Demystifying Role of Phonetics in Complete Denture

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Abstract

Speech, as formulated, perceived and decoded, is unique to humans. Speech is a learned process which makes use of the anatomical structures designed primarily for deglutition and respiration. The production of sounds requires selective modification and control of an outgoing air stream, which originates from the respiratory apparatus. Speech is a very sophisticated autonomous and unconscious activity. Speech in matured man in a learned habitual neuromuscular pattern which makes use of anatomical structures designed primarily for respiration and deglutition. Because oro-dental morphological features also may influence an individual speech, the dentist should therefore recognize the possible role of prosthetic treatment on speech activity. The loss of teeth and supporting structures alters the main articulatory cavity and produces a marked effect on the speech pattern proportionate to the location and magnitude of alterations. An empiric approach to the phonetic 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, dentists should utilize studies in the speech science field to augment their clinical knowledge of the phonetic factor in denture construction.

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The ability to produce, manipulate and articulate with sounds is called speech. Speech is a integral part of human’s function and we hardly ever pause to consider it as a learned process.

The science of sound which is used for speech is the phonetics. (?)

Speech consists of a discrete series of sounds that corresponds to the letters and words of a written language. It needs mental processing for production and recognition of sounds of any language as it has very high complex motor and perpetual skill. And hence its proven that speech plays a vital role in man’s life but its usually taken for granted.

Role of articulatory system is to produce sounds. It involves several structures of the oral cavity — tongue, lips, teeth, hard palate and soft palate. When any changes are detected in oral cavity it affects speech. This is more evidently seen in edentulous arches where there are no teeth present which ultimately affects the speech quality. It has to be taken into consideration while fabricating complete denture. (Sharry and McGraw Hill Book Company, 1974)

DISCUSSION

The role of phonetics in complete denture is an important aspect to be taken care of during its fabrication. Proper speech delivery is related to patient comfort, satisfaction as well as his mental health. There has been various studies which have been carried out in the past decades keeping in mind to study the importance of phonetics in the denture construction and in all the studies speech has been proved to be highly effective to give a successful denture to the patient. All these studies conducted from the year of 1950 till date have shown the role of speech in complete dentures using various methodologies and devices have been grouped together and simplified in a tabular format (Table 1) for a better understanding.

A denture can be called successful when cardinal factors involved those are mechanical, esthetics and phonetics altogether these blends so well that perfect harmony is achieved. So that patients not only just chew food but they feel satisfied by denture with its facial expression and phonetics. Walia and Walia (2012) While talking about all the three factors all due consideration is given to 2 factors that is mechanical and esthetic but phonetics has not been given much priority. This can be justified by a fact that usually patients get adapted to the dentures over a period of time and improve their speech. (Zarb, 2004)

Its unbearable for singers and public speakers with missing premolars to allow for lateral emission. Usually anterior emission is caused due to missing anteriors which interferes with speaking till an accepting articulating pattern is attained. When a major amount of gingival tissues are lost they deny the tongue to attain its usual contact with tissues. It leaves potential escape for stream of air within the interspaces of parts of teeth which are uncovered. (Mantri et al., 2019) There are number of factors which affect speech articulation those are tooth movement which has occurred mechanically in upper arch or if the arch is expanded or constricted. And so, it would be appropriate for dentists to be well versed with speech articulations which happens in the oral cavity. In order to provide quality of health service its very important to rehabilitate speech with dental treatment. Its an compulsion of the profession to rehabilitate speech, failing to do so affects the quality of treatment provided to the patient. As speech is a simple ultimate way of communicating it becomes keystone to establish and organize the society. Nowadays a person is not just judged by what he says but also with the way of saying. Dentists they are guardian of oral health and they are involved in modifying structures within the oral cavity to lessen the effects of diseases as well as developmental abnormality. (Nomura et al., 2011)

The foremost amount of articulation of speech is carried out in the oral cavity and when any structures are altered it eventually affects speech of a person. About 2500 year ago studies were conducted on phonetics in ancient India.

