



## **Co-occurrence of Cleft Palate in Pierre Robin Syndrome and Associated Challenges**

M. Pushpavathi<sup>1</sup>

*All India Institute of Speech and Hearing*

Kavya V.<sup>2</sup>

*All India Institute of Speech and Hearing*

Akshatha V.<sup>3</sup>

*All India Institute of Speech and Hearing*

Received : 01.01.2018  
Accepted : 02.08.2018  
Published : 30.09.2018

### **Abstract**

Pierre Robin Sequence (PRS) is a condition characterized by malformation of the lower jaw (retrognathia), abnormal positioning of the tongue (glossoptosis) and cleft palate. Children with PRS may exhibit speech and language difficulties and hypernasality among others, based on the type and severity of cleft palate and the age at which surgery was done. The present study is an attempt to describe speech and language characteristics in toddlers with PRS before and after speech language therapy. Two toddlers, who were diagnosed to have Expressive Language Delay secondary to repaired cleft of palate with PRS, were considered for the Early Intervention Program using Focused Stimulation approach. The children selected were matched for language, vocabulary size and the IQ level. The baseline was established and various measures such as type and pattern of the vowels, consonants, true and proto words were analyzed. Speech and language therapy was given for 20 sessions. Post-therapy measurement was done after 20 sessions. Pretest-Posttest design was used to compare the differences in speech and language measures for the pre-therapy and post-therapy conditions. The results revealed that the type and number of vowels, consonants and words were variable in the toddlers, which could be attributed to individualistic variations and the way in which the mothers implemented the approach at home. The speech and language behaviors of each child have been discussed in detail in the full length paper. The present study is one of the first attempts to emphasize the speech and language characteristics of children with PRS and also highlights the clinical implications of early intervention.

**Keywords** Pierre Robin Sequence, cleft palate, Early Intervention Program, Focused Stimulation, Language measures

### **1. Introduction**

Pierre Robin Sequence (PRS) is a condition characterized by severe malformation of the lower jaw (retrognathia) or an abnormally small jaw (micrognathia), abnormal positioning of the tongue (glossoptosis) and associated cleft palate and feeding related issues (Breugem & Van der Molen,

<sup>1</sup> Bio: Prof. in Speech Pathology, All India Institute of Speech and Hearing (AIISH), Mysore-06, Research interests are in the area of clinical evaluation and management of cleft lip and palate. Cor. Author: [shivanna.pushpa@gmail.com](mailto:shivanna.pushpa@gmail.com)

<sup>2</sup> Bio: Research officer, AIISH, Mysore, Email: [kavya.vijayan@gmail.com](mailto:kavya.vijayan@gmail.com)

<sup>3</sup> Bio: Research officer, AIISH, Mysore, Email: [akshathavshwnth@gmail.com](mailto:akshathavshwnth@gmail.com)

2009). Initially this condition had been considered as a syndrome, but in the present time it is believed to represent a specific outcome of an anomalous developmental process. The major cause for the condition to develop as illustrated by various studies is the inability of the lower jaw to develop adequately during prenatal condition. Inadequate development of the lower jaw results in lack of downward movement of the tongue which in turn leads to the formation of cleft palate.

One of the earliest descriptions of Pierre Robin syndrome was provided by two authors named Lannelongue and Menard in 1891, which included features such as glossoptosis, micrognathia and cleft palate (Tewfik & Trinh, 2015). In the year 1923, after a French dental surgeon named Pierre Robin published a case study detailing the various features, the syndrome came to be named after him. Till the 1970s, the condition was commonly known as Pierre Robin syndrome. Later, the term 'sequence' was coined in order to include a set of anomalies caused by a series of events set off by a particular malformation. Now the condition is commonly known as Pierre Robin Sequence (PRS). Previously the term Robin Anomalad was also used by a few authors (Bush & Williams, 1983).

Besides the physical characteristics discussed above, children with PRS may also exhibit various problems such as feeding issues, respiratory problems, ear infections, reduced hearing and delays in speech and language among others (Filip et. al., 2015). Some of these issues may resolve as the child grows and others may require surgical, non-surgical or prosthetic intervention. Studies have shown that PRS may also manifest conditions affecting cognitive function, and overall psychological adjustment (Drescher et. al., 2008).

