely open to allow passage of air and during phonation, the vocal folds move together so that the passage of air between them causes vibration of cords. The pitch of vibration is depends on stretching or relaxing the vocal cords and also by changing the shape & mass of the vocal cords edges. The force of expiration affects the intensity of speech. The various letters of alphabets are pronounced by the contact with the pharynx, nasal cavity, palate, tongue, teeth, root of the tongue and lips.

Voluntary phonation[5]

A. Bhashita or talking: It is the general release of the expiratory air and is controlled by the orator as per his desire.

B. Gita or singing: is a special type of phonetic activity and is caused by certain rhythmical inflection and controlled voluntary release of the air from the lungs.

Involuntary phonation includes the various sounds like *kasa* (coughing), *ksavathu* (sneezing), sighing, groaning etc.

Articulation and Resonance[12]

Articualation means the muscular movements of the mouth, tongue, larynx etc. which are responsible for emission of sound. The important organs of articulation are the lips, tongue and soft palate. Resonators include the mouth, nose and associated nasal sinuses, pharynx and chest cavity.

Definition and types of Shabda (sound & voice)[13]

The attribute which is perceived by ears is *Shabda*. *Shabda* (Sound) is the distinguishing quality due to the *Akasha mahabhuta.* Whithout *akasha mahabhuta* origination of *shabda* is not possible.

Word (Shabda) consists of sounds. They are four types of words[14]

A. Drustartha- (Based on observations).
B. Adrustartha- (Based on unobservable phenomena).
C. Satya- (Truth).
D. Anruta- (False).

It is two types[15]

A. Dhwanyatmaka Shabda (Inarticulate sound): It is produced with the help of a stroke with a stick or by hand or finger on a kettel drum *(Nagara).* When musical instrument comes in contact with the stroke of air forced with lungs then a sound is produced in the *akasha* (ether) and transmitted to another place with the help of *vayu* (air waves). The union *(samyoga)* and disunion (*vibhaga*) with two or more ends take place and these actions (or attributes) of union and disunion produce sound.

B. Varnatmaka Shabda (Alphabetical sound):[16] It is produced by the union and disunion of the vocal cords of human beings. When a person desires to speak something and when the soul desires to express any idea through voice, it initiates *manas* with the help of intellect *(buddhi),* the body power (*kayagni* or vital energy in the form of *prana vayu* etc.) initiates the air of the lungs to come out through larynx. The air passing through the larynx and vocal cords produces different types of syllables. Eight places viz. throat, shira (head), root of the tongue, teeth, nose, lips and palate which are responsible for pronunciation of the different letters of alphabet. These letters of alphabet are different in separate languages. Letters of alphabet are of two kinds viz.

A. Vowels- for example A, E, I, O and U in English language.
B. Consonants- for example *ka, kha, ga* etc. in Hindi and B, C, D etc. in English language. Following consonants are produced by various structures as below[17]

Lips- Pa, Pha, Ba, Bha, Ma.
Labiodental- Ta, Tha, Da, Dha, Na.
Lingual- Cha, Ja, Jha.
Palatal- Ka, Kha, Ga, Gha.

Prognosis and voice

The normal voice of person becoming abnormal without any apparent reason, is to be considered as *Arista* (fatal sign).[18] The low (feeble), peevish, inaudible, stammering, sudden loss of voice even the person is anxious to speak, indicates the shortly occurring deaths**.**[19]

Normal and abnormal voice[20]

According to *Charaka Samhita* the normal human voice resembles the voice of *hamsa* (swan), *krauncha* (demoiselle crane), *nemi* (wheel), *dundubhi* (kettle drum), *kalavinka* (house sparrow), *kaka* (crow), *kapota* (dova) and *jarjara* (a type of drum). The voice of moribund patients resembles that of sheep, or wild goat, and is feeble, inaudible, indistinct, choked, hoarse, painful and stammering**.** If the abnormal type of voice manifest spontaneously in an individual there are many such abnormal types of voice or if only one abnormal voice in the individual appears to be of diverse types, then this indicates imminent death**.**

DISSCUSSION

Panchamahabhutas are the chief controller of this universe. By the *Lok-Purusha Samya Siddhanta*[21], all the *Bhavas* present in the *Purusha* (human body) are represented in the universe and vice versa. Hence the *doshas* are the functional representatives of *panchamahabhutas*, they are the chief controllers of all the bodily functions. When *doshas* are in normal state in the living body, they maintain homeostasis in all the functions. Predominance of *Akash* and *Vayu mahabhutas* are responsible for *Vata*, which is essential for to generation and maintaining all the activities in living body[22]. There are five types of *Vata Dosha* i.e. *Prana, Vyana, Udana, Samana, Apana*. The direction of udan vayu is upwards and stays in chest region (uras). It helps in the Vak Pravrutti (Speech formation) and also helps in *Bhaashitageetadi karma* (singing, respiration etc.).

CONCLUSION

Vata is mainly responsible for all the function occurs in the body. *Udana Vayu* and *Prana Vayu,* are having opposite movement but still they are performing their routine works and thus they are very important for the performing the *urdhwa-jatrugata* functions. *Prana Vayu* helps in the *Nishwas* (Inspiration) by taking oxygen in the body and whereas the *Udana Vayu* helps in the *Ucchwas* (Expiration). This continuous process of respiration takes place throughout the life. When the *Udana Vayu* is get aggravated then it is responsible for the *urdha-jatru-gata roga, swarabheda, kasa-shwasa, hikka* in the body i.e. the disease concerned with eyes and ears, nose, throat etc. *Udana Vayu* helps in the *Vak Pravrutti* (Speech formation) and also helps in

Bhaashitageetadi karma (singing, respiration etc.).

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