When dentist fails in contouring palate in accommodating normal contact of tongue it leads to inappropriate speech patterns for a long period of time. It also varies with the skills of patient and amount of discrepancy within the palatal contours. This period of inarticulation is for patients to get accustomed to dentures, it could be decreased or eliminated completely if palatal contouring is done appropriately at time of try-in appointments. Inappropriate speech patterns are not at all necessary even for short span of time. It becomes a matter of embarrassment for a person who is listening and as well as for patients. (Pisulkar et al., 2019) Eventually it adds up load for patient to adapt to the denture. Although its very true that problems associated with speech patterns gets reduced in practice period of patient
| Year     | Study                                      | Results                                                                                                                                                                                                 |
|----------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1957     | (Kaires, 1957)                             | “Conducted a study by which they measured quantitatively, with the help of electronic means, using the VDO which was determined beforehand, there is role of pressure applied in the palate in pronouncing palatalolingual speech sounds. It was observed that during the act of speech and swallowing remunerative changes occurring in the tongue results just not in changing the intensity of pressure applied by palate but also to the various time intervals during those that pressures are applied.” |
| 1973     | (Tanaka, 1973)                             | “Studied the speech patterns in edentulous patients related to speech”                                                                                                                                     |
| 1978     | (Hamlet et al., 1978)                      | “Studied the feasibility of using conditioning prosthesis for speech adaptation.”                                                                                                                          |
| 1982     | (Goyal and Greenstein, 1982)               | “In this study contours of palate could be altered by a person’s tongue-to-palate contact for proclamation of speech normally on immediate denture insertion.”                                                  |
| 1983     | (Kestenberg, 1983)                         | “Studied the various types of speech tests such as spontaneous samples, imitative samples, samples by reading, and deep samples have been discussed.”                                                      |
| 1985     | (Petrovi, 1985)                            | “Evaluated the role of speech sound which is due changes occurring in the oral cavity dimensions accompanied by denture of various morphologies were assessed.”                                            |
| 1986     | (Howell, 1986)                             | “Conducted an investigation in which the values of various mandibular movements while reading of a regular passage of text were calculated with the help of magnets and softwares.”                               |
| 2006     | (Hasssel and Holste, 2006)                 | “They compared the improvement in speech function of upper complete denture with and without sand blasting of the palatal region of denture.”                                                              |
| 2008     | (Kong and Hansen, 2008)                    | “This study proposed a technique to customize palatal contours of a maxillary complete denture.”                                                                                                           |
Table 1 continued

| Author(s) and Year | Description |
|--------------------|-------------|
| Bortun et al., 2004 | “Proposed the phonetic assessment of the patient who are non dentulous co-related with the numerous artificial teeth arrangements assessed the phonetic alterations in complete denture patients” |
| Pound, 2006       | “This study utilized the speech to simplify a personalized denture service, stated that the range of various movements of mandible which were seen with speech speech restored the patient’s original horizontal and vertical overlaps. These could be helpful in managing factors affecting occlusion.” |
| Patil et al., 2008 | “In this critical review was established of the role of palatal rugae and their relevance for complete dentures” |
| Stezle et al., 2010 | “They assessed speech of patients when they were wearing dentures and also when they were not wearing it. They assessed using automatic, computer-based methods.” |
| Schwartz et al., 2012 | “They evaluated grounding stop place systems in the perceptuo-motor substance of speech on the universality of the labial-coronal-velar stop series.” |
| Nomura et al., 2012 | “The assessment of speech quality and intelligibility after replacement of lost teeth with removable dentures: review of literature” |
| Durgesh et al., 2012 | “In the article ‘phonetics related to prosthodontics’ stated the correlation between occlusion and speech.” |
| Krishna et al., 2012 | “They performed the study on dentures which were modified using phonetics. Its palate was contoured.” |

This were conducted using palatography and spectrography.

“The values derived by progressive function refinement of this information through the controlled use of diagnostic treatment dentures incorporating tissue treatment material, and a free running occlusal scheme have been reviewed.”

“In this study patients whose speech is sensitive to a changed relationship of the tongue to a palatal prosthesis may require surface texture to orient the tongue.”

“It has been proved that Automatic Speech Recognition is significantly helpful tool for application in assessing speech assessment in a standard manner.”

“Authors have used an articulatory acoustic model of the vocal tract to examine stop consonant place in terms of both articulation and formant values.”

“After analysis of data in current literature conclude that alterations in oral cavity caused by tooth loss and resorption of alveolar ridges can produce changes in speech quality and intelligibility.”

“This study emphasizes to utilize phonation for placing upper anteriors in complete and partial denture rehabilitation if pre extraction records have been lost.”

