Middle-East Journal of Scientific Research 12 (1): 31-35, 2012
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2012.12.1.988

Phonetics Related to Prosthodontics

[1]Abdul-Aziz Abdullah Al Kheraif and [2]Ravikumar Ramakrishnaiah

[1]Dental Biomaterials Research Chair, College of Applied Medical Sciences,
King Saud University, Riyadh - 11541, Saudi Arabia
[2]Dental Biomaterials Researcher, Dental Biomaterials Research Chair,
College of Applied Medical Science, King Saud University, Riyadh, 11541, Saudi Arabia

Abstract: The proper knowledge about speech production and phonetic parameters will enable the clinician to fabricate dentures with good phonetic capabilities. Obtaining optimum phonetic potential by providing correlation among three key objectives (mechanics, esthetics and phonetics) of prosthodontics is the ultimate goal of every prosthodontist. This article elucidates the correlation between occlusion and speech, since these two factors are mostly not considered related to each other. But during phonation, the lower teeth function independently and there should not be any contact with upper teeth. This article also highlights the utilization of phonation as a tool for placement of upper anterior teeth in complete and partial denture rehabilitation; this is because while restoring natural teeth, we may have to depend on pre-extraction records in order to achieve necessary objectives. However if these records are missing, determining the position of artificial teeth becomes more challenging. Hence here we use phonetics as a guideline for proper placement of artificial teeth.

Key words: Phonetic parameters · Teeth position · Speech articulation

INTRODUCTION

Proper knowledge about phonetics enables a dentist to fabricate prosthesis which meet the key objectives of oral rehabilitation [1-3]. Hence, this article focuses on explaining the consequences of teeth arrangement on phonation. This article also sheds light on the utilization of phonetic parameters for teeth arrangement [4, 5]. Voice is mainly produced in larynx and modified by tongue by constantly altering its shape, position and by contacting lips, teeth, alveolar processes, hard palate and soft palate [6]. Voice from larynx is divided into two air streams- upper and lower by the velum. The upper air stream is used to pronounce sounds like "N", "M" and "NG". Resonance and all other sounds are produced by the lower air stream as it strikes palate and gets altered by the oral structures [7].

Normal functioning of speech is mainly influenced by five aspects which are as follows:

- Motor: Consists of the lungs and associated muscles, which supplies air.
- Vibrator: Consists of the vocal cord, which offers pitch to the voice.
- Resonator: Consists of oral, nasal, pharyngeal cavities and paranasal sinuses, which create tone and is specific for each individual.
- Enunciators and Articulators: Consisting of lips, tongue, soft palate, hard palate and teeth which form musculoskeletal valves to control the amount of air passage.
- Initiator: motor speech area of brain and nerve pathways which convey motor speech impulses to speech organs [8, 9].

The main concern here is the change in the stream of air passing through the oral cavity. Lips, tongue, soft palate, hard palate and teeth, which form the musculoskeletal valves to control the amount of air passage are more vital to us [10]. Amongst all this, the tongue plays a major role in pronouncing consonants by making contact with specific parts of oral cavity like teeth, alveolar ridge and hard palate. These structures are replaced by dentures when the person becomes

Corresponding Author: Abdul-Aziz Abdullah Al Kheraif, Dental Biomaterial Research Chair,
College of Applied Medical Sciences, King Saud University, Riyadh - 11541, Saudi Arabia.
Mob: +966554299995, Fax: +9664693637.

edentulous and hence the dentist should have a sheer knowledge of speech production and phonetic parameters with the aim of fabricating phonetically good dentures [11].

The consonants which are relevant to clinician can be classified according to the anatomic structures involved in their production [10]:

Palatolingual sounds - produced by tongue and hard or soft palate.
Linguodental sounds - formed by tongue and teeth.
Labiodentals sounds - formed by lips and teeth.
Bilabial sounds - formed by lips.

RESULTS AND DISCUSSION

Speech is vital to human activity. Thus, phonetics must be considered with mechanics and esthetics, as a cardinal factor contributing to a successful dental prosthesis. The following are few considerations which dentists should bear in mind while strategizing fixed or removable prosthodontic rehabilitation.

