

# SPEECH DISORDER IN PATIENTS WITH NASAL DEFECTS

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**Abstract—** Normal speech might seem effortless, but it is actually a complex process that requires precise timing, nerve, and muscle control. When we speak, we must coordinate many muscles from various body parts and systems, including the larynx, which contains the vocal cords; the teeth, lips, tongue, and mouth; and the respiratory system. The ability to understand language and produce speech is coordinated by the brain.

Some people with speech problems, particularly articulation disorders, may have hearing problems. Even mild hearing loss may have an impact on how a person reproduces the sounds they hear. Disorders of speech are associated with many things but the concern in this research is with the nasal defect only. It is proposed first to consider the essential differences between normal and nasal speech, showing the causes, to discuss physiological mechanisms, and finally to consider surgical therapy in the light of these findings.

**Index terms-** speech disorder, hypo nasal speech, nasal emission, cleft palate, velopharyngeal dysfunction.

## I. INTRODUCTION

Specialized physicians are often not fully aware of the differences due to the several types of nasal speech which are not easily diagnosed. Increased nasal resonance leads to open nasality (hyper nasal speech), affecting all oral speech sounds that should not be nasal. Organic causes impair the accuracy of palatal occlusion during emission of the non-nasal sounds. Among these are paralyses, congenital malformation, injury, or defects of the palate. The functional causes of palatal sluggishness include imitation, faulty speech habits, dialectal influences, hearing loss, mental retardation, or psychiatric disorders.

Decreased nasal resonance produces closed nasality (hypo nasal speech), which muffles the three nasal resonant (m, n, and ng). The best known organic causes are an acute cold, hay fever, large adenoids, and all other nasal diseases that obstruct the airway. Functional causes are less frequent, in the form of a rare, faulty speech habit; occasionally the problem comes from mental retardation or from severe language disability.

Mixed nasality poses a serious problem; it stems from the combination of one cause of open nasality with another of closed nasality (one may be of organic type and the other functional, or both may be organic). A typical combination is the open nasality from paralysis (paresis) of the palate (or its congenital deficiency) combined with closed nasality from obstruction of the nasopharynx by adenoids. The resulting mixed nasality causes the nasal resonant to sound muffled and subdued, while careful testing reveals slight open nasality on all oral sounds.

Treatment of nasal speech is unlikely to be successful without prudent balancing of all factors involved. This responsibility rests primarily with the diagnosing otolaryngologist or pediatrician. The complaint of "talking through the nose" should never warrant a [tonsil](#) and [adenoid](#) operation without complete evaluation. If this were done in the example cited just above, removal of the obstructing adenoids would alleviate only the closed nasality, while making the open component more severe with marked deterioration of the patient's speech. This dilemma is often present when adenoids cause chronic middle-ear disease with hearing loss, while the palate is incompetent, as from a slight congenital malformation or paresis. In such case, the patient's general health and his hearing must be weighed against the possibility of making his speech worse.

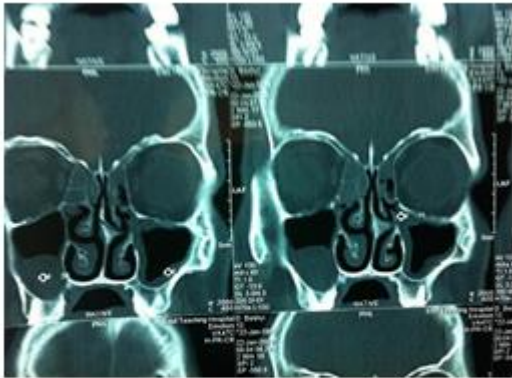
## II. THE DIFFERENCE BETWEEN NORMAL AND NASAL SPEECH

Phonemes are the fixed sounds assorted when we have normal speech, some of which are differentiated by the larynx into voiced and unvoiced elements, according to the presence or absence of the laryngeal vibration. If the flow of expired air passes freely across the resonators of the oropharynx and mouth, the sounds which are formed are called vowels. On the other hand, if the flow of laryngeal air is impeded or checked in any part of the buckle cavity, the sounds thus made are known as consonants.

