

PROSTHETIC MANAGEMENT OF DYSPHONIA IN PALATAL DEFECT-A REVIEW

By

* Dr. Joju K.J.

** Dr. K. Chandrasekharan Nair

*** Dr. K.N. Velayudhan Nair

**** Dr. Mahesh Verma

INTRODUCTION

Palatal defects cause difficulty in phonation, deglutition and mastication. Rehabilitation with an obturator can often solve the problem of deglutition and mastication. But dysphonia needs an accurate evaluation, therapy and follow up, since these patients develop defective sound production and even 'correct defective' sound production.

Management is made easier by classifying the palatal defects. Among the numerous classifications available, one made by Veau is the simplest.

1. Classification of Cleft palate by Veau¹

Class-I : Which involves only the soft palate.

Class-II : Which involves the soft and hard palate but not the alveolus.

Class-III : Which involves the soft and hard palate continuing through the alveolus on one side of the premaxillary area.

Class-IV : Which involves soft and hard palates and cleft continuing through the alveolus on both sides leaving a free maxilla.

2. Anatomy of sound production³

Albery, Pigott and Hathorn proposed that sounds are initially produced in the larynx by the co-ordinated movements of Abdominal, thoracic and Laryngeal muscles. Subsequent modifications of laryngeal sound to produce meaningful speech occurs principally within the pharyngeal, oral and nasal cavities.

According to Fredricle Darley-Respiration provides the raw material for speech. Speech is the alteration of inspiratory- expiratory cycle, with prolonged expiratory, portion by a series of musculoskeletal valves. The learned noises that surrounds a person which he associates with sensations, perceptions, concepts, feelings, desires and emotions translates them into words.

Phonation:- The breath stream sets into vibration by the approximated vocal folds of the larynx.

Articulation refers to a mechanism where by the laryngeal sound is modified within the resonating chambers by the activity of organs such as lips, tongue, teeth and soft palate to produce speech.

Resonance:- is the selective amplification of the voiced tone. The pharynx, oral cavity and nasal cavity serve as resonators.

Resonators are those air filled spaces situated above and below the vocal cords to which sound waves have access. By the process of resonance of sympathetic vibration, the resonators act as acoustic filters amplifying selected frequencies and attenuating others, thus enhancing and modifying the basic sound produced by the larynx.

3. Type of Sounds³

i) Vowels:

These are open voiced sounds, i.e., sounds involving vibration of vocal folds and relatively unimpeded by the oral valves in their egress. A,E,I,O,U, and sometimes Y

ii) Diphthongs:

These are blend of two vowels spoken within a single syllable without interruption of phonation. ai, ou

iii) Consonants: are phonemes.

Characterised by impedance of breath stream and used adjacent to vowels and diphthongs to build syllables.

iv) Combination:

A blend of a consonant and a vowel, articulate in quick succession, that are identified as a single phoneme.

* Post graduate student

** Associate Professor

*** Professor-Dept. of Prosthodontics-Dental College, Thiruvananthapuram.

**** Associate Professor, Maulana Azad Medical College, New Delhi.

4. Classification of manner of production of sound

- i. **Nasals:-** eg: /ing/ /m/, /n/
- ii. **Plosives:-** /p/ /b/ /t/ /d/
- iii. **Fricatives:-** /f/ /v/ /φ/ as in think
/z/ as in zoos

Sibilants are any 'S' like sounds of fricatives, misarticulation of sibilants called as lisping or sigmatism.

iv. **Affricatives:-**

Combination of two consonants produced in quick succession, without interruption of breath stream.

/tʃ/ as in church

/dʒ/ as in judge

v. **Glides:-**

/hw/ as in way - involve relatively little glide.

/j/ as in yes - impede of air stream.

vi. **Semivowels:-**

/r/ red - least impede of

/l/ lull breath stream of all

Cleft palate is a structural defect that affects the articulators and the mechanism for controlling oronasal resonance. Speech production and voice are of prime concern. Of these, speech production is more important. Palatography is the technique for studying tongue contact with palate. Other methods used to study tongue contacts include, Cine fluorography and sound spectrograph.

The speech pathology associated with cleft palate include:

- (a) **APHASIA:-** Impairment of language processing. This can be due to cleft lip, cleft in the soft palate. Cleft in hard palate need not give rise to Aphasia, since compensating mechanism by tongue, closing up the defect is seen.
- (b) **DYSPHONIA:-** All types of impairment of phonation both organic and non-organic.
- (c) **DYSLABIA:-** An articulatory problem without apparent neurological basis.

