

Research Article

Correlation Between Articulation Disorders and Oral Motor Mechanism

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Abstract | Function of oral cavity is to produce speech sounds for verbal communication along with performance of its primary functions. Its defects can decrease intelligibility of speech while affecting production of phonemes. Description of this relationship is important for etiologic diagnosis and treatment planning among children without any disability or ignored craniofacial deformities. Studies highlighting this relationship are rare to none in Pakistan. Therefore, this study aims to detect the type and extent of relationship between these two factors.

Methods: A descriptive cross sectional study was conducted on a sample of 140, which were 4-8 years old children with speech sound disorders, without any disability, and visiting various speech clinics in Pakistan. Test for Assessment of Articulation and Phonology in Urdu (TAAPU) was applied as it contains both oral motor screen and articulation tests.

Results: The study examined the relationship between Oral Motor Mechanism (OMM) and Articulation Disorders. Oral motor screening of 140 children showed that (23%) had OMM defects among these 33% had substitution errors, 60% distortion errors, and 3.03% omission errors whereas no addition errors were found. The correlation of 0.763 positive relationships between two variables was noticed. High percentage of distortion errors among children having OMM defects shows strong connection between the two otherwise substitution is most prevalent error.

Conclusion: Conclusively it can be stated that anatomical and physiological defects of oral cavity lead to articulation errors. Children with articulation deficit had distorted speech with multiple oral motor anomalies.

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Keywords | Oral Motor Mechanism, Articulation Disorder, Substitution Disorder, Omission Disorder, Distortion, TAAPU

Introduction

The complicated activity of speech is based on human culture, growth and development, language, anatomy and physiology and development of brain. Articulation is described as motor activity in the oral cavity for production of speech sounds for speech.⁽¹⁾

Articulation disorders have been studied in relation

to delayed speech development, hearing impairment, cleft palate, various syndromes and neuromotor disorders. Whereas studies focusing on these disorders in relation to oral motor structural deviation in children without any disability or congenital malformation are rare. In Pakistan there is no related literature available to highlight articulation disorder in relation to Oral mechanism. Timely intervention and referral to the concerned professional could help

in improvement of articulation disorders. Ignored or undetected minor structural deviations can hamper correction of articulation disorder unless intervened surgically. Noticeable recovery in correct phoneme production is seen after surgical intervention. ⁽¹³⁾

Articulation of speech sounds involves intact structure and coordination in movement of articulators i.e. lips, teeth, tongue and palate. During development children learn to produce sounds in an expected order. Articulation disorders are speech errors that are persistent and continue after the age of development of a particular sound. ⁽²⁾ Articulation of speech is considered a disorder when a child is unable to produce speech sound with correct manner and at correct place in the oral cavity. The child may have lisp (saying /th/ instead of /s/) or the child may replace one sound with another like using /t/ instead of /k/ in words. ¹ Children with dental mal occlusion and gap in teeth have distorted speech due to imprecise production of /ch,j,s or z/ sounds as these sounds need accurately controlled outflow of air stream by the articulators. ⁽¹³⁾

Articulation disorder is one of the subtypes of speech sound disorders and usually studied in researches in combination with phonological disorders. These disorders are common among preschool and school age children and the prevalence is as high as 32% worldwide. ⁽³⁾

Data collected from the patient record registers from 1st January 2011 to 31st December 2012, of hospital based speech therapy clinics of Islamabad and Rawalpindi showed 10-12% school age children visit with articulation and phonological disorders. ⁽⁴⁾

Speech sounds are divided into two main categories consonants and vowels. Consonants matter most to the intelligibility of speech and produced by partial or complete obstruction to the out flowing air in the oral cavity referring to as manner of sound production. Speech sounds are produced with the contact of various articulators in the oral cavity, among which tongue is the most mobile articulator along with upper lip that moves in production of bilabial sounds, /p/, /b/ and /m/ as well as velum, the soft palate, that moves to couple or uncouple the oral and nasal cavities in production of nasal and oral sounds respectively. Any defect in anatomy and physiology of these articulators can cause articulation disorder. ⁽⁵⁻⁷⁾