Using Phonetics to Position the Upper Anterior Teeth: During teeth arrangement for complete or partial dentures, formulating exact position of upper anterior teeth is an essential task because arrangement of these teeth determines the position of the rest. As briefed by Robinson, when a patient is pronouncing “5”, “55”, “F” and “V” sounds, incisal edges of maxillary central incisors should contact vermillion border of lower lip at the junction of moist and dry mucosa and this position is referred as “F” position [12, 3]. The correct position of the maxillary anterior teeth cannot be established until the lower anteriors are placed in exact “S” position and satisfactory phonetics, lower lip support, esthetics, anatomic harmony are achieved [5]. The position of tongue and its relation with teeth are also crucial at this stage as in when the patient pronounces “3” and “33”, there should be enough space for the tip of the tongue to protrude between the anterior teeth; simultaneously when the patient repeats “Emma” and “Mississippi” the upper and lower teeth should not contact [3].

Pronunciation of labiodentals sounds like “F” and “V” are also used to determine accurate occlusal plane; these letters are produced by the air stream being forced through a narrow gap between lower lip and incisal edges of upper anterior teeth. If occlusal plane is set too high the exact positioning of lower lip may be difficult. On the other hand, if the plane is too low, lip will overlap labial surfaces of upper teeth to a greater extent which is required for normal phonation and the sounds produced may be affected [6, 7].

Using Phonetics to Position the Lower Anterior Teeth: Positioning of the lower anterior teeth should always be associated with that of the upper anterior teeth. If the upper anterior teeth are placed incorrectly, then lower anteriors as well as the entire posterior teeth placement will be incorrect. The key to this crucial bond is usually known as “S” position. This “S” position is offered by setting incisal edges of four lower anterior teeth slightly lingual to labial edges of upper incisors teeth with a space of 1 - 1.5 mm when “S” or “Z” is pronounced. This position is most protruded position of mandible ever seen during speech and the most intimate or closest contact of any teeth during speech [4, 5]. The method is not only helpful for functional positioning of anterior teeth for complete dentures, but also for locating incisal edges of maxillary and mandibular anteriors for fixed and removable partial denture rehabilitation.

Using Phonetics to Position Posterior Teeth: Every effort should be made to give enough space for dorsum of the tongue to make contact with palatal surfaces of upper posterior teeth during articulation of consonants such as “T”, “D”, “S”, “N”, “K” and “C”, because if teeth are set to an arch which is too narrow then the tongue will be cramped affecting the size and shape of the air flow [6, 7].

Using Phonetics to Determine the Class of Occlusion: Determining the vertical dimension and centric relation are crucial steps in denture construction. By using technique suggested by Pound, we can accurately record the patient’s class of occlusion, vertical dimension, centric occlusion and incisal guidance [4]. This technique involves determining the “S” position as previously mentioned. From this mode, allow the patient to relax in the hinge position and note the amount of retrusion. The sum of movements will indicate patient’s occlusion and also when closed at this position we will be able to make conclusion about the patients original vertical dimension.

If there is 2 to 3 mm of retrusion, the incisal edges of lower anterior teeth will be seen close to the cingulum of the upper anterior teeth. Hence this will automatically assume a class - 1 occlusion. If there is distal movement of anterior teeth of more than 3mm for the “S” position,

the incisal edges of lower anteriors will be distal to the cingulum of upper anteriors and many a times, may be against the palatal soft tissues assuming a class -2 relation. If there is no distal movement from the "S" position the incisal edge of lower anteriors will be positioned in edge to edge relation, thus assuming a class -3 relation [4, 5].

Using Phonetics to Record the Maxillomandibular Relationship: Speech is used as an aid in various ways to record maxillomandibular relation. Silverman's closest speaking space measures the vertical relation of the mandible in the phonetic method [13, 14]. The closest speaking space calculates the vertical relation when the mandible and its muscles are involved in physiologic function of speech. The occlusal rims are located in the mouth and height is adjusted until the minimum space exists between maxillary and mandibular occlusal rims when the patient pronounces the letter "S".

Vertical dimension can also be quantified in the physiologic relax mode, by asking the patient to pronounce letters "P", "B", or "M", but with "P" and "B", lips part quite forcibly that the resultant sound is produced with an explosive effect, whereas in the "M" sound, the lip contact is passive. Due to this, "M" can be used as an aid to obtain correct vertical height by guiding the patient's mandible to the rest position [6]. In an added technique, we engage the patient in a conversation that will divert his concentration from conscious participation in the procedure. A pause in speech followed by relaxation will automatically guide the mandible to it's relax position. At this instant, we measure the distance between two previously marked points that will provide an amount of vertical dimension at relax [3].

