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# Voice Onset Time of Persian Plosives in Children with Repaired Cleft lip and Palate Comparing to Normal Peers

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**Abstract**

Voice onset time (VOT) is the time between release of a stop consonant and pulses in larynx while making a following vowel or sonorant. In this research VOT is one of the most important acoustic distinctive features in recognition of voicing of Persian plosives, produced by repaired cleft lip and palate (RCLP) children in the onset of words. So, two groups of six participants with average age of 11, a group of two RCLP boys and four RCLP girls and a group of clients (two boys and four girls), were asked to repeat CVC framed words after the researchers, each word was consisted of one of the plosives in the onset and offset of the pattern and one of the Persian vowels in the center. The words were recorded using a Shure microphone and then they were analyzed using PRAAT software. The VOT of plosives was measured and compared between two groups of participants. The results indicate that DISABILITY, GENDER, VOICE, and PLACE OF ARTICULATION OF PLOSIVES affect mean VOT of them. The mean VOT of plosives in clients was less than RCLPs and boys produced plosives with shorter mean VOT comparing to girls. The mean VOT of voiceless plosives was more than that of voiced ones. Moreover, moving from bilabial to velar plosives the mean VOT increased.

***Keywords***: Cleft lip and palate, Gender, Voice, Plosives

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## 1. Introduction

Speech is the process of making phonemes which transfers the meaning to the listener. It is also a useful tool for human beings to communicate with each other. The act of speaking needs adaptation between articulators. Speech disorder is a word used to mention a condition which affects the production of sounds. The size of vocal tract can also affect the quality of sounds. Cleft lip and palate, a kind of innate disorder in vocal tract, causes changes in the process of speech production. There are two types of cleft palate, cleft of the primary palate, alveolus and upper lip, and cleft of secondary palate, hard palate and uvula. Cleft lip is also divided into two types, unilateral cleft lip and bilateral cleft lip. A person may suffer from one of the mentioned disorders, in other conditions people may suffer from some or all of them (kummer, 2014, p. 26, 40, 43; Saudler, 2004, pp. 390-394). Type and the amount of severity of the mentioned disorders may cause difference in the speech of people who suffer from them (Rezaei et al. 2014).

**Research questions:**

The present study aims to measure voice onset time (VOT) in speech of children with repaired cleft lip and palate and compare them with normal peers in order to check if there is a difference between these groups with DISABILITY, GENDER, VOICE, and PLACE OF ARTICULATION OF PLOSIVES as factors.

## 2. Literature Review

Recent studies showed that any disorder in speech causes disability in communication (Amiri shouki et al. 2015). Studying the speech of children with cleft lip and palate proves the mentioned point and showed that speech of these children is different from speech of normal clients(Moren et al., 2017) and children who have repaired cleft lip and palate has more phonetic problems comparing to normals (Deepthi & Pushpavathi, 2017). In another

study by Casal et al (2002) it was proved that there was a significant difference between people with cleft lip and palate comparing to normal peers. Hypernasality is another disorder faced by children with cleft lip and palate (Derakhshandeh & Poorjavad, 2012).

Voice onset time, length of time that passes between the release of a stop consonant and the onset of voicing which is the most important acoustic distinctive feature in recognition of voicing of Persian plosives, will be affected by different factors, one of these factors is disability (Yanagida et al., 2014; Lane et al., 1994; khouw & Ciocca, 2007). In a researche done by Roohparvar et al. (2010) on hearing aideds and another research done by Bechet et al. (2008) on people with cleft lip and palate it was proved that plosives produced by participants with mentioned disabilities have longer mean VOT comparing to normals. Another factor which affects VOT is place of articulation of plosives, moving from lips to the back of vocal tract the mean VOT of plosives increases Fischer and M. Goberman, 2010; Klatt, 1975; Morris, Mc Crea, and Herring, 2007; Theodore et al., 2009; Oh, 2011; Thornburgh and Ryalls, 1998; Ferenc Bunta et al., 2016; Rezaei et al. 2013; Salehi et al. 2013).

