Chapter 11: Disorders of speech

Debbie Sell

The aim of this chapter is to describe the range of paediatric speech disorders that may present to the otolaryngologist. It is hoped that by providing the otolaryngologist with insight into speech therapy, it will promote effective teamwork between the disciplines involved as emphasized by Bull and Cook (1976).

Speech is arguably the most interesting and certainly one of the most complex and highly skilled learned behaviours of which man is capable (Code and Ball, 1984).

Speech is viewed here as a generic term to cover the complex motor activity of the vocal tract in the production of spoken language. However, it is more than just motor activity. Speech is intimately involved with language, and is dependent on maturation and intelligence, and audiological, physiological, environmental and psychosocial factors.

The distinction between speech and language has been described elsewhere (Crystal, 1980). It is important to appreciate this dichotomy. It is also possible to view the relationship between language and speech as a hierarchy of interacting levels from semantic, syntactic (language) to phonetic (speech) with the phonological level acting as a bridge between the two (Lyons, 1968).

It can be appreciated therefore that a disorder of speech implies that the formulation of meaning is not affected, but the transmission of messages through the medium of sound is in some way impaired. The production of speech requires the controlled integration of the respiratory-phonatory, resonatory and articulatory musculature. These three muscular systems of the vocal tract are inextricably interwoven and interrelated, but for simplicity, each system will be discussed separately.

A disorder can occur in one or more systems. Alternatively a problem in just one system may be reflected in another system as a consequence of the development of compensatory gestures in the vocal tract. For this reason the aetiology of a speech disorder may not be easy to identify (Crystal, 1980).

In broad terms, the causes of speech disorders can be organic or functional, but are very often a combination of the two. Therefore, the severity of the speech disorder may not be directly related to the degree of organic involvement. Functional causes include faulty learning, habit, imitation, environmental or psychological factors.

Furthermore, in paediatrics, any communication disorder must be considered within the context of the normal processes and sequences of development generally. Therefore the speech disorder is evaluated taking into account the maturation of the relevant skills in the individual child, and with regard to the possibility of delay in this maturational process.

The speech therapist considers the whole range of communication abilities of the child referred with a speech disorder and not just his speech production. Where appropriate, the following may be investigated: feeding history, prelanguage skills, communicative
competence, play and non-verbal skills, the child's level of understanding, his use and content of language, stage of development in grammatical structures, and his attention and listening skills.

In considering appropriate intervention and management strategies, the speech therapist selects from a range of possibilities, including referral to other agencies, instigation of a therapy programme, and the possible prescription of alternative or augmentative communication systems.

This chapter, however, focuses on the classic area of speech disorders. Disorders of articulation, resonance and phonation-respiration are each considered. This is followed by a discussion of complex speech disorders found in association with hearing impairment, craniofacial abnormality, and long-term tracheostomy. Finally the disorder of stammering is covered (Table 11.1).

**Table 11.1 Classic areas of speech disorders**

<table>
<thead>
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<td></td>
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<td>Disorders of resonance:</td>
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<td></td>
<td>Hyponasality</td>
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<td></td>
<td>Mixed nasality</td>
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<tr>
<td>Disorders of phonation / resonance:</td>
<td>Organic</td>
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<td></td>
<td>Congenital, eg, structural abnormalities</td>
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<td>Functional / psychogenic, eg, vocal abuse and vocal nodules, mutational falsetto</td>
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<tr>
<td>Combined disorders of articulation,</td>
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<tr>
<td>resonance, phonation-respiration</td>
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Hearing impairment
Craniofacial abnormality
Long-term tracheostomy
Stammering

**Disorders of articulation**

An articulation disorder exists if there is a failure to communicate effectively using spoken language, resulting from abnormal pronunciation. It is intended for this discussion to focus on the impairment at the segmental level, that is individual phonemes or speech sounds. A discussion of the suprasegmental features of speech, including intonation, stress, rhythm and phrasing is considered below under hearing impairment.
The nature and severity of articulation disorders is highly variable, and ranges from complete unintelligibility to a mild error in speech, such as a difficulty with a particular sound or group of sounds, as with lisping or a ‘weak’ r. Aetiology of articulation disorders is often multifactorial.

Traditionally the phonetic aspect of an articulation problem was stressed but, with the recent contributions of linguistics, there have been considerable advances made in the understanding of articulation disorders such that it is now possible to view articulation as both physiological and linguistic in nature. It is therefore important to appreciate the complex relationship between phonetics and phonology, to understand fully the nature of speech disorders.

The phonetic aspect of articulation refers to the physical adjustments and movements of the speech articulators (lips, tongue, and palate being the primary articulators), in the modification of the air stream for the production of individual speech sounds. The phonological aspect refers to the way in which the sound system of a language is organized into a system of contrasts that has the role of distinguishing meanings in a language. For example, in the words - sea, key, bee, me - the initial sounds /s, k, b, m/ function contrastively with each other to distinguish the different word meanings. When the child is limited in his ability to signal these contrasts, he has a problem at the phonological level. It should be noted, however, that phonological disorders are not satisfactorily classified as disorders of articulation but for logistic reasons will be dealt with in this way.

Classification of articulation disorders

Two groups can be identified:

(1) phonetic disorders
(2) phonological disorders.

Phonetic disorders

A disorder leading to a speech disability at the phonetic level, involves an inability or difficulty in the physical production of speech. The phonological sound system may or may not be complete. There is some kind of physical distortion in sound production. A common example is the variation heard in the production of /l/ or /s/ speech sounds. A phonetic disorder is usually a result of an organic deficiency in the speech mechanism, such as a structural abnormality, sensory impairment, or impairment of neurophysiological functioning.

Two distinct types of phonetic disorders that are distinguished using a medical classification are articulatory dyspraxia and dysarthria.

Articulatory dyspraxia occurs when the child knows what he wishes to say but exhibits great difficulty in achieving the intended pronunciation. The controlled coordinated sequence of articulatory movements that is required, presents major difficulties. The child frequently has a generalized oral-motor problem that affects non-speech oral activities including feeding. There is no paralysis, and the disorder is distinguished by its variability so that a movement
that may be presenting difficulties on one occasion may be adequately performed at another time (Grunwell, 1982).

Dysarthria reflects a neuromuscular involvement of the articulators, characterized by muscular weakness and lack of muscular control. There is a disturbance in the execution of the motor patterns for speech and feeding, due to paralysis or incoordination of the speech musculature. This is often seen in children with cerebral palsy.

**Phonological disorders**

A disorder leading to a speech disability at the phonological level, involves the use of an abnormal, inadequate, or disorganized system of sound patterns. The child is usually able to make articulatory movements and most speech sounds can be easily elicited in isolation or non-meaningful speech. In other words the child is able to make all the sounds required, but has difficulty organizing these sounds into a system for signalling differences in meaning. For example, a common phonological problem is one where in speaking, the child only makes lingual sounds at one place in his mouth, despite the ability to produce a full range of tongue movements, and the individual speech sounds, in isolation. The usual wide range of tongue placements used in speech is reduced to one. Continuing the example above, if /s, k, t/ were all produced at the alveolar ridge as a /d/ sound, this would result in the words sea, key, tea all being produced dee. The child would thus have a severely reduced sound system. The cause of a phonological disability is not fully understood, but appears to be a neurolinguistic dysfunction at the phonological level of cortical representation, and organization of the language system (Grunwell, 1982).

