

**PROTOCOL FOR THE ASSESSMENT OF  
SPEECH IN INDIVIDUALS WITH CLEFT LIP  
AND PALATE**

Registration Number: 05SLP018

**Teena . P**

A dissertation submitted in part fulfillment for  
the degree of M.Sc, (Speech Language Pathology)  
University of Mysore,  
Mysore.

ALL INDIA INSTITUTE OF SPEECH AND HEARING  
NAIMISHAM CAMPUS, MANASAGANGOTTHRI,  
MYSORE - 570 006.

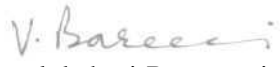
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*Dedicated to my dear  
Father and Mother*

## CERTIFICATE

This is to certify that this dissertation entitled, "**Protocol for the Assessment of Speech in Individuals with Cleft Lip and Palate**" is the bonafide work in part fulfillment for the degree of Master of Science (Speech Language Pathology) of the student (Registration Number: 05SLP018). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other university for the award of any other diploma or degree.

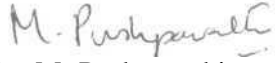
Place: Mysore  
April 2007

  
Dr. Vijayalakshmi Basavaraj  
Director,  
All India Institute of Speech and Hearing  
Naimisham Campus, Manasagangothri,  
Mysore - 570006.

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Place: Mysore  
April 2007

  
Dr. M. Pushpavathi,  
Reader,  
Dept. of Speech Pathology  
All India Institute of Speech and Hearing  
Naimisham Campus, Manasagangothri,  
Mysore - 570006.

## **DECLARATION**

This dissertation entitled, "**Protocol for the Assessment of Speech in Individuals with Cleft Lip and Palate**" is the result of my own study under the guidance of Dr. M. Pushpavathi, Reader, Department of Speech Pathology, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier at any university for any other diploma or degree.

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children, one of the most critical areas of concern to the parents and to all professional disciplines involved, is the child's speech. Speech is recognized as one of the key outcomes of the cleft team care (McWilliams et al., 1984). Although the existence of speech problems in this population has long been recognized, only during the past 20 to 30 years have they been studied in detail.

It is generally agreed (Eckelman and Baldrige, 1945; Van Riper, 1963; Van Riper and Irwin, 1958) that one of the major speech problems exhibited by individuals with clefts is a deficiency in articulating speech sounds. Counihan and Starr (1956) assessed articulation differences between the consonants classified in to the following categories: (a) lip sounds, (b) tongue-tip simple sounds, (c) tongue-tip complex sounds, and (d) back-of-tongue sounds. They concluded that consonants in the latter two categories are more frequently defective than are lip or tongue-tip simple consonants.

Peterson-Falzone (1990) conducted a cross-sectional analysis of speech for 240 children (age 4 years to 10 years 11 months) with repaired cleft palate. More than 90 % of the young school aged children she studied demonstrated articulation problems related to place or manner of production. Approximately 17 % exhibited consistent audible nasal emission with associative hypernasality. According to Peterson-Falzone (1990) only 3% of the children she studied demonstrated speech that was entirely asymptomatic. It is noted that those patients who had received secondary surgical/prosthetic management for VPI were excluded from this study during subject selection. It is also noted that many of the patients studied by Peterson-

Falzone (1990) had received primary palatal surgery. This findings account for the high prevalence of articulation problems observed in her school aged group.

In addition to deviations in speech sound articulation, it is generally agreed that individuals with cleft palate also exhibit a voice deviation usually referred to as "nasality" (Eckelman and Baldrige, 1945; Van Riper and Irwin, 1958). It has been suggested that individuals with cleft palates are deviant in both vocal pitch and vocal intensity. Berry and Eisenson (1956) state that the speech of a cleft palate child may be described as "...frequently shrill in pitch and sometimes changing with growth to an unnaturally low, gravel voice" and also as "uncontrolled in loudness". Cobb and Lierle (1936) report that a general lack of vocal intensity and pitch variation were noted in the cleft palate subjects that they studied.

Another characteristic exhibited by cleft palate individuals is what is referred to as "nasal air emission". Nasal air emission can be defined perceptually as the amount of air passing out of the nasal cavities or, in perceptual term, as the amount of audible nasal emission (Moll, 1968). Nasal emission in cleft palate speakers has been observed usually during the production of consonant speech sounds whereas on the other hand, nasality is perceived in almost all the speech sounds.

In addition to speech problems, individuals with cleft palate also exhibit unnatural visible mannerisms. The most common mannerism noted is a constriction of the nasal alae (Berry and Eisenson, 1956; Morley, 1962) although "aversion of the head" also has been reported to exist (Berry and Eisenson, 1956). Another problem frequently reported by mothers of cleft palate children is difficulty in feeding.

Feeding, on the average, is reported to take longer with the children with clefts and also lead to nasal regurgitation (Morris, 1968).

Hearing disorders are also prevalent among individuals with cleft palate. These disorders are a result of middle ear dysfunction, involving both ears. Middle ear disease in children with cleft palate has a prolonged recovery and a substantial incidence of late sequelae. Spriesterbach (1962) found significant hearing loss for 5.5% of a group of 163 children with cleft lip and palate or cleft palate only.

Along with the widely reported speech difficulties, additionally, if these speech difficulties are not treated appropriately, and in a timely manner, then a child may have communication problems, which can lead to learning problems (Jocelyn et al., 1992), social exclusion (Broder et al., 1992), and adverse psychosocial adjustment and well being.

Various assessment techniques have been suggested and widely used in assessing each of the speech problems and associated difficulties in the cleft palate population. Some investigators (Spriestersbach, 1955; Van Demark, 1964) have used perceptual or subjective measures for assessment whereas other investigators (Bensen, 1951; Young, 1953) had relied on use of instruments or objective methods for assessment (Morris, 1968). The preliminary studies have explored much in to any single aspect of speech such as frequent articulation errors, nasality perception, speech intelligibility or voice deviations. But there is lot of disagreement between authors who have developed such assessment measures as to which method needs to be used, different parameters needs and different scales to be considered to assess the

different speech parameters etc.,. Although it is well recognized that there is a need for one international approach to speech analysis (McComb, 1989; Henningsson and Hutters, 1997) there remains no consensus about the methods that should be used (Henningsson and Hutters, 1997; Hirschberg and VanDemark, 1997).

There is also disagreement about parameters that should be included in a cleft speech measure. Intelligibility provides an example of such a controversy. Dalston et al (1988) recommends that hypernasality, hyponasality, nasal escape, intelligibility and articulation should be reported always. Witzel (1991) and Sell et al (1994) however, both caution against reporting intelligibility, because it is difficult to rate reliably and can be influenced by many variables. Another issue regarding the assessment methods is that the reliability and validity of assessment methods are rarely reported (D'Antonio and Scherer, 1995; Lohmander-Agerskov and Olsson, 2004).

More recently various clinics have started developing their own protocols with provisions to assess all the speech characteristics and other associated difficulties in cleft palate individuals in one concise form. Thus, started the advent of the usage of protocols in assessing speech and other characteristics of cleft palate individuals and research from then focused on developing standardized protocols for the same.

One of the outcomes of the national United Kingdom (U.K) study for cleft lip and palate teams is mandatory regular clinical assessment and also clinical audit of outcomes (Clinical Standards Advisory Group [CSAG] Report, 1998, Department of Health, 1999, Beam et al, 2001). This audit process was introduced into health care

within the U.K. following the Bristol Enquiry (Department of Health, 1999) and is now practiced widely.

In this line, several protocols have been developed to assess speech problems in children with cleft lip and palate. Some of the assessment protocols that have been developed are Protocol for Evaluation of Speech and Hearing of a patient with Velopharyngeal Dysfunction (Hirshberg and Van Demark, 1997), The Great Ormond Street Speech Assessment (GOS.SP.ASS; Sell et al., 1994,1999), Cleft Audit Protocol for Speech (CAPS; Harland, 1996), Cleft Audit Protocol for Speech - Augmented (CAPS-A; Alexandra John et al, 2006).

The protocol proposed by Hirshberg and Van Demark (1997) consists of two parts: a documentation of the personal data, history and status of the patient followed by perceptual and instrumental evaluation. The suggested parameters to be assessed during the speech and hearing evaluation are the following: nasal resonance, nasal escape, articulation and its disorders, facial grimacing, speech intelligibility, expressive language and voice.

Following this protocol, The Great Ormond Street Speech Assessment (GOS.SP.ASS; Sell et al., 1994, 1999) was developed as a standardized approach to assessing speech in the clinical setting in the U.K. It provided an evaluation of resonance, nasal emission, nasal turbulence, grimace, articulation characteristics, and phonation, together with a systematic approach to an oral examination, the mirror test, and description of the visual appearance of speech.

The Cleft Audit Protocol for Speech (CAPS; Harding et al., 1997) is closely aligned with GOS.SP.ASS. and was developed specifically for clinical audit purposes. The protocol includes a measure of all the recommended speech parameters, including consonant errors, but the validity and reliability of the measure have not been tested rigorously. A modified version of CAPS was used in the national CSAG cleft outcome study in the U.K. (CSAG Report, 1998). Good inter-examiner reliability was established for the two raters who assessed the speech outcomes (Sell et al., 2001).

#### **NEED FOR THE STUDY:**

All the protocols developed so far, were developed abroad and these include only subjective assessment procedures for assessing parameters such as resonance, articulation, voice and intelligibility. So there is a burning need for a speech assessment protocol for subjects with in the Indian scenario. This led to the need for the present study for developing such a protocol which would assess all the above mentioned parameters using both subjective and objective assessment measures. The present protocol would incorporate some of the rating scales for assessing resonance parameters from the Cleft Audit Protocol - Augmented (CAPS-A; Alexandra John et al, 2006). It would also adopt the type of articulation testing from the Bzoch Error Pattern Diagnostic Articulation Test (Bzoch, 1978). A comprehensive and structured protocol thus developed can be used for routine clinical practice, for documenting prognosis from therapy and for research purpose.

AIMS OF THE STUDY:

- > To develop a comprehensive and structured protocol for assessing the speech of individuals with cleft lip and/ palate (repaired/ unrepaired)
  
- > To administer the same to individuals with cleft lip and/ palate both before and after speech therapy.

## CHAPTER 2

### REVIEW OF LITERATURE

Cleft is a separation or space between parts that are normally joined, thus interrupting the continuity of the structure. Although orofacial clefts can be acquired through various traumas, the vast majority of those of the lip and/or hard and soft palates are due to congenital failures of the structures to join. It is common knowledge that children born with cleft lip and/ or palate are at risk for various communication disorders including: language impairment, hearing impairments, speech impairment, disorders of phonation and resonance.

#### **Language Impairment:**

Many studies (Cobb & Lierle, 1936; Bzoch, 1956) suggests that there may be lag in language acquisition during early years of development for many children with orofacial clefts, but as the individual gets older the gap closes (Me Williams, 1953). By adulthood, no significant language differences remain. Conversely, Morris H, Ozaane A, (2003) identified a subgroup of children with cleft palate who exhibited delays in early expressive language and continued to have delayed language and disordered phonological patterns at a later age. The reasons for language delays in these children may be disruption in early experience of oral touch-pressure sensation, oral cavity exploration, perceptual motor deprivation, prolonged deprivation during formative language period and reduced hearing sensitivity. The other possible reasons may be insufficient language stimulation due to low expectations for verbal responsiveness given the child's physical problem and negative reactions of listeners which causes the child to limit the frequency and elaboration of speech language



attempts (Mc Williams, 1953). Some authors have speculated that the reported delays in the language development in the children with clefts may be related to problems in mother child interaction (Wasserman et al, 1988).

Various authors have studied language abilities in individuals with cleft lip and or palate. Cobb and Lierle (1936) report that 26.8% of their group of 56 cleft subjects exhibited "delayed speech". Bzoch (1956) attempted to study the language development of cleft palate children, aged 3 to 6 years. He concluded that the cleft palate children did not differ greatly from normal children in babbling and use of jargon. He found, however that 43% of the cleft palate subjects were reported to have used their "first true word" after 14 months of age, which was considered to represent the upper limit of the normal range. Bzoch (1956) thus reported that 30 out of the 60 subjects were judged to have been delayed in speech development. Generally, vocabulary delays (Bzoch, 1956; Spriestersbach et al., 1958; Morris, 1962; Nation, 1970), shorter mean length of utterance (Spriestersbach et al., 1958), and decreased structural complexity (Morris, 1962) has been noted in children with cleft palate.

### **Hearing Impairment**

Hearing disorders are prevalent among individuals with cleft palate. These disorders are a result of middle ear dysfunction, involving both ears. Middle ear disease in children with cleft palate has a prolonged recovery and a substantial incidence of late sequelae. These problems exist in all infants with unrepaired clefts of palate under the age of 2 and in about 70 to 80% of older children with repaired clefts (Mc Williams, 1953).

**Speech Impairment:**

Speech is the key to human existence. It bridges the differences and helps to give meaning and purpose to life. Speech is considered to be the product of the selective modification and control of the outgoing air stream (Huntington, 1968). Individuals with cleft lip and or palate are at higher risk for speech problems. The speech impairments in children with cleft lip and or palate include articulation impairments, resonance and voice impairments, reduction in speech intelligibility and prosodic deficits (Mc Williams, 1953).

**Articulation**

Lowe (1996) refers to articulation as the overt level of speech production. Articulation describes the motor components of sounds that can be seen, heard and produced. Gammon and Dunn (1985) indicate that the phonetic or articulatory component of the sound system encompasses a) the way sounds are formed by the speech mechanism, b) their acoustic or physical components, and c) their perception by the listener. Although the term, "articulation" has a physiological connotation, while referring to cleft palate speech, it is used only in the perceptual sense. It is defined in relation to whether a speech sound production is or is not judged to be an acceptable sample of the phoneme intended (Eckelman, 1945; Van Riper, 1963).

Individuals with cleft palate are retarded in their general articulation skills (Moll, 1968). The particular level of articulation skill exhibited by an individual with cleft palate depends to some degree, on the age at time of testing. Morris (1962) reported that articulation test scores improved with age upto 7 years and there was a little improvement beyond this age. Sounds most frequently misarticulated by

children with cleft lip and palate are *Is/* (63%), *IzJ* (61%), */d/* (48%), */ch/* - (44%), */p/* - (11%) and */b/* - (9%) (Mc Williams, 1953). */s/* is the speech sound most frequently and most consistently misarticulated by cleft palate individuals. Also individuals with cleft palate exhibit compensatory articulations; that are, they tend to use compensatory strategies in order to overcome their structural defect and thus end up producing sounds that are not originally present in a particular language (Mc Williams, 1953).