Over the last two decades many studies have been conducted in order to assess the effect of micrognathia and retrognathia on airway obstruction. But very few studies have focused on the speech and language difficulties in children with PRS. The smaller size of the lower jaw is one of the major deterrents for speech and associated oromotor problems in children with PRS. In conditions wherein the mandible is set significantly behind the maxilla there may be chances of the tongue getting displaced posteriorly, closer to the throat. This backward displacement of the tongue may cause respiratory difficulties for the baby. Also the small size of the mandible and oral cavity may lead to limited movements of the tongue (Gangopadhyay, Mendonca & Woo, 2012).

Cleft palate has been reported to occur in 1 for every 700 children born with PRS (Cleft Palate Foundation, 2007). Due to the presence of cleft palate, children with PRS may exhibit speech and language difficulties and hypernasality due to velopharyngeal dysfunction (VPD). It is also influenced by the type and severity of cleft palate and the age at which surgery was done. There have also been contradictory findings which suggest that children with PRS do not have a greater frequency of velopharyngeal dysfunction after the repair of cleft lip and palate (CLP) and may not need supplementary surgical procedures for correction (Goudy, Ingraham & Canady, 2011).

One of the earliest studies to assess speech and language characteristics in children with PRS was conducted by Williams, Williams, Walker and Bush



(1981). This study aimed to investigate the speech, language, hearing and educational abilities of thirty children with PRS. A total number of 55 children were considered for the study out of which 14 (26%) had CLP. The children were seen to have variable linguistic patterns and a disparity was observed in comprehension and expressive language. This disparity could range from normal language skills to a delay in either or both receptive and expressive language skills. Some children also demonstrated atypical linguistic patterns, deviant articulatory patterns and severe nasal air emissions. Thus it would appear that children with PRS may also benefit from early language intervention programs. By involving the mothers in the intervention programs, strategies learnt in the clinical setup could be generalized to communication throughout the day.

It has been established that toddlers with repaired cleft lip and palate (RCLP) exhibit expressive language delay in addition to multiple associated problems which needs to be dealt by a team of experts (Scherer, 1999). Toddlers with RCLP have been seen to demonstrate features such as reduced mean length of utterance (MLU), reduced lexical diversity, smaller phonetic inventory and various deviant phonological processes during the development of speech and language (Morris & Ozanne, 2003). Early language intervention is warranted for such children and in their study, it was clearly illustrated that early language intervention programs have been successful in facilitating both language and speech in children with CLP (Scherer & Kaiser, 2007). Various studies have also emphasized the constructive changes seen in the language skills of children by involving parents/mothers in a structured parent-implemented program (Scherer, 1999; Pamplona et. al., 1999, 2004). Focused Stimulation approach (Girolametto, 1988; Girolametto et. al., 1996, 1997) is one such method which has been widely used for enhancing language and for building vocabulary in children with CLP (Scherer, D'Antonio & McGahey, 2008). There have been limited studies focusing on the importance of early intervention in children with PRS and the changes seen in their linguistic abilities when provided with a structured parent-implemented program. Thus a series of studies have been carried out in our institute to highlight the favourable effects of the early intervention program. The results of these studies indicate that the toddlers with RCLP demonstrated significant changes in their speech and language abilities. There were notable improvements in the toddlers articulatory repertoire, vocabulary and mean length of utterance (Pushpavathi, Kavya & Akshatha, 2017 a,b). These findings stress upon the importance of providing intensive language stimulation in the early years which is the critical period for speech and language development.

Hence, the present study is aimed to describe the speech and language characteristics and non-verbal behaviors in toddlers with PRS before and after speech-language intervention. The objectives of the present study are as follows:

- (1) To study the impact of early language intervention program on the speech related parameters such as frequency of occurrence of vowels and consonants in children with PRS.

- (2) To investigate the effect of early language intervention program on the development of linguistic skills such as prototype words, true words and jargon utterances.

## 2. Methodology

### 2.1 Participants

Two toddlers aged between 2 and 2.6 years who were diagnosed to have Expressive Language Delay secondary to repaired cleft palate with PRS served as the subjects for the study. The participants were enrolled for the Early Language Intervention Programme (ELIP) at Unit for Structural and Oro-facial Anomalies, All India Institute of Speech and Hearing (AIISH). An informed consent (approved by AIISH Ethical Committee) was obtained from the parents prior to their participation in the study. Psychological evaluation for both the participants revealed age-adequate developmental and mental age. The detailed description of the subjects is shown in Table 1.

