

An Insight of Physiology of Speech Production

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Abstract

Speech production is one of the highest functions of humans through which we all communicate one another, express our thoughts and views about any particular thing. Speech production is a multiphase phenomenon. It is an outcome of combined efforts of your acoustic signals, articulatory system and the musculature attached to respective organs and which is not possible with nervous assistance. An appropriate and well assisted outcome of all the above structures is, transferred thoughts into verbal notations. However, *Ayurveda* has a different approach towards speech production viz. *Vaka pravrutti*. The efforts to put sound as an outcome is initiated by *Vata dosha* but the other two also accompany it to bring out the fruitful result. The *Vaka pravrutti* is an outcome of physical and psychological impact as per *Ayurveda*. It has also mentioned the circulating channels (*strotas*) through which sound is produced and travels as well viz. *Swarvaha strotas*. The description of mechanism of speech production as per ancient Ayurvedic scholars needed to be studied along with modern parlance with time. So there arises a need to study more about the physiology and its neurological axis to understand and incorporate the speech symptoms as a diagnostic tool thus giving a healthy outcome of it.

Keywords

Ayurveda, Vaka pravrutti, Vata dosha, Swarvaha strotas



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INTRODUCTION

VAKA PRAVRUTTI

Ayurvedic approach towards speech production is reflected as *Vaka pravrutti* which is an important function of *vata dosha* and to be precise *udana vayu* a subtype of *vata dosha*¹. The three *doshas* together balances the homeostasis inside body by involving in successful, spontaneous and consistent completion of cycles of all the physiological activities of body. Even though each particular *dosha* and its subtype are associated with a particular physiological process inside body, the other subtype assists the previous one. *Ayurveda* science has a psychological approach towards completion of any physiological process in body as all the activities are very well propagated through *Mana* (Psyche), *Indriya* (Sense and Motor organs) and *Indriyartha* (Subject of perception)². Even though the completion of articulation movements and outcome of speech is accompanied by *doshas* the ultimate perception of this subject is done with the help of *Mana* (Psyche). The *Indriya* responsible for speech is a *karmendriya* viz. *Vagindriya* a motor organ which acts as a passive partner on receiving command from its higher center located in *Shira* (brain), which is ultimately a site for location of control centers of all motor as

well as sense organs and thus is said to be

*Uttamaang*³.

PROCESS OF PERCEPTION OF KNOWLEDGE

Speech is nothing but the motor response through which human express their thoughts and ideas developed in mind. This motor response or nevertheless perception of knowledge or knowledge gaining process in *Ayurveda* is explained by a cascade of things connected very effectively with one another and this whole process is controlled by *Mana* which is again closely accompanied with *Atma* (soul). The following chart explains it –

$$\text{Atma} + \text{Mana} = \text{Indriya} = \text{Indriyartha} = \text{Subjects} \sqrt{(1.\text{Shabda} \ 2.\text{Sparsha} \ 3.\text{Roopa} \ 4.\text{Rasa} \ 5.\text{Gandha})} \text{ Buddhi}$$

It does means that for any perception of knowledge, the collective combination of *Mana* along with *Atma* and *Indriya*, which further connects to its own subject as per responsibility means *Indriyartha* together all annexes *budhi* the intellect and the perception of knowledge process is complete. Here in case of *Vaka pravrutti*, the thoughts or ideas which are emerged in your intellect have to be expressed as a speech. So the desire to speak words is initiated and this desire is brought into action by efforts of *Udana vayu*. Prior that speech being a action seen in living body and in this your liveliness is sustained by presence of *prana* in