### **Voice**

Voice is the element of speech that provides the speaker with the vibratory signal upon which speech is carried (Stemple, 2000). Voice is produced by the vibration of the vocal folds. Voice problems are also evident in children with cleft lip and or palate. It has been suggested that individuals with cleft palates are deviant in both vocal pitch and vocal intensity. Because of loss of air through the velopharyngeal port, some cleft patients have difficulty creating a voice that is of sufficient loudness to serve them well in communication or they use reduced loudness as a compensatory strategy. Often accompanying the soft-voice syndrome is the monotonous voice with little pitch variation.

Berry and Eisenson (1956) state that the speech of a cleft palate child may be described as "...frequently shrill in pitch and sometimes changing with growth to an unnaturally low, gravel voice" and also as "uncontrolled in loudness". Cobb and Lierle (1936) report that a general lack of vocal intensity and pitch variation was noted in the cleft palate subjects that they studied. Ritchie (1937) mentions that a "flat monotone" intonation pattern is typical of the voices of individuals with clefts.

Hamlet (1973) speculated that glottal tightness might contribute to vocal abuse which would lead to hoarseness, harshness, and vocal nodules secondary to hypernasality in individuals with cleft palate. Cleft palate patients with voice problems are often unable to demonstrate pitch variations of more than 3 or 4 tones (Hamlet, 1973).

### **Resonance**

Resonance is the modification of the glottal tone by the oral and nasal cavities. Velopharyngeal dysfunction, inadequate closure of the velopharyngeal valve during speech causes abnormal resonances like hypernasality, hyponasality and mixed nasality in individuals with cleft lip and or palate (Mc Williams, 1953).

Hypernasality is the perception of excessive nasal resonance during the production of non-nasal speech sounds. Hypernasality occurs when vowels and voiced consonants are excessively resonated in the nasal cavity. This behaviour occurs when the velopharyngeal port remains open during the production of the phonemes other than the nasal consonants /m/, /n/ and /ng/ (Stemple, 2000). This usually results from inadequate closure of the velopharyngeal valve during speech, but it may also be caused by the entrance of air into the nasal cavity through an open cleft palate or fistula in hard or soft palate.

Hyponasality is the speech characteristic associated with a reduction in nasal resonance during the production of nasal speech sounds. Hyponasality or Denasality occurs when the normal nasal resonance is not present on the phonemes /m/, /v/, /ng/ (Stemple, 2000). A reduction in normal nasal resonance usually results from blockage or partial blockage of the nasal airway by any number of causes, including upper

respiratory tract infection or a wide obstructing pharyngeal flap, or the presence of moderately large adenoids.

Nasal air emissions or the air pressure that is emitted through the nostrils during the production of the pressure consonants is also evident in individuals with cleft lip and or palate. Nasal air emission is the excessive airflow through the nose that can often be measured and perceived; heard most frequently during the production of voiceless plosives and fricatives; typically indicative of an incomplete seal between the oral and nasal cavities (Pena Brooks and Hegde, 2000). If the escape is sufficient in quantity, the nasal emission of air pressure is audible and distorts the acoustic signal of the speech sound.

Various types of techniques have been developed to obtain measures of nasality by various authors and this is one of the parameter that has been researched extensively in cleft palate speech. Cobb and Lierle (1936) reported that all of their 56 subjects exhibited "impaired resonanace," while MacCollum (1956) observed nasality in only nasality in 29% of their consecutive series of cases. Between these two extreme findings are those of Bzoch (1956), Counihan (1956), and Starr (1956), who reported that 62 to 76% of their subjects with cleft palate were judged to exhibit "mild to severe resonance distortion". The only statement that can be made with any certainty is that, on the average, nasal voice quality is more prevalent in the cleft palate population than the non cleft palate population (Moll, 1968).

### **Other Associated Problems**

In addition to speech, language and hearing impairments, children with cleft palate also exhibit additional difficulties such as feeding difficulties, dental anomalies and reduced general intelligence levels. Children born with cleft lip and or palate are often reported to be having feeding difficulties. Mothers with children who had clefts often reported feeding problems such as "gas in stomach, choking because the milk flowed too fast," and "vomiting or spitting up, milk or other food particles coming out through the nose" than did the mothers of normal children. Feedings, on the average, were reported to take longer with the children with clefts and also lead to normal regurgitation (Morris, 1968).

Dental anomalies are also often quite common in children with cleft lip and or palate. Brown and Oliver (1940) reported that 30 of their 33 subjects with cleft palate had missing teeth or gaps between the anterior teeth, and that 28 had occlusal deviations; they considered both factors might possibly have an adverse effect on speech sound articulation.

Another problem which is always not very evident, but yet found to have been associated with cleft palate; more specifically in clefts associated with syndromes is reduced intelligence level. In general, indications are that children with cleft lip and palate are significantly impaired, on the average, in their intellectual development and that the impairment is most substantial in the area of verbal intellectual skills (Goodstein, 1961).

Since the research on all these associated problems in cleft palate individuals have focused in to all these aspects and have tried to explore these areas, they have also been included in to the assessment domain. Further with the growing **trend** for team management of cleft palate individuals, the associated problems have also been observed and assessed by speech pathologists who play a significant part of this management team.

### **Assessment of Speech in Individuals with Cleft lip and Palate**

Of the various deviations and deficiencies exhibited by individuals with clefts of the lip and palate, probably the most important are those involving the process of speech communication (Moll, 1968). Though language delays are observed in these children, one of the most critical areas of concern to the parents and to all professional disciplines involved, is the child's speech. Speech is recognized as one of the key outcomes of the cleft team care (McWilliams et al., 1984). Although the existence of speech problems in this population has long been recognized, only during the past 20 to 30 years have they been studied in detail. In these studies, various techniques of measurement used for evaluating each of the areas of speech impairments are described and discussed since evaluation and comparison of research findings necessitates consideration of the specific measurement procedures used.

Speech impairments associated with cleft palate include disorders of articulation, resonance and voice. It is generally agreed (Eckelman and Baldrige, 1945; Van Riper, 1963; Van Riper and Irwin, 1958) that one of the major speech problems exhibited by individuals with clefts is a deficiency in articulating speech sounds. Procedures which have been used for assessing the speech sound articulation

of individuals with cleft palates can be grouped into two general categories: (a) articulation tests, and (b) judgments of overall articulation ability (Moll, 1968). Although all articulation tests involve the evaluation and scoring of individual sound productions, they differ in numerous ways. Articulation of specific sounds may be assessed in nonlanguage units such as nonsense syllables (Klinger, 1956; McDermott, 1962), in words (Bzoch, 1956; Byrne, 1961), or in specifically constructed phrases or sentences (McWilliams, 1954; Van Demark, 1964). Some investigators have utilized pictures to elicit the speech productions (Spriesterbach, 1956) while others have used repetition or reading of the speech unit (Van Demark, 1964). Some have scored the responses at the time of testing (Bzoch, 1956); others have scored them from tape recordings (Byrne, 1961). In addition, classifications of the type of articulatory errors observed have varied greatly between studies.

At about 2 ½ to 3 years of age, the average child will be co-operative for a more formal articulation testing. One of the articulation tests that has been developed for this purpose is the Iowa Pressure Articulation Test, (IPAT, Morris et al, 1964). This test uses the following classifications for errors: omissions, substitutions, substitutions- nasal, substitutions-glottal, substitutions-pharyngeal, substitutions-interdental, oral distortions (mild, moderate and severe) and nasal distortions (mild, moderate, severe).

Van Demark (1964) constructed a test with the score representing the number of plosives, fricatives, and affricates correctly produced in words elicited within sentences. This test also provides useful and necessary diagnostic information. The Templin-Darley Test of Articulation, 2<sup>nd</sup> edition (Templin, Darley, 1969) is also



another extensive test used to obtain a detailed description and evaluation of a child's articulation. It tests the articulation of consonant singles and clusters, vowels and diphthongs. It also comprises the IPAT for testing plosives, fricatives and affricates. Provisions are made in the scoring booklet for recording responses from conversation samples and for stimulability testing.

The Photo Articulation Test (PAT, Pendergast and associates, 1964) is the antithesis of the Templin-Darley tests, with respect to two characteristics: the excellent vivid, colour photographs contrast with the rather subdued drawings of the Templin-Darley, and it is a very quick, simple test. It consists of 72 pictures of common objects, testing 23 consonants in three positions in the words, and 18 vowels. Along with this, 3 pictures are also provided to evoke a story from the child.

Differing techniques have also been utilized for obtaining judgments of overall articulation skills. In some instances, gross categorizations such as "good, moderate, and poor" have been utilized, while in other instances such psychological scaling procedures as equal-appearing intervals (Morris, 1962; Spriesterbach, 1955) or direct magnitude estimation (Cooker, 1961; Van Demark, 1964) have been employed. Samples which have been utilized include conversational speech (Morris, 1962; Spriesterbach, 1955), reading passages (Cooker, 1961), and repeated sentences (Van Demark, 1964). The number and type of judges used in obtaining such ratings also have differed.

Wide variation in measurement procedures also is evident in the assessment of the speech intelligibility of cleft palate subjects. Overall ratings of intelligibility have

been used by some investigators (Bzoch, 1956; Counihan, 1956). More frequently, however, a perceptual rating of samples heard from tape-recorded speech have been done (Subtelny, 1961). Subtelny (1961) measured intelligibility in terms of percent of utterances intelligible to the panels of listeners. However, Fudala (1970) suggested a seven point rating scale for rating speech intelligibility. He suggested that a child's speech rating on an intelligibility continuum should be made based on the number of speech sound errors a client made in single-word productions, with the target sounds weighted according to their probable frequency of occurrence in the American speech. The wide range of techniques used to measure articulation and intelligibility presents a number of problems. To the degree that different procedures lead to different findings, this variation makes comparison and combination of research results difficult. It also leads to confusion as to which type of procedure should be selected for use in future investigations.

In addition to deviations in speech sound articulation, it is generally agreed that individuals with cleft palate also exhibit a voice deviation usually referred to as "nasality" (Eckelman and Baldrige, 1945; Van Riper and Irwin, 1958). The procedure utilized to assess nasal voice quality in individuals with cleft palates can be divided into two general categories: (a) listener-judgment procedures and (b) "objective" measures of nasality. One type of judgment procedure which has been used is that of categorization (Bzoch, 1956; Counihan, 1956), procedure which requires listeners to classify the speech of an individual into such categories as "normal," "mildly nasal," and "moderately nasal." Psychological scaling procedures such as those used for rating articulation skills also have been utilized in the assessment of nasality. Although listener judgments of nasal voice quality have been

used widely, there is no standard rating scale used unanimously that leads to difficulty in completely relying on the judgments. With the invention of modern technology, more objective measures of nasality are being used widely. The nasometer has been used for measuring the ratio of the nasal and oral airflow (Kelleher, 1960). The readings are then recorded either directly by the investigator or graphically for later measurements. Also attempts have been made to assess nasality by the use of spectrographic analyses (Hanson, 1964; Millard, 1957). In most instances, sonographic records of speech have been inspected for various characteristics which are presumably related to nasality. Again, this technique has no face validity as a measure of perceptual phenomenon. Some acoustic characteristics have been identified as accompanying nasalization (Fant, 1960); however, the studies of Dickson (1962) and Hanson (1964) demonstrate that such characteristics do not consistently differentiate nasal from nonnasal speakers as identified by listener judgments and that they do not provide continuous measures of nasality.

Velopharyngeal dysfunction, inadequate closure of the velopharyngeal valve during speech causes abnormal resonances like hypernasality and mixed nasality in individuals with cleft lip and or palate (Mc Williams, 1953). It is difficult to visualize the velopharyngeal region during the oral examination. So, various instruments have been used for this purpose. Videoendoscopy, in which a fiberoptic tube connected to a monitor is inserted through the nose and held just above the velopharynx gives a clear picture of the velopharyngeal function during speech. However, this technique requires expertise and efficiency.

It is also reported that individuals with cleft palate are also deviant in both vocal pitch and vocal intensity. As with vocal pitch and intensity characteristics, there are not many systematic studies which indicate that voice quality disorders other than hypernasality are more prevalent among speakers with cleft palates than among those without clefts. Recently, voice assessment softwares are being used for assessing the voice parameters in the cleft palate population.

The ultimate aim of cleft lip and palate care is for the child to be able to achieve his or her full potential and to function well in society. Assessment is an important aspect before carrying out any kind of intervention in individuals with cleft lip and or palate. Also assessment has to be done comprehensively keeping in mind that cleft palate individuals require a team management approach and that each professional involved in the team must be aware of the other professionals' area of concern and their contribution to the rehabilitation. For this purpose, it is always advisable to use a protocol that throws light on all the aspects with which a cleft palate individual has difficulties.

Until 1980's, there was no uniform measure for assessing all the speech characteristics described above, in cleft palate population. More recently various clinics have started developing their own protocols with provisions to assess all the speech characteristics and other associated difficulties in cleft palate individuals in one concise form. Thus, in 1990s, the advent of the usage of protocols in assessing speech and other characteristics of cleft palate children started and research, from then, focused on developing standardized protocols for the same.

One of the outcomes of the national U.K study for cleft lip and palate teams is mandatory regular clinical assessment and also clinical audit of outcomes (Clinical Standards Advisory Group (CSAG) Report, 1998, Department of Health, 1999, Beam et al, 2001). This audit process was introduced into health care within the U.K. following the Bristol Enquiry (Department of Health, 1999) and is now practiced widely. Clinical audit is defined by the National Institute for Clinical Excellence (2002) as "a quality improvement process that seeks to improve patient care outcomes through systematic review of care against explicit criteria and the implementation of change." Therefore, clinical audit includes an accepted baseline standard, the documentation of the process of care (such as the nature and quantity of speech therapy intervention or secondary surgical procedures), outcomes, and the implementation of change if required. Generally, audit studies provide a lower level of evidence than clinical trials do; they can be less rigorous in their design and more tolerant of bias and heterogeneity of subjects, with results that are less generalizable (Sell, 2005). However, as in research studies, there is still the need for a clearly defined question or objective, with explicit, reliable, and valid measurable outcomes. Therefore, audit has an important place within the evaluation of clinical practice and service delivery, helping practice to be informed by scientifically derived findings rather than opinion, past practice, and past teaching (Reilly et al., 2003).

In order to undertake clinical audit, well-defined and validated outcome measures are required. However, there is a general lack of agreement about how to measure and report cleft speech outcomes. Various authorities have highlighted the inconsistent and incomparable speech reporting methods within the literature, particularly for reporting surgical outcomes. Although it is well recognized that there

is a need for one international approach to speech analysis (McComb, 1989; Henningsson and Hutters, 1997; Kuehn et al., 2002; Whitehill, 2002; Sell, 2005) there remains no consensus about the methods that should be used (Henningsson and Hutters, 1997; Hirschberg and Van Demark, 1997).