Table 1

*Detailed description of participants*

	Participant A	Participant B
Age/Gender	2.6 years/Female	2 years/Male
Age of primary surgery	1.6 years	1 year
REELS*	RLA: 27-30 months ELA: 16-18 months	RLA: 22-24 months ELA: 9-10 months
Hearing evaluation	Hearing sensitivity within normal limits	Bilateral minimal hearing loss due to middle ear pathology
Other findings	<ul style="list-style-type: none"> <li>• Facial dysmorphism</li> <li>• Nasal-bridge depression</li> <li>• Visual problems</li> <li>• Receding mandible</li> </ul>	<ul style="list-style-type: none"> <li>• Micrognathia</li> <li>• Glossoptosis</li> <li>• Palatal fistula present</li> </ul>

\*Note: REELS- Receptive Expressive Emergent Language Scale (Bzoch & League, 1971)

RLA- Receptive language age

ELA- Expressive language age

### 2.2 Data collection and processing

A detailed pre-therapeutic evaluation was conducted to establish the baseline related to speech and language features of the children. The audio video recordings were carried out in a quiet room during unstructured play sessions between the Speech Language Pathologist and the child, with the mother also being involved in the sessions. Recordings were done using a Handycam recorder (Sony DCR-SR88). The recorder was placed on a tripod stand at a distance of approximately 8-10 feet from the child. The spontaneous interaction between mother and child were recorded in the baseline audio-video recording and a post therapy audio-video recording was done after the 20<sup>th</sup> session. Thus in total, 2 video recordings and analyses for each participant were carried out by a qualified Speech Language Pathologist. The parameters assessed in each child's inventory were frequency of occurrence of vowels, consonants, proto words and true words.



### 2.3 *Speech and Language therapy*

Speech-language therapy was conducted in the clinical setup for sessions lasting forty-five minutes each. Speech therapy sessions were carried out by a qualified Speech Language Pathologist. This was done by preparing a master lesson plan by taking up the specific goals and activities. Play way method was used to improve vowel and consonant inventory, functional communication skill and to increase the frequency of meaningful utterances. Focused stimulation approach was demonstrated to the mother during therapeutic sessions using low-cost materials and commonly available toys. A multisensory approach was used to increase the oromotor movements. Visual feedback using mirror work and tactile cues with interesting oromotor activities was provided appropriately wherever required. A corpus of vocabulary was prepared which contained the most commonly used functional words by toddlers. This was done with the aim of increasing the child's functional vocabulary. The positive behaviors, and behaviors which were attempted correctly by the child were reinforced with token and tangible reinforcements to improve their cooperation and confidence in doing the activity. The mothers were also told to carry out a similar training program at home in the absence of direct supervision of the SLP. A total number of 20 therapy sessions were conducted.

### 2.4 *Data analysis*

Each of the video and audio-taped session of mother-child interaction during unstructured play was transcribed using International Phonetic Alphabet (IPA) symbols. The frequency of occurrence of vowels and consonants were calculated. Vowels were classified as high (/i/), mid (/e/, /æ/) and low (/a/) based on the tongue height and their frequencies were calculated. The frequency of occurrence of different consonants were calculated based on place of articulation (bilabials, glottals, labiodentals and semi-vowels). Also the total number of true words and proto words were obtained and tabulated. In addition, any positive changes in the child's vocabulary and the overall improvement in the expressive language were investigated. The tabulated data was entered in a Microsoft excel sheet and the difference in the frequency of occurrence of vowels, consonants, true words and proto words were calculated and analyzed from baseline to 20<sup>th</sup> session using descriptive statistics.

## **3. Findings**

The present study is an attempt to explore the impact of focused language stimulation program in two children with PRS, by throwing light on the changes in the phonemic inventory of the children. The findings obtained have been highlighted below.

### 3.1. *Effect of intervention on speech related measures.*

The effect of early intervention on speech related measures were analyzed by calculating the frequency of occurrence of vowels and consonants. Vowels were classified based on their tongue height and consonants were classified based on the place of articulation.

### 3.1.1. Frequency of occurrence of vowels

The frequency of occurrence of vowels across participants and sessions were obtained and analyzed. These vowels were classified as high (/i/), mid (/e/, /æ/) and low (/a/) based on the tongue height.