Some patients have these disorders despite having normal hearing, with no detectable neurological, physiological or anatomical deficit. Comprehension of speech is normal, intelligence is within the average range, and often expressive language appears to be developing along normal lines, although this is difficult to assess as the children often have reduced intelligibility.

Although much remains unknown about these problems, several types of phonological disorders can be distinguished. Children with developmental phonological disorders may exhibit delayed or deviant pronunciation patterns. The delayed phonological pattern follows the normal sequence of development but is appropriate for a younger child. The deviant pattern is characterized by features not seen in normal phonological development.

It is possible to have either a phonetic or a phonological disorder, but the majority of articulation problems are a combination of the two.

**Aetiology of phonetic and phonological disorders**

Organic and functional factors may be identified as causes of articulation disorders, although very often the aetiology is unknown or a result of a combination of factors.
Organic causes

Structural deviations

Structural deviations of the oral cavity, such as malocclusion, abnormalities of dentition, microglossia or macroglossia, tongue tie, tongue thrust and repaired cleft palate, may or may not affect speech. A simple one-to-one relationship does not exist between structural deficits and defective speech characteristics. There is also much individual variation, as described below under craniofacial abnormality. Here, a discussion of two of the more common conditions follows.

Tongue thrust

Often tongue thrust may be seen in association with mouth breathing and enlarged tonsils, such that the latter may be an aetiological factor in the development of tongue thrust (Hanson, Barnard and Case, 1969). This may or may not be associated with an articulation problem, but when it is, may well present as an interdental /s/. The sounds /sz/ normally made at the alveolar ridge are produced with the tongue between the teeth resulting in the sound /th/.

Tongue tie or ankyloglossia

It is often thought that tongue tie may be the cause of speech difficulties. Research has failed to prove a positive relationship between tongue tie and speech disorders, or other oral motor dysfunction (Bloomer, 1971). In practice, it is seldom the case that a tongue tie is the cause of a speech difficulty. In a child presenting with tongue tie and a speech problem all the factors that may impinge on the speech disorder should be taken into account in assessing each child. A speech therapy assessment will determine the degree to which the tongue tie and the speech disorder are related.

If the child is able to protrude his tongue beyond his central incisors, or there is some evidence of the use of alveolar placements in his speech, such as the sounds /t, d, l, s/ it is unlikely that the tongue tie is significantly affecting his speech and its release is unnecessary (McEnery and Gaines, 1941). Speech therapy is recommended to establish a full sound system.

The situation may arise, however, when a child consistently fails to maintain the use of these sounds in conversation or alternatively it may not be possible to elicit alveolar sounds. This may occur where the child has additional problems. There then may be an argument for releasing the tongue tie, but this decision should be based on the speech therapist's assessment and knowledge of the child's progress in therapy.

Williams and Waldron (1985) described a method of clinical measurement in an attempt to obtain a more objective system for evaluating lingual function.

Hearing impairment

This is discussed more fully below.
Neuromotor pathology

This has been briefly discussed in the preceding section and further discussion is not pertinent to the concerns of this chapter. The reader is referred elsewhere for information on speech disorders associated with neurophysiological deficits (Darley, Aronson and Brown, 1975).

Functional causes

Research has been directed to the role of auditory perceptual skills as a causal factor, and although it has been found that a relationship does exist between speech sound discrimination and impaired phonology, the precise nature of this relationship is not fully understood (Winitz, 1969).

Research has failed to demonstrate a significant and consistent relationship between oral sensory function, or depressed oral motor skills, and speech disorders (Bernthal and Bankson, 1981). Acquisition of the adult sound system is positively related to maturation and problems in language acquisition, and later difficulties in reading and writing. Many diverse environmental influences, such as poor speech models, sibling status, lack of stimulation, inappropriate reinforcement, or the child's emotional reaction to the speech difficulty are often felt to be significant in the development and maintenance of a disorder. Such factors are not easily verified by research.

Assessment of articulation disorders

The speech therapist assesses the child's speech, using principles of phonetic and phonological analysis, and standardized test procedures that give quantitative and qualitative evaluations. In addition, the therapist fully assesses the speech mechanism and oral-motor skills, language, and other aspects of speech production. Referral for audiological assessment should be considered. The listening skills involving auditory memory, discrimination and sequencing are all evaluated, and may be a focus for remediation. It is then possible to differentiate between the different types of disorder, that is phonological, phonetic, or both. This information is added to that gained from the case history, and assessments of other aspects of the child's abilities and related behaviour.

Traditionally, an articulation disorder was assessed in terms of omissions, substitutions, or distortions of speech sounds. This is now regarded as an inadequate framework, in that it considers each mispronounced sound separately and not in relation to each other. Instead the aim of the phonological analysis is to compare patterns of contrast used in the child's system with those used in the adult system.

Management of articulation disorders

The focus of therapy in a phonological disorder is to facilitate change in the child's patterns, so that the child can be assisted to acquire the missing phonological contrasts together with the required motor movements to signal them. The focus of therapy in a phonetic disorder is directed at the mechanics of articulation often aimed towards developing compensatory movements.
Referral guidelines

The following are broad guidelines for referral:

1. the child who presents to the otolaryngologist with no words at 20-24 months
2. the child who is not speaking in phrases at 28 months
3. the child who is unintelligible at 3 years or above.

Early referral to the speech therapist is essential in the long-term management of the speech-impaired child (Byers Brown, 1981). Any suggestion of parental concern should be investigated thoroughly by a speech therapist.

Disorders of resonance

Normal resonance

Resonance is a complex attribute of speech that is not completely understood. It refers perceptually to the overall tone or timbre of the voice. In physical terms it may be defined as the vibratory response of a body or air-filled cavity to a frequency imposed upon it (Wood, 1971). The resonating cavities anatomically consist of the supraglottic larynx, the hypopharnyx, the oropharynx and nasopharynx, and the oral and nasal cavities.

Resonance depends primarily on the size and shape of the pharynx as altered by the pharyngeal muscles, and on the patency of the oral and nasal cavities. In the normal speaker there is a balance between nasal and oral resonance and in English the balance is primarily oral. Resonance is further influenced by the extrinsic laryngeal muscles, which affect not only the shape of the pharyngeal resonators, but also the mode of vocal fold vibration (MacCurtain and Fourcin, 1982). Movement of the articulators, especially the tongue, also affects resonance.

Almost all sounds in the English sound system are characterized by oral resonance. Plosives /p, b, t, d, k, g/, fricatives /s, z, f, v/, affricatives /ch, ge/, all require varying degrees of intraoral pressure, and are dependent on effective velopharyngeal closure for their adequate production. The only exceptions are the nasal continuants /m, n, ng/. These sounds are produced by the lowering of the velum, effectively coupling the nasal and oral resonators. A certain amount of nasal resonance may also be normally heard in vowels that occur adjacent to the nasal continuants. In other languages, different situations may be observed. In French, for example, oral vowels function contrastively with nasalized vowels to signal different word meanings.

Disordered resonance

Resonance is deviant when there is an imbalance in the overall harmonic spectrum of the voice leading to abnormal tone. This occurs when the usual size or shape of the resonators is changed significantly in some way. There are two distinct causes.