Using Phonetics During a Try-in Appointment: The use of phonetics in a try-in appointment is more valuable, since teeth have been arranged and wax has been contoured properly. Looking for the correct placement of the teeth assists in identifying errors before final acrylization. Instruct the patient to say "33"; there should be space between anterior teeth to allow for the thrust of tongue. When the patient pronounces the word "Emma", there should be no contact of the teeth. When the patient pronounces "55", incisal edge of the maxillary central incisor should contact the vermillion border of the lower lip at the junction of the rough and smooth mucosa without tooth interference posteriorly. When "Mississippi" is pronounced, there should be no contact of teeth [13].

Phonetics as it Is Related to Denture Thickness: One of the reasons for improper articulation of speech is decreased air volume and loss of tongue space in the oral cavity which occurs usually due to thick dentures. Most significant is the thickness of denture base covering centre of the palate, since production of palatolingual sounds involves contact of tongue with palate and alveolar process of teeth. With consonants "T" and "D"; tongue makes firm contact with anterior part of the hard palate and suddenly drawn downwards to produce an explosive sound. When pronouncing letters "S", "C", "Z", "R" and "L" sounds, contact occurs between tongue and most anterior part of hard palate. In case of "S", "C" and "Z" sounds a slit like channel is formed between tongue and palate through which air escapes. If denture base is made too thick in these areas, air flow will be obstructed, eventually causing impairment in the sounds [6]. According to Slaughter, smoothness of the denture gets disturbed and without producing rugae at anterior part of hard palate, the tongue loses its capacity for orientation [15]. This is because while pronouncing palatolingual sounds, tongue must be placed firmly against anterior part of the palate.

A denture which has a thick border at posterior palatal seal area, or posterior edge finished in square instead of chamfered, will irritate the dorsum of the tongue resulting in faulty articulation of speech. In some instances, the denture may become unseated further impairing the speech. Careful evaluation in these situations will reveal that the dentures rise and fall with the tongue movements during speech [6].

Speech Problems at the Time of Denture Delivery: In spite of taking immense care in recording maxillomandibular jaw relations, proper placement of occlusal plane, arranging anterior and posterior teeth in their accurate positions, speech problems do exist at times of final denture delivery. This is due to the manner in which speech problems are assessed during the trial stage, because, the tongue and lips interact in a different manner with wax (used during the trial stage) compared with the finished dentures. Another reason is the copious salivary flow often associated with insertion of new dentures, which alters speech. Usually, adaptability of the patient is sufficient to attain adequate speech [6, 7, 16].

The most common phonetic problems encountered during denture insertion and their causes are:

- Whistling when "S" is pronounced: The anterior part of the tongue is obstructed by the upper premolars making a groove too large for the escape of air.

- Lisping when "S" is pronounced: The air space is too small thus the palatal part of the denture must be made thinner.
- TH and T sounds indistinctive: There is inadequate inter-occlusal space, or the anterior teeth are too far lingual and must be moved labially.
- In the normal F and V sounds, the upper anterior teeth contact the lower lip at its highest point: If these sounds are indistinctive, the upper incisors must be moved either vertically or horizontally to the proper position [3-5].

Phonetics Considerations in Esthetic Dentistry: In our modern competitive society a pleasing appearance often means the difference between success and failure in both personal as well as professional lives. Since the mouth is one of the focal points of the face, the smile plays a major role indicating how we perceive ourselves as well as the impress people around us. The smile depends on the oral musculature and the existence of teeth, but every person is not blessed with a beautiful smile. The solution for preceding problem is esthetic dentistry which has developed the latest technologies and materials. The prosthodontist is the best individual to analyze the smile and is capable of altering the quality of the smile with available innovative techniques and materials. So, before we proceed to change the smile, we need to analyze its quality. Furthermore, analysis of the smile includes a study of facial features and lip movements in line with tooth using facial, dentolabial and phonetic parameters, in order to achieve optimal and final esthetics. Subsequently dental and gingival aspect completes esthetic analysis. Careful evaluations of these parameters allow clinicians to create restorations that are integrated not only in the oral cavity, but also in relation with patient's facial look [17].

