

Prosthodontic Considerations of Speech in Complete Denture

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Abstract: Phonetics is the study of vocal cord sounds. Communication between the individuals is the basis for civilized growth of the community and speech dominates human communication. The ability to produce, manipulate and articulate with sound is called speech. The restoration of form and function of missing teeth and oral structures not only denotes esthetics and mastication, but also phonetics if applied correctly aid in fabrication of physiologically and functionally sound prosthesis.

Keywords: Complete Denture, Components of speech, Phonetics, Sound.

I. Introduction

Speech is a very sophisticated, autonomous and unconscious activity. Its production involves neural, muscular, mechanical, aerodynamic, acoustic and auditory factors. It is a combination of phonation and articulation.¹

Phonetics was studied early as 2,500 years ago in ancient India, with Panini's account of the place and manner of articulation of consonants in his 5th century BC treaties on Sanskrit. The major Indian alphabets today order their consonants according to Panini's classification.²

The voice is principally produced in the larynx while the tongue, by constantly changing its shape and position of contact with the lips, teeth, alveolar processes and hard and soft palate gives sound form and influences its qualities.³

The oral cavity, nasal cavity and sinuses act as resonant chambers and the muscles of abdomen and thorax control abdomen and thorax control the volume and rate of flow of the air stream passing into speech mechanism. The source of speech production is supplied by exhaled air from the lungs, and as the air passes through glottis it is set into vibrations. The exhaled air eventually reaches structures which acts as valves to stop air stream completely or to narrow spaces from its passage. These structures are called articulators and include lips, mandible, velum, posterior and lateral pharyngeal walls, hyoid bone, teeth, tongue and hard palate. The movement of the articulators is articulation and it is this functions that produces difficult sounds.⁴

II. Components Of Speech

All speech sounds are produced by controlling the airstreams that is initiated in the lungs and passes through the larynx and vocal cords. Speech sound requires more air than quiet exhalation; consequently, subtle adjustments in air flow contribute to variations of pitch and intensity of the voice. The structural controls for speech sounds are the various articulations or valves made in the pharynx and the oral and nasal cavities. Each sound is affected by the length, diameter and elasticity of vocal tract and by the locations of constrictions along its length.²

Kantner and West divided speech into 5 components: -

1. Respiration.
2. Phonation.
3. Resonation.
4. Articulation.
5. Neural integration

Chierici and Lawson added a sixth component i.e. audition or the ability to hear sounds is Audition⁹

Audition: -

Audition, or the ability to receive acoustic signals, is vital for normal speech. Hearing permits receptions and interpretation of acoustic signals and allows the speaker to monitor and control speech output. Compromised hearing can preclude accurate feedback and hence, affect speech. Speech development and subsequent speech therapy is hampered in-patient with hearing impairments.

III. Sounds

Sounds are produced by passing a stream of air from the lungs through one or more resonators. Resonators are

1. Pharyngeal cavity.
2. Oral cavity.
3. Labial cavity.
4. Nasal cavity

Sounds can be categorized as consonants and vowels, voice and nasals.²

IV. Consonants And Vowels

The distinction between consonants and vowels is made in the following manner. If the air, once out of the glottis, is allowed to pass freely through the resonators, the sound is a vowel. If the air, once out of the glottis, is obstructed, partially or totally, in one or more places, the sound is a – consonant⁵

In verbal communication we combine words to form sentences. The words are formed by combining various syllabus / speech sounds. The speech sound production is a complex process. In the process the speech organs move together in a coordinated manner. During these movements various speech sounds such as vowels, consonants and diphthongs are produced. The branch of linguistics that deals with the characteristics of speech sounds is called phonetics. There are further subdivisions such as Articulatory phonetics, Acoustic Phonetics and Auditory Phonetics.⁶

Table No. 1: - Classification of speech sounds.⁷

Voiceless speech sounds (created by air alone)		
Fricatives Plosives Affricatives	Air is forced by tongue through a narrow aperture & is associated with friction Explosive release of air A combination of the friction & explosive elements	s, sh, th, f P, t, k ch
Voice speech sounds (created by laryngeally produced noise)		
Vowels Voiced consonants	Formed from continuous vocal cord vibrations; tongue & lip positions impart structural overtones A combination of air produced sounds & laryngeal tone	a, e, i, o, u b,d,j, m,q,r
Classification according to anatomic sound formation .		
Palatolingual Tongue & Hard palate Tongue & Hard palate Tongue & soft palate Linguodental Labiodental Bilabial	Tongue is positioned just behind the maxillary incisor teeth with the sides of tongue in contact with maxillary posterior teeth & alveolar ridge Tongue is placed firmly against the anterior hard palate Posterior dorsal tongue is raised to occlude with soft palate Tip of tongue is placed between maxillary and mandibular teeth Formed by lower lip contacting the incisal edge of the maxillary incisor teeth These sounds are formed between the lips	s t, d ,n k, g, ng th f,v b,p,m