There is also disagreement about the parameters that should be included in a cleft speech measure. Intelligibility provides an example of such a controversy. Dalston et al. (1988) recommend that hypernasality, hyponasality, nasal escape, intelligibility, and articulation should be reported always. Witzel (1991) and Sell et al. (1994), however, both caution against reporting intelligibility, because it is difficult to rate reliably and can be influenced by many variables other than the speech characteristics that are being assessed, such as developmental speech immaturities, hearing related errors, or the listener's experience of disordered speech. In view of this, Witzel (1991) recommends that intelligibility should be reported only in conjunction with detailed descriptions of consonant production and nasality. More recently however, Whitehill (2002) has emphasized the need for a global measure of speech performance, such as intelligibility, but has recommended a detailed quantitative methodology. This is particularly appropriate for research studies, but would not be applicable in audit studies. Lohmander-Agerskov and Olsson (2004), in their review, conclude that resonance, nasal airflow, and consonant production are the parameters of speech that should be evaluated in speech outcome studies.

Disagreement also exists about the scales that should be used to assess the different speech parameters. The scalar points in existing measures tend to be poorly defined (Wirz and Mackenzie Beck, 1995) and few of the scales currently in use have

been tested for reliability and validity. Furthermore, previous approaches to speech assessment have provided little detailed information on consonant errors. For example, the Pittsburgh Scale (McWilliams and Philips, 1979) and the Categorical System of Articulation Problems in Cleft Palate (Ainoda and Okazaki, 1993) both focus on velopharyngeal function, with minimal detail recorded about consonant errors.

The Temple Street Scale of Nasality and Nasal Airflow Errors was developed by Sweeney, 2000. This scale is a reliable and valid perceptual profile for the assessment of nasality and nasal airflow errors in speech. This scale aimed to describe the nature and the degree of nasality and nasal airflow errors in speech. The validity of the perceptual profile was then assessed using instrumental assessment. But this scale did not evaluate consonant errors. To facilitate cross-linguistic outcome studies, the Eurocleft Speech Group developed a method for assessing speech outcome across five Northern European languages. Acceptable levels of interrater reliability were achieved (Eurocleft Speech Group, 1994, 2000). This assessment, however, was developed specifically for older children who were beyond the speech development phase and focused on a procedure that provided a detailed analysis of the phonetic characteristics of speech. It is therefore not suitable for use in an intercenter audit where outcomes are collected at age 5 years (when speech is still developing).

It is widely accepted that reliable and detailed perceptual speech data are required (McWilliams et al., 1984; Kuehn and Moller, 2000), and yet it is recognized that complex speech disorders, such as those that occur in association with cleft palate, are often associated with low transcriber agreement (Shriberg and Lof, 1991;

Howard and Heselwood, 2002). More detailed transcription provides greater information, but has limited reliability (Shriberg and Lof, 1991). A further problem is ill-defined terminology. Both Kent et al. (1999) and Whitehill (2002) discuss the need for an equivalent understanding of terminology and their definitions; however, definitions are rarely included in cleft speech measures. The reliability and validity of assessment methods are rarely reported, despite recommendations to the contrary (D'Antonio and Scherer, 1995; Wyatt et al., 1996; Lohmander-Agerskov and Olsson, 2004). Other issues that have arisen in relation to reliability are methods and training in transcription, descriptive category judgments, equal interval scaling, direct magnitude estimation, paired comparison, fewer choices on a rating scale, and consensus listening (Shriberg et al., 1984; Mc Williams and Philips, 1979; Young, 1969; Kent et al., 1999; Keuning et al., 1999).

In 1989, an International Cleft Palate Symposium was held in Budapest, Hungary. At the conclusions of that meeting, the Cleft Palate Committee of IALP felt it important to develop a standardized method of evaluating the speech and hearing of individuals with cleft palate and velopharyngeal dysfunction. The goal of this effort was to develop an evaluation system to describe and document the speech and hearing of these individuals which could be used on an international basis.

A protocol was proposed by Hirshberg J and Van Demark D. R (1997) using this suggested method. This protocol consists of two parts: a documentation of the personal data, history and status of the patient followed by perceptual and instrumental evaluation. The authors recognize that ratings are subjective, however, it has been clearly demonstrated that experienced clinicians can reliably rate articulation



defectiveness, intelligibility, nasality, and velopharyngeal dysfunction by the use of the rating scale technique. Instrumental examination of a patient with velopharyngeal dysfunction is always recommended to either confirm or reject the perceptual observation made. It is well recognized that no single instrumental measure correlates perfectly with perceptual measures, and thus a battery of several instrumental measures is recommended in the evaluation of velopharyngeal dysfunction. Furthermore, instrumental measures should help to assess the degree and type of velopharyngeal dysfunction so that such measures can assist in the treatment of the individual. Methods traditionally used are radiological assessment, or assessment by ultrasound and other visual techniques. Aerodynamic measures and assessment of nasal vibration may indicate the degree of dysfunction but do not necessarily help describe the type or area of dysfunction. In some instances EMG and/ or histological assessment of the soft palate muscular tissue may be indicated.

According to this protocol, the suggested parameters to be assessed during the speech and hearing evaluation are the following: nasal resonance, nasal escape, articulation and its disorders, facial grimacing, speech intelligibility, patient teachability, expressive language and voice. The authors also describe a five-point scale description system (a rating of one is considered as normal and a rating of five is considered as severe), which can be used also for assessment of hearing, velopharyngeal function and other attributes of the cleft palate or velopharyngeal dysfunction individual. The most important diagnostic procedures as recommended by these authors are: X-ray (video/cinefluoroscopy), nasopharyngoscopy, nasometry, in dubious cases it is also fundamental to clarify the etiology with electrophysiological methods. The protocol presented was a suggestion for

standardization of observations. By using the suggested measures in this protocol, the committee hoped that more accurate diagnosis will be made, evaluation of therapeutic results will become more reliable, and that more effective management will occur on an international level. However this protocol is very lengthy and time consuming and the reliability of this protocol has not been reported.

The Great Ormond Street Speech Assessment (GOS.SP.ASS; Sell et al., 1994, 1999) was developed as a standardized approach to assessing speech in the clinical setting in the U.K. It provides an evaluation of resonance, nasal emission, nasal turbulence, grimace, articulation characteristics, and phonation, together with a systematic approach to an oral examination, the mirror test, and description of the visual appearance of speech. This protocol describes a four point rating scale for rating resonance, nasal emission, nasal turbulence and grimace. A score of zero indicates absence of a feature and a score of three indicates a severe error in that particular feature. The consonant production form checks for the articulation production in syllable initial and syllable final targets. The rater is also encouraged to identify etiological factors and to detail the management plan.

A survey of speech assessment protocols used by specialist therapists in the U.K. was undertaken to encourage the adoption of one common protocol (Razzell and Harding, 1995). The survey is known as the Turner project. Its aim was to identify a common protocol to facilitate inter-centre comparisons. Six speech assessment protocols were compared across four parameters: ease of use, speed of use, comprehensiveness of information and accessibility of information from completed forms. GOS.SP.ASS. (Sell, 1994) was selected as the preferred clinical and research

tool. The survey also revealed significant ambiguities in the protocol. Thus the GOS.SP.ASS, revised version (1998) aimed to remove the ambiguities, facilitate form completion, and also include additional parameters which are useful in caseload management.

Razzell (1996) extended the survey with the aim of developing a more succinct protocol specifically for clinical audit purposes which would use GOS.SP.ASS (1994) as its foundation. This audit protocol was generated simultaneously as the revisions to GOS.SP.ASS (1998) proceeded. In the revised version more complex sentences were added which contains /s/ clusters and may identify any residual anterior cleft type characteristics (speech characteristics specific to cleft/ velopharyngeal incompetence) in otherwise normal speech patterns. A training video is also available which provides examples of variations of nasal resonance, emissions, turbulence and cleft type characteristics for each of the different points in the rating scale used in this protocol. The changes outlined in the categorization of cleft type characteristics in GOS.SP.ASS (1998) were developed within the CAPS project (Razzell *et al.* 1996, Harding *et al.* 1997) and are reported to be straightforward both to apply and to analyse. Although good levels of interrater reliability have been achieved using GOS.SP.ASS (1998), this method is considered too detailed for use in audit studies. It is, however, intended that GOS.SP.ASS (1998) should continue to be used in clinical work

The Cleft Audit Protocol for Speech (CAPS; Harding *et al.*, 1997) is closely aligned with the GOS.SP.ASS, and was developed specifically for clinical audit purposes. The protocol includes a measure of all the recommended speech parameters

as in the GOS.SP.ASS, including consonant errors, but the validity and reliability of the measure have not been tested rigorously. A modified version of CAPS was used in the national CSAG cleft outcome study in the U.K. (CSAG Report, 1998). Good interexaminer reliability was established for the two raters who assessed the speech outcomes (Sell et al., 2001).

The experience of using CAPS in the CSAG study highlighted some limitations in the measure within the nasality and nasal airflow sections, and also in the recording of the prevalence of consonant errors (Sell et al., 2001). Furthermore, it was difficult to assess the levels of existing needs for therapy and velopharyngeal surgery from the data that were collected. The latter are needed to inform commissioners of health services about the residual needs for treatment that exist within a population, and thus the adequacy of the clinical services that are being provided and resources needed.

Following the CAPS, a revised version, CAPS-A (Cleft Audit Protocol for Speech - Augmented) was proposed by John A, Sell D and others (2006). This version included a more detailed and explicit assessment for cleft type characteristics unlike the earlier version. This used a colour coding rating system for indicating the severity of the cleft type characteristic (CTC) present. A dark green shading indicates the absence of the CTC whereas an yellow shading for two consonants affected and a red shading for three or more consonants affected. Furthermore, this version of CAPS summarized the CTCs in to four categories of anterior, posterior, nonoral and passive and this achieved very good intra and inter-rater reliability. The rating scales that have been used for rating resonance, nasal airflow and grimace were similar to that used by

the GOS.SP.ASS (Sell et al, 1998). This protocol also evaluates a perceived requirement of speech and language therapy for cleft speech problems at some point which was not at all mentioned in the CAPS, 1997 version. The tool was designed to provide data on the individual parameters of speech and on the overall quality of speech. It also was designed to indicate existing treatment needs, including the need for further investigation and management of structural problems and/or speech therapy intervention. In this way it provided an indirect measure of the continuing burden of care for health professionals, patients and families. However, one limitation in the procedure of developing this protocol was the small sample size used for establishing reliability. But, the authors have cited that they have planned to test the validity and reliability of the tool in future iterative tests of reliability.

A recent survey revealed that 201 different European teams used 194 protocols for one cleft subtype, making comparison of outcomes impossible (Shaw et al., 2000). Another problem pertains to the fact that speech outcomes were routinely reported by professionals other than speech pathologists (Jackson et al., 1983), thus calling the validity of the results into question. The situation has changed over the past decades, and speech-language pathologists are now valued members of the interdisciplinary team (Grunwell and Sell, 2001). However, procedures for speech assessment continue to vary considerably, and the validity of results can still be questioned.

Thus, there is growing interest in coordination of procedures for speech assessment in patients with cleft lip and palate, primarily between centers and within languages. With this intent, all the above described protocols have been developed,

but unfortunately, none of them could accomplish their goal. Also, these protocols have been used as reliable measures abroad; they cannot be adapted directly for the Indian population. This is due to the fact that they were developed based upon studies done on their own western population which has a wide variation in many aspects like culture, language and type of available clinical services from that of the Indian population. Thus the present protocol has been developed with these points in view.

## CHAPTER 3

### METHOD

The present study aimed at developing a comprehensive and structured protocol for assessing the speech of individuals with cleft lip and/palate (repaired/unrepaired) and administering the same to individuals with cleft lip and/ palate both before and after speech therapy.

### PROCEDURE

The study procedure was divided into three phases, Phase I, Phase II and Phase III.

### PHASE I

#### Developing the Protocol

**Item Pooling:** As this study is aimed to construct a protocol for the assessment of speech in individuals with cleft palate, the literature review constituted a vital part and the first step of this study. Detailed review of literature was done about the available different tools and protocols used by different authors/ clinics to assess the speech in cleft palate population. Different speech assessment formats/ protocols, journal articles and web based search were done. All these items were pooled from the literature. These served as the basis for the construction of the present protocol. Based on the available information, a protocol was proposed.

The protocol was developed for the assessment of speech in individuals with cleft palate. The protocol comprises the following parameters for speech assessment:

- Demographic data

Subjective assessment: The clinician has to assess the following parameters subjectively by carefully observing the subject and obtaining the other detail information from the subject / guardian:

- Oro facial examination- This includes the assessment of oral structures and function (adapted from Oral and facial examination, Raymond Kent, 1994)
- Other general observations and other findings are recorded.
- Details of surgery/ surgeries undergone by the client such as the date of surgery, type of surgery, place of surgery.
- Vegetative skills- Non speech oral functions are included in this measure.
- The Modified Striped 'Y' classification (Kernahan and Stark, 1958) is included for representing the type and extent of the cleft of lip and/ palate.
- Presence or absence of nasal regurgitation for liquid, semisolid and solid food items are noted.
- Assessment of resonance - This includes subjective tests for resonance such as the mirror fogging test, modified tongue anchor test and listening test for nasal emission. Also rating for hypernasality, hyponasality, nasal air emissions, nasal grimaces and nasal turbulence are included. All these rating scales were adapted from CAPS-A (Alexandra John et al, 2006).
- Articulation assessment adapted from Bzoch Error Pattern Articulation Test (Bzoch, 1978) is included. The stimuli used in our present study was adapted from the Kannada Articulation Test (Babu, Rathna and



Bettageri, 1972). The target phonemes are specified. Depending on the language, clinician can select the stimuli.

- Also, a provision for rating the cleft type characteristics adapted from the GOS.SP.ASS (Sell, 1998) is included.
  - Assessment of intelligibility using 7 - point rating scale (Developed at the Cleft Speech conference, Chennai, 2002) is included.
  - A subjective assessment of voice parameters is included. Also the maximum phonation duration for the sounds, /a/, /l/, /u/, /s/, /z/ is also recorded.
  - Assessment of fluency - Presence of any dysfluencies, types of dysfluencies and any secondaries observed are noted.
- Objective assessment: The following parameters are assessed using objective methods by the clinician:
    - Assessment of resonance:
      - > Nasometry- The stimulus recommended for assessment using nasometry is to be adapted from the study, "Normative scores for Nasometer in Kannada" by Jayakumar (2005). The values thus obtained are also recommended to be compared with the norms obtained in his study. Similar assessment can be done for the different languages for oral and nasal sentences/ syllables and comparison can be made with the available normative data.
      - > Nasoendoscopy- This has to be done by the qualified professional in the presence of the speech pathologist.