The other factor affecting VOT is vowel context, plosives that are produced before high vowels have longer mean VOT (Fischer & M. Goberman, 2010; Klatt, 1975; Morris et al., 2007; Oh, 2011; Sudarshan et al., 2014; Bijankhan & Nourbakhsh, 2009; Rezaei et al. 2013). Gender is another factor affecting VOT Which was proved by Thornburgh & Ryalls (1998); Whiteside et al., (2004); Roohparvar et al. (2010); Bigankhan & Nourbakhsh (2009); Whiteside & Marshal (2001); Morris et al. (2007). Next factor affecting VOT is Voicing of plosives (Whiteside & Marshal, 2001).

## 3. Methodology

Two groups of 12 children (2 boys and 4 girls with repaired unilateral cleft lip and cleft of primary palate (RCLP) who took part in language therapy classes

for 144 hours and 2 boys and 4 girls as normal peers with no mental or physical problems) with average age of 11 took part in this study as volunteers and could leave it when they wanted to. They were asked to repeat CVC framed words with one of the Persian plosives [p, b, t, d, k, g] in the onset and coda and a vowel [a, e, o, ɒ, i, u] in the center of each word, [pap] ،[pep] ، [pop] ،[pɒp] ،[pup], [pip] are examples of the mentioned words. The total number of words was 432 and they were all recorded in an acoustic room using a shure microphone. Then PRAAT software was used to analyze the sounds and the boundaries between vowels and consonants and text greed were made for each word. After that PRAAT script was used to measure VOT of plosives. Repeated measure ANOVA test in SPSS software was used to compare mean VOT of plosives in both groups of participants according to mentioned factors, DISABILITY, GENDER, VOICE, and PLACE OF ARTICULATION OF PLOSIVEs.

## 4. Results

The results revealed that DISABILITY, GENDER, VOICE, and PLACE OF ARTICULATION OF PLOSIVES affect mean VOT of them. Results of Post Hoc Bonferroni test showed that mean VOT of plosives in normal children was 19.319 ms less that mean VOT of them while they were produced by RCLPs. Moreover, girls produce plosives with longer mean VOT comparing to boys, the mean difference between them is 16,500 ms. This test also showed that the mean VOT of voiceless plosives is 47.361 ms less than mean VOT of voiced ones. By moving from lips to the back of vocal tract the mean VOT of plosives increase. The difference between mean VOT of bilabial plosives with alveolar and velar ones are 15.448 ms and 25.063 ms respectively and the difference between mean VOT of alveolar and palatals is 9.615ms. It is also important to mention that there is interaction between GENDER and VOICE. The results of Post Hoc Bonferroni test show that Boys produce voice less plosives with longer mean VOT comparing to girls, the mean difference

between these genders is 29.582 ms. But, the results are not the same about voice plosives. The mean VOT of plosives produced by boys is 3.472 ms more than the mean VOT of them while they are produced by girls.

## 5.Conclusion

Regarding the aim of the present study, the effect of cleft lip and palate on VOT of plosives, the results showed that VOT of plosives in RCLP children is different from that of normal. As it was proved, the mean VOT of normals is less than the mean VOT of RCLPs. The results also showed that boy produce plosives with shorter mean VOT comparing to girls and voiceless plosives were produced with longer mean VOT comparing to voiced ones. Moving from lips to back of the tongue, mean VOT of plosives with different places of articulation increases. The mentioned results can be useful for language therapists who work with RCLP children as this research is the first study on Persian plosives with DISABILITY, GENDER, VOICE, and PLACE OF ARTICULATION OF PLOSIVES as factors. So, language therapists can use them in different stages of their teaching methods in order to help people with cleft lip and palate while comparing patients' type of disability, their gender and their age.

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