V. Discussion

Articulatory system is of particular interest or significance to the dentist, owing to the fact that the various components of the articulatory system consists of surfaces of the oral cavity. Hence, knowledge of the phenomenon and mechanism of speech production is an essential feature in comprehensive dental treatment.⁸

Factors affecting phonation.

1. Influence of the thickness the palatal vault on closest speaking space.¹⁰

Phonetic tests while patients are producing sibilant sounds enable the dentist to identify the smallest speaking vertical separation of the anterior teeth occlusal rims .Burnnet(1994), Silverman(1952) affirms that the

closest speaking space (CSS) of each individual is constant through out life. This would allow dynamic determination of the vertical dimension of occlusion (VDO) in both dentate and edentulous patients.

2. Denture thickness and peripheral outline¹¹

- Front vowels are more affected by palates than back vowels.
 - Consonants were affected by artificial palates more than twice as much as vowels.
 - Speech deteriorated in direct proportion to the thickness of the palate.
 - Decreased air volume and loss of tongue space in the oral cavity due to thick dentures.
 - Thicker denture base specially at the palate would affect the clarity of the sounds /t/, /d/, /s/, /c/, /z/, /r/ and /l/.
- 3. Post dam area- the extension of the denture base¹²** is very important for a stable and retentive denture .if the borders are on to the movable tissues it tends to dislodge and patient will not be able to speak. Also liguopalatal consonants such as k, ng, g, and c(hard) are affected by incorrect post dam extensions. Mehiring E J(1963) and Prendergart W.K (1935) one of the most important area which will affect the vowels I and E and the palate – velar consonants K.G.
- 4. Width of the denture-¹²**Prendergart W.K (1935) and Sharry JJ(1952) stated that is arch is narrow it will crumple the tongue which affects the size and the shape of the air channel resulting in faulty occlusion of the consonant like d,n,l,s,t where lateral margins of the tongue makes contact with the palatal surface of the upper posterior teeth.
- 5. Relationships of the upper anterior teeth with lower anteriors.¹³** Mehring E.J(1963) Rowe Arthur (1936) and Pingo (2003): The S sound requires near contact of the upper and lower incisor teeth so that the air stream is allowed to escape through a slight opening between the teeth. Silverman(1967) stated that the whistle and swish sounds are produced during speech due to air abnormally passing over the tongue and through the interincisal space.
- 6. Vertical Dimension:¹⁴**Fymbo (1936) pointed out that defective speech is most frequently associated with increased vertical dimension which may result in difficulty in pronouncing sound like b, m, p, f, v. Landa (1947) recommended various phonetic tests to determine proper vertical dimension using such sound as s, c, z.
- 7. The Occlusal Plane:¹⁵**Earl Pound (2006) and Rothman R (1961) concluded if upper anteriors are too short of occlusal plane the word “v” will more likely pronounce as “f”. If upper anteriors are arranged below the occlusal plane the word “f” will pronounced like “v”. The labiodental sounds like “f”, “v” are helpful in determining the antero-posterior positioning of the upper incisors and occlusal plane.

VI. Summary

An empiric approach to the phonetics factor in denture construction frequently places the burden for compensating for speech changes for the adaptability of the tongue. Additionally, significant is the fact that the speech mechanism is highly susceptible to degenerative diseases. If dentures are to contribute effectively to the functions of speech, dentist should use studies in speech science field to increase their critical knowledge of the phonetics factor in denture construction.¹⁶

The aim of the well designed prosthesis is not only to restore proper function and esthetics but also to facilitate acceptable phonetics. Accurate approximation of palatal contours of maxillary complete denture to a patient’s tongue can improve speech clarity, if other factors such as tooth position, occlusal plane, vertical dimension, thickness of palatal vault are satisfactory. Because oro-dental morphological features may influence an individual speech, the dentist should therefore recognize the possible rate of phonetic treatment on speech activity.⁷

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