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# PHONETICS IN COMPLETE DENTURE PATIENTS

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## ABSTRACT

Phonetics is a complex phenomenon of the emission of voice, the combination of phonemes at different frequencies. Each person's voice is unique and is determined by the size of the resonator system which comprises of the oral cavity, larynx, pharynx, vocal folds, paranasal sinuses, that vibrates at different frequencies to produce sound. phonetics can also guide proper rehabilitation with complete denture. Speech can identify natural anterior tooth position (Tench RW, 1927; Allen LR, 1958; Pound E,, 1970). Speech can also assess the occlusal vertical dimension, extent of denture border, thickness of denture base and other important parameters. So phonetics is an important determinant for accurate denture construction, and its value should not be overlooked. This review article presents the importance of phonetics in complete denture patients

**KEYWORDS:** Phonetics; Complete Denture, Speech Test, Tooth Position.

## INTRODUCTION

Speech consists of respiration, phonation, resonation, articulation, neural integration, and audition (Haitas GP, Wolfaardt JF, Carr L., 1985). Of these components, articulation is most readily affected by the construction of a complete denture (Christina A. Gitto, Salvatore J. Esposito, and Julius M. Draper, 1999).

The functional problems that arise because of errors in articulation may be classified into three types (Laivson WA, Bond EK., 1968):

1. Omissions: The phoneme that should be present for normal pronunciation is absent, eg, ook for look (l omitted); ba for ball {ll omitted).
2. Substitutions: The wrong word is used, eg, sink for think [s replaces th).
3. Distortions: The substituted phoneme is nonstandard rather than standard. Although normal pronunciation is approximated, it is not close enough to be acceptable, eg, ink for sink (s distorted).

The interaction of the tongue, palate, lips, teeth, and jaws is integral to the valving and articulatory process that modifies the flow of air to produce speech sounds. A denture that significantly alters the position of the teeth or palatal contours can affect or interfere with speech articulation and intelligibility. Speech sounds are produced as a result of the acoustic excitation of the human vocal tract. The acoustic theory of speech shows that modifications of the vocal tract shape cause alterations of its acoustic output, i.e. of speech sounds production (Fant, 1960). Therefore, investigation of the correlation between speech and different denture morphology was undertaken. In a preliminary report, (Petrovic, 1974), the existence of a correlation between the quality of speech, expressed in the form of spectrograms, and denture morphology was concluded.

Changes in fundamental frequency induced by the use of different dental prostheses were noticed by an 80-year-old male patient who had volunteered for many years to have his dental work performed by dental students at Muenster University, Germany (Eberhard Seifert, Christoph Runte, Michael Riebandt, Antoinette Lamprecht-Dinnesen, and Friedhelm Bollmann, 1999).

Sounds that are frequently affected include bilabial ("p," "b"), labio-dental ("f," "v"), linguo-dental ("th"), and linguo-palatal ("s") sounds. The "s" sound is made by the contact between the tongue tip and the palate at the rugae area with a small space created for the escape of air. If this space is too small, a whistle usually results. If the space is too broad and thin, "s" is replaced by "sh," which sounds like a lisp.

The sounds formed in the labiodental, linguodental, and linguoalveolar regions therefore are of special interest to the dentist. Studies on speech sound production may have a clinical impact because many patients attach great importance to undisturbed speech sound production after dental treatment. Heyink et al (1971) found that 28 (21%) of 131 denture wearing individuals from an elderly Dutch population had speech problems.

**Use of Phonetics in Denture Construction**

The loss of one or more teeth can alter phonetics. Spaces created by tooth loss are, at times, closed by the tongue, lips or cheeks. Phonetic articulation is often difficult, and can cause increased salivation. There are various causes of speech sound problems in complete denture wearers.

A satisfactory result can only be achieved if the natural structure of the arch (before tooth loss) is restored with the new prosthesis. A correct prosthetic treatment plan should include detailed occlusal, functional, aesthetic and phonetic analyses.