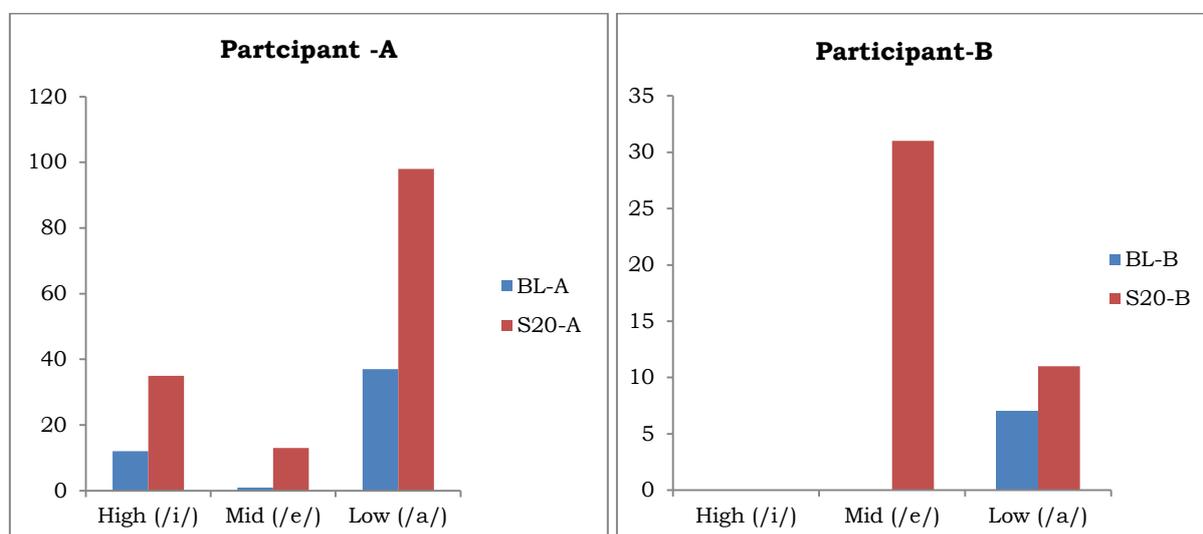


Figure 1. Frequency of occurrence of vowels w.r.t. tongue height in the two participants in pre- and post-therapy conditions. (BL – Baseline; S20 – 20<sup>th</sup> session).

Figure 1 clearly depicts the frequency of vowels from baseline to the 20<sup>th</sup> session for both the cases. With reference to participant A, at the time of baseline recording, vowels present in the child's inventory included /i/, /u/, /æ/ and /a/. The post-therapy recording showed the presence of vowel /ə/ in addition to the others. The trend clearly indicates that the low vowels showed the greatest improvement followed by high and mid vowels. Low vowel /a/ showed the greatest increase with respect to frequency from 40 to approximately 100. The high vowel /i/ also showed a fairly good improvement, with the frequency increasing from 12 to 35. In terms of frequency, mid vowels also showed an increase from 1 to 13 at the time of post-therapy recording. With respect to participant B, only low vowels (/a/) were present at the time of baseline recording. However post-therapy recording showed the occurrence of mid vowels such as /æ/ and /ʌ/ adding up with low vowels.

### 3.1.2. Frequency of occurrence of consonants

The frequency of occurrence of different types of consonants across participants and sessions were calculated based on place of articulation (bilabials, glottals, labiodentals and semi-vowels).