- Assessment of voice:
  - > Vaghmi software (Voice and Speech systems, Bangalore) is used for obtaining the frequency and intensity related information.
  - > Aerodynamic measures such as vital capacity and mean airflow rate are assessed using the Vitalograph.
  - > Heterodyne Analyser is used for assessing the natural frequency and optimum frequency.
- Digital recording of speech sample of the subject is also included for further analysis of articulatory errors.

## **PHASE II**

### **Testing the face and content validity of the tool**

Face and content validity was judged using a process in which the proposed copies of the protocol was sent to 20 speech language pathologists who are working in centers dealing with rehabilitation of cleft lip and palate in India and abroad. They were briefed about the purpose of developing this protocol and were asked to use this tool clinically and to provide suggestions. Out of the 20 speech pathologists, 14 speech pathologists provided feedback and suggestions for the protocol. Based upon their ratings and suggestions, necessary modifications were incorporated. The suggestions which were suggested by most of the judges were considered.

## **PHASE III**

### **Administering the protocol to individuals with cleft palate**

Three subjects with operated cleft lip and / palate between the age range of 5 to 17 years were selected as subjects for the study. These subjects were selected as

they had not undergone speech and language therapy prior to the assessment by using the developed protocol. The protocol thus developed was administered to these individuals with cleft lip and/palate. The protocol was administered prior to attending speech and language therapy and/ after attending few sessions of speech and language therapy. Digital recording of their speech samples was also done for analysis of articulatory errors and speech intelligibility.

## CHAPTER 4

### RESULTS AND DISCUSSION

The aim of the present study was to develop a protocol for the assessment of speech in individuals with cleft lip and palate and to validate the protocol. A detailed literature review was done and the information from the literature was pooled out. Then this information was used in constructing the present protocol (Phase I). Following the construction of this protocol, it was mailed to twenty speech pathologists who are working in centers dealing with rehabilitation of individuals with cleft lip and palate. They were asked to provide suggestions regarding any necessary modifications in the protocol. Based on their suggestions, necessary and feasible modifications were incorporated. Then the protocol was administered to three subjects with repaired cleft lip and/ palate before and after attending few sessions of speech therapy.

The results of this study are discussed under the following parameters:

- > The modifications suggested by the speech language pathologists for the proposed protocol.
- > The sensitivity of the protocol in assessing the speech characteristics in the subjects with cleft lip and/ palate prior to and after attending a few sessions of therapy.

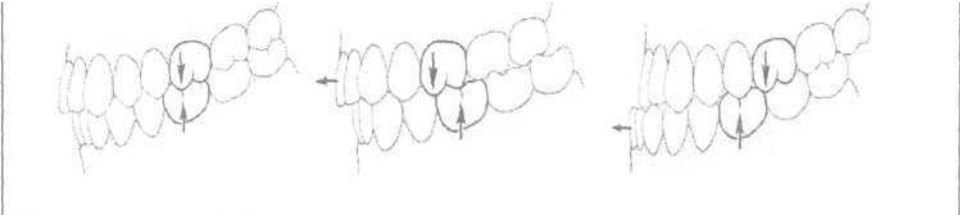
#### **Modifications of the Protocol:**

Fourteen speech language pathologists (SLPs) provided various suggestions to be incorporated in the protocol. The suggestions that were proposed by majority of the judges were considered. The table 1 shows the Protocol proposed in Phase I and

the present protocol in which the suggestions were incorporated. Major suggestions were provided for modifications in the Oro facial examination. The suggestions that were provided mainly included addition of pictures for better representation of the abnormalities in the oral structures, and also addition of a provision for recording the surgery details. Another major suggestion provided by many SLPs was to include Nasometric evaluation in the instrumental assessment. Accordingly nasometric evaluation was included in the instrumental assessment. There were only minor modifications suggested in the other domains and they were incorporated as given in the table.

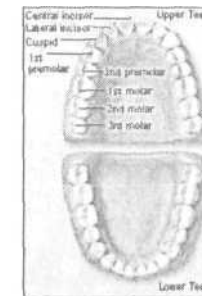
An important finding was that almost all SLPs had suggested the inclusion of a provision for recording the individuals' language status. But this was not included as this protocol is only aimed at assessing the speech related behaviors of the cleft palate individual.

Table 1: Protocol developed in Phase I and the Protocol after incorporating the suggestions provided by the SLPs

S.No	Protocol developed in Phase I	Protocol after incorporating the suggestions provided by the SLPs
1.	<p><u>Pro-facial Examination</u></p> <p><u>I. Facial characteristics:</u></p> <p>A. Frontal view:</p> <ul style="list-style-type: none"> <li>• Nasal area: Deviated septum/ Obstructed/ Deviated columella</li> <li>• Lips: Cupid's bow: Present/ Absent</li> <li>• Lip function: Pursing/ Puckering/ Rounding/ Spreading/ Adequate closure/Restricted movement</li> </ul> <p><u>II. Intraoral characteristics:</u></p> <p>A. Dentition:</p> <ul style="list-style-type: none"> <li>• General dental hygiene:</li> <li>• Occlusional relationships: Normal/ Class I/ Class II/ Class III/</li> </ul>	<p><u>Oro-facial Examination</u></p> <p><u>I. Facial characteristics:</u></p> <p>A. Frontal view:</p> <ul style="list-style-type: none"> <li>• Nasal area: Deviated septum/ Obstructed/ Deviated columella/ Deviated ala cartilage</li> <li>• Lips: Repaired / Unrepaired Cleft</li> <li>• Cleft lip (if present): Unilateral/Bilateral/Median</li> <li>• Cupid's bow: Present/ Absent / Deviated</li> <li>• Lip function: Adequate closure      Restricted movement               <ul style="list-style-type: none"> <li>o Pursing</li> <li>o Puckering</li> <li>o Rounding</li> <li>o Spreading</li> </ul> </li> </ul> <p><u>II. Intraoral characteristics:</u></p> <p>A. Dentition:</p> <ul style="list-style-type: none"> <li>• General dental hygiene: Normal / Discolouration / Decay of tooth</li> <li>• Occlusional relationships: Class I/Class II/Class III</li> </ul> <p style="text-align: center;">Class I Type Occlusion      Class II Type Occlusion      Class III Type Occlusion</p> 

- Bite: Under bite/ Over bite/ Over jet/ Open bite/ Cross bite/  
Anterior open bite
- Sibilant production with teeth in occlusion  
/s/          /z/          /ʃ/          /ʒ/
- Missing teeth

- Bite: Under bite/ Over bite/ Over jet/ Cross bite/ Posterior open bite/  
Anterior open bite
- Production of these sounds with teeth in occlusion:  
/s/                                  /z/                                  /ʃ/
- Missing teeth: Present / Absent



- Other anomalies (specify):
- B. Tongue:
- Size: Normal/ Macroglossia/ Microglossia
  - Tongue movements:                                  Adequate                                  Inadequate
    - o Protrusion
    - o Retraction
    - o Elevation
    - o Lateral movements
  - Lingual frenum: Normal/ Tongue tie

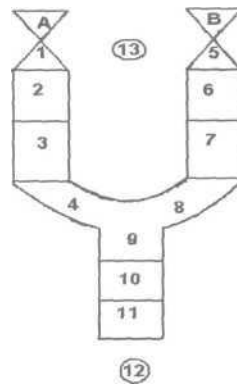
<p>B. Hard palate:</p> <ul style="list-style-type: none"> <li>• Coloration : Midline, Lateral</li> <li>• Bony midline (palpate): Normal/ Cleft/ Submucous cleft</li> <li>• Contour : High arch/ Low arch/ Narrow arch</li> </ul> <p>C. Soft palate/ Velum:</p> <ul style="list-style-type: none"> <li>• Midline muscle union: Complete/ Cleft/ Submucous cleft</li> <li>• Velar elevation: Normal/ Reduced/ Other</li> <li>• Range of velar excursion(up &amp; back stretching during Phonation) :Excellent/Moderate/Minimal</li> </ul> <p>D. Uvula:</p> <ul style="list-style-type: none"> <li>• Shape: Normal/ Bifid/ Broken/ Other</li> <li>• Position: Midline/ Lateral/deviated</li> </ul> <p>E. Fauces:</p> <ul style="list-style-type: none"> <li>• Isthmus: Open/Tonsillar obstruction of isthmus</li> <li>• Tonsil coloration: Normal/ Inflamed</li> </ul>	<p>C. Hard palate:</p> <ul style="list-style-type: none"> <li>• Coloration:                    Normal                    Abnormal <ul style="list-style-type: none"> <li>o Midline</li> <li>o Lateral</li> </ul> </li> <li>• Bony midline (palpate): Normal/ Cleft/ Submucous cleft / Fistula</li> <li>• Contour : High arch/ Low arch/ Narrow arch / Wide arch</li> <li>• Cleft (if present) : Repaired / Unrepaired</li> <li>• Type of cleft : Unilateral/ Bilateral / Median</li> </ul> <p>D. Soft palate/ Velum:</p> <ul style="list-style-type: none"> <li>• Midline muscle union: Complete/ Cleft/ Submucous cleft</li> <li>• Cleft (if present): Repaired / Unrepaired</li> <li>• Type of cleft : Unilateral/ Bilateral / Median</li> <li>• Velar elevation (on phonation of/a/): Normal/ Reduced/ Other</li> <li>• Range of velar excursion (up &amp; back stretching during phonation): Excellent/ Moderate/ Minimal/ Restricted</li> </ul> <p>E. Uvula:</p> <ul style="list-style-type: none"> <li>• Shape: Normal/ Bifid/ Broken/ Other</li> <li>• Position: Midline/ Deviated</li> </ul> <p>F. Fauces:</p> <ul style="list-style-type: none"> <li>• Isthmus: Open/ Tonsillar obstruction of isthmus</li> <li>• Tonsil coloration: Normal/ Inflamed / Tonsillectomy / Adenoidectomy</li> </ul>
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<p>F. Pharynx:</p> <ul style="list-style-type: none"> <li>• Passavant's ridge: Present/Absent (During physiologic activity)</li> <li>• H/o surgical removal of adenoids: Present/ Absent (Details if present)</li> <li>• Gag response: Positive/ Negative/ Weak</li> </ul> <p>G. Tongue:</p> <ul style="list-style-type: none"> <li>• Size: Normal/ Macroglossia/ Microglossia</li> <li>• Tongue movements: Protrusion/ Retraction/ Elevation/ Lateral movements</li> <li>• Lingual frenum: Normal/ Tongue tie</li> </ul> <p>II. General observations and other findings:</p>	<p>G. Pharynx:</p> <ul style="list-style-type: none"> <li>• Passavant's ridge: Present/ Absent (During physiologic activity)</li> <li>• H/o surgical removal of adenoids: Present/ Absent (Details if present)</li> <li>• Gag response: Positive/ Negative/ Weak</li> </ul> <p>II. General observations and other findings:</p>
	<p>III. Surgerv Details:</p>

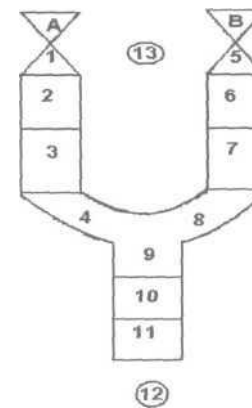
**Cleft palate profile:**

Modified Striped 'Y' classification:



**Cleft palate profile:**

Modified Striped 'Y' classification:



A, B- Nose

1, 5 -Floor of nostrils

2, 6 - Lips

3, 7- Alveolus

4, 8 - Hard palate anterior to incisive foramen

9, 10- Hard palate posterior to incisive foramen

11 -Soft palate

12 - Velopharyngeal port

13 - Premaxilla

(\*Join with dotted lines 13 to 9 in case of presence of premaxillary protrusion.

\*Join with dotted lines 12 to 11 in case of presence of Velopharyngeal inadequacy)

**Vegetative skills:**

Adequate

Inadequate

Remarks (if inadequate)

Sucking:

Blowing:

Biting:

Chewing:

Swallowing:

**Vegetative skills:**

Vegetative skill	Adequate		Inadequate		Remarks (if inadequate)
	Closing nostrils	Without closing nostrils	Closing nostrils	Without closing nostrils	
Sucking					
Blowing					

Vegetative skill	Adequate	Inadequate	Remarks (if inadequate)
Biting			
Chewing			
Swallowing			

4. **Nasal regurgitation:**  
 Present      Absent      Remarks (if present)  
 For solids:  
 For semisolids:  
 For liquids:

Resonance

**Mirror fogging test:** Pass / Fail

**Modified tongue anchor test:** Pass/ Fail

**Ability to maintain intraoral breath pressure:**

"Nares occluded: Adequate/ Inadequate

"Nares unoccluded: Adequate/ Inadequate

**Nasal regurgitation:**  
 Present      Absent      Remarks (if present)

For solids:  
 For semisolids:  
 For liquids:

Resonance

**Mirror fogging test (on phonation of /a/):** Pass / Fail

**Modified tongue anchor test:** Pass/ Fail

**Nasal Emission (on phonation of /a/):** Present / absent (by listening through listening tube / straw)

**Ability to maintain intraoral breath pressure:**

Nares occluded: Adequate/ Inadequate

Nares unoccluded: Adequate/ Inadequate



		/x/ /d/ /s/											
	Post alveolar	/th/ /dh/ /sh/ /ch/											
	Velar	/j/ /k/											
<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below)</p> <ul style="list-style-type: none"> <li>• Lateralisation: 0 2 3 4 5 <b>6</b></li> <li>• Palatalisation: 0 2 3 4 5 <b>6</b></li> <li>• Backing to velar: 0 2 3 4 5 <b>6</b></li> <li>• Backing to uvular: 0 2 3 4 5 <b>6</b></li> <li>• Pharyngeal: 0 2 3 4 5 <b>6</b></li> <li>• Glottal: 0 2 3 4 5 <b>6</b></li> <li>• Active nasal fricative: 0 2 3 4 5 <b>6</b></li> <li>• Weak/ nasalized consonants: 0 2 3 4 5 <b>6</b></li> <li>• Nasal realizations: 0 2 3 4 5 <b>6</b></li> <li>• Absent pressure consonants: 0 2 3 4 5 <b>6</b></li> <li>• Omission of fricatives or plosives: 0 2 3 4 5 <b>6</b></li> <li>• Anterior sibilants' distortions: 0 2 3 4 <b>5 6</b></li> <li>• Reduced IOP on fricatives: 0 2 3 4 <b>5 6</b></li> <li>• Imprecise tongue tip movements: 0 2 3 4 <b>5 6</b></li> </ul>													
<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below \Summary'of CTCs: 0 - No CTCs, 1 - Anterior oral CTCs 2 - Posterior oral CTCs, 3 - Non oral CTCs, 4 - Passive CTCs, 5 - Developmental errors, 6- Other}</p> <ul style="list-style-type: none"> <li>• Lateralisation: 0 1 <b>2</b> 3 4 5 6</li> <li>• Palatalisation: 0 1 <b>2</b> 3 4 5 6</li> <li>• Backing to velar: 0 1 <b>2</b> 3 4 5 6</li> <li>• Backing to uvular: 0 1 <b>2</b> 3 4 5 6</li> <li>• Pharyngeal articulation: 0 1 <b>2</b> 3 4 5 6</li> <li>• Glottal articulation: 0 1 <b>2</b> 3 4 5 6</li> <li>• Active nasal fricative: 0 1 <b>2</b> 3 4 5 6</li> <li>• Weak/ nasalized consonants: 0 1 <b>2</b> 3 4 5 6</li> <li>• Nasal realizations: 0 <b>1</b> 2 3 4 5 6</li> <li>• Absent pressure consonants: 0 <b>1</b> 2 3 4 5 6</li> <li>• Omission of fricatives or plosives: 0 <b>1</b> 2 3 4 5 6</li> <li>• Anterior sibilants' distortions: 0 <b>1</b> 2 3 4 5 6</li> <li>• Reduced IOP on fricatives: 0 <b>1</b> 2 3 4 5 6</li> </ul>													

• Double articulation: 0 1 2 3 4 5 6

• Imprecise tongue tip movements: 0 1 2 3 4 5 6

• Double articulation: 0 1 2 3 4 5 6

(Summary of CTCs: 0- No CTCs

- 1- Anterior oral CTCs
- 2- Posterior oral CTCs
- 3- Non oral CTCs
- 4- Passive CTCs
- 5- Developmental errors
- 6- Other}

7.