Phonetics can be used to facilitate different phases of denture construction :

- Determination of Vertical Dimension
- Determination of Neutral Zone
- Anterior Teeth Placement

Ribner ME (1965) summarized the benefits of utilizing phonetic exercises in denture prescription by listing seven examples:

1. Posterior border of the denture. When the patient says /ah/, the junction of the fixed and movable palate is established and therein determines within limits the posterior extension of the denture,
2. Vertical dimension. With the correctly trimmed maxillary occlusal rim in place, the mandibular nm is trimmed so that 1 mm of space exists between the two when the patient says /s/. If there is insufficient vertical height, /p/ and /b/ will be affected,
3. Height of the anterior teeth and thus the occlusal plane. Once the wax record block or try-in is in the patient's mouth, if he or she is unable to clearly enunciate W or/v/, then the anterior teeth are either too far above or below the functional plane of occlusion.
4. Overjet, This may be established hy using the /s/ sound,
5. Labiolingual position of the mandibular anterior teeth, A lisp in the /s/ sound indicates that the teeth are placed too far lingually.
6. Thickness of the anterior region of the palate. This may be assessed by having the patient say /t/ ; a lisp indicates excessive thickness.
7. Tliickness of the post dam. Any difficulty in saying /g/ indicates excessive thickness of the denture base in the post dam region.

**Determination of Vertical Dimension**

The exact measurement of the natural vertical dimension is most essential in the successful practice of many phases of dentistry. It has been found that the greatest cause of full denture difficulties is the failure to duplicate the normal vertical dimension. The maintenance of a correct freeway space is fundamental to restore a good phonatory space.

The vertical dimension of occlusion in rest position and in centric occlusion has been deeply analyzed since the '50s and '60s by renound researchers like Silverman M.(1956) and Atwood DA.( 1959).

**Recording Rest Position**

1. Have the patients repeat the name Emma until they are aware of the contacting of the lips as the first syllable em is pronounced.
2. Engage patient in a conversation to divert their attention. A pause in speech, followed by relaxation as indicated by a drop in mandible, is indication for measurement.

**Recording Vertical Dimension of Occlusion**

It has been suggested that the mandibular position during the pronunciation of sibilant sounds can be used to establish OVD (Silverman MM. 1953; Pound E. 1977).

It is believed that closest speaking space for each individual is constant throughout life. In addition, it was stated that speech positions are not affected by the removal of teeth (Mehringer EJ.,1963)

The speaking method of measuring vertical dimension is a physiologic phonetic method which measures vertical dimension by means of the closest speaking space. This space is measured before the loss of the remaining natural teeth to give us the patient's natural vertical dimension which can be recorded and used at later dates. The same closest speaking space should be reproduced in full dentures as is found in the natural dentition. This space is also the means of proving that vertical dimension must not be increased.

(Cited from Arthur O. Rahn ,Charles M.Heartwell, Textbook of Complete Denture; 5th Edition, 2003)

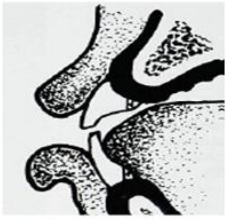
- Phonetics tests of the vertical dimension consist more of listening to speech sound production than of observing the relationships of teeth during speech : James D. Anderson.
- S sound : Silverman M., Pound,
- M sound : Wagner,
- Emma, Mississippi: Turrel

'Three thirty-three': there should be enough space for the tip of the tongue to protrude between the anterior teeth.

'Fifty-five': the incisal edge of the maxillary central incisors should contact the vermillion border of the lip at the junction of the moist and dry mucosa.

'Emma' and 'Mississippi': the teeth should not contact.

Position of lips, teeth, and tongue, when "m" sound is produced



Tooth and tongue and lip positions used in enunciation of "s" or sibilant sounds.

Note addition of cingulum on teeth

**The Speaking Method, Meyer M. Silverman, 1953**

The patient is seated in an upright position without the use of the headrest, with the eyes forward, and the occlusal surfaces of the upper posterior teeth parallel to the floor. The measurement is taken under identical conditions of posture and vigor of speech. The head must not tilt forward or backward, and the patient should speak rapidly in a calm and relaxed manner. A particular observation must be made that the patient does not consciously control the movement of the mandible, as any variation from normal might affect the measurements. Direct the patient to close into centric occlusion, with the upper and lower teeth together in maximum occlusal contact. Draw the centric occlusion line with a sharp pencil on a lower anterior tooth at the horizontal level of the incisal edge of the opposing upper anterior tooth. Have the patient say "yes," and while the phonetic sound s is being pronounced, draw the closest speaking line on the same lower anterior tooth at the horizontal level of the upper incisal edge. The distance between the centric occlusion line (lower line) and the closest speaking line (upper line) is called the closest speaking space. This closest speaking space is the measurement for vertical dimension.