The four types of articulation errors are substitution, omission, addition and distortion. Substitution occurs when a sound in the word is replaced by another sound e.g. if a child says /tite/ instead of /kite/, /k/ is being replaced by /t/ sound. In case of omission error, child can utter /poon/ instead of /spoon/, here the child is missing the production of /s/. Some sounds are produced together and known as blends like /bl/ in the word black or /sk/ in the word school etc. When an extra sound is added in these blend sounds, above-mentioned words will be pronounced as /balak/ and /sakool/ respectively. These types of articulation errors are called addition errors. Distorted sounds are imprecisely produced sounds due to loose contact of articulators or anatomical defects and are termed as distortion errors. ⁽⁸⁻⁹⁾

In utterance of encoded speech signals, intact oral motor structure and function are mandatory. Aligned teeth, accurate dental occlusion, lip contact and palatal movement is necessary for production of bilabial, lingua-dental and labio-dental, lingua-alveolar and lingua palatal consonants. These sounds are produced by complete or partial constriction to the outflowing air in the oral cavity. The manner of production speech sounds is based on structure and accurate contact of articulators. ⁽¹⁻¹²⁾

There is ample evidence in literature about congenital anatomical defects like, micro-glossia, cleft of lip and palate, orthodontic malformation and resection of tongue and other oral structure as a result of diseases affect speech production. Similarly, developmental malformation and dysfunction of oral mechanism affect speech sounds. Adverse affects are reported on speech in case of oral motor defects requiring surgical intervention. ^(12,13)

Macrogathia, micrognathia, gap in teeth especially upper incisors, missing dentition, sublingual short frenulum and velopharyngeal inadequacy are major contributors of articulation disorders, if caused by defective OMM. ^(11, 13, 14, 21, 22)

Methodology

A Cross Sectional study was conducted on a sample of 140 children visiting speech clinics of Pakistan. Children of 4-8 years of age with only speech sound disorders without any disability were included in the study. Whereas children having speech disorders due

to any disabling condition like hearing impairment, intellectual or physical disability were excluded. Sample was collected using convenience-sampling method during standardization of Test for assessment of Articulation and Phonology in Urdu (TAAPU). The study was conducted from March to October 2016 to detect articulation disorders and assessment of oral mechanism and the correlation between the two variables. The researcher identified and approached speech therapy clinics in capitals of four provinces as well as specified cities of Pakistan for data collection. Data from speech clinics in Lahore, Rawalpindi, Sargodha, Abbotabad and Peshawar were collected personally by researchers. Therapists working in speech therapy clinics of Quetta, Karachi, Mandibahauldin, and Khushab were contacted over the telephone by the principal investigator, and the title as well as the objectives of the study were explained. Children having hearing impairment, neurological disorders, intellectual disability, physical disabilities and cleft palate were excluded from the study.

TAAPU assesses OMM before assessment of articulation and phonology. The data gathered by oral motor screening and performance of speech task was entered in SPSS-21 to determine the correlation.

Results

Table 1 shows the frequency of Articulation disorders in the whole sample. 66% of children with or without oral motor defect had substitution errors, 19 % distortion errors and 14% omission errors whereas there were no addition errors. Last column of Table 1 shows mode, which is the most frequently occurring item. The value of mode was 1 whereas in coding of statistical data substitution was coded as 1. So in other words substitution errors were the most frequent errors existing in children with or without oral motor defects.

Table 1: Frequency distribution of articulation disorders

Articulation disorders	Frequency	Percentage	Cumulative percentage	Mode
Substitution	93	66.4	66.4	
Omission	27	19.3	85.7	
Distortion	20	14.3	100.0	1
Total	140	100.0		140

Table 2 depicts the frequency distribution of Oral Motor Mechanism. 62.2% of children had intact,

14.0 % dental problem, 2.3% tongue problem, 1.2% VPI and 1.7% had both dental and tongue problem. Last column of Table 2 shows mode, which is the most frequently occurring item. The value of mode was 1 whereas in coding of statistical data Intact was coded as 1. In other words, children with Articulation and phonological disorders had intact OMM.