1. Abnormal coupling of the nasal and oral cavities as a result of structural abnormalities, such as cleft palate, or oral or nasal obstruction.
(2) Non-structural deficits, such as abnormal articulatory postures, excessive muscular tension in the vocal tract, and habitual poor oral opening.

The fine line between normal and pathological conditions is often a matter of the listener's preference, affected by linguistic factors, and emotional reactions to speech.

**Classification of disorders**

Resonance disorders can be classified into three main types:

(1) hypernasality  
(2) hyponasality  
(3) mixed nasality.

**Hypernasality (rhinolalia aperta, hyperrhinolalia, and open nasality)**

Hypernasal resonance refers to a type of abnormal tone characterized by excessive nasal resonance of voiced sounds, particularly vowels and the voiced consonants. The anatomical-physiological basis is faulty velopharyngeal port to attain and maintain sufficient closure. Nasal escape and nasal grimacing are often associated with hypernasality. Nasal escape refers to an audible or inaudible, abnormal escape of air from the nostrils. This accompanies or replaces the target sounds, in particular fricatives. This is also sometimes referred to as nasal snort. A mirror clouding test can be used to test for nasal escape. The patient should repeat a sentence that is free of all nasal sounds, for example 'Katy's sister was six yesterday', with a mirror placed under the nares. Fogging may indicate velopharyngeal incompetence. It may help to identify hypernasality by asking the patient to repeat the test sentence above with nostrils pinched and unpinched.

Nasal grimacing refers to occlusion of the nares by contraction of the alae, and in its more severe form, may include the forehead too, resulting in facial grimace. It occurs as an unconscious attempt to effect velopharyngeal closure.

Hypernasality and nasal escape associated with velopharyngeal incompetence, is the major type of resonance disorder. This is partly because of their high association with cleft lip and palate, and their far-reaching effects on speech and language. It is a complex problem to manage, and requires a multidisciplinary team approach often involving the plastic surgeon, orthodontist, radiologist and speech therapist.

**Hyponasality (denasality, rhinolalia clausa, and closed nasality)**

This refers to speech in which there is reduction or absence of normal nasal resonance of the nasal continuants and a loss of normal nasal assimilation. It is also detectable in the production of vowels. In common everyday terms, it is called adenoidal speech, and usually has an organic basis.

Two subtypes of hyponasality are defined.
Rhinolalia clausa posterior

When there is an obstruction in the posterior region of the nasal cavities or nasopharynx, the nasal /m, n, ng/ sound more like their voiced oral plosive equivalents /b, d, g/. In a sentence loaded with nasal sounds such as 'Mummy and Nanny are mending', the /m, n, ng/ sound more like /b, d, g/, that is 'bubby and daddy are bedding'. Using the mirror clouding test while saying such a sentence may indicate that the normal fogging that the nasal sounds produce may be prevented or reduced.

Rhinolalia clausa anterior, cul de sac

This type of hyponasality is detectable when all the vowels and nasal are produced with a muffled, hollow sounding resonance, owing to an obstruction in the anterior region of the nasal cavities. This sounds equivalent to the resonance produced when the nose is pinched.

Mixed nasality (rhinolalia mixta)

This refers to the coexistence of hyper- and hyponasality and reflects simultaneously velopharyngeal incompetence and nasal obstruction. There is fluctuating resonance, which the listener perceives as abnormal.

Aetiology of resonance disorders

Aetiology can be broadly classified as organic or functional. Organic causes include structural abnormalities, congenital, or acquired neurological conditions. Functional factors include poor learning, habit, imitation, poor motivation, immature, or improper use of the articulators (Table 11.2). A resonance disorder may be exacerbated by intellectual and environmental factors.

Assessment of resonance disorders

Correct identification of nasality type is not easy for the untrained listener. Aronson (1985) described how many professional people in medicine and allied health fields, as well as parents, often describe hyponasal speech erroneously as nasal, inferring velopharyngeal insufficiency instead of nasopharyngeal obstruction. A study by Razzell, Anthony and Watson (1983) however, demonstrated the accuracy of the trained ear of the speech therapist in the assessment of nasal air escape and resonance. The speech therapist's role in dealing with resonance problems is to identify type, degree, consistency, and severity of disordered resonance.

Hypernasality

In addition to assessing hypernasal resonance, the therapist detects nasal air escape, and describes fully the range of phonetic contexts in which it occurs. Velopharyngeal incompetence not only causes hypernasality and nasal escape, but is often associated with articulation problems.
When the velopharyngeal port is left open, air escapes through the nose and the necessary oral air pressure required for plosives, fricatives and affricatives is then either reduced or absent. This may lead to a weak nasally distorted production of the target sound, or the development of compensatory articulation patterns. One example of this is the use of laryngeal sounds or pharyngeal sounds, such as the glottal stop or pharyngeal fricative. Another compensatory pattern is the excessive use of velar placement referred to as tongue bunching.

The presence of these abnormal articulation patterns may complicated the evaluation of the velopharyngeal mechanism. In a tongue bunching pattern the back of the tongue may habitually force air through the velopharyngeal area with the resulting impression of velopharyngeal incompetence (Huskie, 1983). The opposite may arise when speech is characterized by an excessive amount of glottal stops. Since these sounds are released well before air can be lost at the velopharyngeal sphincter, it may sound as if there is a competent sphincter mechanism.

### Table 11.2 Aetiology of resonance disorders

<table>
<thead>
<tr>
<th>Organic</th>
<th>Functional</th>
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<tbody>
<tr>
<td>Hypernasality</td>
<td>Hyper- and hyponasality:</td>
</tr>
<tr>
<td>- history of repaired cleft palate</td>
<td>- Habit</td>
</tr>
<tr>
<td>- submucous cleft palate</td>
<td>- Imitation</td>
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<tr>
<td>- occult cleft palate</td>
<td>- Poor motivation</td>
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<tr>
<td>- congenitally short soft palate</td>
<td>- Poor learning</td>
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<tr>
<td>- large nasopharynx</td>
<td></td>
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<tr>
<td>- post adenoidectomy</td>
<td></td>
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<tr>
<td>- trauma</td>
<td></td>
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<tr>
<td>- severe hearing loss</td>
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<tr>
<td>- following midfacial osteotomy</td>
<td></td>
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<tr>
<td>- neuromuscular impairment, eg, palatal paresis, cerebral palsy</td>
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<tr>
<td>Hyponasality</td>
<td>Mixed nasality</td>
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<tr>
<td>- deviated nasal septum</td>
<td>- combination of aetologies of hyper- and hyponasality</td>
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<tr>
<td>- space-occupying lesion</td>
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<tr>
<td>- construction of a pharyngeal flap</td>
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<tr>
<td>Hypernasality</td>
<td></td>
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<tr>
<td>- Inappropriate tongue postures</td>
<td></td>
</tr>
<tr>
<td>Hyponasality</td>
<td>- Degree of mouth opening</td>
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<td>- norm in physiological function</td>
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In addition, velopharyngeal insufficiency may encourage the development of dysphonia from compensatory vocal abuse, and abnormal use of tongue patterns.