In some patients, the mandible will move forward during the pronunciation of some or all speech sounds.( Silverman, Meyer M. , 1950,1951) This forward movement will not affect the accuracy of the measurement because the same movement occurs, and the vertical distance between the lines is always re-measured in the same manner with both natural and artificial teeth.

The closest speaking space may vary in different individuals. In the series of patients examined, (Silverman, Meyer M, 1951) the measurements ranged from 0 to 10 mm., which proves that there is no such thing as "an average" in measuring vertical dimension. Measurement must be made with accuracy as it has been found that increasing the vertical dimension only one millimeter will cause discomfort to the patient (Silverman, Meyer M.,1952). The closest speaking space has been found to be constant in each individual, It is felt that the closest speaking space should be constant throughout life.

The closest speaking line should first be located and marked by the use of individual words containing the six sibilants as described above. In order to be certain the patient did not control the movements of the mandible consciously, it is advisable to check further for accuracy. Have the patient say "Mississippi" which contains many sibilants. Then a magazine is given to the patient to read aloud. While the sibilants of the talking or reading matter are pronounced, it should be noted whether the incisal edges of the upper tooth coincide with the closest speaking line drawn on the lower tooth as determined by the use of individual words. If there is variation in the position of the closest speaking line, it is generally due to a voluntary muscular control of the lower jaw. When the patient speaks or reads rapidly, the function of the mandible is unconsciously accurate because all conscious control of the mandible is eliminated.

Whenever lines cannot be drawn on the lower anterior tooth due to space between the upper and lower teeth, In this example, there is no vertical overlap in the dentition which is to be measured for its closest speaking space. The centric occlusion line of this edge-to-edge relationship is at the incisal edges of the lower anterior teeth. The closest speaking line is at the incisal edges of the upper anterior teeth. The closest speaking space is the distance between these two lines as measured. The closest speaking space as measured in the natural dentition must be reproduced in full dentures after the loss of the remaining natural teeth.

When we build full dentures for patients without pre-extraction records of the closest speaking space, we are back again to guessing at the proper vertical dimension. With an understanding of the speaking method and its closest speaking space, we can more intelligently approximate the vertical dimension, and eventually record the patient's natural vertical dimension after the shrinkage of the alveolar ridges or wear of the artificial teeth. The accurate closest speaking space is eventually

obtained by measuring at intervals until the patient is free of sore spots and is relatively comfortable.

It is always advisable to measure the closest speaking space of all full denture patients at least once a year until it is found that there is an end to discomfort, and perhaps to alveolar shrinkage or wear of the artificial teeth. If the closest speaking space remains constant in the full dentures, it is simple to duplicate this same vertical dimension when registering the maxillo-mandibular relation of new dentures, with the additional help of tattoo dots on the alveolar ridges (Silverman, Meyer M.,1950).

The closest speaking space to measure the vertical dimension in this speaking method must not be confused with the free-way space of the centric relation method (Niswonger, M. E., 1934). The free-way space establishes vertical dimension when the muscles involved are at complete rest, and the mandible is in its rest position. The closest speaking space measures vertical dimension when the mandible and muscles involved are in the active full function of speech.

The measurement of vertical dimension by use of the speaking method with its closest speaking space has been found to be the missing link in successful full denture construction.

During the pronunciation of the phonemes /i/ and /m/, muscles in the oral cavity assume the rest position,( Fenn H.R.B., 1953) which is an important feature in determining the vertical dimension of occlusion.

It is advisable to measure and record the closest speaking space of all patients after they are past 20 years of age, for possible use in later years (Meyer M. Silverman, 1953).

**ch, s, j sound** : lower incisors should move forward to a position nearly directly under and almost touching the upper incisors.

If the distance is too large, it means that too small a vertical dimension of occlusion may have been established.

If the anterior teeth touch when these sounds are made, the vertical dimension is probably too great.

Likewise, if the teeth click together during speech, the vertical dimension is probably too great.

Incisive guidance is established by arranging the anterior teeth in occlusion rims before recording VDO (Pound and

Murrel , 1971) : ‘f’, ‘v’ : position of maxillary teeth is determined by the position of the maxillae.

‘s’: position of mandibular teeth by position of mandible.

From ‘s’ position to a comfortable retruded relation, close vertically until a firm posterior contact is encountered.