Table 2: Frequency distribution of Oral Motor Mechanism

Oral motor mechanism	Frequency	Percent	Cumulative percent	Mode
Intact	107	62.2	76.4	1
Dental problem	24	14.0	93.6	
Tongue problem	4	2.3	96.	
VPI	2	1.2	97.9	
Dental and tongue problem	3	1.7	100.0	
Total	140	100.0		140

Table 3: Cross tabulation of Oral Motor Mechanism and Articulation Disorders

Oral motor mechanism	Articulation disorders			Total
	Substitution	Omission	Distortion	
Intact OMM	71	26	10	107
Dental problem	9	1	14	24
Tongue problem	3	0	1	5
VPI	0	0	2	2
Dental and tongue problem	0	0	3	3
Total	91	27	31	140

Table 3 and bar graph in Figure 1 show that among children with intact OMM substitution is 66% most prevalent among APD but with defected OMM distortion error is 60%, substitution is 33% and omission is 3.03%".

Table 4: Correlation between Articulation disorders and Oral Motor Mechanism

Oral motor mechanism		
Articulation Disorders	Pearson Correlation	.763
	Sig. (2-tailed)	.054
	N	140

Table 4 shows bivariate correlation between two variables: Articulation disorders and Oral Motor Mechanism. The Pearson correlation coefficient takes value

