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The impact of palatal repair before and after 6 months of age on speech characteristics

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ABSTRACT

Objective: Optimal timing of palatal repair is still subject of discussion. Although literature provides some evidence that palatal closure prior to 6 months positively influence speech outcome in children with clefts, only few studies verified this hypothesis. The purpose of this study was to describe and compare articulation and resonance characteristics following early (≤6 months) and later (>6 months) palatal repair, performed using the Sommerlad technique.
Methods: Comparison was made between 12 Ugandan children with isolated cleft (lip and) palate following early palatal repair (mean age: 3.3 m) and 12 Belgian patients with later palatal repair (mean age: 11.1 m), matched for cleft type, age and gender. A Ugandan and Belgian age- and gender-matched control group without clefts was included to control for language, culture and other environmental factors. Articulation assessments consisted of consonant inventories and phonetic and phonological analyses that were based on consensus transcriptions. In addition, resonance was evaluated by perceptual consensus ratings and objective mean nasalance values.
Results: The Belgian and Ugandan control groups were comparable for the majority of the variables. Comparison of cleft palate groups revealed no clinically relevant significant group differences for consonant inventory or phonological processes. Phonetic analysis showed significantly more distortions in the Belgian cleft palate group due to higher occurrence frequencies for (inter)dental productions of apico-alveolar consonants. Neither perceptual consensus ratings of hypernasality, hyponasality, cul-de-sac resonance and nasal emission/turbulence, nor objective mean nasalance values for oral speech samples revealed significant group differences ($p > 0.05$).
Conclusion: Articulation and resonance characteristics of young children following palatal repair before and after 6 months of age seem to be at least comparable.

1. Introduction

Timing of cleft closure, and particularly timing of palatal repair, was subject of discussion during the previous decades. While some authors advocated an early closure of the cleft palate (CP) to improve speech outcome, others advised delayed palatal repair to optimize midfacial growth. Today, craniofacial teams in northern countries such as Europe and North-America still show a huge diversity in timing sequences for cleft closure. Results from the Eurocleft project illustrate that the majority (135/201, 67%) perform lip closure at the age of about 3 months [1], followed by a one- or two-stage soft and hard palatal closure at some later age in infancy or childhood [2]. In resource-poor countries, this treatment protocol is often adapted. High default rates were noted for palatoplasty after successful lip repair [3,4] because of financial considerations [5], huge travel distances [6] and removal of the social stigma due to recovered esthetics [7]. Consequently, synchronous closure of cleft lip and palate (CLP) and simultaneous closure of cleft soft and hard palate are advocated [8]. Considering the inability of patients with CP to adequately breastfeed and the

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consequential risk for malnutrition and death [9], the craniofacial team of the Comprehensive Rehabilitation Services in Uganda (CoRSU) hospital recommends this surgical sequence as soon the patient reaches a target weight of 3 kg, often resulting in cleft closure before 6 months of age [4].

Such early repair of the velopharyngeal mechanism might prevent that articulation errors get well-established in the children's neuromuscular speech patterns [10]. In babies with unrepaired CP, delays in onset of canonical babbling as well as differences in frequency and quality of productions have been noted [11]. The canonical babbling stage is however a crucial step toward verbal vocabulary. Consonants frequently used in canonical babbles will arise in the children's first words [12]. Therefore, deviations in canonical babbling will most likely be reflected in later speech–language development [13].

Literature currently provides evidence that closure of the CP before the age of 6 months positively influences speech outcome in children with clefts. To our knowledge, nine studies have described speech outcome following palatal closure before the age of 6 months [14–22]. Four other studies compared speech results of children with palatal closure before and after 6 months of age [23–26]. An overview of these studies is provided in Table 1. Descriptive studies reported overall small deviations from normality for speech intelligibility, articulation and resonance, despite some exceptions. Moreover, three out of four comparative studies reported significantly improved speech in children with early palatal repair [23–25]. The overall better speech outcome after later compared to early hard palatal closure observed by Doucet et al. [26] was attributed to differences in surgical technique, in particular to the success of intravelar veloplasty (Sommerlad technique) performed in the later CP closure group.

Drawing overall conclusions from these studies is however difficult due to several reasons. Patients with various cleft types were included and several palatal closure techniques were performed. Furthermore, materials and method section in some studies offers very few information regarding age [16,17,23], cleft type [17], assessed speech samples [16,17,23–26] and perceptual rating strategies [16–18,23,25]. In addition, objective assessment techniques to evaluate speech characteristics were generally not performed. Regarding study design, only four studies compared the experimental group with children without clefts [18,22,23,25]. Moreover, in studies comparing patients with early and later palatal closure, information on whether the two experimental groups were matched for cleft type [23], age [23,24] and/or gender [23,24] was often missing.