Pound (1976) developed a technique to determine the vertical dimension based on the concept of the freeway space during the pronunciation of the phoneme /s/. He recommended that to avoid contact with teeth during speech and rapid conversation, /S/-vowel sounds should be used. If the classic /S/ position is restored the following benefits are noted: (1) Developing centric relation requires little judgement. (2) Developing VDO requires only closure of lower teeth to contact upper teeth after retrusion. (3) Incisal guide angle is automatically re-established (4) Degree of retrusion from the classic /S/ position usually re-established patients former class of occlusion.

It should be noted that the “s” sound may be made one of two ways. For most patients, the mandible translates to an end-to-end position. This is referred to as the typical “s” sound. A smaller percentage of patients will form th “s” sound in an overlapped position.

This is called the atypical “s” sound (Peter E. Dawson, 1974).

Silverman stated that approximately 2 mm should exist between the teeth when the S sound is made. While this standard is accurate, it does not correlate to the original OVD of the patient. Denture patients often wear the same prosthesis for more than 14 years and during this time lose 10 mm or more of their original OVD. Yet, all of these patients are able to say Mississippi with their existing prosthesis. If speech was related to the original OVD, these patients would not be able to pronounce the S sounds because their teeth would be more than 12 mm apart. Patients with temporomandibular joint dysfunction with surgical increases in OVD and patients with severe atrophy with long-term dentures demonstrate that OVD may vary more than 20 mm, yet most of them are able to speak clearly.

Pound (1977) further developed this concept for the establishment of centric and vertical jaw relationship records and wrote ‘Let /S/ be your Guide.’ He found :

1. /S/ sound is the most forward, most closed position of mandible during speech.
2. No teeth or denture parts should contact during speech
3. The mandible, with or without teeth is consistently carried forward and upward to the same /s/ position.
4. At the /s/ position the condyles are usually anterior to terminal hinge position, and because of this semiprotrusive position it is possible to obtain a definitive horizontal recording of the body of the mandible at its most closed position during speech. The body of the mandible assumes an easily

recordable, repetitive horizontal and vertical position when the patient is at the /s/ position during speech.
5. At proper /s/ clearance, the vertical and centric relation positions can be recorded by simply retruding the mandible to a comfortable hinge position and then closing until the lower anterior teeth make contact with the upper teeth
6. If retrusion results in a palatal contact an acceptable vertical dimension of occlusion can be attained by a study of the posterior speaking space.

He also considered the importance of Posterior Speaking Space: Existing between posterior teeth and also between edentulous ridges.

At established vertical dimension with /s/ sound :
- Class III occlusion exhibit little or no overlap, therefore posterior space is only 1 - 1.5 mm
- Class I jaw relation have vertical overlap of incisors that vary from 1.5 to 3 mm, posterior speaking space have corresponding smaller spaces.
- Class II occlusions have as much as 10 mm of posterior speaking space.
- Classes I and II the posterior speaking space diminishes with the lack of forward movement.

Burnett (2000) found that the closest speaking space of subjects who suffered severe anterior toothwear is smaller than that in the control group. This finding indicates a functional adaptation to toothwear. Although these findings may be significant, it is unknown whether this adaptation occurs with the edentulous predicament.

**Speech Tests**

The phonetic aspect of denture construction deserves equal consideration with esthetics and mechanics and should be checked at the time of the waxed try in when it is possible to alter palatal contour to accommodate speech articulation.

First test is of random speech and is best accomplished by engaging the patient in conversation and obtaining a subjective speech.

The second test is to specific speech sounds. This is best accomplished by having the patient pronounce six or eight words containing the sound and then combining these words into a sentence.

In the third test, the patient is asked to read a short paragraph containing an abundance of s, sh, and ch sounds.

| | | |
|---|---|---|
| s and sh | Six, sixty, ships, sailed, Mississippi, sure, sign, sun, shine. | Sixty-six ships sailed the Mississippi. Sure sign of sunshine |
| t, d, n, and l | Locator, located, tornado, near, Toledo | The locator located the tornado near Toledo. |
| ch and j | Joe, Joyce, Joined, George, Charles, church | Joe and Joyce joined George and Charles at the church. |
| k | Committee, convened, political, convention, Connecticut | The committee convened at the political convention in Connecticut. |
| f and v | Vivacious, Vivian, lived, five, fifty-five, fifth, avenue | Vivacious Vivian lived at five fifty-five Fifth Avenue |