The speech therapist makes a detailed oral examination of structure and function, and performs a full phonetic and phonological analysis. The ease with which resonance, nasal escape or defective articulation may be modified is ascertained. This perceptual assessment is supplemented by the objective techniques of nasoendoscopy and multiview videofluoroscopy which provide invaluable information about velopharyngeal structure and function and are essential for determining appropriate management. These techniques determine the nature of and contexts in which velopharyngeal closure can be achieved. Furthermore, the reasons for incompetency and the potential for closure can be identified. The
speech therapist should be present during these procedures, so that the nature of the speech sample elicited can be determined according to the individual child's speech problem. All the assessments are discussed with the surgeon and future management is then decided. Other information may be gained from nasal anemometry (Ellis, 1979). This investigates abnormal nasal air flow, its instant of occurrence, and its peak value during speech. Although equipment has been designed to measure the area of velopharyngeal opening and resistance to airflow during speech, as a method of assessment of the velopharyngeal port (Warren, 1964), this is not readily available for routine clinical use.

**Management of hypernasal resonance**

The speech therapist contributes to a differential diagnosis identifying the organic, functional and other contributory factors and recommending therapy where appropriate.

Speech therapy may be sufficient in some cases, but if surgery is required, this should always be supported by pre- and postoperative speech therapy assessment.

In velopharyngeal incompetence, where the disorder is purely one of resonance, speech therapy is unsuccessful (McWilliams, 1983). Surgical intervention is indicated, although obturation may be an alternative method of management.

However, when velopharyngeal incompetence is associated with other articulation problems, there is a case for speech therapy directed at these while waiting definitive assessment and surgery. Indeed, sometimes a course of therapy, aimed at eliminating erroneous tongue patterns, may be an essential precursor to allow for the accurate assessment of the sphincter mechanism or endoscopy. Furthermore, parents sometimes accept more easily that a surgical procedure is required if a course of speech therapy has been followed, and been only partially successful. This group of children usually requires postoperative therapy.

Speech therapy is appropriate when closure at the velopharyngeal sphincter is achieved on some sounds, but not others. Here, habit may be a factor. These cases underline the importance of the speech therapist's presence at endoscopy and multiview videofluoroscopy, so that the best possible oral speech sample is used. Otherwise the child could be submitted to unnecessary surgery.

Children may present with inconsistent nasal escape and hypernasality. This variation may be related to phonetic context, rate of speech, length, spontaneity of utterance, or psychosocial factors such as fatigue or stress. A timing defect of closure may account for this, reflecting poor coordination. In borderline cases of incompetency it is not always straightforward to determine if physical management or speech therapy is required (McWilliams, Morris and Shelton, 1984). In the first instance speech therapy is indicated. Such cases may be appropriate for a palatal training device in collaboration with the orthodontist, for example as developed by Selley (1979). This possibly assists the relaxation of the palatoglossus muscle which may in turn allow the levator palati to be more efficient. It encourages dorsal tongue relaxation, thereby reducing hypernasality by increasing oral patency. This aid alone may be sufficient, but it may be necessary to improve the timing
defect with the help of a visual speech aid. This provides immediate visual feedback of soft palate movement in therapy.

**Acquired hypernasality**

One of the most worrying problems for any otolaryngologist is when an apparently normal child develops hypernasal speech following adenoidectomy. Excessive nasality and nasal escape may develop temporarily, but this usually does not persist for longer than a few days or weeks at the most. A study by Neiman and Simpson (1975) concluded that the velopharyngeal mechanism normally compensates for the imbalance between pharyngeal dimensions and velar length caused by adenoidectomy.

When, however, there is a deficit in the velopharyngeal valving mechanism, and the adenoids are removed, hypernasality will persist. Assessment and management of this disorder are then indicated. A brief period of therapy should be tried, aimed at encouraging oral resonance and preventing the development of nasal grimace. Usually this condition responds poorly to therapy. Objective investigations are then instigated, and surgery is frequently indicated.

The patients at greatest risk for this outcome postadenoidectomy are those where there is a history of cleft palate, submucous cleft palate, congenital short palate, large nasopharynx, motor deficits, or scarring from tonsillectomy producing a stiff immobile palate. Adenoidectomy should actively be avoided in these cases. Possible predictive factors for incompetency have been described (Mason, 1973; Morris, Krueger and Bumsted, 1982). They stated that evidence of any structural or neurological abnormality of the velopharyngeal structures, family history of cleft lip, cleft palate, congenital velopharyngeal insufficiency, or related disorders, especially nasalization, and nasal leakage during feeding in infancy all appear to be relevant.

Careful joint assessment, if there is any doubt, with the speech therapist and radiologist is recommended. Croft et al (1978) described indications of potential velopharyngeal incompetence that can be seen on multiview videofluoroscopy, in particular any sign of borderline valving.

**Functional hypernasality**

Speech therapy is appropriate when no demonstrable organic deficit is found, and faulty learning or psychological factors are the cause (Peterson, 1975).

**Hyponasality**

Hyponasality is almost always organically based, although occasionally it may have a functional basis, such as imitation or habit. For example, the voice may continue to be hyponasal following tonsillectomy or adenoidectomy. Therapy may be indicated.
Disorders of phonation

Normal phonation

Perkins (1971) described as efficient, a voice that yields maximum acoustic output, flexibility and pleasant tonal qualities, with minimal effort in phonation. Wilson (1979) considered that the rate of speech is also an important factor in normal voice production.

Adequate voice production depends on a finely balanced interaction in the vocal tract between airflow, vocal fold tension, and supraglottic gesture, that is changes in size, and/or shape of the oropharynx, nasopharynx, hypopharynx, and oral cavity. It demands adequate breath control and capacity, combined with relaxed musculature and good posture, efficient use of the articulators and forward tone. Van Deinse (1982) stated that the whole of the vocal tract is involved in the production of voice.

Disorders of phonation

A disorder of phonation, often referred to as dysphonia, exists when the abnormality of voice production is located at the laryngeal level. The psychoacoustic or perceptual parameters of voice, that of quality, pitch, and intensity, deviate from that expected for the age, sex and cultural group of the child.

These parameters and their potential abnormalities are outlined below.

Voice quality

Voice quality is the perception of the physical complexity of the laryngeal tone, modified by resonance. Disturbed voice quality caused by laryngeal dysfunction is usually described using terms such as harsh, breathy, or hoarse. Such terminology has its limitations as rarely is the disordered voice characterized by only one type of quality. Studies have also found that there is inconsistency among speech therapists in their choice of labels (Wynter, 1974). However, as voice quality cannot yet be measured through instrumentation this descriptive terminology is still used.

Harshness is characterized by abrupt voice onset, low pitch, weak intensity, and overadduction of the vocal cords. There is frequent excessive tension of the laryngeal musculature involving a constricted vocal tract. It is often associated with generalized upper body tension.

Breathiness is a combination of phonation and the whispery noise components of turbulent air. It occurs when the vocal folds are not fully approximated, as in bowing, or vocal cord palsy, and unvibrated air is audible. In its more extreme form, when no air is set in vibration, the resulting voice is produced without phonation, and is described as aphonic. The breathy voice is characterized by limited intensity, and low pitch.

Hoarseness combines the acoustic characteristics of harshness and breathiness and usually results from laryngeal pathology. Pitch is usually low, restricted in range with pitch breaks. Aphonic episodes may also be observed.
Pitch

Pitch can be inappropriately high, low, uncontrolled, or restricted in range. Glottal fry is a term used to describe the creaky voice associated with the inappropriate use of lower pitch range.