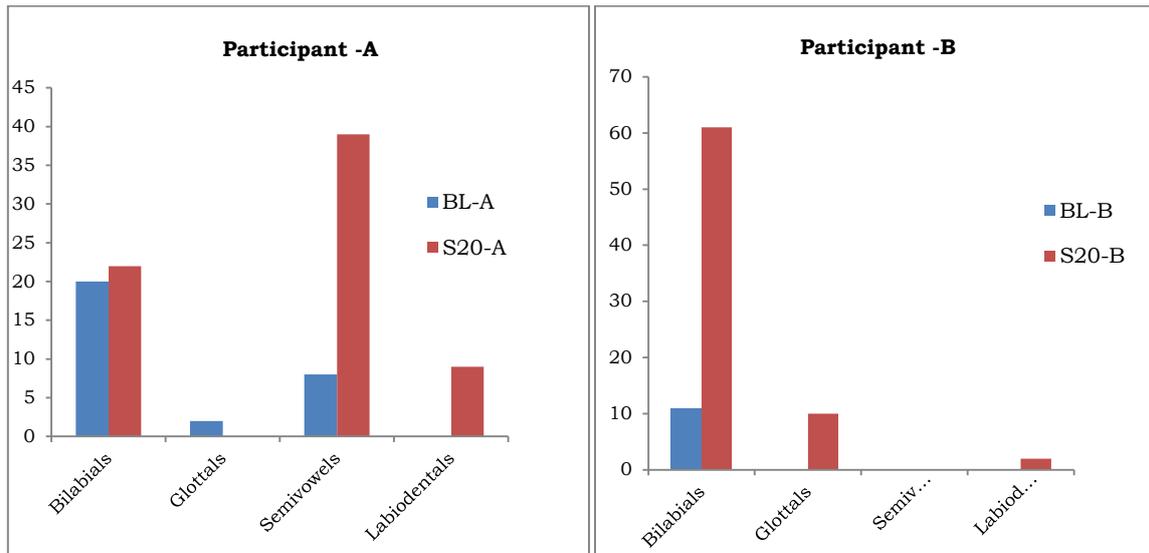


Figure 2. Frequency of occurrence of various consonants in the two participants in pre- and post-therapy conditions. (BL – Baseline; S20 – 20<sup>th</sup> session).

Figure 2 illustrates the changes in the frequency of consonants in the children’s inventory between the baseline and post-therapy conditions. At the time of baseline recording, with respect to place of articulation, consonants such as bilabial /m/, glottal /h/ and semivowel /j/ were present in the inventory of participant A. During the post-therapy recording, additional consonants such as voiced bilabial /b/, labiodental /v/, and lateral /l/ were acquired by the child. In terms of frequency, semivowels showed the greatest improvement. There was a small increase in bilabials. Labiodentals which were absent during the baseline showed an emergence by the 20<sup>th</sup> session. It is also interesting to note that glottal fricative which was present during the baseline session was not seen at the post-therapy recording. With reference to Participant B, only bilabials nasals (/m/) were present in the child’s inventory. While at the end of 20<sup>th</sup> session child showed a marked increase in the number of bilabials. The post therapy recording also showed the emergence of glottals (/h/) and labiodentals (/v/). The voiceless labiodental was not attempted as /f/ is not present in the phonetic corpus of Kannada language.

### 3.2. Effect of intervention on language related measures.

The effect of early intervention on language related measures were analyzed by depicting the number of true words, proto words and non-meaningful utterances. The frequency of all the language related parameters measures the positive changes in the child’s vocabulary and subsequently their language.

#### 3.2.1. Frequency of occurrence of true-words and proto-words.

The frequency of occurrence of true and proto words were analyzed. True words were considered based on their meaningfulness and articulatory

accuracy. Proto words were words which resembled true words and are not meaningful.

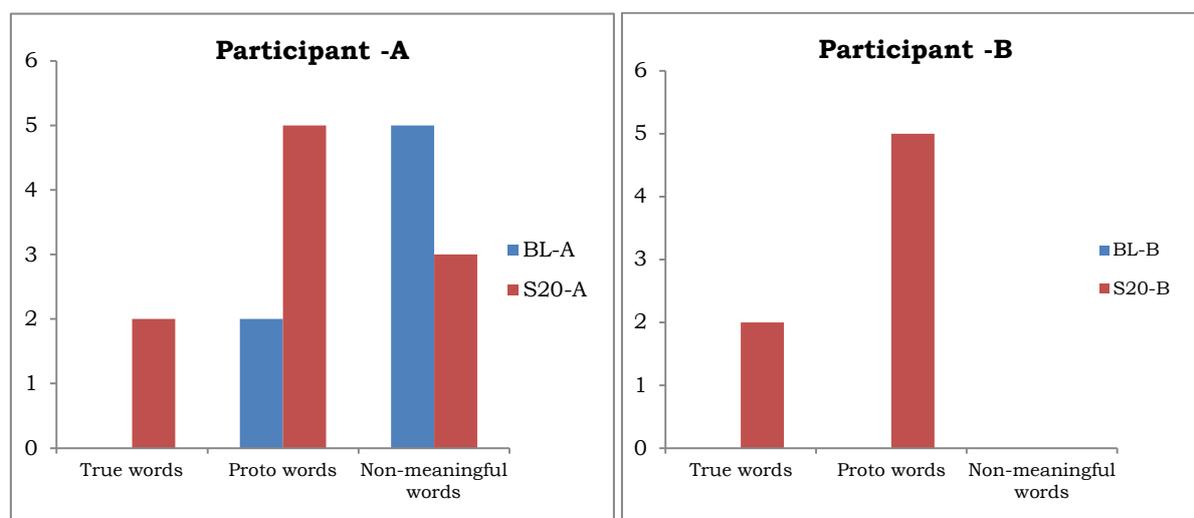


Figure 3. Frequency of occurrence of true words, proto words and non-meaningful words across participants and sessions. (BL – Baseline; S20 – 20<sup>th</sup> session)