According to Nagle and Sear (1962) , when we ask a patient to say a speech sound such as “f” or “v” or even the sibilant “s”, we are establishing an artificial relationship; even if we ask the patient to to express the famous words “Mississippi” or “ fifty-five”, we are still establishing an artificial speech situation which a patient may perform satisfactorily. Such a view of speech does not imply the symbolic , communicative and psychologic aspect of speech in which phonetics is only an automatic contributory phenomenon rather than the focal point of a speech situation. Thus, a patient may subordinate the swallowing and respiratory function in order to pass the phonetic speech test for the the prosthodontist. A better speech test for a denture involves engaging the patient in meaningful conversation in which he (1) express himself emotionally and employs his facial muscles in the expression of thought, (2) modifies and adjusts his respiratory rate and vigor in response to these emotional moods, and (3) repeatedly swallows his accumulated saliva. Such a speech evaluation at the try-in session requires adequate time in which to talk and to ask the patient to change his seat, to sit, and to walk about. It also requires stable baseplates. The speech test which requires such time also offers one of the best ways to evaluate the esthetics of the denture, for when a patient talks he reveals the exent of his animation, and we may thus observe the range of movements of the muscles during function (Nagle RJ and Sear VH, 1962).

**Palatograms**

Palatograms are the area of tongue contact for a given sound displayed on an artificial palate through a medium of non scented talcum powder. To learn the area of normal contact for the tongue in pronouncing the various phonems, palatograms are made.

Pre-requisites for making a palatogram: The artificial palate must be accurately adapted and refined so that it can be worn comfortably without an adhesive until speech is normal and natural. Subject who does not

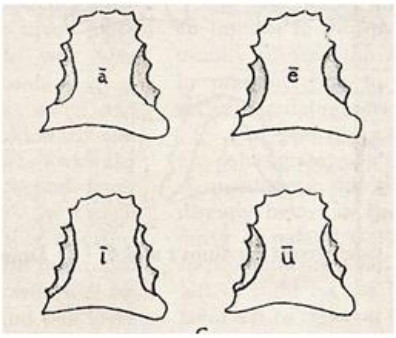
accommodate or who gags after a 15 minutes practice speaking period should not be used. The subject should be trained to pronounce the sound distinctly, and then to open his mouth with the tongue out of contact with the palate and not to swallow until the palate is removed. The tracing medium should not be distasteful, permit ease of application and removal from the artificial palate. The colour of the medium should contrast with the palate sufficiently to display area of tongue contact. he palate must be dried thoroughly before dusting with talc, and care must be taken in inserting and removing the tracings.

A palatographic study of all the vowels revealed tongue palatal contact for all except 'O'. The similarity of the tongue contact area on the palatograms is because phenomes are usually composed of more than one phone and that each phone requires separate articulation. The phone wich, occurs singly in pronouncing the vowel 'e' is prevalent in a, i and u.

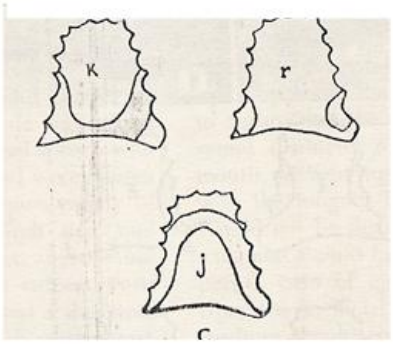
Consonants cannot be used in making palatograms, because the vowels included in the pronunciations involve tongue palatal contact, which would obscure the tracing of the articulation for the stop or affricative. Example: in pronouncing t and d, the occlusive articulations is made first followed by 'e', 'a' .

In pronouncing S, n or l , the mid-vowel 'e' precedes the articulations for the sibilant s, the nasal n, or the lateral l. To make the palatographic study of consonantal articulation, the 'O' was used in conjunction with the consonant to be studied, even though the combination did not result in a standard English word.

Tracings of the vowels




Tracings of k, r, j




Palatograms can be obtained not only statically but also electronically with sensors applied on palatal plate (electropalatogram). Recorded sound is transferred to a computer and processed by a specialized program (Gartenberg, R.,1975.; Stone, M., Faber, A., Raphael, L. J., Shawker, T. ,1992.). Images evaluate regions of superior surface of vocal path, determined by tongue contact with palatal arch on consonant pronunciation. Comparative to the electropalatograms, the static palatograms are simple to achieve in case of modest investigation conditions. Practically the existing error is greater in this case compared to the elecropalatograms, where the images are preciser within the same parameters of contact between the tongue and the palatal plate.

