



Prevalence and types of articulation errors in Saudi Arabic-speaking children with repaired cleft lip and palate



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ABSTRACT

Objectives: The purpose of this study was to assess prevalence and types of consonant production errors and phonological processes in Saudi Arabic-speaking children with repaired cleft lip and palate, and to determine the relationship between frequency of errors on one hand and the type of the cleft. Possible relationship between age, gender and frequency of errors was also investigated.

Methods: Eighty Saudi children with repaired cleft lip and palate aged 6–15 years (mean 6.7 years), underwent speech, language, and hearing evaluation. The diagnosis of articulation deficits was based on the results of an Arabic articulation test. Phonological processes were reported based on the productivity scale of a minimum 20% of occurrence. Diagnosis of nasality was based on a 5-point scale that reflects severity from 0 through 4. All participants underwent intraoral examination, informal language assessment, and hearing evaluation to assess their speech and language abilities. The Chi-Square test for independence was used to analyze the results of consonant production as a function of type of CLP and age.

Results: Out of 80 participants with CLP, 21 participants had normal articulation and resonance, 59 of participants (74%) showed speech abnormalities. Twenty-one of these 59 participants showed only articulation errors; 17 showed only hypernasality; and 21 showed both articulation and resonance deficits. CAs were observed in 20 participant. The productive phonological processes were consonant backing, final consonant deletion, gliding, and stopping. At age 6 and older, 37% of participants had persisting hearing loss.

Conclusions: Despite early age at time of surgery (mean 6.7 months) for the studied CLP participants in this study, a substantial number of them demonstrated articulation errors and hypernasality. The results showed desirable findings for diverse languages. It is especially interesting to consider the prevalence of glottal stops and pharyngeal fricatives in a population for whom these sound are phonemic.

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1. Introduction

Cleft lip and palate (CLP) affects the whole pneumophonoarticulatory apparatus, typically involving abnormal nasality, nasal air

emission, nasal turbulence, and abnormal consonant production including compensatory articulations (CAs) [1]. CLP affects approximately 1 in 750 births around the world [1]. Similar incidence rate of CLP in Arab populations such as Jordan (1.39 per 1000) [2] and Oman (1.5 per 1000) [3] was reported. In Saudi Arabia (SA) where this study was conducted, different rates (2.2 per 1000) [4], and (1.4 per 1000) [5] were reported for different regions in the country. Aljohar et al. [6] studied prevalence of CLP in 807 cases in Saudi Arabia and reported that Riyadh region had (32.0%), Asir had (15.6%) and Eastern province (where this study was performed) had (14.6%) of registered cases.

It is well known that cleft lip and palate causes speech articulation and resonance problems and even after initial repair of

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the cleft is done, these problems persist in many speakers [1,7–9]. Residual resonance problems, specifically, hypernasality, typically implicate continuing velopharyngeal insufficiency (VPI) [8,10,11]. A distinction has been made recently to differentiate between “passive” or “obligatory” errors such as hypernasality, persistent nasal emission, and weak oral pressure obstruents, which can be attributed to VPI and/or oronasal fistula, and “active” or “compensatory” errors such as active nasal fricatives, which presumably developed as a learned attempt to compensate for physiological constraints, but may persist even after the initial repair of physiologic constraint [7,12].

Children with CLP also may present with developmental articulation/phonological errors. These include errors such as persistent phonological processes that may be related to expressive language delay and or structural deviations associated with CLP [9,15,16,21]. While some studies showed that speech of children with CLP indicated similar instances of phonological processes usage by 5-year old [1,10,37], other studies indicated that such phonological processes may persist beyond that age [9,15,16]. Although this study primarily investigates types of articulation errors in a relatively older age group (school age), the phonological based errors were explored by using phonologic processes analysis.

Studying the characteristics of the consonant sound system associated with CLP has diagnostic and therapeutic value. Specifically, such study will help in predicting speech proficiency of adolescents with CLP [13], standardizing evaluation measurements cross-linguistically [14], designing speech intervention plans [15], and evaluating treatment outcomes of these plans [16,17].