Intelligibility

**Speech intelligibility rating:** (Based on spontaneous speech)

Clinician Parent Self

- 1. Intelligible
- 2. Listener attention needed
- 3. Occasional repetition of words required
- 4. Repetitions/ rephrasing necessary
- 5. Isolated words understood
- 6. Occasionally understood by others
- 7. Unintelligible

Intelligibility

**Speech intelligibility rating:** (Based on spontaneous speech)

Clinician Parent Self

- 1. Intelligible
- 2. Listener attention needed
- 3. Occasional repetition of words required
- 4. Repetitions/ rephrasing necessary
- 5. Isolated words understood
- 6. Occasionally understood by others
- 7. Unintelligible

**Voice: (based on phonation task)**

Maximum Phonation Duration: /a/-	seconds
/i/	seconds
<b>lul-</b>	seconds
/s/-	seconds
<b>lzl-</b>	seconds

Pitch: High/ Low/ Appropriate

Loudness: Reduced/ Increased/ Adequate  
 Quality: Harsh/ Hoarse/ Breathy/ Strained  
 Pitch Breaks: Present/ Absent  
 Biphonation: Present/ Absent  
 Tremors: Present/ Absent

9.

**Fluency**

Dysfluencies: Present/Absent

(Description of dysfluencies if present)

**Voice: (based on phonation task)**

Maximum Phonation Duration (Average of 3 trials): /a/-	seconds
/i/	seconds
/u/	seconds
/s/-	seconds
/z/-	seconds

Pitch: High/ Low/ Appropriate

Pitch Range: Normal/ Reduced/ Monotonous

Loudness: Reduced/ Increased/ Adequate  
 Quality: Harsh/ Hoarse/ Breathy/ Strained/Nasality  
 Pitch Breaks: Present/ Absent  
 Biphonation: Present/ Absent  
 Tremors: Present/ Absent

**Fluency**

Dysfluencies: Present/ Absent

Types of dysfluencies (if present):	Frequency	Duration
o Repetitions		
o Prolongations		
o Hesitations		
o Pauses		
o Hard contacts		
o Secondaries		
o Other dysfluencies		

	Rate of speech: Fast/ Slow/ Normal words per minute	Rate of speech: Fast/ Slow/Normal Words per minute
10.	<i>Prosody (based on perceptual analysis)</i> Stress: Intonation: Rhythm:	<i>Prosody (based on perceptual analysis)</i> Stress: Intonation: Rhythm: Pause/ Juncture:
11.	<b>Instrumental assessment:</b> (based on the availability of the instruments)	<b>Instrumental assessment:</b> (based on the availability of the instruments)
		<b>Nasometer:</b> Nasalance (%)      Tonar (Ratio) Oral syllables Nasal syllables Oral sentences Nasal sentences
	<b>Nasoendoscopy:</b>  <b>Structure      Movement</b> Soft palate: Posterior pharyngeal wall: Lateral walls: Size of gap: Large/ Moderate/ Minimal Nature of defect: Coronal/ Sagittal/ Central	<b>Nasoendoscopy:</b>  <b>Structure      Movement</b> Soft palate: Posterior pharyngeal wall: Lateral walls: Size of gap: Large/ Moderate/ Minimal Nature of defect: Coronal/ Sagittal/ Central





### **The Sensitivity of the Protocol:**

After incorporating the necessary suggestions, the protocol was administered to three subjects with cleft lip and/ or palate before and after five to ten sessions of speech therapy. The following are the details obtained from the administration of the protocol to the subjects:

#### **Subject X:**

Subject X was a five year old female diagnosed as having delayed speech and language with hypernasality and repaired cleft palate. She had a complete midline cleft of the hard and soft palate which was repaired at the age of one and half years. She had also undergone a surgery for tongue tie at the age of three years. She was recommended for speech and language therapy. The following are the details of the assessment done for her using the present protocol.

### **Oro-facial Examination**

#### **I. Facial characteristics:**

##### A. Frontal view:

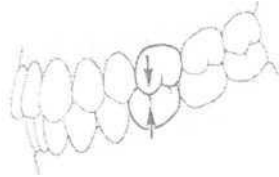
- Nasal area: Normal
- Lips: Normal
- Cleft lip (if present): Absent
- Cupid's bow: Present
- Lip function:
  - o Pursing                      Adequate
  - o Puckering                    Adequate
  - o Rounding                     Adequate
  - o Spreading                    Adequate

## II. Intraoral characteristics:

### A. Dentition:

- General dental hygiene: Normal
- Occlusional relationships: Class I

Class I Type Occlusion

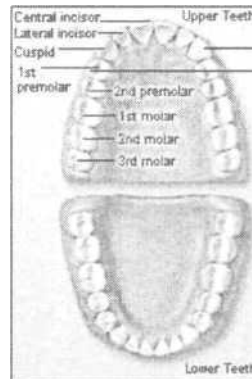


Bite: Cross bite ( posterior)

Production of these sounds with teeth in occlusion:

/s/ - Distorted      /z/ - Unable to produce      /f/ - Distorted

Missing teeth: Present



Missing

- Other anomalies (specify): - nil-

### B. Tongue:

- Size: Normal
- Tongue movements:
  - o Protrusion      Adequate
  - o Retraction      Adequate
  - o Elevation      Inadequate
  - o Lateral movements      Adequate
- Lingual frenum: Tongue tie released

## C. Hard palate:

- Coloration:
  - o Midline            Pink
  - o Lateral            Pink
- Bony midline (palpate): Normal
- Contour: Narrow arch
- Cleft (if present): Repaired
- Type of cleft : Median

## D. Soft palate/ Velum:

- Midline muscle union: Complete
- Cleft (if present): Repaired
- Type of cleft : Median
- Velar elevation (on phonation of/a/) : Reduced
- Range of velar excursion (up & back stretching during phonation): Minimal

## E. Uvula:

- Shape: Broken
- Position: Midline

## F. Fauces:

- Isthmus: Open
- Tonsil coloration: Normal

## G. Pharynx:

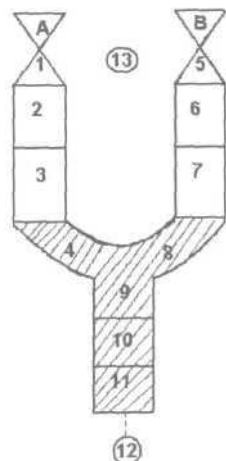
- Passavant's ridge: Absent (During physiologic activity)
- H/o surgical removal of adenoids: Absent
- Gag response: Positive

Surgery Details:

Palate repair was done at the age of 1 ½ years. Surgery for release of tongue tie was done at the age of 3 years.

**Cleft palate profile:**

**Modified Striped 'Y' classification:**



- A, B - Nose
- 1, 5 - Floor of nostrils
- 2, 6 - Lips
- 3, 7 - Alveolus
- 4, 8 - Hard palate anterior to incisive foramen
- 9, 10 - Hard palate posterior to incisive foramen
- 11 - Soft palate
- 12 - Velopharyngeal port
- 13 - Premaxilla

(\*Join with dotted lines 13 to 9 in case of presence of premaxillary protrusion.  
\*Join with dotted lines 12 to 11 in case of presence of Velopharyngeal inadequacy)

**Vegetative skills:**

Vegetative skill	Adequate	Inadequate	Remarks (if inadequate)
	Closing nostrils	Without closing nostrils	
Sucking	Adequate	Inadequate	Has difficulty in building intra oral breath pressure
Blowing	Adequate	Inadequate	Has difficulty in building intra oral breath pressure

Vegetative skill	Adequate
Biting	Adequate
Chewing	Adequate
Swallowing	Adequate

**Nasal regurgitation:** \_\_\_\_\_

- For solids: Absent
- For semisolids: Absent
- For liquids: Absent

Resonance**Mirror fogging test (on phonation of/a/): Fail****Modified tongue anchor test: Fail****Nasal Emission (on phonation of/a/): Present (by listening through listening tube / straw)****Ability to maintain intraoral breath pressure:**

Nares occluded: Adequate

Nares unoccluded: Inadequate

**Nasality and Nasal airflow:** (based on spontaneous speech)

(0 - Absent, 1 - Borderline, 2 - Mild, 3 - Moderate, 4 - Severe)

Hyper nasal resonance: 3

Hypo nasal resonance: 0

Audible nasal emission: 3

Nasal turbulence: 1

Grimace: 0

Articulation

Test administered: Kannada Articulation Test

Mode of stimulus presentation	Stimulability
o Auditory	Poor
o Auditory visual	Fair
o Auditory visual tactile	Good
o Auditory visual tactile grapheme	Good

Table 2 : Pre therapy assessment and the post therapy assessment data of the subject X using the present protocol:

<b>Consonant production</b> : (The words should be selected for these sounds from the articulation test)					<b>Consonant production</b> : (The words should be selected for these sounds from the articulation\ test)					
Place of articulation	Sounds	Word initial position	Word medial position	Word final position	Place of articulation	Sounds	Word initial position	Word medial position	Word final position	
Labial	/p/ *	/pustaka/	/to:pi/	—	Labial	/p/ *	/pustaka/	/to:pi/	—	
		/tjuaa:/	/o:ji/	—			/puaa:/	/o/ pi/	—	
	/b/ *	/ble:du/	/dabbi/	—			/b/ *	/ble:du/	/dabbi/	—
		/eitu/	/babbi/	—			/be:du/	/babbi/	—	
	/m/ *	/mu:ru/	/ombattu/	/jama/		/m/ *	/mu:ru/	/ombattu/	/jama/	
		/mu:mu/	/ommaivu/	/jama/			/mu:mu/	/omma:vu/	/jama/	
	/m/ *	—	—			If/ *	—	—		
Alveolar	/nl *	/na:ji/	/kanna:di/	/pennu/	Alveolar	/nl *	/na:ji/	/kanna:di/	/pennu/	
		/a-ji/	/anna:ji/	/ennu/			/ayi/	/annaiji/	/ennu/	
	/t/ *	/to:pi/	/kitaki/	—			/t/ *	/to:pi/	/kitaki/	—
		/o:ji/	/jarji/			/oyi/	/ijaiji/	—		

	/d/ *	/dabbi/	/ble:du/	---
	/s/ *	/babbi/	/ē:tu/	---
	/s/ *	/su:rya/	/bassu/	---
	/s/ *	/ũ:ja/	/atʃu/	---
Post alveolar	/th/ *	/takkadi/	/ko:ti/	---
		/aã:ji/	/õ:ji/	---
	/dh/ *	/ɖa:limbe/	/kuɖure/	---
		/a:imbe/	/uvũ:e/	---
	/sh/ *	/ʃartu/	/braʃʃu/	---
		/attu/	/ahhu/	---
	/ch/ *	/tʃamatʃa/	/ba:tʃanige/	---
		/ammaja/	/ã:janije/	---
	/j/ *	/dzade/	/su:dzi/	---
		/ajẽ/	/ũ:ji/	---
Velar	/k/ *	/kanadaka/	/pustaka/	---
		/anajaja/	/tʃuaã:/	---
	/g/ *	/gadija:ra/	/mu:gu/	---
		/ajijã:ja/	/mu:mu/	---

\* Target word

	/d/ *	/dabbi/	/ble:du/	---
	/s/ *	/babbi/	/be:du/	---
	/s/ *	/su:rya/	/bassu/	---
	/s/ *	/ũ:ja/	/atʃu/	---
Post alveolar	/th/ *	/takkadi/	/ko:ti/	---
		/aã:ji/	/õ:ji/	---
	/dh/ *	/ɖa:limbe/	/kuɖure/	---
		/a:imbe/	/uvũ:e/	---
	/sh/ *	/ʃartu/	/braʃʃu/	---
		/attu/	/ahhu/	---
	/ch/ *	/tʃamat a/	/ba:tʃanige/	---
		/ammaja/	/ã:janije/	---
	/j/ *	/dzade/	/su:dzi/	---
		/ãje/	/ũ:ji/	---
Velar	/k/ *	/kanadaka/	/pustaka/	---
		/anajaja/	/puaã:/	---
	/g/ *	/gadija:ra/	/mu:gu/	---
		/ajijã:ja/	/mu:mu/	---