Figure 3 illustrates the number of true words, proto words and non-meaningful words for the two toddlers between baseline and the 20<sup>th</sup> session. The graph clearly depicts a notable increase in the frequency of true and proto words and a reduction in the non-meaningful words. At the time of baseline recording, the repertoire of participant A did not consist of any true words. It is encouraging to note that by the 20<sup>th</sup> session the child had acquired 2 true words that is /ba/ and /ba:l/. Similarly the frequency of proto words increased from 2 to 5. At the time of post-therapy recording the child was consistently using proto words such as /a:ji/ for /ba:ji/, /alu/ for /hallu/, /ija:/ for ‘meow’, /ija:u/ for ‘bow’ and /ijal/ for ‘twinkle’. Another noteworthy result is the decrease in the number of non-meaningful words from 5 to 3. The child frequently used semivowel and vowel combinations such as /a:ji/, /ija:/ and /jaja/ among others.

During the baseline recording of Participant B, the child’s repertoire did not consist of any true words. By the 20<sup>th</sup> session child had acquired 2 to 3 true words. The first word acquired by the child was /amma/ and this word showed the maximum frequency of occurrence post-therapy. Also there were no proto words in the child’s repertoire during baseline. However post-therapy there were almost 4-5 proto words present in the child’s repertoire. The proto words in the child’s vocabulary included /amam/ for food, /aha/ for /akka/, /na/ for /aŋŋa/ and /ma/ for /amba/. Non-meaningful gestures were not reported, however vocalization with varying intonation patterns was present.

#### 4. Conclusions

In conclusion, the results of the present study illustrate that there was a noteworthy expansion in the repertoire of phonemes and vocabulary in both of the participants. This improvement can be attributed to the continuous



parent-implemented intervention program in addition to intensive home training. The findings of the present study highlight the fact that early intervention in children with PRS could prevent active deviances from being established and also confirms that intensive early intervention programs are necessary in order to change already established deviant behaviors.

## **5. Discussion**

Research over the last two to three decades has led to the findings that children with CLP in general, usually exhibit a delay in the production of their first word and also early vocabulary (Scherer 1999). Children with PRS on the other hand, have been seen to demonstrate variable language patterns with no consensus between the receptive and expressive language skills (Williams et.al., 1981). This could be attributed to the presence of structural anomalies such as cleft palate, microgathia and cognitive deficits. Children with PRS also have many medical issues which require long-term medical treatment.

Issues such as airway obstruction and feeding problems were encountered by Participant A as a neonate. The surgical correction of the palate was done at the age of 1.6 years and no intervention was sought for in terms of speech and language till the age of 2.6 years. Thus there was a delay in the acquisition of expressive vocabulary and the phonemes present in the child's repertoire was also limited. This could probably be attributed to the lack of stimulation at home and to the delay in initiating the intervention program. In case of Participant B, surgical correction of the palate was done at the age of 1 year and speech and language intervention was begun from the age of 2 years. The speech and language characteristics of the children have been discussed below.

The aim of the present study was to investigate the frequency of occurrence of vowels among the two toddlers with RCLP associated with PRS. Studies have shown that children with CLP demonstrate a better proficiency for vowels compared to consonants since these sounds do not require velopharyngeal competency (Williams et. al.,1981; Van Demark et. al., 1979). The findings of the present study indicate that children with PRS also follow a similar trend, wherein low and high vowels displayed a 100% accuracy compared to mid vowels, although Participant B acquired some mid vowels post-therapy. The frequency of vowels in the repertoire of both the participants greatly increased after the intervention program which support the findings of previous studies carried out in children with RCLP recently (Pushpavathi, Kavya & Akshatha, 2017 a,b). There was a disparity in the type of vowels acquired in both the participants which supports the findings of Williams et. al. (1981) who reported that children with PRS demonstrate atypical articulatory patterns.

The presence of a repaired cleft palate and also the small size of the mandible and oral cavity might have led to the child presenting with limited oromotor movements which could explain the limited vowel inventory. This finding supports the results of previous studies which report that the spatial constraints of the lower jaw as one of the major setbacks for speech which

may lead to oromotor problems in children with PRS (Gangopadhyay, Mendonca & Woo 2012).