“A simple technique of addition customized rugae and palate contours to the maxillary denture…..introduced this method for achieving normal speech after denture fabrication.”

Continued on next page
| Year | Authors | Study Description | Findings |
|------|---------|-------------------|----------|
| 2013 | Hattori et al. | They experimented the automatic evaluation of speech impairment caused by wearing a dental appliance. | The results of the automatic test system and the conventional evaluation system by humans were co-related. Their findings suggested that these systems could be helpful in evaluating speech intelligibility of denture wearers. |
| 2013 | Adaki et al. | They performed a study on patients with and without rugae incorporated in dentures by use of Acoustic analysis and speech intelligibility. | Findings of this study suggested that when acoustic analysis was carried out pronunciation of S, SH, T, D. was clear in dentures with rugae. |
| 2014 | Hala et al. | This study aimed in evaluation of the effects of various methods for palatal denture base configurations in pronouncing various speech sounds. | With proper denture fabrication, the palatine rugae played a significant role in pronouncing various speech sounds. They stated that there has to be anatomic landmark where tongue could best recognize and produce certain sound. |
| 2015 | Mahross and Baroudi | They did the spectrogram analysis of complete dentures with different thickness and palatal rugae materials on speech production. | It is recommended to reproduce the rugae area in complete denture because the phonetic quality of complete denture with rugae was superior to the conventional denture. |
| 2008 | Jeannin et al. | This describes an original experimental procedure to measure mechanical interactions between tongue and teeth during speech production. | The device permits the measurement of contact pressure without introducing any additional perturbation other than the prosthesis itself. The preliminary results show a well synchronization between the two signals. |
| 2017 | Rimmy et al. | This study aims to compare difference in speech sounds of different phonemes at different phonemes at different syllable positioning observed with conventional and customized palatal contoured denture. | It proved that there was difference in pronunciation of various phonemes at different positions. |
| 2018 | Chaturvedi et al. | This study aimed in comparing patients with conventional CD, without dentures and dentures with modified palatal contours. In these groups speech intelligibility was assessed. | There was a substantial difference found in pitch and intensity of speech sound amongst 4 stages. The small opening type of palatal coverage enhanced speech intelligibility. |
but still it’s completely unethical to avoid palatal contouring while try in phase.

It is not going to reduce responsibilities of prosthodontist’s to rehabilitate speech following denture delivery. Palatal contouring is not at all a difficult task it just require immense knowledge of anatomy of tongue and phonetics for speech articulation. (Sharry and McGraw Hill Book Company, 1974)

Changes in complete denture affects speech due to this reasons –

1. Articulation and Resonance is affected by surface changes.
2. When denture is thick in palatal region it decreases tongue space, ultimately which affects Articulation and Resonance.
3. Sensory feedback mechanism is affected.
4. Behavioral responses of the patients.

There is important role of dental practitioner to recognize importance of prosthodontics treatment on speech patterns. (Zarb, 2004)

In prosthodontics speech plays a vital role as it’s been used to attain appropriate tooth positions, and to establish vertical dimensions which eventually simplifies denture design.

Though, there are few studies which have been done in the literature which have used sound spectrographic analysis combined with perception of individual for analysis of variations seen in the use of denture.

Complete dentures they have 3 common requirements those are: “Esthetics”, “Mastication” and “Speech”. Since from patients view point they prioritize mastication and esthetics as compared to speech, whereas while the period when patient remains edentulous esthetics as well as mastication both are not affected more than speech. Speech is drastically altered during edentulous span so that is why speech should me given maximum consideration while fabrication of complete denture. (Kaires, 1957)

**CONCLUSIONS**

Speech problems as consequences of oral rehabilitation with complete dentures are usually a transitory issue. When this speech problem arises it is difficult to be resolved. And so struggle is to ignore speech issues with the help of pretreatment records. Also by assessing speech by various speech test and takin

proper history of patients so that initially only the abnormalities in speech could be detected, immediately after oral rehabilitation. In the past speech therapist have been expected to undertake the diagnosis as well as the management of ones who suffer from speech disorders.

Not only the face but speech also reflects an individual’s inner being. Any abnormality or defect in the same can affect his/her psychology and social behavior. Hence, a prosthodontist play a pivotal role in understanding the basic mechanisms involved in the various speech pathology and provide prudent treatment for the same to enhance an Individual’s personality.

**Conflict of Interest**

The authors declare that they have no conflict of interest for this study.

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