\* Target word



**A**

<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below (Summary of CTCs:</p>	<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below {Summary of CTCs:</p>
<p>0 - No CTCs, 1 - Anterior oral CTCs, 2 - Posterior oral CTCs, 3 - Non</p>	<p>0 - No CTCs, 1 - Anterior oral CTCs, 2 - Posterior oral CTCs, 3 - Non</p>
<p>oral CTCs, 4 - Passive CTCs, 5 - Developmental errors, 6 - Other}</p>	<p>oral CTCs, 4 - Passive CTCs, 5 - Developmental errors, 6 - Other}</p>
<ul style="list-style-type: none"> <li>• Lateral isation: 0</li> <li>• Palatalisation: 0</li> <li>• Backing to velar: 0</li> <li>• Backing to uvular: 0</li> <li>• Pharyngeal articulation: 4</li> <li>• Glottal articulation: 4</li> <li>• Active nasal fricative: 4</li> <li>• Weak/nasalized consonants: 0</li> <li>• Nasal realizations: 4</li> <li>• Absent pressure consonants: 4</li> <li>• Omission of fricatives or plosives: 1</li> <li>• Anterior sibilants' distortions: 1</li> <li>• Reduced IOP on fricatives: 1</li> <li>• Imprecise tongue tip movements: 1</li> </ul>	<ul style="list-style-type: none"> <li>• Lateral isation: 0</li> <li>• Palatalisation: 0</li> <li>• Backing to velar: 0</li> <li>• Backing to uvular: 0</li> <li>• Pharyngeal articulation: 4</li> <li>• Glottal articulation: 4</li> <li>• Active nasal fricative: 4</li> <li>• Weak/nasalized consonants: 0</li> <li>• Nasal realizations: 4</li> <li>• Absent pressure consonants: 4</li> <li>• Omission of fricatives or plosives: 1</li> <li>• Anterior sibilants' distortions: 1</li> <li>• Reduced IOP on fricatives: 1</li> <li>• Imprecise tongue tip movements: 1</li> </ul>

<ul style="list-style-type: none"> <li>• Double articulation: 0</li> </ul>	<ul style="list-style-type: none"> <li>• Double articulation: 0</li> </ul>
<p><i>Intelligibility</i></p> <p><b>Speech intelligibility rating:</b> (Based on spontaneous speech)</p> <p>Clinician: Unitelligible (7)</p> <p>Parent : Occasional repetition of words required (3)</p> <p>Child : Not aware of her speech unintelligibility</p>	<p><i>Intelligibility</i></p> <p><b>Speech intelligibility rating:</b> (Based on spontaneous speech)</p> <p>Clinician: Occasionally understood by others (8)</p> <p>Parent : Occasional repetition of words required (3)</p> <p>Child : Not aware of her speech unintelligibility</p>

**Voice: (based on phonation task)**

Maximum Phonation Duration (Average of 3 trials): /a/- 5 seconds

/ʌ/- 5 seconds

/u/- 5 seconds

/s/- 2 seconds

/z/- Unable to produce /z/

Pitch: Appropriate

Pitch Range: Reduced

Loudness: Adequate

Quality: Nasality

Pitch Breaks: Absent

Biphonation: Absent

Tremors: Absent

**Fluency**

Dysfluencies: Absent

Rate of speech: Normal

120 Words per minute

**Prosody (based on perceptual analysis)**

Stress: Appropriate

Intonation: Appropriate

Rhythm: Appropriate

Pause/ Juncture: Appropriate

**Voice assessment using VAGHMI and / or Dr.Speech;**

Fundamental frequency (Phonation of/a/): 260 Hz

Intensity (Phonation of/a/): 110dB

Frequency range (Spontaneous speech): Lowest: 235 Hz    Highest: 280 Hz

Intensity range (Spontaneous speech):    Lowest: 95 dB    Highest: 115 dB

**Vitalograph assessment:**

Vital Capacity (CC): 1200 CC

Mean Airflow Rate: (CC/S): 240 CC/ S

**Recording of speech sample:**

**Date** of recording: 09- 03- 07 and 23- 03- 07

Compact disc title: Recording of cleft speech samples

Sample No.: 1 and 2

**Case Summary and Other Findings:** Subject X was a five year old female diagnosed as having delayed speech and language with hypemasality and repaired cleft palate with velopharyngeal dysfunction. She had a complete midline cleft of the hard and soft palate which was repaired at the age of one and half years. She had also undergone a surgery for the release of tongue tie at the age of three years. In the pre therapy assessment, she exhibited omissions of all the consonants except /m/ and /n/. In therapy, focus was given mainly on improving language. The post therapy assessment was done after 10 sessions of speech and language therapy. In the post therapy assessment, she was able to produce /p/, and /b/ with 70% consistency. She also had moderate hypemasality with nasal air emissions. Her production of the sound /p/ and /b/ in all positions in word level has improved after attending speech therapy.

**Subject Y:**

Subject Y was a five year old male diagnosed as having Misarticulations with hypernasality and repaired cleft palate. He had a bilateral complete cleft of lip and palate His lip repair was done at the age of four days. He had undergone a palate repair at the age of 6 months. He had also undergone a surgery for nasal reconstruction and release of tongue tie at the age of one and half years. He was recommended for speech therapy. The following are the details of the assessment done for him using the present protocol.

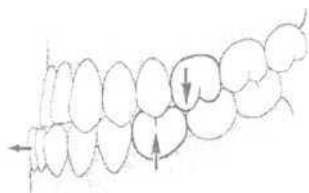
**Oro-facial Examination****I. Facial characteristics:****A. Frontal view:**

- Nasal area: Deviated columella & Deviated ala cartilage
- Lips: Repaired Cleft
- Cleft lip (if present): Bilateral
- Cupid's bow: Absent
- Lip function:
  - o Pursing      Restricted movement
  - o Puckering    Restricted movement
  - o Rounding      Restricted movement
  - o Spreading     Restricted movement

**II. Intraoral characteristics:****B. Dentition:**

- General dental hygiene: Decay of tooth
- Occlusional relationships: Class III

Class III Type Occlusion





- Velar elevation (on phonation of /a/): Reduced
- Range of velar excursion (up & back stretching during phonation): Restricted

E. Uvula:

- Shape: Broken
- Position: Midline

F. Fauces:

- Isthmus: Open
- Tonsil coloration: Normal

G. Pharynx:

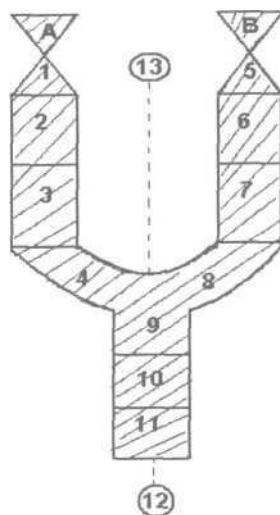
- Passavant's ridge: Absent (During physiologic activity)
- H/o surgical removal of adenoids: Absent (Details if present)
- Gag response: Positive

Surgery Details:

Surgery for the lip was done at the age of four days. He had undergone a surgery for cleft of palate at the age of 6 months. He had also undergone a surgery for nasal reconstruction and release of tongue tie at the age of one and half years.

**Cleft palate profile:**

Modified Striped 'Y' classification:



A, B - Nose

1, 5 - Floor of nostrils

2, 6 - Lips

3, 7 - Alveolus

4, 8 - Hard palate anterior to incisive foramen

9, 10 - Hard palate posterior to incisive foramen

11 - Soft palate

12 - Velopharyngeal port

13 - Premaxilla

(\*Join with dotted lines 13 to 9 in case of presence of premaxillary protrusion.

\*Join with dotted lines 12 to 11 in case of presence of Velopharyngeal inadequacy)

**Vegetative skills:**

Vegetative skill	Adequate	Inadequate	Remarks (if inadequate)
	Closing nostrils	Without closing nostrils	
Sucking	Adequate	Inadequate	Has difficulty in building intra oral breath pressure
Blowing	Adequate	Inadequate	Has difficulty in building intra oral breath pressure

Vegetative skill	Adequate
Biting	Adequate
Chewing	Adequate
Swallowing	Adequate

**Nasal regurgitation:**

	Present	Remarks (if present)
For solids:	Present	Regurgitation occurs very frequently
For semisolids:	Present	
For liquids:	Present	

**Resonance****Mirror fogging test (on phonation of/a/):** Fail**Modified tongue anchor test:** Fail**Nasal Emission (on phonation of/a/):** Present (by listening through listening tube / straw)



Ability to maintain intraoral breath pressure:

Nares occluded: Inadequate

Nares unoccluded: Inadequate

Nasality and Nasal airflow: (based on spontaneous speech)

(0 - Absent, 1 - Borderline, 2 - Mild, 3 - Moderate, 4 - Severe)

Hyper nasal resonance: 4

Hypo nasal resonance: 0

Audible nasal emission: 4

Nasal turbulence: 3

Grimace: 2

Articulation

Test administered: Tamil Articulation Test

Mode of stimulus presentation	Stimulability
o Auditory	Poor
o Auditory visual	Fair
o Auditory visual tactile	Good
o Auditory visual tactile grapheme	Good

Table 3: Pre therapy assessment and the post therapy assessment data of the subject Y using the present protocol:

<b>Consonant production</b> : (The words should be selected for these sounds from the articulation test)					<b>Consonant production</b> : (The words should be selected for these sounds from the articulation test)					
Place of articulation	Sounds	Word initial position	Word medial position	Word final position	Place of articulation	Sounds	Word initial position	Word medial position	Word final position	
Labial	/p/ *	/puli/	/pa:ppa/	—	Labial	/p/ *	/puli/	/pa:ppa/	—	
		/uli/	/a:ppa/	—			/puli/	/pa:ppa/	—	
	/b/ *	/bomma/	/karumbu/	—			/b/ *	/bomma/	/karumbu/	—
		/omma/	/ajumbu/	—			/bomma/	/ajumbu/	—	
	/m/ *	/malai/	/erumbu/	/maram/		/m/ *	/malai/	/erumbu/	/maram/	
		/malai/	/ejurnbu/	/majam/			/malai/	/ejumbu/	/majam/	
	/f/ *	—	—	—		<i>IV</i> *	—	—	—	
Alveolar	/n/ *	/na:j/	/vandi/	/pen/	Alveolar	<i>ltd</i> *	/na:j/	/vandi/	/pen/	
		/na:j/	/vanni/	/en/			/na:j/	/vanni/	/pen/	
	/t/ *	/ta:tta/	/pa:ttu/	—			/t/ *	/ta:tta/	/pa:ttu/	—
		/a:a/	/p'aijju/			/a;a/	/pa:jju/			

		<i>Idl</i>	*	/dappa/ /ajja:/	/kadai/ /ajai/	— —
		/s/	*	/si:ppu/ /hi:ppu/	/ka:su/ /ka:ju/	— —
Post alveolar		/th/	*	/te:l/ /e:l/	/puttagam/ /pujajam/	— —
		/dh/	*	/udadu/ /udadu/	— —	— —
		/sh/	*		—	—
		/ch/	*	/tja:vi/ /tja:vi/	/pu:tftfi/ /pu:tjtji/	— —
		<i>l)l</i>	*	/dzannal/ /tfannal/	/mandzal/ /manjal/	— —
Velar		<i>Ikl</i>	*	/ka:i/ /ɛ:/	/kattarika:i/ /ajjajia:i/	— —
		/g/	*	/kurangu/ /ujangu/	— —	— —

\* Target word

		/d/	*	/dappa/ /ajja:/	/kadai/ /ajai/	— —
		/s/	*	/skppu/ /hi:ppu/	/ka:su/ /ka^u/	— —
Post alveolar		/th/	*	/te:l/ /e:l/	/puttagam/ /pujajam/	— ...
		/dh/	*	/udadu/ n /udadu/	— —	— —
		/sh/	*		—	...
		/ch/	*	/tja:vi/ /tja:vi/	/pu:tjtji/ /pu:tjtji/	— —
		/j/	*	/dzannal/ /tfannal/	/mandzal/ /manjal/	— —
Velar		<i>Ikl</i>	*	/ka:i/ /ɛ:i/	/kattarika:i/ /ajjajiri/	— —
		/g/	*	/kurangu/ /ujangu/	— —	— —

\* Target word

<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below {Summary of CTCs: 0 - No CTCs, 1 - Anterior oral CTCs, 2 - Posterior oral CTCs, 3 - Non oral CTCs, 4 - Passive CTCs, 5 - Developmental errors, 6 - Other})</p> <ul style="list-style-type: none"> <li>• Lateralisation: 0</li> <li>• Palatalisation: 1</li> <li>• Backing to velar: 0</li> <li>• Backing to uvular: 0</li> <li>• Pharyngeal articulation: 0</li> <li>• Glottal articulation: 4</li> <li>• Active nasal fricative: 4</li> <li>• Weak/ nasalized consonants: 4</li> <li>• Nasal realizations: 4</li> <li>• Absent pressure consonants: 4</li> <li>• Omission of fricatives or plosives: 6</li> <li>• Anterior sibilants' distortions: 1</li> <li>• Reduced IOP on fricatives: 4</li> <li>• Imprecise tongue tip movements: 1</li> <li>• Double articulation: 0</li> </ul>	<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below {Summary of CTCs: 0 - No CTCs, 1 - Anterior oral CTCs, 2 - Posterior oral CTCs, 3 - Non oral CTCs, 4 - Passive CTCs, 5 - Developmental errors, 6 - Other})</p> <ul style="list-style-type: none"> <li>• Lateralisation: 0</li> <li>• Palatalisation: 0</li> <li>• Backing to velar: 0</li> <li>• Backing to uvular: 0</li> <li>• Pharyngeal articulation: 0</li> <li>• Glottal articulation: 4</li> <li>• Active nasal fricative: 4</li> <li>• Weak/ nasalized consonants: 4</li> <li>• Nasal realizations: 4</li> <li>• Absent pressure consonants: 4</li> <li>• Omission of fricatives or plosives: 6</li> <li>• Anterior sibilants' distortions: 1</li> <li>• Reduced IOP on fricatives: 4</li> <li>• Imprecise tongue tip movements: 1</li> <li>• Double articulation: 0</li> </ul>
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<i>Intelligibility</i>	<i>Intelligibility</i>
Speech intelligibility rating: (Based on spontaneous speech)	Speech intelligibility rating: (Based on spontaneous speech")
Clinician: Isolated words understood (5)	Clinician: Repetitions/ Rephrasing necessary (4)
Parent: Occasional repetition of words required (3)	Parent: Occasional repetition of words required (3)
Self: Unintelligible (7)	Self: Unintelligible (7)

Voice: (based on phonation task)

Maximum Phonation Duration (Average of 3 trials): /a/- 7 seconds

/i/-7 seconds

/u/- 7 seconds

/s/- 3 seconds

/z/- Unable to produce /z/

Pitch: Appropriate

Pitch Range: Reduced

Loudness: Adequate

Quality: Hoarse and Nasality

Pitch Breaks: Absent

Biphonation: Absent

Tremors: Absent

Fluency

Dysfluencies: Absent

Rate of speech: Normal

150 Words per minute

Prosody (based on perceptual analysis)

Stress: Appropriate

Intonation: Appropriate

Rhythm: Appropriate

Pause/ Juncture: Appropriate

Voice assessment using VAGHMI and / or Dr.Speech;

Fundamental frequency (Phonation of/a/): 220 Hz

Intensity (Phonation of/a/): 112 dB

Frequency range (Spontaneous speech): Lowest: 197 dB Highest: 248 dB

Intensity range (Spontaneous speech): Lowest: 92 dB Highest: 120 dB

Vitalograph assessment:

Vital Capacity (CC): 1210 CC

Mean Airflow Rate: (CC/S): 173 CC/ S

**Recording of speech sample:**

Date of recording: 12- 04 - 07 and 26- 04- 07

Compact Disc Title: Recording of cleft speech samples

Sample No.: 3 and 4

**Case Summary and Other Findings:** Subject Y was a five year old male diagnosed as having misarticulations with hypemasality and repaired cleft palate. He had a bilateral complete cleft of lip and palate. His lip repair was done at the age of four days. He had undergone a palate repair at the age of 6 months. He had also undergone a surgery for nasal reconstruction and release of tongue tie at the age of one and half years. He exhibited predominant omissions of the sounds, /kl, /l/ and /th/ and d/stort/ons of the sounds, /p/, /b/, /tl, ldl, /dh/, /l/, /j/ and /s/ during the pre therapy assessment. The post therapy assessment was done after ten sessions of speech therapy. His production of the sounds /p/ and Pol had improved in the post therapy assessment. Also, the overall speech intelligibility of the client has improved following speech therapy.