The other aim was to analyze the frequency of occurrence of consonants among the two toddlers. There were significant changes seen in the consonant inventory between the baseline and post-therapy conditions of both the participants. There was a disparity in the trend followed by both the participants in terms of the type of consonants acquired, with respect to place of articulation. Participant A showed a noteworthy increase in semivowels and labiodentals whereas Participant B displayed a significant increase in bilabials and glottal consonants. These findings are in consonance with the findings of Williams et. al. (1981) who stated that children with PRS exhibit atypical articulatory patterns and atypical phoneme substitutions.

The limitation in children's consonant inventory can also be attributed to the presence of palatal fistula which limits the oral cavity to build up sufficient intra-oral pressure and release it. This is in consonance with the findings of a previous study which reported that the reduced variety of sounds in children with CLP could also be attributed to their inability to build intraoral pressure required for the production of pressure consonants (Willadsen & Enemark, 2000). Thus it can also be concluded that children with PRS also exhibit deviant articulatory patterns similar to that of children with CLP, which was also depicted in a previous study (Williams 1981). The findings obtained in the present study are in agreement with the study of Sreedhanya et. al., (2015) that suggest that the limitations in the oral structures of children with CLP may lead to a small consonant inventory. In addition to the limitations seen in the oral structures the small size of the mandible might have contributed to limited tongue and oromotor movements resulting in a restricted consonant inventory.

The frequency of occurrence of true words and proto words were also investigated. Both children in the present study had age-adequate receptive language skills, whereas a delay was observed in the expressive language abilities. Participant B exhibited a relatively slower rate of improvement compared to Participant A in terms of expressive language abilities and sound inventory. This is in consonance with the findings of a previous study which reported that the linguistic patterns of children with the Robin Anomalad are variable and there may exist a disparity between the comprehension and expressive language skills (Williams et. al., 1981).

With reference to the vocabulary of Participant A, a spurt was seen for both true words and proto words whereas non-meaningful words showed a decline. This could be attributed to the fact that, as the child began acquiring and using meaningful words, the non-meaningful words in the repertoire became redundant. The child had been habituated to using non-verbal gestures such as pointing, nodding, hand waving and different facial expressions among others and post-therapy it was seen that there was a decrease in the non-verbal behaviors. This could be attributed to the emerging vocabulary of the child. The role of Focused Stimulation approach as an effective means to remediate speech and language problems in children with CLP has been established previously (Scherer, D' Antonio & McGahey, 2008; Pushpavathi, Kavya & Akshatha, 2017 a,b). The findings of



the present study highlight the importance of this approach as an efficient method to improve the linguistic abilities of children with PRS too.

For Participant B, the delay in expressive language could be attributed to the presence of middle ear pathology that could have influenced the effectiveness of early intervention program. The child had also developed non-verbal means of communication such as gestures, pointing, nodding and non-verbal actions that could have contributed to the decreased rate of improvement. The accelerated rate of development seen in Participant A can be attributed to the continuity in the number of sessions attended whereas Participant B received therapy only thrice a week. This lack of continuous stimulation by the Speech Language Pathologist could be the explanation for slower rate of development.

In essence, the results of the present study highlights the associated speech and language manifestations seen in children with PRS as a result of their structural and orofacial limitations. The study also stresses on the need for early intervention in this population with respect to speech-language therapy involving trained professionals by means of establishing its beneficial effects. The present study also highlights the importance of intensive home training and speech and language stimulation by parents in order to obtain a positive outcome.

### **Acknowledgements**

This is a part of ongoing research on “Efficacy of Early Language Intervention Program for Children with Repaired Cleft lip and Palate”, funded by the Department of Science and Technology (DST - No. SB/SO/HS/02/2014), Government of India. The authors would like to thank DST for funding the project. The authors would also like to thank Dr. S. R. Savithri, Director, All India Institute of Speech and Hearing, Mysuru, for providing the infrastructure to carry out the study.

### **References**

- Breugem, C. C., & Mink van der Molen, A.B. (2009). What is ‘Pierre Robin sequence’? *Journal of Plastic, Reconstructive & Aesthetic Surgery*, 62 (12), 1555-8.
- Bush, P.G., & Williams, A.J. (1983). Incidence of the Robin Anomalad (Pierre Robin syndrome). *British Journal of Plastic Surgery*, 36, 434-437.
- Bzoch, K.R., & League, R. (1971). *Receptive Expressive Emergent Language Scale*, Florida: Anhinga Press, Gainesville.
- Cleft Palate Foundation. (2007). Pierre Robin Sequence; Available from: <http://www.cleftline.org/parents-individuals/publications/pierre-robin-sequence/>.
- Drescher, F.D., Jotzo, M., Goelz, R., Meyer, T.D., Bacher, M., & Poets, C.F. (2008). Cognitive and psychosocial development of children with Pierre Robin Sequence. *Acta Paediatrica*, 97 (5), 653-666.
- Filip, C., Feragen, K.B., Lemvik, J.S., Lindberg, N., Andersson, E., Rashidi, M., et al. (2015). Multidisciplinary aspects of 104 patients with Pierre Robin Sequence. *Cleft Palate-Craniofacial Journal*, 52 (6), 732-742.