In English language only three consonants M (m) and N (n) and (ng) (the sound "NG") are made with a nasal intonation by allowing some air to escape up behind the soft palate into the nose. All other sounds demand that the nose should be shut off from the mouth during their production. This simplified

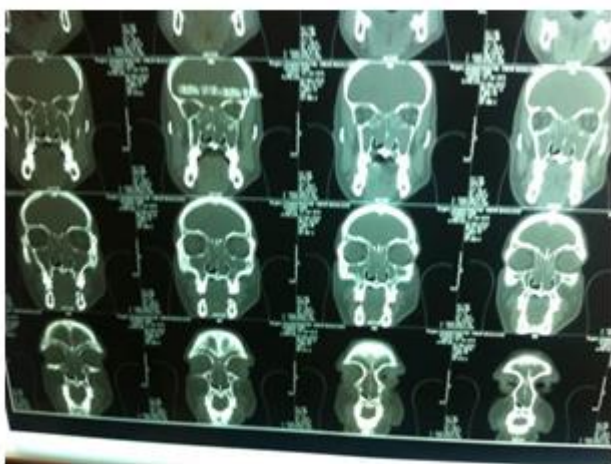
phonetic description will serve as an introduction to the subject, so let us now consider what happens to the individual who is unable to close off his nose from his mouth. (Davenport & Hannahs, 2005)

There are many reasons for the production of nasal sounds (which are not nasal) some of these reasons are due to the defects and obstacles because of physical and psychological aspects.



Septal deviation, Allergic rhinitis, sinusitis

An enlarged adenoid may cause childhood nasal obstruction due to blockage of posterior choanae. This may give the voice a nasal quality, induce mouth-breathing and interfere with eating. The child tends to have a runny nose since the normal nasal secretions are sufficiently cleared from the nose.



Nasal polyps

If the adenoid becomes infected, the anterior rhinorrhoea may become profuse and offensive. Children with enlarged adenoids often snore; in combination with big tonsils, the adenoid may sufficiently narrow the upper airways to cause obstructive sleep apnoea. (Corbridge, p.28, 2011)



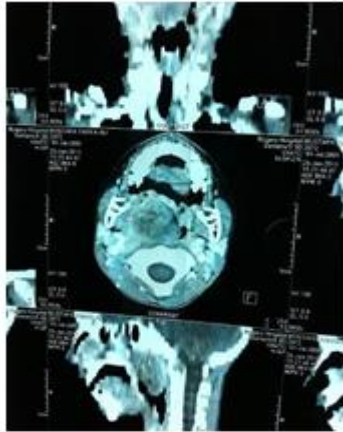
Adenoid hypertrophy

Rhabdomyosarcoma (RMS) is the most common soft tissue tumour in children, with the head and neck region accounting for 35-40% of cases. Nasopharyngeal RMSs tend to grow rapidly and invade adjacent structures (Healy JN1, Borg MF, p, 2010). On the other hand children with nasopharyngeal rhabdomyosarcoma may present with nasal obstruction, rhinorrhea and symptoms secondary to Eustachian tube obstruction (Allen M. Seiden, Thomas A. Tami Thieme, page 228, 2011)



Tumor (Rhabdomyosarcoma)

Chordoma is a relatively rare tumor of the skull base and sacrum thought to originate from embryonic remnants of the notochord. Anterior extension of Chordoma can obstruct the airway causing dyspnea or the velopharynx causing hyponasal speech. (Griffith R. Harsh, Ivo P. Janecka Thieme, page 146, 2011)



Tumor (chordoma)

The effects on speech of an incompetent mechanism for closure of the nasopharynx may be listed briefly into primary faults and secondary faults. The primary (i.e. dependent essentially on an incompetent nasopharyngeal mechanism) is:

- (1) Weak pressure for all vowels and consonants.
- (2) Lack of clarity of articulation-i.e. a lack of crispness.
- (3) Lack of adequate voice projection.
- (4) Nasal escape of air, and frequently a nasal breathe sound or whistle when the nasal septum is deflected.
- (5) Excessive nasal resonance.

The secondary (as a result of certain adjustments to the disability) faults are:

- (1) Glottal stop sounds are substituted for P, T, K, B, D, and G, because the necessary air pressure for the production of these plosive sounds cannot be built up or maintained in the mouth. The sound is therefore made further back, in the larynx.
- (2) Pharyngeal fricative sounds replace the consonants S, Z, Sh, Zh, and sometimes Ch and J, for similar reasons.
- (3) Articulatory insufficiency; by that I (it) mean a type of articulation due to insufficient use of the tongue, lips and jaws.
- (4) Unintelligible vocalisation, such as a snort.
- (5) Harshness of voice due to attempts to overcome the effects of excessive nasal resonance.
- (6) Nasal grimace.
- (7) Breathlessness during conversation.