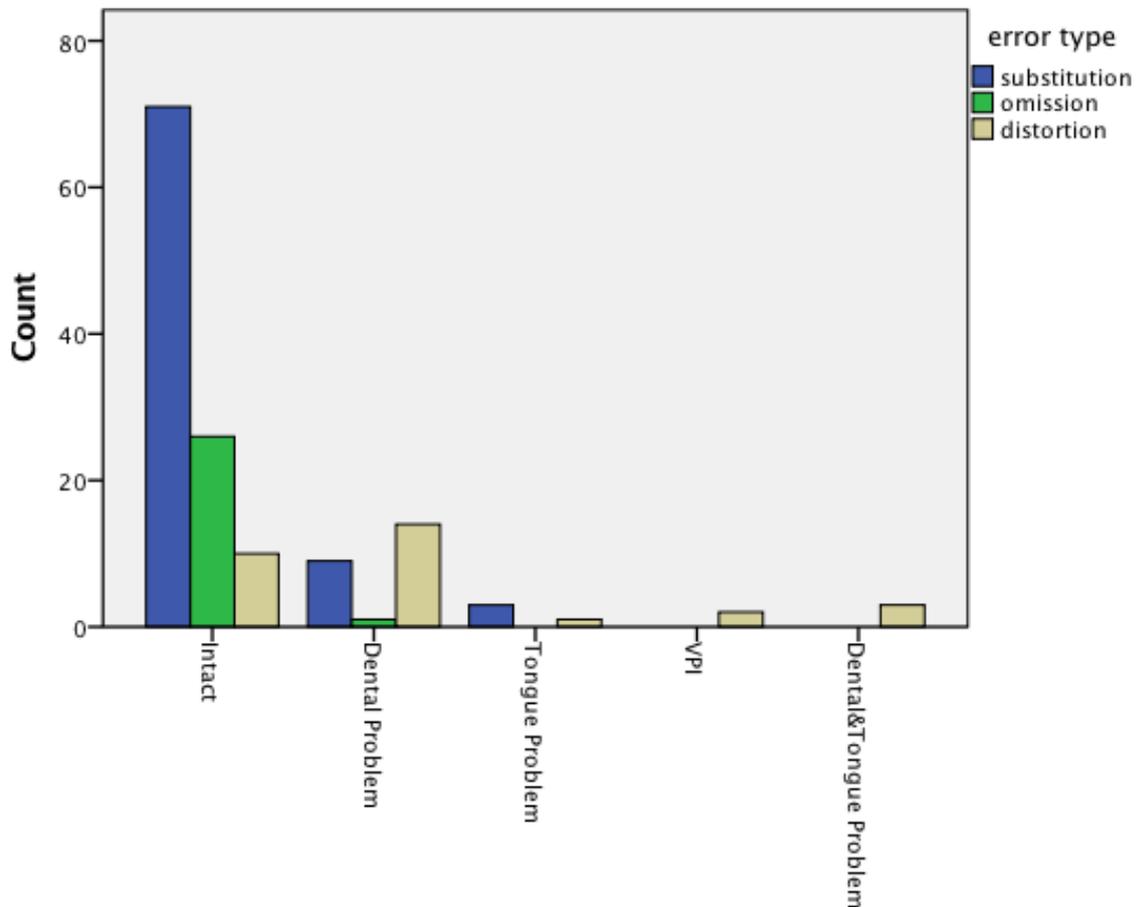


Figure 1: Oral Motor Mechanism and Articulation Disorders

from -1 to 1, above 0.70 is considered as high positive correlation. 0.763 value shows that there is a significant positive correlation between OMM defects and articulation disorders.

Discussion

The relationship of speech disorders with congenital malformation like microglossia, partial or complete cleft has been explored and discussed worldwide. (13,14,15,16) Association in relation to the malformation of orofacial complex has been studied in different syndromes. (13,17,18) Though intact structure and function of oral cavity are indispensable in production of sounds for error free speech, however, the literature on relationship of articulation disorders with oral motor structure and mechanism in children without any disabling condition is rare. This study determined that there is significant connection between OMM and articulation disorders.

Children of 4-8 years were tested using TAAPU for speech errors along with oral motor screen as in Clinical Assessment of Articulation and Phonology (CAAP) and Diagnostic Evaluation of Articulation

and Phonology (DEAP) assessed. (20,21) Literature suggests articulation disorders are motoric in nature that are based on malfunctioning of the structures of oral cavity (14,15) this study explored the association between these two variables and a high positive correlation shown in table-4 suggests positive association.

Results of articulation test with application of TAAPU showed high frequency of substitution errors and omission and distortion errors are lesser Table 1. When the articulation errors were studied in reference with OMM as shown in Table 3 and Figure 1, distortion errors were found out to be predominant among the three disorders. However, it is noted that children also substituted lingua alveolar with lingua dental sounds, bilabial sounds with labiodental sounds and in case open bite omitted bilabial sounds.

Velopharyngeal inadequacy (VPI) leads to an overall nasal distortion in speech though all children with VPI do not necessarily have sub-mucosal cleft or a history of nasal regurgitation. Habitual malfunctioning of VPI causes functional hyper-nasality hence a careful oral motor screening is required for future

planning and diagnosis. ^(12,13,15) Table 3 and Figure 1 also revealed that children found out to have VPI had distortion in speech.

Studies suggest severe malocclusions cause speech disorders that may require surgical intervention ^{13,21} in the present analysis children having dental problems like open bite, cross bite and gap in teeth had distorted speech or substituted sounds requiring accurate closure of teeth. Distortion errors are highly related with dental problems (Table 3).

Tongue makes contact with lower alveolar ridge to produce /s,z/, with teeth for /ch,dz/ production and rise high towards palate in the front of mouth to produce /l,r/ production ^(6,7,12) Literature suggests articulation is affected by the extent of tongue tie by limiting the range of movement of tongue to make contact with other articulators. ^(14,18) Figure 1 and Table 3 showed children having tongue problems had substitution and distortion errors involving tongue elevation and vibration.

Conclusions

This study depicted the relationship of OMM with articulation disorders and discovered significantly high positive correlation between the two variables. It was noticed that speech sounds are not precisely uttered if there is any structural or functional deficit in the oral cavity. Performing an oral motor examination, prior to assessing articulation disorders, is vital in clinical decision making for planning therapy or referral to other related professionals. Correct aetiology based diagnosis could help saving time and disappointment in case of impassable progress.

Author's Contribution

Sadaf Noveen: Conceived, conducted, analyzed and drafted the article.

Shaista Habib Ullah: Supervised the complete research .

Babar Alam: Guided and supervised in data analysis and reviewed result portion..

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