**Restoration of Speech**

These include the labial or palatal displacement of the anterior teeth; the coverage of the hard palate; an incorrect vertical dimension of occlusion; artificial teeth which may disturb the air flow, causing misarticulation; the concave shape of the palatal vaults of maxillary complete dentures (Tanaka H., 1973). In the construction of a removable denture, the design of the alveolar area is crucial because, during speech, the tongue comes into contact with sections of teeth, alveolar ridge and hard palate (Rothman R.,1961).Optimal phonetics can be best achieved by obtaining a proper occlusal vertical dimension and occlusal plane, correctly positioning the anterior and posterior teeth according to the esthetic and functional requirements of the patient, and adequately contouring the palatal surface.

Palatal contour of the denture: Snow (1899), recommended restoring the anterior lingual alveolar area to improve phonetics, particularly the pronunciation of s & sh. Prendergast (1935) pointed out that proper thickening of the lingual alveolar area was important for proper speech. Sears (1949) recommended making a palatogram on cases where the median sulcus of the tongue does not coincide with the midline of the palate. He recommended grooving the palate just above the median sulcus for the patient who had little or no tongue sulcus and thickening this area for the patient who had a deep tongue sulcus.

By altering the palatal contour of the maxillary denture for a patient who has sibilant distortions, improved intelligibility of the sounds and/or a reduced period of adaptation can be achieved (Hyung-Jun Kong, Carl A. Hansen, 2008).

Metal bases sometimes are used to enhance the physical properties of complete dentures. Unfortunately, improper

positioning of metal-resin finish lines may adversely affect phonetics. Junction in a maxillary complete denture is critical to the development of optimal physiologic and phonetic contours. The resultant prostheses should exhibit surfaces that reestablish proper anatomic, physiologic, and phonetic contours.( Patrick A. Mattie, and Rodney D. Phoenix, 1996)

**Effect of palatal rugae**

There are persons whose speech is sensitive to these changed relationships and have difficulty accommodating. These patients often require a tactile sense to orient the tongue. The palatal rugae and the incisive papilla can often serve as a "cue."( Palmer JM., 1979; Pound E., 1953). Because the lack of texture impede proper articulation, one solution is to add palatal rugae. Palatal rugae may aid in lingual placement during speech production by providing landmarks for the tongue. It is a tool for the alleviation of the speech problems encountered by patients sensitive to the changed relationships caused by the introduction of a prosthesis into the mouth (Christina A. Gitto, Salvatore J. Esposito, and Julius M. Draper, 1999).

Effect of denture thickness and peripheral outlines : If the thickness of the denture base covering the palatal area is more, then lisping of the sounds will occur. The upper denture base in posterior region must be kept thin and the posterior border should be merge with soft tissues. The denture base thickness in the postdam area will irritate the dorsum of the tongue which will impede the speech and there is a possibility in producing feeling of nausea and denture may be unseated during sounds, which requires sudden repositioning of the tongue to control and stabilize it. If the lingual flange of the lower denture is too thick in the anterior region, will encroach the space needed by the tongue and this results in faulty production of 's' sound. It can be corrected by arranging the artificial teeth, in same position as the natural teeth will occupy and shaping the lingual flange so that there will be enough tongue space to establish.

Effect of tooth position on speech : If the lower anterior teeth are arranged too lingually, the tongue is forced to arch itself up to a higher position and the airway is to be too small and there will be faulty pronunciation in 's' and 'z' sounds. 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 be pronounced like 'v'. The labiodental sounds like 'f', 'v' are helpful in determining the anteroposterior positioning of the upper incisors and the occlusal plane.

Effect of vertical dimension on speech : Fymbo (1936) pointed out that defective speech is most frequently associated with increased vertical dimension which may result in difficulty in pronouncing sounds like 'b, m, p, f, v'. Silverman (1956) stated that sibilient sound 's' as a mean for determining the correct vertical dimension. He established the "closest speaking space" and used this as clearance area between the dentures.

Effect of dental arch form on speech: If the arch is narrow, which will crample the tongue which affects the size and shape of the air channel results in faulty articulation of the consonants like ' n, s, ' where lateral margins of the tongue makes contact with palatal surfaces of the upper posterior teeth. The correction can be done by the slight thickening of the denture base in the center of the palate, so that tongue does not have to extend up as far as into narrow palatal vault.