Intensity

Intensity, or volume can be inappropriately soft or loud, or uncontrolled.

Rate of utterance and resonance, need to be considered, because of the important role they play in the overall voice as highlighted by Perkins (1971).

Taking an overall view, although pitch and intensity can be measured objectively with instrumentation, such as electrolaryngography, quality relies on the subjective impression of the listener. This lack of measurement means the decision that the voice is abnormal is culturally and environmentally determined, and relies upon the orientation of the listener. Most studies quote the incidence of phonatory disorders as approximately 6-9% of the school-aged population, and yet probably a significant number of these children are not referred for investigation. This is reflected in a study by Wertz and Mead (1975) showing how phonatory disorders were rated by teachers as the least handicapping communication difficulty compared with other disorders. Parents are often unaware of the voice disorder, in that they have never known their child to sound any different.

As some authors claim that the disordered voice in adults may have its roots in childhood (Ellis, 1959), it is very important for the paediatric voice disordered population to be treated. Ellis identified the particular risk factors in children as vocal strain, habitual shouting, screaming, or singing in an unnatural pitch range.

Assessment of phonation

The aim of the speech therapist's assessment, which usually takes at least one hour, is to provide the otolaryngologist with a detailed description of the patient's voice characteristics, and the significant psychosocial factors. A voice case history is obtained, such that environmental, physical, personality and emotional factors are explored. The voice history examines onset, duration, variability, severity of the voice disorder and patterns of voice use.

The therapist considers posture and respiratory function. Restricted thoracic movement or poorly coordinated movement of the muscles of respiration may lead to inadequate control of the expiratory air stream. This results in irregularities of vocal fold function, particularly affecting intensity and strength of glottal closure. However, for the majority of voice disordered patients, respiration is anatomically and physiologically normal. Compromised breathing patterns are probably due to anxiety and tension, or faulty habits, causing shallow upper chest and clavicular breathing, and inadequate control of the air stream.

The therapist subjectively evaluates different parameters of voice production pitch range, optimal pitch, habitual pitch, pitch discrimination, intensity, voice quality, maximum phonation time, and sites of musculoskeletal tension. Often rating scales are used, such as the
Buffalo voice profile, designed by D. K. Wilson (1979). This allows the therapist to make several simultaneous severity evaluations on different aspects of voice. An assessment of the potential to change individual vocal parameters is also made.

It is important to assess the child’s awareness of the problem and to explore the ways in which the voice disorder may limit his activities, or alternatively be of benefit to him. For example he may be excluded from a disliked activity on the basis of his voice problem. Parental attitudes, and those of significant persons need also to be taken into account. The detailed case history allows the therapist to identify potential aetiology, and perpetuating factors. The original causes are often different from the factors maintaining the disorder. The therapist judges if the child would benefit from voice therapy.

It is vital for the results of the assessment to be coordinated with the findings of the other team members. Indeed, many researchers advocate a team approach as the most effective for treating children with voice disorders (Wilson, 1979).

**Classification of voice disorders**

One method of classifying disorders is on the basis of aetiology. Voice disorders exist on a continuum, with structural disorders at one end, and functional or psychogenic at the other (Wilson, 1979). There is an intimate relationship between the two. In practice, it is often not possible to separate organic from psychogenic factors. For example, a psychologically based voice disorder can lead to organic changes, conversely an organic condition can engender in a patient a psychological reaction which may persist after the organic condition has been medically treated. However, for ease, in this discussion, voice disorders are classified aetiologically into organic or functional.

**Aetiology of voice disorders**

**Organic disorders**

(1) *Congenital*: These include stenosis, web, vocal fold paralysis, laryngeal cyst, chromosomal defects, neurological disorders (Aronson, 1985).

(2) *Acquired*: These include neurological disease, papillomata, inflammation, or trauma, particularly long-term intubation, resulting in acquired stenosis, web formation, or cricoarytenoid fixation. Occasionally laryngeal candidiasis may complicate steroid therapy for asthma.

**Psychogenic or functional disorders**

This term is used when the degree of pathology, if any, is disproportionately small compared to the severity of the voice problem. The vocal folds commonly appear normal, mildly inflamed, or fail to adduct completely as in bowing.

Brodnitz (1965) has observed how often the dysphonia persists long after any organic involvement disappears, highlighting the importance of the case history seeking out psychological factors. Some patients have long-standing emotional difficulties while, in others,
the voice disorder may occur as an acute reaction to a stressful situation. In some patients, the psychogenic nature of the disorder is less clear, and these patients may seem to have a purely habitual voice disorder. Research into adult voice disorders has shown that there is frequently a physiological basis to these problems. The extrinsic and intrinsic laryngeal muscles are so sensitive to emotional stress that their overcontraction may be observed resulting in measurable tension in the muscles of the vocal tract (Berry et al, 1982) and hyperfunctional voice disorders (Aronson, 1985). The whole vocal tract is frequently involved, so that the shape of the supralaryngeal resonators is aberrant and inadequate air pressure is characteristic (Berry et al, 1982). Therefore there would appear to be a relationship between functional dysphonia, musculoskeletal tensions, and environmental factors.

Management of organic disorders

One of the commonest organically based paediatric voice disorders results from prolonged intubation secondary to airway problems. Possible sequelae are anterior commissure webbing and posterior glottic stenosis (Dejonckere, 1984). In a study by Hengerer, Strome, and Jaffe (1975) persistent breathiness and hoarseness were observed in postinubation cases with a history of aphonia at extubation, caused by cricoarytenoid fixation. They observed that children who are not aphonie at extubation, but hoarse, usually have a normal voice at one year of age. They concluded that the degree of phonatory problem at extubation relates to the degree of damage to the larynx.

In congenital or acquired structural problems such as laryngeal web, or stenosis, the voice is often characterized by excessive contraction of all the muscles participating in phonation, with observable excess tension and effort (Luchsinger, 1965). The voice of a child with laryngeal web is typically high-pitched and weak. Other structural anomalies, for example stenosis, are usually characterized by a low-pitched, hoarse voice. When a tracheostomy is required, reconstructive laryngeal procedures are aimed at improving the airway as a primary objective, such that some children manage to be decannulated at the expense of their voice.

Sometimes, if the surgical management leaves a roughened free margin on the vocal folds, for example following the removal of papillomata, dysphonia may persist and voice therapy is advocated (Prater and Swift, 1984).

The speech therapist determines if the dysphonia is of a greater severity or different in character than that warranted by the lesion, in which case a functional element is suspected. The aim of therapy is to obtain the best voice possible within the patient's anatomical and physiological capabilities, by developing compensatory phonatory and respiratory patterns, or muscle strengthening techniques, for example in vocal cord palsy.

The voice disorder found in association with neurological and developmental problems, such as cerebral palsy or Down's syndrome may play a relatively minor part in the total communication disorder, when there is impairment of the respiratory, resonatory and articulatory systems, and language skills. Sometimes, however, the abnormal voice may be causing concern, and it then becomes the focus of therapy.
Psychogenic or functional disorders

Vocal abuse and vocal nodules

Dysphonias in school-aged children are mostly a result of vocal abuse, and vocal misuse, which frequently lead to mucosal changes, and vocal nodules. The dysphonia associated with vocal nodules is often breathy or husky in quality, with a tendency towards low pitch. The mass results in reduced glottal resistance, increased airflow, and a shortened phonatory time. Patterns of vocal abuse such as shouting, yelling, excessive talking, can often be identified (Toohill, 1975) and associated with a marked degree of musculoskeletal tension.