5. **Assessment of Cleft Palate**

According to Curtis Weiss, Mary Gordon and Herold S. Lilly White, the following defects in speech should be noted to understand the underlying type of speech defects, its physiologic alteration etc.

They are:

- (1) Determine the adequacy of pressure consonants. This is by listening carefully the affricates, fricatives and plosives-which come under pressure consonants.
- (2) Test⁴ articulation in contextual speech, place and manner of articulation, by "Iowa pressure articulation test and Bzoch Error pattern diagnostic test.

Characteristics of the test include:-

- a. Test must contain fair number of pressure consonants. Building up and release of oral air pressure is possible only if the palate serves properly as a partition between oral and nasal cavities. Nor a palate can serve as a partition when velopharyngeal opening cannot be closed during speech even though anteriorly the structure is intact. Performance of this test provides information about the degree, to which partitioning is effective during speech. If partitioning is not effective during speech even with intact palate, the likelihood is that the problem with the velopharyngeal mechanism.
- b. Test must contain fair number of fricatives and affricates that are sibilants because these sounds get distorted in articulation when there is dental malocclusion, or tongue tip placement factors or both.
- c. Test must contain fair number of glides, even though glides are unassociated with structural defects but still cleft palate children have more trouble with glides than normal children.
- d. Test must contain fair number of nasals to determine whether the velopharyngeal opening can be properly opened. If not, nasal can be heard as plosives and speech regarded as denasal or hyponasals. This is the findings in the presence of enlarged adenoids or a wide pharyngeal flap. Hence one has to check for nasal passage clearance.
- e. Test must be long enough to contain a sufficient number of these items to reflect, short enough to hold every one's attention and economically realistic.

Importance of error type is that it distinguishes the error pattern in the sound production, nasalised or velopharyngeal function. Errors that are nasalised raise questions about velopharyngeal function. Errors that are oral indicate the defects in articulation. Facial movement also must be observed.

(3) Assess adequacy of velopharyngeal mechanism by asking the patient to pronounce nasals. If velopharyngeal closing is not proper nasals can be heard as plosives. Defects in velopharyngeal function causes unusual facial movement during pronunciation of pressure consonants. They include movements of nares, mid face or even brow, because the patient attempt to prevent nasal emission of air at the level of nares that cannot be prevented by the velopharyngeal mechanism.

(4) Look for fistula

(5) Check for hypernasality, hyponasality, mixed nasality, Cul de sac resonance and nasal air flow.

Defective nasal twang is due to the incompetent velopharyngeal function. This is mostly evident when fricatives are pronounced. Incomplete closure carries hypernasality, nasal air emission and articulation errors. Voiced sounds like /b/ /d/ etc are produced by adduction and vibration of vocal folds during exhalation of air sending air waves into pharynx and oral cavity to be shaped by the tongue and lips. Voiceless sounds /p/ /t/ etc are produced when vocal folds abduct as air stream passes through larynx.

^{5,6} Methods of assessing includes listener judgments of resonance, nasal air emission, articulation, intelligibility and acceptability. Mirror test indicates presence of nasal air emission during speech. ⁷Tonar system developed by Fletcher measures the resonant frequency of oral and nasal chambers during speech. Accelerometer measures vibrations on the surface of the nose also correlates with the rating of hypernasality.

(6) Assess velopharyngeal co-ordination in contextual speech.

This is done by comparison between performance on word articulation test and performance during connected speech.

(7) Determine if aspiration is sufficient for consonants.

(8) Assess tongue physiology and substitutions particularly blade for tip substitutions and back of mouth for front of mouth substitutions.

(9) Determine overall intelligibility.

(10) Test hearing.

6. Definitive management of palatal defect.

A defect in the hard palate only the usual problem that can be seen is that the patient will be unable to pronounce the pressure consonants. If the defects is involving the Alveolus, the linguadental consonants.

eg: (θ) as in Think

(0) as in These

Lingua-alveolar consonants /t/, /d/, fricatives /s/, /z/

Affricatives /tʃ/ - Church /dʒ/ Judge found to be defective.

Impression is made in these cases using stock metal tray and alginate. Before the impression is made, make sure the defect is closed using gauze pack. This prevents alginate from getting locked inside the defect. Stone plaster is poured and cast is made. After blocking out the under cut, wax spacer of 2 mm placed over the cast and Acrylic resin special tray is made, with stops. Using low fusing impression compound the defect is recorded and over which a wash rubber base impression is made; and stone cast made.

An obturator is made in self cure acrylic resin, and delivered.