**Subject Z:**

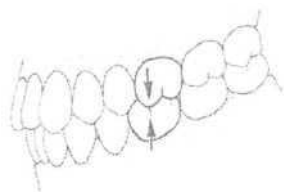
Subject Z was a 17 year old male diagnosed as having misarticulations with hypernasality and repaired cleft palate. He had a midline cleft of soft palate which was repaired at the age of seven years. He had again undergone a re-surgery for palate at the age of sixteen years. He was recommended for speech therapy.

**Oro-facial Examination****I. Facial characteristics:****A. Frontal view:**

- Nasal area: Normal
- Lips: Normal
- Cleft lip (if present): Absent
- Cupid's bow: Present
- Lip function
  - o Pursing                                   Adequate closure
  - o Puckering                                Adequate closure
  - o Rounding                                 Adequate closure
  - o Spreading                                Adequate closure

**II. Intraoral characteristics:****B. Dentition:**

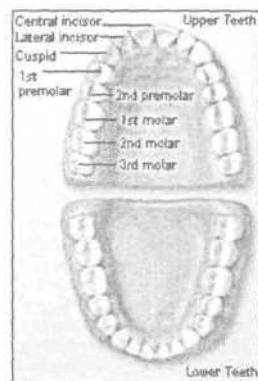
- General dental hygiene: Decay of tooth
- Occlusional relationships: Class I  
Class I Type Occlusion



Bite: Normal



- Production of these sounds with teeth in occlusion:  
   /s/- Distorted      /z/-      Unable to produce      /f/ - Good
- Missing teeth: Absent



- Other anomalies (specify): -nil-

#### B. Tongue:

- Size: Normal
- Tongue movements:
  - o Protrusion      Adequate
  - o Retraction      Adequate
  - o Elevation      Adequate
  - o Lateral movements      Adequate
- Lingual frenum: Normal

#### C. Hard palate:

- Coloration:
  - o Midline      Pink
  - o Lateral      Pink
- Bony midline (palpate): Normal
- Contour: Normal
- Cleft (if present) : Absent
- Type of cleft: Absent

#### D. Soft palate/ Velum:

- Midline muscle union: Complete
- Cleft (if present): Repaired
- Type of cleft: Median
- Velar elevation (on phonation of /a/): Reduced

- Range of velar excursion (up & back stretching during phonation):  
Moderate

E. Uvula:

- Shape: Absent
- Position: Absent

F. Fauces:

- Isthmus: Open
- Tonsil coloration: Normal

G. Pharynx:

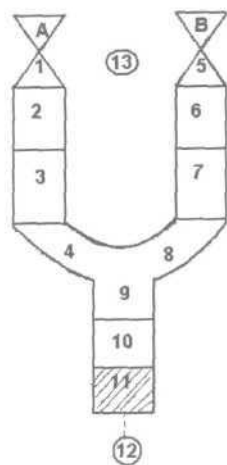
- Passavant's ridge: Absent (During physiologic activity)
- H/o surgical removal of adenoids: Absent (Details if present)
- Gag response: Positive

Surgery Details:

Cleft of soft palate which was repaired at the age of seven years. He had again undergone a re-surgery for palate at the age of sixteen years.

**Cleft palate profile:**

Modified Striped 'Y' classification:



- A, B - Nose  
 1,5- Floor of nostrils  
 2, 6 - Lips  
 3, 7- Alveolus  
 4, 8 - Hard palate anterior to incisive foramen  
 9, 10- Hard palate posterior to incisive foramen  
 11 -Soft palate  
 12 - Velopharyngeal port  
 13 - Premaxilla

(\*Join with dotted lines 13 to 9 in case of presence of premaxillary protrusion.

\*Join with dotted lines 12 to 11 in case of presence of Velopharyngeal inadequacy)

**Vegetative skills:**

Vegetative skill	Adequate		Inadequate	Remarks (if inadequate)
	Closing nostrils	Without closing nostrils	Closing nostrils	
Sucking	Adequate	Adequate		
Blowing	Adequate		Inadequate	Has difficulty in building intra oral breath pressure

Vegetative skill	Adequate
Biting	Adequate
Chewing	Adequate
Swallowing	Adequate

**Nasal regurgitation:**

For solids: Absent

For semisolids: Absent

For liquids: Absent

**Resonance****Mirror fogging test (on phonation of /a/):** Fail**Modified tongue anchor test:** Pass**Nasal Emission (on phonation of /a/):** Present (by listening through listening tube / straw)**Ability to maintain intraoral breath pressure:**

Nares occluded: Adequate

Nares unoccluded: Inadequate

**Nasality and Nasal airflow:** (based on spontaneous speech)

(0 - Absent, 1 - Borderline, 2 - Mild, 3 - Moderate, 4 - Severe)

Hyper nasal resonance: 3

Hypo nasal resonance: 0

Audible nasal emission: 1

Nasal turbulence: 0

Grimace: 0

**Articulation**

Test administered: Kannada Articulation Test

Mode of stimulus presentation	Stimulability
o Auditory	Fair
o Auditory visual	Good
o Auditory visual tactile	Good
o Auditory visual tactile grapheme	Good

Table 4: Pre therapy assessment and the post therapy assessment data of the subject Z using the present protocol:

<b>Consonant production</b> : (The words should be selected for these sounds from the articulation test)					<b>Consonant production</b> : (The words should be selected for these sounds from the articulation test)					
Place of articulation	Sounds	Word initial position	Word medial position	Word final position	Place of articulation	Sounds	Word initial position	Word medial position	Word final position	
Labial	/p/ *	/pustaka/	/to:pi/	—	Labial	/p/ *	/pustaka/	/to:pi/	—	
		/pustaka/	/to:pi/	—			/pustaka/	/to:pi/	—	
	/b/ *	/ble:du/	/dabbi/	—			/b/ *	/ble:du/	/dabbi/	—
		/blerdu/	/dabbi/	—			/blerdu/	/dabbi/	—	
Alveolar	/m/ *	/mu:ru/	/ombattu/	—	Alveolar	/m/ *	/mu:ru/	/ombattu/	—	
		/mu:ru/	/ombattu/	—			/mu:ru/	/ombattu/	—	
	/f/ *	—		—			/f/ *	—		—
Alveolar	/n/ *	/na:ji/	/kanna:di/	/pennu/	Alveolar	/n/ *	/na:ji/	/kanna:di/	/pennu/	
		/na:ji/	/kanna:di/	/pennu/			/na:ji/	/kanna:di/	/pennu/	
	/t/ *	/to:pi/	/kitaki/	—			/t/ *	/to:pi/	/kitaki/	—
		/to:pi/	/kijaki/				/to:pi/	/kijaki/	— <sup>a</sup>	

	/d/ *	/dabbi/	/ble:du/	---
		/dabbi/	/ble:du/	---
	/s/ *	/su:r̥ya/	/bassu/	---
		/hū:r̥ja/	/bahhū/	---
Post alveolar	/th/ *	/takkadi/	/ko:ṭi/	---
		/takkadi/	/koṭi/	---
	/dh/ *	/da:limbe/	/kuḍure/	---
		/da:limbe/	/kuḍure/	---
	/sh/ *	/ʃartu/	/braʃʃu/	---
		/hartu/	/brahhu/	---
/ch/ *	/tʃamatʃa/	/ba:ʃanige/	---	
	/tʃama tʃa/	/ba:ʃanige/	---	
/j/ *	/dzade/	/su:dzi/	---	
	/tʃade/	/su:tʃi/	---	
Velar	/k/ *	/kannadaka/	/puṣṭaka/	---
		/kannadaka/	/puṣṭaka/	---
	/g/ *	/gadija:ra/	/mu:gu/	---
		/gadija:ra/	/mū:ku/	---

\* Target word

	/d/ *	/dabbi/	/ble:du/	---
		/dabbi/	/ble:du/	---
	/s/ *	/su:r̥ya/	/bassu/	---
		/hū:r̥ja/	/bahhū/	---
Post alveolar	/th/ *	/takkadi/	/ko:ṭi/	---
		/takkadi/	/koṭi/	---
	/dh/ *	/da:limbe/	/kuḍure/	---
		/da:limbe/	/kuḍure/	---
	/sh/ *	/ʃartu/	/braʃʃu/	---
		/hartu/	/brahhu/	---
/ch/ *	/tʃamatʃa/	/ba:ʃanige/	---	
	/tʃama tʃa/	/ba:ʃanige/	---	
/j/ *	/dzade/	/su:dzi/	---	
	/tʃade/	/su:tʃi/	---	
Velar	/k/ *	/kannadaka/	/puṣṭaka/	---
		/kannadaka/	/puṣṭaka/	---
	/g/ *	/gadija:ra/	/mu:gu/	---
		/gadija:ra/	/mū:ku/	---

\* Target word

<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below {Summary of CTCs: 0 - No CTCs, 1 - Anterior oral CTCs, 2 - Posterior oral CTCs, 3 - Non oral CTCs, 4 - Passive CTCs, 5 - Developmental errors, 6 - Other})</p> <ul style="list-style-type: none"> <li>• Lateralisation: 0</li> <li>• Palatalisation: 0</li> <li>• Backing to velar: 0</li> <li>• Backing to uvular: 0</li> <li>• Pharyngeal articulation: 0</li> <li>• Glottal articulation: 4</li> <li>• Active nasal fricative: 4</li> <li>• Weak/ nasalized consonants: 3</li> <li>• Nasal realizations: 4</li> <li>• Absent pressure consonants: 4</li> <li>• Omission of fricatives or plosives: 6</li> <li>• Anterior sibilants' distortions: 1</li> <li>• Reduced IOP on fricatives: 0</li> <li>• Imprecise tongue tip movements: 0</li> </ul>	<p><b>Cleft type characteristics (CTCs):</b> (Please encircle the appropriate one according to the summary provided below {Summary of CTCs: 0 - No CTCs, 1 - Anterior oral CTCs, 2 - Posterior oral CTCs, 3 - Non oral CTCs, 4 - Passive CTCs, 5 - Developmental errors, 6 - Other})</p> <ul style="list-style-type: none"> <li>• Lateralisation: 0</li> <li>• Palatalisation: 0</li> <li>• Backing to velar: 0</li> <li>• Backing to uvular: 0</li> <li>• Pharyngeal articulation: 0</li> <li>• Glottal articulation: 4</li> <li>• Active nasal fricative: 4</li> <li>• Weak/ nasalized consonants: 3</li> <li>• Nasal realizations: 4</li> <li>• Absent pressure consonants: 4</li> <li>• Omission of fricatives or plosives: 6</li> <li>• Anterior sibilants' distortions: 1</li> <li>• Reduced IOP on fricatives: 0</li> <li>• Imprecise tongue tip movements: 0</li> </ul>
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<ul style="list-style-type: none"> <li>• Double articulation: 0</li> </ul>	<ul style="list-style-type: none"> <li>• Double articulation: 0</li> </ul>
<p><i>Intellisibility</i></p> <p><b>Speech intelligibility rating:</b> (Based on spontaneous speech)</p> <p>Clinician: Listener attention needed (2)</p> <p>Parent: Intelligible (1)</p> <p>Self: Occasional repetition of words required (3)</p>	<p><i>IntellisibUity</i></p> <p><b>Speech intelligibility rating:</b> (Based on spontaneous speech)</p> <p>Clinician: Listener attention needed (2)</p> <p>Parent: Intelligible (1)</p> <p>Self: Occasional repetition of words required (3)</p>



**Voice: (based on phonation task)**

Maximum Phonation Duration (Average of 3 trials): /a/- 18 seconds

/il/- 18 seconds

/wl/-18 seconds

/s/- 5 seconds

/zJ/- Unable to produce /z/

Pitch: Appropriate

Pitch Range: Normal

Loudness: Adequate

Quality: Nasality

Pitch Breaks: Absent

Biphonation: Absent

Tremors: Absent

**Fluency**

Dysfluencies: Absent

Rate of speech: Normal

150 Words per minute

**Prosody (based on perceptual analysis)**

Stress: Appropriate

Intonation: Appropriate

Rhythm: Appropriate

Pause/ Juncture: Appropriate

**Voice assessment using VAGHMI and / or Dr.Speech:**

Fundamental frequency (Phonation of/a/): 170 Hz

Intensity (Phonation of/a/): 115 dB

Frequency range (Spontaneous speech): Lowest: 140 Hz Highest: 202 Hz

Intensity range (Spontaneous speech): Lowest: 106 dB Highest: 118 dB

**Vitalograph assessment:**

Vital Capacity (CC): 2100 CC

Mean Airflow Rate: (CC/Sec): 116 CC/S

**Recording of speech sample:**

Date of recording: 20- 04- 07 and 27- 04- 07

Compact Disc title: Recording of cleft speech samples

Sample No.: 5 and 6

**Case Summary and Other Findings:** Subject Z was a 17 year old male diagnosed as having misarticulation with hypernasality and repaired cleft palate. He had a midline cleft of soft palate which was repaired at the age of seven years. He had again undergone a re-surgery for palate at the age of sixteen years. He had distortions of the sounds, /dh/ /sh/, and /ch/ in word level during the pre therapy recording. He also had nasalization of the consonants, /p/, /t/, /b/ and /r/ The post therapy assessment was done after five sessions of therapy. In the post therapy assessment, although there was not much improvement in the production of the error sounds, the overall speech intelligibility of the client had improved.