It is logical to consider these disorders as organic, and yet more properly they should be classified as psychogenic. It is important to appreciate the significance of this. These disorders are the result of abnormal speaking behaviour, frequently associated with personality or emotional factors, so that vocal nodules were described by Brodnitz and Froeschels (1954) as 'visible organic changes that are the consequence of a functional disorder'.

Children who develop nodules differ in personality and family history from those who do not. Nemec (1961) found that children with vocal abuse, including vocal nodules, were more aggressive, less mature, and had more difficulty in managing stressful situations than children with normal voice. These personality traits have been supported by other studies (Aronson, 1985). Other causal factors, such as chronic upper respiratory tract infections in association with allergies, have been described in the literature, but basic to all, is a constitutional tendency in these children towards the development of nodules (Luchsinger, 1965).

Management

Previously speech therapy was not advocated (Greene, 1972), but therapy is now considered not only appropriate but essential (Wilson, 1979). Surgery alone is insufficient - if the aetiological factors are not changed, there will be a recurrence of nodules. Therapy aims to eliminate vocal abuses, to attend to the personality and environmental problems, and thereby reduce the stress factors that created the patterns of vocal abuse, and where appropriate, work directly at modifying individual vocal parameters. It is frequently unsuccessful however to instruct the mother to tell her child to stop a specific abusive pattern. This usually fails and is frustrating for the parent and the child.

Instead the effective management of vocal abuse is through a carefully structured behavioural programme that extends into the child's home environment, school, and clubs. This is achieved through reinforcing desirable behaviour patterns using charts, with an individually designed reward system built into them. Parental and teacher cooperation is an integral part of therapy.

Mutational falsetto (puberphonia, disturbed mutation)

The majority of male adolescents have uneventful voice change. However, the period of voice change can be stormy, with sudden voice breaks from high to low pitch, or the reverse, with a marked degree of hoarseness or huskiness. When the voice fails to change
from the higher pitched voice of prepubescence to the lower pitched voice of adolescence and adulthood, the pathological condition of mutational falsetto or puberphonia exists. This condition can be found in patients of all ages, some as young as 14 or 15 years. The voice is characterized by high pitch, with pitch breaks, and restricted pitch range. It is often thin, weak, and breathy, and gives the impression of an immature and effeminate personality.

During phonation, the larynx is characteristically held high in the neck; the vocal folds are lax and stretched thin, with the body of the larynx tilted downwards. Respiration is often shallow, with inadequate subglottal air pressure so that only the medial edges of the folds vibrate.

Puberphonia may have a neurological basis, or may be associated with severe hearing impairment or an endocrine disorder. In the absence of these conditions it is considered a psychogenic disorder. The voice disorder may signal the rejection of the responsibilities and roles of adulthood. The patient may be embarrassed by his low pitched voice among his peers, or may unconsciously want to retain his higher-pitched singing voice. He may attend as a teenager motivated by teasing, or brought by his parents, or as a young adult tired of being taken for a woman on the telephone, or not achieved job expectations.

It is relatively easy to elicit and establish the appropriate voice in therapy. It is much more difficult to maintain the use of the new voice outside the clinic. Counselling and a carefully structured maintenance programme may be required in order to achieve long-term success.

**Hypofunctional voice disorders**

Bowing of the vocal folds seen on direct laryngoscopy may occur as a result of prolonged hyperfunctioning.

**Psychogenic aphonia**

Children fortunately rarely present with conversion voice disorders. The possibility of elective mutism should be considered in making a differential diagnosis. In severe cases if there are deep-seated emotional problems, referral to a psychologist or psychiatrist is indicated.

**Hearing impairment**

The speech of the deaf differs from normal speech as a result of the altered sensory conditions under which speech is learnt. The deaf individual has to rely on imitating and reproducing an incoming signal which he hears in a distorted manner (Monsen, 1983). The important factors that affect the eventual quality of speech achieved include date of diagnosis, use made of residual hearing, age of onset of hearing loss, family support and quality of the language environment, individual differences, and speech training where necessary.

All forms of deafness can affect speech production. Even intermittent otitis media may affect not only speech and language development, but also cognitive, and educational achievements (Klein, 1984; Needleman, 1977; Paradise, 1981; Penniceard, 1981). There is
also some suggestion of a link between early middle ear disease that subsequently resolves, and later language and educational difficulties (Penniceard, 1981).

The speech of the hearing impaired may show abnormalities in each of the systems of the vocal tract previously outlined - respiratory control, phonation, resonance, and articulation.

**Segmental features**

The speech of the hearing impaired characteristically shows disordered patterns in both consonant and vowel usage. The consonant system is frequently reduced, for example, high frequency sounds are often not established. The system is often characterized too by sounds that are visually distinct as these are easily learnt. In the vowel system, diphthongs are typically reduced or neutralized to a central vowel. It is important to appreciate that the deaf child may be using phonological contrasts in a highly individual way. For example, instead of using the consonant contrast /m, b/ to differentiate meaning in a pair of words such as 'me' and 'bee', the deaf child uses a /mb, b/ contrast to mark this distinction. A traditional way of viewing this would be to classify /mb/ as a distortion of /b/. It would then appear logical to eliminate the distortion therapeutically as not being a meaningful phoneme of English, but that would ignore that individual child's way of making a meaningful phonological contrast. If eliminated the individual's ability to signal the contrast between the words 'me' and 'bee' may be lost so rendering the person more unintelligible! The speaker needs to retain his individual method of making these contrasts even though the distortion at the phonetic level is abnormal (Fisher et al, 1983).

**Suprasegmental features**

The suprasegmental features, or prosodic features are those characteristics that relate to entire phrases or sentences. Such features include intonation, stress, rhythm, and phrasing. They have a very important function in normal speech in that they signal differences in meaning. These features are not usually markedly affected unless the degree of deafness is severe.

Inaccurate duration of phonemes may lead to stress distortion. All the syllables may be equally stressed, or the wrong stress pattern used. This is partly because the hearing impaired person maximizes his articulatory feedback, and in so doing exaggerates articulatory movement. This leads to slow speech often with extra vowels inserted. Intonation may be flat and monotonous, or characterized by one favourite intonation pattern.

With regard to resonance and phonation there are a variety of different manifestations of the hearing impaired speakers difficulty in controlling his speech output. Concerning resonance, there may be hypernasality. With respect to other aspects, frequency is often too high with wide pitch range. Voice quality may be abnormal. With regard to respiratory control, talking, on an inspiratory air stream or inappropriate phrasing may be observed.

Poor suprasegmental features can not only mask intelligibility but may be socially unacceptable (for example inappropriately high overall pitch). Currently, visual feedback such
as the electrolaryngograph is extensively employed in therapy to help the child monitor certain suprasegmental features, such as pitch changes (Abberton and Fourcin, 1984).