your body. The *prana* as per different scholars is five subtypes of *vayu* or *prana vayu* or essence of being live viz. *Ayu*⁴(*pranaii saha samyog*). So with existence of *prana vayu*, the *udana vayu* with its efforts initiates the desire to speak. The *prana vayu* carries function of (*dharana*) sustenance of *buddhi* (Intellect), *hridaya* (Heart), *indriya* (Sense and Motor organs) *chitta*⁵ (Pschye) so as to complete the clause of *samyogvahi* mentioned in definition of *sharir*⁶. This *samyogvahi* clause is completed by speech response which is outcome of articulation of all the structures which accompany together to produce voice notes. This *prana vayu* is accompanied by the *sadhak pitta* to perform the same. *Sadhak pitta* mentioned in *Ayurveda* text resides in heart and performs the function to complete the desires or wishes which are sprouted up in your mind. Functions of *sadhak pitta* as mentioned is *Manorath sadhanath*⁷, this *pitta* or a type of *Agni-Sadhakagni*⁸ is responsible for transformation of your conscious, subconscious desires into well organized and processed actions. The third biological humor which assists in speech is a subtype of *kapha dosha*, *Avalambaka*, *Bodhaka* and *Tarpaka kapha*. *Avalambaka kapha* performs the same function as like *prana vayu* and *sadhaka pitta*. It promotes initiates and provides energy to fulfill your desires. *Bodhaka kapha* is necessary as it

resides on the *vagindriya*⁹ which keeps moist environment maintained locally. *Avalambana-svakarma samarthyu utpad karoti*¹⁰; it motivates all the structures and components to get going into their respective function to fulfill it. Moreover the third subtype of *kapha dosha*, *tarpaka kapha* is also very important here. As mentioned above the *shira* is main organ having control centers of all the organs, activities of body. Thus being a very crucial part it must always be having an optimum nutrition and hydration level maintained in it. Locally it is done by *tarpaka kapha*. It performs function of providing *prinana*, *tarpana*¹¹, and nourishment to *murdha* and all the centers of *Indriya* located in it. Overall this *3doshas* work together to achieve and sustain the constant internal environment of body, that too in balanced manner.

Speech or sound production is mainly accompanied with the travelling of sound waves which is employed by *akasha mahabhuta*¹² and the one component initiating the action is *vayu*¹³. The *akasha* mentioned is space which allows the action to be completed without hindrance (*apratighatavta*)¹⁴. Similarly *Sushruta* has mentioned the *swarvaha strotasa* while describing *swarbhedha*¹⁵. The foresaid *vayu* promotes the *swarvaha strotasa* and the *vagendriya* for *vakapravrutti* via *swarvahi dhamnis*.

Other theory of perception of knowledge is also proposed by ancient scholars. In this the object which is to be perceived is very well known only when the sense organs including *Indriya* within them get synchronous with the *mana* (psyche). However this perception of knowledge initially is purely limited to psychological level later it involves *buddhi* which is essential to take necessary decision by studying its wholesome and unwholesome effects. Here with regards to speech property this intellect or *buddhi* determines the specific property of object that implicit an individual to speak or act intelligently in similar way¹⁶.

Another theory according to grammatologist Panini, the *Shabda utpatti* involves the stimulation of *Agni* inside *Sharira*. This is another concept regarding the speech production. The decisive power of *buddhi* along with the soul initiates the process whether to and what to talk. This moreover stimulates mind and which further stimulates *kayagni*. The *kayagni* then stimulates *vayu* to proceeds through the thorax, lungs and throat and into mouth to pronounce and sound. This is accompanied by the

b. *Dwanyatmaka*:- Due to any instrument. Ex. Tabla, Guitar

TONGUE AS KARMENDRIYA²⁰

The five *karmendriya* or motor organs mentioned in *Ayurvedic* treatise states the

articulation of peripheral speech apparatus on proper command of nervous control.¹⁷

TYPES OF SHABDA^{18,19}

Types of *shabda* according to cause-

- 1) *Samyogaja*:- By combination of two or more objects. Ex- Clapping
- 2) *Vibhagaja*:- By separation of two or more objects. Ex- Logging wood, separating paper sheets
- 3) *Shabdaja*:- By actual speech or talk of an individual.

Types of *shabda* according to nature-

a. *Varnyatmaka*:- Due to *Vani* which can be again classified as per the organs from which the sound has originated.

Articulation and speech production according to different parts-

- i. *Kanthya* (Throat)
- ii. *Talvya* (Palate)
- iii. *Murdhya* (Palate)
- iv. *Dantya* (Dental)
- v. *Oshtya* (Lips)
- vi. *Anunasika* (Nasal)

organ corresponding to separate *Indriya*. This mainly deals with the response which is to be seen after proper combination of *mana-indriya* and its object and intellectual

decision taken with the help of *buddhi*. Thus this represents motor organs.