Effect of denture esthetics on speech : Speech is some times related to patients emotional attitudes towards the denture esthetics. Lawson (1973) stated that when there is any change in patient mouth, then there will be anxiety reaction will occur some patients dissatisfied with their teeth appearance in denture and to overcome this problem they shows abnormal movement of lip, jaws, and tongue during speech.

**Complete denture stability and retention**

In case of the edentulous patients, the success of the denture therapy depends upon the biomechanical prodigy of support, stability and retention (Jacobson & Krol 1983). The main objective of the complete denture therapy in case of the patients with severe reduction of residual ridges is to replace the missing teeth as well as to support the associated structures. In this procedure, it may occupy a substantial volume. As it is quite crucial to satisfy mechanical requirements of the prosthesis, the denture base thickness must be carefully limited in this area. Complete dentures structurally redefine potential spaces in the oral cavity. However, placing an inappropriate denture tooth or physiologically unacceptable denture base contour or volume may lead to inefficient tongue posture and function (Wright, Swartz & Godwin 1961) hyperactive gagging (Kuebker 1984) and compromised phonetics (Martone & Black 1962). Cautiously designed external dentures contours like cameo or polished denture surfaces contribute substantially towards the prosthesis retention and stability. Poorly designed prostheses that fail to accommodate anticipated muscular function may result in compromised denture stability and reduced retention. On the other hand, when optimally contoured, complete dentures occupy space in the oral cavity within the physiologic limits of acceptable muscular function, stability and retention during phonation, mastication and deglutition (Beresin & Schiesser 1976).

**Other techniques**

Causes and corrections of whistle and swish sounds (Silverman, M.M., 1967.)

Whistle sound- shrill musical sound; prolonged sibilant, ors lisp Swish sound- lateral lisp; substitution of mushy sh or zh sound when trying to say /s/.

Causes: (a)maxillary anteriors too far posteriorly- s sounds like "sh" (b) abnormal interincisal space- rule of thumb/vertical overlap should equal closest speaking space (c) palatal form incorrect- palatograms (Coles); reproduction of reverse curves (Snow); wax addition to trial bases(Allen, Pound); soft wax in processed denture replaced by quick set acrylic(Swerdlow).

**Diagnosing denture problems using pressure - indicating media**

Use of an indicating medium is one of several strategies that clinicians can employ for improving diagnosis and correction of denture-related problems. Denture adjustments are more accurate and effective when made using an indicating medium. The patient can be asked to repeat problematic sounds with the media covering the palate. Different sounds result in different contact patterns which can be modified by selective removal from or additions to the palatal contour (Robert W. and Mark E. Knechtel, 2009).

Improving the Speech Function of Maxillary Complete Dentures by sandblasting

Alexander J. Hassel and Thomas Holste (2006) analyzed whether sandblasting could improve speech performance, as this process increases the tactile surface area in the anterior region of tongue-to-denture contact. The palate area between the tubercula of the canines, incisors, and the midpalate was sandblasted. This area was chosen because an important part of tongue-to-denture contact takes places in this region, and the normal anatomy of this area shows unevenness.

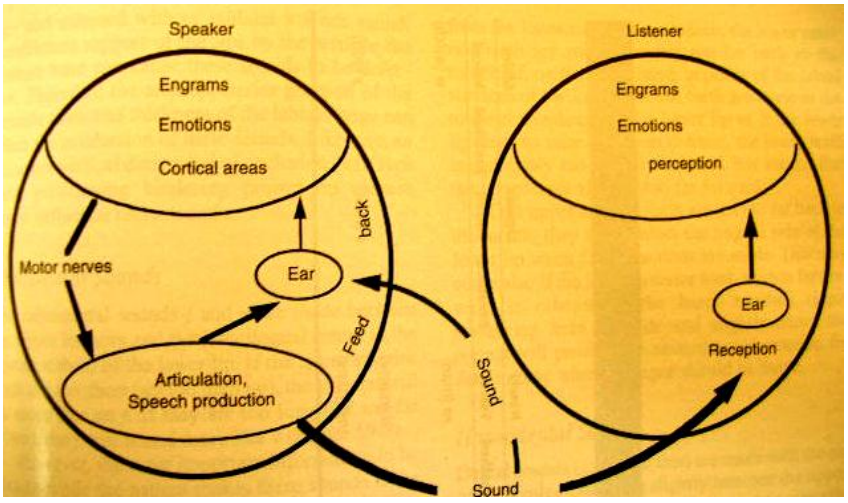
The result of the study confirmed that sandblasting cannot solve all problems related to speech function; however, the results showed moderate improvement in most cases. Stops and fricatives particularly improved after sandblasting. A rougher surface can also increase problems with plaque accumulation, stain, and discoloration. However, if deterioration takes place, the denture can be easily restored by polishing the roughened surface.