Many a times the patient would have got adapted with the defect and could speak and lingua alveolar and linguadental consonants. These correct, 'defective sound' is produced by unaspirated or minimally aspirated fricatives, plosives by glottal and pharyngeal substitution.

The faulty tongue position, and 'correct defective' sound production can be identified by

- Close observation of the manner of sound production, cine fluorography and palatography.

This is treated by

1. Explaining the patient, the correct type of tongue position during each syllable by diagrams.
2. Using a small metallic wire loop at the anterior part of the palatal plate. This helps to remind the patient by the temperature difference alone and alter the tongue position.

7. Management of the defect in soft and hard palate^{8,9}

Defects at the hard and soft palate, occur alone or in combination. This can occur prenatally due to cleft of palate, short soft palate, abnormal nasopharyngeal size etc. Post-natally, abnormal palatopharyngeal neuromuscular development, partial or total paralysis of soft palate as a result of central nervous system or peripheral nervous system damage including myasthenia gravis, bulbar poliomyelitis, traumatic brain injuries cardiovascular accidents etc.

Speech characteristics of palatopharyngeal incompetency and palatopharyngeal insufficiency are:

- hypernasality
- nasal emission
- Decreased intelligibility of speech due to weak consonant production.

Patient can develop glottal stop to compensate for lack of production pressure consonants. Patients with paralysis develop abnormal speech articulatory patterns and diminution of breath pressure causing a reduction of oral pressure and air flow.

To achieve acceptable speech⁸ Mazaheri M and Mazheri E.H. proposed.

- Speech and myofunctional therapy with lip, tongue and palate exercise for stimulation. Physical therapy of musculature for reduction of hypernasality.
- Surgical procedures to reduce palatopharyngeal gap.
- Faradization and electrical massage to stimulate palatal function.
- Prosthetic elevation and stimulation of soft palate for patients with palatopharyngeal incompetency and obturation of palatopharyngeal lumen for patients with velopharyngeal insufficiency.
- A combination of surgery and prosthesis.

8. Methods of Assessing

- (1) Speech testing procedures- by listener judgements of resonance.
- (2) Radiographic evaluation such as Cine Radiography, Cephalometrics, Sectional Laminography or Tomography.
- (3) Devices for assessing oral nasal air pressure and air flow. Accelerometer measures the vibration on the surface of the nose and correlates with rating of hypernasality.
- (4) Electric instrumentation such as tonar⁷ and sonography.
- (5) Mirror test indicates the pressure of nasal air emission during speech⁶.

9. Criteria for patient selection

- (1) Perceived speech differences that can be attributed to

symptoms of velopharyngeal incompetence and that are identified as a problem.

- (2) Velopharyngeal incompetence that is not phoneme specific nor patient stimuable.
- (3) Patient with mental capacity.
- (4) Patient or parent who prefer non surgical treatment.
- (5) There are no blockage in air way through nose.
- (6) Patient or parent who are committed to its implementation.
- (7) Patient or parent who can maintain good oral hygiene and keep appliance clean.
- (8) Patients who are able to co-operate for treatment.

For treatment of patients with palato pharyngeal inadequacy, palatal lift or a combination prosthesis used. Palatal lift used to elevate soft palate to its maximal position during normal speech and deglutition. Palatal lift prosthesis reduces the size of palatopharyngeal lumen, thereby decreasing nasal air flow, increases oral pressure for consonant articulation and improve voice quality. It also stimulates soft palate, muscles and Eliminate Palate disuse atrophy. (Fig. 1)

Combined prosthesis is preferable if soft palate is insufficient to achieve proper palatopharyngeal closure. Prosthesis will elevate soft palate, obturate palatopharyngeal gap and stimulate palatopharyngeal activity and pharyngeal muscle contraction. (Fig. 2).