To date, there are only two studies on the prevalence of articulation disorders in Arabic speaking individuals with repaired CLP. In the first study, Shaheen investigated the cleft palate speech characteristics in Palestinian Arabic [18], she investigated articulation errors in three Palestinian children with CLP aged 3.3, 5.0, and 5.6 years. She reported place, manner, and voicing production errors including hypernasality, weak expiratory air, weak pressure consonants, nasal emission, backing, devoicing, glottal replacement, stopping, and implosive airstream. The second study, Al-Tamimi et al. investigated the cleft palate speech characteristics in Jordanian Arabic [19]. The authors investigated articulation errors in 15 Jordanian children with CLP aged 4.2–6.6 years. They reported the following errors: backing, stopping, lateralization, final consonant deletion and depharyngealization (deemphasizing ‘emphatic’ consonants). No significant differences between boys and girls were reported in Al-Tamimi et al. [19] study. Interestingly, in both studies no articulation errors were found to be specific to Arabic-speaking children with cleft palate. Unfortunately, there are no studies on the prevalence of articulation disorders and types of CAs in Saudi-Arabic speaking individuals with repaired CLP. Therefore, investigating speech disorders in languages such as the language under study is important to verify whether English-based findings can be generalized to Arabic language.

CAs have been given substantial therapeutic and research attention. Cross-linguistic research has added tremendously to our knowledge of the universal and language-specific features of CAs. CAs may be related to VPI, oral structural/dental deviations or may be developmental [1,7–9]. Several studies of children with CAs have demonstrated that children with repaired CLP have impaired place of production compared to the almost intact manner of articulation [20,21]. The nature and types of CAs have been well documented in the published literature. The typical compensatory errors in English-speaking children with repaired CLP include glottal stop, pharyngeal fricative, velar fricative, pharyngeal stop, posterior nasal fricative, and palatal stop [21]. However, some CAs

vary from one language to another, which indicates that the phonology of a language influences the types of CAs caused by palatal clefting. Specifically, cross-linguistic studies showed that the types of CAs appear to be different across languages based on whether they are phonemic (an authentic component of language-phonological system) or non-phonemic in phonologic repertoire [14,22]. For example, in English, compensatory articulations such as glottal stop [ʔ], voiced pharyngeal fricative [ʕ], voiceless pharyngeal fricative [ħ] and uvular fricatives [χ, ʁ] are considered non-English alternative realizations of English consonants [23,24]. Whereas, they are considered part of substitution errors in Arabic language because they are realized as authentic sounds in Arabic phonological repertoire [18,19,25].

Therefore, investigating how do non-oral articulations, observed in cleft speech in many other languages, manifest in Arabic where they form part of the target phonological system is potentially important contribution to the literature. Furthermore, investigating whether the typical realization of these non-oral phonemes affected by the pressures imposed on the speaker to produce non-oral compensatory articulations could form an extremely valuable outcome of this study. The question of universal versus language specific characteristics in CLP population may also have clinical implications in both assessment and treatment of CLP-related articulation errors. Specifically, it may have an influence on whether conventional phonetic or phonologically based treatment approaches are used in error management [12,15,16].

Like Palestinian and Jordanian Arabic, SA serves as an excellent testing ground for CLP-related articulation and resonance deficits because of its unique phonologic repertoire such as emphatic consonants and glottal stop. For example, the frequently reported pharyngeal, glottal, and uvular compensatory articulations such as [ʕ, ʔ, ħ, χ, ʁ] are phonemic in Arabic. In addition, the presence of emphatic sounds in Arabic versus absence of these sounds in English may be reflected in the types of errors in CLP population in the two languages. Emphatic sounds in Arabic include [ð̤] (a voiced dental emphatic fricative), [t̤] (a voiceless alveolar emphatic plosive), [d̤] (a voiced alveolar emphatic plosive), and [s̤] (a voiceless alveolar emphatic fricative). This group of sounds is considered the most difficult in Arabic because it requires a primary articulation of constriction and a secondary articulation of pharyngealization [26]. Hence, it is interesting to investigate whether Arabic speakers with repaired CLP have the same normal developmental errors (e.g., substituting emphatic consonant with their nonemphatic cognates) or have preference toward production of more pharyngealized sounds (e.g., voiceless pharyngeal stop). Investigating these errors in SA is especially interesting in light of the dramatic phonological contrasts that characterize SA, particularly with respect to CAs. The types of CAs in Saudi Arabic speech sound system may behave differently from those reported for CLP speakers of other languages.

Some studies have reported on the prevalence of articulation disorders in speakers with repaired CLP in various language populations [27–33]. For example, Lohmander et al. [27] reported the prevalence of retracted oral articulation 23% and 6% at ages 7 and 10 years respectively. These articulation deficits improved when participants reached age 16 years where only 4% of prevalence retracted oral articulation was noticed in 55 included individuals. Havstam et al. [28] reported that 42% of 54 participants had normal articulation, 38% had mildly deviant articulation, and 20% had moderately deviant articulation at 7 years of age. The reported articulation deficits were improved at 10 years of age where 65% had normal articulation, 20% had mildly deviant articulation, and 10% had moderately deviant articulation. Sell et al. [29] examined consonant production in 218 participants at 12 years old. They reported that 38 participants (17%) had at

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