Tongue is the teen (three) *angula* muscular organ representing as a speech organ or also named as *vagendriya* which is a type of *karmendriya*. This is again of two types-*sat* (true) and *asat* (false)²¹. Out of which the former can be compared to light which illuminates the world, life after death and all reality of life whereas the later indicates the darkness which again may lead to confusion and obstruction in knowledge pathway.

LAWS OF SPEECH PROPOGATION

There are two different aspects regarding speech-Speech production and Speech propulsion. The former has been elaborated earlier whereas the later is explained in ancient treatise by two different laws. *Vichitaranga nyaya* and *Cadambamukul nyaya*²². The sound thus generated firstly in case of propulsion forms a thin film known as *Vichi* which later starts propagating in the form of wave (*Tarang*) and so on. This happens repeatedly and consistently so that the former wave is propagated by the push of preceding one. The sound at the centre of this films the spreads in all directions in series. It can be greatly experienced by tapping a calm and non-running water surface. This may again leads to confusion

whether the sound is directed in all direction but in horizontal pattern or what? For this reason the next law proposed clarifies the same namely *Cadambamukul nyaya*. The flowering pattern of *cadamba* tree is that all the flowers bloom or blossoms spontaneously and all together, similarly the sound thus produced is transferred in all directions at the same time.

SPEECH PRODUCTION²³

Speech is a motor response which is an outcome of systematic connections of articular-nervous-morphological systems and its associated organs. The speech thus produced is manifested by the possible vibrations of vocal cords at laryngeal level only by associated commands as per nervous control over them. So there are controlling and working centre namely central and peripheral speech apparatus. The disorders of speech are thus related with the possible defects occurring at peripheral speech apparatus or at central speech apparatus hampering sensory and motor or both centers at gross level.

Formation of speech in case of modern science reveals formation of new neuronal circuits as it is associated with memory. The words heard are stored as memory and are recalled back when appraised with due to

memory. For such speech or word production or rather speech development, the necessary auditory and visual centers are thus connected by a pathway by formation of new neuronal circuits. The major areas thus involved in speech are- Wernicke's area-area of understanding of words or ideas developed and send it to next area viz. Broca area-which is the major of all speech area. It is motor area indeed but regulates the movements of peripheral structures as like-tongue, lips, larynx and vocal cords. Both these areas are connected by neuronal tracts namely arcuate fasciculus. The other major supporting areas for speech production are-secondary visual and secondary auditory areas. This are important as the words, thoughts, ideas which are needed to be expressed are first understand and developed very well here. The command of motor activities is received by the peripheral speech apparatus which results in systematic coordination of movements of tongue, lips, larynx and vocal cords. Thus any defect, abnormality or impairment in the morphology and or functioning mechanism of centre located in brain leads to speech related disorders. Majority of it includes inability to speak-Aphasia having defect in central speech apparatus others include

Dysarthria-defect in articulation at laryngeal region.

DEVELOPMENT OF SPEECH²⁴

Development of speech in child occurs in two stages-

First stage-where there occurs the association of certain words with visual, tactile, auditory and other sensations, aroused by objects in external world which is thereafter stored as a memory.

Second stage-the information stored in the form of memory is then recalled and recited by formation of new neuronal circuits between auditory, visual and speech areas. The ultimate effect is the child thereafter attempts to formulate and pronounce the words by practicing them.

CONCLUSION

- 1) Speech is a motor response seen in biotic component accompanied by the biological humors of body-*doshas*.
- 2) It is well systematic response generated after proper coordination of morphological structures at physiological and psychological level.
- 3) Theories proposed about speech production states the diversity about the same which can be accepted by accelerating

the role of *doshas* to initiate, carry and sustain the activity in living body.

4) *Jatharagni* has a keen role to play with the speech production. *Dosha* and types of *jatharagni* due to *dosha* might reflect an impact on all physiological activities of body and so *vaka pravrutti*.

5) There are variants and diversities seen in *vaka pravrutti* viz. speech due to *dosha* impact in normalcy as in *prakruti* and in abnormalcy as seen in any diseased condition or a symptom of any disease ex. *Swarbheda*.

6) The development of speech in case of *Ayurveda* is associated with *dosha* and *jatharagni* as well whereas the same in modern sciences shows relevance with anatomical base by formation of newer synapses and neuronal circuits.

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