As shown by this literature review, more comparative studies on speech characteristics after early ($\leq$6 months) and later palatal closure (>6 months) are necessary. In CoRSU, palatal repair is generally performed before the age of 6 months. In contrast, the Belgian craniofacial team of the Ghent University Hospital performs a one-stage palatal repair at the age of 12 months on average. In both teams, palatal closure is carried out by an experienced surgeon using the Sommerlad technique (A.H., K.B.), what provides an excellent opportunity for assessing speech characteristics after early vs. later palatal closure. However, comparison of both patient groups is complicated due to differences in language backgrounds. According to Hutters and Henningsson [27] the level of difficulty to cope with a language for patients with CP is determined by phonetic characteristics of the sounds included in the language's consonant inventory. Considering that pressure consonants (i.e. plosives, fricatives and affricatives) are the most vulnerable sounds for patients with CP, the amount of these consonants in speech samples should be weighted in order to eliminate the variable 'language background' and increase the validity of comparisons [28].

The aim of the current study is to describe and compare articulation and resonance characteristics of Ugandan patients with isolated cleft (lip and) palate (C(L)P) following early palatal repair ($\leq$6 months) with Belgian patients having isolated clefts repaired after the age of 6 months. An identical surgical technique (Sommerlad) was used in both groups. The CP groups are matched for cleft type, age and gender. A well-defined speech assessment approach, including objective assessment techniques and perceptual consensus evaluations, is used [22,29,30]. In order to control for differences in language, culture and other environmental factors, two control groups are included. Each control group (Ugandan/Belgian) is matched with one of the CP groups (Ugandan/Belgian) for country, age and gender. In accordance with previous comparative literature about early vs. later palatal closure [23–25], fewer articulation and resonance disorders are hypothesized in patients with early compared to later palatal closure.

2. Materials and methods

The research protocol was approved by the Ethical Committee of the Ghent University Hospital, Belgium (EC2011/269). All subjects gave informed consent to the work.

2.1. Participants

The current study included a Ugandan and Belgian CP group as well as a Ugandan and Belgian control group. The Ugandan CP group was recruited at the Speech Language Therapy department of CoRSU during four 10-day-long missions between January 2012 and January 2013 and included all Ugandan patients with isolated clefts of the soft and hard palate, who underwent one-stage palatal repair at the age of 6 months or earlier and who adequately performed English articulation and nasometric assessments. From the 84 patients with an early one-stage CP closure ($\leq$6 months), 72 children were excluded due to incomplete articulation assessments (n = 4), presence of associated anomalies (n = 6), a young age (i.e. <2.6 years) (n = 56) or lack of cooperation (n = 6). Twelve Ugandan patients were selected for further assessment. They all were able to speak and understand English, since this is their second language. English is one of the official languages of Uganda [31] and is deeply rooted in media, administration and education [32]. The Ugandan CP group included four males and eight females with a mean age of 4.9 years (range: 3.2–7.2 years), presenting with CP (n = 1), unilateral CLP (n = 10, UCLP) or bilateral CLP (n = 1, BCLP). UCLP and BCLP were closed during a synchronous lip and palatal repair, while CP was repaired by a one-stage soft and hard palatal closure. All surgical cleft closures were carried out by one experienced surgeon (A.H.) at 3.3 months on average (range: 2–6 months). A modified Millard repair (UCLP) and a modified Mulliken technique (BCLP) were applied for lip closure. CP was repaired using the Sommerlad technique. Secondary surgery for minor postoperative complications was performed in 7 patients (7/12, 58%), including one closure of palate dehiscence and six fistula repairs. None of the patients received speech therapy or hearing treatment (e.g. ventilation tubes) prior to speech assessment.

For each participant of the Ugandan CP group, a Belgian Dutch-speaking patient with surgically closed isolated cleft matched for cleft type and age, was recruited from the craniofacial team of the Ghent University Hospital between January 2012 and February 2013. Matching for gender was possible for 11 children (11/12, 92%). The Belgian CP group consisted of five males and seven females with CP (n = 1), UCLP (n = 10) or BCLP (n = 1). Mean age was 4.7 years (range: 2.6–6.11 years). Dutch was the mother language of all patients. At 3.3 months on average (range: 2–5 months), lip repair was performed using a modified Mulliken (n = 1), modified Millard (n = 7), Manchester (n = 2) or Fisher (n = 1)