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Case Report

Customizing the palatal contour of a complete denture using a Palatogram in a case of partial glossectomy

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3) The sensory feedback mechanism for swallowing is also affected as there will either be a premature or an incomplete contact between the tongue and the palatal surface of an improperly fabricated denture.

The rapid adaptability of the tongue is the key to obtain optimum phonetics after insertion of an oral prosthesis. If the tongue is compromised due to natural or surgical reasons then it poses a greater challenge to the rehabilitation procedure performed by a Prosthodontist.^{4,5}

Case report

Introduction

Our ability to speak is the result of a learned, habitual, neuromuscular process. Speech is a sophisticated, autonomous, unconscious activity. Its production involves neural, muscular, mechanical, aerodynamic, acoustic and auditory factors. Markedly slow and weak speech may result from a weakened physical condition and may indicate a need for complete medical examination. An improperly fabricated oral prosthesis may modify speech due to the following reasons^{1–3}

- 1) Change in surface will affect articulation and resonance.
- 2) Increased thickness of the denture in the palatal area reduces tongue space and hampers its movement, thereby affecting articulation.

A 54-year-old male patient completely edentulous operated for carcinoma of the tongue, was referred to this hospital. The patient had undergone wide surgical excision (2 cm × 2 cm and 8 mm invasion) of the left lateral margin of tongue and floor of the mouth, 06 months ago. This was followed by a course of radiotherapy. On examination, the patient was using maxillary and mandibular complete dentures since 08 years and all along pursued singing as his hobby. Intraoral examination revealed ill-fitting dentures and marked alteration in speech following the surgery. Mouth opening was restricted to 32 mm in the anterior region and the tongue movements were restricted. After a thorough evaluation, a decision was made to fabricate conventional maxillary and mandibular complete dentures with reinforced heat cure polymethyl methacrylate resin. The palatal surface of the maxillary denture was to be customized using a Palatogram.

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Impressions were made using putty and wash formulations of addition silicon impression material (Panasil). Permanent denture bases were fabricated using reinforced heat cure polymethyl methacrylate denture base acrylic resin. The denture base was evaluated for retention and stability, followed by face bow transfer and jaw relation recording. Teeth were arranged on occlusal rims after which anterior and posterior trial insertions were done separately.

Phonetics was evaluated at this stage with both the trial dentures in the mouth. The teeth were rearranged to ensure unhindered movement of the tongue. The patient was made to read out sentences that simulated specific sounds (Table 1) and these were recorded by a digital audio–video recorder.

Recording of speech using Palatogram:⁶

It was observed that the tongue came in contact with the palate while producing palatolingual consonants such as s, t, d, n and l. Hence, these were repeated and assessed for proper pronunciation.

While the mandibular denture remained in the mouth, a thin layer of eugenol free zinc oxide impression material (Pulpdent corporation, USA) was applied on the palatal aspect of the maxillary denture base that was in contact with the patient's tongue. When the initial setting of the paste began, the denture was inserted into the patient's mouth. He was then guided to read out aloud the sentences as listed in Table 1, in a deliberate manner. When the material was seen to be completely set, the maxillary denture was removed. The surface of the material on the palatal surface of the denture was checked visually for uniform contact (Fig. 1). Areas where the denture base was exposed were trimmed using a fine carbide bur. The paste then was completely removed from the maxillary denture and was reapplied as described previously. The same procedure was repeated for all the sounds mentioned until proper phonation was achieved. The final assessment was made by making the patient to read out all the sentences in the presence of a neutral observer. The resultant Palatogram recording of the customized palatal surface ensured a uniformly thin layer of material (Fig. 2). The excess material extending over the tooth surface was removed. The denture bases were then waxed up, flaked and processed. The prosthesis was polished in a manner that ensured minimal alteration on the palatal aspect. The final prosthesis (Fig. 3) was inserted into the patient's mouth and the speech once again recorded using a digital audio–video

Fig. 1 – Intraoral view showing partial glossectomy.

recorder. The patient was seen to be comfortable with this treatment (Figs. 3 and 4).

The patient was reviewed after five months. His speech was clear and he had since resumed his hobby of singing.

Discussion

- Vowels are voiced sounds wherein the vocal cords are activated by vibration. There is free emission of speech sounds through the mouth and require only subglottic pressure for specific sounds (a, e, i, o and u).
- Consonants are produced as a result of the air stream being impeded, diverted, or interrupted before it is released. p, g, m, b, s, t, r, and z are consonants. Plosive consonants such as p and t are produced when an overpressure of air has been built up by contact between soft palate and the pharyngeal wall and released in an

Fig. 2 – Denture base with impression paste.