Tooth visibility in relax position, mouth slightly opened and lips relaxed varies with age. Facial esthetic value depends to a great extent on tooth display in vertical dimension of the rest, which can be observed during speech, with ease. According to the degree of muscle laxness and level of lower frontal plane, one will notice either maxillary teeth a characteristic of youth, or a mandibular anterior segment, which by loading the facial third, suggests age and disdain. It is mandatory to understand these parameters such as tooth visibility before any restorative processes, from full mouth rehabilitation to one limited to the anterior segments are carried out.

The preliminary determination of the level of the lower frontal plane and its coordination with the horizontal constraints of the vestibular frame represents a necessary step in any esthetic restorative procedure. It will reveal the key esthetic elements for future reconstruction aimed at promoting a rhythmic equilibrium in the dentofacial composition [18, 19].

CONCLUSION

With the increased tendency to arrange anterior teeth in an irregular mode, dentist must be aware of the consequences to phonetic impairment. Therefore, appropriate measures must be taken to correct phonetic problems. Finally, if the speech problem persists in spite of providing the patient with phonetically correct dentures, then the dentist must consider the patient's level of education.

ACKNOWLEDGEMENT

Authors would like to extend their appreciation to the Dean for Scientific Research at King Saud University for funding this work through research group project No RGP-VPP-152.

REFERENCES

1. Kessler, H.E., 1958. Study of tongue patterns is clue to better speaking dentures, Dental Survey, 34: 1015-1017.
2. Herbert Sherman, 1970. Phonetic capability as a function of vertical dimension in complete denture wearers – a preliminary report, Journal of Prosthetic Dentistry, 23(6): 621-632.
3. Moustafa A. Hassaballa, 2004. Clinical Complete Denture Prosthodontics, Post Insertion Denture Problems, King Saud University, 1st Ed, pp: 388.
4. Pound, E., 1970. Utilizing speech to simplify a personalized denture service, Journal of Prosthetic Dentistry, 24(6): 586-600.
5. George A. Murrell, 1974. Phonetics, Function and anterior occlusion, Journal of Prosthetic Dentistry, 32(1): 23- 31.
6. Liddelow F. Gimson's. 1989. Clinical dental prosthodontics, Phonetics, Butterworth and Co, ltd. Publishers, pp: 136-139.
7. Rothman, R., 1961. Phonetic considerations in denture prosthesis, Journal of Prosthetic Dentistry, 11(2): 214-223.

8. Kessler, H.E., 1954. Speech Considerations in Denture Construction, Dental Survey, 30: 1570-1572.
9. Kessler, H.E., 1957. Phonetics in denture construction, Journal of American Dental Association, 54: 347-351.
10. Landa, J.S., 1954. Practical full denture prosthesis, London, Dental Items of Interest Publishing Co., pp: 311-329.
11. Allen, L.R., 1958. Improved phonetics in denture construction, Journal of Prosthetic Dentistry, 8: 753-763.
12. Robinson, S.C., 1969. Physiological Placement of Artificial Anterior Teeth, Canadian Dental Journal, 35: 260-266.
13. Heartwell, C.H. and A.O. Rahn, XXXX. Syllabus of Complete Denture, Recording Maxillomandibular 4th Ed, pp: 279.
14. Silverman, M.M., 1956. Determination of Vertical Dimension by Phonetics, Journal of Prosthetic Dentistry, 6: 465-471.
15. Slaughter, M.D., 1954. Speech correction in full denture prosthesis, Dental Digest, 51: 242-246.
16. Pound, E., 1951. Esthetic dentures and their phonetic values, Journal of Prosthetic Dentistry, 1(2): 98-111.
17. Goldstein, RE., 1997. Change your Smile, Ed. 3 Chicago, Quintessence.
18. Chiche, G.J., 1994. A Pinault. Artistic and scientific principles applied to Esthetic Dentistry, Esthetics of anterior fixed prosthodontics, Quintessence Publishing Co. Inc, pp: 21-22.
19. Rufenacht, C.R., 2000. Principles of Esthetic Integration, Principles of Esthetic Setup, Quintessence Publishing Co. Inc, pp: 217-218.