Craniofacial abnormalities

These patients present the speech therapist with an interesting problem caused by the interaction between structure and function. Bloomer (1971) stated: 'The correspondence between structure and function is imperfect because some speakers are capable of compensating for seemingly unsurmountable handicaps of orofacial deformity, whereas other speakers whose structures are anatomically satisfactory reveal handicapping effects of function'.

The commonest abnormality is cleft lip and palate.

Cleft lip and palate

It is well recognized that children with cleft lip and palate risk developing problems with speech and language development, facial growth, dentition, hearing and psychosocial well-being.

This condition illustrates the complex nature of speech and language development. Its adequate development is related, not just to the type and degree of cleft but many other factors.

These include conductive hearing loss, and its treatment, the timing and nature of surgical intervention, effective velopharyngeal closure, the presence of palatal fistulae, occlusion and dentition, neuromotor ability, and oral-motor perception. If intelligence is limited, this may affect the child's ability to compensate for an anatomical defect.

The importance of regular audiological and otolaryngological review cannot be overemphasized, since all children with cleft palate are born with fluid in their middle ears. They are at increased risk for conductive hearing loss in the preschool years which, combined with the other risk factors for speech development, has serious implications.

Psychosocial and environmental factors may be significant, for example if there is a family history of clefting. Early counselling by the therapist in the first few months is important to influence any preconceived notions regarding future speech and language development.

Resonance

Resonance is at risk not only from velopharyngeal insufficiency but also the frequent high association of deviant structures of the nasal cavity. The role of the velopharyngeal valve may possibly be obscured until the nasal airway is corrected.

The primary speech disorder of hypernasality and nasal escape may need to be managed as previously described.
Articulation

This may be characterized by weakness of plosives, fricatives and affricates, compensatory articulatory placement patterns as described above, and nasal escape and nasal grimace. Sometimes these occur alongside developmental phonological delay or disorder, or phonological patterns associated with hearing loss. In addition, phonetic defects directly attributable to abnormal occlusion and dentition may be operating. For example, rotated or supernumerary teeth will distort the production of fricatives. Maxillary hypoplasia, resulting in a class three malocclusion, restricts tongue movement for the anterior lingual consonants. Palatal fistulae may lead to phonetic distortions although usually small fistulae do not affect resonance or cause nasal escape.

The speech therapist's differential diagnosis identifies the exact nature of the articulatory defects. This diagnosis will change over time altered by factors, such as facial growth, maturation and age, the state of hearing, and surgical intervention at the velopharyngeal sphincter.

Phonation

Phonatory disorders are also found in association with cleft lip and palate. They occur as the result of efforts to compensate for excessive nasality, and the child's unconscious effort to overcome unintelligibility. Breathy voice quality and reduced intensity have been reported. The need for higher intraoral pressures and for increased loudness causes the compensatory development of excessive tensions throughout the vocal tract. A phonatory disorder is easily overlooked when there are severe defects of resonance and articulations. Auditorily it may not be perceptible because of the masking effect of nasality (Edwards, 1980). McWilliams, Bluestone and Musgrave (1969) documented a high incidence of vocal nodules in patients with cleft palate.

Language

These children are at risk of delayed language development, especially in the preschool years. In school-aged children, expressive language is at greater risk than receptive language, but generally improves with age. It is quite probable that in adulthood the cleft population is less verbal than the non-cleft population (McWilliams, Morris and Shelton, 1984).

Research into speech disorders associated with clefting has focused on the velopharyngeal mechanism, and yet this discussion highlights the complex nature of the total speech disorder and the involvement of the whole vocal tract. Many of the coexisting characteristics described interact and alter each other in an individual who is growing and changing. This group must be managed from birth to maturity by a multidisciplinary team, of which the otolaryngologist and speech therapist are integral members (McWilliams, 1983).

Rare craniofacial syndromes

Major craniofacial malformations, such as Apert's and Crouzon's syndromes, are replete with features that affect the acquisition of speech and language, for example structural anomalies, frequent association of depressed hearing levels, mental retardation, and the
profound psychosocial effect of craniofacial anomaly (Elfenbein, Wazim and Morris, 1981). Patients with these syndromes are specifically at risk for phonetic distortions related to severe malocclusion, and multiple intraoral anomalies. Resonance may be affected due to abnormalities of the velopharyngeal sphincter, either incompetency or nasopharyngeal obstruction. Since palatal clefts occur in approximately 154 syndromes, all the features of speech disorders associated with velopharyngeal incompetence need to be considered (Cohen, 1978).

Morrees et al (1971) stated that the likelihood of defective speech increases as the number of structural deviations increases, but there is no direct relationship implying that the more severe anatomical deformity causes more severe speech problems. Many authors attest to the remarkable ability of speakers to compensate within limits in the vocal tract (Bloomer, 1971).

It is the role of the speech therapist to determine if the patient is speaking to his potential. Therapy is usually recommended if there is evidence that structure is compatible with better speech than is actually being produced. Furthermore, Witzell (1983) also maintains that it is the responsibility of the speech therapist to document speech problems in rare craniofacial syndromes, to record changes in articulation and resonance after craniofacial surgery and predict changes that may occur due to specific operative procedures. This is due to the lack of studies in this area and therefore it is important to begin to build a data base of detailed case studies and their profiles.

**Communication and the long-term tracheostomy child**

Tracheostomy in early childhood is often followed by aphonia so that even the cry is lost. This may be unavoidable if there is severe laryngeal obstruction, but even in children with an apparently normal larynx (for example in sleep apnoea), the voice may be absent. As a result, the infant experiences little, if any, auditory-vocal feedback, and a decrease in oral behaviour is seen. If aphonia extends into the child's second year, this inevitably leads to a potentially severe delay in the development and use of expressive language, with delay in the acquisition of phonology. The child's own lack of voice often renders him less attentive to other speakers over a period of time, such that attention and listening skills become disrupted and poorly developed so that receptive language skills are affected (Kaslon and Stein, 1985).

It is therefore important to strive for vocalization in any tracheostomized child. A close working relationship between the surgeon and the speech therapist is advocated. Fortunately, many children find the airleak around the tube sufficient to produce voice, while others require a fenestrated tube. This can either be a silver Alder Hey pattern with a speaking valve, or a Great Ormond Street (GOS) pattern tube fenestrated, using a lateral neck X-ray as a template and employing a silver di-santi valve.

Unfortunately, accurately maintaining the fenestration in line with the tracheal lumen is a constant problem, and some children are reluctant to tolerate a valved tube. This leads to a group of children who are aphonic, or have insufficient vocalization to support the development of expressive language.
Speech therapy management

The importance of early intervention by the speech therapist has been advocated by Harlor (1980), Tucker (1982), and Simon and Handler (1981). The review by Kaslon, Grabo and Ruben (1978) showed that in the past, these children were rarely referred. Handler, Simon and Fowler (1983) outlined reasons for this lack of referral.

If phonation is not possible the therapist focuses her intervention on fostering the development of the child's early communicative intent, normal gesture, and the development of prelanguage skills. Once the child reaches 12-18 months, the use of sign language as an alternative method of communication, is advised (Simon, Fowler and Handler, 1983). In this way, the child has a structured means of expression, as an interim measure, before oral language is possible. Research has proved that the use of signing augments the rate of language acquisition (Kiernan and Reid, 1984).