(Patient with complete cleft palate)

When most of these faults are present that person is said to have cleft palate speech. This term is not a good one, for, as will be shown later, this type of speech may occur in a person who has no cleft palate and who indeed may have a normal palate. In using this term one may be manoeuvred into the foolish position of having to say that a patient has "cleft palate speech without cleft palate". (Davenport & Hannahs, 2005).



(Two patients have complete cleft palate)

For the purpose of studying its effect on speech, nasal escape may be produced experimentally by passing a firm rubber tube down one nostril into the pharynx. In this way the resultant disability from an air-leak may be observed by the volunteer and listener alike. It may also be studied in children and adults with congenital cleft palate or other defects of the palato-pharyngeal mechanism. Nasal escape may be present from the beginning, so that the development of normal speech is prevented. In such cases severe disturbances of articulation are commonly found. Nasal escape may also occur after the development of normal speech. If the onset is gradual the effect on articulation is minimal: there may be some lack of clarity and poor voice projection and tone, but little disturbance of the vowels and consonants. Such an event may occur in the normal and in cleft palate patients in adolescence. When, however, the onset of nasal escape has been sudden, such as may occur after the surgical removal of adenoid tissue, more severe disturbances in speech associated with considerable emotional upsets are encountered. (Davenport & Hannahs, 2005).



(Patient with complete cleft palate)



### III. NASAL SOUNDING SPEECH

There are a variety of reasons for nasal sounding speech. Hyponasal speech is when there is an abnormally reduced nasal airflow during speech often in a setting of nasal obstruction or congestion. Hypernasal speech is when there is the presence of an abnormally increased nasal airflow during speech. Examination is by nasal endoscopy. Children older than 5 years old generally tolerate the exam well enough to follow verbal commands. This is one of the reasons for choosing the patients under this range of age. Treatment of nasal speech depends on the cause and may include surgery and/or speech therapy. It is worth mentioning that nasal voice is an incorrect term as the voice itself is normal. It is the speech quality which is affected. The following are some examples of the cases causing non nasal sounds to be nasal:

1. Velopharyngeal Closure: the lumpy mass coming down from the ceiling on exam, the palate does not move in coordination with speech. However, at other times, it does move properly. With good speech therapy, this should improve over time.

2. Velopharyngeal Insufficiency: one can see air bubbles where air is escaping between the soft palate and back wall of the nasopharynx (throat). This case is different from example 1 as in this case; it never makes a tight seal. Surgical correction is by bulking up the posterior wall by injection **nasopharyngoplasty** (pharyngoplasty) until a tight seal occurred.



(Patient with velopharyngeal insufficiency having short and submucosal palate)

3. After Cleft Palate Repair with Small Central Velopharyngeal Insufficiency: there is nasal sounding speech (hypernasal), especially with plosives /p/, /b/ (pah, bah) and the sibilant 'sh'. The air escape demonstrated by bubbles. Also, the palate never really makes a tight seal with the back wall centrally known as velopharyngeal insufficiency. However, there is a lateral squeeze present. Surgical procedures to correct this velopharyngeal insufficiency focus on closing this central gap without affecting the lateral aspects. Such procedures include posterior pharyngeal flap (see example 6 below) or posterior pharyngoplasty (injection or graft). In this patient, the tonsils and adenoids aid in speech and removal may result in worsening of speech quality. This small opening can be easily resolved by injection nasopharyngoplasty.



(A: Cleft palate, preoperative. B: Closure of cleft palate)

4. After Cleft Palate Repair with Large Central Velopharyngeal Insufficiency: compared to the prior example, this patient is also after cleft palate repair has nasal speech due to a very large central velopharyngeal insufficiency. There is some degree of palate elevation as well as lateral squeeze, but not enough to provide complete closure which is always present. In the distance, you can see the child's epiglottis.

5. Right Lateral Velopharyngeal Insufficiency; the prior examples (3, 4) were due to central velopharyngeal insufficiency. However, lateral velopharyngeal insufficiency also exists, but is rarer. Here is a patient without any history of cleft palate who has a small insufficiency on the right side. There are bubbles that emanate from small opening and tight closure where. It seems that the patient had a temporary soft palate paralysis that resolved spontaneously along with resolution of the velopharyngeal insufficiency after around one month.