**Post-insertion care**

Owing to initial feeling of bulk,excess of saliva it is not unusual for a patients speech to be distorted.

It takes patients from 2 – 3 weeks to accustom themselves to dentures. Patients are adaptable and generally will correct speech difficulties (not directly related to technical error) within 2 or 3 weeks, so most patients can be assured they will get past the difficulty.

Patient should be encouraged to read aloud. Helps in slowing patients speech, diverts the intense concentration on speech defects, assumes natural tone and fluency with time. Patient should be instructed not to pronounce same word or sound repeatedly




Adaptation to complete dentures may be explained by feedback mechanism related to speech motor programming.

Deviations in the volume of dentures or in the temporomandibular relation may cause changes in fundamental frequency and in range of voice that are audible to the patient. Before denture modification or replacement, patients should be informed of the possibility of a new set of dentures influencing not only speech articulation but also voice. If patients notice a subsequent change in voice characteristics, the treating dentist, the phoniatrician, and speech and voice therapist should be informed about this phenomenon. (Eberhard Seifert, Christoph Runte, Michael Riebandt, 1999).

**Summary**

Sound is formulated into meaningful speech by the articulation of the tongue, lips, teeth, alveolus, hard palate and velum. It is well known that insertion of a prosthodontic restoration may lead to disturbed pronunciation (Bond EK, Lawson WA., 1968) and, in certain patients, even involve the parameters of the vocal

fold (Seifert E, Runte C, Riebandt M, Lamprecht-Dinnesen A,, 1999).

During denture fabrication, phonetic evaluation is frequently neglected (Farley DW, Jones JD, Cronin RJ, 1998) while more emphasis is placed on other key elements of successful denture treatment such as esthetics, function, and comfort (Terrell WH., 1958). It is generally assumed that patients will successfully adapt to new dentures within a few weeks (Allen LB., 1958 Tanaka H., 1973). It may take longer to compensate for changes in palatal contours of maxillary complete dentures, especially for elderly patients (Zarb GA, Bolender CL., et al, 2003) Unfortunately, some patients never acclimate to the new dentures and continue to experience difficulties in pronouncing intelligible sounds, especially the sibilant sounds (Sharry JJ., 1974. Runte C, Lawerino M, Dirksen D, et al. 2001).

The phonetic adaptation of a patient with complete denture is achieved depending on: selection and placing of the artificial teeth; thickness of maxillary prosthetic base in the frontal area; optimal space for the tong; individual adaptation capacity; patients' sound recognizing capacity (Bortun Cristina1, Leretter Marius, Sandu Liliana, 2004).

There are many ways that dentures can be improved, and dentists should be able to assess the quality of a denture in terms of aesthetics, support, retention, stability, occlusion, vertical dimension, extension of the denture bases and phonation. Phonetics and proper functioning of denture can be improved by guiding fabrication of denture with the help of patient's phonetics, for example, determining proper vertical dimension, proper arrangement of artificial teeth, incorporating proper palatal contour, etc.

Verification of proper phonetics in try-in stage and after denture delivery should be done with utmost care. Post insertion follow up should be done. Clinician must carefully evaluate the denture for faults in horizontal and vertical jaw relationships before concluding that the patient's complaint is related to age, gender, or general medical condition. In addition to clinical and technical skills, insight into patient behavior and psychology and communication techniques are also necessary.

## CONCLUSION

Artificial dentures are replacement for lost natural teeth and their associated investing structures. These replacements are required to simulate the harmonious relationship of the natural teeth during the performance of the essential functions of mastication, deglutition, speech, and respiration. A denture that significantly alters the position of the teeth or palatal contours can affect or interfere with speech articulation and intelligibility.

Role of phonetics in fabrication of complete denture should be evaluated properly. Phonetics can determine patients existing vertical dimension and also can guide and judge proper placement of anterior artificial teeth, location of neutral zone, posterior palatal seal and other border or limiting area of the complete denture. Phonetics is a fundamental feature of prosthetic rehabilitation and, if not adequately considered in the treatment plan for a fixed or removable reconstruction, satisfactory results cannot be obtained.

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