## CHAPTER 5

### SUMMARY AND CONCLUSIONS

Cleft lip and palate is one of the most common of all the birth defects resulting in structural abnormality of the oral and facial structures. It has been found that cleft palate occurs 1 in every 700 live births, making it one of the most common major birth defects. Of the various deviations and deficiencies exhibited by individuals with clefts of the lip and palate, probably the most important are those involving the process of speech communication (Moll, 1968). Though language delays are observed in these children, one of the most critical areas of concern to the parents and to all professional disciplines involved, is the child's speech. Speech is recognized as one of the key outcomes of the cleft team care (Mc Williams et al., 1984). Speech impairments associated with cleft palate include disorders of articulation, resonance and voice.

Assessment is an important aspect before carrying out any kind of intervention in individuals with cleft lip and or palate. However there is lot of disagreement about the parameters that should be included in a cleft speech measure. Disagreement also exists about the scales that should be used to assess the different speech parameters. More recently various clinics have started developing their own protocols with provisions to assess all the speech characteristics and other associated difficulties in cleft palate individuals in one concise form. Thus, there is growing interest in coordination of procedures for speech assessment in patients with cleft lip and palate, primarily between centers and within languages. In this line, several protocols have been developed to assess speech problems in children with cleft lip and palate. Some

of the assessment protocols that have been developed are Protocol for Evaluation of Speech and Hearing of a Patient with Velopharyngeal Incompetence (Hirshberg and Van Demark, 1997), The Great Ormond Street Speech Assessment (GOS.SPASS; Sell et al., 1994,1999), Cleft Audit Protocol for Speech (CAPS; Harland,1996), Cleft Audit Protocol for Speech - Augmented (CAPS-A; Alexandra John et al, 2006).

With the intent of coordinating the procedures for speech assessments in patients with cleft lip and palate across clinics, all the above described protocols have been developed, but unfortunately, none of them could accomplish their goal. Also, these protocols have been used as reliable measures abroad; they cannot be adapted directly for the Indian population. This is due to the fact that they were developed based upon studies done on their own western population which has a wide variation in many aspects like culture, language and type of available clinical services from that of the Indian population. Thus the present protocol has been planned

A detailed review of literature was done about the different tools and protocols used by different authors/ clinics to assess the speech in cleft palate population. Different speech assessment formats/ protocols, journal articles and web based search was done. All these items were pooled from the literature. These served as the basis for the construction of the present protocol. Based on the available information, a protocol was proposed.

The protocol was developed for the assessment of speech in individuals with cleft palate. The protocol comprised of domains like orofacial examination and

assessment for speech parameters such as articulation, resonance, fluency and voice. The focus was given for both subjective and objective assessment.

The proposed protocol was sent to 20 speech language pathologists who are working in centers dealing with rehabilitation of cleft lip and palate in India to check for the content and face validity. Out of the 20 speech pathologists, 14 speech pathologists provided suggestions for the protocol. Based upon their ratings and suggestions, necessary modifications were incorporated.

The protocol thus developed was administered to three individuals with cleft lip and/palate prior to and after attending speech and language therapy for five to ten few sessions.

This protocol is an attempt in Indian scenario, to profile the entire speech characteristics in cleft palate speech. This protocol can be used as for assessment, treatment and for monitoring the progress of the client with cleft lip and palate. This can also be used as a comprehensive protocol which facilitates better communication between the speech language pathologist and other professionals in the management team of cleft palate rehabilitation.

### **Limitations**

- > The main aim was to develop the protocol and due to lack of time, finding the sensitivity and specificity of the same was not given much focus. But an attempt is made to administer the protocol to individuals with cleft palate

before and after attending speech and language therapy. The same is explained in the results section.

- > The protocol was administered only on three subjects. So, the results obtained with this small sample size alone cannot be used effectively for describing the sensitivity of the protocol.

**Implications:**

- > The developed protocol will serve as a useful and comprehensive tool for assessing the speech of children with cleft palate in clinical practice.
- > This protocol can be used as a comparative measure between pre and post intervention speech status of the children with cleft palate and can be used for assessing the outcome of speech therapy.
- > This protocol will throw light on the speech measures in which the child with cleft palate has deficits and this can be used for deciding upon further intervention measures.

**Directions for future research:**

This protocol can be administered to more number of individuals with cleft lip and palate and if required the modifications may be done. This can also serve as a tool to find the efficacy of the rehabilitation measure.

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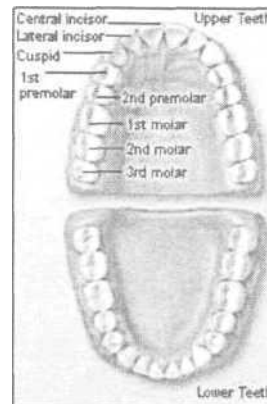
Bite: Under bite/ Over bite/ Over jet/ Cross bite/ Posterior open bite/ Anterior open bite

Production of these sounds with teeth in occlusion:

/s/

/z/ /f/

Missing teeth: Present / Absent



Other anomalies (specify):

#### B. Tongue:

- Size: Normal/ Macroglossia/ Microglossia
- Tongue movements: Adequate Inadequate
  - o Protrusion
  - o Retraction
  - o Elevation
  - o Lateral movements
- Lingual frenum: Normal/ Tongue tie

#### C. Hard palate:

- Coloration: Normal Abnormal
  - o Midline
  - o Lateral
- Bony midline (palpate): Normal/ Cleft/ Submucous cleft / Fistula
- Contour : High arch/ Low arch/ Narrow arch / Wide arch

- Cleft (if present): Repaired / Unrepaired
- Type of cleft : Unilateral/ Bilateral / Median

D. Soft palate/ Velum:

- Midline muscle union: Complete/ Cleft / Submucous cleft
- Cleft (if present): Repaired / Unrepaired
- Type of cleft : Unilateral/ Bilateral / Median
- Velar elevation (on phonation of/a/): Normal/ Reduced/ Other
- Range of velar excursion (up & back stretching during phonation): Excellent/ Moderate/ Minimal/ Restricted

E. Uvula:

- Shape: Normal/ Bifid/ Broken/ Other
- Position: Midline/ Deviated

F. Fauces:

- Isthmus: Open/ Tonsillar obstruction of isthmus
- Tonsil coloration: Normal/ Inflamed / Tonsillectomy / Adenoidectomy

G. Pharynx:

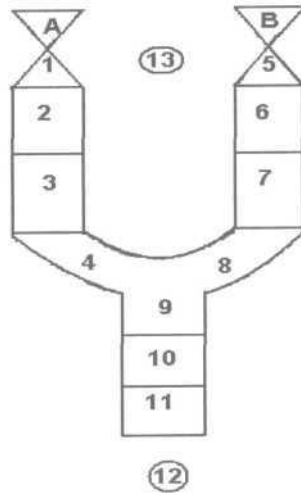
- Passavant's ridge: Present/ Absent (During physiologic activity)
- H/o surgical removal of adenoids: Present/ Absent (Details if present)
- Gag response: Positive/ Negative/ Weak

II. General observations and other findings:

III. Surgery Details:

**Cleft palate profile:**

**Modified Striped 'Y' classification:**



A, B - Nose

1,5 — Floor of nostrils

2, 6 - Lips

3, 7 - Alveolus

4, 8 - Hard palate anterior to incisive foramen

9, 10- Hard palate posterior to incisive foramen

11 - Soft palate

12 - Velopharyngeal port

13 - Premaxilla

(\*Join with dotted lines 13 to 9 in case of presence of premaxillary protrusion.

\*Join with dotted lines 12 to 11 in case of presence of Velopharyngeal inadequacy)

**Vegetative skills:**

Vegetative skill	Adequate		Inadequate		Remarks (if inadequate)
	Closing nostrils	Without closing nostrils	Closing nostrils	Without closing nostrils	
Sucking					
Blowing					

Vegetative skill	Adequate	Inadequate	Remarks (if inadequate)
Biting			
Chewing			
Swallowing			

**Nasal regurgitation:**

	Present	Absent	Remarks (if present)
For solids:			
For semisolids:			
For liquids:			

**Resonance**

**Mirror fogging test (on phonation of/a/):** Pass / Fail

**Modified tongue anchor test:** Pass/ Fail

**Nasal Emission (on phonation of/a/):** Present / absent (by listening through listening tube / straw)

**Ability to maintain intraoral breath pressure:**

Nares occluded: Adequate/ Inadequate

Nares unoccluded: Adequate/ Inadequate

**Nasality and Nasal airflow:** (based on spontaneous speech)

(0 - Absent, 1 - Borderline, 2 - Mild, 3 - Moderate, 4 - Severe)

Hyper nasal resonance: 0 1 2 3 4

Hypo nasal resonance: 0 1 2 3 4

Audible nasal emission: 0 1 2 3 4

Nasal turbulence: 0 1 2 3 4

Grimace: 0 1 2 3 4

**Articulation**

Test administered:

	Stimulability		
Mode of stimulus presentation	Good	Fair	Poor
o Auditory			
o Auditory visual			
o Auditory visual tactile			
o Auditory visual tactile grapheme			



Glottal articulation:	0	1	2	3	4	5	6
Active nasal fricative:	0	1	2	3	4	5	6
Weak/ nasalized consonants:	0	1	2	3	4	5	6
Nasal realizations:	0	1	2	3	4	5	6
Absent pressure consonants:	0	1	2	3	4	5	6
Omission of fricatives or plosives:	0	1	2	3	4	5	6
Anterior sibilants' distortions:	0	1	2	3	4	5	6
Reduced intra oral pressure on fricatives:	0	1	2	3	4	5	6
Imprecise tongue tip movements:	0	1	2	3	4	5	6
Double articulation:	0	1	2	3	4	5	6

### **Intelligibility**

**Speech intelligibility rating:** (Based on spontaneous speech)

	Clinician	Parent	Self
1. Intelligible			
2. Listener attention needed			
3. Occasional repetition of words required			
4. Repetitions/ rephrasing necessary			
5. Isolated words understood			
6. Occasionally understood by others			
7. Unintelligible			

### **Voice:** (based on phonation task)

Maximum Phonation Duration (Average of 3 trials): /a/ \_\_\_\_\_seconds

/i/ \_\_\_\_\_seconds

/u/- \_\_\_\_\_seconds

/s/- \_\_\_\_\_seconds

/Z/- \_\_\_\_\_seconds

Pitch: High/ Low/ Appropriate

Pitch Range: Normal/ Reduced/ Monotonous

Loudness: Reduced/ Increased/ Adequate

Quality: Harsh/ Hoarse/ Breathy/ Strained/ Nasality

Pitch Breaks: Present/ Absent

Biphonation: Present/ Absent

Tremors: Present/ Absent

### **Fluency**

Dysfluencies: Present/ Absent

Types of dysfluencies (if present):	Frequency	Duration
-------------------------------------	-----------	----------

- o Repetitions
- o Prolongations
- o Hesitations
- o Pauses
- o Hard contacts
- o Secondaries
- o Other dysfluencies

Rate of speech: Fast/ Slow/ Normal

\_\_\_\_\_ Words per minute

### **Prosody (based on perceptual analysis)**

Stress:

Intonation:

Rhythm:

Pause/ Juncture:

**Instrumental assessment:** (based on the availability of the instruments)

### **Nasometer:**

Nasalance (%)

Tonar (Ratio)

Oral syllables

Nasal syllables

Oral sentences

Nasal sentences

**Nasoendoscopy:**

Structure

Movement

Soft palate:

Posterior pharyngeal wall:

Lateral walls:

Size of gap: Large/ Moderate/ Minimal

Nature of defect: Coronal/ Sagittal/ Central

**Voice assessment using VAGHMI and / or Dr.Speech:**

Fundamental frequency (Phonation of/a/):

Intensity (Phonation of/a/):

Frequency range (Spontaneous speech): Lowest: \_\_\_\_\_ Highest: \_\_\_\_\_

Intensity range (Spontaneous speech) Lowest: \_\_\_\_\_ Highest: \_\_\_\_\_

**Vitalograph assessment:**

Vital Capacity (CC):

Mean Airflow Rate: (CC/S):

**Optimum frequency measurement using Heterodyne Analyzer:**

Natural frequency:

Optimum frequency:

**Recording of speech sample:**

Date of recording:

Cassette title:

Side:

Sample No.:

Other details:

**Case Summary and Other Findings:**



## APPENDIX 2

### Cleft Type Characteristics (CTCs)

- **Lateralization/lateral articulation:** Lateralization or realization of consonants by a lateral fricative.
  
- **Palatalization/palatal articulation:** Secondary articulation modifying a correct target realization and palatal realizations which replace the target consonant. Realizations which would also be categorized as palatalized are alveolo-palatal fricatives which are post-alveolar fricatives with involvement of the body of the tongue making simultaneous palatal approximation.
  
- **Backing:** This is separated into two distinct categories:
  - **Backing to velar:** Backing of alveolar targets to velar place of articulation.
  - **Backing to uvular:** Realization of alveolar or velar targets at the uvular place of articulation.
  
- **Pharyngeal articulation:** Realization of consonants at the pharyngeal place of articulation.
  
- **Glottal articulation:** Realization of consonants at the glottal place of articulation.

- **Active nasal fricatives:** Realization of fricative targets by voiceless nasals with additional audible nasal emission. Articulation of active nasal fricatives involves complete oral closure at the place of articulation with the air stream directed exclusively nasally.
- **Weak/nasalized consonants:** Imprecise, weak, articulations associated with nasalized consonant production.
- **Nasal realization:** Nasal realization of fricatives involves a passive escape of air nasally. Nasal realization of plosives also involves a passive escape of air nasally and is associated with a lack of intraoral pressure.
- **Absence of pressure consonants:** Lack of pressure consonants. This is a strong indicator of velopharyngeal dysfunction (VPD).
- **Omission of fricatives or plosives:** Complete absence of fricatives and plosives.
- **Anterior sibilants' distortion:** Imprecise realizations of anterior sibilants such as /s/.
- **Reduced intra oral pressure on fricatives:** Weak production of fricatives with reduced oral pressure.

- **Imprecise tongue tip movements:** Imprecise tongue tip contacts with the teeth, alveolar region and palate and uncoordinated tongue tip movements.
- **Double articulation:** Two simultaneous equal strictures at two places of articulation frequently noted in realizations of target alveolar consonants /t d/ when alveolar/velar contacts [tkk dkg] are used.