6. Resolved Central Velopharyngeal Insufficiency after Pharyngeal Flap Surgery: this is an adult patient underwent velopharyngeal insufficiency after cleft palate repair as a child. There is a bridge of mucosa from the soft palate to the posterior wall which is the flap. When relaxed, there is an opening on either of the flap which is called 'lateral ports' to allow for nasal breathing. When talking, the lateral ports close to prevent air escape. The risks with the procedure include creating too small a flap which would result in persistent hyper-nasal speech (see next example) or too large a flap which would result in nasal obstruction and a hypo-nasal speech. A plastic surgery will solve this problem; through creating the perfect sized flap that is not too large or too small as in this case.

7. Un-resolved Velopharyngeal Insufficiency after Pharyngeal Flap Surgery and Obturator use: in this case the patient is adult underwent pharyngeal flap surgery to correct a central velopharyngeal insufficiency after cleft palate repair. Unlike the prior example where there was complete closure of the lateral ports with phonation, this unfortunate patient has a small VPI on both, **this unfortunate patient has a small VPI on both** sides. In order to resolve this VPI, the patient used an obturator in order to completely close the lateral ports thereby eliminating his hypernasal speech. However, use of an obturator resulted in near-complete nasal obstruction.

8. Failed Pharyngeal Flap Surgery with Persistent Left VPI: this patient underwent pharyngeal flap surgery to correct a velopharyngeal insufficiency after cleft palate repair several years prior. Nevertheless, unlike the previous example (6) which is a perfect outcome, there is a persistent large opening

on the left side resulting left velopharyngeal insufficiency causing hypernasal speech. Also, the pharyngeal flap is shifted right of midline instead of being perfectly in the middle. This patient's pharyngeal flap failed in two aspects resulting in VPI. First, the flap was created right of midline resulting in no lateral port on the right and a very large left lateral port. Second, the flap was made too small so even if the flap was perfectly in the midline, most likely VPI would still have occurred.

9. Adenoid Hypertrophy: On exam, the nasal sounding speech (hyponasal) appeared and the patient also had fluid in the ears. Looking in the back of the nose, large adenoid tissue is seen which looks like a pink cauliflower growing down from the top. The adenoids are so large that they are obstructing the eustachian tube opening preventing adequate ventilation with the ear resulting in fluid build-up. The large adenoid is the cause of the nasal sounding speech. Treatment was adenoidectomy (adenoid removal).

10. Other common anatomic causes of hyponasal speech include deviated septum, turbinate hypertrophy, and allergies. Often these issues along with large adenoids cause a "snotty" nose in kids.

#### IV. CONCLUSION

Speech treatment is rarely done for hypernasality or generalized nasal emission because these characteristics suggest a structural defect or physiological disorder which requires surgical management. When these characteristics are noted, a referral should be made to a regional craniofacial or cleft palate team (even if there is no history of cleft) for further assessment and management. On the other hand, hyponasality and cul-de-sac resonance suggest obstruction in the vocal tract. When this is noted, a referral can be made to the local otolaryngologist.

Although intervention does not correct abnormal structure, it does correct abnormal function. Treatment is appropriate for those children who demonstrate phoneme-specific nasality or nasal emission due to faulty articulation, and those children who use compensatory articulation productions due to a history of velopharyngeal dysfunction. In addition, intervention is often necessary after surgical management of velopharyngeal dysfunction to help the child to learn to make the best use of the new structures.

The treatment for these types of cases is done through standard articulation therapy. Blowing and sucking exercises should never be used to improve velopharyngeal function. They are not effective because the physiology of these activities is different than that for speech.

Several simple treatment techniques are usually effective. If there is nasal emission on sibilants only, have the child produce

a /t/ sound with the teeth closed. Next, have the child prolong that sound. If the child has a normal velopharyngeal valve, this should result in a normal /s/ without nasal emission. This skill can then be transferred to the other sibilant sounds.

If the child co-articulates /ng/ for /l/ or /t/, or if the child has a high tongue position for vowels, it is often helpful to have the child co-articulate a yawn with the sounds. With a yawn, the back of the tongue goes down and the velum goes up.

If the child continues to demonstrate hypernasality or nasal emission after a few months of treatment, that child should be referred to a specialist for further assessment and consideration of physical management. No child should be kept in treatment and asked to perform a speech task that is physically impossible to do.

In summary, resonance disorders are commonly seen in pediatric settings, including the schools. A basic knowledge of this area is necessary for the SLP to know when to treat, how to treat, and when to refer.

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