If the tracheostomized child is able to vocalize, language development should proceed normally. However, it may not necessarily do so, especially if there has been some months of aphonia, during which the tracheostomized child typically develops a sophisticated non-verbal communication system which persists and reduces his need to develop oral language.

In older children, when vocalization is not possible, and expressive language and speech are developed, the child is aphonic, and mouths his words. This has been referred to as buccal speech or 'Donald Duck' voice. The air stream appears to be created by the larynx acting as the initiator which is indicated by the production of ejectives for target plosives. Very occasionally the speech therapist may recommend an electrolarynx.

By providing speech therapy during cannulation, the child's predicted delay in language acquisition is minimized and the child is stretched to communicate to his potential. Frustration due to a lack of systematized communication system is lessened, and therefore the risk of emotional problems, well documented to occur in association with speech and language delay, are reduced (Rutter and Martin, 1972).

Stammering (stuttering)

Definition

Stammering is a disorder of the rhythm of speech in which the speaker knows precisely what he wishes to say but cannot for the moment say it, because of involuntary repetitions, prolongations, or cessation of sounds (World Health Organization, 1978). It is more than just a disruption in the smooth flow of words, as the syndrome is typically characterized by emotional reactions to the trouble experienced in speaking. Therefore it should be viewed as a disorder of communication rather than purely a speech symptom. If it persists into adolescence or adulthood it frequently becomes a major obstacle to the formation of close relationships and careers.
Onset

Stammering is a disorder of childhood often occurring between the ages of 2 and 10 years, but more commonly between 2 and 5 years (Bloodstein, 1960). It is at exactly this time when non-fluency may be observed as a normal stage in language development. The child has ideas which he wishes to communicate, but his expressive language has not developed sufficiently to allow him to do so and therefore there are hesitancies as he plans his utterances. It is vital that a differential diagnosis between normal non-fluency and the onset of stammering is made, to prevent the development of a chronic handicap.

Normal non-fluency consists mainly of whole word or phrase repetitions (for example it's ... it's ... cold today, or put the ... put the ... ball there), interjections, and revisions (the man ... the boy is happy) with occasional partword repetitions. The stammering child is characterized by an increase in partword repetitions (bbbbbbball), sound prolongation (b ... ball) and the insertion of the schwa vowel after the initial sound (tu-tu-tu-today). Sometimes the child may be seen to struggle to get the word out, disrupting the expiratory airflow. Variations of the pitch, intensity and rate of the voice may be observed. Concomitant movements of the head and trunk and word and situation avoidance may develop.

Part of the reason that this disorder is so complex, is due to its variability in severity and frequency with time and circumstance.

Aetiology

Many theories as to aetiology have been proposed from organic, psychogenic to viewing stammering as a learned behaviour. Despite much research, however, the aetiology is still not fully understood. It is known, however, that there is often a familial pattern. The risk of stammering among first degree relatives exceeds the population risk by a factor of three, and this risk is increased for the offspring of female stammerers. It is quite probable that environmental factors do play a part in the development and maintenance of the syndrome, and that possibly the psychogenic aspects, in particular difficulties with social adjustment, develop as a learned reaction to the handicap. Stammerers often demonstrate poor interpersonal skills, avoid social contact, and do not initiate communication.

Current research is studying neurophysiological theory on the supposition that there is a neurological inadequacy.

Incidence

In childhood, the prevalence in the prepubertal population is 1% dropping to 0.8% at 16 years of age. The distribution of stammerers between males and females is three to one. This disproportion increases with age, and the remission of stammering is more common in girls than boys. This has been attributed to differences in constitution, in particular physical maturation and speech and language development, and to the different parental attitudes and expectations of boys and girls (Andrews et al, 1981).
Management

The speech therapist's assessment of stammering is complex. A quantitative and qualitative assessment of the overt behavioural manifestations of dysfluency is made. Other aspects of speech and language behaviour are assessed and information on educational achievements sought. Environmental factors including the child's and parents' attitudes, and other significant persons, are all carefully explored.

Current approaches to therapy can take widely different forms, and is determined by the assessment. Treatment usually is based on three main principles.

(1) Modification of the environmental factors that are contributing to the development and maintenance of stammering may be indicated.

(2) Therapy may be needed to modify directly aspects of speech production, with attention to the effective carryover and maintenance of fluency (Rustin and Cook, 1983).

(3) The importance of changing the child's perception of himself as a stammerer, sometimes needs to be worked upon in therapy.

This developmental disorder should never be ignored on the assumption that it will go away, especially if parental concern is expressed. The earlier the problem is identified and the factors contributing to it understood, the better the prognosis (Shine, 1980).

Appendix 11.1: Glossary (Nikolosi, Harryman and Kreschek, 1983)

**Affricate:** consonant sound beginning with a stop closure which is released as a fricative.

**Articulation:** the physical production of speech sounds.

**Consonant:** a speech sound that is produced when the expired air stream, with or without voice, passes through a stricture of either complete closure or close approximation.

**Fricative:** consonant sound made by forcing the air stream through a narrow opening, resulting in audible high frequency sounds.

**Glottal stop:** a plosive sound produced by a tight closure of the vocal folds followed by the sudden release of subglottic air pressure.

**Hyperfunction:** excessive forcing and straining, usually at the level of the vocal folds, but which may occur at various points along the vocal tract.

**Hypernasality:** excessive amount of perceived nasal resonance on voiced consonants and vowels.

**Hypofunction:** reduced vocal capacity resulting from prolonged overuse, muscle fatigue, tissue irritation, or general laryngeal or specific problems relating to the opening and closing of the glottis. It is characterized by air loss and sometimes hoarseness and pitch breaks.

**Hyponasality:** reduction or absence of nasal resonance especially of the nasal consonants.

**Intensity:** force or stress with which a sound is produced by a speaker, equivalent to the loudness perceived by the listener.
Pharyngeal fricative: a fricative produced by constriction of the pharyngeal walls and the retraction of the root of the tongue towards the back wall of the pharynx.

Phonation: physiological process whereby the energy of moving air in the vocal tract is transformed into acoustic energy within the larynx.

Phoneme: sound segment in a given language that can be recognized as being distinct from other sounds in the language. It is the minimal distinctive unit used to signal a meaning difference.

Phonetics: study of the production and perception of speech.

Phonology: study of the structure and function of speech sounds in a language.

Pitch: perception of an aspect of the voice related to its fundamental frequency.

Plosive: consonant sound produced by stopping the air flow in the mouth and then suddenly releasing it, while there is velopharyngeal closure.

Resonance: the vibratory response of an air-filled cavity to a frequency imposed upon it.

Semantics: the study of meaning.

Suprasegmental: the characteristics that span linguistics units longer than a phonetic segment such as intonation, voice quality, stress and rhythm.

Syntax: the study of phrase, clause and sentence structure.

Vocal abuse: mistreatment usually by overuse of the laryngeal and pharyngeal musculature.

Vocal misuse: incorrect use of pitch, quality, volume, breath support, or rate, singularly or in combination.

Voice quality: the perception of the physical complexity of laryngeal tone, modified by resonance.

Voiced/voiceless consonant: speech sounds produced with the vocal cords vibrating or not.

Vowel: a voiced speech sound produced when the vocal tract, primarily the oral cavity, changes shape producing change in the resonance of the tract.