- Gangopadhyay, N., Mendonca, D.A. & Woo, A.S. (2012). Pierre Robin Sequence. *Seminars in Plastic Surgery*, 26(2), 76-82.
- Girolametto, L. E. (1988) Improving the social-conversational skills of developmentally delayed children. *Journal of speech and hearing disorders*, 53, 156-167.
- Girolametto, L. E., Pearce, P., & Weitzman, E. (1997). Effects of lexical intervention on the phonology of late talkers. *Journal of Speech and Hearing Research*, 39, 1274–1283.
- Girolametto, L.E., Pearce, P., & Weitzman, E. (1996) Interactive focused stimulation for toddlers with expressive vocabulary delays. *Journal of Speech and Hearing Research*, 39, 1274–1283.
- Goudy, S., Ingraham, C. & Canady, J. (2011). The occurrence of velopharyngeal insufficiency in Pierre Robin Sequence patients. *International Journal of Pediatric Otorhinolaryngology*, 75(10), 1252-4.
- Lannelongue, O. M., & Menard, V. (1891). Pierre Robin Syndrome; Available from: <https://www.slideshare.net/SaharKamall/sahar-60937529/>.
- Morris, H., & Ozanne, A. (2003). Phonetic, phonological and language skills of children with a cleft palate. *Cleft Palate-Craniofacial Journal*, 40(5), 460-470.
- Pamplona, M.C., Ysunza, A. & Espinosa, J. (1999). A comparative trial of two modalities of speech intervention for compensatory articulation in cleft palate children, phonologic approach versus articulatory approach. *International Journal of Pediatric Otorhinolaryngology*, 49(1), 21-26.
- Pamplona, M.C., Ysunza, A. & Ramirez, P. (2004). Naturalistic intervention in cleft palate children. *International Journal of Pediatric Otorhinolaryngology*. 68(1), 75-81.
- Pushpavathi, M., Kavya, V., & Akshatha, V. (2017). Efficacy of early intervention program for children with cleft lip and palate: A case study. *Journal of Child Language Acquisition and Development*, 5(1), 31-42.
- Pushpavathi M., Kavya V., & Akshatha V. (2017). Efficacy of Focused Stimulation in early language intervention program for toddlers with repaired cleft palate. *Global Journal of Otolaryngology*, 9(1), 555-563.
- Scherer, N.J. (1999). The speech and language status of toddlers with cleft lip and/ or palate following early vocabulary intervention. *American Journal of Speech-Language Pathology*, 8, 81–93.
- Scherer, N.J. & Kaiser, A. (2007). Early intervention in children with cleft palate. *Infants & Young Children*, 20, 355-366.
- Scherer, N.J., D' Antonio L., & McGahey H. (2008), Early intervention for speech impairments in children with cleft palate. *Cleft Palate-Craniofacial Journal*, 45, 18–31.
- Sreedhanya, P.K., Hariharan, S.V., & Nagarajan, R. (2015). Early language development and phonetic repertoire in children with unrepaired cleft lip and palate: A preliminary study. *Journal of Cleft Lip Palate and Craniofacial Anomalies*, 2(1), 34-40.
- Tewfik, T.L., Trinh, N., editors (2015). Pierre Robin Syndrome- Medscape; [cited 2015 Nov 6]. Available URL: <http://emedicine.medscape.com/article/844143-overview>.



- Van Demark, D.R., Morris, H.L., & Vandehaar, C. (1979). Patterns of articulation abilities in speakers with cleft palate. *Cleft Palate - Craniofacial Journal*, 16(3), 230-239.
- Willadsen, E. & Enemark, H.A. (2000). A comparative study of prespeech vocalizations in two groups of toddlers with cleft palate and a non-cleft group. *Cleft Palate-Craniofacial Journal*, 37, 172-178.
- Williams, A.J., Williams, M.A., Walker, C.A. & Bush, P.G. (1981). *Archives of Disease in Childhood*, 56, 663-668.