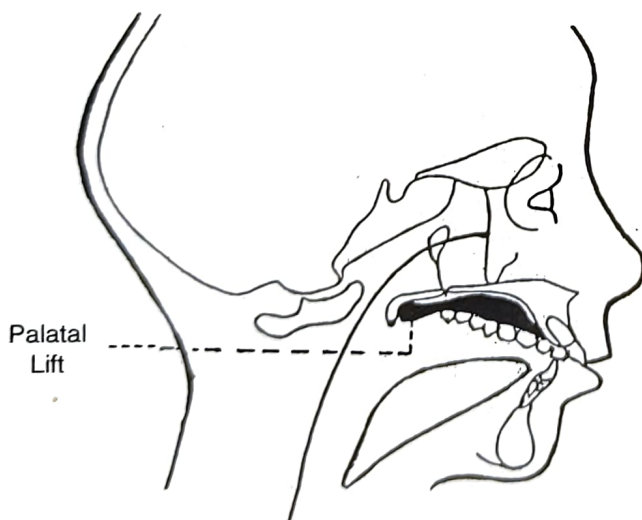


Fig. 1 Palatal Lift prosthesis with elevated soft palate

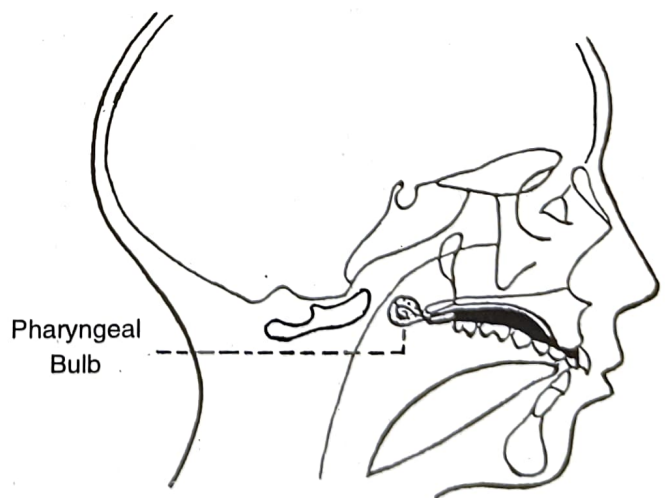


Fig. 2 Combination prosthesis Pharyngeal bulb & palatal lift prosthesis

10. Objectives in making a palatal lift and combination prosthesis.

1. Reduce hypernasality and escape of nasal air by palatal elevation.
2. To reduce the degree of palatal disuse atrophy.
3. To increase palatopharyngeal function by constant and continuous stimulation.
4. To increase neuromuscular response by gentle stimulation and speech exercise.
5. To assist in repositioning of tongue.

11. Pre requisities of the palatal lift combination prosthesis

1. Maximal portion designed to achieve optimal retention.
2. Lift portion of the prosthesis should be placed so that palatal elevation occur in the area where normal palatopharyngeal closure occurs.
3. Elevation of soft palate should be gradual so that soft palate becomes less resistant to displacement.
4. Pharyngeal section should be placed in the region where constriction of the posteropharyngeal wall takes place to, encourage muscle stimulation and activity.
5. Reduction of pharyngeal section should be gradual.
6. Speech therapy including lip, tongue and palatal exercise and placement should be instituted in conjunction with the construction and insertion of prosthesis.

²Treatment by therapeutic exercise considerably increased by velopharyngeal function. Exercise done is swallowing movement for 20 mts. continuous, for three times daily for 27 days.

12. Steps in making a pharyngeal, lift prosthesis

1. Patient positioned with the maxillary occlusal plane made 45° to the floor anteriorly.
2. Perforated stock metal tray is selected and impression made after blocking the defect with wet gauze.
3. Stone plaster poured into the impression and a acrylic special tray made with spacer and occlusal stop.
Using an 18 gauge stainless steel wire, loop is made and attached to that part of the tray near the defect.
4. In an edentulous arch, peripheral sealing done and using low fusing impression compound the defect is also recorded. The functional movements include swallowing rotating the head to either side after head tilted 30° down the frankforts horizontal plane, stretch-

ing the head fully backwards and forwards after making the patient to stand up. These helps to mould the low fusing compound correctly.

5. Secondary wash impression made using rubber base impression material-RTV silicone.
6. Stone plaster mould poured and acrylic plate made with the obturator.
7. Palatal lift prosthesis with correct extension delivered. The posterior part is extended in increments after adding the material in increments, in subsequent recall appointments.
This is maintained until patient regains sufficient control over velopharyngeal function.
8. Once the patient had achieved adequate control, the palatal extension can be changed for an 18 gauge orthodontic wire contoured to shape.

13. Steps in making a pharyngeal bulb prosthesis (Combination Prosthesis)

1. As before, palatal plate made and bulb of acrylic added at the posterior end. The size of the bulb increased gradually to attain adequate closure.
2. Once the function is regained, in due course of time the size is decreased and at a later stage the bulb is removed.

14. Muscle exercise advisable²

1. Such a glass of water using straw.
2. Try to build up pressure in the oral cavity and slowly forcefully blow it out.
3. Try to blow a balloon.

15. Conclusion

Increased incidence of carcinoma of maxillary sinus and associated parts of palate have increased the chances for palatal defect along with congenital defects. To enhance, speech and thereby the mental status of the patient and relatives, palatal prosthesis is of considerable help.

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