Table 1 – Sentence simulating specific sounds.

Sentence	Sound
Chennai to Chandigarh	Ch
January and June	J
Shoe is shining	Sh
Zebra in the zoo	Z
Tomorrow is Tuesday	T
Eddy brought a Teddy	D
Nineteen ninety nine	N
Sixty six	S

Fig. 3 – Final surface after a Palatogram.

explosive way. On the other hand, fricatives such as s and z, also called as sibilants, are characterized by their sharp and whistling sound quality created when air is squeezed through the nearly obstructed oral cavity. Affricative consonants are a mix between plosive and fricative ones. Nasal consonants like m, n and g are produced due to oral exit of air (Table 2).

Production of sounds and the role of teeth and other oral structures:⁶

Prosthetic considerations for speech

It usually takes 2–4 weeks before a patient is able to adapt his speech to new complete dentures.⁷

The adoption of certain guidelines during the fabrication of dentures would go a long way in achieving clarity of speech.^{8–18}

Fig. 4 – Denture with customized palatal contour.

Table 2 – Anatomic sound formation.

s	Tip of tongue behind the maxillary incisors and sides in contact with posteriors
t,d,n,l	Tongue against the hard palate
th	Tip of the tongue between maxillary and mandibular incisal edges
f,v	Lower lip contacting the incisal edges of maxillary incisors
b,p,m	Between the lips

- The bilabials like 'm' help in determining the vertical dimension. When saying 'm', there is a passive contact between the upper and lower lip. A strained appearance during lip contact indicates premature occluding of the rims due to increased vertical height.
- Labiodental sounds like f and v are helpful in determining the antero-posterior position of upper incisors and occlusal plane.
- The thickness of the denture base is an important determinant of phonetics. A thick denture base reduces the space available for the tongue and also the oral air volume. If the post dam area is thick it is likely to irritate the dorsum of the tongue, impeding speech and possibly produce a feeling of nausea. Denture may even be unseated while speaking.
- If the lingual flange of lower denture is too thick in the anterior region, it will encroach on the space needed by the tongue and this may result in altered production of 's' sound.
- Arrangement of mandibular anterior teeth too far lingually forces the tongue to arch itself up to a higher position constricting the airway. Beside the syllable 't' would sound like 'd'.
- Narrow arches resulting from incorrect teeth arrangement tend to cramp tongue movements. The articulation of consonants like t, d, n and s are adversely affected by this. It is recommended that artificial teeth be placed in the same position as occupied by the natural teeth with the lingual flange allowing ample tongue space.
- When a long time denture wearer begins to wear a new set of dentures, duplication of the arch form of the previous prosthesis ensures early adaptation of the new prosthesis and the ability to speak clearly.

Role of tongue in phonetics

- To describe its role in speech, the dorsum of the tongue is divided into a posterior portion, which approximates the soft palate, and an anterior portion, which approximates the hard palate, and the lateral sides are referred to as the tongue blade and the apex called the tongue tip.
- While pronouncing the syllable 'a', the dorsum of the tongue is arched and its lateral borders contact the alveolar ridge. The tip of the tongue rests behind the lower incisors. The tongue position while saying 'e' is essentially the same, except the dorsum is arched higher, there is more contact with the alveolar ridge and the tip raised slightly. To pronounce syllable 'i', the tongue is pulled back with the dorsum flattened at the beginning to the sound, but raised to the 'e' position for completion. To pronounce 'u', the

tongue first assumes the 'e' position then falls back with the dorsum flattened for the second part of the sound. For syllable 'o', the tongue is in a flat and lower position with no palatal contact. The tongue is also the principal articulator for consonantal speech and contacts some portions of the hard palate while pronouncing them.

Speech defects

Irregularity, disruption or reduction in controls of the physiologic process leads to speech defects. The disturbances may be transient such as those due to emotional reactions or they may persist as in problems resulting from age, respiratory problems or neurologic impairment. Congenital defects and acquired disease or injury may produce malfunction of the structures which results in resonance of speech. During prosthetic rehabilitation of patients, it is necessary to achieve adequate balance of oronasal sounds. Defects in these structures determine the degree of nasality.

Conclusion

Speech is a dynamic process and its adequate restoration is one of the principal goals of prosthetic rehabilitation in which a Prosthodontist has a greater role. It is crucial to differentiate defects that are denture related from those caused by coexistent conditions. Appropriate measures are to be adopted during fabrication of oral prosthesis to ensure that functions of esthetics, mastication and speech are of optimum quality.

Conflicts of interest

All authors have none to declare.

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